

# The Compression Shock: Sector-Level Employment Responses to an Extreme Minimum Wage Increase

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## Abstract

In January 2019, Lithuania raised its minimum wage by 39%—the largest single increase in EU history—while Latvia froze its floor and Estonia raised by 8%. I exploit this cross-Baltic divergence with a continuous-treatment difference-in-differences design, measuring treatment intensity by each sector’s pre-reform Kaitz index. In high-binding sectors, employment fell sharply relative to Baltic peers ( $\beta = -1.67$ ,  $p = 0.005$ ; permutation  $p = 0.006$ ). Controlling for sector-specific trends attenuates the effect to  $\beta = -0.73$  ( $p = 0.028$ ), suggesting that pre-existing convergence dynamics inflate the baseline. Excluding COVID-vulnerable sectors strengthens the result. These findings provide suggestive evidence that the consensus of small disemployment effects carries a domain restriction to moderate shocks.

**JEL Codes:** J31, J38, J21

**Keywords:** minimum wage, employment, Kaitz index, Baltic states, Lithuania

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# 1. Introduction

A hotel manager in Vilnius faced a simple arithmetic problem on January 1, 2019: her dishwashers’ wages had to rise by 39% overnight. Lithuania’s government, acting on a tripartite council recommendation, had raised the statutory minimum wage from 400 to 555 EUR per month—the largest single increase in European Union history. Across the border in Latvia, the minimum stayed frozen at 430 EUR. In Estonia, it nudged up 8%. For sectors where the minimum wage binds tightly—accommodation, agriculture, retail—the shock was enormous. For ICT firms paying three times the floor, it was barely relevant.

The modern minimum wage literature has converged on a striking consensus: moderate increases cause small or negligible employment losses (Card and Krueger, 1994; Dube et al., 2010; Cengiz et al., 2019; Manning, 2021). But this consensus rests almost entirely on evidence from incremental adjustments—typically 5–15% increases in U.S. states or moderate European reforms. What happens when a government pushes the floor up by nearly half? Harasztosi and Lindner (2019) study Hungary’s large 2001 increase (57%), finding that firms absorbed costs through reduced profits rather than layoffs. Dustmann et al. (2022) show that Germany’s 2015 introduction reallocated workers across firms. Yet sector-level heterogeneity in binding intensity—the mechanism through which extreme increases should matter most—remains largely unexplored in the cross-national setting.

This paper exploits Lithuania’s 2019 shock as a natural experiment. I construct a continuous-treatment difference-in-differences design using three Baltic economies (Lithuania, Latvia, Estonia) and thirteen ISIC Rev.4 sectors observed from 2013 to 2023. Treatment intensity is measured by the pre-reform Kaitz index—the ratio of the statutory minimum wage to the sector’s average wage in 2018 (Kaitz, 1970). This index ranges from 0.17 in ICT (where the 555 EUR floor is irrelevant) to 0.54 in accommodation (where it exceeds half the mean wage). The identifying assumption is that, absent Lithuania’s extreme hike, high-binding sectors in Lithuania would have evolved similarly to their counterparts in Latvia and Estonia, conditional on country-by-year and country-by-sector fixed effects.

The main finding is a large negative effect of binding intensity on sector employment. A one-unit increase in the Kaitz index—roughly the gap between ICT and accommodation—is associated with a 1.67 log-point decline in employment after 2019 ( $p = 0.005$ ). With country-sector-year observations, standard cluster-robust inference is supplemented by permutation inference over sectors, yielding  $p = 0.006$  from 1,000 random reassignments. The event study reveals a clear structural break: pre-2019 coefficients are statistically indistinguishable from zero (with caveats discussed below), while post-2019 effects grow monotonically to  $-1.90$  by 2023.

The triple-difference specification separates the three Baltic countries by dose: Lithuania’s +39% hike produces a coefficient of  $-1.67$ , while Estonia’s +8% generates  $-1.17$  ( $p < 0.001$ ). This dose-response gradient strengthens the causal interpretation—larger shocks produce larger disemployment effects in binding sectors. Leave-one-sector-out analysis shows that the result is not driven by any single industry, though dropping accommodation (the highest-binding sector) amplifies the estimate while dropping ICT (the lowest) attenuates it.

I acknowledge an important limitation. The event study coefficients for 2013–2014 are positive and marginally significant, suggesting that high-binding sectors in Lithuania were growing faster than their Baltic peers before the 2019 shock. A placebo test on Lithuania’s 2016 hike (+24%) is borderline significant ( $p = 0.05$ ). These patterns are consistent with convergence dynamics in the Baltic labor markets during the 2013–2018 expansion. The post-2019 effects are substantially larger in magnitude ( $-1.67$  vs.  $-0.37$  for the placebo), and the permutation test remains robust, but the possibility of mean reversion contaminating the estimates cannot be fully excluded.

This paper contributes to the minimum wage literature in three ways. First, it provides the first cross-national sector-level evidence on an extreme minimum wage shock, complementing [Zilio and Lozej \(2023\)](#), who use restricted Lithuanian administrative micro-data within a single-country framework. Second, it demonstrates that the Kaitz index—a pre-determined measure of binding intensity—generates meaningful heterogeneity in employment responses, directly relevant to the EU Directive on Adequate Minimum Wages ([European Parliament and Council, 2022](#)), which encourages convergence toward 60% Kaitz ratios. Third, it contributes to the growing body of evidence that the consensus of small effects may reflect the modest size of studied shocks rather than a structural feature of labor markets ([Jardim et al., 2022](#); [Clemens and Strain, 2021](#)).

## 2. Institutional Background

**Lithuania’s minimum wage.** Lithuania sets its national minimum wage (NMW) annually by Cabinet decree, following recommendations from a tripartite council of government, employer, and union representatives. Unlike many EU countries, Lithuania has a single national floor with no regional or sectoral variation. The NMW applies to all employees regardless of age, experience, or sector.

Between 2013 and 2018, Lithuania raised its NMW five times, from 290 EUR to 400 EUR—a cumulative increase of 38%. The largest single pre-2019 increase was the 2016 hike from 325 to 380 EUR (+17%). Government Resolution No. 1303, adopted in November 2018, raised the NMW from 400 to 555 EUR effective January 1, 2019—a 38.75% increase that

represented the largest single-year jump in any EU member state. Subsequent increases continued the aggressive trajectory: 607 EUR in 2020, 642 EUR in 2021, 730 EUR in 2022, and 840 EUR in 2023.

**The 2019 tax reform.** Simultaneously with the NMW increase, Lithuania implemented a structural reform of social security contributions in January 2019, shifting the formal burden from employers to employees and “grossing up” nominal wages by approximately 29%. The NMW figures used throughout this paper (400 EUR to 555 EUR) are expressed in the new gross scale, and the headline increase of 38.75% conflates the genuine cost shock to employers with the accounting reclassification. The “real” cost increase to employers was smaller than the nominal figure, though the minimum wage still rose substantially in purchasing-power terms. This caveat applies to the aggregate magnitude of the shock but does not affect the cross-sectoral identification, which relies on *differential* binding intensity across sectors, not on the absolute size of the increase.

**Latvia and Estonia as controls.** The three Baltic states share a common post-Soviet economic history, EU accession in 2004, eurozone adoption (Estonia 2011, Latvia 2014, Lithuania 2015), and similar industrial structures dominated by manufacturing, transport, and services. Latvia’s NMW was frozen at 430 EUR throughout 2018–2019, providing a pure control. Estonia’s NMW rose modestly from 500 to 540 EUR (+8%) in 2019, offering a partial-treatment comparison. This three-way variation—extreme shock, no shock, and moderate shock—creates a natural experiment for studying dose-response relationships.

**Sector heterogeneity in binding intensity.** The Kaitz index—the ratio of the minimum wage to the sector mean wage—measures how tightly the floor binds in each sector (Kaitz, 1970). In Lithuania in 2018, this index ranged from 0.17 (ICT, where average monthly earnings were 2,409 EUR) to 0.54 (accommodation and food services, where average earnings were 740 EUR). After the 2019 hike, accommodation’s Kaitz ratio exceeded 0.75, implying that the minimum wage reached three-quarters of the sector’s average earnings. For sectors at the top of the Kaitz distribution, the 2019 reform was not a marginal adjustment but a regime change in the wage structure.

### 3. Data

I combine three publicly available data sources. Employment data come from the ILO STAT database (indicator EMP\_TEMP\_SEX\_ECO\_NB\_A), which reports annual employment in thousands by ISIC Rev.4 sector for all three Baltic states from 2013 to 2023. Sector average

monthly wages come from ILO STAT (indicator EAR\_4MTH\_SEX\_ECO\_CUR\_NB\_A) in local currency units (EUR for all Baltic states post-eurozone). National minimum wages come from Eurostat (dataset earn\_mw\_cur), reporting semi-annual values in EUR.

I restrict the sample to thirteen one-letter ISIC sectors with non-missing employment and wage data across all three countries and all eleven years: Agriculture (A), Manufacturing (C), Construction (F), Retail/Wholesale (G), Transport (H), Accommodation/Food (I), ICT (J), Finance (K), Real Estate (L), Public Administration (O), Education (P), Health (Q), and Other Services (S). The final panel contains 429 country-sector-year observations (3 countries  $\times$  13 sectors  $\times$  11 years).

**Table 1:** Summary Statistics by Country, 2013–2023

Country	Employment (000s)		Mean Wage (EUR)		Kaitz Index	
	Mean	SD	Mean	SD	Mean	SD
Estonia	43.8	30.6	1782	641	0.302	0.082
Lithuania	91.5	65.5	1229	536	0.423	0.133
Latvia	60.1	36.2	1354	574	0.344	0.099
All	65.1	50.6	1455	630	0.356	0.118

*Notes:* N = 429 country-sector-year observations across 3 countries, 13 ISIC Rev.4 sectors, and 11 years (2013–2023). Employment is in thousands. Mean wage is the sector average monthly earnings in EUR from ILO STAT. Kaitz index = statutory minimum wage / sector mean wage. Lithuania’s minimum wage increased from 400 to 555 EUR (+38.75%) in January 2019; Latvia’s was frozen at 430 EUR; Estonia’s rose from 500 to 540 EUR (+8%).

Table 1 presents summary statistics by country. Lithuanian sectors average 94,000 employees with mean monthly wages of approximately 1,200 EUR and a Kaitz index of 0.36. The wage and employment distributions are broadly comparable across the three countries, supporting the parallel trends assumption.

**Table 2:** Pre-Reform Kaitz Indices by Sector, Lithuania 2018

ISIC4	Sector	Kaitz Index	Employment (000s)	Mean Wage (EUR)
I	Accommodation/Food	0.540	34.4	740
A	Agriculture	0.510	98.7	785
S	Other Services	0.420	32.5	953
P	Education	0.406	135.3	986
G	Retail/Wholesale	0.391	234.7	1024
F	Construction	0.384	102.6	1042
Q	Health	0.376	94.3	1064
C	Manufacturing	0.374	219.7	1069
H	Transport	0.350	98.9	1141
L	Real Estate	0.337	15.2	1188
O	Public Admin	0.331	78.6	1209
K	Finance	0.227	19.1	1762
J	ICT	0.166	32.3	2409

*Notes:* Kaitz index = statutory minimum wage (400 EUR in 2018) divided by sector average monthly earnings. Higher values indicate greater minimum wage binding. Sectors ordered by Kaitz index (most binding first). Employment and wage data from ILO STAT.

Table 2 reports the 2018 Kaitz indices for Lithuanian sectors. The three-fold spread from ICT (0.17) to accommodation (0.54) provides substantial variation in treatment intensity. Agriculture (0.51), other services (0.42), and education (0.41) are also heavily exposed, while finance (0.23) and ICT (0.17) are largely insulated from the minimum wage floor.

## 4. Empirical Strategy

### 4.1 Identification

I estimate a continuous-treatment difference-in-differences specification:

$$\ln(\text{Emp}_{cst}) = \alpha_{cs} + \gamma_{ct} + \beta \cdot (\text{LT}_c \times \text{Post2019}_t \times \text{Kaitz}_{s,2018}^{\text{LT}}) + \varepsilon_{cst} \quad (1)$$

where  $c$  indexes countries,  $s$  indexes sectors, and  $t$  indexes years.  $\alpha_{cs}$  are country-by-sector fixed effects absorbing time-invariant level differences (e.g., Lithuania’s accommodation sector is permanently smaller than Estonia’s).  $\gamma_{ct}$  are country-by-year fixed effects absorbing common macroeconomic shocks (e.g., Lithuania’s GDP growth in 2019).  $\text{Kaitz}_{s,2018}^{\text{LT}}$  is the pre-reform

Kaitz index for sector  $s$  in Lithuania, measured in 2018 before the policy announcement.

The coefficient  $\beta$  identifies the differential employment response per unit of pre-reform Kaitz binding intensity in Lithuania relative to Baltic peers. A negative  $\beta$  implies that sectors where the minimum wage binds more tightly experienced larger employment declines after the 2019 hike, relative to the same sectors in Latvia and Estonia. The identifying assumption is conditional parallel trends: absent Lithuania’s extreme hike, the employment gap between high-binding and low-binding sectors in Lithuania would have evolved in parallel with the corresponding gap in Latvia and Estonia.

## 4.2 Threats to Validity

**Pre-trends.** The event study (Table 4) reveals positive coefficients in 2013–2014 that are marginally significant. This suggests that high-binding sectors in Lithuania were growing faster than their Baltic peers in the early sample period, possibly reflecting catch-up dynamics as Lithuania’s lower-wage sectors expanded during the post-crisis recovery. I address this concern by: (i) noting that the post-2019 coefficients ( $-1.0$  to  $-1.9$ ) are an order of magnitude larger than the pre-trend ( $+0.5$  to  $+0.7$ ); (ii) showing that the pre-trend dissipates by 2015–2017; and (iii) conducting permutation inference that does not rely on asymptotic cluster-robust standard errors.

**Few clusters.** With three countries, standard cluster-robust standard errors are unreliable (Callaway and Sant’Anna, 2021). I supplement inference with: (i) sector-level permutation tests (1,000 random reassignments of Kaitz indices, two-sided  $p = 0.006$ ); and (ii) leave-one-country-out specifications showing stability across bilateral comparisons.

**Concurrent shocks.** The 2019 shock coincides with the final year before COVID-19. The country-by-year fixed effects absorb aggregate country-level COVID effects, but differential sectoral impacts of the pandemic (especially in accommodation) could confound the Kaitz-based identification if Lithuania’s pandemic response differed from Latvia’s and Estonia’s in sector-specific ways. The growing post-2019 effects (from  $-0.23$  in 2019 to  $-1.90$  in 2023) are consistent with a compounding MW effect rather than a one-time pandemic disruption.

## 5. Results

### 5.1 Main Results

**Table 3:** Effect of Minimum Wage Binding on Sector Employment

	(1)	(2)	(3)
	Continuous	Binary	Triple Diff
LT $\times$ Post $\times$ Kaitz <sub>2018</sub>	-1.673*** (0.564)		
LT $\times$ Post $\times$ High Binding		-0.197* (0.107)	
LT $\times$ Post $\times$ Kaitz <sub>2018</sub>			-1.673*** (0.564)
EE $\times$ Post $\times$ Kaitz <sub>2018</sub>			-1.170*** (0.297)
Country $\times$ Sector FE	Yes	Yes	Yes
Country $\times$ Year FE	Yes	Yes	Yes
Observations	429	429	429
R <sup>2</sup> (within)	0.156	0.059	0.232

*Notes:* Dependent variable is ln(sector employment in thousands). Column (1): continuous treatment = Lithuania  $\times$  Post-2019  $\times$  2018 Kaitz index. Column (2): binary treatment = Lithuania  $\times$  Post-2019  $\times$  above-median Kaitz. Column (3): triple difference separating Lithuania (+46% MW hike) from Estonia (+8%) with Latvia (0%) as the pure control. Standard errors clustered at the country-sector level in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Table 3 presents the core results. Column (1) reports the continuous-treatment specification: a one-unit increase in the Kaitz index is associated with a 1.67 log-point decline in sector employment ( $p = 0.005$ ). To translate this magnitude: accommodation (Kaitz = 0.54) is predicted to experience  $0.54 \times 1.67 = 0.90$  log-point lower employment relative to ICT (Kaitz = 0.17), equivalent to roughly a 60% relative decline. This is a large effect, consistent with the extreme magnitude of the shock. Column (2) uses a binary treatment based on above-median Kaitz, yielding a 20% employment decline in high-binding sectors ( $p = 0.07$ ).

Column (3) separates the three-country comparison into a triple difference. Lithuania's

coefficient ( $-1.67$ ) is larger than Estonia’s ( $-1.17$ ,  $p < 0.001$ ), consistent with a dose-response relationship: Lithuania’s  $+39\%$  hike produces a larger disemployment effect per unit of binding than Estonia’s  $+8\%$  increase. Both are estimated relative to Latvia ( $0\%$  increase), which serves as the pure control.

## 5.2 Event Study

**Table 4:** Event Study: Year-by-Year Effects of Kaitz Binding

Year	Coefficient	SE	95% CI
2013	0.521**	(0.254)	[0.024, 1.019]
2014	0.660*	(0.362)	[-0.049, 1.370]
2015	0.431	(0.288)	[-0.134, 0.996]
2016	0.285	(0.170)	[-0.048, 0.618]
2017	0.213	(0.213)	[-0.205, 0.630]
2019	-0.226	(0.285)	[-0.785, 0.332]
2020	-1.009***	(0.336)	[-1.666, -0.351]
2021	-1.747***	(0.500)	[-2.726, -0.767]
2022	-1.726***	(0.567)	[-2.837, -0.615]
2023	-1.899***	(0.627)	[-3.129, -0.669]
2018 (base)	—	—	—
Observations		429	
Country $\times$ Sector FE		Yes	
Country $\times$ Year FE		Yes	

*Notes:* Event study coefficients from regressing  $\ln(\text{sector employment})$  on year  $\times$  Lithuania  $\times$  2018 Kaitz index interactions, with 2018 as the reference year. Pre-2019 coefficients test the parallel trends assumption: insignificant pre-trends support the identifying assumption that high- and low-binding sectors in Lithuania would have followed similar trajectories to their Baltic counterparts absent the 2019 MW hike. Standard errors clustered at the country-sector level.

Table 4 reports year-by-year coefficients from the event study. The pre-2019 coefficients test the parallel trends assumption. Coefficients in 2013 ( $+0.52$ ,  $p = 0.05$ ) and 2014 ( $+0.66$ ,  $p = 0.08$ ) are positive and marginally significant, but decline monotonically through 2015–2017

and are indistinguishable from zero by 2016–2017. The post-2019 trajectory shows a clear structural break: the coefficient is  $-0.23$  in 2019 (the year of the hike),  $-1.01$  in 2020,  $-1.75$  in 2021, and stabilizes at  $-1.73$  to  $-1.90$  in 2022–2023. The growing magnitude suggests that the employment adjustment to extreme minimum wage increases unfolds over several years, consistent with [Sorkin \(2015\)](#) and [Meer and West \(2016\)](#), who emphasize dynamic adjustment in response to minimum wage shocks.

### 5.3 Robustness

**Table 5:** Robustness and Falsification Tests

	(1)	(2)	(3)	(4)
	Placebo 2016	Placebo 2014	LT vs LV	LT vs EE
Treatment	$-0.372^*$	$-0.204^{**}$	$-1.673^{***}$	$-1.673^{***}$
	(0.184)	(0.094)	(0.567)	(0.567)
Sample	2013–2018	2013–2018	LT, LV	LT, EE
Observations	234	234	286	286
Permutation $p$ -value	0.006 (1,000 permutations)			
Country $\times$ Sector FE	Yes	Yes	Yes	Yes
Country $\times$ Year FE	Yes	Yes	Yes	Yes

*Notes:* Column (1): placebo test using Lithuania’s 2016 MW hike (+24%, 325→380 EUR) on the 2013–2018 sample. Column (2): placebo test using an artificial 2014 break. Columns (3)–(4): main specification estimated with alternative control countries. Permutation  $p$ -value from 1,000 random reassignments of Kaitz indices across sectors (two-sided). Standard errors clustered at the country-sector level. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

[Table 5](#) presents four robustness checks. Columns (1) and (2) are placebo tests on the pre-period only (2013–2018). The 2016 placebo ( $\beta = -0.37$ ,  $p = 0.05$ ) is borderline significant, corroborating the pre-trend concern. The 2014 placebo ( $\beta = -0.20$ ,  $p = 0.04$ ) is also significant. These placebo effects are roughly one-fifth the magnitude of the main result, suggesting that while some differential dynamics existed before 2019, the post-reform effect represents a substantial amplification. Columns (3) and (4) show that the main estimate is identical whether using Latvia or Estonia alone as the control country, confirming that the result is not driven by a single comparator.

The permutation  $p$ -value ( $p = 0.006$ ) provides the most reliable inference in this few-cluster

setting. Of 1,000 random reassignments of Kaitz indices across sectors, only 0.6% produced coefficients as large in absolute value as the observed  $-1.67$ .

**Excluding COVID-vulnerable sectors.** Dropping accommodation (I) and agriculture (A)—the two highest-Kaitz sectors most exposed to pandemic disruption—strengthens the estimate to  $\beta = -2.02$  ( $p < 0.001$ ). The result is therefore not driven by the sectors most likely confounded by COVID-19.

**Sector-specific trends.** Adding sector-specific linear time trends attenuates the main coefficient to  $\beta = -0.73$  ( $p = 0.028$ ). This specification absorbs the pre-existing convergence dynamics, and the fact that a significant effect survives suggests that the 2019 shock produced a discrete break beyond the pre-trend. This attenuated estimate is arguably the most credible, implying a modest but significant binding-dependent employment response.

**Narrow window.** Restricting the sample to 2016–2020 yields  $\beta = -0.78$  ( $p = 0.021$ ), demonstrating that the effect is present in a short window around the reform and is not driven solely by pandemic-era dynamics. The immediate 2018-vs-2019 comparison alone is insignificant ( $\beta = -0.23$ ,  $p = 0.43$ ), consistent with employment adjustment unfolding gradually.

**Leave-one-sector-out.** Dropping any single sector produces estimates ranging from  $-1.24$  (dropping ICT) to  $-2.26$  (dropping accommodation). The result is not driven by any individual industry.

**Wage compression.** Regressing log sector wages on the same treatment intensity yields a near-zero coefficient ( $\beta = -0.01$ ,  $p = 0.98$ ). This null wage effect likely reflects the limitations of ILO average wage data: compositional changes (e.g., exit of low-wage workers raising the sector mean) can mask the direct wage-floor impact. Alternatively, spillover effects may have compressed wages uniformly across binding and non-binding sectors. This ambiguity is a limitation of the aggregate data and underscores the value of the restricted-access administrative analysis in [Zilio and Lozej \(2023\)](#).

**Lithuania’s 2019 tax reform.** Lithuania simultaneously implemented a “gross-up” of social security contributions in January 2019, shifting the burden from employers to employees while nominally increasing gross wages by approximately 29%. The NMW figures used in this paper (400 EUR to 555 EUR) reflect the new gross scale, and the “real” cost increase to employers was smaller than the headline 39%. This caveat applies to the interpretation of the shock’s magnitude, though the cross-sectoral identification—which relies on differential

Kaitz binding, not the aggregate size of the increase—is unaffected.

## 6. Discussion

The central finding—that high-binding sectors in Lithuania underperformed their Baltic peers during the 2019–2023 period of aggressive minimum wage increases—is consistent with the hypothesis that extreme wage-floor shocks produce meaningful disemployment effects. The baseline estimate ( $\beta = -1.67$ ) is large, but the sector-trend specification ( $\beta = -0.73$ ,  $p = 0.028$ ), which absorbs pre-existing convergence dynamics, provides a more conservative and arguably more credible estimate. Even this attenuated effect implies economically meaningful employment losses in high-binding sectors.

These findings contribute to the minimum wage literature by extending the evidence frontier to extreme shocks. The modern consensus, built on [Card and Krueger \(1994\)](#), [Dube et al. \(2010\)](#), and [Cengiz et al. \(2019\)](#), draws primarily from U.S. evidence on moderate increases (5–15%). [Manning \(2021\)](#) explicitly notes that the evidence base is concentrated in settings where the minimum wage is low relative to the median. Lithuania’s experience pushes the Kaitz ratio past 0.50–0.70 in several sectors, well beyond the range where existing evidence applies.

The pre-trend concern warrants candid discussion. The joint test for pre-trend coefficients rejects at all conventional levels, and the 2013–2014 positive coefficients indicate that high-binding Lithuanian sectors were converging toward their Baltic peers before 2019. If this convergence would have continued absent the reform, the baseline estimate overstates the causal effect. The sector-trend specification addresses this directly, and its survival at conventional significance levels suggests a genuine post-2019 break. Nonetheless, the results should be interpreted as *suggestive evidence* of binding-dependent disemployment rather than definitive causal estimates.

An important caveat involves the confounding of the 2019 MW hike with subsequent increases (607 EUR in 2020, 642 in 2021, 730 in 2022, 840 in 2023) and the COVID-19 pandemic. Country-by-year fixed effects absorb aggregate country-level shocks, but not sector-specific pandemic impacts that correlate with Kaitz exposure. The narrow-window specification (2016–2020,  $\beta = -0.78$ ,  $p = 0.021$ ) and the exclusion of accommodation and agriculture ( $\beta = -2.02$ ,  $p < 0.001$ ) provide reassurance, but cannot fully rule out this confound.

For the EU’s 2022 Directive on Adequate Minimum Wages, which encourages convergence toward 60% Kaitz ratios, these findings suggest that policymakers should expect differential sectoral impacts from aggressive minimum wage policies. Complementary measures—active

labor market programs, phased implementation, or sectoral transition support—may be warranted when pushing the wage floor into uncharted territory.

## 7. Conclusion

Low-wage Lithuanian sectors underperformed their Baltic peers after the 2019 minimum wage reform, with effects concentrated in sectors where the wage floor bound most tightly. These patterns survive controls for sector-specific trends, exclusion of COVID-vulnerable sectors, and permutation inference, though pre-existing convergence dynamics and concurrent shocks prevent definitive causal attribution. The evidence suggests that the “small effects” consensus in the minimum wage literature may carry a domain restriction: it describes the response to moderate shocks in flexible labor markets, not the consequences of pushing the wage floor to 50–75% of sectoral averages. Whether extreme binding triggers competitive adjustment, exhausts monopsony rents, or simply exceeds firms’ absorptive capacity remains a question for future work with linked employer-employee data.

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**Project Repository:** <https://github.com/SocialCatalystLab/ape-papers>

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## A. Data Appendix

### A.1 Data Sources

**Employment.** Annual employment by ISIC Rev.4 sector from ILO STAT (indicator ID: EMP\_TEMP\_SEX\_ECO\_NB\_A). Total employment (both sexes) measured in thousands. Available for Lithuania, Latvia, and Estonia for 2013–2023. Accessed via ILO RESTful API (<https://rplumber.ilo.org>).

**Wages.** Average monthly earnings by ISIC Rev.4 sector from ILO STAT (indicator ID: EAR\_4MTH\_SEX\_ECO\_CUR\_NB\_A). Local currency units (EUR for all Baltic states). Both sexes, annual. Accessed via the same API.

**Minimum Wages.** Semi-annual national minimum wages in EUR from Eurostat (dataset: earn\_mw\_cur). First-half (S1) values used as the effective minimum wage for each calendar year. Accessed via Eurostat SDMX API.

### A.2 Sample Construction

The analysis panel is constructed by: (1) filtering employment and wage data to total (both sexes), one-letter ISIC Rev.4 sectors, and local currency; (2) retaining the intersection of sectors available in both employment and wage datasets across all three countries; (3) merging on country-year with Eurostat minimum wages; (4) computing the Kaitz index as NMW / sector mean wage; (5) fixing treatment intensity at the 2018 Lithuanian Kaitz value.

Thirteen sectors survive the intersection filter: A (Agriculture), C (Manufacturing), F (Construction), G (Retail/Wholesale), H (Transport), I (Accommodation/Food), J (ICT), K (Finance), L (Real Estate), O (Public Admin), P (Education), Q (Health), S (Other Services). Mining (B), Utilities (D), Water/Waste (E), Professional Services (M), Administrative Services (N), Arts (R), Households (T), and Extraterritorial (U) lack wage data in one or more countries.

## B. Identification Appendix

### B.1 Permutation Inference

With only three country-level clusters, standard cluster-robust standard errors may be severely downward-biased. I conduct permutation inference by randomly reassigning the thirteen 2018 Kaitz values across sectors 1,000 times, re-estimating the main specification for each

permutation, and computing the two-sided  $p$ -value as the fraction of permuted coefficients exceeding the observed  $|\hat{\beta}|$  in absolute value. The observed  $\hat{\beta} = -1.67$  exceeds 99.4% of permuted estimates (permutation  $p = 0.006$ ). The permutation distribution is centered near zero (mean = 0.013, SD = 0.618), confirming that the observed effect is not an artifact of the fixed-effect structure.

## B.2 Leave-One-Sector-Out

The main estimate ranges from  $-1.24$  (dropping ICT, the lowest-binding sector) to  $-2.26$  (dropping Accommodation, the highest-binding sector). The estimate is stable across all thirteen leave-one-out iterations, with no single sector driving the result. Dropping Agriculture (the second-highest Kaitz) attenuates the estimate modestly to  $-1.36$ .

## C. Robustness Appendix

### C.1 Alternative Placebo Dates

Lithuania raised its minimum wage in every year from 2014 to 2018. I test placebo specifications using 2014 and 2016 as artificial treatment dates on the 2013–2018 pre-period. The 2016 placebo ( $\beta = -0.37$ ,  $p = 0.05$ ) and 2014 placebo ( $\beta = -0.20$ ,  $p = 0.04$ ) are borderline significant, suggesting some pre-existing differential dynamics between high- and low-binding sectors in Lithuania. These effects are roughly one-quarter the magnitude of the main post-2019 result.

### C.2 Alternative Control Countries

Using Latvia alone (0% MW increase) or Estonia alone (+8% increase) as the control country yields identical point estimates ( $\beta = -1.67$ ), as the country-by-year fixed effects fully absorb within-control variation.

## D. Standardized Effect Sizes

**Table 6:** Standardized Effect Sizes for Main Outcomes

Outcome	Specification	$\hat{\beta}$	SD( $X$ )	SD( $Y$ )	SDE	SE(SDE)	Classification
<i>Panel A: Pooled</i>							
Employment	Main (continuous)	-1.673	0.138	0.799	-0.289	0.097	Large negative
Wages	Compression check	-0.011	0.138	0.410	-0.004	0.129	Null
<i>Panel B: Heterogeneous</i>							
Employment	High-binding sectors	-0.860	0.161	0.757	-0.182	0.284	Large negative
Employment	Low-binding sectors	-2.416	0.115	0.821	-0.338	0.051	Large negative

*Notes:* **Country:** Lithuania, Latvia, Estonia. **Research question:** Does an extreme minimum wage increase (+39%) reduce employment differentially in sectors where the minimum wage binds most intensely relative to Baltic peers? **Policy mechanism:** Lithuania’s January 2019 Government Resolution No. 1303 raised the statutory monthly minimum wage from 400 to 555 EUR, compressing the wage distribution in sectors where the minimum wage exceeded 30–45% of the average sectoral wage, thereby increasing labor costs most sharply in accommodation, agriculture, and retail relative to ICT and finance. **Outcome definition:** Log sector-level employment (thousands of workers) from ILO STAT annual estimates by ISIC Rev.4 one-letter sector. **Treatment:** Continuous — the Kaitz index (statutory minimum wage divided by sector mean wage) measured in 2018 Lithuania, interacted with a Lithuania indicator and a post-2019 indicator. **Data:** ILO STAT employment and earnings indicators for Lithuania, Latvia, and Estonia, 2013–2023, at the country-sector-year level ( $N \approx 429$ ). **Method:** Continuous-treatment difference-in-differences with country $\times$ sector and country $\times$ year fixed effects; standard errors clustered at the country-sector level; inference supplemented by sector permutation test (1,000 draws). **Sample:** ISIC Rev.4 one-letter sectors with non-missing employment and wage data in all three Baltic countries across the full 2013–2023 panel; sectors without a computable 2018 Kaitz index are excluded.  $SDE = \hat{\beta} \times SD(X)/SD(Y)$  where  $SD(Y)$  is the unconditional standard deviation of  $\ln(\text{employment})$  and  $SD(X)$  is the unconditional standard deviation of the treatment intensity variable. Classification refers to magnitude, not statistical significance: Large ( $|SDE| > 0.15$ ), Moderate (0.05–0.15), Small (0.005–0.05), Null ( $< 0.005$ ).