Labor Market Effects of the 2002 Molise Earthquake: A Difference-in-Differences and Triple-Difference Research Proposal

Group 12

Bocconi University

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Abstract

This proposal outlines an empirical strategy to estimate the short- and medium-run effects of the October 31, 2002 Molise earthquake on local labor market outcomes using administrative microdata (INPS LoSaI). Building on faculty feedback, we (i) foreground the theoretical chain-of-effect linking shocks to outcomes, (ii) re-focus comparisons across *types of workers*—public, private, and self-employed—rather than across regions alone, and (iii) implement a unified triple-difference design that nests within-region and cross-region contrasts. Primary outcomes are employment probability, monthly wage/earnings, and contract stability. We test identifying assumptions with pre-trends and rich robustness checks, and we discuss key mechanisms (public-sector insulation, reconstruction-driven demand, liquidity constraints for the self-employed) that generate heterogeneous effects.

1 Research Question and Context

On October 31, 2002, an earthquake struck the Molise region. We ask: *How did the shock affect individual labor market outcomes such as employment probability, wage growth, and contract stability in the short- to medium-run?* We benchmark Molise against Basilicata given proximity and similarity, while leveraging variation across *worker types* that differ in exposure and institutional protection.

2 Conceptual Framework: Chain of Effects

We articulate a mechanism that maps the shock to labor outcomes:

1. **Immediate disruption (capital and demand)**: Destruction of physical capital and business interruption reduce labor demand; firm closures and temporary suspensions increase separations and lower hours/wages.

2. **Institutional insulation (public sector)**: Budget continuity, nominal wage rigidity, and redeployment possibilities shield public employees, muting separations and wage variability relative to private counterparts.

3. **Reconstruction and reallocation** (medium run): Public transfers and reconstruction spending increase demand, especially in construction and related services, potentially raising male employment and earnings while services facing displaced population or damaged infrastructure lag.

4. **Credit and liquidity constraints (self-employed)**: Business owners and the self-employed face balance-sheet shocks; limited access to credit amplifies exits and depresses earnings relative to wage employees.

5. **Compositional channels**: Migration, firm entry/exit, and occupational switching alter observed averages; identifying assumptions require monitoring population and workplace changes.

Hypotheses. (H1) Public employees experience negligible or smaller negative impacts than private employees. (H2) Self-employed are the most exposed (largest employment and income declines) in the short run. (H3) Medium-run recovery is strongest in construction and sectors tied to reconstruction, possibly offsetting aggregate losses among men.

3   Data

We use the Long Sample INPS (LoSaI), following all resident individuals in Molise (treated) and Basilicata (control). The main sample covers five pre-years (1997–2001) and five post-years (2003–2007), excluding the shock year(s) for clean treatment timing. Key variables:

- **Outcomes**: (i) Employment probability; (ii) monthly earnings or daily wage; (iii) contract stability (e.g., permanent contract indicator, contract duration); (iv) separation/transition indicators; (v) hours if available.

- **Worker types**: Public employee, private employee, self-employed (constructed from sector/contract codes).

- **Controls**: Age, gender, tenure, occupation, sector (NACE), municipality of residence and workplace. We exploit individual and time fixed effects.

Optional enhancements: Merge municipality-level exposure (distance to epicenter or macroseismic intensity) to study dose-response; flag inter-municipality migration to check compositional change.

4 Empirical Strategy

4.1 Baseline DiD (Region-by-Time)

Let i index individuals, $r \in \{\text{Molise, Basilicata}\}$ regions, and t years. Define $\text{Post}_t = 1$ for $t \geq 2003$ and $\text{Molise}_r = 1$ for Molise residents pre-shock. For outcome Y_{irt}:

$$Y_{irt} = \alpha + \beta \left(\text{Molise}_r \times \text{Post}_t\right) + \gamma_i + \lambda_t + \varepsilon_{irt}, \tag{1}$$

where γ_i are individual fixed effects and λ_t year effects. Coefficient β captures the average treatment effect on Molise residents.

4.2 Worker-Type Heterogeneity and Triple Difference

To align with the feedback to compare types of employees, we specify a DDD that contrasts private (or self-employed) with public employees across regions and time:

$$Y_{irst} = \alpha + \theta \left(\text{Molise}_r \times \text{Post}_t \times \text{Private}_s\right) + \phi \left(\text{Molise}_r \times \text{Post}_t \times \text{Self}_s\right)$$
$$\tag{2}$$
$$+ \text{ two-way interactions} + \gamma_i + \lambda_t + \mu_s + \varepsilon_{irst},$$

where s indexes worker type and μ_s are type fixed effects. Parameters θ and ϕ measure treatment *relative to* public employees, our insulated benchmark.

4.3 Event-Study for Dynamics and Pre-Trends

We estimate dynamic effects and test parallel trends using an event-study:

$$Y_{irt} = \alpha + \sum_{k \neq -1} \beta_k \mathbb{1}[t - t_0 = k] \times \text{Molise}_r + \gamma_i + \lambda_t + \varepsilon_{irt}, \tag{3}$$

where $t_0 = 2002$ and $k = -1$ is omitted. We will also interact event-time dummies with worker types to visualize heterogeneous trajectories.

4.4 "Three Environments" Presentation

To make results transparent and aligned with the requested comparisons, we will present:

1. **Within Molise**: Private vs. public before/after (DiD).

2. **Within Basilicata**: Private vs. public before/after (placebo DiD).

3. **Across regions**: Triple difference (Molise vs. Basilicata) $\times$ (post vs. pre) $\times$ (private/self vs. public), as in Eq. 4.2.

This triangulation clarifies that any private–public divergence unique to Molise post-2002 is attributed to the shock.

5   Identification, Inference, and Robustness

Assumptions.   (A1) *Parallel trends*: Absent the earthquake, Molise and Basilicata would have evolved similarly; we probe this with pre-trends by worker type. (A2) *No spillovers*: Basilicata not directly affected; we test sensitivity excluding border municipalities. (A3) *Stable composition*: We monitor migration and sample entry/exit; robustness excludes movers or re-weights to stable cohorts.

Standard errors and clustering.   We cluster at the individual level and consider two-way clustering by municipality-of-work to account for spatial correlation.

Robustness checks.

- Alternative control regions (e.g., Puglia) and synthetic control for Molise as a pre-trends validation.

- Placebo shocks in pre-period years; permutation tests across unaffected regions.

- Vary post window (e.g., 2003–2005 vs. 2003–2007); include 2002 with a separate indicator to absorb contemporaneous disruptions.

- Dose-response using municipality intensity or distance to epicenter; spatial gradient tests.

- Composition: re-estimate on balanced panels and by gender/age to probe differential selection.

6   Outcomes and Estimation Details

- **Employment probability**: linear probability models with FE; logit/probit in robustness.

- **Earnings/wages**: inverse hyperbolic sine transformation or logs (winsorized); control for hours if available.

- **Contract stability**: permanent contract indicator; contract duration; renewal probability.

- **Heterogeneity**: gender, age groups, sectors (construction vs. services), firm size.

- **Weighting**: person weights if provided; otherwise unweighted individual FE.

7 Expected Results and Interpretation

Short-run: employment and earnings decline for private employees and especially for the self-employed; public employees remain largely unaffected. Medium-run: recovery in construction and reconstruction-linked activities partially offsets losses, particularly among men; services exposed to population displacement lag. We will interpret magnitudes through the mechanism in Section 2, distinguishing demand destruction from reconstruction-driven stimulus and institutional insulation.

8 Deliverables and Timeline

- Clean codebook and cohort construction (Week 1).

- Baseline/event-study figures by worker type (Weeks 2–3).

- Main tables: DiD, DDD, robustness, and heterogeneity (Weeks 4–5).

- Mechanism deep-dives: sectoral and self-employed analyses; intensity gradient (Weeks 6–7).

9 Limitations

Potential data limitations (e.g., hours, measurement of self-employment), migration confounding, and policy confounds (concurrent national reforms) may complicate identification; we will address these through controls, fixed effects, and robustness analyses.

References

Administrative data documentation (INPS LoSaI) and standard references on DiD, DDD, and event studies will be followed (Angrist and Pischke, Callaway and Sant'Anna, Sun and Abraham).