Trade Liberalization and Working Conditions

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[1] The views expressed in this work are those of the authors and do not represent the opinions of the BdF.

Motivation

1. Globalization's impact on workers is a key policy debate.

2. Trade liberalization affects employment and wages.
   - Most studies focus on wage adjustments.
   - Some examine employment effects.
   - Focus on import liberalization.

$\Longrightarrow$ Gap in the literature :
   - Little is known about job stability, contract types, and work schedules.
   - Non-wage working conditions are key for job quality (OECD JQI).
   - Role of export liberalization.

This paper

How do trade–induced demand shocks affect *working conditions*?

1. **Setting: EU Enlargement as a natural experiment** ▸ More details
   - Accession countries adopt old EU members' MFN tariffs and existing PTAs.
   - Sharp changes in tariff schedules across partners and products.

2. **Outcomes and Data**
   - Move beyond wages and employment levels.
   - Study non-wage margins: temporary contracts and atypical hours.
   - Worker-level evidence from Eurostat SES (2002, 2014).

3. **Possible Economic Mechanism** (among others)
   - Export liberalization raises exposure to foreign demand volatility.
   - With firing costs, firms prefer temporary to permanent workers.

4. **Contribution**
   - Show that globalization affects job quality, not just wages or jobs.

Literature and contributions

- **Import liberalization and workers:** Emphasis on wages.

  Mild to negative wage effects across settings (Richardson '95; Topalova '10; Kovak '13; Autor et al. '13; Dauth et al. 2014; Dix-Carneiro & Kovak '17, '19; Hakobyan & McLaren '16).
  Participation, unemployment, hours and sector choice (Kim & Vogel '21).

  ⇒ **We extend this margin to working conditions.**

- **Export liberalization and workers:** Focus on earnings.

  Mostly firm- and sector-level evidence (Amiti & Davis '11; Dauth et al. '14; Feenstra et al. '19).
  Worker-level outcomes remain limited (Krishna et al. '14; Dauth et al. '21).

  ⇒ **We show export liberalization also shapes job quality.**

- **Labor market flexibility and uncertainty:**

  Temporary contracts buffer with firing costs (Bentolila & Saint-Paul '92; Bentolila & Bertola '90).
  Use of temporary contracts during downturns (Holmlund & Storrie '02; Caggese & Cuñat '08).

  ⇒ **We show a *permanent* shift in composition driven by trade-induced volatility.**

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Fact 1: EU liberalization expanded both exports and imports

Table 1 – EU-induced trade liberalization and EECs' export and imports

Dep. Variable	Δ ln Import			Δ ln Export		
	2014 - 2009			2014 - 2009		
	(1)	(2)	(3)	(4)	(5)	(6)
Δ Import Tariff$_{2008-1997}$	0.251	1.189	0.519**			
	(0.272)	(0.780)	(0.188)			
Δ Export Tariff$_{2008-1997}$				2.201***	3.308***	3.981***
				(0.795)	(1.084)	(1.054)
θ_c	Yes	No	Yes	Yes	No	Yes
θ_s	No	Yes	Yes	No	Yes	Yes
Obs.	117	117	117	117	117	117
R-squared	0.563	0.290	0.805	0.188	0.135	0.293

The dependent variables are the difference in the log of imports (columns 1-3) and exports (columns 4-6) in the post EU-enlargement period 2014-2009 for each country-sector combination. Standard errors, clustered at sector level, are in parentheses. Significance levels are denoted as ***, **, * for 1%, 5%, and 10%, respectively

▸ Δ Tariff ▸ Δ # PTAs ▸ Δ Temp. Contract

Fact 2: Trade liberalization and revenues volatility.

Table 2 – Trade liberalization and firm-level revenue volatility

Dep. Variable	Firm revenue volatility		
	(1)	(2)	(3)
Export Liberalization × Post	1.118***	1.235***	1.153***
	(0.448)	(0.438)	(0.447)
Import Liberalization × Post	-0.246	-0.160	-0.199
	(0.186)	(0.178)	(0.182)
Period FE	Yes	Yes	Yes
Region FE	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes
Post period	08-14	06-14	08-18

Notes: The dependent variable is the standard deviation of annual log revenue growth computed at the firm-period level. Pre period runs from 2000 to the year before accession, and the post period starts four years after accession. For 2004 accession countries, the post period is 2008–2014. For Bulgaria and Romania, it is 2011–2014. Liberalization measures are NUTS1-level exposure indices and enter only through their interaction with the post dummy. All specifications are estimated by OLS with standard errors clustered at the NUTS1 level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$..

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Theory: Intuition

- **Central idea**: Greater demand volatility induced by trade liberalization can lead firms to rely more heavily on temporary rather than permanent workers.
  - Permanent workers are more productive ($\Psi > 1$), but costly to dismiss (firing cost $f > 0$).
  - Temporary workers are less productive but allow firms to adjust without dismissal costs.
  - Greater uncertainty can make flexibility more valuable, and firms may prefer temporary workers.

- **Firm's trade-off**:
  - Permanent workers generate a productivity gain, but expose the firm to future severance costs and periods of overstaffing (commitment cost).
  - Temporary workers provide flexibility when demand fluctuates.

$$\underbrace{w(\psi - 1)}_{\text{Productivity gain}} \quad \textit{versus} \quad \underbrace{\delta\kappa}_{\text{Expected commitment cost}}$$

Theory: The mechanism

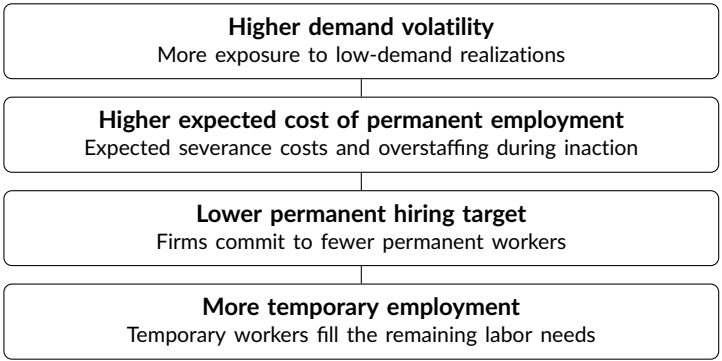
- **Firm's decision problem**:
  1. Firm inherits permanent workers P_{t-1} and chooses P_t before the next demand realization.
     - If P_{t-1} is below hiring target, the firm hires up to target.
     - If P_{t-1} exceeds the firing target, the firm dismisses permanent workers.
     - If P_{t-1} lies in between, the firm leaves permanent workers (i.e., overstaffing cost) - **inaction region**.
  2. Demand shock realizes.
  3. The firm uses temporary workers to fill the gap between desired labor units and P_t.
     - Within the inaction region, temporary workers adjust.

- **Dynamic mechanism**:
  - Hiring a permanent worker implies both the expected dismissal cost and the cost of carrying unwanted worker, i.e., commitment cost $\kappa(P, A, \sigma^2)$.
  - At the hiring target the firm balances productivity gain against discounted commitment cost:

$$w\left(\psi - 1\right) = \delta\kappa\left(P, A, \sigma^2\right)$$

  - $\uparrow$ volatility $\rightarrow$ frequent low-demand realization $\rightarrow \uparrow$ commitment cost $\rightarrow \downarrow$ hiring target.

Theory: The mechanism



▸ More details

Theory: The role of trade liberalization

1. Export liberalization increases foreign exposure.
2. Foreign exposure (may) increase demand volatility.
   - The effect depends on the variances and covariance of domestic and foreign demand shocks.
   - Details on demand volatility ▸ More details
3. Firms adjust their employment mix: A lower permanent hiring target raises temporary employment at the hiring margin.

Empirical predictions

- Export liberalization raises the temporary employment share through the volatility channel when it increases demand variance and the model's aggregation conditions hold.
- The effect of import liberalization is ambiguous (competition + input sourcing effect).

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Eurostat's Structure of Earnings Survey (SES)

- SES: Detailed individual-level harmonized surveys.
  - Data from 2002 (pre-enlargement) and 2014 (post-enlargement).
- Key labor market variables:
  - Contract type: Temporary vs. permanent.
  - Work schedule: Overtime, atypical hours (shift, night, and weekend work).
  - Wage and employment : Earnings (total, overtime, payments for atypical hours) – hours paid.
  - Other individual characteristics: Education, age, gender, collective bargaining, job spell.
- Firm characteristics:
  - Size (50+ employees), private/public ownership.
  - NACE 2-digit industry, NUTS 1-digit region.

$\Longrightarrow$ Covers 4.8 million workers across 9 countries and their 15 regions: Bulgaria, Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Romania, Slovakia and their 15 NUTS.

Workers' exposure to tariff liberalization

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

- $Lib^{I}_{r(c)}$: Tariff liberalization measure for workers in region r and country c (Kovak, 2013).
- $\Delta ln(1+\tau^{I}_{cs})$: Change in export or import tariffs of sector s in country c between 1997 (first year of data) and 2008 (phasing-in) ▸ Details.
- $\lambda_{r(c)st_0}$: Share of regional r labor employed in sector s at t_0.
- ϕ_{cs}: Cost share of non-labor factors at t_0, approximated by the ratio of gross operating surplus to value added (Dix-Carneiro and Kovak, 2017).
- Normalized between 0 and 1.
- Robustness check using Autor et al. (2016) measure.

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Econometric specification

$$y_{i_{(rsc)}t} = \sum_{l=M,X} \gamma_{1l} \left[Lib^{l}_{r_{(c)}} \times \mathbf{I}_{2014} \right] + \mathbf{Z}^{1'}_{rt}\gamma_{\mathbf{1}} + \mathbf{Z}^{2'}_{ct}\gamma_{\mathbf{2}} + \mathbf{X}'_{it}\gamma_{\mathbf{3}} + \theta_r + \theta_t + \theta_{g(i)} + \epsilon_{i_{(rsc)}t}$$

- $y_{i_{(rsc)}t}$: Worker i's outcome in region r, sector s, and cell c at time t.
  - Working conditions: (i) short-term contract, (ii) shift-work, (iii) overtime.
  - Earnings and hours worked.
- $Lib^{l}_{r_{(c)}}$: Regional export and import tariff liberalization indexes.
- $\mathbf{I}_{2014}$: Post-enlargement indicator.
- $\mathbf{Z}^{1}_{rt}$, $\mathbf{Z}^{2}_{ct}$: Region (pop), country (FDI, net mig., CPI index, per-capita GDP, unemp. rate).
- $\mathbf{X}_{it}$: Large corp., public corp., collective bargaining, job spell, log hours.
- Fixed effects: region θ_r, year θ_t, gender-education-age cell $\theta_{g(i)}$.
  - Augmented specification: sector $\times$ year θ_{st}.
- $\epsilon_{i_{(rsc)}t}$: Error term.

Identification: Quasi-Natural Experiment

- **Identification**: Compare observational equivalent workers before *vs* after the enlargement across regions having faced different Lib_r^I.

- Causal interpretation relies on the exogeneity of trade shocks $\Delta ln(1+\tau_{cs}^I)$.
  - Even when shares are not exogenous, shift-share design is valid if shocks are quasi-random (Borusyak et al. 2022, 2024).

- Shift-share validity tests:
  - Sufficient number and dispersion of shocks: ▸ In-Sample
    - 115 industry-country pairs ensure sufficient number of shocks.
    - Employment shares ($\beta_{r(c)s}$, $\lambda_{r(c)s}$) are evenly distributed ▸ HHI.
  - Pre-treatment orthogonality: ▸ Initial Condition (Panel A)
    - No significant correlation between initial tariffs (τ_{cs,t_0}) and 2002 working conditions.

$\Longrightarrow$ Exogeneity of post-enlargement tariffs supports quasi-random nature of our shocks.

Falsification & robustness checks

- Falsification tests (Borusyak et al. 2022): ▸ Balance tests (Panel B & C)
  - Industry-level balance test: Regress sector-level confounders on $\Delta ln(1 + \tau^{I}_{cs})$.
  - Region-level pre-trend test: Regress 2002 regional labor outcomes on $Lib^{I}_{r(c)}$.

  $\Longrightarrow$ No significant relationships: Supports the quasi-experimental nature of the shocks.

- Robustness:
  - Cluster standard errors at the level of the shock (industry-country). ▸ Cluster cs

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Baseline results: Working conditions

Table 3 – Baseline results – Working conditions

	Temporary contract			
	(1)	(2)	(3)	(4)
Export lib.	0.123***		0.121***	0.118***
	(0.015)		(0.011)	(0.011)
Import lib.		-0.027	-0.010	-0.010
		(0.038)	(0.007)	(0.007)
Control	Yes	Yes	Yes	Yes
θ_r	Yes	Yes	Yes	Yes
θ_t	Yes	Yes	Yes	No
θ_{st}	No	No	No	Yes
θ_g	Yes	Yes	Yes	Yes
Obs.	4,287,509	4,287,509	4,287,509	4,287,509

The dependent variable is an indicator for having a temporary contract. All specifications are estimated using logistic regressions. Reported coefficients are marginal effects evaluated at sample means. Standard errors, clustered at the NUTS-1 region level, are reported in parentheses. Significance levels are denoted by ***, **, and * for the 1%, 5%, and 10% levels, respectively.

In regions that experienced large Exp. Lib. (top decile), workers have 6.7 p.p. larger probability of being employed on temporary contract than in regions with small Exp. Lib. (bottom decile).

Baseline results: mechanism

Table 4 – Temporary contracts: the role of revenues volatility

Dep. variable	Temporary contract			
	(1)	(2)	(3)	(4)
Export lib.	0.114***	0.126***	0.176***	0.172***
	(0.015)	(0.012)	(0.028)	(0.027)
Import lib.	-0.014	-0.010	0.011	0.010
	(0.011)	(0.009)	(0.011)	(0.011)
Export lib x High Vol.		0.040	0.157**	0.152**
		(0.026)	(0.063)	(0.063)
Import lib x High Vol.	0.041		-0.217**	-0.206**
	(0.053)		(0.093)	(0.093)
Controls	Yes	Yes	Yes	Yes
θ_r	Yes	Yes	Yes	Yes
θ_t	Yes	Yes	Yes	No
θ_{st}	No	No	No	Yes
θ_g	Yes	Yes	Yes	Yes
Obs.	4,287,509	4,287,509	4,287,509	4,287,509

The dependent variable is an indicator for having a temporary contract. *High vol* is a dummy variable equal to one if the region r experienced a *change* in the average volatility of revenues in pre- vs post-enlargement period above the median. All specifications are estimated using logistic regressions. Reported coefficients are marginal effects evaluated at sample means. Standard errors, clustered at the NUTS-1 region level, are reported in parentheses. Significance levels are denoted by ***, **, and * for the 1%, 5%, and 10% levels, respectively.

Baseline results: Working schedule

Table 5 – Working schedule

	Atypical schedule	
	(1)	(2)
Export liberalization	0.151***	0.142***
	(0.022)	(0.020)
Import liberalization	-0.006	-0.015
	(0.015)	(0.013)
Control	Yes	Yes
θ_r	Yes	Yes
θ_t	Yes	No
θ_{st}	No	Yes
θ_g	Yes	Yes
Obs.	4,287,509	4,287,509

The dependent variables are indicators for working on atypical hours and working overtime. All specifications are estimated using logistic regressions. Reported coefficients are marginal effects evaluated at sample means. Standard errors, clustered by NUTS-1 regions, are in parentheses. Significance levels are denoted as ***, **, * for 1%, 5%, and 10%, respectively

Strengthening identification: Pseudo-panel approach

- To improve identification, we take two steps toward a pseudo-panel approach:
- Cohort-level analysis: ▸ Cohorts
  - Track workers aged 20–29 in 2002 and 30–49 in 2014.
  - Compare workers with similar characteristics across pre- and post-accession periods.
  - Control for gender and education; fixed effects for region and sector-year.
- Cell-level aggregation: ▸ Cell panel
  - Aggregate worker-level data into region-sector-education-gender-age cells.
  - Improves comparability by grouping similar individuals.
- Findings:
  - Cohort analysis: Export lib. $\uparrow$ temporary contracts, import lib. $\downarrow$ temporary contracts.
  - Cell-level analysis: Same patterns, with a precisely estimated negative effect of import lib.

$\Longrightarrow$ Results confirm baseline findings and strengthen causal identification.

Baseline results: hours and earnings

Table 6 – 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 $\times$ year-specific effects. Standard errors, clustered by NUTS-1 regions, are in parentheses. Significance levels are denoted as ***, **, * for 1%, 5%, and 10%, respectively.

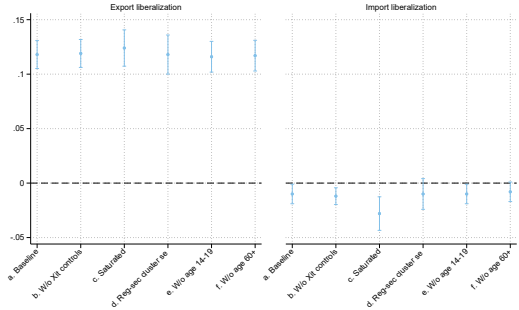
Results by occupation categories

			Temporary Contracts			Permanent Contracts		
				Wages			Wages	
	Temp. cont.	Atyp. Sch.	Hours	Total	Atypical	Hours	Total	Atypical
A. Managem.								
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. Prod. & Serv.								
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 $\times$ year-specific effects, and cell-specific effects based on gender, education, and age. 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.

Robustness checks

- Drop worker controls (X_{it}).
- Region-sector-cell FE (θ_{rstg}).
- Region–sector clustered SEs.
- Exclude age 14–19 and 60+.
- Autor et al. (2016)-style index ADH
- By sector Temp Atypical
- Using 2018 SES data 2018



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Conclusion

- EU tariff reforms provide exogenous variation in export and import market.
- Export liberalization:
  - Raises the incidence of temporary contracts and atypical hours.
  - Effects are persistent and widespread across sectors and regions.
- Import liberalization:
  - Limited impact on contract composition.
  - Operates mainly through downward pressure on earnings.
- The pattern matches theory. Export liberalization:
  - Increases exposure to foreign demand fluctuations.
  - Raises the long-run value of flexible labor relative to permanent positions.
- Takeaway. Trade integration:
  - Reallocates workers across contract types.
  - Has lasting consequences for job quality beyond wages and employment levels.

THANKS FOR YOUR ATTENTION

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EU accession and labor market institutions

- EU enlargement in 2004/07.
  - Largest EU expansion regarding the number of countries and workers involved.
  - Heterogeneity of new member states in terms of industrial composition.
  - Adoption of the applied MFN tariffs already implemented (and designed) by old EU members.
  - Adoption of European Union's pre-existing preferential trade agreements (PTAs).

- Identification concern:
  - Relevance of non-EU origins/destinations for EECs non-EU
  - EU accession may induce labor market reforms.
  - If correlated with trade exposure, outcomes may reflect institutions rather than trade Corr .

- EU legal competence over labor markets:
  - Limited authority under the "Treaty of the Functioning of the EU".
  - Article 153(5): pay setting, collective action, and strikes excluded.
  - Article 153(4): national autonomy over core labor market institutions preserved.

- Accession conditionality (European Commission '03):
  - No requirements on employment protection, temporary contracts, or wage setting.
  - Labor market institutions remain national and non-harmonized .

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ECCs' trade towards non-EU countries

Table 7 – EECs' share of total imports/exports from/to from non-EU 15 countries.

Country	Import sh. 1997 (in %)	Import sh. 2014 (in %)	% Δ	Export sh. 1997 (in %)	Export sh. 2014 (in %)	% Δ
Bulgaria	70	64	-8	65	63	-2
Czech Republic	39	55	40	41	44	7
Estonia	43	65	51	52	58	10
Hungary	41	55	33	37	50	34
Lithuania	60	72	19	69	76	10
Latvia	65	83	26	50	71	41
Romania	58	58	0	60	57	-4
Slovakia	60	68	14	59	53	-8

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

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Labor market reforms and identification

Table 8 – Trade liberalization and pre-accession employment protection

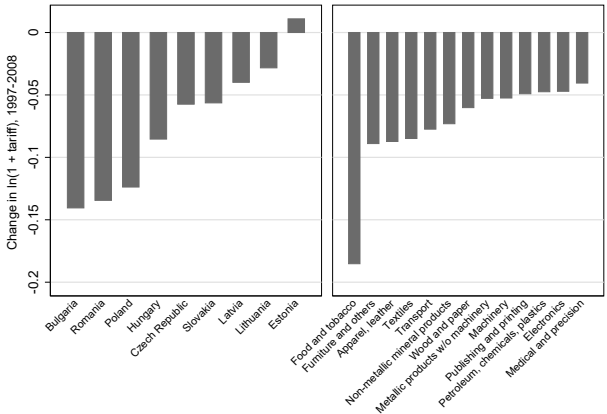
Dep. Variable	Import Lib.		Export Lib.	
	(1)	(2)	(3)	(4)
Emp. protection individual dismissal 2004	-0.218		0.280	
	(0.173)		(0.143)	
Emp. protection collective dismissal 2004		-0.135		0.071
		(0.318)		(0.282)

Notes: The dependent variables are NUTS1 import (columns 1-2) and export liberalization (columns 3-4) indices. Explanatory variable are OECD Employment protection against individual and collective dismissals as of 2002 (https://www.oecd.org/en/data/datasets/oecd-indicators-of-employment-protection.html). Employment protection data in 2002 available only for the following EECs : Czech Republic, Hungary, Poland and Slovak Republic. Standard errors clustered at country level in parenthesis. Significance levels are indicated as ***, **, * for 1%, 5%, and 10%, respectively.

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Fact : Reduced MFN import tariffs

Figure 1 – Change in Applied MFN Tariffs Between 1997 and 2008



Source: Authors' calculation using WTO data.

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Fact : Increased number of PTAs

Table 9 – 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 is the end of the post-accession transition to EU trade policy adoption. *Source:* Authors' calculation using WTO data.

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Fact : Change in the shares of temporary contracts

Table 10 – Share of Temporary Contracts (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.

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Theory: Environment

- Regions r, sectors s, periods t. Representative producer in each (r, s).
- Production and revenue (CES demand, $\nu > 1$):

$$Y_{rst} = (\Psi P_{rst} + T_{rst})^{\zeta}, \qquad R_{rst} = A_{rst}\,(\Psi P_{rst} + T_{rst})^{\alpha}$$

  - $\Psi > 1$: permanent workers are more productive.
  - $\alpha = \zeta(\nu - 1)/\nu \in (0, 1)$.
  - A_{rst}: demand shifter.

- Demand shocks (AR(1) in logs):

$$\ln A_{rst} = m_{rs} + \rho\,(\ln A_{rs,t-1} - m_{rs}) + \eta_{rst}, \qquad \rho \in (0, 1)$$

- Shock composition:

$$\eta_{rst} = (1 - \chi_{rs})\xi^{dom}_{rst} + \chi_{rs}\xi^{for}_{rst}$$

  - $\chi_{rs} \in [0, 1]$: exposure to foreign demand shocks.
  - ξ^{dom}, ξ^{for}: domestic/foreign shocks with variances $\sigma^2_{dom}, \sigma^2_{for}$ and covariance σ_{df}.

Theory: Trade and volatility nexus

- Demand-shock variance:

$$Var(\eta_{rst}) = \sigma^2_{rst} = (1-\chi_{rs})^2\sigma^2_{dom} + \chi^2_{rs}\sigma^2_{for} + 2\chi_{rs}(1-\chi_{rs})\,\sigma_{df}$$

- Export liberalization raises foreign exposure χ_{rs}.

$$\frac{\partial \chi_{rs}}{\partial[-\Delta \ln(1+\tau^X_{cs})]} > 0$$

- Openness raises volatility when :

$$\frac{\partial \sigma^2_{rs}}{\partial \chi_{rs}} = 2\left[\chi_{rs}\sigma^2_{for} - (1-\chi_{rs})\sigma^2_{dom} + (1-2\chi_{rs})\sigma_{df}\right] > 0$$

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Theory: Firm's problem

- Firm's decision problem:
  1. Firm inherits permanent employment $P_{rs,t-1}$.
  2. Demand shock A_{rst} is realized.
  3. The firm chooses permanent employment P (no hiring cost, firing cost f if $P_{rs,t} < P_{rs,t-1}$).
  4. The firm chooses temporary employment T (flexible, no adjustment cost).
  5. Production and sales occur.

- The firm's optimal level of effective labor from profit maximization (L^o):

$$L^o_{rst} = \left(\frac{\alpha A_{rst}}{w_{rst}} \right)^{\frac{1}{1-\alpha}}$$

- Permanent workers supply ΨP units. Temporary workers fill the gap (if $L^o > \Psi P$):

$$T^*_{rst} = \left(L^o_{rst} - \Psi P_{rst} \right)^+$$

Theory: Firm's problem

- Operating profits are:

$$\tilde{\pi}(P, A; w) = \Pi(A; w) + w(\psi - 1)P - \Omega(P, A; w)$$

- where:
  - $\Pi(A; w) = (1 - \alpha)A(L^o)^\alpha$ is benchmark profit.
  - $\Omega(P, A; w) \geq 0$ is the overstaffing loss (zero when temporary employment is positive).
  - $w(\psi - 1)P$ is the productivity gain from using permanent workers.

- And the value function of a producer who inherits P_{t-1} is:

$$V(P_{t-1}, A_t) = \max_{P \geq 0} \left[\tilde{\pi}(P, A_t, w) + \delta E[V(P, A_{t+1}) \mid A_t] - f(P_{t-1} - P)^+\right]$$

- Partial derivative with respect to P defines optimal P^*:
  - The producer fires (hires) to P^f (P^h) when she starts above (below) it.
  - The firing cost f implies an inaction band (i.e., marginal value of P is negative but $< f$).
  - Within the inaction band adjustment happens through temporary workers.

Theory: Firm's problem

- The envelope condition gives the marginal value of permanent employment:

$$Q_P(P, A) = \underbrace{w(\psi - 1)}_{\text{prod. gain}} - \underbrace{\Omega_P(P, A; w)}_{\text{overstaf. cost}} - \delta \underbrace{\kappa(P, A; \sigma^2)}_{-E[V_P|A_t]}$$

- V_P is the derivative of value function wrt permanent worker:
  - V_P is the marginal cost of additional P carried into next period (i.e., f or 0 or $-Q_P$).
  - κ includes the severance and the cost of carrying the worker through periods of inaction.

Theory: Firm's problem

- Given P^*_{rst} and T^*_{rst}, steady-state objects are:

$$\bar{P}^*_{rst} = \mathbb{E}[P^*_{rst}], \quad \bar{T}^*_{rst} = \mathbb{E}[T^*_{rst}], \quad \theta^*_{rst} = \frac{\bar{T}^*_{rst}}{\bar{P}^*_{rst} + \bar{T}^*_{rst}}$$

- At a fixed wage, and under the two following assumptions:
  - **h1**: Risk raises the cost of permanent hire ($\partial\kappa/\partial\sigma^2 > 0$).
  - **h2**: Permanent steady-state employmment does not rise with risk.

- An increase in risk σ^2:
  - Raises temporary employment.
  - Increases θ^*_{rst}.

Theory: Testable Implications

Under the assumptions above (h1 and h2):

1. Export liberalization raises the steady-state temporary share through the volatility channel if it increases region–sector demand variance.

2. Import liberalization has no sharp prediction for volatility or the temporary share in this framework (competition + input sourcing effect).

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Tariff data on new EU members

- **Import tariffs**: Applied HS 6-digit MFN tariffs (WTO).
  - τ_{cs}^{M}: Country c's weighted avg. tariff across HS6 within NACE industry s.
  - Post-enlargement MFN tariff scheme exogenously set by Western EU members.
  - Zeroing *vis-à-vis* Western EU countries accounted for.

- **Export tariffs**: Effectively applied tariffs imposed by partner countries (WTO, WITS).
  - τ_{cs}^{X}: Weighted avg. effectively applied tariff faced by exporting firms in c.
  - Market access gains driven by integration into pre-existing (arguably exogenous) EU PTAs.

- In-sample descriptive statistics ▸ In-sample.

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In-sample descriptive

	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
$\Delta ln(1+\tau^{X}_{cs})$	-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
$\lambda_{r_{(c)}s}$	0.058	0.057	0.010	0.017	0.044	0.074	0.120
$\beta_{r_{(c)}s}$	0.077	0.067	0.016	0.032	0.060	0.103	0.158
Collec. agre. (1/0)	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).

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HHI of employment shares

Table 11 – Shift-level specific distribution of HHI index of exposures (i.e. $\lambda_{r(c),s}$ and $\beta_{r(c),s}$).

	10pct	25pct	50 pct	75pct	90pct
HHI $\lambda_{r(c),s}$	0.0001	0.0003	0.0018	0.0077	0.0323
HHI $\beta_{r(c),s}$	0.0005	0.0018	0.0057	0.0185	0.0375

Note: Authors' calculations on SES, World Bank WDI and Eurostat data.

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Falsification test

Balance variable	*Imp. shock* Coef.	SE	*Exp. shock* 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	

Notes: 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 cluster 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 cluster 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 cluster at region level.

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Baseline Results: Country-sector cluster

Table 12 – Country-sector cluster standard errors.

	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)
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 country-sector, are in parentheses. Significance levels are denoted as *, , * for 1%, 5%, and 10%, respectively

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Baseline Results: Cell-Panel Approach

Table 13 – 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)
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 $\times$ 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.

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Baseline results: following workers' cohorts

Table 14 – 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)
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.	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 $\times$ 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

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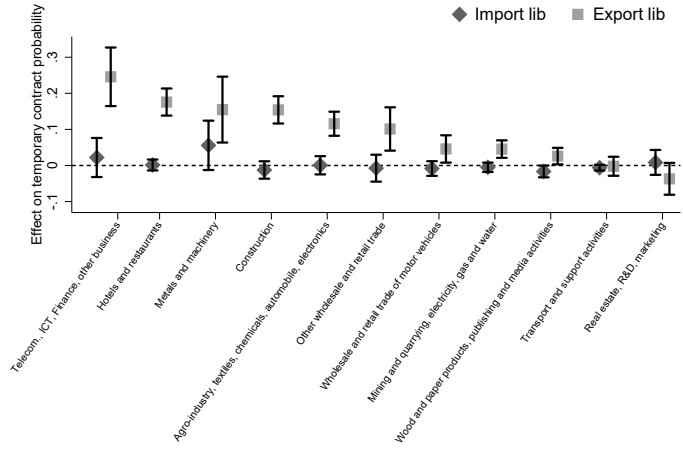
Robustness check using ADH index.

	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 $\times$ 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

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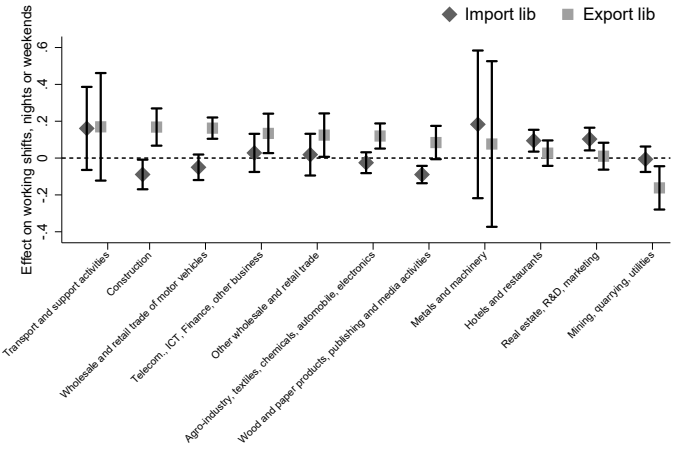
Results by Sector: Temporary contract



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.

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Results by sector: Atypical schedule



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.

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Results using SES 2018

Table 15 – Working conditions – Using 2018 SES data

	Temporary contract			
	(1)	(2)	(3)	(4)
Export lib.	0.070***		0.099***	0.097***
	(0.012)		(0.027)	(0.027)
Import lib.		-0.054***	0.032	0.027
		(0.017)	(0.030)	(0.031)
Control	Yes	Yes	Yes	Yes
θ_r	No	No	No	No
θ_t	Yes	Yes	Yes	No
θ_{st}	No	No	No	Yes
θ_g	Yes	Yes	Yes	Yes
Obs.	4,506,927	4,506,927	4,506,927	4,506,927

The dependent variable is an indicator for having a temporary contract. All specifications are estimated using logistic regressions. Reported coefficients are marginal effects evaluated at sample means. Standard errors, clustered at the NUTS-1 region level, are reported in parentheses. Significance levels are denoted by ***, **, and * for the 1%, 5%, and 10% levels, respectively.

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