Markups and Public Procurement: Evidence from Czech Construction Tenders

Marek Chadim

Tobin Center for Economic Policy - Yale University

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Does Public Procurement Affect Firm Market Power?

- **Public procurement** represents ≈$11 trillion globally each year
  - Roughly 12% of GDP across OECD countries; ∼29% of government spending
  - Predominantly infrastructure, construction, and public services

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- **Possible explanations**:
  - Government contracts may allow firms to charge higher markups due to discretion: less competition, political connections (Palguta and Pertold 2017; Titl 2023; Baránek & Titl 2024)
  - Or, more efficient "superstar" firms win contracts and have higher markups naturally: higher productivity and product quality (De Loecker et al. 2020; Autor et al. 2020; Miller 2024)

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  - Or, more efficient "superstar" firms win contracts and have higher markups naturally: higher productivity and product quality (De Loecker et al. 2020; Autor et al. 2020; Miller 2024)
- This paper: **What is the causal effect of public procurement on firm markups?**

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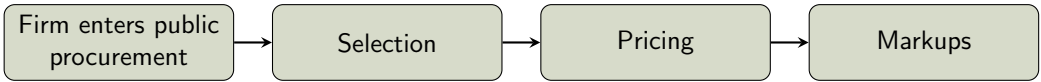
This Paper: Data and Research Design



Approach

- A **firm–contract linked panel**: financial statements matched to the procurement register
- **Firm-time markups** via the production approach (De Loecker & Warzynski 2012)
- **Identification** under selection-on-observables, synthetic control, and matrix completion

Research questions

Q1. Do government contractors charge higher markups than private-sector firms?

Q2. Has the procurement markup premium changed over time?

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Findings

1. **On average, government contractors charge significantly higher markups**
   - **$\sim$15% higher** *cross-sectionally*, controlling for inputs and 47 year$\times$subindustry effects (gap reflects selection *and* treatment)
   - Markups rise **$\sim$12%** *within firms* on entry — the causal effect, net of selection
   - Robust across **six estimators** and three identification strategies

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   - Markups rise **∼12%** *within firms* on entry — the causal effect, net of selection
   - Robust across **six estimators** and three identification strategies

2. **The premium declines substantially over the sample**
   - From **30% in 2006** to **10% in 2021**
   - Decline coincides with **institutional reforms** (2012 single-bidding elimination)
   - Consistent with reduced **discretion and favoritism**

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Czech Public Procurement: Context

All public contracts must be **publicly disclosed** under Czech law

- Contracts awarded by central, regional, **and** municipal governments
- Government-owned enterprises also included
- **2012 Reform**: Eliminated single-bid procedures (Titl 2023)
- **EU co-financing**: Increased monitoring and transparency (Baránek & Titl 2024)

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I study **1,297 construction firms from 2006–2021**

- Unbalanced panel with **7,261 firm-year observations**
- Link **financial statements** to **procurement contracts**
- Observe firms that enter, exit, and remain in procurement
- **44%** of observations involve government contracting ▸ Details

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Data Sources

1. **Firm Financial Statements** (Dun & Bradstreet MagnusWeb)
   - Sales, costs, materials, labor, capital
   - Industry classification (NACE 2-digit)
   - **Sample trimmed at** top/bottom 1% by sales-to-COGS ratio

2. **Public Procurement Records** (Datlab s.r.o.)
   - Contract values, dates, awarding entities
   - Procurement procedures used
   - Cleaned and validated by a private data provider

3. **Constructed Variables**
   - Binary indicator for government tender sales
   - Firm-specific markups from production function estimation

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Estimating Markups: The DLW Approach

Standard definition: Markup is price relative to marginal cost

$$\mu_{it} \equiv \frac{P_{it}}{\lambda_{it}}$$

The *production approach* to market power (Hall 1988; De Loecker–Warzynski 2012) — a conduct-free complement to the demand/NEIO approach (Bresnahan; Berry).

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Intuition (De Loecker & Warzynski 2012):

- Cost minimization implies markup equals:

$$\mu_{it} = \theta_{it}^{V} \cdot \left(\alpha_{it}^{V}\right)^{-1}$$

  where θ_{it}^{V} = output elasticity of variable input, α_{it}^{V} = expenditure share
- No demand system or conduct assumption needed (with output quantities)
- Only requires **production function estimation** and **first-order conditions**

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Implementation:

- Estimate translog production function, control for productivity
- Obtain firm-time specific output elasticities $\hat{\theta}_{it}^{V}$

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Production Function Specification

Translog production function:

$$y_{it} = \beta_v v_{it} + \beta_k k_{it} + \beta_{vv} v_{it}^2 + \beta_{kk} k_{it}^2 + \beta_{vk} v_{it} k_{it} + \omega_{it} + \varepsilon_{it}$$

where y_{it} = log output (deflated sales), v_{it} = log variable inputs, k_{it} = log capital

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Two-stage estimation (Ackerberg et al. 2015):

1. Estimate expected output: $y_{it} = \phi_t(v_{it}, k_{it}, pp_{it}) + \varepsilon_{it}$
2. Productivity law of motion: $\omega_{it} = g_t(\omega_{it-1}, pp_{it-1}) + \xi_{it}$

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2. Productivity law of motion: $\omega_{it} = g_t(\omega_{it-1}, pp_{it-1}) + \xi_{it}$

Moment conditions:

$$E[\xi_{it}(\beta) \cdot \mathbf{Z}_{it}] = 0$$

where $\mathbf{Z}_{it} = (v_{it-1}, k_{it}, v_{it-1}^2, k_{it}^2, v_{it-1} k_{it})$

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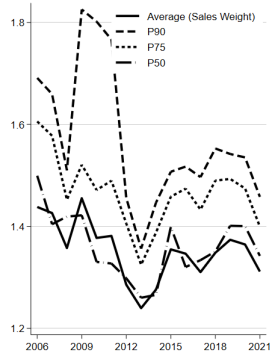
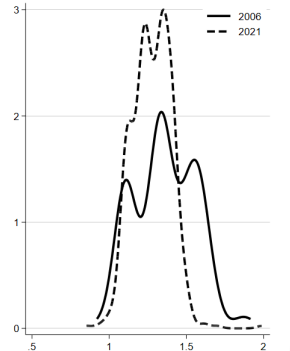
Estimation Result: Aggregate Markups Have Declined

Average Markups:

- **1.44** (2006) $\rightarrow$ **1.31** (2021)
- Decline driven by **top of distribution**

$\Rightarrow$ Contrast: US aggregate markups *rose* 1.21$\rightarrow$1.61 over a similar period (De Loecker, Eeckhout & Unger 2020); sector / period / revenue-PF differences.





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Identification 1: Selection on Observables

Potential outcomes framework:

- $Y_i(0)$ = markup without procurement, $Y_i(1)$ = markup with procurement
- Treatment effect: $\tau_i = Y_i(1) - Y_i(0)$
- Goal: Estimate ATT $= E[Y_i(1) - Y_i(0)|W_i = 1]$

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Assumptions:

1. **Unconfoundedness**: $W_i \perp Y_i(0)|X_i$
2. **Overlap**: $0 < Pr(W_i = 1|X_i) < 1$

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Implementation (following Imbens & Xu 2024):

- Balanced panel of 26 firms, 2010-2021 (312 obs.)
- Condition on 4 years of lagged outcomes and covariates
- Trim observations with extreme propensity scores (> 0.8) ‣ Plot

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Selection on Observables: Results

ATT estimates cluster in the 12–16% range (doubly-robust ≈ 0.15):

Method	**Contract Year**	**Placebo (Pre-contract)**
Difference-in-Means	0.12 (0.02)	0.03 (0.02)
Regression	0.16 (0.01)	-0.00 (0.01)
GRF	0.13 (0.01)	0.03 (0.01)
PSM	0.13 (0.01)	-0.00 (0.01)
AIPW-GRF	0.15 (0.01)	0.00 (0.01)
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Validation:

- **Placebo tests**: No pre-treatment effects ▸ Plot
- **Sensitivity analysis**: Results robust to confounders $3\times$ as strong as Y_{-1}
- **Quantile effects**: Heterogeneity across distribution

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Identification 2: Panel Methods for Selection on *Unobservables*

Three estimator families relax the same assumption three ways:

1. **Heterogeneity-robust DiD** (balanced panel) — Borusyak et al., Callaway–Sant'Anna, Sun–Abraham; Goodman–Bacon diagnostic ▸ Bacon ▸ Event study

2. **Synthetic control** (balanced panel) — SDID + Augmented SC; cohort effects 2011–2018 ▸ SDID ▸ ASC

3. **Matrix completion / interactive FE** (full panel) — data-driven rank; placebo + carryover tests

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⇒ All three agree: a positive premium that **shrinks sharply over time** — the result is not an artifact of one estimator's assumptions.

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Panel Data Results: Declining Premium Over Time

Matrix completion estimates (full unbalanced panel):

Period	ATT	SE	# Treated
2006-2009	0.30	0.016	45
2010-2015	0.25	0.011	107
2016-2021	0.10	0.007	389
2006	0.294	0.016	12
2012 (Reform)	0.236	0.013	18
2021	0.098	0.008	58

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Main findings:

- Premium declined from **30% to 10%** over 15 years
- Sharp drop around **2012 reform** (single-bidding elimination)
- Diagnostic tests support model validity (placebo $p > 0.4$)

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Interpreting the Premium: Conduct & Residual Demand

Markup $= f$**(residual-demand elasticity, conduct)**; procurement can shift each:

1. **Productivity-based selection**
   - More efficient firms win contracts, charge higher markups
   - Can cover fixed costs of procurement entry
   - Consistent with heterogeneous firm models
2. **Demand elasticity differences**
   - Government provides stable, long-term demand
   - Less elastic demand $\rightarrow$ higher optimal markups
   - Lock-in effects from contract specifications
3. **Discretion and favoritism**
   - Political connections enable rent extraction
   - Single-bidding reduces competition
   - Evidence: premium declined after 2012 reform

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$\Rightarrow$ The 2012 reform offers a test: if discretion drives the premium, it should fall when discretion is curtailed.

Evidence on Reform Effectiveness

2012 Czech Procurement Reform (Titl 2023, 2025):

- Eliminated single-bid procedures
- Reduced prices by **6.1% of estimated costs**, with no quality loss
- *But* prices of **connected / anonymously-owned** firms did not fall

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This paper's contribution:

- Reform coincides with a **declining markup premium**
- Premium falls from 25% (2010–2011) to 10% (2021)
- Complements price evidence with **market-power measures**
- Consistent with reduced **rent extraction**

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EU co-financing effects (Baránek & Titl 2024):

- Increased monitoring reduced favoritism costs by 6%
- Consistent with our declining premium finding

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Summary

Main findings:

1. Entry into public procurement causally **increases markups by $\sim$12%** within firms (cross-sectional gap $\sim$15%)
2. The premium **declines**: 30% (2006) $\rightarrow$ 10% (2021)
3. Decline coincides with competition-enhancing **procurement reform**

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Contributions:

- First **firm-level market-power** evidence on public procurement
- Integrates the **production approach** with heterogeneity-robust panel identification
- **Policy-relevant** quantification of procurement competitiveness around reform dates
- **Template** for measuring the markup gap between public and private contractors

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Limitations and Future Directions

Data limitations:

- Deflated sales $\Rightarrow$ price bias in markup *levels* (not our focus)
- The **premium** is the identified object: bias differences out *exactly* under Cobb-Douglas, approximately under translog (DLW 2012; De Ridder et al. 2026) — we report both
- **Within-firm** entry effect nets out firm-level demand and quality

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Identification challenges:

- Lack of experimental or IV induced variation in public procurement
- SUTVA in **competitive procurement markets** requires careful interpretation

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Work in progress:

- **All-bidder** tender data (not just winners) — natural control firms to identify the competition channel directly
- **Dynamic entry/exit game** recovering fixed costs of entry to public procurement — ability to evaluate counterfactual interventions within the estimated model

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External Relevance

Broader relevance:

1. **Public Finance - Efficiency of Government Expenditures**
   - $10+ trillion globally in annual procurement
   - Marginal markup reductions imply **first-order fiscal savings**

2. **Political Economy - Role of Institutions**
   - Institutional design can **constrain rent extraction**
   - Quantifies the role of **transparency and competition**
   - Relevant for developing countries, state capacity

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Thank you!

marek.chadim@yale.edu

Replication files: github.com/marek-chadim/Markups-and-Public-Procurement

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Appendix: Sample Construction

Starting universe:

- All Czech construction firms in MagnusWeb (2006-2021)
- NACE codes 41 (buildings), 42 (civil eng.), 43 (specialized)

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Final sample:

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- 44% of observations involve procurement contracts
- Balanced panel (26 firms) for selection-on-observables

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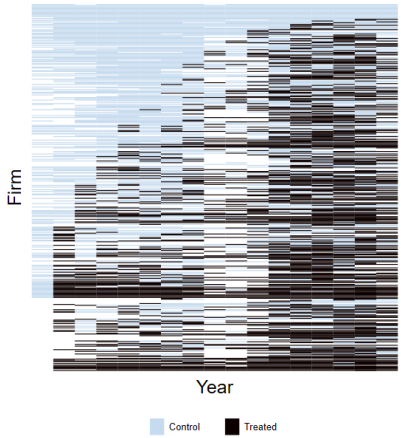
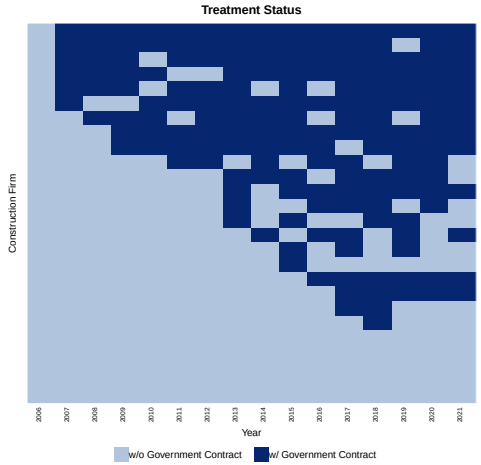
Appendix: Treatment Status and Data Structure, Full vs Balanced Panel





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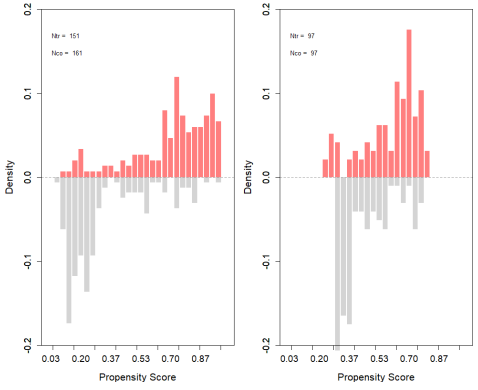
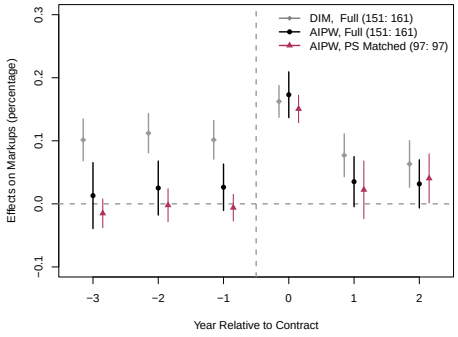
Appendix: Propensity Score 1:1 Matching, Selection Bias in Dynamic ATT for Unmatched Balanced Panel





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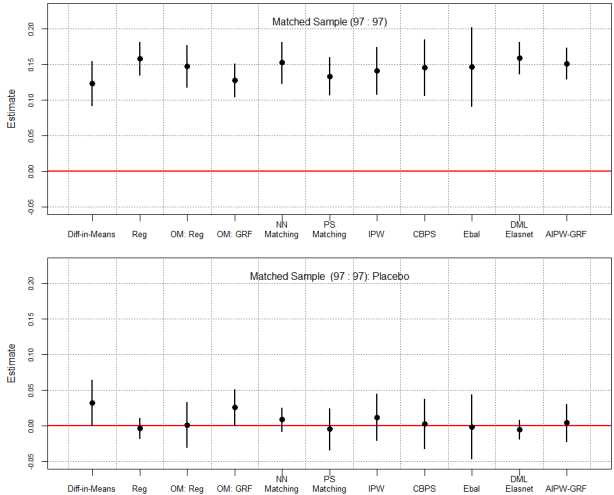
Appendix: Matched Sample Selection on Observables Results, Year of Contract ATT and Placebo Outcomes



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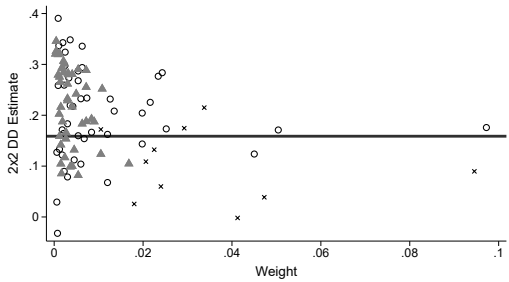
Appendix: Staggered Adoption TWFE Decomposition

- Goodman-Bacon decomposition of 2x2 DiD weights.
- Significant weight on "Later vs Earlier Treated" comparisons (circles), bias under heterogeneous treatment effects.

Goodman-Bacon Decomposition



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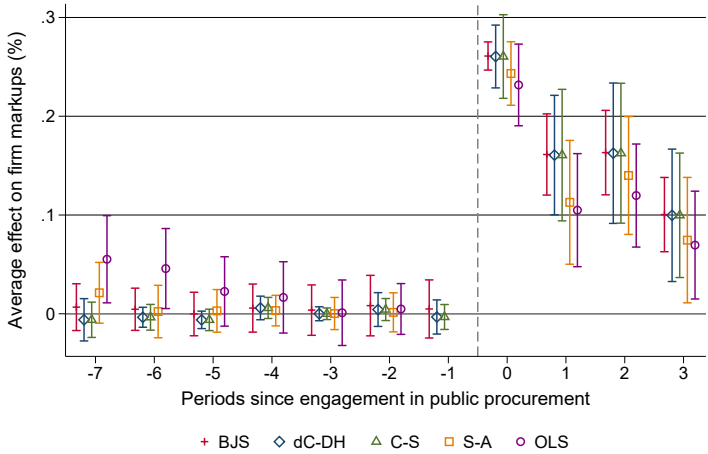
Appendix: Heterogeneity Robust Event Study Estimators



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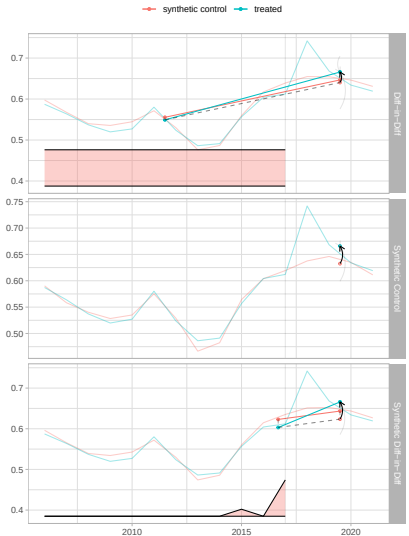
Appendix: Synthetic Diff-in-Diff SDID 2018 Cohort Visualization

SDID time weights (example):

- $\lambda_{2017} = 0.838$, $\lambda_{2015} = 0.162$
- Other years receive zero weight
- Data-driven selection of relevant periods



Back

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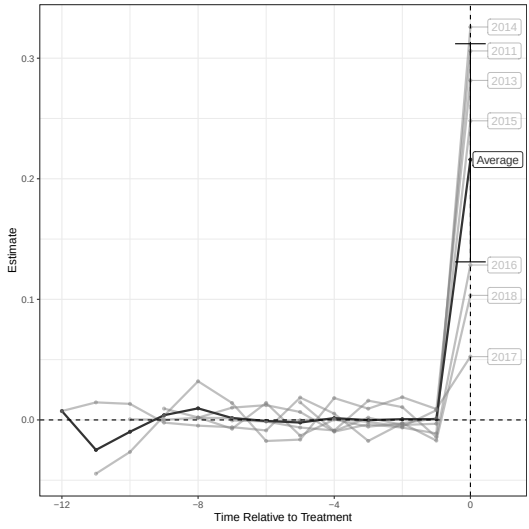
Appendix: Augmented Synthetic Control Year of Contract ATT



▸ Back

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Questions?

marek.chadim@yale.edu

Additional results and replication code available at:
github.com/marek-chadim/Markups-and-Public-Procurement

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