Trade Liberalization, Wages and Working Conditions

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Abstract

This paper shows a significant and sizeable deterioration of working conditions and wages of workers in sectors facing a reduction in import tariffs during the process of accession of Eastern European countries to the European Union. These effects are magnified by the erosion of labor market institutions that these countries experienced over the accession process. Our results show non neutral effects of both the reduction in import tariffs and the erosion of Eastern European labor market institutions across regions, sectors, firms and workers. (JEL: F14, F16, J20, J40)

1. Introduction

There is a popular perception that globalization has generated greater inequality making the majority of workers worse off. The extent to which this sentiment rises and affects the political debate is significantly different across countries.[1] While in some countries popular concerns over the effects of trade liberalization are widespread and have generated marked protectionist responses by governments, in other cases opposition to trade liberalization has

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1. The global attitudes survey conducted by the PEW Research Center in 2018 reveals a negative sentiment towards trade liberalization across E.U. countries (https://ropercenter.cornell.edu/CFIDE/pewglobal/question_view.cfm?qid=1890&cntIDs=&stdIDs=).

been much less intense (Colantone & Stanig 2018, Dippel et al. 2020).[2] This observation stresses the importance of assessing whether trade liberalization episodes have affected labor market outcomes (wage and working conditions) and how labor market institutions, notably unionization (*via* trade unions erosion), shaped the effects of trade liberalization among different countries.

In this paper, we show that the working conditions and wages of Eastern European workers in countries that have faced large tariffs declines during the accession process to the E.U. have worsened more than those of workers in countries having experienced mild tariff liberalization. We conduct our analysis by using a new and detailed individual-level dataset for workers across Eastern European countries (EEC hereafter) allowing us to analyze the effects of trade liberalization also on individuals' working conditions which have received far less attention than wages in the previous literature.[3] Since the information spans over many Eastern European countries, we are able to show that the effects of trade liberalization are magnified by the erosion of labor market institutions in these countries. To the best of our knowledge, this is the first paper that systematically explores the role of labor market institutions in shaping the workers' specific responses to a common trade liberalization episode.

Our empirical analysis makes use of a very large cross-section of about 2.8 millions of Eastern European workers in 2014 across 9 countries and 20 regions. The dataset allows us to identify workers that work at night or over weekend and also on the number of overtime hours they spend in the firm (these information are used here as proxies for working conditions). It also gives precise details about workers' attributes such as education, age, occupation, gender or type of contract and some information about the firm they are working for, such as her size, sector of activity, and the statutory regime (i.e. private or state-owned). We can therefore compare the wages and working conditions of workers with similar characteristics in countries and regions that have faced large tariffs declines during the accession process to those that have faced smaller tariffs declines. The trade liberalization index is constructed as in Kovak (2013) and Dix-Carneiro and Kovak (2017, 2019) and inform on the change in

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2. Colantone & Stanig (2018) and Dippel et al. (2020) show that a high exposure to trade causes the increase in support for nationalist, extreme right and isolationist parties.

3. We follow a broad definition of working conditions that are hours worked during "non-standard" working hours, including shift, weekend and night work.

region and product specific applied MFN import tariffs cuts between 1997 to 2014.[4] This period covers the two last European Enlargement in 2004 and 2007. We therefore focus on the change in the applied MFN import tariff that Eastern European countries faced as a consequence of their accession to the EU Custom Union. The applied MFN tariff scheme that Eastern European countries had to adopt in such a circumstance was already implemented (and designed) by old member states and therefore hardly affected by the lobby activity of firms in Eastern Europe.[5]

We find that workers employed in regions that have faced large tariffs declines experienced a hardening of their working conditions characterized by a higher prevalence of atypical work such as night work or shift work or overtime work and a significant reduction of their wages. This result is particularly interesting if one considers the mental health problems (i.e. depression) caused by working conditions (Cottini & Lucifora 2013, Robone et al. 2011), and notably by effort-reward imbalances among Central and Eastern countries populations (Pikhart et al. 2004). Our results also confirm non-neutral effects of trade liberalization across firms and workers of different type. We find larger negative effects of trade liberalization on wages in private firms while the likelihood of having shift work in job increases in larger firms. While the effect of trade liberalization on wages is comparable across sectors, its impact on workers' working condition is slightly larger for manufacturing than for service sectors. The negative effect of trade liberalization on wages is much more pronounced for workers employed in elementary occupations than for managers. All these effects are magnified by the erosion of labor market institution such as the decline in unionization: in less regulated labor markets the effects of trade liberalization and import competition are likely to be exacerbated.

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4. Country-sector specific MFN tariff shocks have been brought at region-sector level using the seminal approach in Kovak (2013).

5. All Eastern European countries had preferential trade agreements (PTAs) with the E.U.-15 before the Enlargement (see for example the 1993 Slovak E.U. Agreement, or the 1991 Poland Interim Agreement signed in 1991). All these bilateral PTAs already covered tariffs reductions between the EU-15 and candidate country, but i) only for a sub-sample of products and ii) did not apply to the external tariff scheme of EECs (vis-a-vis the rest of the word). The typical scheme of a pre-accession PTA implied zero-tariffs for a (very) narrow set of products and a progressive tariffs reduction for the rest. In most of cases, the vast majority of products were unaffected by pre-enlargement bilateral PTAs.

This paper is related to the broad literature that has looked at the impact of globalization on labor markets. Over the 1990s, many empirical studies found trade liberalization having a mild effect on wages and employment, attenuating the common concern that globalization may have a negative impact on labor market outcomes (see Richardson 1995 for a survey).[6] However, recent empirical evidence - conducted mainly at local labor market level - revamped this debate by showing strong evidence of the negative impact of trade liberalization episodes on employment in both developed (Autor et al. 2013) and developing countries (Topalova 2007, Dix-Carneiro & Kovak 2017, 2019).[7] We contribute to this literature by studying the consequences of exogenous trade liberalization episodes on the working conditions of Eastern European workers. Wage is not the only determinant of worker's welfare. Working conditions matter, and understanding how these are affected by exogenous shocks is key for the overall comprehension of the labor market consequences of trade liberalization. Moreover, this is the first paper that uncovers the role of the labor market institutions in shaping the labor market consequences of a trade liberalization episode.

By providing a direct link between trade liberalization and the worsening of individuals' working conditions, our paper provides an explanation for the mental health effect of trade liberalization highlighted in the previous literature. Indeed, the worsening of working conditions have been widely associated to

6. For many years, the standard factor proportion theory of trade (Heckscher-Ohlin-Samuelson theory) was used by trade economists to predict the labor market consequences of trade liberalization. According to this class of models globalization is expected to create winners and losers. Namely, while trade liberalization is expected to have null effect on employment, it is expected to increase (decrease) wage inequality in developed (developing) countries.

7. Topalova (2007) and Dix-Carneiro & Kovak (2017) find significant negative impact of trade liberalization episodes on employment in India and Brazil respectively. Autor et al. (2013) specifically test the effect of Chinese imports penetration on manufacturing employment across US local labor markets. By comparing two commuting zones over the period 2000 through 2007, one at the 25th percentile and one at the 25th percentile of exposure to Chinese import growth, Autor et al. (2013) find that the more exposed commuting zone experiences a differential 4.5 percent fall in the number of manufacturing employees.

mental distress (Cottini & Lucifora 2013, Robone et al. 2011, Marchand et al. 2005),[8] and these to trade liberalization (Colantone et al. 2019)[9].

The rest of the paper is organized as follows. Section 2 describes the history and the institutional environment of EU enlargements in 2004 and 2007. Section 3 presents the main data sources employed in the empirical section and some descriptive statistics aiming at motivating the research question. Section 4 describes the econometric strategy and section 5 discusses the results. In section 6 we present a counterfactual exercise aimed at quantifying the econometric results. Section 7 concludes.

2. Historical Background

2.1. European Enlargement and Tariffs Liberalization

The 2004 and 2007 European Enlargement represents the largest expansion of the European Union, in terms of states and number of workers involved.[10] The process of integration started in the mid-1990s as many of the new Eastern European members engaged in preferential trade agreements with EU-15.[11] The accession to the EU implied not only a substantial reduction in the Eastern European countries' import tariffs with respect to other members of the European community, but also a drastic trade liberalization *vis-á-vis* the rest of the world (through the adaptation of their external tariff scheme to

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8.   Using European Working Conditions Surveys, Cottini & Lucifora (2013) investigate the link between working conditions and mental health across 15 European countries and show evidence of a positive causal effect of adverse working conditions on mental health distress. In the same vein, using British Household Panel Survey, Robone et al. (2011) show overwhelming evidence of the working conditions effect on health and psychological well-being. Marchand et al. (2005) analyze the contribution of working conditions to the probability of experiencing single or repeated episodes of psychological distress find evidence of a causal relationship between job insecurity and psychological distress events.

9.   Colantone et al. (2019) find that import competition has a significant negative impact on many indicators of individual mental distress (such as anxiety and depression, social dysfunction and loss of confidence).

10.   Hungary, Poland, Estonia, the Czech Republic, Slovenia, Cyprus, Slovakia, Latvia, Lithuania and Malta enter in 2004 and Romania and Bulgaria enter in 2007.

11.   The Europe Accession negotiations started officially in March 1998 with Czech Republic, Estonia, Hungary, Poland, Slovenia and Cyprus and in October 1999 with Bulgaria, Latvia, Lithuania, Malta, Romania and Slovakia.

that of old member states). Between 1994 and 1999 each Easter European candidate country signed a bilateral Interim agreement containing trade related provisions with old E.U. member states.[12] These provisions were specific and varied according to particular sectors and countries. In 2004 and 2007, with the official access to the European custom union, the new member states became even more integrated into the internal market and incorporated the rules of the common trade policy. By imposing the compliance to the European Union MFN bound and applied tariffs on external trade relationships, the 2004 and 2007 enlargements represent important and exogenous trade liberalization episodes for new member states.[13] Moreover, most of the applied MFN tariffs reductions occurred during the post-enlargement period.[14] Our empirical strategy exploits this exogenous source of variation to identify the effect of trade liberalization on workers' working conditions and wages.

Over our sample period which spans from 1997 to 2014, the reduction in Eastern European countries' applied MFN tariffs across countries is significant as visualized in Figure 1, and compares in magnitude with other trade liberalization episodes analyzed in the previous literature (such as the Brazilian one described by Dix-Carneiro and Kovak, 2019).

<center>– Insert Figures 1 and 2 about here. –</center>

The large average decline in applied MFN import tariff showed in Figure 1 comes with a substantial heterogeneity in tariffs cuts across industries, with some industries such as medical and precision facing small tariffs changes, and others such as food and tobacco facing declines of more than 18 percentage points. See Figure 2.

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12. Tariffs liberalization with the European members was gradual and asymmetric with faster liberalization on the E.U. side than on the side of the candidate countries. The Interim Agreements defined few sectors such as in the food, textiles and clothing industries that were excluded from the immediate trade liberalization granted by the European Community The European Commission (2006).

13. As seen in Appendix table A1, the Eastern European shares of imports from the rest of the world are still important in 1997, the starting year of our analysis.

14. The contribution of the change in MFN tariffs pre-enlargement to the overall variation of MFN tariffs between 1997-2014 is about 20%.

2.2. *The Evolution of Labor Markets in Eastern European Countries*

Beyond trade liberalization, the enlargement of the EU towards Eastern European countries induced a series of structural reforms in new members states that had important consequences on labor markets (Riboud et al. 2002). The changes in labor market regulations across Eastern European countries have important repercussions on the type of employment contracts, the boundaries for wages and benefits, hours worked and working conditions, and the rules for collective representation and bargaining of Eastern European Workers (Cazes 2002; Fialová & Schneider 2009). While the economies of Eastern Europe have different regulations regarding wages and working time, they share a similar trend with respect to the liberalization of their labor markets.

Union density is an important indicator of the ability of unions to negotiate collective agreements and one of the key indicators to be considered to understand the labor market transition in Eastern European countries (Richard 1994). In Central and Eastern European countries, the decline in union density has been quite dramatic, due to the collapse of the union affiliation rate after the fall of central planning. In Table 1, we summarize the key feature of union density processes in the pre and post-Enlargement period.

– Insert Table 1 about here. –

Since 1990, the numbers of trade-union members has decreased substantially to reach a level of union density which varies between 10% and 15% across Eastern European countries in 2014. Bulgaria, Estonia, Czech Republic, Romania and Slovakia which have the highest figures in 1998 have experienced the largest decrease in the number of members of trade unions over the sample period.[15] The erosion of trade union can be explained by numerous factors such as high levels of unemployment, privatization, growing numbers of small and medium-sized companies and the expansion of service and flexible jobs over manufacturing and traditional permanent jobs – where the trade unions are more represented. The decline of trade union density has been particularly

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15. The pervasive fall in union density among Eastern European countries observed here (during the period 1998-2004) fits into the historical transition pattern of post-Communist countries started in the late eighties. As reported in Richard (1994), Table 8.2, as of 1991 the union density in Czechoslovakia, Hungary, Bulgaria and Romania was respectively the 70%, 60%, 45% and 64%.

steep in Slovakia, Latvia, Czech Republic and Bulgaria. The liberalization of labor markets in Eastern European countries also reflects in the decrease of the share of workers covered by collective bargaining. In the pre-enlargement period, collective agreements are mostly conducted at the firm level.[16]

The marked changes in the labor market institutions discussed above may have offset or magnified the labor market responses to the trade shock induced by the accession of Eastern European countries into the European custom union. Indeed, in increasingly less regulated labor markets the effects of trade liberalization (i.e. import competition) are likely to be exacerbated. This is at the core of the empirical test conducted in what follows.

3. Data and Definition of Variables

To investigate the effects of European enlargement on workers' wages and working conditions, we use detailed cross-sectional data at individual level from the Eurostats Structure of Earnings Survey (SES) dataset. This information is matched with seven different sources to test the heterogeneous responses of workers located into different local labor markets.

3.1. Individual Worker's Wages and Working Conditions

Our main data source is the Eurostat Structure of Earnings Survey (SES) dataset. The SES is a collection of detailed individual-level and harmonized surveys on earnings and other individual workers characteristics conducted among a large panel of European countries in years 2002, 2006, 2010 and 2014. Each survey is addressed to firms and collected for those with at least 10 employees operating in all areas of the economy except agriculture and public administration defined in Statistical Classification of economic activities in the European Community (NACE). The SES surveys report information on the worker's wage, the number of hours and overtime hours worked and the "premium payments during the reference month for shift work, night work or weekend work where these are not treated as overtime". While overtime hours can be voluntary or mandated by the worker's company, shift and night

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16. See Gebel (2008) or Bronstein (2003) for an interesting survey of the country specific features of the wage bargaining systems before and during the Transition.

work is usually considered to be a risk factor for health, safety and social well being (Harrington 1994; Costa 2003; Cottini & Lucifora 2013), and thus represents a signal for the worsening of working conditions. This information on the likelihood of working during "non-standard" working hours, including shift, weekend and night work is used here to construct our main proxy of working condition.

The worker's total wage include the payments of "*regular*" and "*overtime*" hours of work.[17] The information collected relates to the earnings paid to each "job holders", without collecting information on earnings by the same employee elsewhere in a second or third job. It also contains useful individual characteristics such as the worker's level of education, occupation, age and gender. Age is available in 5-year intervals. To reduce measurement error we keep the active population of individuals aged 20 to 59 years old. Concerning the education variable, we use the 4 categories already present in the SES and based on the 2011 version of the International Standard Classification of Education (ISCED).[18] We use the 2008 International Standard Classification of Occupations (ISCO) at the 1-digits level to classify the occupation of workers.[19] Moreover, the survey reports limited but important information on the worker's employer; such as the firm's size category, the broad sector of activity, her private-owned status and the type of labor contract between the employer and the worker (part time vs full time jobs and length of service).[20]

The SES has the advantage to cover cross-sectional information at individual level for the vast majority of European countries prior and after the two last enlargements of the European Union to the Eastern European

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17. Overtime hours are paid at higher rates of wages. This rate varies across countries.

18. The first category includes individuals with lower secondary education, the second category contains individuals with higher secondary education and post-secondary non-tertiary education, the third category includes graduates and the fourth category is post-graduate education.

19. We exclude agricultural, army workers, and all the education-system related occupations from the sample as due to the lack of the agricultural, education and army sectors in our data, these are very few observations that are not present in each and every country. We also exclude drivers because they missing in data for Italy and only marginally affected by trade shocks.

20. Countries adopt different sectoral aggregation in the original SES files, but all are based on the NACE Rev.2 classification. So we harmonized the sector of activities to allow cross-country comparison. Our harmonization results in 14 sectors spanning over manufacturing and services.

countries. For each of the 4 years, our sample contains harmonized information for 9 countries including Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia.[21] For Bulgaria, Hungary, Poland and Romania we also have information at regional NUTS 1-digit level. Our final dataset consists on a cross-section of 2,765,815 Eastern European workers aged 25-59 employed in the formal sector of each country in 2014.

These data have various advantages relative to previous studies on the effects of trade liberalization on individual workers' earnings and working conditions. Compared to Autor et al. (2013), Kovak (2013) and Dix-Carneiro & Kovak (2019), our data cover a wide range of countries with different labor market institutions. This allows us to analyse how the labor market consequences of the EU enlargement spread across Eastern European countries with different labor market institutions. The dataset provides also detailed information at firm and worker levels that allows investigating the effect of liberalization across firms, occupations, job spells and different types of contract. This allows a deeper comprehension with respect to other similar studies conducted at the local labor market level (Autor et al. 2013) on who are the *winners* and the *losers* from trade liberalization.

3.2. Tariffs Liberalization in Eastern European Countries

We follow the recent literature on the labor market consequences of trade liberalization, and measure the effect of trade liberalization on individuals' labor outcomes using a *weighted* average of changes in tariffs across sectors of a given country-region combination (Kovak 2013, Edmonds et al. 2010, Dix-Carneiro & Kovak 2017, 2019, Topalova 2007, 2010).[22] The weights are based on the industrial composition of employment in each country-region. Under the assumption that changes in import tariffs are (fully or partially) passed into prices, any variation in the applied MFN tariff represents a good proxy for

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21.   Croatia, Malta and Slovenia are excluded from the estimation sample as we only have data in 2010 for Croatia and in 2014 for Malta and Slovenia. So, for these countries we could not compute the change in the weighted tariff liberalization - see section 3.2.

22.   Autor et al. (2013) also investigate the impact of trade liberalization at sub-national level using U.S. data. However they study the effect of *import penetration* from China rather than trade policy based liberalization.

variation in domestic price and degree of competition.[23] Our proxy for trade-liberalization induced change in price is as follow: [24]

$$RTR_{rc} = -\sum_k \beta_{rck} \Delta ln(1 + \tau_{ck}) \ \ with \ \ \beta_{rck} = \frac{\lambda_{rck} \frac{1}{\varphi_{ck}}}{\sum_{k'} \lambda_{rck'} \frac{1}{\varphi_{ck'}}} \tag{1}$$

where $\Delta ln(1 + \tau_{ck})$ is the difference in the applied MFN tariffs between the pre-enlargement year 1997 and the post-enlargement year 2014 for a given sector k and country c. We took 1997 as pre-enlargement year because this is the oldest available year in the WTO tariffs dataset covering an exhaustive set of countries and sectors.[25] We use applied MFN to capture specifically the spirit of the EU enlargement, i.e. the fact that Eastern European Countries had to adopt the MFN applied tariffs scheme of old-member states following the accession to the EU.[26]

β_{rck} reflects the importance of each sector k in region r of country c in terms of both employment share of the sector (λ_{rck}) and the importance of labor on the sector specific production technology ($1/\varphi_{ck}$). Region specific information on the cost-share of non-labor factors - φ_{ck} - is not available, so we assume this technology to be constant across regions within the same country.[27] In order to compute β_{rck}, we need information on λ_{rck} and φ_{ck}. λ_{rck} is the share of region $r's$ workforce initially employed in sector k of country c. We use the SES 2002

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23. This assumption has been widely used in the literature on export supply elasticity (Romalis 2007, Fajgelbaum et al. 2020). By focusing on applied MFN import tariffs, when Preferential Trade Agreements between the EU and a given non-EU country imply a full use of preferential rates, our measure of trade liberalization may underestimate the effective trade liberalization episode. However the use of MFN tariff strongly reduce endogeneity concern that might rise if one uses applied preferential rates.

24. Details on the computation are given in the Appendix section B.1.

25. Except for Slovakia and Romania for which the base years are respectively 1998 and 1999 due to lack of data for 1997.

26. Since we focus on MFN applied tariffs, our bilateral tariff and trade dataset shows tariff rates invariant across partner countries (i.e. the same applied MFN rate is repeated across partner countries). However we want to account also for the huge tariff liberalization implied by the zeroing of tariff towards EU-partners after the accession to the common EU market. To this end, for the post-accession year 2014, we set to zero the MFN applied towards EU partners and took the weighted average rate across EU end non-EU partners (with import share in 1997 used as a weight).

27. Being an intrinsic measure of the technology of sector's production process we can fairly assume φ_{ck} to be constant across regions of a given county.

data for Poland and Bulgaria, and the Eurostat Structural Business Survey at the regional level for Romania (in 2002) and Hungary (in 2001) to compute λ_{rck} as this information is not available in the SES dataset.[28] φ_{ck} is the cost share of non-labor factors in industry k and country c obtained from Eurostat data for the years preceding the enlargement (Eurostat Structural Business Survey).

Since the original source of variation in tariff change is country-sector specific (the regional variation is *de-facto* induced by λ_{rck}), as a robustness check we also a construct a trade-liberalization variable RTR_c, which varies across countries (not region) in the econometric analysis. This also allow us to relax the assumption that the cost-share of non-labor factors in a given sector is constant across regions of a given country. λ_{ck} is then the share of country $c's$ workforce initially employed in sector k using the Eurostat SES data in 2002 and the European sector classification NACE Rev1.

3.3. Labor Market Liberalization

We collect data on the evolution of Eastern European labor market institutions, and study the role of union density on individual wage and working conditions. The union density variable is the share of workers with union membership and is obtained from the ICTWSS database. We compute the change in union density rates between 1998, the earliest available data in ICTWSS database and 2014. By interacting this variable with the RTR variables, we analyse whether the erosion of trade unions magnifies the impact of trade liberalization.

3.4. Other Controls

The EU enlargements in 2004 and 2007 had several economic consequences. They promoted goods and services trade, intensified Foreign Direct Investment and other capital flows, and reinforced labor mobility between EU countries. We therefore add in our econometric specification country-level controls to take into account various shocks that correlate with both the tariffs liberalization variable and the labor market outcomes. Such shocks are computed as the log difference of the variable between 1997 and 2014. We account for productivity shocks by

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28. We use SES 2002 data to compute country level λ_{ck} for EECs without regional level information (i.e Czech Republic, Estonia, Lithuania, Latvia, Slovakia). We use the HS 6-digit product's import share to aggregate the data on applied MFN tariff at NACE level

including the log-difference of the GDP per capita.[29] The underlying data on GDP and population are taken from the World Bank's World Development Indicator (WDI) database. We also control for foreign labor supply shocks by including the net migration flows from 1997 to 2014 over the total population of Eastern European countries as provided by Eurostat. We use the Eurostat dataset on the net foreign property income over GDP to compute the foreign capital shocks aimed at controlling for the change in the presence of multinational corporations between 1997 to 2014. The net foreign property income, as computed by Eurostat national accounts, is the difference between the property income received by domestic agents from abroad and the income received by foreign agents from domestic agents (i.e. the property incomes distributed abroad).

Finally, we also control for the dynamics of prices across countries by taking the difference in the Consumer Price Index between 1997 and 2014. The information is taken from the World Development Indicator dataset.

The other remaining control variables are taken from the SES data. To control for the differences in worker's labor market outcomes based on the type of contract, we always include a dummy variable that takes the value of one for workers under short term contracts. We add an indicator for gender which takes the value of one for women workers. We also control for the employer' size by including a dummy variable equal to one for firms with more than 50 employees. Table 2 provides the descriptive statistics of the variables used in the econometric exercise.

– Insert Table 2 about here –

4. Empirical Specification

Our empirical strategy exploits the differences in the reduction of import MFN tariffs across regions with different industry mixes to compare the wages and working conditions of workers with similar characteristics. We examine whether the outcomes of workers in regions that have faced large tariffs declines during

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29.   As reported in Rogerson (2008), one of the main determinants of changes in labor demand over time (and of the marked reduction in hours worked in rich EU countries) is productivity dynamics.

the accession process are significantly lower (or higher) than those of workers in regions that have faced smaller weighted tariffs declines.

Over the period considered here, Eastern European countries also experienced a marked erosion of trade unions (here used as a proxy for labor market institutions), hence we also examine how the labor market institutional changes affected workers' outcomes and how they shaped the impacts of trade liberalization. The baseline equation includes therefore measures of trade and labor market liberalization that we also interact in most specifications. The estimation is defined as follows:

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\begin{aligned}
y_{i,f,c,r} &= \alpha_0 + \alpha_1 RTR_{rc} + \alpha_2 LMI_c + \alpha_3 (RTR_{rc} \times LMI_c) \\
&+ \mathbf{\Phi}'_i \alpha + \mathbf{X}'_c \gamma + \eta_i + \xi_{i,f,c,r}
\end{aligned}
\tag{2}
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where the dependent variable $y_{i,f,c,r}$ is the labor market outcome of worker i employed in firm f of region r in country c in 2014. We focus on workers' hourly wage and the likelihood of working on "atypical" working time (shift, weekend and night work) in the main body of the text. The likelihood to work overtime and the share of overtime hours worked are reported in the appendix table A2.

RTR_{rc} and LMI_c are our main explanatory variables which describe the reductions in region specific tariffs and the erosion of union density. We consider the interaction between the two variables, RTR_{rc} and LMI_c in order to study how the interplay between trade and labor market liberalization affect workers' wage and working conditions.[30]

The wages and working conditions of Eastern European workers do not solely depend on the changes in specific tariffs and in labor market regulations. We include in equation 2 a set of worker and a country specific controls to reduce any concern regarding potential bias from omitted variables. The set of worker specific controls ($\mathbf{\Phi}'_i$) includes a dummy for the size of the employing company which takes the value of one when firms are larger than 50 employees, an indicator for the type of contract which takes the value of one if the worker

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30. For the sake of simplicity in the interpretation of interaction coefficient α_3, variables RTR_{rc} and LMI_c are centered on their sample mean. So, for countries having experienced "average" trade and labor institution shocks, the contribution of the interaction term α_3 vanishes, and the coefficient attached to RTR_{rc} and LMI_c indicate respectively the average effect of trade and labor market institution changes.

has a part-time contract, and a gender dummy variable that takes the value of one for women.

In order to isolate the effect of trade liberalization from other factors such as migration and capital flows, in the set of country controls ($\mathbf{X}'_c$) we include the change in the country's net migration and a control for change in capital flows. Since the wages and working conditions might reflect changes in productivity or prices, in $\mathbf{X}'_c$ we also control for productivity shocks approximated by changes in country's per capita GDP and changes of the country specific CPI index. All these controls are computed as log difference between 1997 and 2014.

The set of worker-specific fixed effects η_i includes: (i) worker-firm match-specific factors (i.e., job-spell fixed effects), (ii) the age interacted by the level of education of workers (Education × Age fixed effects), (iii) 2-digits occupation specific fixed effects, and (iv) a fixed effect for the sector of the employing company.[31] We therefore exploit the variation of import tariffs liberalization across regions and within sector to analyze workers wages and worker conditions.

$\varepsilon_{i,f,c}$ is the error term. The baseline equation is estimated using OLS on a sample of 2,765,815 workers. The standard errors are allowed to be adjusted for clustering at the country and NUTS regional level to account for heteroskedasticity and non-independence across repeated observations within countries and regions.

5. Results

5.1. Baseline Results.

Table 3 shows the results of the baseline specification. The first two columns report results regarding the hourly wage of workers. The last two columns present the results on the worker's likelihood to work at night, during weekend or work in jobs that require shift schedules. Each specification includes specific workers characteristics and sector fixed effects. We therefore use the variation within sector and across regions between workers with similar characteristics to identify the effects of trade and labor market liberalization.

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31. Notice that this strategy is more conservative than controlling for the observable characteristics only. It requires a large number of workers within a cell to identify the effect of liberalization on the wage and employment of workers within cell across country.

The impact of tariffs liberalization on hourly wages is negative and significant at the 99 percent confidence level. Given workers, firms and country characteristics, this result suggests that workers in regions which faced larger import tariff reductions have lower relative wages. This finding supports the results of Dix-Carneiro & Kovak (2017, 2019) on the impact of trade liberalization on wages of Brazilian workers. The coefficient estimate of -0.005 in column (1) indicates that the average worker in regions facing 10 percentage points larger weighted tariff reduction has an hourly wage in 2014 which is about 5% smaller relative to the average. We do not find any statistical evidence on the impact of the reduction of union density on workers' hourly wage. A recent paper by Knepper (2020), suggests that trade unions and more generally collective bargaining agreements target employee benefits rather than wages. The coefficient of the LMI_c variable is negative as expected but falls below the conventional 90 percent level of significance.

In column (2), we interact the labor market institution and the trade liberalization variable to analyze whether the erosion of trade union modifies the impact of import tariff reductions. We find a negative and significant effect of the interacted coefficient, which suggests that labor markets liberalization magnifies the negative impact of trade liberalization on wages. Interestingly, the direct effect of the LMI_c variable becomes statistically significant with sign in line with intuition. This finding suggests that the decline in trade unions has a significant and negative effect on wages only once we account for the interplay with changes in the scale of trade liberalization across regions.

In columns (3) and (4), we examine the impacts of trade and labor market liberalizations on workers' likelihood of working on atypical working time (shift, weekend and night work). In column (3), trade liberalization does not influence the likelihood of working on atypical working time whereas the erosion in trade union rate has a positive and statistically significant impact. The latter finding suggests that the erosion of trade unions has pushed more workers to work on atypical working hours. In column (4), the change in magnitude and significance of the trade liberalization coefficient indicates the importance of examining the cross-effect of trade and labor market liberalization in affecting working conditions. We find that both the erosion of the union rates and trade liberalization deteriorate workers' working conditions. These effects reinforce each other - see interaction term in column (4).

Control variables have the expected signs, in line with previous studies. Namely, female Eastern European workers are paid less than male workers in line with the gender wage gap showed by Blau & Kahn (1994) for the US and Brainerd (2000) for Eastern European countries.[32] Moreover, we obtain overwhelming evidence of wage discrimination against workers holding temporary contracts. This result is in line with Blanchard & Landier (2002), Booth et al. (2002) and Perugini & Pompei (2017) respectively for French, UK and EEC workers.[33] We however do not find a degradation of working conditions for part-time workers. As expected large firms pay higher wages than smaller firms even after controlling for the quality of a worker – as we include a set of specific individual effects. Workers in large firms are also more exposed to atypical working time. These latter results suggest that workers employed in firms having more than 50 employees earn and work more than observationally equivalent workers in smaller firms.

As a first robustness check, in Table 4 we use the country specific measure of trade liberalization (RTR_c). We therefore identify the effect of tariffs liberalization across countries. Importantly, the estimations using the country-specific index produce the same qualitative results as before. We find negative and significant effect of trade liberalization on wages and on working conditions which is magnified by the erosion of trade unions. The order of magnitude are also similar to those presented in Table 3. In a second robustness check reported in Table A2 we use the probability of working over time and the share of overtime hours worked as dependent variables. Trade liberalization is associated with a higher probability of doing overtime work (extensive margin, in line with the deterioration of working condition discussed above) and a lower share of overtime workers (intensive margin).

– Insert Table 4 about here –

To assess the reliability of our results and interpretations, we conduct a series of placebo experiments. We randomly assign the values of the

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32. In particular, Brainerd (2000) show the increasing pattern of gender wage inequality in Easter European countries after the fall of the Iron Curtain.

33. Perugini & Pompei (2017) investigate the determinants of wage inequality in Central-Eastern European countries by employing EU-SILC microdata over the period 2007-2012, and show that workers holding a temporary contract suffer a statistically significant negative wage gap with respect to workers holding permanent positions.

liberalization variables and their interaction across the regions in our sample. We estimate specifications (2) and (4) of Table 3 using the permuted variables and repeat the exercise 3,000 times in total. The distribution of coefficients obtained from estimation of equation 2 on *randomized RTR_{rc}* and *LMI_c* variables are reported in figure 3. As expected, the average coefficient of the placebo variables distribute around zero. This indirectly confirms that the significance of the *observed RTR_{rc}* and *LMI_c* shocks in affecting wages and working conditions of workers.

<div align="center">– Insert Figure 3 about here –</div>

5.2. *Non-neutral Effects of Trade Liberalization and Union Erosion across Sectors, Firms and Worker types.*

Trade and labor market liberalization episodes are almost never neutral. By nature, they never benefit all workers equally, and they have distributional consequences. Both create economic opportunities for some activities, while reducing opportunities for others. As long as the expanding activities do not employ factors of production in the same proportion as contracting activities, relative demand for factors will change. And as long as supply reacts slower than demand, changes in demand imply important distributional outcomes. For this reason in what follows we report a set of sample stratification exercises aimed at testing the non-neutral effect of trade and labor market liberalization across sectors, firm and worker types.

In Table 5, we investigate the effects of trade and labor market liberalization on both wages and working conditions in manufacturing and in services industries.[34] We expect the baseline results to be particularly important for workers in the manufacturing sector because the trade liberalization variable is based on tariffs changes of tradable (i.e. manufacturing) products. Interestingly, our results suggest that tariffs-induced trade liberalization also affects services workers. The negative effects on wages across industries support the results of Dix-Carneiro & Kovak (2019). It also suggests that the tradable and non-tradable labor markets are sufficiently integrated that trade shocks affect workers in both industries. This integration may occur through changes in

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34. Services sectors are all sectors included in our sample with the exception of those affected by tariffs changes, i.e. the manufacturing and the mining and quarrying sectors as defined in the NACE rev2 classification.

consumer demand for local non-tradables or because workers compete for jobs in both the tradable and non-tradable sectors.[35] Demand shocks and competition among workers affect their working conditions. Our result suggest that the negative effects of trade liberalization on workers' wages and working conditions in both sectors are exacerbated by the erosion of trade unions.

– Insert Table 5 about here –

In Table 6, we examine whether changes in wages and working conditions are different across different population of workers. We define three broad categories of occupations according to the ISCO classifications: (i) high skilled jobs such as managers (H: ISCO 1), (ii) medium skilled jobs covering technical, administrative and skilled production workers (M: ISCO 2-8), and (iii) low skilled jobs or elementary occupations (L: ISCO 9).[36] All workers see a deterioration of their wages and working conditions due to trade and labor market liberalization, with a stronger wage effect on low skilled workers.

– Insert Table 6 about here –

We also investigate the effects of trade and labor market liberalization on workers' wages and working conditions by firms' type and size. The results are reported in Table 7. Almost 90% of Eastern European workers in our sample are employed in private firms. We therefore keep the sample of private firms and show that our main results remain. Finally, we run baseline regression on two sub-sample for large and small firms (i.e. firms with respectively more or less than 50 employees). We show that our main results remain unchanged in both sample, with a slightly stronger effect of RTR on wage and working condition of individuals employed in large firms..

– Insert Table 7 about here –

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35. The increase in import competition among manufacturing sectors might have implied a long-run movement of workers toward services sectors (internal mobility of workers) with the consequent reduction in wages also in non-tradable sectors that were not directly exposed to trade liberalization shocks.

36. ISCO classification developed by the ILO available here https://www.ilo.org/public/english/bureau/stat/isco/docs/publication08.pdf.

6. Quantitative Exercise

The empirical analysis discussed so far shows that trade liberalization has a negative impact on wages and working conditions of Eastern European workers, which is reinforced by the erosion of trade unions. To show that these effects are quantitatively relevant, we proceed with a counterfactual exercise that compares *predicted* labor market outcomes (i.e. wages and working conditions) in *presence* vs *absence* of trade liberalization and trade union erosion shocks. Namely, we compare the predicted labor market outcomes delivered by our complete econometric model in equation 2 (i.e. using observed RTR_{rc} and LMI_c shocks) with the counterfactual predicted wage and working condition assuming respectively the absence of trade liberalization shock (RTR_{rc} index equal to zero) and the absence of trade union erosion (LMI_c index equal to zero). These two counterfactual scenarios are computed as follows:

$$\hat{y}_{i,f,c,r}^{RTR=0} = \hat{\alpha}_0 + \hat{\alpha}_2 LMI_c + \mathbf{\Phi}'_i\hat{\alpha} + \mathbf{X}'_c\hat{\gamma} + \hat{\eta}_i + \xi_{i,f,c,r} \tag{3}$$

$$\hat{y}_{i,f,c,r}^{LMI=0} = \hat{\alpha}_0 + \hat{\alpha}_1 RTR_{rc} + \mathbf{\Phi}'_i\hat{\alpha} + \mathbf{X}'_c\hat{\gamma} + \hat{\eta}_i + \xi_{i,f,c,r} \tag{4}$$

where coefficients $\hat{\alpha}$, $\hat{\gamma}$ and $\hat{\eta}$ are obtained from estimation of equation 2. In Table 8, for each country-region in the sample, we show the difference in predicted wage and working condition between the the *counterfactual* scenario (obtained as in equation 3 and 4 respectively) and the *real* scenario (based on observed values of RTR_{rc} and LMI_c).[37]

– Insert Tale 8 about here –

The two first columns indicate the country and region considered.[38] The two following columns give the predicted change in hourly wage (in %) and the predicted change in the share of workers doing atypical hours (in pp)[39]

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37. By using the fit of the estimated equation 2 and forcing the zero respectively the indices RTR_{rc} and LMI_c, we implicitly assume all other factors and shocks happened over the period to be unaffected by RTR_{rc} and LMI_c; i.e. partial equilibrium approach.

38. For countries where there is no regional decomposition at the NUTS 1-digit level, then the counterfactual correspond to the entire country and the region field is left blank.

39. We go from the comparison of predicted probability to work in shift to the change in the share of the population doing this type of work by multiplying this counterfactual change with the share of the workforce concerned by atypical work. For instance, if the counterfactual change

in the absence of tariff liberalization. For most regions, wages would have been higher and the share of workers doing shift-work lower in the absence of tariff liberalization.[40] In particular, in absence of trade liberalization, the hourly wage of Hungarian workers would have been from 77% to 85% higher (depending on the region). An interesting exception is Poland, that would have experienced higher shares of shift-workers in absence of the EU-induced trade liberalization. This counterfactual isolates the effect of labour market liberalization and highlights the relevance of looking at the interaction between the two liberalizations. Hence, Romanian workers would have been much better off in the absence of tariff liberalization as it magnified the negative effect of labor market liberalization. Interestingly, Estonian workers would have lower hourly wages in that situation. This peculiarity comes from the total free-trade approach of Estonia before the EU enlargement, meaning that tariffs actually increased when the country joined the European Union in 2004.

The two last columns shows the changes in labor market outcomes when union densities are considered unchanged over the period. In all country-regions, with constant labor market institutions the share of workers doing shift (night or weekend) work would have been lower, and wage higher. In particular, in absence of trade union erosion, the hourly wage of Hungarian workers would have been from 33% to 46% higher (depending on the region). Interestingly, working conditions in Baltic Republics would have been worse off in the absence of labor market liberalization.

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in probability is -30% , workers who were already working in shifts will see their probability to do so decrease from 100% to 70%. If they represent half of the workforce, the counterfactual change in the share of shift-workers is therefore -15% points. If the counterfactual change is positive, only some of the workers not working in shifts will start to do so.

40. At first glance, the positive changes in the share of workers doing atypical hours may appear of greater magnitude than negative share. This comes from the way this statistics has been computed: if the change is positive only workers not doing shift-work in the baseline are affected and have a greater probability to do so. While a negative change will affect workers already working in shift. In most countries the share of workers doing atypical hours is less than half. Hence, a positive change will be imputed to a larger share of the workforce and result in a greater number.

7. Conclusion

We use a novel worker-level Eurostat dataset containing precise information on earnings and individual characteristics to study the impact in terms of wages and working conditions of the tariffs liberalization that accompanied the EU enlargements in Eastern European countries over the period 1997-2014. We also make use of the multi-country aspect of our dataset to understand the link between tariffs liberalization and the labor market liberalization that characterized the EECs over the same period. We find that tariffs liberalization had a negative effect on hourly wages and increased the share of workers doing shift-work and overtime hours. Labor market liberalization, here approximated by trade unions erosion, exacerbated this loss of wages and degradation in working conditions. Then we proceed to test the non-neutrality of firm and individual characteristics. We find that low skilled occupations were more affected by trade and labor market liberalization, and that the wage and working condition erosion effect of trade liberalization were more pronounced for individuals employed by large firms. Finally we conduct a range of scenarios analysis in order to quantify our findings. In particular, there had not been any labor market liberalization, hourly wages in Poland would be from 32.5% to 42.3% higher (depending on the region), and the share of workers doing shift work from 18.6% to 21.5% less in Romania.

Bibliography

Autor, D. H., Dorn, D. & Hanson, G. H. (2013), 'The geography of trade and technology shocks in the united states', *American Economic Review* **103**(3), 220–25.

Blanchard, O. & Landier, A. (2002), 'The perverse effects of partial labour market reform: fixed-term contracts in france', *The Economic Journal* **112**(480), F214–F244.

Blau, F. D. & Kahn, L. M. (1994), 'Rising wage inequality and the us gender gap', *The American Economic Review* **84**(2), 23–28.

Booth, A. L., Francesconi, M. & Frank, J. (2002), 'Temporary jobs: Stepping stones or dead ends?', *The Economic Journal* **112**(480), F189–F213.

Brainerd, E. (2000), 'Women in transition: Changes in gender wage differentials in eastern europe and the former soviet union', *ILR Review* **54**(1), 138–162.

Bronstein, A. S. (2003), Labour law reform in the EU candidate countries : achievements and challenges, Technical report.

Cazes, S. (2002), 'Do labour market institutions matter in transition economies? an analysis of labour market flexibility in the late nineties', *An Analysis of Labour Market Flexibility in the Late Nineties* .

Colantone, I., Crinò, R. & Ogliari, L. (2019), 'Globalization and mental distress', *Journal of International Economics* **119**(C), 181–207.

Colantone, I. & Stanig, P. (2018), 'The Trade Origins of Economic Nationalism: Import Competition and Voting Behavior in Western Europe', *American Journal of Political Science* **62**(4), 936–953.

Costa, G. (2003), 'Shift work and occupational medicine: an overview', *Occupational Medicine* **53**(2), 83–88.

Cottini, E. & Lucifora, C. (2013), 'Mental health and working conditions in europe', *ILR Review* **66**(4), 958–988.

Dippel, C., Gold, R., Helblich, S. & Pinto, R. (2020), 'The effect of trade on workers and voters', *Economic Journal* **conditionally accepted**.

Dix-Carneiro, R. & Kovak, B. K. (2017), 'Trade Liberalization and Regional Dynamics', *American Economic Review* **107**(10), 2908–2946.

Dix-Carneiro, R. & Kovak, B. K. (2019), 'Margins of labor market adjustment to trade', *Journal of International Economics* **117**, 125 – 142.

Edmonds, E. V., Pavcnik, N. & Topalova, P. (2010), 'Trade Adjustment and Human Capital Investments: Evidence from Indian Tariff Reform', *American Economic Journal: Applied Economics* **2**(4), 42–75.

Fajgelbaum, P. D., Goldberg, P. K., Kennedy, P. J. & Khandelwal, A. K. (2020), 'The return to protectionism', *The Quarterly Journal of Economics* **135**(1), 1–55.

Fialová, K. & Schneider, O. (2009), 'Labor market institutions and their effect on labor market performance in the new eu member countries.', *Eastern European Economics* **47**(3), 57 – 83.

Gebel, M. (2008), *Europe enlarged: A handbook of education, labour and welfare regimes in Central and Eastern Europe*, 1 edn, Bristol University Press.

Harrington, J. (1994), 'Shift work and health–a critical review of the literature on working hours', *Annals of the Academy of Medicine, Singapore* **23**(5), 699—705.

Knepper, M. (2020), 'From the fringe to the fore: Labor unions and employee compensation', *Review of Economics and Statistics* **102**(1), 98–112.

Kovak, B. K. (2013), 'Regional effects of trade reform: What is the correct measure of liberalization?', *American Economic Review* **103**(5), 1960–76.

Marchand, A., Demers, A. & Durand, P. (2005), 'Do occupation and work conditions really matter? a longitudinal analysis of psychological distress experiences among canadian workers', *Sociology of Health & Illness* **27**(5), 602–627.

Perugini, C. & Pompei, F. (2017), 'Temporary jobs, institutions, and wage inequality within education groups in central-eastern europe', *World Development* **92**, 40 – 59.

Pikhart, H., Bobak, M., Pajak, A., Malyutina, S., Kubinova, R., Topor, R., Sebakova, H., Nikitin, Y. & Marmot, M. (2004), 'Psychosocial factors at work and depression in three countries of central and eastern europe', *Social Science & Medicine* **58**(8), 1475 – 1482. Health inequalities and the psychosocial environment.

Riboud, M., Sanchez-Paramo, C. & Silva-Jauregui, C. (2002), *Does Eurosclerosis Matter? Institutional Reform and Labor Market Performance in Central and Eastern Europe*, The World Bank.

Richard, F. (1994), What Direction for Labor Market Institutions in Eastern and Central Europe?, *in* O. Blanchard, K. . Froot & J. Sachs, eds, 'Transition in Eastern Europe', Vol. 2 of *NBER*, University of Chicago Press, chapter 8.

Richardson, J. D. (1995), 'Income inequality and trade: How to think, what to conclude', *Journal of Economic Perspectives* **9**(3), 33–55.

Robone, S., Jones, A. & Rice, N. (2011), 'Contractual conditions, working conditions and their impact on health and well-being', *The European Journal*

of Health Economics **12**(5), 429–444.

Rogerson, R. (2008), 'Structural Transformation and the Deterioration of European Labor Market Outcomes', *Journal of Political Economy* **116**(2), 235–259.

Romalis, J. (2007), 'Nafta's and cusfta's impact on international trade', *The Review of Economics and Statistics* **89**(3), 416–435.

The European Commission (2006), Enlargement, two years after:an economic evaluation, Technical report, European Commission.

Topalova, P. (2007), Trade Liberalization, Poverty and Inequality: Evidence from Indian Districts, *in* 'Globalization and Poverty', NBER Chapters, National Bureau of Economic Research, Inc, pp. 291–336.

Topalova, P. (2010), 'Factor Immobility and Regional Impacts of Trade Liberalization: Evidence on Poverty from India', *American Economic Journal: Applied Economics* **2**(4), 1–41.

FIGURE 1. **Change in Applied MFN Tariffs between 1997 and 2014 by Country**
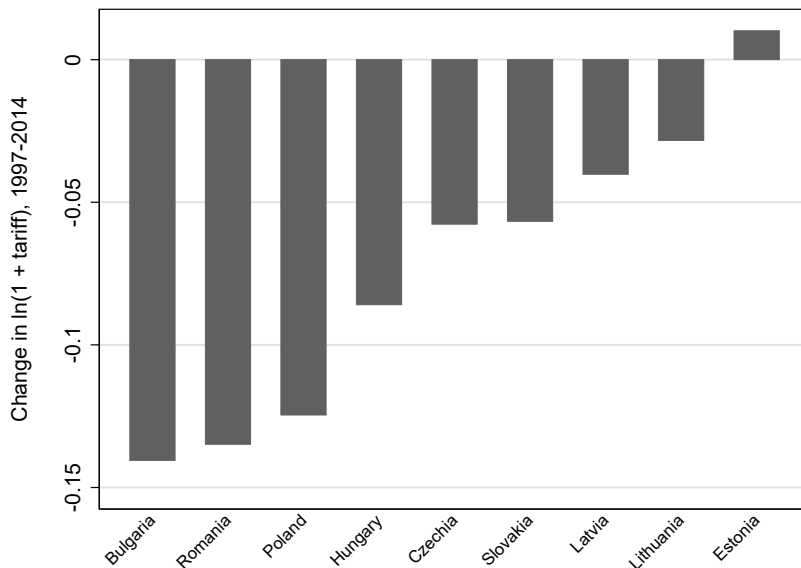
FIGURE 2. **Change in Applied MFN Tariffs between 1997 and 2014 by Sector**
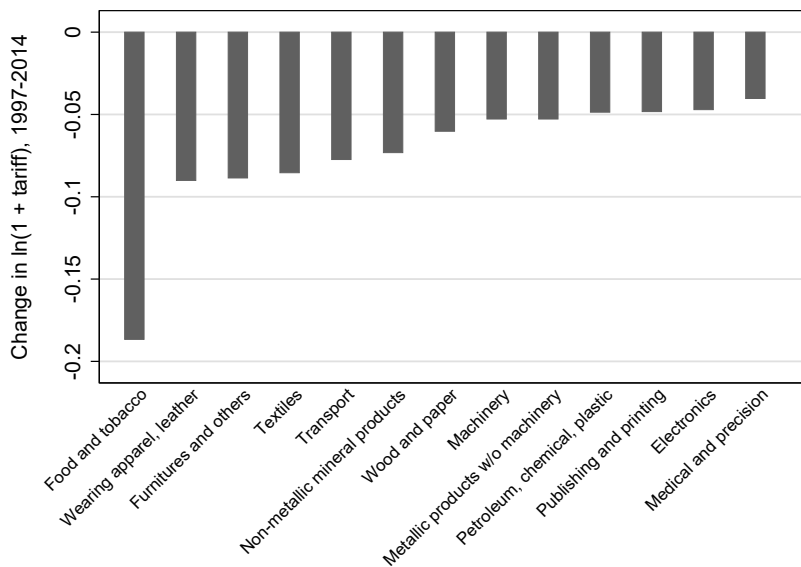
Table 1. **Change in Union Density in Eastern European Countries**

	Union Density in 2014 (%)	Δ relative to pre-enlargement period (pp)
Bulgaria	14	-15.7
Czech Rep.	12.9	-19.2
Estonia	5.5	-11.6
Hungary	10.2	-17
Lithuania	8.1	-6.5
Latvia	12.7	-18.3
Poland	12.8	-6.4
Romania	22.1	-23
Slovakia	12.8	-23.4

Source: data extracted from the ICTWSS database, except for Latvia for which we use national sources. Because of data availability, we use 1998 as pre-enlargement year, except for Lithuania (1999) and 2012 instead of 2014 for Romania.

Table 2. **Descriptive Statistics**

	Mean	Std. dev.
Hourly wage (log)	1.51	0.60
Shift, weekend, night work (1/0)	0.43	0.50
RTR_{rc} (Normalized)	55.13	25.26
RTR_c (Normalized)	57.65	26.19
LMI_c (Union density)	0.18	0.06
LMI_c (Coverage rate)	0.28	0.18
LMI_c (Minimum wage)	5.13	7.67
Part-time	0.19	0.39
Large firm	0.87	0.33
Women	0.44	0.50
Δ_{97-14} Productivity	0.52	0.14
Δ_{97-14} Net migration	0.07	3.96
Δ_{97-14} Capital flows	-0.05	0.02
Δ_{97-14} CPI index	0.75	0.48

TABLE 3. **Baseline Results**

Dep. Variable	Wages		Night–Weekend–Shift Work	
	(1)	(2)	(3)	(4)
RTR_{rc}	-0.005***	-0.014***	-0.000	0.007***
	(0.001)	(0.002)	(0.000)	(0.002)
LMI_c	-0.512	-1.515***	0.955***	1.877***
	(0.399)	(0.318)	(0.249)	(0.324)
RTR_{rc} x LMI_c		-0.116***		0.106***
		(0.029)		(0.030)
Large firm	0.248***	0.254***	0.147***	0.141***
	(0.018)	(0.018)	(0.020)	(0.021)
Part-time	-0.127***	-0.123***	0.003	-0.000
	(0.017)	(0.016)	(0.015)	(0.016)
Women	-0.175***	-0.175***	-0.050***	-0.050***
	(0.013)	(0.013)	(0.008)	(0.008)
Δ_{97-14} Productivity	Yes	Yes	Yes	Yes
Δ_{97-14} Net migration	Yes	Yes	Yes	Yes
Δ_{97-14} Capital flows	Yes	Yes	Yes	Yes
Δ_{97-14} CPI index	Yes	Yes	Yes	Yes
Education x Age	Yes	Yes	Yes	Yes
Occupation	Yes	Yes	Yes	Yes
Sector	Yes	Yes	Yes	Yes
Job Spell	Yes	Yes	Yes	Yes
Observations	2,765,815	2,765,815	2,765,815	2,765,815
Adj. R^2	0.599	0.601	0.413	0.415
Countries	9	9	9	9
Regions	20	20	20	20

Note: Dependent variable is the log (hourly) wages and dummy variable equal to 1 if the individual works in shift, during weekend or at night in 2014. RTR_{rc} is the change in the weighted regional tariffs between 1997 and 2014. LMI_c is the change in the percentage of unionized workers between 1998 and 2014. Standard errors adjusted for clustering by NUTS regions and country are in parentheses. ***, **, * significantly different from 0 at the 1%, 5%, and 10% levels respectively.

Table 4. **Using Country-Specific Measure of Trade Liberalization**

Dep. Variable	Wages		Night–Weekend–Shift Work	
	(1)	(2)	(3)	(4)
RTR_c	-0.005***	-0.015***	-0.000	0.009***
	(0.001)	(0.002)	(0.000)	(0.003)
LMI_c	-0.522	-1.774***	0.968***	2.244***
	(0.435)	(0.264)	(0.285)	(0.390)
RTR_c x LMI_c		-0.132***		0.135***
		(0.028)		(0.037)
Large firm	0.247***	0.255***	0.147***	0.139***
	(0.020)	(0.020)	(0.024)	(0.024)
Part-time	-0.128***	-0.124***	0.003	-0.001
	(0.022)	(0.022)	(0.024)	(0.024)
Women	-0.175***	-0.175***	-0.050***	-0.050***
	(0.016)	(0.016)	(0.009)	(0.009)
Δ_{97-14} Productivity	Yes	Yes	Yes	Yes
Δ_{97-14} Net migration	Yes	Yes	Yes	Yes
Δ_{97-14} Capital flows	Yes	Yes	Yes	Yes
Δ_{97-14} CPI index	Yes	Yes	Yes	Yes
Education x Age	Yes	Yes	Yes	Yes
Occupation	Yes	Yes	Yes	Yes
Job Spell	Yes	Yes	Yes	Yes
Sector	Yes	Yes	Yes	Yes
Observations	2,765,815	2,765,815	2,765,815	2,765,815
Adj. R^2	0.599	0.600	0.413	0.415
Countries	9	9	9	9

Note: Dependent variable is the log (hourly) wages and dummy variable equal to 1 if the individual works in shift, during weekend or at night in 2014. RTR_c is the weighted tariffs reduction variable between 1997 and 2014. LMI_c is the fall in the percentage of unionized workers between 1998 and 2014. Standard errors adjusted for clustering by country are in parentheses. ***, **, * significantly different from 0 at the 1%, 5%, and 10% levels respectively.

FIGURE 3. **Trade and Labour Market Liberalization Coefficients Estimated with Permutted Values on Wage (left) and Shift-work (right) Outcomes**
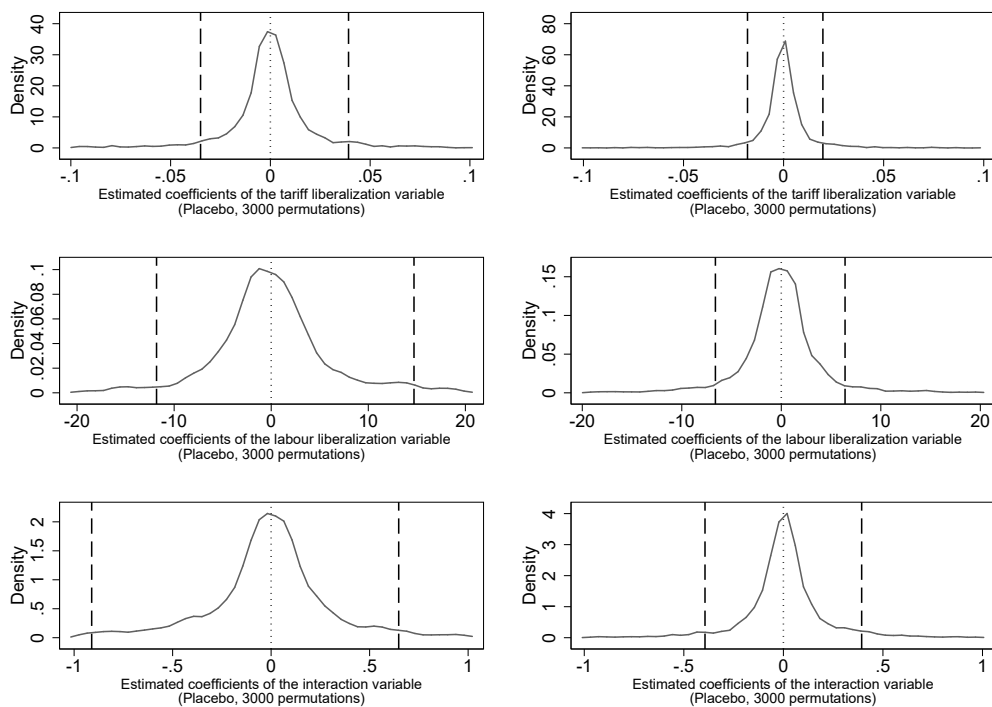
Table 5. **Manufacturing and Services Industries**

Sector	Manufacturing		Services	
Dep. Variable	Wages	Night–Weekend–Shift Work	Wages	Night–Weekend–Shift Work
	(1)	(2)	(3)	(4)
RTR_{rc}	-0.012***	0.008***	-0.015***	0.006***
	(0.002)	(0.003)	(0.002)	(0.002)
LMI_c	-1.466***	2.023***	-1.512***	1.658***
	(0.367)	(0.387)	(0.323)	(0.311)
RTR_{rc} x LMI_c	-0.088**	0.110***	-0.130***	0.097***
	(0.031)	(0.036)	(0.030)	(0.027)
Large firm	0.298***	0.201***	0.233***	0.113***
	(0.020)	(0.024)	(0.019)	(0.022)
Part-time	-0.104***	-0.008	-0.128***	0.010
	(0.014)	(0.010)	(0.023)	(0.021)
Women	-0.213***	-0.054***	-0.148***	-0.048***
	(0.011)	(0.007)	(0.016)	(0.009)
Δ_{97-14} Productivity	Yes	Yes	Yes	Yes
Δ_{97-14} Net migration	Yes	Yes	Yes	Yes
Δ_{97-14} Capital flows	Yes	Yes	Yes	Yes
Δ_{97-14} CPI index	Yes	Yes	Yes	Yes
Education x Age	Yes	Yes	Yes	Yes
Occupation	Yes	Yes	Yes	Yes
Sector	Yes	Yes	Yes	Yes
Job Spell	Yes	Yes	Yes	Yes
Observations	1,271,154	1,271,154	1,494,661	1,494,661
Adj. R^2	0.617	0.395	0.597	0.402
Countries	9	9	9	9
Regions	20	20	20	20

Note: Dependent variable is the log (hourly) wages and dummy variable equal to 1 if the individual works in shift, during weekend or at night in 2014. RTR_{rc} is the change in regional tariffs between 1997 and 2014. LMI_c is the fall in the percentage of unionized workers between 1998 and 2014. Manufacturing gather all workers in the mining and quarrying sector and the manufacturing sector, as defined in the NACE rev2 classification. Services gather all workers from other sectors included in our analysis. Standard errors adjusted for clustering by NUTS regions and country are in parentheses. ***, **, * significantly different from 0 at the 1%, 5%, and 10% levels respectively.

TABLE 6. **Results by Type of Occupation**

Type of occupation	Low		Medium		High	
Dep. Variable	Wages	Night–Weekend Shift Work	Wages	Night–Weekend Shift Work	Wages	Night–Weekend Shift Work
	(1)	(2)	(3)	(4)	(5)	(6)
RTR_{rc}	-0.021***	0.007***	-0.016***	0.008***	-0.008**	0.006***
	(0.001)	(0.002)	(0.002)	(0.002)	(0.004)	(0.001)
LMI_c	-2.801***	1.869***	-1.811***	2.086***	-0.962*	1.481***
	(0.320)	(0.306)	(0.372)	(0.333)	(0.529)	(0.155)
RTR_{rc} x LMI_c	-0.199***	0.110***	-0.141***	0.122***	-0.063	0.089***
	(0.024)	(0.028)	(0.033)	(0.029)	(0.047)	(0.015)
Large firm	0.166***	0.154***	0.240***	0.154***	0.470***	0.050***
	(0.014)	(0.022)	(0.020)	(0.021)	(0.030)	(0.008)
Part-time	0.002	0.032*	-0.153***	0.017	-0.233***	-0.006
	(0.021)	(0.017)	(0.017)	(0.021)	(0.043)	(0.007)
Women	-0.131***	-0.043***	-0.181***	-0.062***	-0.217***	0.017***
	(0.017)	(0.010)	(0.012)	(0.009)	(0.039)	(0.005)
Δ_{97-14} Productivity	Yes	Yes	Yes	Yes	Yes	Yes
Δ_{97-14} Net migration	Yes	Yes	Yes	Yes	Yes	Yes
Δ_{97-14} Capital flows	Yes	Yes	Yes	Yes	Yes	Yes
Δ_{97-14} CPI index	Yes	Yes	Yes	Yes	Yes	Yes
Education x Age	Yes	Yes	Yes	Yes	Yes	Yes
Occupation	No	No	No	No	No	No
Sector	Yes	Yes	Yes	Yes	Yes	Yes
Job Spell	Yes	Yes	Yes	Yes	Yes	Yes
Observations	217,816	217,816	2,368,812	2,368,812	179,187	179,187
Adj. R^2	0.595	0.407	0.506	0.369	0.391	0.285
Countries	9	9	9	9	9	9
Regions	20	20	20	20	20	20

Note: Dependent variable is the log (hourly) wages and dummy variable equal to 1 if the individual works in shift, during weekend or at night in 2014. RTR_{rc} is the change in regional tariffs between 1997 and 2014. LMI_c is the fall in the percentage of unionized workers between 1998 and 2014. "High" occupations are managers, "Low" occupation are elementary occupations, as defined in the ISCO-08 classification, and "Medium" occupations are all other occupations. Standard errors adjusted for clustering by NUTS regions and country are in parentheses. ***, **, * significantly different from 0 at the 1%, 5%, and 10% levels respectively.

TABLE 7. **Private, Small and Large Firms**

Sector	Private firms		Small firms		Large firms	
Dep. Variable	Wages	Night–Weekend Shift Work	Wages	Night–Weekend Shift Work	Wages	Night–Weekend Shift Work
	(1)	(2)	(3)	(4)	(5)	(6)
RTR_{rc}	-0.015***	0.007**	-0.014***	0.004***	-0.013***	0.007***
	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)
LMI_c	-1.554***	1.862***	-1.267**	1.185***	-1.379***	1.854***
	(0.333)	(0.351)	(0.524)	(0.269)	(0.339)	(0.307)
RTR_{rc} x LMI_c	-0.136***	0.099***	-0.105***	0.066***	-0.115***	0.104***
	(0.031)	(0.032)	(0.031)	(0.015)	(0.033)	(0.030)
Large firm	0.267***	0.142***				
	(0.019)	(0.024)				
Part-time	-0.116***	0.004	-0.072***	0.008	-0.122***	-0.001
	(0.015)	(0.016)	(0.020)	(0.008)	(0.017)	(0.017)
Women	-0.175***	-0.048***	-0.079***	-0.014***	-0.188***	-0.058***
	(0.014)	(0.009)	(0.012)	(0.004)	(0.009)	(0.007)
Δ_{97-14} Productivity	Yes	Yes	Yes	Yes	Yes	Yes
Δ_{97-14} Net migration	Yes	Yes	Yes	Yes	Yes	Yes
Δ_{97-14} Capital flows	Yes	Yes	Yes	Yes	Yes	Yes
Δ_{97-14} CPI index	Yes	Yes	Yes	Yes	Yes	Yes
Education x Age	Yes	Yes	Yes	Yes	Yes	Yes
Occupation	Yes	Yes	Yes	Yes	Yes	Yes
Sector	Yes	Yes	Yes	Yes	Yes	Yes
Job Spell	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,440,093	2,440,093	351,568	351,568	2,414,247	2,414,247
Adj. R^2	0.609	0.425	0.553	0.154	0.585	0.388
Countries	9	9	9	9	9	9
Regions	20	20	20	20	20	20

Note: Dependent variable is the log (hourly) wages and dummy variable equal to 1 if the individual works in shift, during weekend or at night in 2014. RTR_{rc} is the change in regional tariffs between 1997 and 2014. LMI_c is the fall in the percentage of unionized workers between 1998 and 2014. Private firms are firms whose private ownership is more than 50%. Small firms have less than 50 employes, large firms have more than 50 employees. Standard errors adjusted for clustering by NUTS regions and country are in parentheses. ***, **, * significantly different from 0 at the 1%, 5%, and 10% levels respectively.

TABLE 8. **Counterfactual Changes in Wages and Work at Atypical Hours**

Counterfactual		No tariff liberalization		No labour market liberalization	
Country	Region	Wages	Night–Weekend Shift Work	Wages	Night–Weekend Shift Work
Bulgaria	North and East	113.6%	-4.7%	103.3%	-9.6%
	South West and Central	103.3%	-3.7%	86.9%	-7.0%
Czechia	-	63.9%	-26.2%	-2.1%	-5.4%
Estonia	-	-0.1%	0.0%	-56.8%	42.3%
Hungary	Central Hungary	76.6%	-5.8%	33.0%	-5.9%
	Transdanubia	78.7%	-10.2%	36.1%	-10.7%
	Great Plain and North	85.4%	-10.2%	46.2%	-12.1%
Lithuania	-	2.8%	13.3%	-6.7%	2.5%
Latvia	-	42.0%	-1.1%	-27.6%	15.7%
Poland	Centralny	7.0%	42.5%	41.7%	-4.3%
	Południowy	6.3%	32.9%	34.1%	-7.7%
	Wschodni	7.0%	38.9%	41.0%	-7.0%
	Północno-Zachodni	7.1%	40.8%	42.3%	-6.2%
	Południowo-zachodni	6.1%	32.8%	32.5%	-6.9%
	Północny	6.8%	39.4%	39.7%	-5.7%
Romania	Macroregion one	190.7%	-16.0%	142.6%	-18.6%
	Macroregion two	199.2%	-16.3%	154.0%	-19.4%
	Macroregion three	193.0%	-18.5%	145.7%	-21.5%
	Macroregion four	191.2%	-17.2%	143.2%	-19.9%
Slovakia	-	85.7%	-19.8%	-0.2%	-4.0%

Note: This table shows how the log (hourly) wages and the share of workers doing shift, night or weekend work would be affected if there had been no tariffs liberalization or labor market liberalization. The table contains percentage changes for hourly wages and percentage point change for the shift work variable. The specification used for these results is presented in 3, columns 2 and 4. Regions for each country are based on the 2014 NUTS classification at the 1-digit. The number corresponds to the offical number used to describe a given region in that classification. For Czechia, Estonia, Lithuania, Latvia and Slovakia, there is no subdivision at the 1-digit level : it corresponds to the entire country.

Appendix A: Tables

TABLE A1. **Eastern European Countries' share of total imports originating from non-EU 15 countries. Years 1997, 2014 and percentage change**

Country	Import Share 1997 (in %)	Import Share 2014 (in %)	% Change
Bulgaria	65	60	-8
Czech Republic	39	53	35
Estonia	42	60	43
Hungary	39	50	29
Lithuania	55	65	16
Latvia	55	67	23
Poland	39	51	32
Romania	48	50	3
Slovakia	58	66	14

Source: Authors' calculation on BACI (CEPII) data.

TABLE A2. **Results on Overtime Hours**

Dep. Variable	Overtime Work		Overtime as Share of Hours Worked	
	(1)	(2)	(3)	(4)
RTR_{rc}	0.000	0.005***	0.000	-0.019***
	(0.000)	(0.001)	(0.001)	(0.005)
LMI_c	0.442***	0.992***	-1.220**	-1.476***
	(0.137)	(0.218)	(0.523)	(0.249)
RTR_{rc} x LMI_c		0.063***		-0.224***
		(0.018)		(0.058)
Large firm	0.091***	0.087***	-0.002	0.008
	(0.007)	(0.007)	(0.018)	(0.015)
Part-time	0.011*	0.009	0.030*	0.031**
	(0.005)	(0.005)	(0.015)	(0.015)
Women	-0.046***	-0.046***	-0.177***	-0.176***
	(0.008)	(0.008)	(0.029)	(0.029)
Δ_{97-14} Productivity	Yes	Yes	Yes	Yes
Δ_{97-14} Net migration	Yes	Yes	Yes	Yes
Δ_{97-14} Capital flows	Yes	Yes	Yes	Yes
Δ_{97-14} CPI index	Yes	Yes	Yes	Yes
Education x Age	Yes	Yes	Yes	Yes
Occupation	Yes	Yes	Yes	Yes
Sector	Yes	Yes	Yes	Yes
Job Spell	Yes	Yes	Yes	Yes
Observations	2,765,815	2,765,815	797,987	797,987
Adj. R^2	0.228	0.229	0.0570	0.0578
Countries	9	9	9	9
Regions	20	20	20	20

Note: Dependent variable is a dummy variable equal to 1 if the individual works overtime and the share of overtime hours over all hours worked in 2014. The number of observation is reduced with the second dependent variable as only inviduals working overtime are considered. RTR_{rc} is the change in regional tariffs between 1997 and 2014. LMI_c is the change in the percentage of unionized workers between 1998 and 2014. Standard errors adjusted for clustering by NUTS regions and country are in parentheses. ***, **, * significantly different from 0 at the 1%, 5%, and 10% levels respectively.

Appendix B: Data Construction

B.1. Construction of the tariff liberalization variable

Following Dix-Carneiro & Kovak (2017), we build the tariff liberalization variable of each region-country by combining country-industry level tariffs decreases and region-industry weights β_{rck}:

$$RTR_{rc} = -\sum_k \beta_{rck} \Delta ln(1 + \tau_{ck}) \ \ with \ \ \beta_{rck} = \frac{\lambda_{rck} \frac{1}{\varphi_{ck}}}{\sum_{k'} \lambda_{rck'} \frac{1}{\varphi_{ck'}}} \tag{B.1}$$

The cost share of non-labor factors φ_{ck} and tariffs changes τ_{ck} are at the sector-country level.[41] In contrast, the labor shares λ_{rck} are at the sector-region level and obtained from two different sources. For most countries and regions, we can extract that information from the 2002 wave of the Structure of Earnings Survey.[42] For Poland and Bulgaria, information on the region where the surveyed individuals live had been removed by national authorities in 2002 due to anonymization reasons. We were able to retrieve indication on Polish Voivoideships and Bulgaria NUTS-1 regions in the local unit and employee identifiers of the survey.[43] For Hungary and Romania, regional information is not available in 2002 SES. Instead, we use the regional level Structural Business Survey of 2001 and 2002, respectively.

The classification of sector adopted in the SES data (Eurostat) is a decomposition made by Eurostat to harmonize SES data for different countries. It is slightly more aggregated than the 2-digit level NACE Rev. 1.

We obtain our tariff liberalization variable expressed in percentage points.[44] Finally, we standardize that variable to be between 0 (lowest value) and 100 (highest value). The final regional tariff liberalization variable exists for 20 regions spanning 9 countries.

As a robustness check, we use a country-level tariff liberalization variable. The only difference is that the labor share is at country-level and is obtained for all countries from the SES 2002.

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41. See sections B.2 and B.3 for additional details on their construction.

42. The Czech Republic, Estonia, Latvia, Lithuania and Slovakia do not have any NUTS 1-digit regional decomposition. Therefore their tariff liberalization is at the country-level. We have 6 regions in Poland, 4 in Romania, 3 in Hungary and 2 in Bulgaria.

43. For Bulgaria in both 2002 and 2014 SES, about 5% of the observations are dropped as we cannot allocate them to a region.

44. Only Estonia has a negative value for the tariff liberalization variable. It is the only country that had to increase its MFN tariffs when joining the EU.

B.2. Construction of cost share of non-labor factors of production

In [Dix-Carneiro & Kovak](2019), the cost-share of non-labor factors φ_{ck} is computed using the beginning of period gross operating surplus and total remuneration. For each sector k :

$$\varphi_{ck} = \frac{gos_{ck}}{gos_{ck} + rem_{ck}} \tag{B.2}$$

with gos_{ck} the gross operating surplus of sector k in country c and rem_{ck} the total amount of remuneration payed in the same sector.[45] Associated with the labor share λ_{rck}, it allows to account for the importance of the labor factor in the production function of each sector k.

We obtain the two components of φ_{ck} from Eurostat's Structural Business Survey (SBS). Optimally, we would only use 2002 data, to match the year of the labor share. However, at the 2-digit level they are several missing values for 2002 and surrounding years. Therefore, we compute an average of gos_{ck} and rem_{ck} over the 2000-2003 period, for each 2-digits NACE Rev. 1 sector. Then we aggregate the 2-digit sectors averages to match the ad-hoc classification used in the SES.[46] Finally we compute φ_{ck} as in equation B.2.

B.3. Construction of tariff changes

The main component of the tariff liberalization variable is the sectoral change in applied MFN tariff from 1997 to 2014. We choose 1997 as base year for two reasons. First, it helps to avoid any anticipation effect of trade to the perspective of the European integration of Eastern Europe. Second, the product-level WTO data we use to construct tariff changes is limited for the years before 1997.[47]

Sector level tariffs are a weighted sum of all product line belonging to the same sector. Weights ω_{ocpk}^{1997} correspond to the share of product p originating from country o in the total imports of a given sector k in a given country c in 1997.

$$\tau_{ck} = \sum_p \sum_o \omega_{ocpk}^{1997} \tau_{ocpk} \quad with \quad \omega_{ocpk}^{1997} = \frac{Imp_{ocpk}^{1997}}{\sum_{p'} \sum_{o'} Imp_{ocpk}^{1997}} \tag{B.3}$$

We keep the weighting scheme of 1997 to build 2014 sector level tariffs. Keeping the weights constant removes the issue of trade being endogenous to

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45. An alternative measure could use the wage-bill of the sector instead of the remunerations, but we try to be as close to possible to [Dix-Carneiro & Kovak](2019) who used "Remuneracoes" from Brazilian data sources.

46. For Slovakia and Latvia, missing data forces us to use an even slightly more aggregated sectoral classification.

47. For Slovakia and Romania we use respectively 1998 and 1999 due to a lack of information before.

tariffs reduction. Imports flows are taken from the BACI database. For the post-accession year 2014, although formally higher than zero, we set the *MFN* applied towards EU partners to zero and took the weighted average rate across EU end non-EU partners (with import share in 1997 used as a weight). It allows to account for the huge tariff liberalization implied by the zeroing of tariffs towards EU-partners after the accession to the common EU market. Ignoring this aspect of the heterogeneity in the drop in tariff would understate the extent of the liberalization. Once we have the sectoral level tariffs, we compute the log-difference by sector and country between 1997 and 2014.

Going from product level data in 1997 an 2014 to a change in sectoral tariffs involves several steps of aggregations. First, we use two different WTO files for the year 1997 and 2014. The former is at the HS 6-digit level while the later is at the 8-digit level. Among all 8-digit lines present in a 6-digit line, we only keep the one with the highest tariff rate.[48] Second, the HS classification used in the 1997 and 2014 WTO files and in BACI are not the same (resp. HS96, HS2012 and HS92). Therefore, we harmonize by converting everything to HS96. Only 7 product lines from are lost at this occasion, amounting to 0.01% of BACI observations at this point. We lose an additional 0.14% of BACI observations when merging with tariffs, due to lines for which we do not have assorted tariffs. Third, to allocate each product line to a sector, we use a conversion table from HS96 to ISIC Rev. 3 classification.[49] No observation is lost in that process. Finally, we need to have the exact same sectors as for the other components of the tariff liberalization variable.[50]

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48. The year 2011 being present in both dataset, we use it as a point of comparison to choose the adequate method of aggregation. Ultimately, the average difference between our reconstructed tariffs and the original 6-digit tariffs is only 0.05% for all products and 0.005% for non-agricultural products in 2011.

49. ISIC Rev. 3 is the UN equivalent to the NACE rev1 classification. They are are full comparable at the 2-digits level.

50. We use a slightly different decomposition for Slovakia and Latvia. See section B.2.

"Trade Liberalization, Wages and Working Conditions" Online Appendix

Table of Content

Appendix A: Data Construction

A.1. Overview of Variables

Dependent variables :

- Log of hourly wage : average gross hourly earnings in the reference month. It is expressed in € and contains the wage of both regular and overtime hours. Source : SES.
- Night-Weekend-Shift work : a dummy equal to 1 if the worker received premium payments during the reference month for shift work, night work or weekend work where these are not treated as overtime. Source : SES.
- Overtime hours : a dummy equal to 1 if the observation worked overtime during the reference month. Source : SES.
- Overtime hours as a share of total hours : the number of overtime hours divided by the total number of hours worked during the reference month. Source : SES.

Explanatory variables :

- Tariff liberalization : we follow Dix-Carneiro & Kovak (2017) to compute a regional level and a country-level index of tariff liberalization between 1997 and 2014. It combines data from the WTO for the product tariffs, BACI to allocate weights to tariffs lines, Eurostat's Structural Business Survey for the computation of the cost-share of non-labor factors and the share of workers by industry for Romania and Hungary and the SES for the share of workers by industry for the rest of the sample. Details on the construction of each part is available in Section B.

- Union density : it is expressed as the change in the share of unionized workers between 1998 and 2014. As it negative for all countries of the sample, we change its sign such it represents union erosion. For Lithuania we use 1999 instead of 1998 and for Romania 2012 instead of 2014. The main data source is the ICTWSS database. For Latvia, we use national data for the number of unionized workers in 1998.
- A note on centering : the tariff liberalization and union density variables are both centered on their baseline sample mean. This allows to express the effect as average sample effect when introducing the interaction term. For all specification on sub-samples, the mean used to center is the same as in the baseline in order to facilitate comparison between coefficients. Using sample-specific means for those regression usually does not alter significantly the results.

SES controls :

- Size of the firm : dummy equal to 1 if the company of the local unit of the observation has more than 50 employees.
- Temporary contract : dummy equal 1 if the observation has a temporary work contract.
- Sex : dummy equal to 1 if the observation is a woman, 0 if a man.

Country-level controls :

- GDP/capita : the log-difference of GDP/capita between 1997 and 2014 serves to control for aggregate demand shocks. Source : WDI.
- Immigration rate : % of immigrants in the total population and is given for every 5-years. We compute its log-difference between 1997 and 2014 and use it as a control for migration shocks that could affect wages and labor supply. Source : UN.
- Exposure to multinationals : there are two possible variables to account for the importance of multinational firms in the country : net foreign property income / GDP . We use the log-difference from between 1997 and 2014 of that variables to control for a shock of multinational implantation in the country. This is particularly relevant for Eastern countries which become production hub in European value chains during the decade of their European integration. Source : Eurostat national accounts.
- CPI : log-difference of the consumer price index, between 1997 and 2014 controls for price evolution due to the fall in tariffs. Source : WDI.

Other SES variables used as fixed-effects or for extensions :

- Age : individuals are split in 3 categories : 20-29, 30-49 and 50-59. Individuals over 59 and under 20 are excluded altogether from the sample. It is used for the extensions of Section B.3.
- Occupation : we use the occupations based on ISCO-08 at the 1-digit level as a fixed-effect. We aggregate in 3 groups when looking at the role of occupations.
- Job spell : 3 categories are used : workers in the company for less than year, in the company from 1 to 4 years and 5 years or more. It is used for the extensions of Section B.3.
- Education : 4 categories based on the ISCED 2011 classification. It is used as fixed-effects and for the extensions of Section B.3.
- Ownership : dummy equal to 1 if the company is publicly-owned. It is used for the regression by sample where we only keep workers from privately-owned companies.
- Sector : 14 categories based on NACE rev2 classification for the fixed-effects and 2 categories (manufacturing and mining and quarrying versus all other sectors) for the table presenting results by sector.
- Part-time of full-time : dummy equal to 1 if the observation works part-time (that is less than 100% of the full-time hours). It is used for the extensions of Section B.3.

A.2. Construction of the Union Density Variable

We measure union erosion with the change in union density, computed in the following way :

$$\Delta UD_c = -\left(\frac{Unionized_c^{2014}}{Workforce_c^{2014}} - \frac{Unionized_c^{1998}}{Workforce_c^{1998}} \right) \tag{A.A.1}$$

with $Unionized_c^t$ being the number of union members among employed workers in year t and $Workforce_c^t$ the total number of employed workers. As it negative for all countries of the sample, we change its sign. We use data from the ICTWSS dataset that does not provide data on a yearly basis. Therefore we use the most complete year as base, that is 1998, with a few exceptions: due to lack of data we use Latvian national data for the number of unionized workers in 1998 and we use 1999 as base year for Lithuania and 2012 as final year for Romania.

A.3. Classifications used for education, sectors and occupations

This part presents the different classification used for sectors, education levels and occupations that we need to conduct our study. In the case of occupation, we had we keep the ISCO-08 classification used in the SES 2014 but removed some specific occupation, as can be seen in Table A3. Another issue is that the

SES data spans over a period of 12 years during which many international classifications were updated and transformed more or less substantially. In particular the NACE classification for sector was updated to its second revision (Rev. 2) in 2008 and the ISCED classification for education level was modified in 2011.[51] As Eurostat decided to keep a certain level of comparability between the different SES waves, they had to create their own versions of sectoral and educational classification. This is explained below in Table A1 for sectors in 2002 and Table A4 for education in 2014. On top of that, to ensure the anonymity of survey participants, Eurostat required some national agency to reduce the level of precision of sector data. A harmonization is therefore necessary and is presented below in Table A2.

Sectors. The aggregation of manufacturing sub-sectors is not the same for all countries in the SES or SBS data, hence two correspondences were designed. The first one to match sectors from SES 2002 with the SBS. It is used to construct the tariff liberalization variable and is presented in table A1. Only Slovakia and Latvia use a different classification due to the missing values in the Structural Business Survey.

The second correspondence only concerns the SES 2014, where the classification for sectors is not the same for all countries. The most common classification is an intermediate between 1 and 2 digits of NACE Rev. 2. It was devised by Eurostat in order to ensure comparability of sectors over the different SES surveys : as they took place in 2002, 2006, 2010 and 2014, they encompass the change of NACE classification in 2008. The intermediate level of aggregation ensure sufficient comparability over the whole 2002-2014 period, even though this is not necessary in our study.

We need to harmonize the country-specific classifications in order to put sector fixed-effects in our regressions. Our correspondence, presented in table A2, results in 14 sectors.

Occupations. The SES data provides information on occupation of individuals at the 2 and 3-digits levels depending on the country and the year. Moreover there is a change of ISCO classification between the years 2006 and 2010. As we do not need the occupation information for 2002, we base our classification on what is available for the SES 2014. We aggregate at the 1-digits level as some occupations at the 2 or 3-digits level are not present in each and every country. However, we drop the occupation corresponding to drivers due to the mobile nature of the job, and also professors and educators, agriculture-related job and army personnel due to the absence of the corresponding sectors in our survey (education, agriculture and government employees). We therefore

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51. The ISCO classification for occupation went from ISCO-88 to ISCO-08 in 2008 but this does not affect us.

TABLE A1. **Sector correspondance between SBS and SES**

Nace Rev1	Most countries	Slovakia and Latvia
15	DA	DA
16	DA	DA
17	17	17
18	18, 19	18, 19, DF to DH
19	18, 20	18, 19, DF to DH
20	20, 21	20, 21
21	20, 21	20, 21
22	22	22
23	DF to DH	18 19 DF to DH
24	DF to DH	18 19 DF to DH
25	DF to DH	18 19 DF to DH
26	DI	DI
27	DJ	DJ
28	DJ	DJ
29	DK	DK
30	30 to 32	30 to 32
31	30 to 32	30 to 32
32	30 to 32	30 to 32
33	33	33
34	DM	DM
35	DM	DM
36	DN	DN
37	DN	DN

TABLE A2. **Sector harmonization in SES 2014**

Industry codes	Composition
B	Mining and quarrying
Manufacturing :	
10 to 12	Food, beverages and tobacco
13 to 15	Textile, wearing apparel and leather
16 to 18, 58 to 60	Wood, paper and publishing and media activities
19 to 23, 26, 27, 29 to 33	Coke, chemicals, rubber, plastic, electronics and transport equipment
24, 25, 28	Metals and machinery
35, 36	Electricity, gas and watetr
F	Construction
45, 46	Wholesale and retail trade of motor vehicles
47	Other wholesale and retail trade
I	Hotels and restaurants
49 to 52	Transport and support activities
53, 61 to 66, 69 to 71, 78, 80 to 82	Telecommunication, ICT, financial services, other business activities
68, 72 to 74, 77, 95	Real estate, R&D, marketing

have 8 occupation categories that are going to be used as fixed-effects in our regression.

TABLE A3. **Occupation classification**

ISCO-08	High, medium and low	Occupation title
1	High	Managers
2		Professionals
3		Technicians and associate professionals
4	Medium	Clerical support workers
5		Service and sales workers
7		Craft and related trades workers
8		Plant and machine operators, and assemblers
9	Low	Elementary occupations

Occupations removed from the sample :

0		Army personnel
6		Agricultural occupations
23		Teaching professionals
83		Drivers

Three categories are created to be used in the regressions on different occupation samples. High-skill occupation (ISCO 1) are gathering managers (7.9% of the full sample). Medium-skill occupations (ISCO 2-8) are professionals, associate professionals, clerks, service workers and salespersons, craft and trade workers and plant and machine operators (85.7% of the full sample). Low-skill workers (ISCO 9) are elementary occupations (6.5% of the full sample).

Education . We keep the 4 education categories provided by the SES 2014 as they are and use them as fixed effects. We also regroup two of those in order to have a decomposition in high, medium and low education level to use for the regression by sample in Section B.3. The classification is based on ISCED-2011.

Table A4. **Education classification**

High, medium and low	SES 2014	ISCED-2011	Education category
Low	1	0-1	Primary education
		2	Lower secondary education
Medium	2	3	Upper secondary education
		4	Post-secondary education
	3	5	Short-cycle tertiary education
		6	Bachelor or equivalent
High	4	7	Master or equivalent
		8	PhD or equivalent

Appendix B: Supplementary Results

This section presents additional results, that were not included in the main text of the paper, due to limitations of space. First, Table A1 reproduce the baseline estimations but without Romanian and Bulgarian regions to ensure the stability of our results on a sample containing only countries that joined th EU in 2004. The baseline effects are not affected by this change. Table A2 reproduced the baseline table but also includes coefficient of macroeconomic controls that were hidden in other tables to save space and clarity. It can be seen that according to our estimations larger productivity increase lead to higher wages and less atypical hours. Net migration is the difference between total immigration and emigration over the 1997-2014 period. It has a positive impact on wages. The capital flows shocks correspond to the difference between property income sent received from abroad and those sent abroad. A negative values means that foreign agents invested a lot in the country and correspond to higher FDIs. Here, foreign investment results in higher wages and an increase in the probability to work in shift. This last elements gives some insight regarding the role of foreign companies in the evolution of working conditions. As expected, the change in CPI index is positively associated with wages. It is also negatively correlated with shift-work.

Then Section B.3 contains extensions of our baseline on a wide variety of samples. We look at the effect of tariff and trade liberalizations on individual working for different length of time in the same company in Table A3. Wages of workers present in the same company for a long period of time (more than 5 years) are clearly less affected, while there is no difference regarding atypical hours. Table A4 splits the sample by age groups and shows that older workers are less affect by the liberalization. Table A5 compares the effect on workers of different education levels. No significant differences between groups is found. Table A6 shows that women's wages were more affected by the liberalizations

than men's. Tables A7 and A8 presents results by work schedule (full-time versus part-time workers) and type of contract (permanent versus temporary). While there is no significant effect of the type of contract, it is clear that part-time workers were hit harder by liberalizations, both in term of wages and probability to do night-weekend-shift work. At last, Table A9 test the differences between different occupation groups, using interaction rather than specific sample, as in Table 6. This is a more restrictive way of looking at the non-neutrality of occupation.[52] It confirms that union erosion plays a lesser role for high occupation individuals as the associated coefficient is not significant for managers regarding hourly wages.

Finally Section B.4 extends some of our results related to the ownership and the sector of firms. First, we compare public and private companies in Table A10. It seems that the adjustment is relies more on the wage channel for privately owned companies while the atypical hours channel is more prevalent in the public sector. We also test whether or not manufacturing industries react differently to services industries in Table A11, using interaction with a manufacturing dummy. Here, we look at marginal effect of manufacturing as we also include the on-interacted variables of interest. The results, in accordance with Table 5, show that manufacturing workers are more likely to work in shift that service workers, for the same decrease in unionization, highlighting the heterogeneity of the role of union across the economy. Finally, Table A12 and A13 present results similar to Table 5 but for each and every individual industry considered in this study.[53] This decomposition allows to see for instance, that in the "Electricity, gas and water" industry the adjustment goes all through the use of atypical hours. Considering the large role of public providers in that sector, the result is consistent with what was found in Table A10.

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52. Table 6 would be equivalent to Table A9 if all controls variables had also been interacted with occupation dummies.

53. See Table A2 for the list of sector and associated Nace Rev2 codes.

B.1. Baseline without Romania and Bulgaria

TABLE A1. **Without Romania and Bulgaria**

Dep. Variable	Wages		Night–Weekend–Shift Work	
	(1)	(2)	(3)	(4)
RTR_{rc}	-0.003***	-0.013**	0.001**	0.009***
	(0.000)	(0.005)	(0.000)	(0.003)
LMI_c	-0.115	-1.184**	1.377***	2.278***
	(0.111)	(0.540)	(0.156)	(0.331)
RTR_{rc} x LMI_c		-0.130*		0.109***
		(0.066)		(0.036)
Large firm	0.232***	0.231***	0.149***	0.150***
	(0.018)	(0.018)	(0.027)	(0.027)
Part-time	-0.133***	-0.133***	-0.006	-0.006
	(0.020)	(0.020)	(0.018)	(0.018)
Women	-0.188***	-0.188***	-0.055***	-0.055***
	(0.008)	(0.008)	(0.008)	(0.008)
Δ_{97-14} Productivity	Yes	Yes	Yes	Yes
Δ_{97-14} Net migration	Yes	Yes	Yes	Yes
Δ_{97-14} Capital flows	Yes	Yes	Yes	Yes
Δ_{97-14} CPI index	Yes	Yes	Yes	Yes
Education x Age	Yes	Yes	Yes	Yes
Occupation	Yes	Yes	Yes	Yes
Sector	Yes	Yes	Yes	Yes
Job Spell	Yes	Yes	Yes	Yes
Observations	2,474,104	2,474,104	2,474,104	2,474,104
Adj. R^2	0.519	0.519	0.407	0.407
Countries	7	7	7	7
Regions	14	14	14	14

Note: Dependent variable is the log (hourly) wages and dummy variable equal to 1 if the individual works in shift, during weekend or at night in 2014. RTR_{rc} is the change in the weighted regional tariffs between 1997 and 2014. LMI_c is the change in the percentage of unionized workers between 1998 and 2014. Standard errors adjusted for clustering by NUTS regions and country are in parentheses. ***, **, * significantly different from 0 at the 1%, 5%, and 10% levels respectively.

B.2. Baseline with Macroeconomic control variables Coefficients

TABLE A2. **With the coefficients of macroeconomic control variables**

Dep. Variable	Wages		Night–Weekend–Shift Work	
	(1)	(2)	(3)	(4)
RTR_{rc}	-0.005***	-0.014***	-0.000	0.007***
	(0.001)	(0.002)	(0.000)	(0.002)
LMI_c	-0.512	-1.515***	0.955***	1.877***
	(0.399)	(0.318)	(0.249)	(0.324)
RTR_{rc} x LMI_c		-0.116***		0.106***
		(0.029)		(0.030)
Large firm	0.248***	0.254***	0.147***	0.141***
	(0.018)	(0.018)	(0.020)	(0.021)
Part-time	-0.127***	-0.123***	0.003	-0.000
	(0.017)	(0.016)	(0.015)	(0.016)
Women	-0.175***	-0.175***	-0.050***	-0.050***
	(0.013)	(0.013)	(0.008)	(0.008)
Δ_{97-14} Productivity	1.914***	0.146	-0.958***	0.668
	(0.200)	(0.429)	(0.172)	(0.402)
Δ_{97-14} Net migration	0.079***	0.031**	-0.014*	0.030**
	(0.007)	(0.013)	(0.008)	(0.013)
Δ_{97-14} Capital flows	-5.286***	-1.982**	-4.389***	-7.428***
	(0.942)	(0.914)	(0.845)	(0.632)
Δ_{97-14} CPI index	0.123**	0.379***	-0.084***	-0.320***
	(0.055)	(0.070)	(0.028)	(0.076)
Education x Age	Yes	Yes	Yes	Yes
Occupation	Yes	Yes	Yes	Yes
Sector	Yes	Yes	Yes	Yes
Job Spell	Yes	Yes	Yes	Yes
Observations	2,765,815	2,765,815	2,765,815	2,765,815
Adj. R^2	0.599	0.601	0.413	0.415
Countries	9	9	9	9
Regions	20	20	20	20

Note: Dependent variable is the log (hourly) wages and dummy variable equal to 1 if the individual works in shift, during weekend or at night in 2014. RTR_{rc} is the change in the weighted regional tariffs between 1997 and 2014. LMI_c is the change in the percentage of unionized workers between 1998 and 2014. Net migration[14−97] is the difference between entry and exit of residents in the country over the whole period divided by the population in 1997. Δ^{14-97} Net property income is the log-difference between 1997 and 2014 of the net property income as a share of GDP. An increase of that variable means that the country is becoming less dependent on foreign capital or that it is investing more abroad. Standard errors adjusted for clustering by NUTS regions and country are in parentheses. ***, **, * significantly different from 0 at the 1%, 5%, and 10% levels respectively.

B.3. Extensions regarding Individual Characteristics

TABLE A3. **By Job Spell**

Job spell in years	(<1)		(1-5)		(5+)	
Dep. Variable	Wages	Night–Weekend Shift Work	Wages	Night–Weekend Shift Work	Wages	Night–Weekend Shift Work
	(1)	(2)	(3)	(4)	(5)	(6)
RTR_{rc}	-0.017***	0.007**	-0.015***	0.007***	-0.011***	0.007***
	(0.002)	(0.003)	(0.002)	(0.002)	(0.003)	(0.002)
LMI_c	-2.069***	1.902***	-1.516***	1.961***	-1.211***	1.770***
	(0.247)	(0.397)	(0.299)	(0.331)	(0.391)	(0.292)
RTR_{rc} x LMI_c	-0.157***	0.102**	-0.126***	0.110***	-0.089**	0.102***
	(0.022)	(0.036)	(0.027)	(0.030)	(0.036)	(0.027)
Large firm	0.201***	0.137***	0.254***	0.134***	0.280***	0.144***
	(0.019)	(0.023)	(0.019)	(0.022)	(0.021)	(0.019)
Part-time	-0.088***	0.023***	-0.117***	0.007	-0.128***	-0.052***
	(0.016)	(0.007)	(0.015)	(0.017)	(0.038)	(0.016)
Women	-0.125***	-0.026***	-0.146***	-0.038***	-0.214***	-0.065***
	(0.008)	(0.006)	(0.013)	(0.007)	(0.017)	(0.010)
Δ_{97-14} Productivity	Yes	Yes	Yes	Yes	Yes	Yes
Δ_{97-14} Net migration	Yes	Yes	Yes	Yes	Yes	Yes
Δ_{97-14} Capital flows	Yes	Yes	Yes	Yes	Yes	Yes
Δ_{97-14} CPI index	Yes	Yes	Yes	Yes	Yes	Yes
Education x Age	Yes	Yes	Yes	Yes	Yes	Yes
Occupation	Yes	Yes	Yes	Yes	Yes	Yes
Sector	Yes	Yes	Yes	Yes	Yes	Yes
Job Spell	No	No	No	No	No	No
Observations	436,595	436,595	916,288	916,288	1,412,932	1,412,932
Adj. R^2	0.575	0.457	0.596	0.423	0.570	0.400
Countries	9	9	9	9	9	9
Regions	20	20	20	20	20	20

Note: Dependent variable is the log (hourly) wages and dummy variable equal to 1 if the individual works in shift, during weekend or at night in 2014. RTR_{rc} is the change in regional tariffs between 1997 and 2014. LMI_c is the fall in the percentage of unionized workers between 1998 and 2014. Standard errors adjusted for clustering by NUTS regions and country are in parentheses. ***, **, * significantly different from 0 at the 1%, 5%, and 10% levels respectively.

Age group	(20-29)		(30-49)		(50-59)	
Dep. Variable	Wages	Night–Weekend Shift Work	Wages	Night–Weekend Shift Work	Wages	Night–Weekend Shift Work
	(1)	(2)	(3)	(4)	(5)	(6)
RTR_{rc}	-0.016***	0.007**	-0.014***	0.007***	-0.012***	0.008***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
LMI_c	-1.851***	1.884***	-1.459***	1.818***	-1.330***	1.982***
	(0.256)	(0.384)	(0.331)	(0.316)	(0.357)	(0.306)
RTR_{rc} x LMI_c	-0.132***	0.104***	-0.111***	0.103***	-0.111***	0.113***
	(0.023)	(0.034)	(0.031)	(0.028)	(0.033)	(0.030)
Large firm	0.234***	0.149***	0.267***	0.142***	0.234***	0.131***
	(0.022)	(0.024)	(0.019)	(0.022)	(0.016)	(0.017)
Part-time	-0.097***	0.006	-0.135***	-0.001	-0.107***	-0.006
	(0.009)	(0.012)	(0.018)	(0.016)	(0.023)	(0.018)
Women	-0.116***	-0.043***	-0.200***	-0.048***	-0.161***	-0.061***
	(0.005)	(0.006)	(0.017)	(0.009)	(0.015)	(0.010)
Δ_{97-14} Productivity	Yes	Yes	Yes	Yes	Yes	Yes
Δ_{97-14} Net migration	Yes	Yes	Yes	Yes	Yes	Yes
Δ_{97-14} Capital flows	Yes	Yes	Yes	Yes	Yes	Yes
Δ_{97-14} CPI index	Yes	Yes	Yes	Yes	Yes	Yes
Education	Yes	Yes	Yes	Yes	Yes	Yes
Occupation	Yes	Yes	Yes	Yes	Yes	Yes
Sector	Yes	Yes	Yes	Yes	Yes	Yes
Job Spell	Yes	Yes	Yes	Yes	Yes	Yes
Observations	587,024	587,024	1,581,793	1,581,793	596,998	596,998
Adj. R^2	0.537	0.444	0.610	0.411	0.605	0.400
Countries	9	9	9	9	9	9
Regions	20	20	20	20	20	20

Note: Dependent variable is the log (hourly) wages and dummy variable equal to 1 if the individual works in shift, during weekend or at night in 2014. RTR_{rc} is the change in regional tariffs between 1997 and 2014. LMI_c is the fall in the percentage of unionized workers between 1998 and 2014. Standard errors adjusted for clustering by NUTS regions and country are in parentheses. ***, **, * significantly different from 0 at the 1%, 5%, and 10% levels respectively.

B.4. Extensions regarding Firm Characteristics

Table A5. **By Education**

Education group	Low		Medium		High	
Dep. Variable	Wages	Night–Weekend Shift Work	Wages	Night–Weekend Shift Work	Wages	Night–Weekend Shift Work
	(1)	(2)	(3)	(4)	(5)	(6)
RTR_{rc}	-0.016***	0.007***	-0.014***	0.007***	-0.020***	0.005***
	(0.001)	(0.002)	(0.002)	(0.002)	(0.004)	(0.001)
LMI_c	-2.549***	2.170***	-1.747***	2.023***	-1.819***	1.092***
	(0.151)	(0.358)	(0.324)	(0.354)	(0.447)	(0.170)
RTR_{rc} x LMI_c	-0.138***	0.101***	-0.112***	0.110***	-0.210***	0.074***
	(0.013)	(0.030)	(0.029)	(0.031)	(0.048)	(0.017)
Large firm	0.167***	0.192***	0.253***	0.158***	0.290***	0.036***
	(0.018)	(0.035)	(0.018)	(0.022)	(0.021)	(0.009)
Part-time	-0.046***	0.017	-0.102***	0.001	-0.209***	-0.011**
	(0.013)	(0.024)	(0.013)	(0.016)	(0.032)	(0.005)
Women	-0.122***	-0.037***	-0.174***	-0.062***	-0.174***	-0.038***
	(0.009)	(0.009)	(0.017)	(0.008)	(0.006)	(0.006)
Δ_{97-14} Productivity	Yes	Yes	Yes	Yes	Yes	Yes
Δ_{97-14} Net migration	Yes	Yes	Yes	Yes	Yes	Yes
Δ_{97-14} Capital flows	Yes	Yes	Yes	Yes	Yes	Yes
Δ_{97-14} CPI index	Yes	Yes	Yes	Yes	Yes	Yes
Age	Yes	Yes	Yes	Yes	Yes	Yes
Occupation	Yes	Yes	Yes	Yes	Yes	Yes
Sector	Yes	Yes	Yes	Yes	Yes	Yes
Job Spell	Yes	Yes	Yes	Yes	Yes	Yes
Observations	209,449	209,449	2,122,390	2,122,390	433,976	433,976
Adj. R^2	0.546	0.437	0.554	0.409	0.437	0.211
Countries	9	9	9	9	9	9
Regions	20	20	20	20	20	20

Note: Dependent variable is the log (hourly) wages and dummy variable equal to 1 if the individual works in shift, during weekend or at night in 2014. RTR_{rc} is the change in regional tariffs between 1997 and 2014. LMI_c is the fall in the percentage of unionized workers between 1998 and 2014. A "High" education level corresponds to attending more than 4 years of tertiary education, a "Low" level is equivalent to attending up to lower econdary education and a "Medium" education level corresponds to attending secondary or tertiary education up to 4 years. Standard errors adjusted for clustering by NUTS regions and country are in parentheses. ***, **, * significantly different from 0 at the 1%, 5%, and 10% levels respectively.

TABLE A6. **By Gender**

Gender	Men		Women	
Dep. Variable	Wages	Night–Weekend–Shift Work	Wages	Night–Weekend–Shift Work
	(1)	(2)	(3)	(4)
RTR_{rc}	-0.011***	0.008***	-0.017***	0.006**
	(0.002)	(0.002)	(0.002)	(0.002)
LMI_c	-1.243***	1.936***	-1.971***	1.807***
	(0.299)	(0.329)	(0.341)	(0.321)
RTR_{rc} x LMI_c	-0.078***	0.116***	-0.171***	0.093***
	(0.027)	(0.030)	(0.032)	(0.029)
Large firm	0.297***	0.151***	0.205***	0.124***
	(0.019)	(0.022)	(0.020)	(0.020)
Part-time	-0.139***	-0.001	-0.103***	-0.001
	(0.021)	(0.015)	(0.013)	(0.016)
Δ_{97-14} Productivity	Yes	Yes	Yes	Yes
Δ_{97-14} Net migration	Yes	Yes	Yes	Yes
Δ_{97-14} Capital flows	Yes	Yes	Yes	Yes
Δ_{97-14} CPI index	Yes	Yes	Yes	Yes
Education x Age	Yes	Yes	Yes	Yes
Occupation	Yes	Yes	Yes	Yes
Sector	Yes	Yes	Yes	Yes
Job Spell	Yes	Yes	Yes	Yes
Observations	1,536,556	1,536,556	1,229,259	1,229,259
Adj. R^2	0.589	0.409	0.587	0.430
Countries	9	9	9	9
Regions	20	20	20	20

Note: Dependent variable is the log (hourly) wages and dummy variable equal to 1 if the individual works in shift, during weekend or at night in 2014. RTR_{rc} is the change in regional tariffs between 1997 and 2014. LMI_c is the fall in the percentage of unionized workers between 1998 and 2014. Standard errors adjusted for clustering by NUTS regions and country are in parentheses. ***, **, * significantly different from 0 at the 1%, 5%, and 10% levels respectively.

TABLE A7. **By Work Schedule**

Work schedule	Full-time		Part-time	
Dep. Variable	Wages	Night–Weekend–Shift Work	Wages	Night–Weekend–Shift Work
	(1)	(2)	(3)	(4)
RTR_{rc}	-0.012***	0.006**	-0.035***	0.010***
	(0.003)	(0.002)	(0.002)	(0.002)
LMI_c	-1.105***	1.717***	-5.285***	2.612***
	(0.350)	(0.326)	(0.390)	(0.426)
RTR_{rc} x LMI_c	-0.088**	0.093***	-0.398***	0.150***
	(0.034)	(0.030)	(0.027)	(0.029)
Large firm	0.255***	0.145***	0.203***	0.099***
	(0.017)	(0.022)	(0.030)	(0.020)
Part-time	-0.121***	0.001	-0.110***	-0.015
	(0.015)	(0.016)	(0.034)	(0.012)
Women	-0.181***	-0.050***	-0.054***	-0.033*
	(0.011)	(0.008)	(0.016)	(0.018)
Δ_{97-14} Productivity	Yes	Yes	Yes	Yes
Δ_{97-14} Net migration	Yes	Yes	Yes	Yes
Δ_{97-14} Capital flows	Yes	Yes	Yes	Yes
Δ_{97-14} CPI index	Yes	Yes	Yes	Yes
Education x Age	Yes	Yes	Yes	Yes
Occupation	Yes	Yes	Yes	Yes
Sector	Yes	Yes	Yes	Yes
Job Spell	Yes	Yes	Yes	Yes
Observations	2,621,268	2,621,268	144,547	144,547
Adj. R^2	0.609	0.413	0.488	0.351
Countries	9	9	9	9
Regions	20	20	20	20

Note: Dependent variable is the log (hourly) wages and dummy variable equal to 1 if the individual works in shift, during weekend or at night in 2014. RTR_{rc} is the change in regional tariffs between 1997 and 2014. LMI_c is the fall in the percentage of unionized workers between 1998 and 2014. Standard errors adjusted for clustering by NUTS regions and country are in parentheses. ***, **, * significantly different from 0 at the 1%, 5%, and 10% levels respectively.

TABLE A8. **By Type of Contract**

Type of contract	Permanent		Temporary	
Dep. Variable	Wages	Night–Weekend–Shift Work	Wages	Night–Weekend–Shift Work
	(1)	(2)	(3)	(4)
RTR_{rc}	-0.014***	0.007***	-0.015***	0.007***
	(0.002)	(0.002)	(0.002)	(0.002)
LMI_c	-1.613***	1.754***	-1.497***	2.077***
	(0.322)	(0.322)	(0.366)	(0.315)
RTR_{rc} x LMI_c	-0.115***	0.101***	-0.125***	0.110***
	(0.030)	(0.030)	(0.026)	(0.023)
Large firm	0.269***	0.140***	0.176***	0.133***
	(0.020)	(0.020)	(0.013)	(0.027)
Women	-0.186***	-0.053***	-0.129***	-0.039***
	(0.018)	(0.009)	(0.009)	(0.005)
Δ_{97-14} Productivity	Yes	Yes	Yes	Yes
Δ_{97-14} Net migration	Yes	Yes	Yes	Yes
Δ_{97-14} Capital flows	Yes	Yes	Yes	Yes
Δ_{97-14} CPI index	Yes	Yes	Yes	Yes
Education x Age	Yes	Yes	Yes	Yes
Occupation	Yes	Yes	Yes	Yes
Sector	Yes	Yes	Yes	Yes
Job Spell	Yes	Yes	Yes	Yes
Observations	2,253,038	2,253,038	512,777	512,777
Adj. R^2	0.610	0.410	0.469	0.442
Countries	9	9	9	9
Regions	20	20	20	20

Note: Dependent variable is the log (hourly) wages and dummy variable equal to 1 if the individual works in shift, during weekend or at night in 2014. RTR_{rc} is the change in regional tariffs between 1997 and 2014. LMI_c is the fall in the percentage of unionized workers between 1998 and 2014. Standard errors adjusted for clustering by NUTS regions and country are in parentheses. ***, **, * significantly different from 0 at the 1%, 5%, and 10% levels respectively.

Dep. Variable	Wages		Night–Weekend–Shift Work	
	(1)	(2)	(3)	(4)
RTR_{rc} x $Occup$ H	-0.004	-0.018***	0.001	0.011***
	(0.003)	(0.006)	(0.001)	(0.002)
LMI_c x $Occup$ H	-1.348	-1.057	0.917**	1.296**
	(1.372)	(2.242)	(0.363)	(0.524)
RTR_{rc} x LMI_c x $Occup$ H		-0.232***		0.158***
		(0.074)		(0.026)
RTR_{rc} x $Occup$ M	-0.006***	-0.016***	-0.000	0.008***
	(0.001)	(0.002)	(0.000)	(0.002)
LMI_c x $Occup$ M	-0.563	-1.903***	1.042***	2.137***
	(0.528)	(0.361)	(0.280)	(0.314)
RTR_{rc} x LMI_c x $Occup$ M		-0.138***		0.116***
		(0.035)		(0.028)
RTR_{rc} x $Occup$ L	-0.006**	-0.016***	-0.001*	0.007***
	(0.003)	(0.003)	(0.001)	(0.002)
LMI_c x $Occup$ L	-1.215	-3.102**	0.900***	2.054***
	(1.022)	(1.355)	(0.225)	(0.409)
RTR_{rc} x LMI_c x $Occup$ L		-0.112*		0.114***
		(0.058)		(0.031)
Large firm	0.238***	0.246***	0.153***	0.145***
	(0.017)	(0.017)	(0.019)	(0.020)
Part-time	-0.169***	-0.157***	0.027	0.021
	(0.018)	(0.018)	(0.021)	(0.022)
Women	-0.198***	-0.196***	-0.052***	-0.053***
	(0.013)	(0.012)	(0.009)	(0.009)
Δ_{97-14} Productivity	Yes	Yes	Yes	Yes
Δ_{97-14} Net migration	Yes	Yes	Yes	Yes
Δ_{97-14} Capital flows	Yes	Yes	Yes	Yes
Δ_{97-14} CPI index	Yes	Yes	Yes	Yes
Education x Age	Yes	Yes	Yes	Yes
Occupation	No	No	No	No
Sector	Yes	Yes	Yes	Yes
Job Spell	Yes	Yes	Yes	Yes
Observations	2,765,815	2,765,815	2,765,815	2,765,815
Adj. R^2	0.517	0.524	0.371	0.375
Countries	9	9	9	9
Regions	20	20	20	20

Note: Dependent variable is the log (hourly) wages and dummy variable equal to 1 if the individual works in shift, during weekend or at night in 2014. RTR_{rc} is the change in the weighted regional tariffs between 1997 and 2014. LMI_c is the change in the percentage of unionized workers between 1998 and 2014. The different $Occup$ variables are dummy equal to 1 for individual belonging to the occupational group. Standard errors adjusted for clustering by NUTS regions and country are in parentheses. ***, **, * significantly different from 0 at the 1%, 5%, and 10% levels respectively.

TABLE A10. **Public versus Private companies**

Company ownership	Private		Public	
Dep. Variable	Wages	Night–Weekend–Shift Work	Wages	Night–Weekend–Shift Work
	(1)	(2)	(3)	(4)
RTR_{rc}	-0.015***	0.007**	-0.009***	0.011***
	(0.002)	(0.002)	(0.002)	(0.001)
LMI_c	-1.554***	1.862***	-2.166***	1.830***
	(0.333)	(0.351)	(0.349)	(0.205)
RTR_{rc} x LMI_c	-0.136***	0.099***	-0.056*	0.163***
	(0.031)	(0.032)	(0.029)	(0.020)
Large firm	0.267***	0.142***	0.175***	0.052*
	(0.019)	(0.024)	(0.027)	(0.028)
Part-time	-0.116***	0.004	-0.116***	-0.020
	(0.015)	(0.016)	(0.016)	(0.018)
Women	-0.175***	-0.048***	-0.132***	-0.086***
	(0.014)	(0.009)	(0.010)	(0.017)
Δ_{97-14} Productivity	Yes	Yes	Yes	Yes
Δ_{97-14} Net migration	Yes	Yes	Yes	Yes
Δ_{97-14} Capital flows	Yes	Yes	Yes	Yes
Δ_{97-14} CPI index	Yes	Yes	Yes	Yes
Education x Age	Yes	Yes	Yes	Yes
Occupation	Yes	Yes	Yes	Yes
Sector	Yes	Yes	Yes	Yes
Job Spell	Yes	Yes	Yes	Yes
Observations	2,440,093	2,440,093	325,722	325,722
Adj. R^2	0.609	0.425	0.565	0.386
Countries	9	9	9	9
Regions	20	20	20	20

Note: Dependent variable is the log (hourly) wages and dummy variable equal to 1 if the individual works in shift, during weekend or at night in 2014. RTR_{rc} is the change in regional tariffs between 1997 and 2014. LMI_c is the fall in the percentage of unionized workers between 1998 and 2014. A company is considered publicly-owned if at least 50% of its capital is detained by public entities. Standard errors adjusted for clustering by NUTS regions and country are in parentheses. ***, **, * significantly different from 0 at the 1%, 5%, and 10% levels respectively.

TABLE A11. **Manufacturing versus Services, using Interactions**

Dep. Variable	Wages		Night–Weekend–Shift Work	
	(1)	(2)	(3)	(4)
RTR_{rc} x $Manuf$	0.000	0.000	-0.001	-0.001***
	(0.000)	(0.000)	(0.001)	(0.000)
LMI_c x $Manuf$	0.056	0.042	-0.066	0.325***
	(0.163)	(0.117)	(0.218)	(0.072)
RTR_{rc} x LMI_c x $Manuf$		-0.000		-0.021***
		(0.005)		(0.003)
RTR_{rc}	-0.005***	-0.014***	-0.000	0.008***
	(0.001)	(0.002)	(0.000)	(0.002)
LMI_c	-0.536	-1.533***	0.969***	1.732***
	(0.403)	(0.314)	(0.258)	(0.309)
RTR_{rc} x LMI_c		-0.116***		0.115***
		(0.029)		(0.028)
Large firm	0.248***	0.254***	0.149***	0.144***
	(0.018)	(0.018)	(0.021)	(0.021)
Part-time	-0.127***	-0.123***	0.003	0.000
	(0.017)	(0.016)	(0.015)	(0.015)
Women	-0.175***	-0.175***	-0.050***	-0.050***
	(0.013)	(0.013)	(0.008)	(0.008)
Δ_{97-14} Productivity	Yes	Yes	Yes	Yes
Δ_{97-14} Net migration	Yes	Yes	Yes	Yes
Δ_{97-14} Capital flows	Yes	Yes	Yes	Yes
Δ_{97-14} CPI index	Yes	Yes	Yes	Yes
Education x Age	Yes	Yes	Yes	Yes
Occupation	Yes	Yes	Yes	Yes
Sector	Yes	Yes	Yes	Yes
Job Spell	Yes	Yes	Yes	Yes
Observations	2,765,815	2,765,815	2,765,815	2,765,815
Adj. R^2	0.599	0.601	0.413	0.416
Countries	9	9	9	9
Regions	20	20	20	20

Note: Dependent variable is the log (hourly) wages and dummy variable equal to 1 if the individual works in shift, during weekend or at night in 2014. RTR_{rc} is the change in the weighted regional tariffs between 1997 and 2014. LMI_c is the change in the percentage of unionized workers between 1998 and 2014. The $Manuf$ variable is a dummy equal to 1 for workers in the mining and quarrying sector and the manufacturing sector, as defined in the NACE rev2 classification. Standard errors adjusted for clustering by NUTS regions and country are in parentheses. ***, **, * significantly different from 0 at the 1%, 5%, and 10% levels respectively.

TABLE A12. **Manufacturing Industries**

Sector	Mining and quarrying		Food, beverages and tobacco		Textile, wearing apparel and leather		Wood, paper and publishing and media activities		Coke, chemicals, rubber, plastic, electronics and transport equipment		Metals and machinery	
Dep. Variable	Wages	Night–Weekend Shift Work	Wages	Night–Weekend Shift Work	Wages	Night–Weekend Shift Work	Wages	Night–Weekend Shift Work	Wages	Night–Weekend Shift Work	Wages	Night–Weekend Shift Work
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
RTR_{rc}	0.005	0.017***	-0.015***	0.009*	-0.010***	0.006**	-0.013***	0.012***	-0.015***	0.005*	-0.012***	0.010***
	(0.007)	(0.005)	(0.002)	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.001)	(0.002)
LMI_c	-0.690	2.213**	-2.232***	2.343***	-1.306**	1.965***	-1.843***	2.474***	-1.618***	1.699***	-1.044***	2.656***
	(1.037)	(0.850)	(0.377)	(0.580)	(0.559)	(0.359)	(0.515)	(0.443)	(0.419)	(0.372)	(0.283)	(0.360)
$RTR_{rc} \times LMI_c$	0.110	0.228***	-0.135***	0.125**	-0.055	0.093**	-0.105**	0.161***	-0.125***	0.072*	-0.064***	0.135***
	(0.102)	(0.070)	(0.032)	(0.057)	(0.049)	(0.037)	(0.039)	(0.038)	(0.042)	(0.037)	(0.021)	(0.028)
Large firm	0.330***	0.155***	0.293***	0.202***	0.173***	0.089***	0.373***	0.169***	0.305***	0.234***	0.263***	0.209***
	(0.070)	(0.045)	(0.028)	(0.029)	(0.024)	(0.023)	(0.026)	(0.027)	(0.027)	(0.024)	(0.025)	(0.037)
Part-time	-0.182**	-0.119***	-0.099***	0.014	-0.033	0.033	-0.133***	-0.008	-0.093***	-0.010	-0.098***	-0.008
	(0.066)	(0.027)	(0.017)	(0.027)	(0.023)	(0.027)	(0.030)	(0.014)	(0.017)	(0.009)	(0.010)	(0.008)
Women	-0.204***	-0.161***	-0.185***	-0.013	-0.192***	-0.086***	-0.168***	-0.066***	-0.220***	-0.050***	-0.204***	-0.061***
	(0.019)	(0.035)	(0.018)	(0.010)	(0.023)	(0.010)	(0.020)	(0.018)	(0.008)	(0.009)	(0.011)	(0.016)
Δ_{97-14} Productivity	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Δ_{97-14} Net migration	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Δ_{97-14} Capital flows	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Δ_{97-14} CPI index	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Education x Age	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Occupation	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector	No	No	No	No	No	No	No	No	No	No	No	No
Job Spell	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	52,680	52,680	118,871	118,871	76,831	76,831	89,619	89,619	670,065	670,065	263,088	263,088
Adj. R^2	0.515	0.340	0.639	0.369	0.681	0.439	0.558	0.387	0.597	0.371	0.548	0.410
Nb of countries	9	9	9	9	9	9	9	9	9	9	9	9
Nb of regions	20	20	20	20	20	20	20	20	20	20	20	20

Note: Dependent variable is the log (hourly) wages and dummy variable equal to 1 if the individual works in shift, during weekend or at night in 2014. RTR_{rc} is the change in regional tariffs between 1997 and 2014. LMI_c is the fall in the percentage of unionized workers between 1998 and 2014. See Table A2 for the precise composition of each sectors in term of NACE Rev2 classification. Standard errors adjusted for clustering by NUTS regions and country are in parentheses. ***, **, * significantly different from 0 at the 1%, 5%, and 10% levels respectively.

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TABLE A13. Services Industries

Sector	Electricity, gas and water		Construction		Wholesale and retail trade of motor vehicles		Other retail trade		Hotels and restaurants		Transport and support activities		Telecommunication, ICT, financial services, other business activities		Real estate, R&D, marketing	
Dep. Variable	Wages	Night–Weekend Shift Work	Wages	Night–Weekend Shift Work	Wages	Night–Weekend Shift Work	Wages	Night–Weekend Shift Work	Wages	Night–Weekend Shift Work	Wages	Night–Weekend Shift Work	Wages	Night–Weekend Shift Work	Wages	Night–Weekend Shift Work
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
RTR_{rc}	-0.005	0.009***	-0.012***	0.009***	-0.016***	0.005**	-0.018***	0.005	-0.017***	0.007**	-0.016***	0.007***	-0.018***	0.008***	-0.010**	0.008***
	(0.005)	(0.001)	(0.001)	(0.001)	(0.004)	(0.002)	(0.003)	(0.004)	(0.001)	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)	(0.003)	(0.001)
LML_c	-0.363	1.000***	-1.627***	1.599***	-1.481**	1.515***	-1.367***	2.637***	-2.098***	1.892***	-2.484***	1.884***	-1.894***	1.664***	-0.831	1.567***
	(0.790)	(0.205)	(0.343)	(0.220)	(0.580)	(0.345)	(0.309)	(0.599)	(0.246)	(0.452)	(0.557)	(0.295)	(0.235)	(0.219)	(0.565)	(0.178)
$RTR_{rc} \times LML_c$	-0.031	0.134***	-0.080***	0.138***	-0.143**	0.073**	-0.189***	0.080	-0.162***	0.103***	-0.131**	0.106***	-0.170***	0.115***	-0.096**	0.108***
	(0.068)	(0.017)	(0.022)	(0.018)	(0.057)	(0.026)	(0.035)	(0.054)	(0.018)	(0.036)	(0.048)	(0.032)	(0.022)	(0.019)	(0.042)	(0.015)
Large firm	0.225***	0.072*	0.312***	0.073**	0.221***	0.095***	0.222***	0.168***	0.185***	0.111***	0.382***	0.205***	0.258***	0.062***	0.191***	0.032***
	(0.034)	(0.036)	(0.024)	(0.033)	(0.030)	(0.028)	(0.022)	(0.046)	(0.019)	(0.019)	(0.027)	(0.014)	(0.026)	(0.020)	(0.030)	(0.010)
Part-time	0.039	-0.022	-0.066***	0.018	-0.125***	0.028**	-0.070***	-0.044**	-0.016	0.012	-0.116***	0.018	-0.133***	0.067**	-0.171***	-0.061
	(0.097)	(0.030)	(0.018)	(0.016)	(0.039)	(0.012)	(0.004)	(0.018)	(0.019)	(0.014)	(0.036)	(0.022)	(0.026)	(0.028)	(0.021)	(0.035)
Women	-0.178***	-0.167***	-0.135***	-0.068	-0.159***	0.009*	-0.173***	0.015	-0.095***	-0.038***	-0.151***	-0.118***	-0.160***	-0.055***	-0.100***	0.004
	(0.015)	(0.040)	(0.018)	(0.039)	(0.025)	(0.004)	(0.031)	(0.011)	(0.015)	(0.008)	(0.024)	(0.018)	(0.013)	(0.011)	(0.013)	(0.017)
Δ_{97-14} Productivity	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Δ_{97-14} Net migration	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Δ_{97-14} Capital flows	No	No	No	No	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Δ_{97-14} CPI index	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Education x Age	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Occupation	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Job Spell	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	91,309	91,309	117,997	117,997	164,230	164,230	269,650	269,650	64,013	64,013	141,583	141,583	561,652	561,652	84,227	84,227
Adj. R^2	0.612	0.304	0.591	0.344	0.574	0.336	0.550	0.550	0.606	0.385	0.507	0.343	0.615	0.364	0.518	0.255
Nb of countries	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
Nb of regions	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20

Note: Dependent variable is the log (hourly) wages and dummy variable equal to 1 if the individual works in shift, during weekend or at night in 2014. RTR_{rc} is the change in regional tariffs between 1997 and 2014. LML_c is the fall in the percentage of unionized workers between 1998 and 2014. See Table A2 for the precise composition of each sectors in term of NACE Rev2 classification. Standard errors adjusted for clustering by NUTS regions and country are in parentheses. ***, **, * significantly different from 0 at the 1%, 5%, and 10% levels respectively.