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Trade Liberalization and Working Conditions

Bastien Alvarez, Gianluca Orefice & Farid Toubal

Highlights

- Workers in regions that face large export liberalization shocks are more likely to work on temporary contracts and non-standard hours.
- This effect is magnified for unskilled (production) workers.
- Import trade liberalization has weak (null) effect on working conditions, but in line with previous literatue has negative effect on wages.

Updated on February 6, 2025

Abstract

This paper examines how trade liberalization-induced labor demand shocks affect wages and non-wage working conditions. Using exogenous trade shocks from EU enlargement and worker-level data, we find that export liberalization increases temporary contracts and atypical work schedules, particularly for production workers. However, it has no significant effect on wages, which may reflect firms' ability to expand employment without raising pay due to labor supply elasticity and unemployment. Import liberalization weakly affects working conditions but, consistent with previous studies, lowers wages as firms face stronger competition and reduced labor demand.

Keywords

Temporary Contracts, Working Conditions, Wages, Employment, Eastern European Enlargement, Trade Liberalization.

JEL

F15, F16, J30, J51, J81.

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February 6, 2025

1 Introduction

In recent years, the impact of globalization on workers has become central to the debate in international economic policy. Increased market competition and access to foreign inputs have been shown to alter labor demand, often with adverse effects on employment and earnings.[1] Beyond employment and wages, these labor demand shifts may also significantly affect the job stability and non-wage working conditions. This paper examines the extent to which trade liberalization-induced demand shocks affect labor demand and hence influence the working conditions of individuals. Namely, we focus on the changes in labor demand induced by the EU enlargement in accession countries.

We investigate how trade liberalization-induced demand shocks influence worker-level

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[1]For a comprehensive review, see McLaren (2022).

labor outcomes, including the level of wages and their components (such as overtime pay and compensation for atypical work hours), as well as employment, with particular emphasis on non-wage working conditions. We define working conditions using temporary contract work as a key indicator of employment stability, and also the work schedule variability of individuals based on shifts, weekend work, and night shifts. These factors are considered essential components of *quality of the working environment* and overall working conditions, as emphasized by the OECD Job Quality Index.[2] Our focus on working conditions sets this study apart from much of the existing literature on the labor market consequences of trade liberalization, which largely examines outcomes such as wages and informality. Moreover, there is relatively little research on the effects of EU enlargement on labor outcomes in Eastern European countries (EECs), primarily due to the lack of detailed data linking workers to their labor market outcomes.

We overcome this challenge using recently released individual-level surveys conducted by Eurostat in all EU member states (Eurostat, 2002; 2014). These datasets allow us to analyze individual working conditions and earnings across Eastern European NUTS 1-digit regions, offering a cross-country coverage that goes beyond what is typically available in other data sources (i.e., country-specific longitudinal data). Namely, our dataset captures the working conditions and earnings of workers across 15 regions in 9 countries during two distinct periods: the pre-enlargement phase in 2002 and the post-enlargement phase in 2014. Our empirical analysis relies on extensive data from these two large cross-sections, incorporating approximately 4.3 million workers. Interestingly, the use of temporary contracts is on the rise in EECs. The proportion of Eastern European workers on temporary contracts increased by 31% between 2002 and 2014, reaching an average of 9.5% of the workforce in the dataset in 2014. In some countries, such as the Czech Republic, the share of workers on temporary contracts rose sharply, by 36%.

We rely on differences across EECs' regions in their exposure to trade shocks to examine

[2]See also https://www.oecd.org/statistics/job-quality.htm

how trade liberalization affects labor outcomes. To ensure a causal interpretation, we exploit the unique institutional features of Eastern European countries' accession to the European Union (EU). The accession introduced significant exogenous changes in export and import tariffs, creating a *quasi-experimental* setting to study trade-induced demand shocks. First, EECs adopted the EU's pre-existing preferential trade agreements (PTAs) upon entry, which opened new markets and increased export opportunities. This shift led to sudden changes in the tariffs faced by EEC exporters, driven by the pre-determined structure of the EU's PTAs. Second, EECs adopted the EU's Most Favored Nation (MFN) import tariff scheme, which was designed by Western European countries well before the enlargement. This comprehensive and rapid adoption ensured that changes in EEC import protection levels were unaffected by domestic political or economic factors, such as lobbying, and unrelated to individual workers' labor market conditions.[3] These institutional features provide a setting where industry-level trade shocks can be treated as plausibly exogenous. The results of the tests using the methodology developed by Borusyak et al. (2022; 2024) confirm the exogeneity of trade shock measures and align well with the causal interpretation of our findings.

To identify the causal effect of trade liberalization on labor outcomes, we further control for region fixed effects and region- and country-specific characteristics, ensuring that other globalization-related factors do not bias our estimates. Moreover, we include worker cell-specific fixed effects, capturing age, gender, education, and job spell characteristics, allowing us to compare 'observationally equivalent' workers across regions with different degrees of trade exposure before and after the EU enlargement. The inclusion of these controls strengthens the causal interpretation of our key coefficients as the effects of trade-induced changes in labor demand on workers' outcomes. Our findings are robust to additional specifications, including region-cell-level regressions that aggregate worker-level information and incorporate cell fixed effects to account for unobserved heterogeneity.

A theoretical framework explains how trade liberalization affects firms' use of temporary

[3]Before enlargement, EECs had preferential trade agreements with the EU-15, but these were limited to certain products and did not concern tariffs on imports from non-EU countries.

and permanent contracts. Export liberalization increases foreign demand, leading firms to hire more workers on temporary contracts to adjust flexibly to changing market conditions. Import liberalization has two opposing effects: stronger competition reduces firms' need for temporary workers, while access to better-quality inputs can boost demand and increase temporary hiring. The overall impact depends on which force dominates. Firms use temporary contracts as a flexible tool to respond to demand shifts, while permanent employment is mainly determined by worker productivity and hiring costs. Labor supply elasticity, possibly due to unemployment, allows firms to expand employment after export liberalization without raising wages. In contrast, import competition lowers wages by reducing labor demand through increased competition and an inward shift in the labor demand curve.

In line with this framework, we show that workers in regions experiencing larger export liberalization are more likely to work on temporary contracts and non-standard hours compared to observationally equivalent workers in regions with smaller exposure to export liberalization. Overall, we do not find evidence of export liberalization causing higher wages, especially among temporary workers. Additionally, our analysis shows a negative but weakly significant impact of import liberalization on non-wage working conditions. However, the statistical significance of this effect becomes more pronounced as we adopt a pseudo-panel approach. Finally, in line with previous literature, import liberalization reduces wages for both permanent and temporary workers.

Our results vary across occupational categories and industries. Several important results emerge. First, export liberalization increases the probability of hiring both management and production workers on temporary contracts, with a notably larger effect for the latter group. Second, export liberalization increases the probability to work on atypical hours across all occupational categories. Third, export liberalization significantly increases the likelihood of temporary contracts and non-standard working hours in the manufacturing (tradable) and services (non-tradable) sectors. This confirms the pervasive effect of trade liberalization on labor markets highlighted in previous papers (Dix-Carneiro and Kovak, 2017).

This paper ties in with the broad literature exploring how labor markets adjust to economic shocks. Focusing on the economic shocks induced by globalization, many empirical studies over the 1990s found trade liberalization had only a mild effect on wages and employment, alleviating widespread concern that globalization might harm workers (see Richardson 1995 for a survey). However, recent empirical evidence – conducted mainly at the local labor market level – has shifted the debate by providing evidence of a negative impact of exposure to import liberalization episodes on employment and earnings in both developed countries (Autor et al., 2013; 2014; 2016; Malgouyres, 2017) and developing countries (Topalova, 2007; Dix-Carneiro and Kovak, 2017; 2019). Dauth et al. (2014) specifically examined the effects of trade shocks in Germany post-Iron Curtain, finding that regions with export-oriented industries gain from new markets, while those reliant on imports face labor market challenges due to increased foreign competition.

Our paper adds a novel dimension to the existing literature on the labor market effects of globalization by emphasizing the effects of liberalization-induced shocks on individuals' non-wage working conditions. This aspect has received relatively less attention compared to the more commonly studied earnings and employment effects.[4] Two exceptions are Robertson et al. (2009) and Tanaka (2020). Robertson et al. (2009) analyze the working conditions effect of trade liberalization in five developing countries (i.e. Cambodia, El Salvador, Honduras, Indonesia, Madagascar), and show that inter-industry wage differential increased in sectors that benefited the most from trade liberalization. Using firm-level data from Myanmar, Tanaka (2020) shows a positive impact of exporting on working conditions in terms of fire safety, health management, and freedom of negotiation, and an insignificant effect of exporting on wages and working hours. We investigate the causal impact of *both* export and import liberalization on the probability of working on temporary contracts and on

[4]Some existing papers study the nexus between trade liberalization and labor standards. See the interesting and recent contributions of Im and McLaren (2023) who show the ambiguous effect of globalization on labor rights and Abman et al. (2023) who study the impact of Regional Trade Agreements on child labor standard, and show that trade agreements with no child-labor provision reduce significantly the fraction of 14-17-year-old child in the labor force.

atypical and overtime hours. Moreover, we explore whether these shocks affect the labor market outcomes (i.e. hours worked and wage) across multiple regions in a multi-country empirical setting, and whether they have heterogeneous consequences on workers in different occupations.

Another strand of the literature highlights that labor markets adapt to significant economic shocks by employing temporary contracts. It is much less costly for firms to adjust the number of temporary than permanent contract (Goux et al., 2001; Bentolila et al., 2012), and temporary workers are used by firms to attain flexibility (Bentolila et al., 1994), survive to adverse macroeconomics shocks (Holmlund and Storrie, 2002), and face financing constraints (Caggese and Cuñat, 2008). The increasing use of temporary workers is coherent with the reduction in the unionization share associated to a stronger import competition (Ahlquist and Downey, 2023). In line with this literature, we show that in regions experiencing positive increases in foreign demand, workers are more likely to be hired on fixed-term contracts and working non-standard hours.

Finally, a growing body of empirical research has investigated the impact of trade liberalization on health outcomes (Fan et al., 2020; Colantone et al., 2019; Hummels et al., 2023). In particular, Fan et al. (2020) and Colantone et al. (2019) find adverse health outcomes from increased working hours and mental distress due to trade-induced changes. Hummels et al. (2023) show that the rise in workers' workload due to increased firm's sales leads to health issues such as stress and heart disease. Our findings complement these studies by showing that increased foreign market access leads to extended and atypical working schedule.[5]

The remainder of the paper is organized as follows. Section 2 describes the dataset and the key variables used in the analysis. Section 3 provides an overview of the EU enlargement process and its implications for trade liberalization. In Section 4, we outline the theoretical framework linking trade liberalization to labor market adjustments. Section 5 details

[5]Research by the American Public Health Association highlights the connections between working conditions and public health (Hagedorn et al., 2016; Malinowski et al., 2015). Also, numerous studies show that worsening working conditions lead to mental distress (Cottini and Lucifora, 2013; Robone et al., 2011; Marchand et al., 2005).

the empirical strategy, including identification techniques and robustness checks. Section 6 presents the main results, highlighting the heterogeneous impacts across occupations, and industries. Finally, the last section concludes.

2 Data and measurement

This section presents the sources of information used in the empirical analysis. A more detailed discussion of the data and of the construction of the main variables of interest is reported in the Online Appendix sections O2, O3 and O4.

2.1 Workers' wages and working conditions

Our main data sources are the Eurostat Structure of Earnings Surveys (SES).[6] Each survey is administered to firms with at least ten employees in all areas of the economy except agriculture and public administration, as defined in the Statistical Classification of Economic Activities in the European Community (NACE). The SESs are detailed, confidential, individual-level harmonized surveys on earnings, hours paid, and other individual workers' characteristics covering a large panel of European countries in 2002, 2006, 2010, and 2014.

The SESs report information on workers' type of contract, whether individuals are employed on temporary or permanent contract, and their work schedules (overtime and flexible work schedules). Based on this information, we build an indicator to identify workers on short-term contracts. This is our main proxy for individuals' working conditions. We also use the information on payments for atypical working hours to construct an indicator on whether an individual works on "non-standard" working hours, including shift, weekend, and night work.[7] Moreover, we construct a third indicator of whether the individual works overtime.[8]

[6] Unlike the European Union Labour Force Survey (EU-LFS), the SES collects detailed, employer-reported data on contract types, hours worked, and earnings, ensuring higher precision. Its firm-based design allows for an analysis of employment dynamics within the formal economy, focusing on firms with at least ten employees and excluding smaller enterprises and certain public sectors.

[7] Shift and night work are considered to be a risk factor for health, safety and social well-being (Harrington, 1994; Costa, 2003; Cottini and Lucifora, 2013).

[8] The details of the construction are provided in the Online Appendix (Section O2).

The SES also contains useful individual characteristics such as the worker's level of education, age, gender, occupation and job spell. Age is available in five-year brackets. We focus on the working population of individuals aged 20 to 59.[9] With respect to the education variable, we use three categories based on the 2011 version of the International Standard Classification of Education (ISCED). The first category covers individuals with lower secondary education, the second category covers upper secondary education and post-secondary non-tertiary education, the third category includes graduates and post-graduates. We use the 2008 International Standard Classification of Occupations (ISCO) at the 1-digit level to classify workers' occupations.

The survey contains little but important information on workers' employers, such as firm size bin, sector of activity, private- vs public-owned status, and the type of collective pay agreement covering the majority of the employees in the firm. The countries in our dataset use different sector aggregation methods, which we harmonize using the NACE Rev.2 classification to produce individual-level information spanning 11 manufacturing and service industries.[10] The SES firm-level variable identifies whether workers are employed in a firm where at least 50% of the workforce is covered by a collective bargaining agreement. As for the type of collective pay agreement, the SES survey distinguishes between national, industrial, firm, and individual agreement. We focus on whether an agreement exists, irrespective of its type, because bargaining frameworks are largely decentralized and heterogeneous in our sample of countries.

The SES has the advantage of containing cross-sectional data at the individual level on the vast majority of new EU member countries before and after their accession in 2004 and 2007. Hence, our estimation sample contains harmonized information for nine new member states and 15 NUTS 1-digit level regions, including Bulgaria, Cyprus, the Czech

[9]While the SES contains younger and older individuals, such workers are heavily affected in their labor participation by factors not concerning middle-aged workers, such as schooling and retirement prospect. Excluding them facilitates the interpretation of our results.

[10]See the Online Appendix in section O3 for more details.

Republic, Estonia, Hungary, Latvia, Lithuania, Romania, and Slovakia.[11] Our dataset spans more countries and regions than other studies, enabling us to investigate whether trade liberalization has affected workers' wages and working conditions in different regions (and countries). Moreover, the detailed firm and worker level information provided by the SES dataset enables us to investigate the heterogeneous effects of liberalization across individuals with different characteristics.

An important drawback of the SES surveys is the impossibility of tracking workers across different years. This prevents us from examining *changes* in worker-specific labor market outcomes between the pre- and post-enlargement period. Instead, we investigate how the tariff liberalization induced by the EU-enlargement (and the consequent labor demand shocks) affected the working conditions of "*observationally equivalent*" workers, several years after the enlargement, across regions that faced different intensities in trade liberalization shocks. We provide additional robustness checks using cohort- and cell-based approaches, which approximate a pseudo-panel structure. While not perfect, this method allows us to track workers with similar characteristics over time, offering a closer examination of the observed patterns.

2.2 Import tariff liberalization and foreign market access

We focus on the 2004 and 2007 EU-enlargement episodes to disentangle the effects of tariff liberalization on both the export and import side. As mentioned in Introduction, following their accession to the EU, the new member countries had to adopt the common EU trade policy and hence the applied MFN import tariff scheme of 'old' EU Member States. Also, new member countries adopted the EU's preferential rates and benefited from the pre-existing EU's preferential foreign market access.

Based on these two features of the EECs accession to the EU, we follow the methodology developed by Topalova (2010) and Kovak (2013) to construct the trade liberalization indexes.

[11] Croatia, Malta, and Slovenia are excluded from the estimation sample as we only had 2010 data for Croatia and 2014 data for Malta and Slovenia so we could not compute the change in weighted tariff liberalization – see Section 2.2. The SES for Poland does not report information on the type of workers' contract in 2002. For Hungary, Romania and Bulgaria, due to the absence of information on the region where workers leave, we use the year 2006 instead of 2002 as pre-liberalization year.

The methodology is particularly useful in contexts where trade liberalization involves significant reductions in tariffs, as in the case of Eastern European countries.[12] The region-specific measures of trade liberalization are constructed by using the weighted average of *changes* in the industry-country level tariff between 1997 (the earliest pre-enlargement available data in the WTO tariff dataset) and 2008 (to include the period of transition to full implementation of the common EU trade policy).[13] The change in industry-country specific tariff reflects the magnitude of export and import trade liberalization (i.e. the *shock* or *shift* in the shift-share research design literature). We allocate these industry-country specific changes in tariffs across regions using time-invariant region and industry specific factor shares that reflect the industrial structure of each region at the beginning of the period t_0 (i.e. the *share*).[14] Hence, our measures of import and export tariff liberalization for region r in country c are defined as follow:

$$Lib^{l}_{r_{(c)}} = -\sum_{s} \beta_{r_{(c)}s} \Delta ln(1+\tau^{l}_{cs}) \quad \text{with} \quad \beta_{r_{(c)}s} = \frac{\lambda_{r_{(c)}st_0} \frac{1}{\phi_{cst_0}}}{\sum_s \lambda_{r_{(c)}st_0} \frac{1}{\phi_{cst_0}}}. \quad \text{and} \quad l = M, X \qquad (1)$$

where superscript l indicates the nature of the shock, i.e. import (M) and export (X) tariff respectively, and $\Delta ln(1+\tau^{l}_{cs})$ is the difference in import and export tariffs, τ^{l}_{cs}, between the post- and pre-enlargement year, for a given sector s and country c. $\beta_{r_{(c)}s}$ informs on the industrial structure of each region in a given country, $r_{(c)}$.

Regional industrial structure. The weights $\beta_{r_{(c)}s}$ depend on two factors: each region-sector's share of employment ($\lambda_{r_{(c)}st_0}$) and the importance of non-labor factors in the sector-

[12]This methodology, also employed by Edmonds et al. (2010) and Dix-Carneiro and Kovak (2017; 2019), effectively captures the broad impact of trade liberalization shocks on both *tradable* and *non-tradable* sectors through income effects. While our approach relies on tariff reductions and their interaction with regional industrial structures, it is conceptually related to the import competition measure developed by Autor et al. (2014), which reflects changes in Chinese imports at the commuting zone level. Unlike our tariff-based framework, the Autor et al. (2014) index captures market-driven import competition rather than policy-induced liberalization. Within our analysis, we replicate the Autor et al. (2014) measure and observe qualitatively similar effects, highlighting the robustness of our findings to different measures of trade exposure.

[13]See European Union, 2003 for a description of tariff phase-in arrangements.

[14]More details on import and export liberalization measures are discussed below and in the Online Appendix (Section O4).

specific production technology (ϕ_{cst_0}) in the initial year t_0. Information on the cost share of non-labor factors (ϕ_{cst_0}) is not indexed by r because it is not available at the regional level. We follow Kovak (2013) and Dix-Carneiro and Kovak (2017) and assume all regions in a country have access to the same technology. The cost share of non-labor factors in the industry s and country c, ϕ_{cst_0}, is obtained from Eurostat data for the years preceding enlargement (Eurostat Structural Business Survey). $\lambda_{r_{(c)}st_0}$ is the share of region $r's$ workforce initially employed in sector s of country c. To compute $\lambda_{r_{(c)}st_0}$ we use the 2002 SES data for Bulgaria and the Eurostat Structural Business Survey at the regional level for Romania (in 2002) and Hungary (in 2001).[15] As Cyprus, the Czech Republic, Estonia, Lithuania, Latvia and Slovakia are not decomposed at the NUTS-1 level (i.e. administratively each country is a single NUTS-1 region), we use the 2002 edition of the SES survey to compute *country*-specific labor shares for these countries.

Import and export tariffs. Series on tariffs, τ^l_{cs}, are from the WTO dataset on applied MFN and preferential tariffs and are available for the period 1997-2014. We take 1997 as pre-enlargement year because this is the earliest available year in the WTO tariff dataset covering an exhaustive set of countries and industries. The base years for Slovakia and Romania are 1998 and 1999 due to a lack of data in 1997. We consider 2008 as the post-liberalization year to consider tariffs phasing-in arrangement within the EU-enlargement process.

On the import side, τ^M_{cs}, is constructed using the applied MFN import tariffs that each new EU member c applies to its trade partners for a given sector s. The applied MFN scheme that the new members had to adopt following their accession to the EU was set well before the entry of the new members and is exogenous to their specific labor market characteristics.[16] The absence of correlation between pre-enlargement MFN tariffs and the working conditions of individuals in 2002 reassures on quasi-experimental nature of the tariff

[15] Information on region-sector specific employment is not available in SES data for Romania and Hungary.

[16] By focusing on applied MFN import tariffs, when preferential trade agreements between the EU and a given non-EU country may allow the use of preferential rates (depending on Rule of Origin restrictions), our measure of trade liberalization may underestimate the effective trade liberalization episode. However, using MFN tariffs strongly reduces the endogeneity concern that might arise if applied preferential rates were used.

changes faced by EECs (see dedicated section 5.1). Over and above the broad MFN tariff liberalization towards non-EU countries, new member states experienced significant import tariff liberalization *vis-à-vis* Western EU member states. Indeed, before the enlargement, few EECs applied the MFN tariffs rates to Western EU member states. This tariff protection was lifted following entry into the EU's Customs Union. We consider the tariff liberalization *vis-à-vis* Western EU member states by computing the pre- versus post-accession change in import tariffs imposed on Western EU member states.

So, for each new member state, the pre- and post-accession import tariff is computed as the weighted average between the MFN tariff rate applied to non-EU trade partners and the tariff rate (MFN or preferential) applied to EU partner countries.[17] Considering the zeroing of tariffs with EU members is an important feature of our identification strategy. Indeed, simply taking the applied MFN *vis-à-vis* non-EU partners would have omitted the major trade liberalization dynamic experienced by new member states with EU members.

For the export tariffs τ_{cs}^{X}, we use the average *effectively applied* tariff rate that each Eastern European country c faces on its exports in a given industry s. It is a weighted average across trade partners based on 1997 export share weights. The variation in the export liberalization variable $\Delta ln(1+\tau_{cs}^{X})$ is, therefore, due to the change in the applied tariff (MFN or preferential)[18] set by each trade partner toward a given Eastern European country. It reflects the market access shocks that the new member states experienced when adopting the EU's Preferential Trade Agreements. As such, also the variation in the export tariffs can be considered exogenous to labor market outcomes in EEC regions. In section 5.1 we test the absence of correlation between export tariff in the pre-enlargement period and the working conditions of individuals in 2002.

Based on the assumption that tariff changes are (fully or partially) passed on to domestic

[17] To reduce any endogeneity concerns, weights are the import shares in 1997. As for pre-enlargement import tariff *vis-à-vis* Western EU member states, we use preferential rates if a PTA was in force between a given EEC and a Western EU member before the EU-enlargement. Otherwise we simply use the MFN rate in the pre-accession period.

[18] We use MFN rates in absence of PTA, and the preferential rate when a PTA is in force.

prices, any variation in the applied MFN import or effectively applied export tariff is a good proxy for variations in the domestic price and the level of competitiveness (i.e. price set in foreign markets) in each industry.[19] We consistently average the tariff series at the NACE 2-digit level to match the industry definition adopted in the SES survey 2002. We therefore have 13 industries in each country (12 in Slovakia and Latvia) and hence a total of 115 shocks (i.e. industry-country combinations) defining our liberalization measures.[20] This is an important feature of our data because in shift-share research design it is important to have a large number of shocks to avoid few shocks driving the entire analysis.[21] Finally, the import and export tariff liberalization indexes, $Lib^M_{r_c}$ and $Lib^X_{r_c}$ are normalized between 0 (minimum values) and 1 (maximum values). An increase in $Lib^M_{r_c}$ and $Lib^X_{r_c}$ represents respectively an import and export tariff cut – see equation 1.

2.3 Other variables

The EU enlargements in 2004 and 2007 had a number of economic repercussions. They not only promoted trade in goods and services, but also drove up Foreign Direct Investment (FDI) and other capital flows, and increased labor mobility between EU countries. We therefore add country and region-level controls in our econometric specification to take into account various shocks that may correlate with both the tariff liberalization variable and the labor market outcomes.[22]

We consider productivity shocks by including the log of NUTS-level per capita GDP, constructed with Eurostat data.[23] As the evolution of the population might affect demand for local goods and services, we also control for population change at the NUTS-level, based

[19] This assumption has been widely used in the literature on export supply elasticity (Romalis, 2007; Fajgelbaum et al., 2020).

[20] The 11 sectors mentioned in Section 2.1 follow a slightly broader aggregation we adopted to harmonize the different cross-country classifications of sectors in SES data. We do not need such a broader sector classification to calculate country-sector specific tariffs.

[21] In section 2.4 we show descriptive statistics on both the *shock* and the *share* components used to build our liberalization measures.

[22] Details and sources of the data are provided in the Online Appendix.

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

on Eurostat data. While the total population affects aggregate demand, it can be weakly linked to labor supply. This is particularly true in Eastern European countries, which have experienced substantial migration waves since the 1990s. Therefore, we also control for foreign labor supply shocks by including the net migration flows as a share of the 1997 population of Eastern European countries as provided by Eurostat.

We use the Eurostat dataset on net foreign property income to GDP to compute foreign capital shocks to control for a change in the presence of multinational corporations between 1997 and 2014. The net foreign property income, as computed by the 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. property income distributed abroad). Finally, we also control for the dynamics of prices across countries through the Consumer Price Index (CPI), and for the unemployment rate. Information on both CPI and unemployment rate is taken from the World Development Indicators database.

2.4 Estimation sample and statistics

The estimation sample includes 4,287,509 individuals working in 15 NUTS 1-digit level regions in 2002 and 2014. Table 1 provides the descriptive statistics for the variables used in the econometric exercise. The 13.7% of individuals in our sample are employed on temporary contracts. The average probability to work on atypical hours is more common, and reported by 43.8% of the sample, while around 30.1% of workers engage in overtime hours. Individuals in our sample work on average 170 hours per months with a monthly wage of about 500 euros.

By comparing the inter-quartile ranges for export and import liberalization (p75 - p25 in Table 1), we observe a larger dispersion in the export liberalization index (0.063) than in the import liberalization (0.010) index, indicating a more pronounced variability in export liberalization values with respect to import liberalization. However, both import and export liberalization indexes have sufficient variability as shown by the large coefficients of variation. This is a key feature of our data, as it provides the cross-regional variation necessary for identification in our econometric analysis.

Table 1: In-sample descriptive statistics

	Mean	Std. dev.	p10	p25	p50	p75	p90
Short-term (1/0)	0.137	0.344	0.000	0.000	0.000	0.000	1.000
Shift work (1/0)	0.438	0.496	0.000	0.000	0.000	1.000	1.000
Overtime (1/0)	0.301	0.459	0.000	0.000	0.000	1.000	1.000
Hours (log)	5.125	0.188	5.059	5.100	5.159	5.215	5.215
Wage (log)	6.279	0.789	5.288	5.799	6.321	6.799	7.203
Import lib. (0, 1)	0.473	0.202	0.415	0.415	0.415	0.425	0.934
Export Lib. (0, 1)	0.369	0.194	0.081	0.324	0.324	0.387	0.647
Collec. agre.	0.628	0.483	0.000	0.000	1.000	1.000	1.000
Large corp. (1/0)	0.866	0.341	0.000	1.000	1.000	1.000	1.000
Public corp (1/0)	0.141	0.348	0.000	0.000	0.000	0.000	1.000
Reg. produc. (log)	11.236	2.030	8.641	9.427	12.479	12.925	12.925
Foreign cap. (log)	-4.774	2.528	-8.124	-8.124	-3.853	-2.849	-1.429
Reg. pop. (log)	15.624	0.600	14.657	15.257	15.505	16.168	16.168
Net migration	-0.211	3.685	-4.437	-0.375	-0.044	3.130	3.130
CPI index	0.614	0.516	0.224	0.372	0.480	0.790	0.976
Unempl. rate	9.390	4.105	6.110	6.110	7.020	13.180	16.090

Note: Authors' calculations on SES, World Bank WDI and Eurostat data (Observation=4,287,509). Unweighted descriptive statistics.

3 Facts on trade liberalization and working conditions

The enlargement of the European Union to Eastern European countries provides a unique setting to study the labor market effects of trade liberalization. In this section, we present four facts on the trade policy changes introduced by the enlargement, and the evolution of the labor markets with respect to temporary contracts.

3.1 Trade liberalization

The EU enlargement to Eastern Europe was the largest expansion in terms of geography and workforce size. Beginning in the mid-1990s, candidate countries signed bilateral interim agreements with existing EU member states, setting the stage for full integration through the adoption of the *Acquis Communautaire*.[24] These interim agreements regulated trade

[24]For instance, in March 1998, Poland and the EU signed the "Partnership for Accession of Poland" aimed to help Poland meeting the EU accession criteria and implement the *Acquis*. Similar agreements were signed

relationships between existing and candidate EU members but excluded certain industries, such as food, textiles, and clothing, from immediate liberalization (see The European Commission, 2006). The terms of liberalization varied across industries and countries, reflecting specific provisions in the agreements.

Notably, these agreements did not affect trade policies toward non-EU countries. It was only after official integration in 2004 and 2007 that new member countries adopted the EU's external trade policy. This included the common MFN tariff scheme and access to the EU's network of PTAs. These policy changes led to significant reductions in import tariffs for EECs and expanded export opportunities through EU PTAs, creating a *quasi-experimental* setting for analyzing the effects of trade liberalization on labor markets in the region.

Fact 1: Reduced MFN import tariffs. The integration into the EU induced substantial changes in trade policy for new member states. On the import side, countries were required to adopt the EU's pre-existing MFN tariff scheme. Figure 1 shows the reductions in applied MFN tariffs across sectors and countries, highlighting substantial heterogeneity. The tariffs cuts were considerable: from 2.5% in Lithuania to almost 15% average tariff cut in Bulgaria. Accordingly, as shown by Table B1 in the Appendix, Eastern European countries' shares of imports from non-EU countries substantially increased between the beginning of our sample period in 1997 and its end in 2014.

The magnitude of trade liberalization was comparable to the episodes described by Dix-Carneiro and Kovak, (2019) for Brazil and Topalova (2010) for India. Figure 1 shows strong heterogeneity in tariff reductions across Eastern European countries, with large tariff cuts in Romania and Bulgaria (having high import protection before the enlargement) and modest tariff changes in the Baltic countries.[25] The large average reduction in applied MFN im-

by all other candidate countries, ending upon their official integration into the EU. Poland joined the EU on May 1, 2004.

[25]The countries with the largest drops in tariffs were Bulgaria across most industries, Romania in the food and tobacco industry and in the metallic products, machinery and transport industries. Estonia is an interesting exception because the accession to the EU implied an increase in its MFN import tariff – due to the very low MFN import tariffs that Estonia had in the pre-accession period.

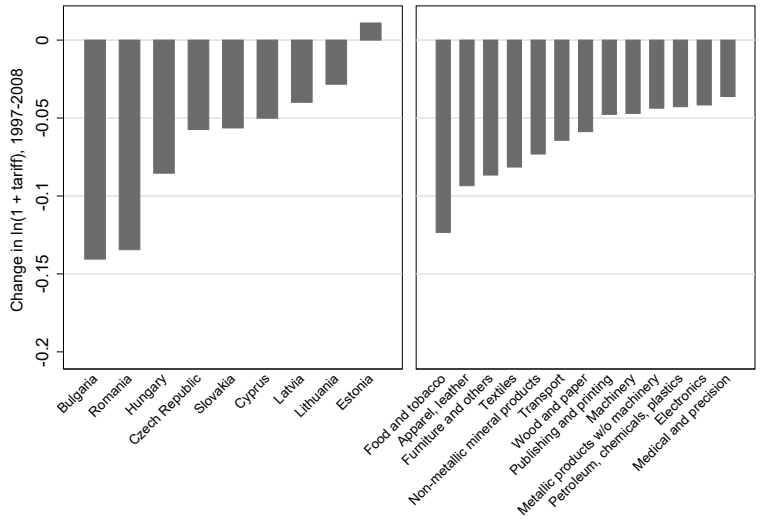

Figure 1: Change in Applied MFN Tariffs Between 1997 and 2008
Notes: Country-sector changes in applied MFN tariffs are averaged over 13 manufacturing sectors in the left panel and over the 9 countries in the right panel. *Source:* Authors' calculation using WTO data.

port tariffs shown in Figure 1 comes with a substantial heterogeneity in tariff cuts across industries. While the electronic and medical precision manufacturing sectors experienced mild tariff cuts below 5%, the food and tobacco industry faced the highest level of tariff liberalization with a decline of more than 18%. Interestingly, as shown in Appendix Figure B1, there are substantial differences in tariff changes across-countries within each sector.

Fact 2: Increased number of PTAs. On the export side, accession granted new member countries access to the EU's existing network of PTAs, significantly expanding their export opportunities. Table 2 shows the increase in the number of PTAs before and after accession.

Before 2004, most of the Eastern European countries preferential trade agreements were signed with EU members and a few non-EU members such as Croatia and Turkey. By adopting the EU PTAs' scheme, Eastern European countries gained access to many countries with which they did not share a trade agreement before. In nearly all countries, the number of PTAs almost doubled, with Cyprus experiencing an increase of almost seven-fold compared to the count before accession.

Table 2: Post-Accession Adjustment in the Number of PTAs

Country	$\#PTA_{2002}$	$\#PTA_{2004}$	$\#PTA_{2008}$
Bulgaria	28	30	65
Cyprus	9	45	65
Czech Republic	30	45	65
Estonia	24	45	65
Hungary	30	45	65
Latvia	24	45	65
Lithuania	25	45	65
Romania	26	30	65
Slovakia	27	45	65

Notes: 2008 marks the end of the post-accession transition to EU trade policy adoption.
Source: Authors' calculation using WTO data going from 1976 to 2010.

3.2 Trends in the share of temporary workers

The integration of Eastern European countries into the European Union brought substantial changes to their labor markets. Before accession, these markets were defined by centralized planning, characterized by rigid employment structures, dominance of state-owned enterprises, and limited contract flexibility. The transition to market economies in the 1990s dismantled these systems but resulted in high unemployment, and a significant decline in collective bargaining coverage (Cazes, 2002; Fialová and Schneider, 2009; Visser, 2016).

Fact 3: Increased shares of temporary contracts. During the period of analysis, temporary employment increased substantially. As shown in Table 3, the average share of workers on temporary contracts rose from 8.29% in 2002 to 9.53% in 2014.[26] The increases were particularly pronounced in the Czech Republic, where the share rose from 14.8% to 20.1%, and in Slovakia, where it rose from 12.7% to 15.7%. These patterns suggest that temporary contracts played a key role in facilitating labor market adjustments, providing firms with the flexibility needed to respond to shifts in labor demand during the economic transition.

[26]The average share of workers on temporary position is different than that reported in Table 1, where we report simple unweighted descriptive statistics.

Table 3: Share of Temporary Contracts by Country (2002 and 2014)

Country	2002 (%)	2014 (%)
Bulgaria	11.4	8.0
Cyprus	4.8	7.5
Czech Republic	14.8	20.1
Estonia	4.9	3.5
Hungary	6.3	4.5
Latvia	7.3	5.6
Lithuania	9.1	5.1
Romania	1.1	3.2
Slovakia	12.7	15.7
Sample Average	8.29	9.53

Source: Authors' calculation using SES data.
Weighted averages

Fact 4: Temporary employment and pre-liberalization level of unemployment. An important question is whether the increase in temporary contracts in the post-liberalization period is linked to the high unemployment levels observed during the pre-liberalization period. Regions with greater labor market slack likely drew from their pool of unemployed workers, who transitioned into temporary jobs as a pathway back into employment. If trade liberalization increases the number of temporary workers, it could play a role in reducing inactivity by providing a pathway for unemployed individuals to re-enter the labor market through temporary jobs. Fact 4 examines this relationship by exploring the connection between unemployment rates and temporary employment.

To examine the link between unemployment and temporary contracts, we construct the share of workers on temporary contracts for cells defined by sector, region, gender, education, and age in 2014 using the SES dataset. These shares are then correlated with unemployment rates from 2002 from the Eurostat, which are specific to gender and education groups.
Table 4 shows a strong positive correlation: regions with higher unemployment rates in 2002 tend to exhibit higher shares of temporary contracts in 2014. The correlation remains robust across various specifications, including controls for region, sector, and demographic fixed effects. For instance, when controlling for region, sector, and demographic characteristics (column 4), the correlation coefficient is 0.285 and statistically significant at the

Table 4: Conditional correlations between unemployment and temporary contracts

Dep. Variable	Share of Temporary Contracts in 2014			
	(1)	(2)	(3)	(4)
Unemployment in 2002	0.547***	0.499***	0.498***	0.285***
	(0.083)	(0.071)	(0.071)	(0.044)
Region	No	No	No	Yes
Sector	No	No	Yes	Yes
Gender×Education ×Age	No	Yes	Yes	Yes
Adj. R^2	0.0994	0.190	0.201	0.357
Obs.	5370	5370	5370	5370

The dependent variable is the share of workers on temporary contracts within each cell defined by sector, region, gender, education, and age in 2014. Unemployment rates in 2002 are specific to gender and education groups. OLS regressions are used, with standard errors clustered by cell (region × education × gender) shown in parentheses. Significance levels are indicated as ***, **, * for 1%, 5%, and 10%, respectively.

1% level. This suggests that regions with greater labor market slack prior to liberalization were more likely to rely on temporary contracts as a means of absorbing labor during the post-enlargement period.

4 Temporary contracts and trade liberalization

To interpret the changes in the share of temporary workers (and other non-wage working conditions) induced by trade liberalization, we draw on the framework outlined in Appendix A. The framework identifies two distinct channels through which trade liberalization shapes firms' labor demand for temporary and permanent workers:

- Export liberalization: Expanding foreign market access raises the demand for intermediate goods, inducing firms to increase hiring. Temporary contracts are particularly well-suited to absorb short to medium term fluctuations in production, leading to an unambiguous rise in temporary employment. However, export liberalization raises employment without necessarily increasing wages because labor supply is elastic and institutions setting.

- Import liberalization: Increased competition from foreign producers reduces domestic demand, prompting firms to adjust by reducing temporary workers. At the same

time, access to cheaper and/or higher-quality imported inputs enhances productivity, potentially driving a rise in temporary employment. The net effect is inherently ambiguous, reflecting the balance of these opposing forces. Import liberalization depresses both permanent and temporary wages by intensifying competition, shifting the labor demand curve inward.

These mechanisms align with the observed heterogeneity in labor market outcomes across regions with different exposures to trade liberalization. Export liberalization unambiguously increases temporary employment, while the impact of import liberalization depends on whether the competition effect or the quality effect dominates. These predictions serve as a theoretical guideline for understanding the empirical patterns presented in Section 6.

5 Empirical strategy

We use changes in weighted import and export tariffs faced by new member states' regions, as discussed in Section 2.2, to identify the impact of trade liberalization on workers' labor outcomes. We focus primarily on individuals' working conditions, measured by the probability to work on temporary contract. We also examine workers' working schedules, total hours worked, and wages. The estimation equation is as follow:

$$y_{i_{(rc)}t} = \sum_{l=M,X} \gamma_{1l} \left[Lib^{l}_{r_{(c)}} \times \mathbf{I}_{2014} \right] + \mathbf{Z}^{1'}_{rt}\gamma_{\mathbf{1}} + \mathbf{Z}^{2'}_{ct}\gamma_{\mathbf{2}} + \mathbf{X'}_{it}\gamma_{\mathbf{2}} + \theta_r + \theta_t + \theta_{g(i)} + \epsilon_{i_{(rc)}t}, \qquad (2)$$

where the dependent variable $y_{i_{(rsc)}t}$ indicates the labor outcomes of individual i in region r, sector s, and cell c at time t; we use indicators for: (i) temporary contracts, (ii) non-standard working hours including nights, weekends, and shift work, (iii) overtime hours, (iv) earnings and (v) hours worked. Our variable of interest in Equation (2) is the interaction term between the trade liberalization indexes $Lib^{l}_{r_{(c)}}$ and a post-enlargement indicator, $\mathbf{I}_{2014}$.[27] We include

[27] We use the 2014 vintage of the SES survey to approximate the long run adjustment of local labor markets to the EU-enlargement induced trade liberalization. The 2010 survey would have been another option, but we consider it temporarily too close to the 2007 EU-enlargement.

region θ_r and year θ_t , as well as cell-specific fixed effects $\theta_{g(i)}$ (where the cell structure incorporates gender, education, and age).[28] So, our empirical approach compares the labor outcomes of "*observationally equivalent*" workers before and after EU-enlargement in regions having faced different intensities of trade liberalization shocks.[29] We also include sector-by-year specific effects, θ_{st} in some specifications, to control for unobserved industry trends that vary over time and are common to all regions in EEC countries. These trends, which could impact labor conditions, include changes in technology and regulatory developments at the industry level. Our main conclusions remain unaffected by the inclusion or exclusion of θ_{st}.

The region-time controls $\mathbf{Z}^1_{rt}$ include the size of the region measured by its population, and the income level of the region measured by its per capita GDP. The country-time controls $\mathbf{Z}^2_{ct}$ include net international migration and capital flows, isolating the impact of trade liberalization from other globalization-related variables. Considering that changes in price indexes and the overall labor market conditions in a country can influence working conditions, we consider the country-specific consumer price index and unemployment rate as additional control variables.

Wages, employment, and working conditions are substantially influenced by specific characteristics of the worker's employer. Hence, in Equation (2), we introduce a set of firm-specific control variables ($\mathbf{X}_{it}$) including factors such as (i) the company's size, (ii) its public or private ownership status, and (iii) exposure to collective bargaining.[30] At the individual worker level, we control for job tenure (i.e. worker's experience). Also, in regressions analyzing work during atypical hours, monthly wages, and monthly earning on atypical schedules, we control for the logarithm of monthly hours worked. For regressions on overtime wages, we additionally control for monthly overtime hours. Controlling for hours worked is important, as working schedules may correlate with the overall workload of individuals (i.e. we compare

[28] We consider 6 bins of age and high, low, and middle-skilled workers.

[29] The direct effect of trade liberalization $Lib^l_{r_{(c)}}$ and the post 2014 dummy variable $\mathbf{I}_{2014}$ is captured by region and year fixed effects.

[30] The exposure to collective bargaining is a firm-specific variable indicating whether the majority of the workforce in the firm is covered by any type of collective pay agreements (national, industrial or company agreements).

wage and non-wage working conditions of individuals having similar workload). By including total hours worked in Equation (2), in estimations that concern the probability to work on atypical hours and overtime, we isolate variation in working schedules conditional on overall workload.[31] ϵ_{irsct} is the error term.

To account for heteroskedasticity and non-independence across repeated observations within countries and regions, standard errors are adjusted for clustering at the NUTS regional level, except where explicitly stated otherwise. We estimate the baseline equation using logistic regressions when using the indicators for temporary contracts, atypical working hours and overtime and OLS when the dependent variable refers to earnings or hours worked. The sample size is 4,287,509 workers.

5.1 Exogenous shocks and shift-share identification

The causal interpretation of our results bases on the as-good-as-random nature of our trade liberalization indices, and specifically, on the exogeneity of trade shocks, $\Delta ln(1+\tau^{l}_{cs})$. Indeed, Borusyak et al. (2022; 2024) suggests that in shift-share research designs, causality can be claimed if shares ($\beta_{r_{(c)}s}$) are not exogenous but shocks are quasi-random and mutually uncorrelated. We explore the exogeneity assumption of our trade liberalization indices in several ways.

First, our shift-share research design relies on the assumption that the average exposure to trade shocks is dispersed (Borusyak et al., 2022; 2024). Table 5 shows that the average and the median of the weights ($\beta_{r_{(c)}s}$) are similar in value, suggesting non-skewed distribution of shares, and the absence of concentration of employment shares in few sectors.[32] Also, our exposure shares add up to one as in the baseline case of shift-share identification.

Second, one may be concerned about the endogenous setting of pre-enlargement import and export tariffs. Unobserved region-specific factors might have influenced the tariff schemes of EEC countries in the pre-enlargement period. To address this potential concern, we include

[31] In the absence of data on hours worked during atypical schedules, we include total monthly hours in regressions concerning wages under atypical schedules and monthly overtime hours for overtime wage regressions, ensuring consistent use of the data.

[32] We show the employment shares ($\lambda_{r_{(c)}s}$) which are used to construct the weights are also dispersed.

Table 5: Distribution of shocks and weights

	Mean	Std. dev.	p10	p25	p50	p75	p90
$\Delta ln(1+\tau^X_{cs})$	-0.024	0.038	-0.070	-0.031	-0.016	-0.008	-0.004
$\Delta ln(1+\tau^M_{cs})$	-0.064	0.065	-0.145	-0.088	-0.060	-0.015	0.004
$\beta_{r_{(c)}s}$	0.077	0.063	0.017	0.033	0.063	0.104	0.147
$\lambda_{r_{(c)}s}$	0.063	0.056	0.011	0.022	0.050	0.085	0.121

Note: Authors' calculations on SES, World Bank WDI and Eurostat data (Observation=4,287,509).

region fixed effects in our empirical strategy. Additionally, we test the orthogonality of initial labor market conditions to tariffs by regressing the working conditions of individuals in 2002 on the initial import and export tariffs faced by each country-sector. This regression controls for the same variables and fixed effects as our baseline specification. See Panel A of Table 6. The absence of a significant correlation reassures us on the orthogonality between the pre-enlargement local labor market conditions and the initial level of EECs' sector tariffs.[33]

Moreover, we conduct two additional tests following Borusyak et al. (2022). First, we regress potential country-sector confounders on the *change* in import and export tariffs (i.e., our *shock*). If the changes in tariffs are as good as randomly assigned to each country-sector, then we should not expect any significant correlation between them and the potential confounders at t_0. In line with Borusyak et al. (2022)[34], we chose the share of tertiary-educated workers, the share of production workers, and the average wage in each country-sector in 2002 as potential confounders. The absence of statistically significant correlation shown in Panel B of Table 6 supports the quasi-experimental nature of tariff changes. Second, we conduct a regional balance test (pre-trend) by regressing the average wage, the share of workers on temporary contracts and atypical hours in each region in 2002, on our measures of trade liberalization. We find no statistically significant relationship between these variables,

[33]Initial export tariffs are significantly correlated with the probability of working on atypical hours in 2002 (panel A Table 6). However, the absence of significant correlation with potential omitted variables (panel B Table 6) and the absence of a pre-trend (panel C Table 6) reassure on the as-good-as-random nature of our liberalization measures with respect to the probability of working on atypical hours.

[34]See section 6.2.3 in Borusyak et al. (2022)

as shown in Panel C of Table 6. This further supports the quasi-experimental nature of our research design. Finally, as suggested in Borusyak et al. (2022), in Table B3 we show a robustness check clustering the standard errors at the level of the shock, i.e. industry-country.

Table 6: Initial condition and balance test

	Imp. shock		*Exp. shock*	
Balance variable	Coef.	SE	Coef.	SE
Panel A: Initial condition test				
Temp. contract (dummy, 2002)	0.020	(0.048)	-0.105	(0.075)
Atyp. hours (dummy, 2002)	0.184	(0.279)	0.848**	(0.364)
Worker wage (log, 2002)	0.051	(0.215)	0.096	(0.388)
N. of individuals	832,842		832,842	
Panel B: Industry-level balance				
High-skilled workers' (share, 2002)	-0.019	(0.177)	-0.021	(0.239)
Production workers' (share, 2002)	0.093	(0.126)	0.023	(0.235)
Average wage (log, 2002)	-0.044	(0.355)	0.375	(0.664)
N. of country-sector	115		115	
Panel C: Region-level balance				
Workers on temp. contract (share, 2002)	0.063	(0.042)	0.022	(0.019)
Workers on atyp. hours (share, 2002)	-0.010	(0.379)	-0.038	(0.196)
Average wage (log, 2002)	0.506	(0.451)	-0.103	(0.201)
N. of regions	15		15	

Note: Panel A reports the coefficients and standard errors (SE) from regressions of individuals' working conditions in 2002 on the initial level of import and export tariff imposed/faced by the country-sector, controlling for employer-specific controls, and region-, sector-, job spell- and sex-age-education fixed effects. Standard errors in Panel A allow for clustering at country-sector level. Panel B reports the coefficients and standard errors (SE) from regressions of several country-sector level proxies of unobserved residuals (i.e. potential confounders) in 2002 on: (i) $\Delta ln(1+\tau_{cs})$ on import and exports, (ii) country fixed effect and (iii) sector fixed effects. Standard errors in Panel B allow for clustering at sector level. Panel C reports the coefficients and standard errors (SE) from regressions of region-specific working conditions in 2002 on import and export liberalization measures, weighted by the total number of surveyed workers in the region in 2002. Standard errors in Panel C allow for clustering at region level.

6 Results

6.1 Baseline results

Tables 7 to 10 present the results of our baseline analysis, examining the effects of export and import liberalization on working conditions in EECs. The analysis primarily focuses

on temporary contracts and working schedules, while also providing insights into working hours, wages, and wage components across different categories of workers. Each specification accounts for a set of control variables, region-specific effects, and cell-specific effects based on gender, education, and age. Moreover, we consistently show results from specifications controlling for sector-by-year fixed effects.

Working conditions and working schedule. The first four columns of Table 7 investigate the probability of workers having temporary contracts, while the last four columns analyze the probability of working during non-standard hours (including nights and weekends) and overtime. The baseline worker-level regressions are estimated using logistic regressions, with marginal effects evaluated at the sample means reported.

Table 7: Baseline results – Working conditions and working schedule

	Working Condition				Working Schedule			
Dep. Variable	Temporary contract				Atypical schedule		Overtime	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Export lib.	0.123***		0.121***	0.118***	0.151***	0.142***	-0.055**	-0.048*
	(0.015)		(0.011)	(0.011)	(0.022)	(0.020)	(0.028)	(0.025)
Import lib.		-0.027	-0.010	-0.010	-0.006	-0.015	-0.051**	-0.048**
		(0.038)	(0.007)	(0.007)	(0.015)	(0.013)	(0.022)	(0.020)
Control	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
θ_r	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
θ_t	Yes	Yes	Yes	No	Yes	No	Yes	No
θ_{st}	No	No	No	Yes	No	Yes	No	Yes
$\theta_{g(i)}$	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	4,287,509	4,287,509	4,287,509	4,287,509	4,287,509	4,287,509	4,287,509	4,287,509

The dependent variables are indicators for having a temporary contract, working on atypical hours and working overtime. Logistic estimations incorporate control variables, region-specific effects, year-specific effects, cell-specific effects based on gender, education, and age and job spell specific effects. Columns (4), (6) and (8) include also sector × year-specific effects. Marginal effects are computed at sample means. Standard errors, clustered by NUTS-1 regions, are in parentheses. Full results are provided in Table B2, and results with standard errors adjusted for clustering at the country and sector level are reported in Table B3. Significance levels are denoted as ***, **, * for 1%, 5%, and 10%, respectively

We find a significant positive effect of export liberalization on the probability of workers having temporary contracts. A 10 percentage point increase in the export liberalization index corresponds to a 1.2 percentage point increase in the probability of working on a temporary

contract. For example, workers in regions that experienced high export liberalization (top decile of $Lib^X_{r_{(c)}}$) are 6.7 percentage points more likely to be employed on temporary contracts than those in regions with mild export liberalization (bottom decile). This finding is consistent with the theoretical insight discussed in Section 4 and Appendix A: increased foreign market access raises demand for final and intermediate goods, leading firms to hire more temporary workers.

Interestingly, import liberalization does not have a significant impact on temporary contracts, as the coefficient for import liberalization is negative but not statistically significant. This result reflects opposing forces: productivity gains from quality upgrading of imported intermediate inputs, which may increase foreign competitiveness of firms and the likelihood of hiring on temporary employment, and direct import competition, which reduces labor demand. These effects appear to cancel each other out.

Export liberalization also has a significant positive effect on the likelihood of working atypical hours. A 10 percentage point increase in the export liberalization index leads to a 1.5 percentage point increase in the probability of working atypical hours. This reflects adjustments to increased foreign demand and in firm operations, such as accommodating different time zones, coordinating with international partners, or aligning production schedules with global demand. In contrast, the effects of export and import liberalization on the probability of working overtime are negative. Trade liberalization may incentivize firms to optimize labor allocation by reducing reliance on costly overtime hours. Also, the additional demand induced by export liberalization may lead firms to adjust by shifting from overtime to more flexible arrangements, such as atypical hours, to meet foreign markets' demand. These adjustments reflect the need for greater flexibility in an increasingly competitive international environment.

These results are robust to the inclusion of sector-by-year fixed effects in columns (4), (6), and (7), indicating that unobserved variation at the sector and year level does not significantly affect the estimated impact of export and import liberalization on working

conditions and schedules.

To improve on the identification, we take two steps toward a pseudo-panel approach. First, in Table B4, we analyze the effects of trade liberalization using cohort-level data. Specifically, we track workers aged 20–29 in 2002 and those aged 30–39 and 40–49 in 2014. This allows us to follow workers with comparable characteristics across the pre- and post-accession periods, with the age difference spanning the 13-year period of analysis. We refine the cell-specific effects to account for gender and education, ensuring that workers are compared within the same region and sector-year (fixed effects). Second, in Table B5, we aggregate worker-level data into region-sector-education-gender-age cells, comparing individuals who are more similar. Both exercises confirm our baseline findings, with some differences. In Table B4, export liberalization increases the probability of workers holding temporary contracts, while import liberalization reduces it. In Table B5, the same patterns emerge, with the negative effect of import liberalization on temporary contracts now precisely estimated. Together, these two exercises support the robustness of our baseline estimations and provide strong evidence of the differential effects of export and import liberalization.

Hours and earnings. The positive effect of export liberalization on the probability of working on temporary contracts and atypical hours, as shown in Table 7, may reflect the concept of *compensating wage differentials*, where workers are compensated with a wage premium for less favorable working conditions (Rosen, 1986). In Table B6 we show that working on temporary contract or atypical hours, if anything, is correlated with lower earnings. The absence of wage premium for working on less favorable conditions suggests the absence of compensating wage differential in our data. Further investigation into the effects of trade liberalization on labor outcomes is conducted through an analysis of hours worked and earnings, as outlined in Table 8. We estimate the models using OLS. As in the analysis of working conditions and schedules, the specifications include control variables, such has unemployment rates, region-specific effects, year or sector-by-year fixed effects, cell-specific

effects, and job spell fixed effects.

Table 8: Hours and earnings.

	Hours		Wages					
Dep. Variable	Total		Total		on atypical schedule		on overtime schedule	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Export lib.	0.127*	0.117*	0.213	0.200	0.597*	0.675**	0.183*	0.207*
	(0.069)	(0.065)	(0.135)	(0.138)	(0.295)	(0.283)	(0.099)	(0.103)
Import lib.	0.106	0.107	-0.731***	-0.725***	-0.820***	-0.828***	-0.845***	-0.863***
	(0.069)	(0.064)	(0.127)	(0.129)	(0.265)	(0.268)	(0.097)	(0.104)
θ_r	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
θ_t	Yes	No	Yes	No	Yes	No	Yes	No
θ_{st}	No	Yes	No	Yes	No	Yes	No	Yes
$\theta_{g(i)}$	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	4,287,509	4,287,509	4,287,509	4,287,509	1,878,836	1,878,836	1,276,486	1,276,486

The dependent variables are the log of hours and the log wage received when working on atypical hours and working overtime. OLS estimations incorporate control variables, region-specific effects, year-specific effects, cell-specific effects based on gender, education, and age and job spell specific effects. Columns (2), (4), (6) and (8) include also sector × year-specific effects. Standard errors, clustered by NUTS-1 regions, are in parentheses. The full results are reported in Table B7. Significance levels are denoted as ***, **, * for 1%, 5%, and 10%, respectively.

The results in Table 8, based on the full sample of workers, show that export liberalization increases the number of hours worked but has no significant effect on total earnings. Wages for atypical hours and overtime do increase, suggesting a mixed effect of export liberalization on pay.[35] In contrast, import liberalization has no impact on hours worked but, in line with previous literature, reduces wages regardless of the working schedule.

Our analysis shows that export liberalization, through the foreign demand channel, increases the likelihood of temporary contracts, the total number of hours worked, and wages for atypical schedules and overtime. However, as indicated in columns (3)–(4) of Table 8, export liberalization has no impact on total earnings. This result, despite the rise in hours worked and the probability of temporary contracts (see Table 7), emphasizes an important

[35]The coexistence of reduced overtime hours in Table 7 and higher overtime wages in Table 8 may reflect firms' adjustments to export liberalization. Firms could substitute toward higher-skilled (better paid) workers, who are more productive and require less use of overtime employment to assure the needed level of output. At the same time, fewer overtime hours may increase the premium paid for such work, as firms incentivize flexibility in a more productive workforce.

point: greater availability of temporary contracts does not lead to higher wages. In the context of unemployment, firms do not adjust wages because labor supply is elastic. While this finding may seem counterintuitive – since workers with less favorable conditions (i.e., temporary contracts) might typically seek to switch employers or relocate – it aligns with the findings of Tanaka (2020), who demonstrate that most workers are geographically immobile.

In the next section, we extend this analysis by examining the effects of trade liberalization across different types of contracts, occupations, and industries.

6.2 Further Results

We analyze the impact of trade liberalization by contract type (permanent vs. temporary), worker category (management vs. production), and industry (tradable vs. non-tradable). Our primary focus is on the probability of holding temporary contracts and working atypical hours. To benchmark our findings with previous studies, we also examine the effects of trade liberalization on overall working hours, total wages, and earnings for atypical hours.

Impact on working conditions and labor outcomes across occupation categories. The consequences of trade liberalization are expected to vary across worker groups. Autor et al. (2014) documented uneven earnings losses from the China shock, driven by differences in workers' initial employment conditions and skill levels. Building on this insight, we examine whether trade liberalization affects working conditions and schedules differently across occupations, reflecting variations in labor demand and the specific roles required by firms in response to increased foreign market access. We categorize occupations into two broad groups: management and production/service workers;[36] and further stratify the sample by type of contract (temporary *vs* permanent).

Columns (1) and (2) of Table 9 present results on the probability of working under temporary contracts and atypical hours by occupation category, without distinguishing contract

[36]The details of the classifications are in Section O3 of the Online Appendix.

types. Columns (3)-(5) focus on hours worked and wages for workers on temporary contracts, while Columns (6)-(8) replicate the analysis for workers on permanent contracts.

Table 9: Impact on working conditions and working schedule across occupation categories

			Temporary Contracts			Permanent Contracts		
				Wages			Wages	
	Temp. Contract	Atypical hours	Hours	Total	Atypical schedule	Hours	Total	Atypical schedule
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
A. Management								
Export lib.	0.047***	0.101***	0.255	0.226	1.219	0.101	0.222	0.969***
	(0.016)	(0.007)	(0.195)	(0.200)	(0.821)	(0.091)	(0.196)	(0.213)
Import lib.	-0.012	-0.017***	0.019	-0.920***	1.819***	0.137	-0.779***	-1.340***
	(0.011)	(0.006)	(0.152)	(0.112)	(0.504)	(0.092)	(0.173)	(0.124)
B. Production & service wkrs.								
Export lib.	0.122***	0.185***	0.172**	-0.006	0.607	0.097	0.106	1.198***
	(0.011)	(0.047)	(0.080)	(0.148)	(0.365)	(0.062)	(0.105)	(0.262)
Import lib.	-0.003	-0.010	0.065	-0.705***	-0.112	0.099	-0.796***	-0.827***
	(0.005)	(0.043)	(0.045)	(0.084)	(0.339)	(0.063)	(0.092)	(0.214)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
θ_r	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
θ_{st}	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
$\theta_{g(i)}$	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Columns (1) and (2) focus on the probability to work on temporary contracts and atypical hours. Columns (3) to (8) are divided into temporary workers (Columns 3-5) and permanent workers (Columns 6-8). Logistic regression is used for Columns (1) and (2), and OLS for Columns (3) to (8), include control variables, region-specific effects, sector × year-specific effects, and cell-specific effects based on gender, education, and age. Table B8 and B9 report the full results. Marginal effects are computed at sample means. Standard errors, clustered by NUTS-1 regions, are in parentheses. Significance levels are denoted as ***, **, * for 1%, 5%, and 10%, respectively.

The results indicate that export liberalization increases the probability of hiring management workers on temporary contracts. This aligns with the idea that exporting firms require specific competences, such as legal expertise, marketing, and engineering, to meet the demands of expanded market access (Matsuyama, 2007; Brambilla et al., 2012; Verhoogen, 2008). Similarly, export liberalization also raises the probability of hiring production and service workers on temporary contracts, with a marginal effect three times larger than for management workers. This suggests a substantial shift in production labor demand following increased foreign market access. Column (2) shows a significant shift in work schedules after export liberalization, with an increase in the probability of working non-standard hours across both occupational categories. The effect is particularly pronounced for production and service workers, indicating that changes in work schedules are largely driven by production labor adjustments.

Import liberalization, on the other hand, has no significant effect on the probability of holding temporary contracts across occupational categories. However, the overall insignificant effect of import liberalization on work schedules shown in Table 7 hides heterogeneous impacts: import liberalization reduces the probability of working atypical hours for management workers, while having no significant effect on production and service workers.

Columns (3) to (8) examine the impact of trade liberalization on working hours and wages by contract type. Among production and service workers on temporary contracts, export liberalization increases working hours but has no significant effect on either total wages or wages for atypical hours (Columns 4-5). For permanent workers in the same occupational group, export liberalization increases wages for atypical hours (Column 8). Conversely, import liberalization leads to lower total wages and wages for atypical hours across both contract types, except for temporary management workers, where wages for atypical hours increase (high-skilled workers in managerial positions who resist to import competition need higher pay to work on temporary contracts and atypical schedule).

Impact on working conditions and labor outcomes across industries. Trade-induced shocks are likely to have different impacts on tradable and non-tradable sectors. In this section, we analyze how trade liberalization affects working conditions and schedules across industries, with a focus on manufacturing versus non-manufacturing sectors. The main results are summarized in Table 10, while detailed estimates, including controls, are presented in Tables B10 to B12 for manufacturing, services, and mining & utilities. Below, we focus on manufacturing and services.

In columns (1) and (2), we find that export liberalization significantly increases the probability of temporary contracts and atypical hours in both manufacturing and service sectors. The positive effects observed in non-tradable (service) sectors highlight reallocation mechanisms similar to those documented by Dix-Carneiro and Kovak (2017) for Brazil and Dauth et al. (2017) for Germany. The positive income effect in tradable sectors driven by export tariff liberalization translates into higher demand for non-traded goods and services, thereby increasing labor demand in these sectors. Firms respond by hiring more temporary workers.[37] Export liberalization also increases the likelihood of working atypical hours across industries. This result is consistent with firms adjusting operations to meet increased foreign demand. In contrast, import liberalization has no significant effect on the probability of temporary contracts or atypical hours in either industry.

[37]In a different context, focusing on import liberalization Dix-Carneiro and Kovak (2019), note that a general equilibrium mechanism explains why import tariff liberalization may affect non-traded (service) sectors. The negative income effect on traded sectors induced by import tariff liberalization translates into a negative demand shock for non-traded service sectors, hence reducing labor demand in the service sectors.

Table 10: Impact on working conditions and working schedule across industries

			Temporary Contracts			Permanent Contracts		
				Wages			Wages	
	Temp. Contract	Atypical hours	Hours	Total	Atypical schedule	Hours	Total	Atypical schedule
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
A. Manufacturing								
Export lib.	0.107***	0.118*	0.297**	0.135	0.541	0.086	0.353***	1.069***
	(0.012)	(0.061)	(0.124)	(0.148)	(0.425)	(0.068)	(0.092)	(0.311)
Import lib.	-0.000	0.015	0.135	-0.563***	-0.078	0.103	-0.683***	-0.852***
	(0.009)	(0.053)	(0.113)	(0.061)	(0.401)	(0.074)	(0.078)	(0.282)
B. Services								
Export lib.	0.132***	0.192***	0.089**	-0.044	-0.232	0.136*	0.180	0.487
	(0.015)	(0.025)	(0.035)	(0.184)	(0.464)	(0.070)	(0.180)	(0.350)
Import lib.	-0.014	-0.014	0.100***	-0.809***	1.156*	0.108	-0.736***	-0.803*
	(0.010)	(0.025)	(0.022)	(0.167)	(0.580)	(0.067)	(0.163)	(0.407)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
θ_r	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
θ_{st}	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
$\theta_{g(i)}$	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Columns (1) and (2) focus on the probability to work on temporary contracts and atypical hours. Columns (3) to (8) are divided into temporary workers (Columns 3-5) and permanent workers (Columns 6-8). Logistic regression is used for Columns (1) and (2), and OLS for Columns (3) to (8), include control variables, region-specific effects, sector × year-specific effects, and cell-specific effects based on gender, education, and age. Tables B10 and Table B11 report the full results. Marginal effects are computed at sample means. Standard errors, clustered by NUTS-1 regions, are in parentheses. Significance levels are denoted as ***, **, * for 1%, 5%, and 10%, respectively.

In Appendix Figures B2 and B3, we present results by a more detailed sectoral classification (11 NACE sectors). Export liberalization increases the probability of working on temporary contracts across most sectors, with stronger effects in "Telecommunications, ICT, and Financial Services," "Construction," "Metals and Machinery," and "Hotels and Restaurants." For atypical hours, the largest effects are observed in "Transport and Support Activities," "Wholesale and Retail Trade of Motor Vehicles," and "Construction."

Columns (3) to (8) in Table 10 examine the impact of trade liberalization on workers with temporary versus permanent contracts in manufacturing and services. For temporary workers in manufacturing and services, export liberalization leads to a significant increase in working hours (Column 3). However, this increase does not translate into higher total wages (Column 4). For permanent workers in manufacturing, export liberalization does not significantly affect hours worked (Column 6), but it does lead to higher total wages and wages for atypical hours (Columns 7 and 8). This suggests that permanent workers may benefit from increased firm productivity or profit-sharing mechanisms in response to export liberalization.

In contrast, import liberalization tends to lower wages for both temporary and permanent workers in manufacturing and services. It also increases working hours for temporary workers in services, while having no measurable effect on hours worked for permanent workers. These findings suggest that the negative income effects of import liberalization primarily affect wages rather than working schedules.

6.3 Robustness checks.

Our baseline findings indicate that export liberalization is associated with an increased probability of temporary contract employment, while import liberalization has a negative, though statistically insignificant, effect. This section presents various robustness checks to validate these findings.

First, we test the sensitivity of our results to alternative proxies for export and import liberalization, adopting the methodology proposed by Autor et al. (2014). The results, shown

in Table 11, are consistent with our baseline findings.

Table 11: Robustness using the liberalization index as in Autor et al. (2016)

	Working Condition				Working Schedule	
Dep. Variable	Temporary contract				Atypical schedule	
	(1)	(2)	(3)	(4)	(5)	(6)
Export lib.	0.146***		0.141***	0.138***	0.195***	0.183***
	(0.028)		(0.020)	(0.019)	(0.033)	(0.030)
Import lib.		-0.0299	-0.0189*	-0.0189*	0.008	-0.018
		(0.040)	(0.010)	(0.010)	(0.021)	(0.018)
Control	Yes	Yes	Yes	Yes	Yes	Yes
θ_r	Yes	Yes	Yes	Yes	Yes	Yes
θ_t	Yes	Yes	Yes	No	Yes	No
θ_{st}	No	No	No	Yes	No	Yes
$\theta_{g(i)}$	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	4,287,509	4,287,509	4,287,509	4,287,509	4,287,509	4,287,509

The dependent variables are indicators for having a temporary contract, working on atypical hours and working overtime. Logistic estimations incorporate control variables, region-specific effects, year-specific effects, cell-specific effects based on gender, education, and age and job spell specific effects. Columns (4), (6) and (8) include also sector × year-specific effects. Table B2 reports the full results. Marginal effects are computed at sample means. Standard errors, clustered by NUTS-1 regions, are in parentheses. Significance levels are denoted as ***, **, * for 1%, 5%, and 10%, respectively

Next, we evaluate the stability of our results under changes in empirical specifications, estimation samples, and levels of aggregation. These checks are summarized in Figure 2 (probability of working on temporary contracts) and Figure 3 (impact on work schedules). Additional robustness checks for total hours worked and earnings are presented in Appendix Figures B5 and B6. Each dot in the figures represents the estimated marginal effects of export and import liberalization from individual regressions, with vertical lines indicating 90% confidence intervals. Specification (a) replicates our baseline results with sector-by-year fixed effects, as shown in columns (4) and (6) of Table 7.

To address potential concerns about unobserved factors influencing worker-firm matches, we exclude firm-level controls X_{it}, which may introduce endogeneity (bad control). Robustness check (b) in Figures 2 and 3 shows that excluding these controls does not alter the results. In specification (c), we define cells based on interactions of region, sector, job spell, gender, age, and education, and include cell and year fixed effects. This more conservative approach confirms our baseline results, though the effect of import liberalization becomes

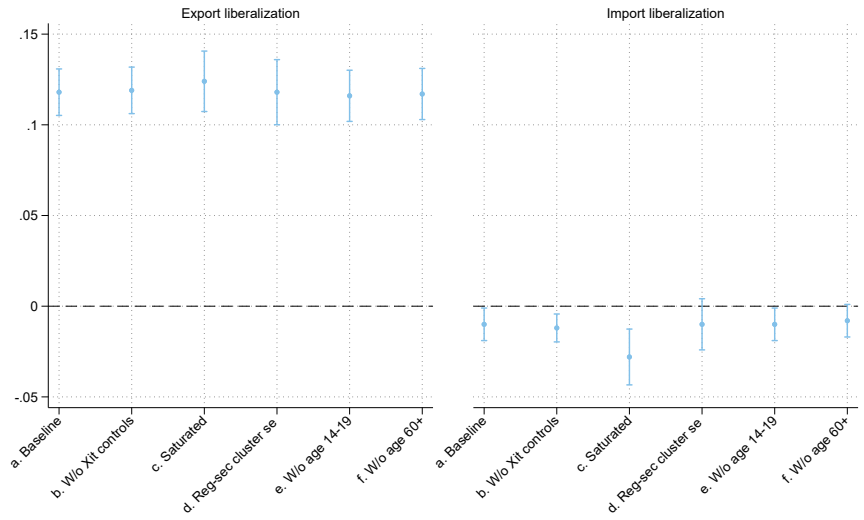

Figure 2: Robustness Checks – Working Conditions

Notes: The average effect is represented with its 90% confidence interval.

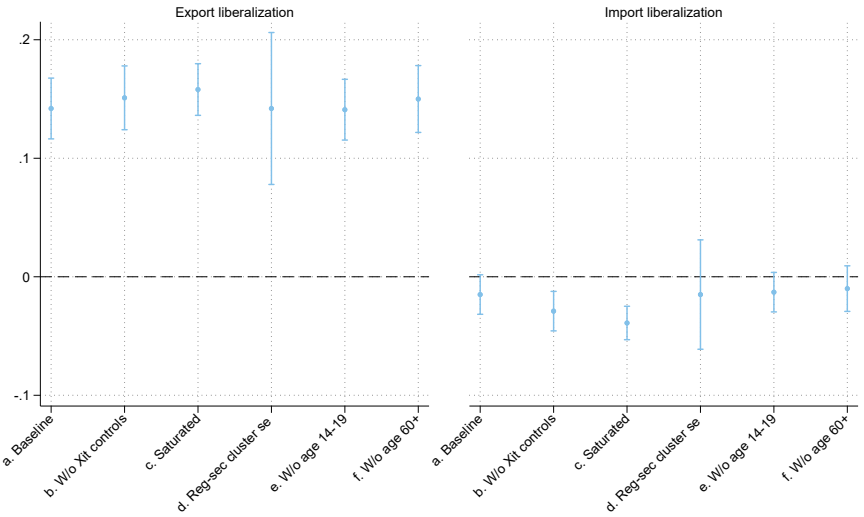

Figure 3: Robustness Checks – Working Schedule

Notes: The average effect is represented with its 90% confidence interval.

marginally significant at the 90% level. We also test the robustness of standard errors in specification (d) by clustering them at the region and sector level to account for potential correlations in working conditions within sectors. While standard errors increase slightly, the effects of export (import) liberalization remain significant (insignificant). To account for differences across age groups, specifications (e) and (f) exclude younger workers (14-19 years

old) and older workers (60+ years old), respectively. The results remain consistent across both subsamples, reaffirming the robustness of our findings.

Overall, these robustness checks support the validity of our baseline findings, reinforcing the conclusion that export liberalization significantly increases temporary employment and atypical work schedules, while import liberalization has a weaker and less consistent impact.

7 Conclusion

Our paper examines the effects of labor demand shocks induced by trade liberalization on the working conditions and earnings of individuals in Eastern European countries. We use the enlargements of the European Union in 2004 and 2007 as a natural experiment to claim causal interpretation of our results. Accordingly, we adopt a shift-share approach and build region-specific import and export trade liberalization indexes using the exogenous *change* in the weighted average country-sector level tariff implied by accession into the EU.

We focus on two aspects of working conditions: employment stability, particularly temporary contracts, and work schedule variability, including atypical working hours and overtime. We also examine the impact of trade liberalization on wages and hours worked. Our empirical strategy employs a reduced-form estimating equation to analyze the impact of trade liberalization shocks at a regional level using large-scale data from multiple countries. We find that export liberalization increases temporary employment and atypical working hours, reflecting firms' adaptation to foreign demand shocks. Namely, in regions that experienced large export liberalization shocks, individuals have 6.7 percentage points larger probability of working in temporary contract than in regions that experienced mild export liberalization. These results are consistent across industries, and are valid for both tradable and non-tradable sector. Export liberalization affects the working conditions of workers in management and production and service occupations, with the marginal effect about three times larger for workers in production and service occupations. On the other hand, import liberalization decreases the probability of working on temporary contract across occupational

categories but the impact is not statistically significant. Consistent with prior research, import liberalization leads to a significant reduction in overall earnings. Our findings show that export liberalization does not increase total earnings, as firms do not adjust wages due to the elastic supply of labor.

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Appendix

A Theoretical Framework

This section develops a conceptual framework to analyze how trade liberalization impacts firms' labor demand, specifically their reliance on permanent versus temporary contracts. The framework serves as a guide for the empirical approach presented in the main text.

Final good production. The final good Y is produced by a competitive sector that aggregates intermediate goods y_i, produced by monopolistically competitive firms $i \in [0, 1]$. The production function is:

$$Y = \left(\int_0^1 (z_i y_i)^\theta \, di \right)^{\frac{1}{\theta}}, \quad \theta \in (0, 1), \tag{3}$$

where θ governs the elasticity of substitution between intermediate inputs. Importantly, z_i represents firm-specific productivity shifters that encapsulate the impact of trade liberalization and input quality.

$$p_i = z_i \left(\frac{Y}{y_i} \right)^{1-\theta}, \tag{4}$$

where p_i is the price of intermediate good i. This setup ensures that the effects of trade liberalization are channeled through z_i, allowing the productivity shock to influence firm output and pricing decisions.

Trade liberalization and productivity shocks. The productivity term z_i, which influences the competitiveness of each intermediate goods producer, is affected by both import

and export liberalization. Specifically, z_i is expressed as:

$$z_i = q_i - \varphi_i(1 - \tau_i^M) + \psi_i \sum_{j \in J} \omega_{ij}(1 - \tau_{ij}^X), \tag{5}$$

where:

- $q_i = 1 + \eta(1 - \tau_i^M)$ represents quality improvements driven by import liberalization. Here, $\eta > 0$ reflects the sensitivity of quality to tariff reductions. Lower import tariffs (τ_i^M) induce firms to enhance product quality to escape foreign competition.
- τ_i^M denotes the import tariff rate. A reduction in τ_i^M decreases z_i directly through increased competition (the term $-\varphi_i(1 - \tau_i^M)$), while simultaneously increasing z_i indirectly via quality upgrading (the term q_i).
- τ_{ij}^X is the export tariff rate applied to trade with country $j \in J$, the set of countries in preferential trade agreements. A reduction in τ_{ij}^X increases z_i via expanded market access (the term $\psi_i \sum_{j \in J} \omega_{ij}(1 - \tau_{ij}^X)$). ω_{ij} captures the trade intensity of firm i with destination country j, and $\varphi_i, \psi_i > 0$ are parameters measuring the sensitivity of z_i to import and export liberalization, respectively.

Import liberalization thus generates a dual effect on z_i: a direct negative effect via increased competition and a positive effect through quality upgrading. In contrast, export liberalization affects z_i positively through enhanced market access.

Intermediate good production. Firms produce intermediate goods using two types of labor: permanent (P) and temporary (T) workers. The production function is given by:

$$y_i = \lambda P_i + T_i, \quad \lambda > 1, \tag{6}$$

where λ represents the productivity premium of permanent workers relative to temporary workers. This setup assumes that both types of workers are perfect substitutes in production,

but permanent workers are more efficient due to factors such as greater training, experience, or specialization. The distinction between worker types allows the model to capture the trade-offs firms face when balancing productivity and costs in response to shocks.

Given the intermediate good demand from the final good producer and a wage w, each firm, i, maximizes the following profit function:

$$\max_{T_i \geq 0} \quad z_i Y^{1-\theta} \left(\lambda P_i + T_i\right)^{\theta} - C\left(P_i, T_i\right) \tag{7}$$

Labor market. By hiring more efficient permanent workers, firms incur in higher expenses as they cover in-kind paiements, b_P.[38] This additional compensation includes exclusive benefits like severance pay, training, and other benefits specific to permanent positions. We assume $b_P = bP^{\alpha}$, where $\alpha > 1$ such that the cost of hiring and managing permanent workers increases at an accelerating rate as more permanent workers are added to the firm.[39] Hence, the cost function takes the following form :

$$C\left(P, T\right) = w\left(P + T\right) + b_P \tag{8}$$

Profit maximization (equation 7) under constraint (equation 8) implies the equality between workers' marginal revenue product and their marginal cost. The first order condition for temporary workers is :

$$\theta z_i Y^{1-\theta} \left(\lambda P_i + T_i\right)^{\theta-1} = w \tag{9}$$

[38] According to ILO (2016), permanent workers are more expensive than temporary workers due to higher recruitment costs, additional benefits not accessible to temporary workers (such as training programs), and provisions for severance packages when necessary (see Tables A5.2 and A5.4 in ILO (2016)).

[39] Integrating adjustment costs for changes in the permanent workforce into our model is a nuanced way to capture the real-world complexities faced by firms. These costs can be conceptualized as being convex, reflecting the increasing marginal difficulty and expense associated with integrating a larger number of new permanent employees. Such costs might include not only the direct expenses of hiring, training (Green 1993; Lynch 2007; Booth et al. 2003) and the provision of lunch and other subsidies, in-house catering, and childcare services but also the less tangible costs related to organizational culture integration and the diminishing returns of assimilating additional employees into established teams.

And for permanent workers :

$$\begin{aligned} & \lambda\theta z_i Y^{1-\theta}\left(\lambda P_i + T_i\right)^{\theta-1} = w + \alpha b P_i^{\alpha-1} \\ \Leftrightarrow \qquad & P_i = \frac{1}{\lambda}\left(\frac{\lambda\theta z_i Y^{1-\theta}}{w + \alpha b P_i^{\alpha-1}}\right)^{\frac{1}{1-\theta}} - \frac{T_i}{\lambda} \end{aligned} \tag{10}$$

Permanent workers receive in-kind payments on top of their regular wages because they are more efficient than temporary workers. Conversely, temporary workers receive wages that match their marginal revenue product. The demand for permanent workers is such that there is an equality between the marginal non-wage cost of permanent workers and the additional productivity provided by permanent workers expressed in wage units. Substituting 9 in 10 easily yields :

$$\begin{aligned} \lambda w &= w + \alpha b P_i^{\alpha-1} \\ w\left(\lambda - 1\right) &= \alpha b P_i^{\alpha-1} \\ \frac{w\left(\lambda-1\right)}{\alpha b} &= P_i^{\alpha-1} \end{aligned} \tag{11}$$

Then we substitute the last equation (10) :

$$\begin{aligned} P_i &= \frac{1}{\lambda}\left(\frac{\lambda\theta z_i Y^{1-\theta}}{w + w(\lambda-1)}\right)^{\frac{1}{1-\theta}} - \frac{T_i}{\lambda} \\ P_i &= \frac{1}{\lambda}\left(\frac{\theta z_i Y^{1-\theta}}{w}\right)^{\frac{1}{1-\theta}} - \frac{T_i}{\lambda} \\ \lambda P_i &= \left(\frac{\theta z_i Y^{1-\theta}}{w}\right)^{\frac{1}{1-\theta}} - T_i \end{aligned} \tag{12}$$

The additional productivity of the marginal permanent workers compared to temporary workers, expressed in wage units, is used to offset their marginal non-wage costs. Based on

equations (10) and (11) the optimal numbers of permanent and temporary workers are :

$$P_i^* = \left[\frac{w\,(\lambda-1)}{\alpha b}\right]^{\frac{1}{\alpha-1}} \text{ and } T_i^* = \left(\frac{\theta z_i Y^{1-\theta}}{w}\right)^{\frac{1}{1-\theta}} - \lambda P_i^* \tag{13}$$

If $\alpha > 1$, then the conditions $\frac{\partial P_i^*}{\partial \lambda} > 0$ and $\frac{\partial P_i^*}{\partial b} < 0$ hold, meaning that both an increase in the productivity of permanent workers λ and a reduction in the non-monetary benefit b increases the demand for permanent workers. Interestingly, our model shows that idiosyncratic shocks don't affect the optimal number of permanent workers but do impact the optimal number of temporary workers. Firms can use temporary workers to deal with these shocks. A negative shock to the firm's productivity (z) results in a drop in the firm's output, where the mechanism is the reduction of temporary workers, while the number of permanent workers is unchanged.[40]

Finally, the ratio of temporary to permanent workers can be expressed as follows:

$$\frac{T_i^*}{P_i^*} = \left(\theta z_i Y^{1-\theta}\right)^{\frac{1}{1-\theta}} \left[\frac{\alpha b}{(\lambda-1)}\right]^{\frac{1}{\alpha-1}} w^{\frac{1}{1-\alpha}-\frac{1}{1-\theta}} - \lambda \tag{14}$$

Export and import liberalization. The impact of trade liberalization on the firm's demand for temporary workers (T_i^*) is analyzed by examining its sensitivity to changes in import and export tariffs. For import tariff reductions (τ_i^M), the derivative of T_i^* with respect to τ_i^M is given by:

$$\frac{\partial T_i^*}{\partial \tau_i^M} = \frac{\partial}{\partial \tau_i^M}\left[\left(\frac{\theta z_i Y^{1-\theta}}{w}\right)^{\frac{1}{1-\theta}} - \lambda P_i^*\right], \tag{15}$$

where z_i encapsulates the composite productivity shock. Substituting the expression for z_i, the total derivative with respect to τ_i^M reveals two opposing forces. First, increased competition reduces z_i through $-\varphi_i$, while quality upgrading enhances z_i via $-\eta(1-\tau_i^M)$.

[40] This effect depends crucially on the shape of the non-wage cost of labour. To have both temporary and permanent workers, the non-wage cost must rise and display a concave pattern as the number of permanent workers increases. This requires the parameter α to be greater than 1.

Combining these effects yields:

$$\frac{\partial z_i}{\partial \tau_i^M} = -\eta + \varphi_i, \tag{16}$$

indicating that the net impact depends on the relative magnitudes of η, which governs the sensitivity of quality upgrades to tariff reductions, and φ_i, which captures the intensity of import competition.

In contrast, a reduction in export tariffs (τ_{ij}^X) has an unambiguously positive effect on z_i. Differentiating z_i with respect to τ_{ij}^X yields:

$$\frac{\partial z_i}{\partial \tau_{ij}^X} = -\psi_i \omega_{ij}, \tag{17}$$

where $\psi_i > 0$ reflects the firm's sensitivity to expanded market access, and ω_{ij} captures the trade intensity with destination j. Lower export tariffs increase z_i, stimulating demand for temporary workers.

These mechanisms illustrate the differential impacts of import and export liberalization on T_i^*. Reductions in import tariffs produce an ambiguous effect: competition reduces z_i, while quality improvements increase it. Conversely, export liberalization unambiguously raises z_i through expanded market access. Together, these results provide a theoretical foundation for understanding how trade liberalization shapes firms' reliance on temporary labor.

Wages. In this extension, we introduce wage differentiation between temporary and permanent workers, denoted as w_T and w_P, respectively. The key insight is that firms facing higher demand due to export liberalization may choose to expand the number of temporary workers without raising wages. This occurs when labor supply is elastic and institutions allow firms to hire temporary workers at fixed or regulated wages. As a result, the equilibrium wage w_T may remain unchanged even as firms increase employment.

For import liberalization, the mechanism operates differently. A reduction in import tar-

iffs (τ_i^M) reduces labor demand by intensifying competition, shifting the labor demand curve inward. This exerts downward pressure on both w_P and w_T. Unlike the export liberalization case, where firms expand employment without raising wages, import liberalization directly suppresses wage levels.

These dynamics highlight the asymmetric effects of trade liberalization on labor market outcomes. While export liberalization primarily influences employment composition by increasing the share of temporary workers, import liberalization affects both employment and wage levels, with potentially adverse distributional consequences.

Empirical Implications. This framework provides a theoretical underpinning for the empirical analysis of trade liberalization and labor demand adjustments. Export liberalization ($\tau_{ij}^X \downarrow$) unambiguously raises temporary employment through increased market access ($z_i \uparrow$). Import liberalization ($\tau_i^M \downarrow$) has an ambiguous effect on temporary employment: competition reduces z_i, but quality upgrading increases it. If competition dominates ($\varphi_i > \eta$), T_i^* falls. Permanent employment (P_i^*) is indirectly affected by firm-level productivity shocks through z_i, given that z_i influences total employment and firms adjust their labor composition accordingly. However, P_i^* remains primarily determined by λ and b, responding positively to λ and negatively to b. Export liberalization has therefore an unambiguous positive effect on the share of temporary contract jobs, while import liberalization has an ambiguous effect.

Import liberalization depresses both permanent and temporary wages by intensifying competition, shifting the labor demand curve inward. Export liberalization raises employment without necessarily increasing wages because labor supply is elastic and institutions setting.

B Appendix: Additional Tables

B.1 Trade Liberalization

Table B1: 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
Romania	48	50	3
Slovakia	58	66	14

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

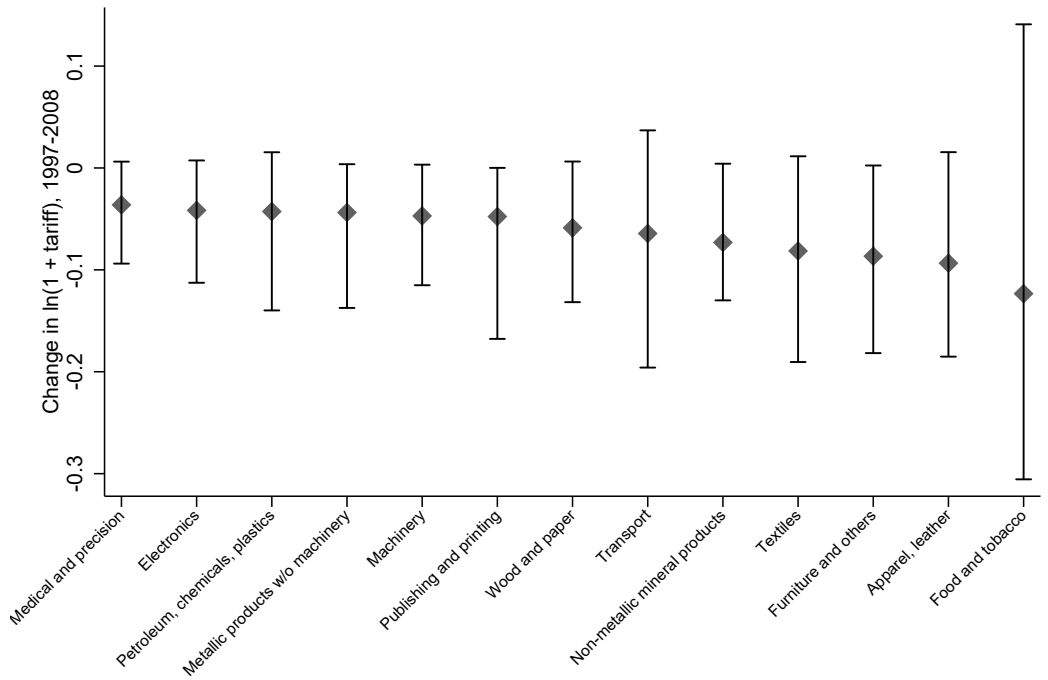

Figure B1: Change in applied MFN tariffs between 1997 and 2008: average, minimum and maximum country values

Notes: For each sector, diamonds correspond to the mean of changes in applied MFN tariffs over the 9 countries, while capped spikes are the minimum and maximum country values. Sectors are ordered by the average value.
Source: Authors' calculation on WTO data.

B.2 Additional tables of results

Table B2: Baseline results – Working conditions and working schedule

	Working Condition				Working Schedule			
Dep. Variable	Temporary contract				Atypical schedule		Overtime	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Export lib.	0.123***		0.121***	0.118***	0.151***	0.142***	-0.055**	-0.048*
	(0.015)		(0.011)	(0.011)	(0.022)	(0.020)	(0.028)	(0.025)
Import lib.		-0.027	-0.010	-0.010	-0.006	-0.015	-0.051**	-0.048**
		(0.038)	(0.007)	(0.007)	(0.015)	(0.013)	(0.022)	(0.020)
Collec. agre.	-0.002	-0.002	-0.002	-0.002	0.062***	0.055***	0.022***	0.016***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.006)	(0.006)	(0.008)	(0.005)
Large corp.	0.017***	0.017***	0.017***	0.015***	0.209***	0.178***	0.050***	0.035***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.005)	(0.005)	(0.017)	(0.011)
Public corp.	0.005**	0.004	0.005**	0.005	0.027	0.022	-0.010***	-0.003
	(0.002)	(0.003)	(0.002)	(0.004)	(0.023)	(0.022)	(0.004)	(0.002)
Reg. produc.	0.139***	0.108**	0.146***	0.147***	-0.093**	-0.076*	-0.210***	-0.182***
	(0.011)	(0.052)	(0.013)	(0.013)	(0.044)	(0.041)	(0.064)	(0.054)
Foreign cap.	-0.017***	-0.006***	-0.017***	-0.016***	-0.014***	-0.019***	0.004	0.003
	(0.002)	(0.002)	(0.001)	(0.001)	(0.004)	(0.003)	(0.004)	(0.003)
Reg. pop.	-0.150***	0.004	-0.170***	-0.186***	0.330***	0.306***	0.235	0.212*
	(0.043)	(0.145)	(0.049)	(0.050)	(0.116)	(0.095)	(0.143)	(0.127)
Net migration	0.013***	0.006	0.014***	0.014***	0.004	0.004	-0.013**	-0.012***
	(0.001)	(0.004)	(0.001)	(0.001)	(0.003)	(0.003)	(0.005)	(0.004)
CPI index	0.107***	-0.025	0.108***	0.100***	0.517***	0.498***	0.228***	0.198***
	(0.031)	(0.066)	(0.024)	(0.025)	(0.059)	(0.050)	(0.075)	(0.067)
Unempl. rate	0.003***	0.000	0.002***	0.002***	-0.006***	-0.005***	-0.000	0.000
	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)
Hours					0.214***	0.224***	0.729***	0.666***
					(0.029)	(0.027)	(0.071)	(0.064)
θ_r	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
θ_t	Yes	Yes	Yes	No	Yes	No	Yes	No
θ_{st}	No	No	No	Yes	No	Yes	No	Yes
$\theta_{g(i)}$	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	4,287,509	4,287,509	4,287,509	4,287,509	4,287,509	4,287,509	4,287,509	4,287,509

The dependent variables are indicators for having a temporary contract, working on atypical hours and working overtime. Logistic estimations incorporate control variables, region-specific effects, year-specific effects, cell-specific effects based on gender, education, and age and job spell specific effects. Columns (4), (6) and (8) include also sector × year-specific effects. Marginal effects are computed at sample means. Standard errors, clustered by NUTS-1 regions, are in parentheses. Significance levels are denoted as ***, **, * for 1%, 5%, and 10%, respectively

Table B3: Working conditions and working schedule. Standard errors cluster at country-industry.

	Working Condition				Working Schedule			
Dep. Variable	Temporary contract				Atypical schedule		Overtime	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Export lib.	0.123***		0.121***	0.118***	0.151***	0.142***	-0.055***	-0.048***
	(0.018)		(0.017)	(0.014)	(0.050)	(0.048)	(0.018)	(0.016)
Import lib.		-0.027	-0.010	-0.010	-0.006	-0.015	-0.051***	-0.048***
		(0.020)	(0.013)	(0.011)	(0.030)	(0.034)	(0.011)	(0.010)
Collec. agre.	-0.002	-0.002	-0.002	-0.002	0.062***	0.055***	0.022***	0.016***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.014)	(0.008)	(0.006)	(0.004)
Large corp.	0.017***	0.017***	0.017***	0.015***	0.209***	0.178***	0.050***	0.035***
	(0.003)	(0.003)	(0.003)	(0.002)	(0.012)	(0.010)	(0.012)	(0.009)
Public corp.	0.005	0.004	0.005	0.005	0.027	0.022	-0.010*	-0.003
	(0.006)	(0.006)	(0.006)	(0.005)	(0.023)	(0.016)	(0.006)	(0.004)
Reg. produc.	0.139***	0.108***	0.146***	0.147***	-0.093	-0.076	-0.210***	-0.182***
	(0.019)	(0.030)	(0.019)	(0.016)	(0.087)	(0.064)	(0.043)	(0.041)
Foreign cap.	-0.017***	-0.006***	-0.017***	-0.016***	-0.014**	-0.019***	0.004	0.003
	(0.002)	(0.002)	(0.002)	(0.002)	(0.007)	(0.007)	(0.003)	(0.002)
Reg. pop.	-0.150***	0.004	-0.170***	-0.186***	0.330*	0.306**	0.235***	0.212***
	(0.054)	(0.074)	(0.057)	(0.051)	(0.170)	(0.128)	(0.068)	(0.068)
Net migration	0.013***	0.006**	0.014***	0.014***	0.004	0.004	-0.013***	-0.012***
	(0.002)	(0.003)	(0.002)	(0.002)	(0.006)	(0.005)	(0.003)	(0.003)
CPI index	0.107**	-0.025	0.108**	0.100***	0.517***	0.498***	0.228***	0.198***
	(0.044)	(0.049)	(0.044)	(0.038)	(0.146)	(0.129)	(0.052)	(0.050)
Unempl. rate	0.003***	0.000	0.002***	0.002***	-0.006**	-0.005*	-0.000	0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.003)	(0.002)	(0.001)	(0.001)
Hours					0.214***	0.224***	0.729***	0.666***
					(0.040)	(0.035)	(0.061)	(0.066)
θ_r	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
θ_t	Yes	Yes	Yes	No	Yes	No	Yes	No
θ_{st}	No	No	No	Yes	No	Yes	No	Yes
$\theta_{g(i)}$	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	4,287,509	4,287,509	4,287,509	4,287,509	4,287,509	4,287,509	4,287,509	4,287,509

The dependent variables are indicators for having a temporary contract, working on atypical hours and working overtime. Logistic estimations incorporate control variables, region-specific effects, year-specific effects, cell-specific effects based on gender, education, and age and job spell specific effects. Columns (4), (6) and (8) include also sector × year-specific effects. Marginal effects are computed at sample means. Standard errors, clustered by *country* × *industry* , are in parentheses. Significance levels are denoted as ***, **, * for 1%, 5%, and 10%, respectively

Table B4: Keeping the group of workers aged $20-29$ in 2002 and those aged $30-39$ and $40-49$ in 2014.

	Working Condition				Working Schedule			
Dep. Variable	Temporary contract				Atypical schedule		Overtime	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Export lib.	0.124***		0.116***	0.115***	0.128***	0.135***	-0.052**	-0.042**
	(0.018)		(0.009)	(0.009)	(0.022)	(0.020)	(0.025)	(0.021)
Import lib.		-0.049	-0.027***	-0.027***	0.024	0.013	-0.035**	-0.035**
		(0.040)	(0.002)	(0.002)	(0.023)	(0.018)	(0.017)	(0.016)
Collec. agre.	0.001	0.001	0.001	-0.001	0.068***	0.061***	0.021***	0.015***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.006)	(0.007)	(0.008)	(0.004)
Large corp.	0.018***	0.018***	0.018***	0.016***	0.209***	0.180***	0.045***	0.031***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.007)	(0.007)	(0.017)	(0.011)
Public corp.	0.009**	0.009**	0.009**	0.009*	0.015	0.027	-0.008***	-0.000
	(0.004)	(0.004)	(0.004)	(0.005)	(0.020)	(0.023)	(0.003)	(0.004)
Reg. produc.	0.106***	0.098*	0.124***	0.125***	0.035	0.049	-0.182***	-0.158***
	(0.016)	(0.053)	(0.017)	(0.017)	(0.037)	(0.033)	(0.050)	(0.041)
Foreign cap.	-0.017***	-0.006***	-0.017***	-0.016***	-0.010***	-0.013***	0.003	0.003
	(0.002)	(0.001)	(0.001)	(0.001)	(0.003)	(0.003)	(0.003)	(0.003)
Reg. pop.	-0.103***	-0.008	-0.155***	-0.180***	0.275**	0.251**	0.206*	0.155*
	(0.036)	(0.143)	(0.038)	(0.041)	(0.119)	(0.111)	(0.110)	(0.091)
Net migration	0.011***	0.006	0.013***	0.013***	0.008**	0.009**	-0.012***	-0.010***
	(0.001)	(0.004)	(0.001)	(0.001)	(0.003)	(0.004)	(0.004)	(0.003)
CPI index	0.116***	-0.015	0.119***	0.113***	0.300***	0.296***	0.188***	0.169***
	(0.035)	(0.057)	(0.017)	(0.016)	(0.055)	(0.039)	(0.054)	(0.051)
Unempl. rate	0.002***	-0.001	0.001***	0.001***	-0.006***	-0.005***	-0.000	-0.000
	(0.001)	(0.001)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)
Hours					0.206***	0.214***	0.662***	0.597***
					(0.034)	(0.033)	(0.082)	(0.069)
θ_r	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
θ_t	Yes	Yes	Yes	No	Yes	No	Yes	No
θ_{st}	No	No	No	Yes	No	Yes	No	Yes
$\theta_{g(i)}$	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	1,729,238	1,729,238	1,729,238	1,729,238	1,729,238	1,729,238	1,729,238	1,729,238

The dependent variables are indicators for having a temporary contract, working on atypical hours and working overtime. Logistic estimations incorporate control variables, region-specific effects, year-specific effects, cell-specific effects based on gender, education, and age and job spell specific effects. Columns (4), (6) and (8) include also sector × year-specific effects. Marginal effects are computed at sample means. Standard errors, clustered by NUTS-1 regions, are in parentheses. Significance levels are denoted as ***, **, * for 1%, 5%, and 10%, respectively

Table B5: Cell Approach.

	Working Condition				Working Schedule			
Dep. Variable	Temporary contract				Atypical schedule		Overtime	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Export lib.	0.061*		0.108***	0.105***	0.097***	0.087***	-0.038	-0.039
	(0.034)		(0.012)	(0.014)	(0.028)	(0.024)	(0.043)	(0.041)
Import lib.		-0.055*	-0.077***	-0.080***	0.008	0.001	0.005	0.005
		(0.029)	(0.014)	(0.014)	(0.012)	(0.011)	(0.023)	(0.023)
Collec. agre.	-0.032*	-0.041*	-0.039*	-0.052***	0.044	-0.003	0.102**	0.071
	(0.018)	(0.020)	(0.020)	(0.017)	(0.030)	(0.035)	(0.042)	(0.046)
Large corp.	0.041**	0.043**	0.042**	0.048**	0.200***	0.162***	0.150***	0.110***
	(0.018)	(0.018)	(0.017)	(0.021)	(0.026)	(0.023)	(0.018)	(0.021)
Public corp.	-0.009	-0.007	-0.007	-0.024	0.021	0.008	-0.078***	-0.052***
	(0.009)	(0.009)	(0.009)	(0.019)	(0.022)	(0.024)	(0.022)	(0.014)
Reg. produc.	0.035	0.055	0.070***	0.067***	-0.019	-0.017	-0.203***	-0.191***
	(0.046)	(0.051)	(0.022)	(0.022)	(0.040)	(0.037)	(0.054)	(0.054)
CPI index	0.120	0.083	0.269***	0.273***	0.213**	0.201**	0.164	0.138
	(0.094)	(0.079)	(0.031)	(0.032)	(0.076)	(0.068)	(0.115)	(0.111)
Foreign cap.	-0.007**	-0.006**	-0.015***	-0.014***	-0.008**	-0.006*	0.008	0.010
	(0.003)	(0.002)	(0.002)	(0.002)	(0.004)	(0.003)	(0.006)	(0.006)
Reg. pop.	0.109	0.059	-0.043	-0.044	0.055	0.052	0.291**	0.281**
	(0.167)	(0.148)	(0.073)	(0.077)	(0.103)	(0.102)	(0.132)	(0.131)
Net migration	0.004	0.004	0.011***	0.010***	0.003	0.002	-0.013**	-0.014***
	(0.004)	(0.004)	(0.002)	(0.002)	(0.003)	(0.003)	(0.004)	(0.004)
Hours					0.022	0.025	0.029	0.005
					(0.029)	(0.030)	(0.022)	(0.021)
θ_r	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
θ_t	Yes	Yes	Yes	No	Yes	No	Yes	No
θ_{st}	No	No	No	Yes	No	Yes	No	Yes
$\theta_{g(i)}$	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	10,807	10,807	10,807	10,807	10,807	10,807	10,807	10,807

The dependent variables are the shares of workers under temporary contracts, working atypical hours, and working overtime. OLS regressions include control variables, region-specific effects, year-specific effects, and cell-specific effects based on gender, education, and age. Columns (4), (6), and (8) also incorporate sector × year-specific effects. Standard errors are clustered at the NUTS-1 regional level and reported in parentheses. Significance levels are indicated as ***, **, and * for 1%, 5%, and 10%, respectively.

Table B6: Wage regressions, 2014

	Total earnings (ln)				
	(1)	(2)	(3)	(4)	(5)
A. Temporary Contract					
Temp. contract dummy	-0.250***	-0.244***	-0.168***	-0.099***	-0.080***
	(0.017)	(0.021)	(0.021)	(0.020)	(0.019)
B. Shift work					
Shift work dummy	0.031	-0.098***	-0.005	-0.003	0.006
	(0.026)	(0.027)	(0.025)	(0.023)	(0.022)
θ_r	Yes	Yes	Yes	Yes	No
θ_s	Yes	Yes	Yes	Yes	No
$\theta_{g(i)}$	No	No	Yes	Yes	No
Job spell	No	No	No	Yes	No
$\theta_r \times \theta_s \times \theta_{g(i)}$	No	No	No	No	Yes
Firm controls	No	Yes	Yes	Yes	Yes
Worker controls	No	Yes	Yes	Yes	Yes
Obs.	4,490,830	4,465,036	4,465,036	4,465,036	4,463,611

The dependent variables is the total wage in 2014. Cell-specific effects are determined by gender, education and age. Firm-specific controls include indicators for whether the firm has more than 50 employees, private ownership status, and exposure to collective bargaining. Worker controls consist of the logarithm of hours worked. Robust standard errors in parentheses. Significance levels are denoted as ***, **, * for 1%, 5%, and 10%, respectively

Table B7: Hours and earnings.

	Hours		Wages					
Dep. Variable	Total		Total		on atypical schedule		on overtime schedule	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Export lib.	0.127*	0.117*	0.213	0.200	0.597*	0.675**	0.183*	0.207*
	(0.069)	(0.065)	(0.135)	(0.138)	(0.295)	(0.283)	(0.099)	(0.103)
Import lib.	0.106	0.107	-0.731***	-0.725***	-0.820***	-0.828***	-0.845***	-0.863***
	(0.069)	(0.064)	(0.127)	(0.129)	(0.265)	(0.268)	(0.097)	(0.104)
Collec. agre.	-0.003	-0.006	0.033	0.029	0.140**	0.111*	0.047***	0.037***
	(0.008)	(0.008)	(0.024)	(0.022)	(0.053)	(0.056)	(0.006)	(0.008)
Large corp.	0.073***	0.067***	0.271***	0.254***	0.460***	0.353***	0.143***	0.133***
	(0.020)	(0.019)	(0.025)	(0.026)	(0.078)	(0.088)	(0.012)	(0.016)
Public corp.	-0.014**	0.004	0.067	-0.013	0.387***	0.224***	0.070**	0.049
	(0.006)	(0.009)	(0.048)	(0.050)	(0.081)	(0.069)	(0.031)	(0.044)
Reg. produc.	0.303***	0.299***	0.164	0.179	-0.413	-0.238	0.441***	0.433***
	(0.055)	(0.050)	(0.113)	(0.114)	(0.422)	(0.375)	(0.080)	(0.069)
Foreign cap.	-0.008	-0.006	-0.025	-0.022	-0.009	-0.023	-0.043***	-0.045**
	(0.009)	(0.009)	(0.018)	(0.019)	(0.049)	(0.048)	(0.014)	(0.015)
Reg. pop.	-0.254	-0.190	-0.492	-0.426	-0.676	-0.435	-0.393	-0.343
	(0.172)	(0.168)	(0.359)	(0.355)	(1.313)	(1.175)	(0.392)	(0.359)
Net Migration	0.026***	0.024***	0.023*	0.022*	0.038	0.040	0.032***	0.031***
	(0.005)	(0.005)	(0.011)	(0.011)	(0.042)	(0.038)	(0.010)	(0.010)
CPI index	-0.281*	-0.303*	0.475	0.427	1.723**	1.592*	0.019	0.068
	(0.155)	(0.143)	(0.312)	(0.317)	(0.773)	(0.759)	(0.277)	(0.292)
Unempl. rate	-0.003	-0.003	-0.062***	-0.062***	-0.070***	-0.064***	-0.066***	-0.064***
	(0.002)	(0.002)	(0.005)	(0.005)	(0.014)	(0.013)	(0.004)	(0.004)
Hours			1.004***	1.003***	0.871***	0.825***		
			(0.047)	(0.049)	(0.127)	(0.155)		
Over. hours							1.008***	1.008***
							(0.005)	(0.005)
θ_r	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
θ_t	Yes	No	Yes	No	Yes	No	Yes	No
θ_{st}	No	Yes	No	Yes	No	Yes	No	Yes
$\theta_{g(i)}$	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	4,287,509	4,287,509	4,287,509	4,287,509	1,878,836	1,878,836	1,276,486	1,276,486

The dependent variables are the log of hours and the log wage received when working on total hours, atypical hours and working overtime. OLS estimations incorporate control variables, region-specific effects, year-specific effects, cell-specific effects based on gender, education, and age and job spell specific effects. Columns (2), (4), (6) and (8) include also sector × year-specific effects. Standard errors, clustered by NUTS-1 regions, are in parentheses. Significance levels are denoted as ***, **, * for 1%, 5%, and 10%, respectively.

Table B8: Impact on Working Conditions and Schedules for Management Staff

			Temporary Contracts			Permanent Contracts		
				Wages			Wages	
	Temp. Contract	Atypical hours	Hours	Total	Atypical schedule	Hours	Total	Atypical schedule
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Export lib.	0.047***	0.101***	0.255	0.226	1.219	0.101	0.222	0.969***
	(0.016)	(0.007)	(0.195)	(0.200)	(0.821)	(0.091)	(0.196)	(0.213)
Import lib.	-0.012	-0.017***	0.019	-0.920***	1.819***	0.137	-0.779***	-1.340***
	(0.011)	(0.006)	(0.152)	(0.112)	(0.504)	(0.092)	(0.173)	(0.124)
Collec. agre.	0.000	0.014***	-0.017	0.042**	0.016	-0.013	-0.001	-0.214*
	(0.001)	(0.003)	(0.016)	(0.016)	(0.209)	(0.008)	(0.026)	(0.101)
Large corp.	0.004**	0.045***	0.116*	0.261***	-0.583***	0.101***	0.461***	0.097
	(0.002)	(0.003)	(0.060)	(0.066)	(0.149)	(0.031)	(0.032)	(0.117)
Public corp.	0.014***	0.011**	-0.049	-0.150***	0.638***	0.025*	-0.102**	0.432***
	(0.004)	(0.004)	(0.048)	(0.023)	(0.077)	(0.013)	(0.048)	(0.142)
Reg. produc. (log)	0.079***	-0.013**	0.503***	0.013	-1.808**	0.271***	0.401**	0.120
	(0.018)	(0.005)	(0.149)	(0.382)	(0.631)	(0.064)	(0.159)	(0.382)
Foreign cap. (log)	-0.007***	-0.008***	-0.027	-0.011	0.011	-0.000	-0.057*	-0.085**
	(0.002)	(0.001)	(0.026)	(0.029)	(0.102)	(0.015)	(0.031)	(0.031)
Reg. pop. (log)	-0.108*	0.194***	-0.037	-1.496*	9.958***	-0.006	-0.775*	-1.478
	(0.056)	(0.034)	(0.437)	(0.711)	(2.699)	(0.175)	(0.402)	(1.919)
Net Migration	0.007***	0.003***	0.048***	0.011	-0.226***	0.023***	0.028	0.080*
	(0.002)	(0.001)	(0.013)	(0.026)	(0.072)	(0.006)	(0.016)	(0.038)
CPI index	0.034	0.252***	0.066	0.984**	-0.176	-0.280	-0.115	2.140**
	(0.033)	(0.014)	(0.422)	(0.430)	(1.608)	(0.223)	(0.476)	(0.841)
Unempl. rate	0.000	-0.002***	0.001	-0.055***	0.019	-0.000	-0.068***	-0.073***
	(0.001)	(0.000)	(0.008)	(0.010)	(0.041)	(0.004)	(0.009)	(0.011)
Hours (log)				1.038***	0.778***		1.049***	0.896***
				(0.047)	(0.051)		(0.038)	(0.228)
θ_r	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
θ_{st}	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
$\theta_{g(i)}$	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	710,044	710,059	57,080	57,080	12,881	652,982	652,982	117,267

Columns (1) and (2) focus on the probability to work on temporary contracts and atypical hours. Columns (3) to (8) are divided into temporary workers (Columns 3-5) and permanent workers (Columns 6-8). Logistic regression is used for Columns (1) and (2), and OLS for Columns (3) to (8), include control variables, region-specific effects, sector × year-specific effects, and cell-specific effects based on gender, education, and age and job spell specific effects. Marginal effects are computed at sample means. Standard errors, clustered by NUTS-1 regions, are in parentheses. Significance levels are denoted as ***, **, * for 1%, 5%, and 10%, respectively.

Table B9: Impact on Working Conditions and Schedules for Production and Services Workers

			Temporary Contracts			Permanent Contracts		
				Wages			Wages	
	Temp. Contract	Atypical hours	Hours	Total	Atypical schedule	Hours	Total	Atypical schedule
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Export lib.	0.122***	0.185***	0.172**	-0.006	0.607	0.097	0.106	1.198***
	(0.011)	(0.047)	(0.080)	(0.148)	(0.365)	(0.062)	(0.105)	(0.262)
Import lib.	-0.003	-0.010	0.065	-0.705***	-0.112	0.099	-0.796***	-0.827***
	(0.005)	(0.043)	(0.045)	(0.084)	(0.339)	(0.063)	(0.092)	(0.214)
Collec. agre.	-0.003	0.109***	0.009	0.057***	0.258***	-0.001	0.058**	0.295***
	(0.003)	(0.016)	(0.006)	(0.017)	(0.053)	(0.008)	(0.024)	(0.072)
Large corp.	0.014***	0.315***	0.060*	0.172***	0.612***	0.049***	0.240***	0.415***
	(0.003)	(0.018)	(0.029)	(0.034)	(0.115)	(0.014)	(0.025)	(0.072)
Public corp.	-0.002	-0.003	0.006	0.021	0.390***	-0.004	0.085**	0.222***
	(0.003)	(0.031)	(0.012)	(0.020)	(0.041)	(0.007)	(0.038)	(0.056)
Reg. produc. (log)	0.185***	-0.182***	0.338**	0.092	-0.289	0.300***	0.118	0.227
	(0.016)	(0.046)	(0.146)	(0.302)	(0.325)	(0.061)	(0.106)	(0.408)
Foreign cap. (log)	-0.020***	-0.024***	-0.012	-0.005	-0.058	-0.003	-0.021	-0.053
	(0.002)	(0.008)	(0.009)	(0.020)	(0.075)	(0.008)	(0.014)	(0.041)
Reg. pop. (log)	-0.281***	0.296**	-0.486	-0.697	4.337***	-0.207	-0.144	0.968
	(0.055)	(0.146)	(0.411)	(0.764)	(1.104)	(0.194)	(0.288)	(1.166)
Net Migration	0.017***	0.006	0.033**	0.010	-0.044	0.018***	0.012	0.058
	(0.002)	(0.004)	(0.014)	(0.026)	(0.032)	(0.006)	(0.010)	(0.040)
CPI index	0.077***	0.734***	-0.287**	0.268	1.510	-0.387**	0.418	1.741**
	(0.022)	(0.129)	(0.130)	(0.277)	(1.126)	(0.149)	(0.260)	(0.711)
Unempl. rate	0.002***	-0.008***	-0.003	-0.051***	-0.021	-0.002	-0.060***	-0.041***
	(0.000)	(0.002)	(0.002)	(0.005)	(0.020)	(0.002)	(0.004)	(0.014)
Hours (log)				1.026***	0.645***		0.973***	0.493**
				(0.048)	(0.122)		(0.097)	(0.215)
θ_r	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
θ_{st}	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
$\theta_{g(i)}$	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	1,828,453	1,828,453	297,247	297,247	211,292	1,531,206	1,531,206	872,736

Columns (1) and (2) focus on the probability to work on temporary contracts and atypical hours. Columns (3) to (8) are divided into temporary workers (Columns 3-5) and permanent workers (Columns 6-8). Logistic regression is used for Columns (1) and (2), and OLS for Columns (3) to (8), include control variables, region-specific effects, sector × year-specific effects, and cell-specific effects based on gender, education, and age and job spell specific effects. Marginal effects are computed at sample means. Standard errors, clustered by NUTS-1 regions, are in parentheses. Significance levels are denoted as ***, **, * for 1%, 5%, and 10%, respectively.

Table B10: Impact on Working Conditions and Schedules on Workers in Manufacturing

			Temporary Contracts			Permanent Contracts		
				Wages			Wages	
	Temp. Contract	Atypical hours	Hours	Total	Atypical schedule	Hours	Total	Atypical schedule
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Export lib.	0.107***	0.118*	0.297**	0.135	0.541	0.086	0.353***	1.069***
	(0.012)	(0.061)	(0.124)	(0.148)	(0.425)	(0.068)	(0.092)	(0.311)
Import lib.	-0.000	0.015	0.135	-0.563***	-0.078	0.103	-0.683***	-0.852***
	(0.009)	(0.053)	(0.113)	(0.061)	(0.401)	(0.074)	(0.078)	(0.282)
Collec. agre.	-0.003	0.106***	0.003	0.068**	0.388***	-0.005	0.078***	0.339***
	(0.002)	(0.008)	(0.007)	(0.028)	(0.064)	(0.007)	(0.025)	(0.065)
Large corp.	0.011***	0.305***	0.069**	0.205***	0.471***	0.060***	0.270***	0.520***
	(0.002)	(0.015)	(0.031)	(0.020)	(0.025)	(0.016)	(0.025)	(0.083)
Public corp.	0.015***	-0.026	-0.022	0.040***	0.352***	-0.002	0.074*	0.136*
	(0.003)	(0.032)	(0.027)	(0.008)	(0.062)	(0.004)	(0.036)	(0.069)
Reg. produc. (log)	0.132***	-0.124**	0.377**	0.271	-1.422**	0.259***	0.405***	0.029
	(0.018)	(0.053)	(0.154)	(0.291)	(0.540)	(0.069)	(0.119)	(0.332)
Foreign cap. (log)	-0.019***	-0.017*	-0.014	-0.023	-0.081	-0.002	-0.053***	-0.049
	(0.001)	(0.010)	(0.017)	(0.018)	(0.097)	(0.010)	(0.013)	(0.051)
Reg. pop. (log)	-0.156***	0.222	-0.614	-0.656	7.512***	-0.166	-0.115	1.834
	(0.050)	(0.239)	(0.377)	(0.685)	(1.422)	(0.186)	(0.339)	(1.192)
Net Migration	0.013***	0.007	0.035**	0.018	-0.128**	0.017**	0.031**	0.031
	(0.002)	(0.006)	(0.013)	(0.025)	(0.045)	(0.006)	(0.011)	(0.037)
CPI index	0.129***	0.475***	-0.383	0.207	3.315**	-0.329*	0.338	2.161**
	(0.024)	(0.159)	(0.246)	(0.218)	(1.325)	(0.162)	(0.226)	(0.820)
Unempl. rate	0.002***	-0.007***	0.005	-0.044***	-0.015	-0.001	-0.057***	-0.043***
	(0.000)	(0.003)	(0.005)	(0.004)	(0.022)	(0.003)	(0.004)	(0.013)
Hours (log)				0.995***	0.753***		1.054***	0.538**
				(0.051)	(0.110)		(0.050)	(0.243)
θ_r	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
θ_{st}	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
$\theta_{g(i)}$	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	1,927,884	1,927,884	257,695	257,695	170,110	1,670,188	1,670,188	860,590

Columns (1) and (2) focus on the probability to work on temporary contracts and atypical hours. Columns (3) to (8) are divided into temporary workers (Columns 3-5) and permanent workers (Columns 6-8). Logistic regression is used for Columns (1) and (2), and OLS for Columns (3) to (8), include control variables, region-specific effects, sector × year-specific effects, and cell-specific effects based on gender, education, and age and job spell specific effects. Marginal effects are computed at sample means. Standard errors, clustered by NUTS-1 regions, are in parentheses. Significance levels are denoted as ***, **, * for 1%, 5%, and 10%, respectively.

Table B11: Impact on Working Conditions and Schedules on Workers in Services

			Temporary Contracts			Permanent Contracts		
				Wages			Wages	
	Temp. Contract	Atypical hours	Hours	Total	Atypical schedule	Hours	Total	Atypical schedule
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Export lib.	0.132***	0.192***	0.089**	-0.044	-0.232	0.136*	0.180	0.487
	(0.015)	(0.025)	(0.035)	(0.184)	(0.464)	(0.070)	(0.180)	(0.350)
Import lib.	-0.014	-0.014	0.100***	-0.809***	1.156*	0.108	-0.736***	-0.803*
	(0.010)	(0.025)	(0.022)	(0.167)	(0.580)	(0.067)	(0.163)	(0.407)
Collec. agre.	-0.002	0.031***	0.001	0.052***	-0.135**	-0.006	-0.008	-0.162***
	(0.002)	(0.004)	(0.008)	(0.014)	(0.054)	(0.009)	(0.024)	(0.042)
Large corp.	0.018***	0.119***	0.063*	0.117**	0.524***	0.073***	0.267***	0.264***
	(0.003)	(0.005)	(0.032)	(0.040)	(0.161)	(0.020)	(0.020)	(0.087)
Public corp.	0.005	0.035**	-0.039	-0.027	0.076**	0.005	-0.038	0.365**
	(0.004)	(0.016)	(0.031)	(0.045)	(0.029)	(0.010)	(0.060)	(0.160)
Reg. produc. (log)	0.154***	0.020	0.390***	-0.182	1.363***	0.294***	0.046	-0.399
	(0.021)	(0.017)	(0.058)	(0.153)	(0.305)	(0.045)	(0.131)	(0.274)
Foreign cap. (log)	-0.017***	-0.021***	-0.008	-0.001	0.093	-0.008	-0.008	0.004
	(0.002)	(0.004)	(0.006)	(0.021)	(0.065)	(0.009)	(0.024)	(0.049)
Reg. pop. (log)	-0.181**	0.354***	-0.206	-0.315	0.427	-0.193	-0.823*	-2.676**
	(0.083)	(0.083)	(0.166)	(0.376)	(1.229)	(0.165)	(0.446)	(0.960)
Net Migration	0.015***	0.006***	0.036***	-0.003	-0.013	0.025***	0.021	0.060**
	(0.002)	(0.002)	(0.005)	(0.011)	(0.029)	(0.005)	(0.014)	(0.028)
CPI index	0.103***	0.431***	-0.357***	0.878**	-4.127***	-0.278	0.545	1.051
	(0.036)	(0.067)	(0.063)	(0.349)	(1.201)	(0.159)	(0.416)	(0.794)
Unempl. rate	0.002***	-0.003***	-0.010***	-0.060***	-0.003	-0.004	-0.066***	-0.077***
	(0.000)	(0.001)	(0.001)	(0.007)	(0.013)	(0.002)	(0.006)	(0.015)
Hours (log)				0.989***	0.867***		0.995***	0.921***
				(0.030)	(0.102)		(0.054)	(0.150)
θ_r	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
θ_{st}	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
$\theta_{g(i)}$	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	2,103,928	2,103,928	309,778	309,778	159,029	1,794,150	1,794,150	567,125

Columns (1) and (2) focus on the probability to work on temporary contracts and atypical hours. Columns (3) to (8) are divided into temporary workers (Columns 3-5) and permanent workers (Columns 6-8). Logistic regression is used for Columns (1) and (2), and OLS for Columns (3) to (8), include control variables, region-specific effects, sector × year-specific effects, and cell-specific effects based on gender, education, and age and job spell specific effects. Marginal effects are computed at sample means. Standard errors, clustered by NUTS-1 regions, are in parentheses. Significance levels are denoted as ***, **, * for 1%, 5%, and 10%, respectively.

Table B12: Impact on Working Conditions and Schedules on Workers in Mining & Utilities

			Temporary Contracts			Permanent Contracts		
				Wages			Wages	
	Temp. Contract	Atypical hours	Hours	Total	Atypical schedule	Hours	Total	Atypical schedule
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Export lib.	0.044***	-0.146**	0.310**	0.699***	3.136**	0.109**	0.290***	0.777
	(0.012)	(0.064)	(0.104)	(0.137)	(1.118)	(0.042)	(0.049)	(0.532)
Import lib.	-0.005	-0.005	0.129**	-1.054***	-2.064***	0.030	-0.615***	-0.687*
	(0.007)	(0.037)	(0.056)	(0.065)	(0.496)	(0.044)	(0.029)	(0.345)
Collec. agre.	-0.006	0.050	-0.022	0.156**	-0.051	0.018	0.106**	0.053
	(0.004)	(0.034)	(0.017)	(0.072)	(0.067)	(0.012)	(0.046)	(0.097)
Large corp.	0.005	0.093**	0.033	0.195***	0.020	0.042*	0.185**	-0.045
	(0.006)	(0.043)	(0.030)	(0.049)	(0.065)	(0.021)	(0.084)	(0.072)
Public corp.	-0.006	-0.029	0.023**	-0.016	-0.128	-0.003	-0.022	0.204***
	(0.005)	(0.028)	(0.009)	(0.051)	(0.116)	(0.006)	(0.052)	(0.067)
Reg. produc. (log)	0.047**	-0.340***	0.702***	0.411	9.704***	0.203***	0.837***	1.832*
	(0.023)	(0.102)	(0.232)	(0.266)	(2.221)	(0.054)	(0.077)	(0.955)
Foreign cap. (log)	-0.004*	-0.004	0.020*	-0.055***	-0.033	-0.003	-0.045***	0.030
	(0.002)	(0.008)	(0.010)	(0.013)	(0.106)	(0.007)	(0.007)	(0.065)
Reg. pop. (log)	-0.107*	0.390	-1.333*	-0.306	-17.834**	-0.182	0.054	-0.457
	(0.063)	(0.408)	(0.674)	(0.685)	(6.128)	(0.145)	(0.296)	(3.190)
Net Migration	0.006***	-0.027**	0.070***	0.078***	0.812***	0.021***	0.055***	0.150
	(0.002)	(0.011)	(0.022)	(0.025)	(0.208)	(0.005)	(0.007)	(0.099)
CPI index	0.037	0.295*	-0.883***	1.789***	-4.074**	-0.015	-0.417**	-0.478
	(0.028)	(0.166)	(0.176)	(0.237)	(1.442)	(0.099)	(0.151)	(1.325)
Unempl. rate	-0.001	-0.015***	0.015***	-0.075***	-0.062	-0.007***	-0.055***	-0.047**
	(0.001)	(0.003)	(0.003)	(0.005)	(0.038)	(0.002)	(0.003)	(0.019)
Hours (log)				1.090***	0.891***		0.860***	0.537*
				(0.094)	(0.089)		(0.143)	(0.286)
θ_r	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
θ_{st}	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
$\theta_{g(i)}$	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	255,685	255,697	21,428	21,428	9,467	234,268	234,268	112,511

Columns (1) and (2) focus on the probability to work on temporary contracts and atypical hours. Columns (3) to (8) are divided into temporary workers (Columns 3-5) and permanent workers (Columns 6-8). Logistic regression is used for Columns (1) and (2), and OLS for Columns (3) to (8), include control variables, region-specific effects, sector × year-specific effects, and cell-specific effects based on gender, education, and age and job spell specific effects. Marginal effects are computed at sample means. Standard errors, clustered by NUTS-1 regions, are in parentheses. Significance levels are denoted as ***, **, * for 1%, 5%, and 10%, respectively.

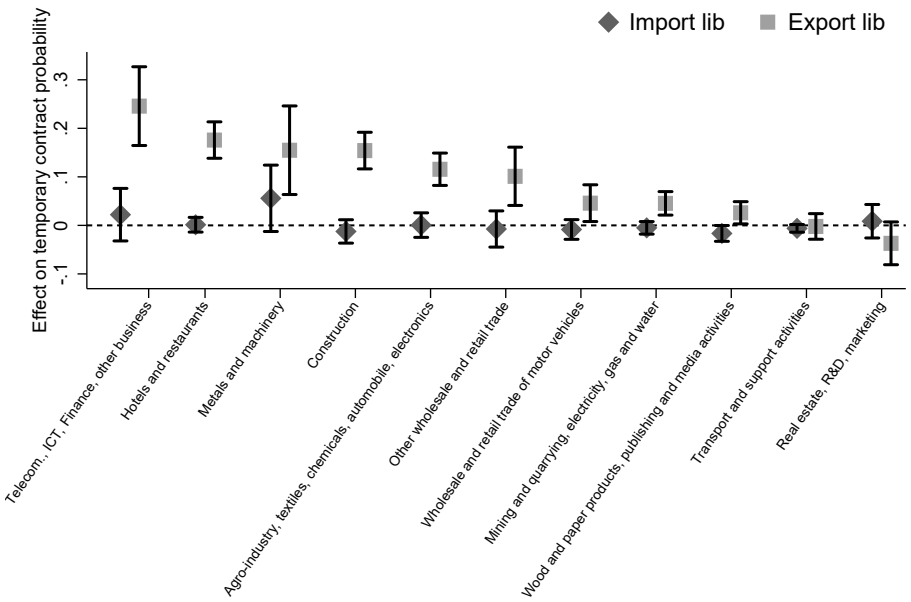

Figure B2: Temporary contract - By sector

Notes: The baseline specification is estimated on samples restricted to a unique sector (on the abscisse). The average effect is represented with a square or a diamand with its 95% confidence interval with caps.

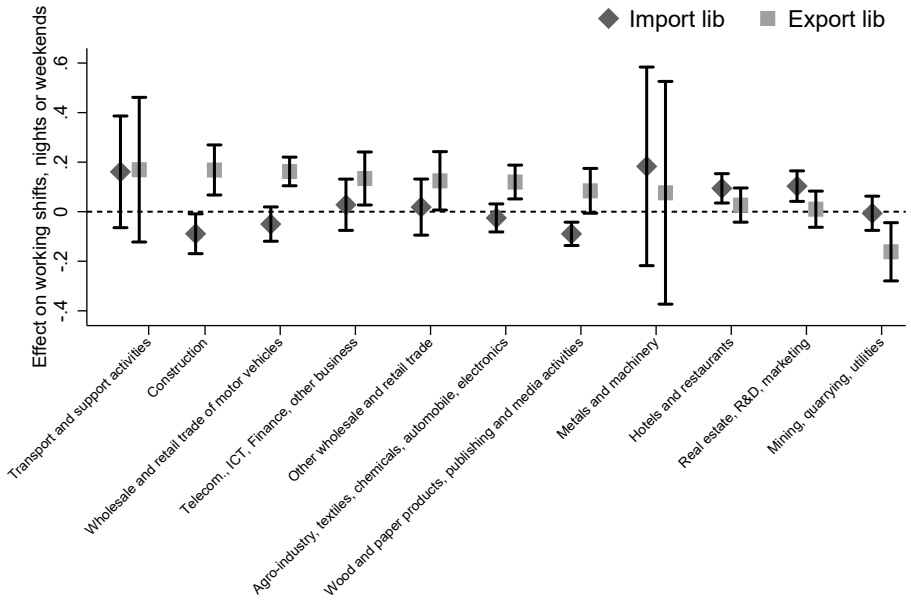

Figure B3: Atypical hours - By sector

Notes: The baseline specification is estimated on samples restricted to a unique sector (on the abscisse). The average effect is represented with a square or a diamand with its 95% confidence interval with caps.

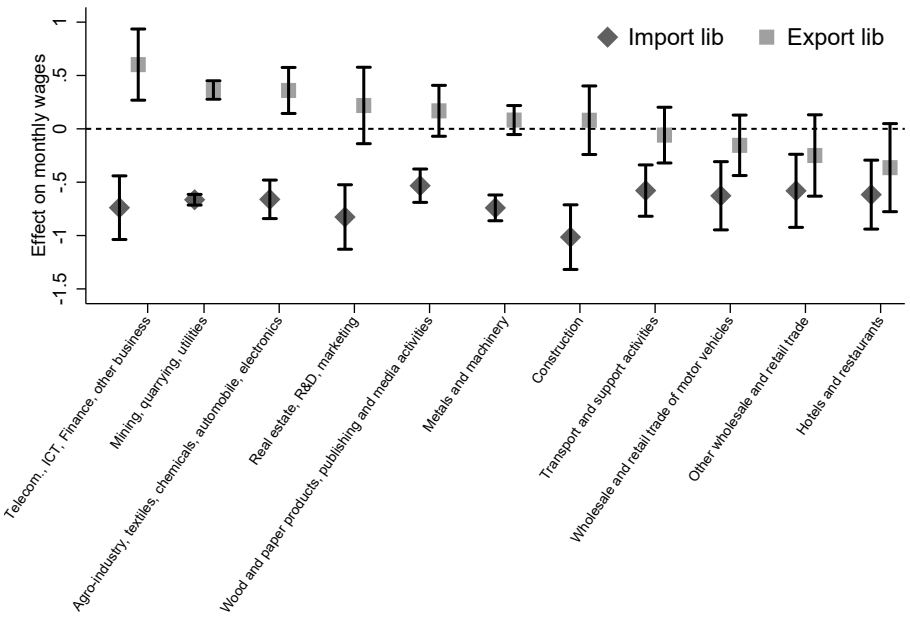

Figure B4: Monthly earnings - By sector

Notes: The baseline specification is estimated on samples restricted to a unique sector (on the abscisse). The average effect is represented with a square or a diamand with its 95% confidence interval with caps.

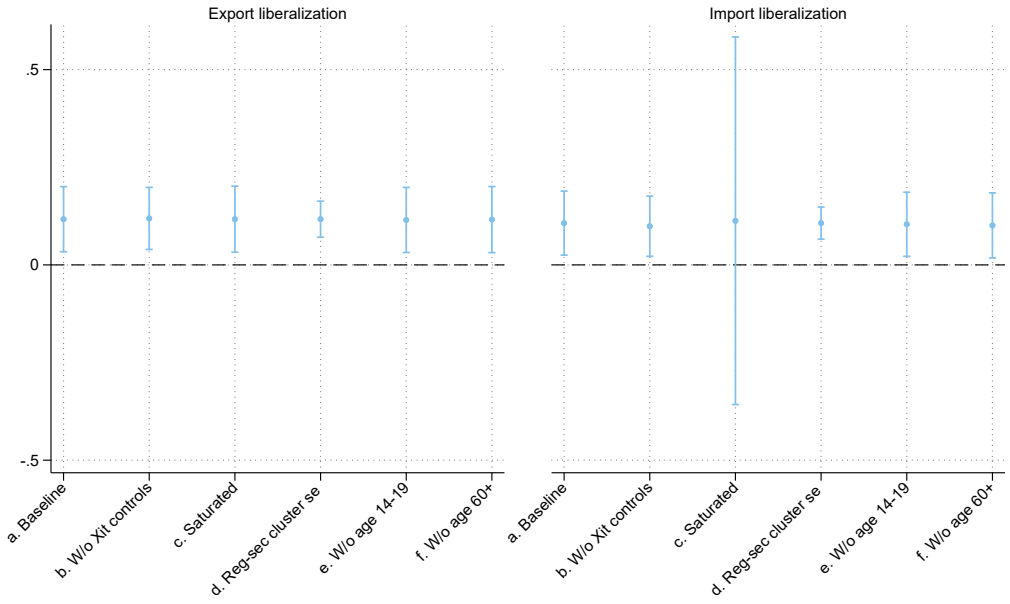

Figure B5: Robustness checks – Hours worked

Notes: The average effect is represented with its 90% confidence interval.

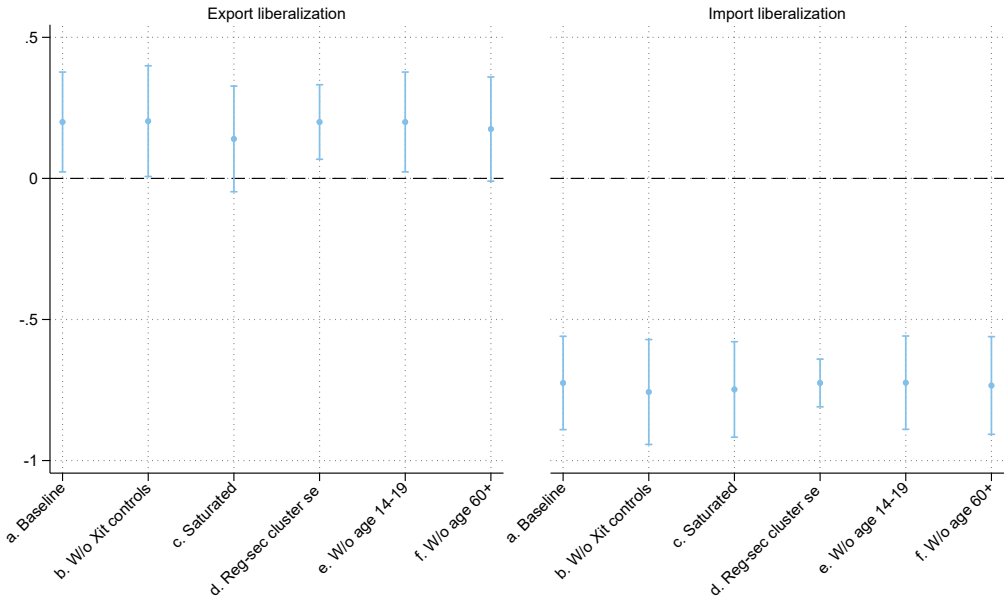

Figure B6: Robustness checks – Total earnings

Notes: The average effect is represented with its 90% confidence interval.

"Working Conditions and Trade Liberalization"

Bastien Alvarez, Gianluca Orefice, Farid Toubal

Online Appendix (Not Intended for Publication)

O2 Dependent variables and controls

This section provides details on the definition and data sources of all variables used in the study.

O2.1 Dependent variables

- Temporary contract: a dummy equal to 1 if the worker is employed on a temporary contract. Source: SES.
- Atypical hours: 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 worker worked overtime during the reference month. Source: SES.
- Log of monthly hours: the total number of hours worked in the reference month, including both regular and overtime hours. This variable is also used as a control in the wage regressions. Source: SES.
- Log of monthly wage: gross monthly earnings in the reference month. It is expressed in euros and includes wages for both regular and overtime hours. In separate specifications, we use the part of the wage corresponding to the atypical hours premium or the overtime pay as dependent variables. Source: SES.

O2.2 Individual and firm-level controls from the Structure of Earnings Survey

- Large corporation (1/0): a dummy equal to 1 if the worker's company has more than 50 employees.
- Public corporation (1/0): a dummy equal to 1 if the firm is a public or mixed private-public ownership company.
- Collective agreement (1/0): a dummy equal to 1 for all workers in a firm where the majority of workers are covered by a collective pay agreement. We identify the type of pay agreement (national, sector, or firm-level) covering the majority of the workforce at any local unit, or whether no such collective agreement exists. Bargaining frameworks vary significantly between countries, so we focus on the main distinction—its existence

rather than its scope. The data does not allow us to separate covered and uncovered workers within the same local unit: if the majority of workers are covered, the entire workforce is coded as being covered by the collective pay agreement in the SES.

O2.3 Country-level controls

- Regional productivity: we use the log-difference of GDP per capita between 1997 and 2014, from the WDI database, to control for productivity shocks that affected Eastern European countries during their EU integration.
- Net migration shock: to control for migration shocks that could affect wages and labor supply, we compute the net migration flow of Eastern European countries from 1997 to 2014 as a share of their 1997 population, based on Eurostat data.
- Foreign capital supply: some Eastern European countries became production hubs in European value chains over the last decades; hence, we measure exposure to multinational firms using the 1997–2014 log-difference in the ratio of net foreign property income over GDP, from Eurostat national accounts.
- CPI index: to control for price evolution due to tariff reductions, we use the 1997–2014 log-difference of the consumer price index, taken from the WDI database.
- Regional labor supply: to control for regional demographic dynamics, such as internal migrations, we compute the log-difference between regional and national population growth over the 1997–2014 period, using Eurostat data.
- Unemployment rate: to control for labor market shocks, we account for country-level unemployment rates, using Eurostat data.

O2.4 Other Structure of Earnings Survey information used as fixed effects or for by-sample estimations

- Region: 15 regions based on the NUTS-1 classification are used as fixed effects to control for all regional specificities.
- Sector: 11 categories based on the NACE Rev. 2 classification are used for fixed effects (in combination with the year), while three broader categories (manufacturing, services, and mining and utilities) are used for the sectoral breakdown in results tables.
- Year: the two years included in the sample are used as fixed effects, interacted with the sector variable.
- Education: three categories based on the ISCED-2011 classification. It is used as a fixed effect alongside length of employment, age, and sex.
- Age: individuals are grouped into three categories (20–29, 30–49, and 50–59). Individuals over 59 and under 20 are excluded from the sample.

- Length of employment: workers are classified as being in the company for (i) less than one year, (ii) 1–4 years, or (iii) five or more years.
- Sex (1/0): a dummy equal to 1 if the worker is a woman, 0 if a man.
- Occupation: based on a harmonized version of ISCO-08 and ISCO-88 information at the two-digit level. We aggregate occupations into three groups for sectoral analyses.

O3 Classifications used for education, industries, and occupations

This sub-section presents the sector, education, and occupation classifications used in our study. Due to the timespan of our data and the number of different data sources, some degree of harmonization is necessary. The SES data spans over a period of 12 years during which many international classifications were updated and transformed substantially. In particular, the ISCED classification for educational attainment was modified in 2011, while the sectoral NACE classification was updated to its second revision (Rev. 2) in 2008.[41] This issue was partially dealt with by Eurostat in the SES data. To keep a certain level of comparability between the different SES waves, Eurostat created their own versions of sectoral and educational classifications by aggregating different two-digit sectors and detailed education categories.

Industries. Two mappings were used in this study concerning the sectoral dimension.

1. The initial mapping, presented in Table O3.1, aligns sectors from the SES 2002 with the Structural Business Survey (SBS) and is employed in computing the import and export liberalization variables. It contains 13 industries, except for Slovakia and Latvia, where, due to missing values in the Structural Business Survey, we employ an alternative classification. Hence, different sectoral aggregations are used for different countries. This does not matter for the final liberalization variables as they are defined at the regional level: sectors are aggregated. Therefore, it is not necessary for the industry classification used to aggregate tariff lines to be uniform across all countries.

2. The second mapping is used to generate industry fixed effects in our econometric analysis. Eurostat introduced a sectoral classification that is intermediate between the 1- and 2-digit levels of NACE Rev. 2, designed to accommodate the NACE classification change in 2008 but tailored to each country. We establish a harmonized correspondence covering the four waves of the SES and the nine countries in our sample, encompassing 11 sectors, including both manufacturing and private services. This harmonized correspondence is presented in Table O3.2.

[41] Regarding the occupation dimension, the ISCO classification for occupation went from ISCO-88 to ISCO-08 in 2008, but we could keep the ISCO-08 classification used in the SES 2014. However, we removed some specific occupations, such as military workers, agricultural occupations, and drivers.

Table O3.1: Industry correspondence 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

Occupations. The SES data provide information on individual occupations, for which we distinguish two groups:

1. Management: ISCO-08 11, 12, 13, 14, 21, 24, 25, 26 and ISCO-88 11, 12, 13, 21, 24.
2. Production and service workers: ISCO-08 71, 72, 73, 74, 75, 81, 82, 93 and ISCO-88 71, 72, 73, 74, 81, 82, 93.

These groups are used to analyze the effect of tariff liberalization on sub-samples, and the results are shown in Table 9.

Educational attainment. The SES 2014 proposes four education categories based on ISCED-11. The SES 2002 contains more categories, based on ISCED-97. For both years, we aggregate them into three levels (high, medium, and low) based on the main categories of ISCED-11. The classification is based on ISCED-2011.

Table O3.2: Sector harmonization used in the study

Industry codes	Composition
B, 35, 36	Mining and quarrying, electricity, gas and water
Manufacturing:	
10 to 15, 19 to 23, 26, 27, 29 to 33	Agro-industry, textiles, app., leather, coke, chemicals, rubber, plastic, transport equi., electronics, furniture and not elsewhere classified
16 to 18, 58 to 60	Wood and paper products, publishing and media activities
24, 25, 28	Metals and machinery
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

Table O3.3: Education classification

Harmonized level	ISCED-2011	Education category
Low	0-1	Primary education
	2	Lower secondary education
Medium	3	Upper secondary education
	4	Post-secondary education
High	5	Short-cycle tertiary education
	6	Bachelor or equivalent
	7	Master or equivalent
	8	PhD or equivalent

O4 Import and export liberalization indexes

Following Dix-Carneiro and Kovak (2017), we build the tariff liberalization variable of each region by combining countries' industry-level tariffs and region-industry weights $\beta_{r_{(c)}s}$:

$$Lib^{l}_{r_{(c)}} = -\sum_{s} \beta_{r_{(c)}s} \Delta ln(1+\tau^{l}_{cs}) \quad with \quad \beta_{r_{(c)}s} = \frac{\lambda_{r_{(c)}st_0} \frac{1}{\phi_{cst_0}}}{\sum_s \lambda_{r_{(c)}st_0} \frac{1}{\phi_{cst_0}}} \quad and \quad l = M, X \tag{18}$$

The superscript l indicates the nature of the shocks, i.e., import (M) or export (X) tariffs, respectively. $\Delta \ln(1+\tau^{M}_{cs})$ is the difference in the tariffs between the pre-enlargement year 1997 and 2008 for a given sector s and country c. The cost share of non-labor factors ϕ_{cst_0} and tariff changes τ_{cs} have a sector-country dimension.

The labor shares $\lambda_{r_{(c)}st_0}$ have a sector-region dimension, are computed for the initial year t_0, and are 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 Bulgaria, the regional indicator had been removed by national authorities in 2002 in the anonymization process. We were able to retrieve an indication of Bulgaria's NUTS-1 regions from the local unit and employee identifiers contained in the survey.[43] For Hungary and Romania, regional information is not available in the 2002 wave of the SES. Instead, we use the regional-level Structural Business Survey of 2001 and 2002, respectively, to compute the regional share of workers in each industry.

The sector classification used in the construction of the tariff liberalization variables is based on the one furnished by Eurostat to harmonize SES data for different years. It is slightly more aggregated than the two-digit level NACE Rev. 1 and is available in Table O3.1 of the Online Appendix.

Treatment of the pre-liberalization year As seen in equation 2, our specification uses two years: 2002 and 2014. We apply the liberalization shock of 2008 to the year 2014, as this is post-liberalization. Indeed, liberalization continued post-2008 but was unrelated to enlargement. Using the 1997–2008 period for the year 2014 prevents conflating enlargement-related liberalization, which is exogenous to the countries in our sample, with the reasons for tariff liberalization. For the year 2002 in our sample, as in equation 2, the interaction of the liberalization variable with the post-enlargement indicator variable $\mathbf{I}_{2014}$ is equivalent to assuming no tariff liberalization.

Rescaling The tariff liberalization variables $Lib^{l}_{r_{(c)}}$ are expressed in percentage points.[44] To ease the interpretation of the regression coefficient associated with $Lib^{l}_{r_{(c)}} \times \mathbf{I}_{2014}$, we

[42] The Czech Republic, Estonia, Latvia, Lithuania, and Slovakia do not have any NUTS 1-digit regional decomposition. Therefore, their tariff liberalization shocks are computed at the country level. We have four regions in Romania, three in Hungary, and two in Bulgaria.

[43] In both 2002 and 2014 SES, about 5% of the observations are dropped as we cannot allocate them to a specific region.

[44] Only Estonia has a negative value for the import liberalization variable since it had to increase its MFN tariffs when joining the EU.

rescale it between 0 and 100 based on the extreme values of the liberalization shocks of the year 2008.[45]

Sections O4.0.1, O4.0.2, and O4.0.3 provide additional details on the construction of each component of the liberalization indexes.

O4.0.1 Change in MFN tariffs on imports

The main component of the import liberalization variable is the industry-level change in the applied MFN tariff from 1997 to 2008. We choose 1997 as the base year for two reasons. First, examining trade policy evolution over the entire accession process helps to avoid any anticipation effect of trade in response to the prospect of European integration. Second, product-level tariff data availability is limited before 1997.[46] As we are only interested in EU enlargement-induced tariff liberalization, we use 2008 as the ending date, once the 2007 enlargement is completed. Indeed, liberalization continued post-2008 but was unrelated to enlargement. Moreover, as countries in our sample were part of the EU at that point, they would have had a way to shape subsequent liberalization, which would be exogenous to their economic situation.

In any given year, sector-level tariffs on imports are a weighted average of all product-level tariff lines belonging to the same sector, weighted by import shares:

$$\tau_{cs}^{M} = \sum_{p} \sum_{o} \omega_{ocps}^{1997} \tau_{ocps} \quad with \quad \omega_{ocps}^{1997} = \frac{Imp_{ocps}^{1997}}{\sum_{p} \sum_{o} Imp_{ocps}^{1997}} \tag{19}$$

where τ_{ocps} are tariffs applied by country c on product p and sector s originating from country o. We obtain these data from the WTO. Weights ω_{ocps}^{1997} correspond to the share of product p originating from country o in the total imports of a given sector s in a given country c in 1997 and are built using the BACI database. We keep the weighting scheme of 1997 to build 2008 sector-level tariffs in order to remove the issue of trade being endogenous to tariff reductions. For the post-accession year 2008, we set the *MFN* applied towards EU partners to zero and took the weighted average rate across EU and non-EU partners (with import share in 1997 used as a weight). This methodology allows us to account for the tariff liberalization implied by the zeroing of tariffs towards EU partners after accession to the common EU market. Ignoring this important aspect of the heterogeneity in the drop in tariffs would understate the extent of the liberalization.

Three technical aspects related to the classification of products should be underlined. First, the 1997 and 2008 WTO tariff data are not aggregated at the same level of detail. The former is at the HS 6-digit level, while the latter is at the 8-digit level. This raises the difficulty of choosing which of the several 8-digit lines corresponding to each 6-digit line should be kept. We decide on the one with the highest tariff rate.[47] Second, to allocate each

[45] As Estonia actually has a negative liberalization over the period, the 0% change in tariffs that affects all regions in the year 2002 in our sample is not a 0 on the 0–100 scale that we apply to the two liberalization variables.

[46] For Slovakia and Romania, we use 1998 and 1999, respectively, due to a lack of information before these years.

[47] The year 2011 is present in both datasets, so it can be taken as a point of comparison to choose the appropriate 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.

product line to a sector, we use a conversion table from HS96 to ISIC Rev. 3 classification.[48] No observations are lost in that process. Finally, we need to have the exact same sectors as for the other components of the tariff liberalization variable. Therefore, we use the classification available in the SES 2002.[49]

O4.0.2 Change in tariffs on exports

We also construct an export liberalization shock based on tariffs encountered by exports of our nine Eastern European economies. That variable is conceptually very close to the import liberalization shock, and we use the same data sources. Again, the main component of the tariff liberalization variable is the sector-level change in tariffs from 1997 to 2008. We use effectively applied tariffs rather than MFN tariffs to better reflect actual tariff changes. Indeed, endogeneity is less of a concern for export tariffs, as these are not set by any of the countries in our estimation sample. Since we consider tariffs from all countries in the world, data availability becomes an issue. The base year for most destination countries is 1997, but depending on tariff data availability, alternative years ranging from 1996 to 2003 are used.[50]

In any given year, sector-level tariffs on exports are a weighted average of destination-product-specific tariff lines within a given sector k, weighted by exports:

$$\tau_{cs}^{X} = \sum_{p} \sum_{d} \omega_{dcps}^{1997} \tau_{dcps} \quad \text{with} \quad \omega_{dcps}^{1997} = \frac{Exp_{dcps}^{1997}}{\sum_{p} \sum_{d} Exp_{dcps}^{1997}} \tag{20}$$

where τ_{dcps} are tariffs applied by destination d on product p and sector s originating from country c. We obtain these data from the WTO. The weights ω_{dcps}^{1997} correspond to the share of product p originating from country c in the total imports of a given sector s in a given country d in 1997 and are built using the BACI database. We keep the weighting scheme of 1997 to build 2008 sector-level tariffs in order to remove the issue of trade being endogenous to tariff reductions.

Going from product-level data in 1997 and 2008 to a change in sector-level tariffs involves several steps of aggregation, which are similar to the ones described above in Section O4.0.1. The only difference involves the choice of the tariff to use. For each tariff line, we use the minimum between the preferential tariff and the MFN tariff, that is, the effectively applied tariff. The final export liberalization variable is built following the equation described in Section O4.

O4.0.3 Cost share of non-labor factors of production

In Dix-Carneiro and Kovak (2019), the cost share of non-labor factors ϕ_{cst_0} allows weighting the industry-level share of workers by the importance of the labor factor in each industry. For each sector s:

$$\phi_{cst_0} = \frac{gos_{cst_0}}{gos_{cst_0} + rem_{cst_0}} \tag{21}$$

[48] ISIC Rev. 3 is the UN equivalent to the NACE Rev. 1 classification. They are fully comparable at the 2-digit level.

[49] See Section O4.0.3. We use a slightly different decomposition for Slovakia and Latvia, but since the final variable is aggregated at the industry level, this does not constitute an issue.

[50] A large majority of tariffs, and in particular the main countries of destination, are for 1997 and surrounding years.

where gos_{cst_0} is the gross operating surplus of sector s in country c in the initial year of our sample, and rem_{cst_0} is the total amount of remuneration paid in the same sector.[51] Together with the labor share $\lambda_{r_{(c)}s}$, the cost share of non-labor factors accounts for the importance of the labor factor in the production function of each sector s.

We obtain the two components of ϕ_{cst_0} from Eurostat's Structural Business Survey (SBS) using the average gross operating surplus and total remuneration over the 2000–2003 period. While optimally, we would use only 2002 data to match the year of the labor share $\lambda_{r_{(c)}s}$, there are several missing values for that year and surrounding years at the 2-digit level. Therefore, we compute an average of gos_{cst_0} and rem_{cst_0} over existing data from 2000 to 2003 for each 2-digit NACE Rev. 1 sector.

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