Markups and Public Procurement: Evidence from Czech Construction Tenders

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Czech Economic Society Young Economist Award

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  - 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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- This paper: **What is the causal effect of public procurement on firm markups?**

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To **identify causal effects**, we need

- Methods addressing **selection on observables and unobservables**
- Panel data tracking firms **before and after** procurement entry
- Understanding of **institutional context** and reform timing

This Paper: Novel Data and Methods

Firm enters public procurement → Selection → Pricing → Markups

What I do

- Construct **novel dataset** linking firm financials to procurement contracts
- Estimate **firm-specific markups** using production function approach (De Loecker & Warzynski 2012)
- Use **multiple identification strategies**: selection on observables, synthetic control, matrix completion

Three research questions

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

Q2. What is the causal effect of entering public procurement on markups?

Q3. Has the procurement markup premium changed over time?

What I Find

1. **On average, government contractors charge significantly higher markups**
    - **15% higher** on average in cross-section
      (Controls: variable input and capital +
      47 year–subindustry interaction dummies)
    - Markups increase by **12%** when firms enter public procurement
    - Results **validated** using complementary identification strategies

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   - From **30% in 2006** to **10% in 2021**
   - Decline coincides with **institutional reforms** (2012 single-bidding elimination)

3. **Results provide evidence of improving procurement efficiency**
   - Consistent with reduced **discretion and favoritism**
   - Suggests reforms targeting competition **have been effective**

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

Data Sources

1. **Firm Financial Statements** (MagnusWeb database)
   - 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

Estimating Markups: The DLW Approach

Standard definition: Markup is price relative to marginal cost

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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
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Implementation:

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

Production Function Specification

Translog production function:

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

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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. Model productivity evolution: $\omega_{it} = g_t(\omega_{it-1}, pp_{it-1}) + \xi_{it}$

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2. Model productivity evolution: $\omega_{it} = g_t(\omega_{it-1}, pp_{it-1}) + \xi_{it}$

Moment conditions:

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

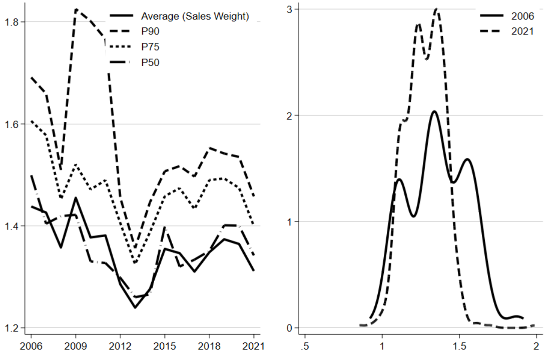
where $\mathbf{Z}_{it} = (v_{it-1}, k_{it}, v_{it-1}^2, k_{it}^2, v_{it-1} k_{it})$

Estimation Result: Aggregate Markups Have Declined

Average Markups:

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

$\Rightarrow$ Relevant for understanding **dynamics in public procurement effects.**



Identification Strategy 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:

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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

Selection on Observables: Results

ATT estimates converge around 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× as strong as Y_{-1}
- **Quantile effects**: Heterogeneity across distribution

Identification Strategy 2: Panel Data Methods

Address selection on unobservables using:

1. **Two-way fixed effects (Balanced Panel)**
   - Goodman-Bacon decomposition reveals potential bias ▸ Plot
   - HTE-robust estimators: Borusyak et al., Callaway-Sant'Anna, Sun-Abraham ▸ Plot
2. **Synthetic control methods, (Balanced Panel)**
   - SDID: Combines SC weights with unit/time fixed effects ▸ Plot
   - Augmented SC: Includes ridge regression adjustment ▸ Plot
   - Cohort-specific effects from 2011-2018 adoptions
3. **Matrix completion and factor models (Full Panel)**
   - IFEct: Interactive fixed effects (specify rank)
   - MC: Nuclear norm regularization (data-driven rank)
   - Test placebo periods and carryover effects

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 $p > 0.4$)

What Mechanisms Drive the Markup Premium?

Potential explanations:

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

Evidence on Reform Effectiveness

2012 Czech Procurement Reform (Titl 2023):

- Eliminated single-bid procedures
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This paper's contribution:

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- Premium fell from 25% (2010-2011) to 10% (2021)
- Complements price evidence with **market power measures**
- Suggests reforms **reduced rent extraction opportunities**

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

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

Summary

Main findings:

1. Entry into public procurement causally **increases markups by 15%**
2. The procurement premium has **declined dramatically**: 30% (2006) $\rightarrow$ 10% (2021)
3. Decline coincides with **institutional reforms** targeting competition

Summary

Main findings:

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3. Decline coincides with **institutional reforms** targeting competition

Contributions:

- **First credible evidence** linking public procurement to firm markups
- **Novel methodology** combining production function estimation with modern panel methods
- **Policy relevance**: Quantifies benefits of procurement reform
- **Benchmark** for assessing procurement competitiveness

Implications

For procurement policy:

- Reforms eliminating discretion can **significantly reduce rent extraction**
- Monitoring and transparency matter for **competitive outcomes**
- Market power effects complement **price-based evaluations**

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For markup-based impact evaluation:

- Selection on observables + unobservables provides **causal bounds**
- Framework applicable to other **demand-side interventions**

Limitations and Future Directions

Data limitations:

- Deflated sales as proxy for quantities $\rightarrow$ potential **omitted price bias**
- Cannot fully separate **cost vs. price effects** within firms
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- No exogenous variation (natural experiments, IV, RDD)
- SUTVA may be violated in **competitive procurement markets**

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Future research directions:

- Contract-level details (procedures, competition intensity)
- Operational data (hours, employee allocation)
- Dynamic game of procurement entry/exit to evaluate **counterfactual policies**

Why This Matters Beyond Czech Construction

Broader relevance:

1. **Public spending efficiency**
   - $10+ trillion globally in annual procurement
   - Even small markup reductions = **large fiscal savings**
2. **Market power and inequality**
   - Government as source of **firm market power**
   - Procurement premiums contribute to **profit concentration**
   - Implications for **labor share** of GDP
3. **Institutional quality**
   - Shows institutions can **constrain rent-seeking**
   - Quantifies benefits of **transparency and competition**
   - Relevant for developing countries, state capacity

Thank you!

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

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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3. Require positive sales, materials, capital
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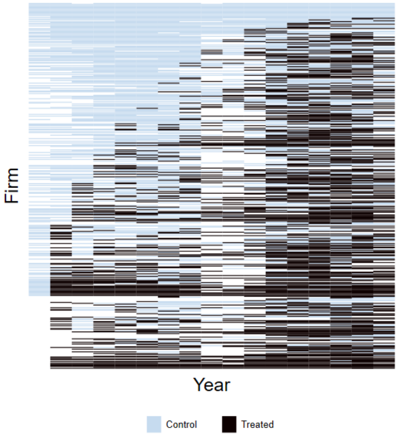
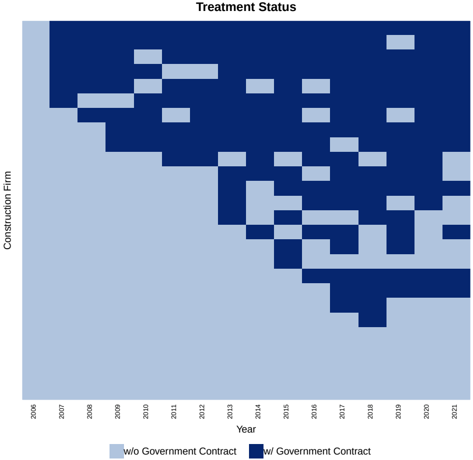
Final sample:

- 1,297 firms, 7,261 firm-year observations
- 44% of observations involve procurement contracts
- Balanced panel (26 firms) for selection-on-observables

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





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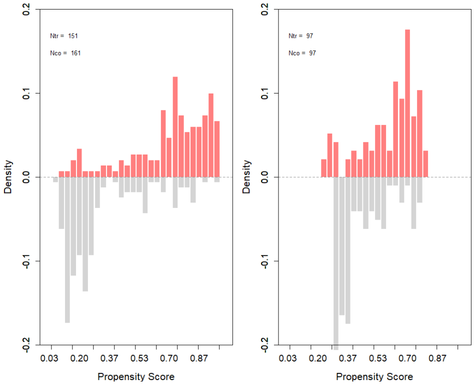
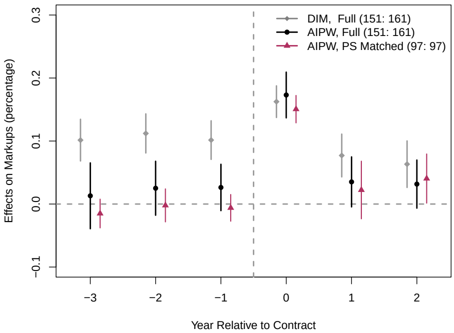
Appendix: Propensity Score 1:1 Matching, Selection Bias in Dynamic ATT for Unmatched Balanced Panel





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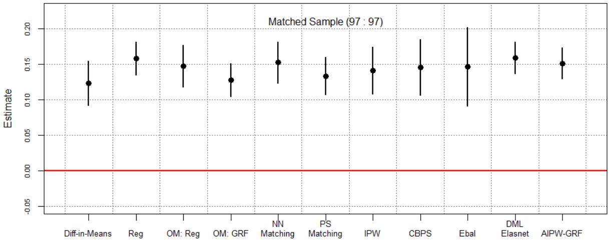
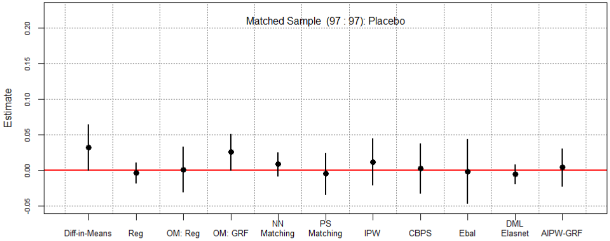
Appendix: Matched Sample Selection on Observables Results, Year of Contract ATT and Placebo Outcomes





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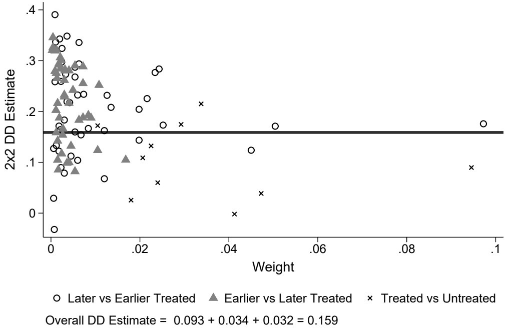
Appendix: Staggered Adoption TWFE Decomposition

- 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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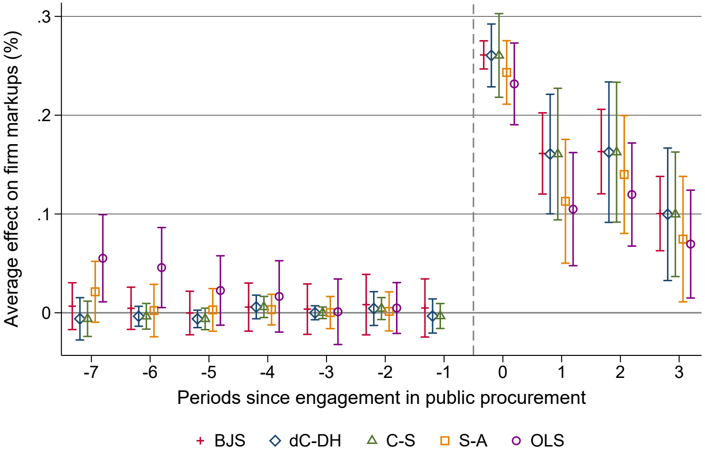
Appendix: Heterogeneity Robust Event Study Estimators



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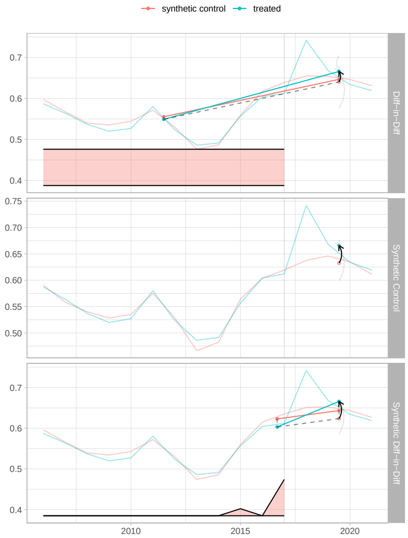
Appendix: Synthetic Diff-in-Diff SDID 2018 Cohort Visualization

SDID time weights (example):

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



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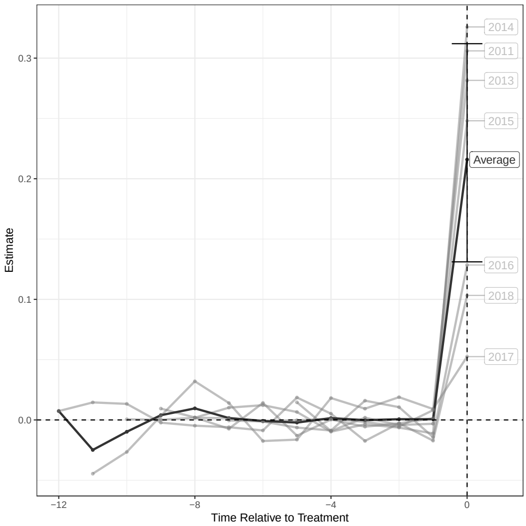
Appendix: Augmented Synthethic Control Year of Contract ATT



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Appendix: Comparison to Previous Literature

Study	Finding
Procurement efficiency:	
Titl (2023)	2012 reform reduced prices 6% (single-bidding)
Baránek & Titl (2024)	Political connections raise prices 6%
Szucs (2024)	Discretion increases prices, reduces productivity
This paper	**Procurement raises markups 15%, declining to 10%**
Markup trends:	
De Loecker et al. (2020)	US markups rose from 21% to 61% (1980-2016)
Hall (2018)	Corroborates US markup increase
This paper	**Czech construction markups fell 44% to 31%**

Novel contribution: First to link procurement to firm markups causally

Questions?

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Additional results and replication code available at:
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