# Percentage Delay Rate (with Time Independent Clean Control): QuickPay (2009-2012)

Mar 13, 2023

- Sample consists of a "time independent" clean control group
    - This means we keep all small projects.
    - We keep only those large projects that don't have a concurrent small project in *any* quarter.
- When we analyze congestion effect, we restrict to only one type of contractor. That is, contractors that hold only small project or only large project in the sample horizon.
- Number of offers received is also winsorized.

## 1 Setup

## 2 Demeaned delay rate (in percentage)

- Subtract the average pre-quickpay delay rate from each observation
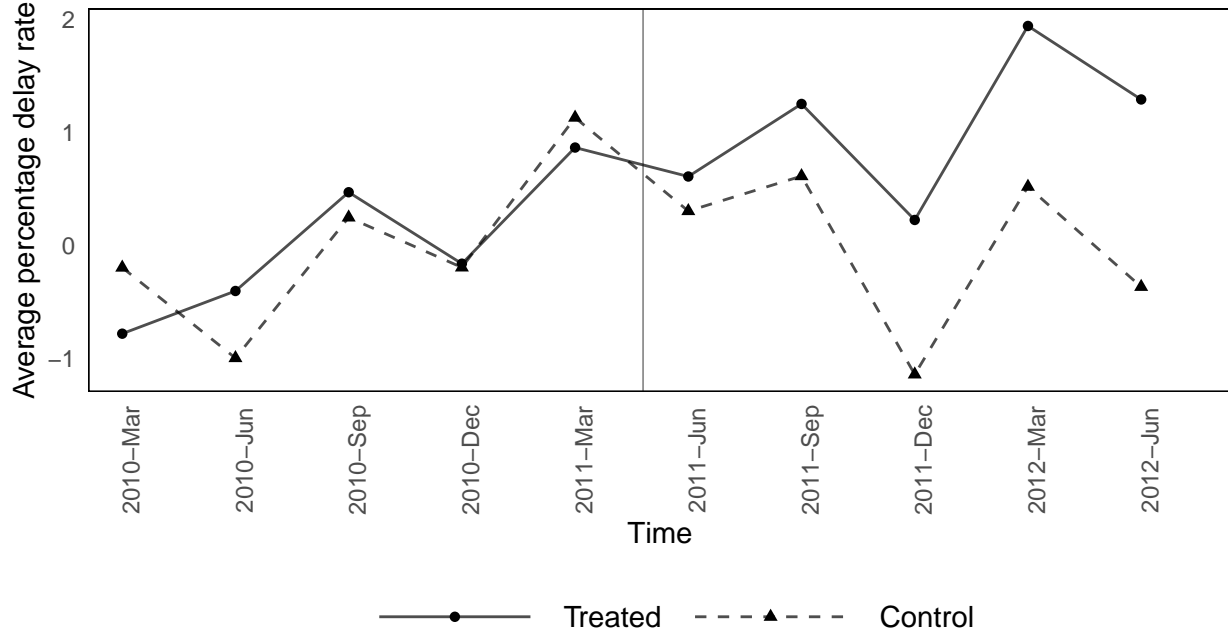


## 3 Summary statistics

## 4 Baseline Regressions

$$PercentDelay_{it} = \beta_0 + \beta_1 Treat_i + \beta_2 Post_t + \beta_3 (Treat_i \times Post_t) + e_{it}$$

| Variable | SB.Mean | SB.Std Dev | SB.5% | SB.95% | SB.Obs | LB.Mean | LB.Std Dev | LB.5% | LB.95% | LB.Obs |
|---|---|---|---|---|---|---|---|---|---|---|
| Percentage delay | 3.88 | 25.08 | 0.00 | 14.07 | 45944 | 5.69 | 30.93 | 0.00 | 33.59 | 35894 |
| Initial duration (in days) | 256.25 | 155.34 | 76.00 | 489.00 | 45944 | 282.14 | 163.94 | 80.00 | 568.00 | 35894 |
| Initial budget (000s) | 534.94 | 2338.67 | 3.31 | 2535.99 | 45944 | 1440.09 | 5164.52 | 3.71 | 7492.45 | 35894 |
| Number of offers | 4.58 | 6.59 | 1.00 | 15.00 | 45944 | 3.96 | 9.30 | 1.00 | 13.00 | 35894 |
| Project stage | 0.33 | 0.23 | 0.02 | 0.75 | 45944 | 0.34 | 0.24 | 0.02 | 0.75 | 35894 |
| Positive delay (indicator) | 0.06 | 0.24 | 0.00 | 1.00 | 45944 | 0.08 | 0.28 | 0.00 | 1.00 | 35894 |
| Negative delay (indicator) | 0.01 | 0.09 | 0.00 | 0.00 | 45944 | 0.01 | 0.09 | 0.00 | 0.00 | 35894 |
| Competitively awarded (indicator) | 0.87 | 0.33 | 0.00 | 1.00 | 45944 | 0.81 | 0.39 | 0.00 | 1.00 | 35894 |
| Contract financing (indicator) | 0.13 | 0.33 | 0.00 | 1.00 | 45944 | 0.14 | 0.34 | 0.00 | 1.00 | 35894 |

Table 1: Before QuickPay

| Variable | SB.Mean | SB.Std Dev | SB.5% | SB.95% | SB.Obs | LB.Mean | LB.Std Dev | LB.5% | LB.95% | LB.Obs |
|---|---|---|---|---|---|---|---|---|---|---|
| Percentage delay | 4.36 | 23.32 | 0.00 | 27.22 | 67523 | 4.54 | 24.02 | 0.00 | 29.59 | 60748 |
| Initial duration (in days) | 293.29 | 179.56 | 87.00 | 606.00 | 67523 | 337.92 | 199.09 | 90.00 | 733.00 | 60748 |
| Initial budget (000s) | 750.96 | 2911.52 | 3.51 | 3886.88 | 67523 | 1824.54 | 6141.86 | 3.72 | 10306.48 | 60748 |
| Number of offers | 4.62 | 5.60 | 1.00 | 15.00 | 67523 | 3.67 | 7.12 | 1.00 | 12.00 | 60748 |
| Project stage | 0.41 | 0.26 | 0.03 | 0.85 | 67523 | 0.43 | 0.26 | 0.03 | 0.85 | 60748 |
| Positive delay (indicator) | 0.09 | 0.28 | 0.00 | 1.00 | 67523 | 0.10 | 0.29 | 0.00 | 1.00 | 60748 |
| Negative delay (indicator) | 0.01 | 0.08 | 0.00 | 0.00 | 67523 | 0.01 | 0.10 | 0.00 | 0.00 | 60748 |
| Competitively awarded (indicator) | 0.87 | 0.34 | 0.00 | 1.00 | 67523 | 0.72 | 0.45 | 0.00 | 1.00 | 60748 |
| Contract financing (indicator) | 0.13 | 0.33 | 0.00 | 1.00 | 67523 | 0.14 | 0.35 | 0.00 | 1.00 | 60748 |

Table 2: After QuickPay

$$
\begin{aligned}
PercentDelay_{it} = \quad & \alpha + \beta_0 Treat_i + \beta_1 Post_t + \beta_2 (Treat_i \times Post_t) \\
+ \quad & X_i + (Post_t \times X_i) + \mu_t + \theta_{firm} + \lambda_{task} + \epsilon_{it}
\end{aligned}
$$

| var_name | SB.before | LB.before | SB.after | LB.after |
|---|---|---|---|---|
| Number of tasks | 786 | 707 | 947 | 900 |
| Number of industries | 64 | 65 | 62 | 64 |

Table 3: Effect of QuickPay on project delay rates

| | $PercentDelay_{it}$ | | | | |
|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) |
| $Treat_i$ | $-1.76^{***}$ | $-1.30^{***}$ | $-1.35^{***}$ | $-0.90^{***}$ | $-0.91^{***}$ |
| | (0.11) | (0.11) | (0.11) | (0.11) | (0.11) |
| | | | | | |
| $Post_t$ | $-0.21^{*}$ | $-5.57^{***}$ | | | |
| | (0.12) | (0.78) | | | |
| | | | | | |
| $Treat_i \times Post_t$ | $1.10^{***}$ | $0.97^{***}$ | $1.01^{***}$ | $0.99^{***}$ | $1.01^{***}$ |
| | (0.14) | (0.14) | (0.14) | (0.13) | (0.13) |
| | | | | | |
| Constant | $5.27^{***}$ | $43.19^{***}$ | | | |
| | (0.10) | (0.61) | | | |
| Duration, Budget, Bids | No | Yes | Yes | Yes | Yes |
| $Post_t \times$ (Duration, Budget, Bids) | No | Yes | Yes | Yes | Yes |
| Project stage | No | Yes | Yes | Yes | Yes |
| Time fixed effects | No | No | Yes | Yes | Yes |
| Task fixed effects | No | No | No | Yes | Yes |
| Industry fixed effects | No | No | No | No | Yes |
| Observations | 223,244 | 201,738 | 201,738 | 201,738 | 201,738 |
| $R^2$ | 0.002 | 0.17 | 0.18 | 0.21 | 0.21 |
| Adjusted $R^2$ | 0.002 | 0.17 | 0.18 | 0.21 | 0.21 |

*Note:* $^{*}$p<0.1; $^{**}$p<0.05; $^{***}$p<0.01
Each observation is a project-quarter.
SEs are robust and clustered at the project level.

# 5    Relative delay

Table 4: Effect of QuickPay on project delay rates

|  | $RelativeDelay_{it}$ | | | | |
|---|---|---|---|---|---|
|  | (1) | (2) | (3) | (4) | (5) |
| $Treat_i$ | −1.98*** | −1.73*** | −1.79*** | −1.17*** | −1.17*** |
|  | (0.16) | (0.14) | (0.14) | (0.14) | (0.14) |
|  |  |  |  |  |  |
| $Post_t$ | 0.09 | −4.20*** |  |  |  |
|  | (0.16) | (1.08) |  |  |  |
|  |  |  |  |  |  |
| $Treat_i \times Post_t$ | 1.65*** | 1.17*** | 1.23*** | 1.20*** | 1.23*** |
|  | (0.19) | (0.18) | (0.18) | (0.17) | (0.17) |
|  |  |  |  |  |  |
| Constant | 6.72*** | 56.90*** |  |  |  |
|  | (0.13) | (0.83) |  |  |  |
| Duration, Budget, Bids | No | Yes | Yes | Yes | Yes |
| $Post_t\times$ (Duration, Budget, Bids) | No | Yes | Yes | Yes | Yes |
| Project stage | No | Yes | Yes | Yes | Yes |
| Time fixed effects | No | No | Yes | Yes | Yes |
| Task fixed effects | No | No | No | Yes | Yes |
| Industry fixed effects | No | No | No | No | Yes |
| Observations | 200,855 | 200,789 | 200,789 | 200,789 | 200,789 |
| $R^2$ | 0.002 | 0.17 | 0.18 | 0.21 | 0.22 |
| Adjusted $R^2$ | 0.002 | 0.17 | 0.18 | 0.21 | 0.21 |

*Note:*                                          *p<0.1; **p<0.05; ***p<0.01
Each observation is a project-quarter.
SEs are robust and clustered at the project level.

# 6 Days of delay (One Quarter)

Table 5: Effect of QuickPay on project delay rates

|  | $DelayDays_{it}$ | | | | |
|---|---|---|---|---|---|
|  | (1) | (2) | (3) | (4) | (5) |
| $Treat_i$ | −3.44*** | −2.28*** | −2.38*** | −1.81*** | −1.84*** |
|  | (0.19) | (0.18) | (0.18) | (0.18) | (0.18) |
| $Post_t$ | 1.24*** | −5.79*** |  |  |  |
|  | (0.20) | (1.23) |  |  |  |
| $Treat_i \times Post_t$ | 1.51*** | 1.69*** | 1.78*** | 1.72*** | 1.74*** |
|  | (0.24) | (0.24) | (0.24) | (0.24) | (0.24) |
| Constant | 8.80*** | 53.07*** |  |  |  |
|  | (0.16) | (0.92) |  |  |  |
| Duration, Budget, Bids | No | Yes | Yes | Yes | Yes |
| $Post_t\times$ (Duration, Budget, Bids) | No | Yes | Yes | Yes | Yes |
| Project stage | No | Yes | Yes | Yes | Yes |
| Time fixed effects | No | No | Yes | Yes | Yes |
| Task fixed effects | No | No | No | Yes | Yes |
| Industry fixed effects | No | No | No | No | Yes |
| Observations | 223,373 | 201,867 | 201,867 | 201,867 | 201,867 |
| $R^2$ | 0.004 | 0.14 | 0.14 | 0.18 | 0.18 |
| Adjusted $R^2$ | 0.004 | 0.14 | 0.14 | 0.17 | 0.17 |

*Note:* *p<0.1; **p<0.05; ***p<0.01

Each observation is a project-quarter.

SEs are robust and clustered at the project level.

# 7 Days of delay (Two Quarters)

Table 6: Effect of QuickPay on project delay rates

|  | $DelayRate_{it}$ | | | | |
| --- | --- | --- | --- | --- | --- |
|  | (1) | (2) | (3) | (4) | (5) |
| $Treat_i$ | $-8.52^{***}$ | $-5.20^{***}$ | $-5.37^{***}$ | $-3.93^{***}$ | $-3.77^{***}$ |
|  | (0.52) | (0.53) | (0.53) | (0.55) | (0.55) |
| $Post_t$ | $4.43^{***}$ | $-18.77^{***}$ |  |  |  |
|  | (0.59) | (3.66) |  |  |  |
| $Treat_i \times Post_t$ | $3.17^{***}$ | $3.58^{***}$ | $3.75^{***}$ | $3.89^{***}$ | $3.87^{***}$ |
|  | (0.70) | (0.73) | (0.73) | (0.74) | (0.74) |
| Constant | $21.06^{***}$ | $116.48^{***}$ |  |  |  |
|  | (0.45) | (2.67) |  |  |  |
| Duration, Budget, Bids | No | Yes | Yes | Yes | Yes |
| $Post_t \times$ (Duration, Budget, Bids) | No | Yes | Yes | Yes | Yes |
| Project stage | No | Yes | Yes | Yes | Yes |
| Year-Quarter fixed effects | No | No | Yes | Yes | Yes |
| Task fixed effects | No | No | No | Yes | Yes |
| Industry fixed effects | No | No | No | No | Yes |
| Observations | 94,123 | 84,737 | 84,737 | 84,737 | 84,737 |
| $R^2$ | 0.01 | 0.17 | 0.17 | 0.22 | 0.22 |
| Adjusted $R^2$ | 0.01 | 0.17 | 0.17 | 0.20 | 0.21 |

*Note:* $^{*}$p<0.1; $^{**}$p<0.05; $^{***}$p<0.01

SEs are robust and clustered at the project level.

# 8 Positive delays: Logit

Table 7: Logit model: Effect of QuickPay

| Dependent Variable: | | | $I(Delay_{it} > 0)$ | | |
|---|---|---|---|---|---|
| Model: | (1) | (2) | (3) | (4) | (5) |
| *Variables* | | | | | |
| Constant | -1.99*** | 3.22*** | | | |
| | (0.02) | (0.13) | | | |
| $Treat_i$ | -0.44*** | -0.22*** | -0.24*** | -0.21*** | -0.23*** |
| | (0.03) | (0.03) | (0.03) | (0.03) | (0.03) |
| $Post_t$ | 0.10*** | -1.42*** | | | |
| | (0.02) | (0.15) | | | |
| $Treat_i \times Post_t$ | 0.21*** | 0.21*** | 0.23*** | 0.23*** | 0.23*** |
| | (0.03) | (0.04) | (0.04) | (0.04) | (0.04) |
| Controls | | Yes | Yes | Yes | Yes |
| Controls $\times Post_t$ | | Yes | Yes | Yes | Yes |
| *Fixed-effects* | | | | | |
| Time | | | Yes | Yes | Yes |
| Task code | | | | Yes | Yes |
| NAICS code | | | | | Yes |
| *Fit statistics* | | | | | |
| Observations | 223,373 | 201,867 | 201,867 | 199,508 | 199,470 |
| Squared Correlation | 0.003 | 0.24 | 0.24 | 0.28 | 0.28 |
| Pseudo $R^2$ | 0.005 | 0.24 | 0.24 | 0.30 | 0.30 |
| BIC | 152,027.7 | 112,255.0 | 112,164.9 | 113,713.7 | 113,928.5 |

*Clustered (Project ID) standard-errors in parentheses*
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

# 9 Positive delays: Conditional TE

Table 8: Conditional TE: Positive delay

| | $PercentDelay_{it}(conditional on positive)$ | | | | |
|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) |
| $Treat_i$ | −5.87 | −22.68*** | −22.85*** | −25.17*** | −25.24*** |
| | (5.42) | (4.28) | (4.28) | (4.59) | (4.64) |
| | | | | | |
| $Post_t$ | −51.73*** | −36.01* | | | |
| | (4.68) | (19.74) | | | |
| | | | | | |
| $Treat_i \times Post_t$ | 15.61** | 22.58*** | 22.77*** | 26.76*** | 28.25*** |
| | (6.20) | (4.98) | (4.99) | (5.03) | (5.03) |
| | | | | | |
| Constant | 160.76*** | 694.17*** | | | |
| | (4.08) | (15.55) | | | |
| | | | | | |
| Duration, Budget, Bids | No | Yes | Yes | Yes | Yes |
| $Post_t \times$ (Duration, Budget, Bids) | No | Yes | Yes | Yes | Yes |
| Project stage | No | Yes | Yes | Yes | Yes |
| Time fixed effects | No | No | Yes | Yes | Yes |
| Task fixed effects | No | No | No | Yes | Yes |
| Industry fixed effects | No | No | No | No | Yes |
| Observations | 24,084 | 24,045 | 24,045 | 24,045 | 24,045 |
| $R^2$ | 0.01 | 0.39 | 0.39 | 0.46 | 0.47 |
| Adjusted $R^2$ | 0.01 | 0.39 | 0.39 | 0.44 | 0.45 |

*Note:* *p<0.1; **p<0.05; ***p<0.01
Each observation is a project-quarter.
SEs are robust and clustered at the project level.

# 10 Negative delays: Logit

Table 9: Logit model: Effect of QuickPay

| Dependent Variable: | $I(Delay_{it} < 0)$ | | | | |
|---|---|---|---|---|---|
| Model: | (1) | (2) | (3) | (4) | (5) |
| *Variables* | | | | | |
| Constant | -4.61*** | -10.07*** | | | |
| | (0.06) | (0.44) | | | |
| $Treat_i$ | -0.29*** | 0.13 | 0.14* | 0.02 | 0.02 |
| | (0.08) | (0.09) | (0.09) | (0.09) | (0.09) |
| $Post_t$ | 0.07 | 1.50*** | | | |
| | (0.07) | (0.56) | | | |
| $Treat_i \times Post_t$ | -0.24** | -0.31*** | -0.32*** | -0.29*** | -0.29*** |
| | (0.10) | (0.11) | (0.11) | (0.10) | (0.10) |
| Controls | | Yes | Yes | Yes | Yes |
| Controls $\times Post_t$ | | Yes | Yes | Yes | Yes |
| *Fixed-effects* | | | | | |
| Time | | | Yes | Yes | Yes |
| Task code | | | | Yes | Yes |
| NAICS code | | | | | Yes |
| *Fit statistics* | | | | | |
| Observations | 223,373 | 201,867 | 201,867 | 177,464 | 176,917 |
| Squared Correlation | 0.0004 | 0.007 | 0.008 | 0.02 | 0.03 |
| Pseudo R$^2$ | 0.004 | 0.05 | 0.06 | 0.12 | 0.12 |
| BIC | 20,766.4 | 19,492.5 | 19,549.3 | 21,853.5 | 22,368.3 |

*Clustered (Project ID) standard-errors in parentheses*
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

# 11 Negative delays: Conditional TE

Table 10: Conditional TE: Negative delay (conditional on negative)

|  | $PercentDelay_{it}$ | | | | |
| --- | --- | --- | --- | --- | --- |
|  | (1) | (2) | (3) | (4) | (5) |
| $Treat_i$ | 3.72* | 2.28 | 2.27 | 0.74 | 1.06 |
|  | (2.15) | (1.98) | (2.00) | (2.43) | (2.47) |
| $Post_t$ | 8.13*** | −2.26 | | | |
|  | (2.01) | (9.66) | | | |
| $Treat_i \times Post_t$ | −8.74*** | −5.62** | −5.44** | −2.87 | −3.55 |
|  | (2.72) | (2.47) | (2.48) | (3.00) | (3.03) |
| Constant | −35.47*** | 7.39 | | | |
|  | (1.66) | (8.06) | | | |
| Duration, Budget, Bids | No | Yes | Yes | Yes | Yes |
| $Post_t \times$ (Duration, Budget, Bids) | No | Yes | Yes | Yes | Yes |
| Project stage | No | Yes | Yes | Yes | Yes |
| Time fixed effects | No | No | Yes | Yes | Yes |
| Task fixed effects | No | No | No | Yes | Yes |
| Industry fixed effects | No | No | No | No | Yes |
| Observations | 1,786 | 1,786 | 1,786 | 1,786 | 1,786 |
| $R^2$ | 0.01 | 0.22 | 0.23 | 0.39 | 0.43 |
| Adjusted $R^2$ | 0.01 | 0.22 | 0.22 | 0.24 | 0.27 |

*Note:* $^{*}$p<0.1; $^{**}$p<0.05; $^{***}$p<0.01
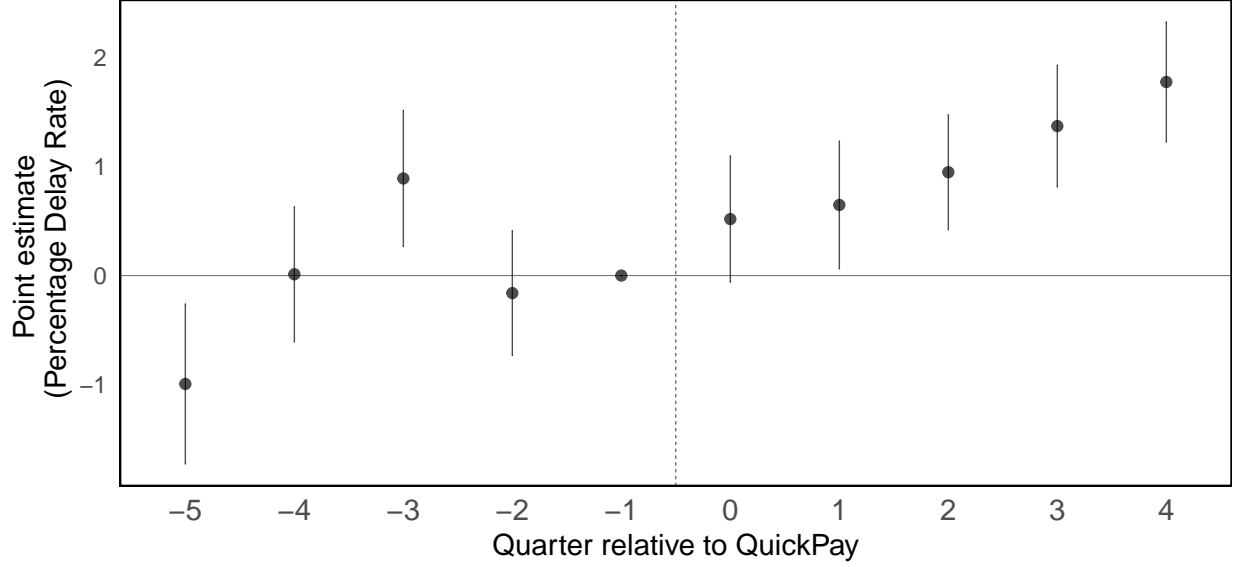
Each observation is a project-quarter.

SEs are robust and clustered at the project level.

# 12 Event study

$$PercentDelay_{it} = \beta_0 + \beta_1 Treat_i + \beta_2 Treat_i \times Quarter_t + Controls + \gamma_{task} + \theta_{naics} + \lambda_{quarter} + \epsilon_{it}$$

```
## Warning: Using `size` aesthetic for lines was deprecated in ggplot2 3.4.0.
## i Please use `linewidth` instead.
```

Point estimate (Percentage Delay Rate) vs. Quarter relative to QuickPay

# 13  Parallel Trends Test

Table 11: Linear Time Trend Before QuickPay

|  | $PercentDelay_{it}$ | | | | |
|---|---|---|---|---|---|
|  | (1) | (2) | (3) | (4) | (5) |
| $Treat_i$ | −1.37*** | −0.65 | −0.65 | −0.44 | −0.52 |
|  | (0.41) | (0.41) | (0.41) | (0.41) | (0.41) |
| $QuarterNum$ | 0.42*** | −1.16** |  |  |  |
|  | (0.08) | (0.50) |  |  |  |
| $Treat_i \times QuarterNum$ | −0.09 | −0.17* | −0.17* | −0.03 | −0.03 |
|  | (0.09) | (0.09) | (0.09) | (0.09) | (0.09) |
| Constant | 3.36*** | 48.76*** |  |  |  |
|  | (0.35) | (2.32) |  |  |  |
| Duration, Budget, Bids | No | Yes | Yes | Yes | Yes |
| $Post_t \times$ (Duration, Budget, Bids) | No | Yes | Yes | Yes | Yes |
| Project stage | No | Yes | Yes | Yes | Yes |
| Time fixed effects | No | No | Yes | Yes | Yes |
| Task fixed effects | No | No | No | Yes | Yes |
| Industry fixed effects | No | No | No | No | Yes |
| Observations | 84,367 | 77,984 | 77,984 | 77,984 | 77,984 |
| $R^2$ | 0.005 | 0.20 | 0.20 | 0.26 | 0.27 |
| Adjusted $R^2$ | 0.005 | 0.20 | 0.20 | 0.25 | 0.26 |

*Note:*                                                      *p<0.1; **p<0.05; ***p<0.01
Each observation is a project-quarter.
SEs are robust and clustered at the project level.
Observations are for quarters before quickpay.

# 14    Temporal Placebo Test

- Restrict to pre-QuickPay observations
- Assign "treatment date" as 2010-09-30

[1] 4

Table 12: Placebo test: Treatment Time 2010-09-30

| | $PercentDelay_{it}$ | | | | |
|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) |
| $Treat_i$ | −1.62*** | −1.56*** | −1.57*** | −0.80*** | −0.85*** |
| | (0.22) | (0.22) | (0.22) | (0.22) | (0.22) |
| | | | | | |
| $Post$ | 1.12*** | −5.03*** | | | |
| | (0.21) | (1.50) | | | |
| | | | | | |
| $Treat_i \times Post$ | −0.20 | 0.23 | 0.23 | 0.31 | 0.32 |
| | (0.25) | (0.25) | (0.25) | (0.25) | (0.25) |
| | | | | | |
| Constant | 4.45*** | 48.36*** | | | |
| | (0.19) | (1.30) | | | |
| | | | | | |
| Duration, Budget, Bids | No | Yes | Yes | Yes | Yes |
| $Post_t \times$ (Duration, Budget, Bids) | No | Yes | Yes | Yes | Yes |
| Project stage | No | Yes | Yes | Yes | Yes |
| Time fixed effects | No | No | Yes | Yes | Yes |
| Task fixed effects | No | No | No | Yes | Yes |
| Industry fixed effects | No | No | No | No | Yes |
| Observations | 84,367 | 77,984 | 77,984 | 77,984 | 77,984 |
| $R^2$ | 0.004 | 0.20 | 0.20 | 0.26 | 0.27 |
| Adjusted $R^2$ | 0.004 | 0.20 | 0.20 | 0.25 | 0.26 |

*Note:*      *p<0.1; **p<0.05; ***p<0.01
Each observation is a project-quarter.
SEs are robust and clustered at the project level.
Observations are for quarters before quickpay.

# 15    Cross-sectional placebo

- Projects are randomly assigned into treatment or control

Table 13: Effect of QuickPay on project delay rates

| | $PercentDelay_{it}$ | | | | |
|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) |
| $Treat_i$ | 0.03 | −0.02 | −0.01 | 0.01 | 0.004 |
| | (0.10) | (0.09) | (0.09) | (0.09) | (0.09) |
| | | | | | |
| $Post_t$ | 0.59*** | −4.34*** | | | |
| | (0.09) | (0.75) | | | |
| | | | | | |
| $Treat_i \times Post_t$ | −0.13 | −0.12 | −0.13 | −0.12 | −0.11 |
| | (0.13) | (0.12) | (0.12) | (0.11) | (0.11) |
| | | | | | |
| Constant | 4.10*** | 41.64*** | | | |
| | (0.07) | (0.58) | | | |
| | | | | | |
| Duration, Budget, Bids | No | Yes | Yes | Yes | Yes |
| $Post_t \times$ (Duration, Budget, Bids) | No | Yes | Yes | Yes | Yes |
| Project stage | No | Yes | Yes | Yes | Yes |
| Time fixed effects | No | No | Yes | Yes | Yes |
| Task fixed effects | No | No | No | Yes | Yes |
| Industry fixed effects | No | No | No | No | Yes |
| Observations | 223,244 | 201,738 | 201,738 | 201,738 | 201,738 |
| $R^2$ | 0.0003 | 0.17 | 0.17 | 0.21 | 0.21 |
| Adjusted $R^2$ | 0.0003 | 0.17 | 0.17 | 0.21 | 0.21 |

*Note:* *p<0.1; **p<0.05; ***p<0.01
Each observation is a project-quarter.
SEs are robust and clustered at the project level.

# 16 Congestion Effect

## 16.1 Number of projects per contractor
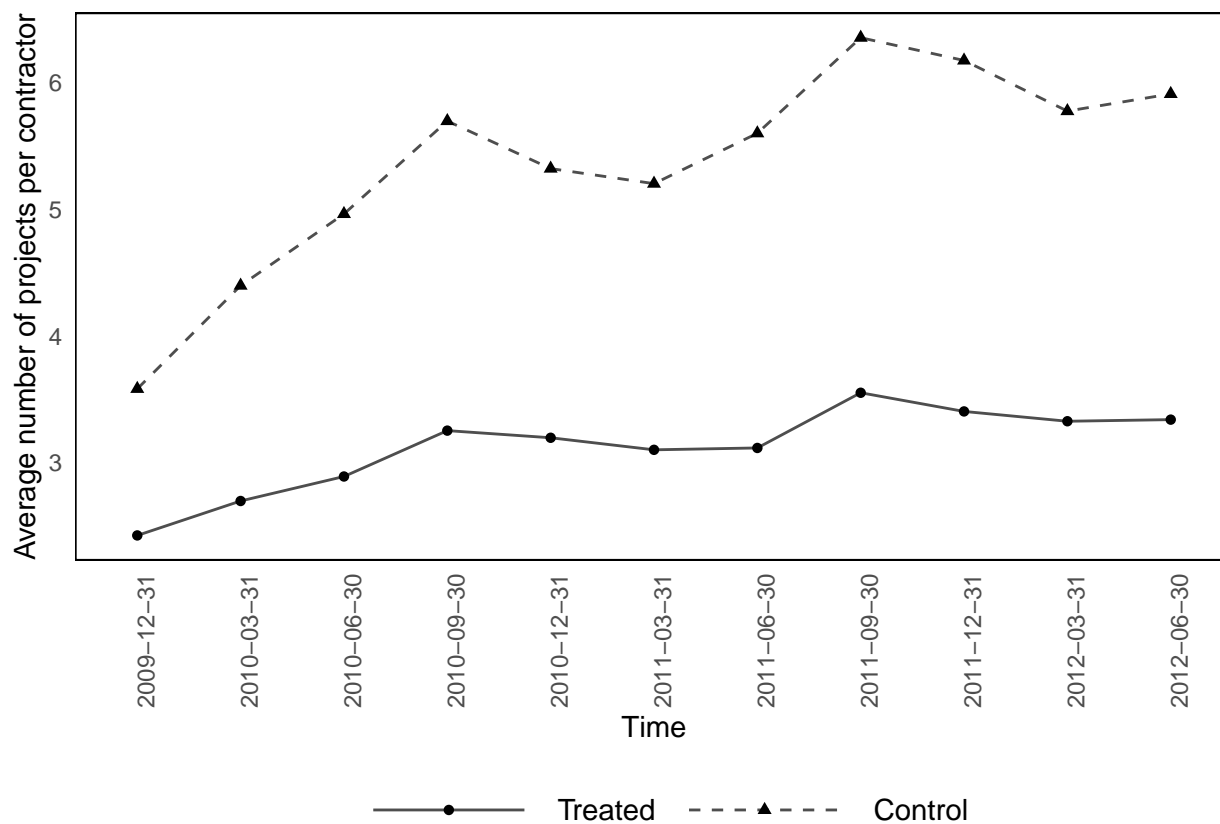
### 16.1.1 Contractors holding only small or only large projects



Table 14: Num Contractor Projects and QuickPay reform

|  | Number of projects | |
| --- | --- | --- |
|  | (1) | (2) |
| $Treat_i$ | −2.03*** | −2.03*** |
|  | (0.39) | (0.39) |
| $Post_t$ | 0.94** | |
|  | (0.41) | |
| $Treat_i \times Post_t$ | −0.58 | −0.58 |
|  | (0.41) | (0.41) |
| Constant | 5.03*** | |
|  | (0.38) | |
| Time fixed effects | No | Yes |
| Observations | 84,391 | 84,391 |
| $R^2$ | 0.005 | 0.01 |
| Adjusted $R^2$ | 0.005 | 0.01 |

| Note: | *p<0.1; **p<0.05; ***p<0.01 |
| --- | --- |
|  | Each observation is a contractor-quarter. |
|  | SEs are robust and clustered at the contractor level. |
|  | Sample restricted to contractors performing only one type of project. |

### 16.1.2   Contractors holding at least one small project are "treated"

## 16.2   Total budget

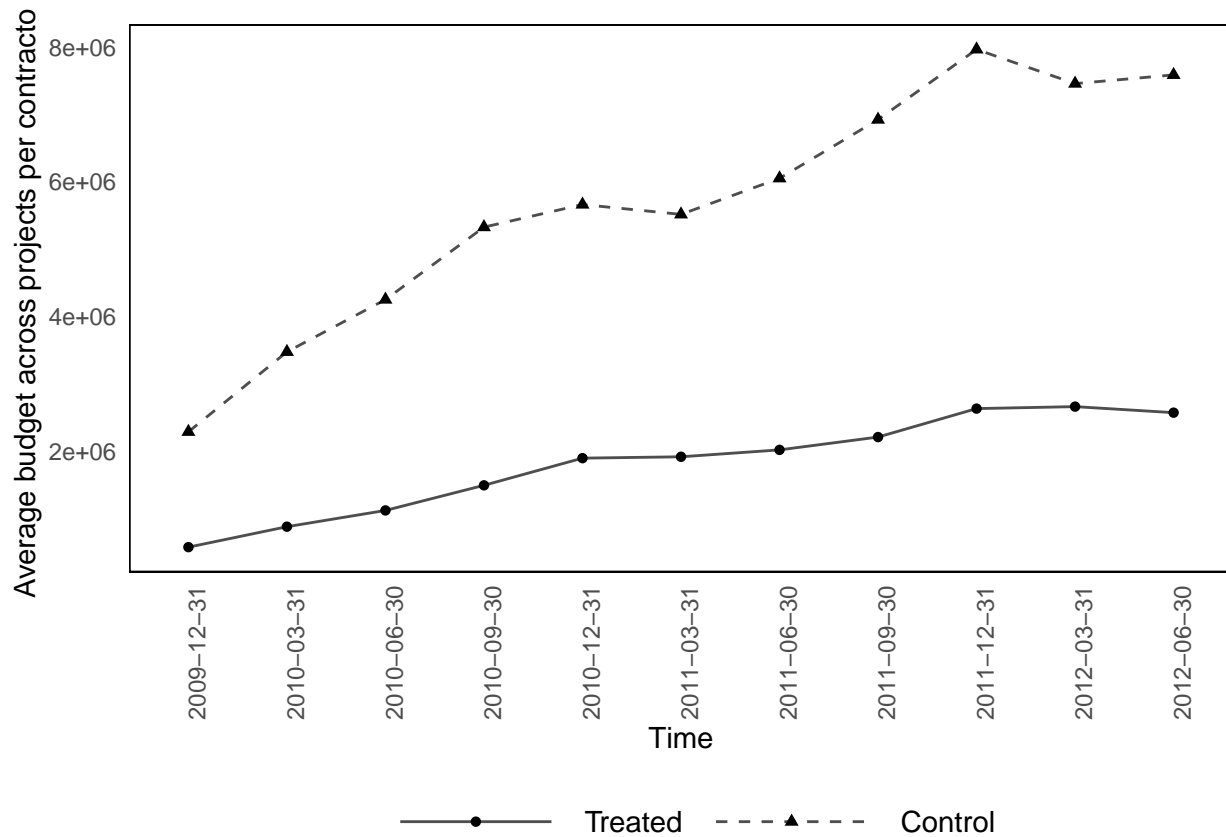### 16.2.1   Contractors holding only small or only large projects

Table 15: Contractor Project Budget and QuickPay reform

| | Total budget (000,000s) | |
|---|---|---|
| | (1) | (2) |
| $Treat_i$ | $-3.30^{***}$ | $-3.30^{***}$ |
| | (0.53) | (0.53) |
| | | |
| $Post_t$ | $2.46^{***}$ | |
| | (0.29) | |
| | | |
| $Treat_i \times Post_t$ | $-1.47^{***}$ | $-1.48^{***}$ |
| | (0.29) | (0.29) |
| | | |
| Constant | $4.73^{***}$ | |
| | (0.52) | |
| | | |
| Time fixed effects | No | Yes |
| Observations | 84,391 | 84,391 |
| $R^2$ | 0.02 | 0.02 |
| Adjusted $R^2$ | 0.02 | 0.02 |

| | |
|---|---|
| *Note:* | $^*$p<0.1; $^{**}$p<0.05; $^{***}$p<0.01 |
| | Each observation is a contractor-quarter. |
| | SEs are robust and clustered at the contractor level. |
| | Sample restricted to contractors performing only one type of project. |

## 16.3 Number of tasks

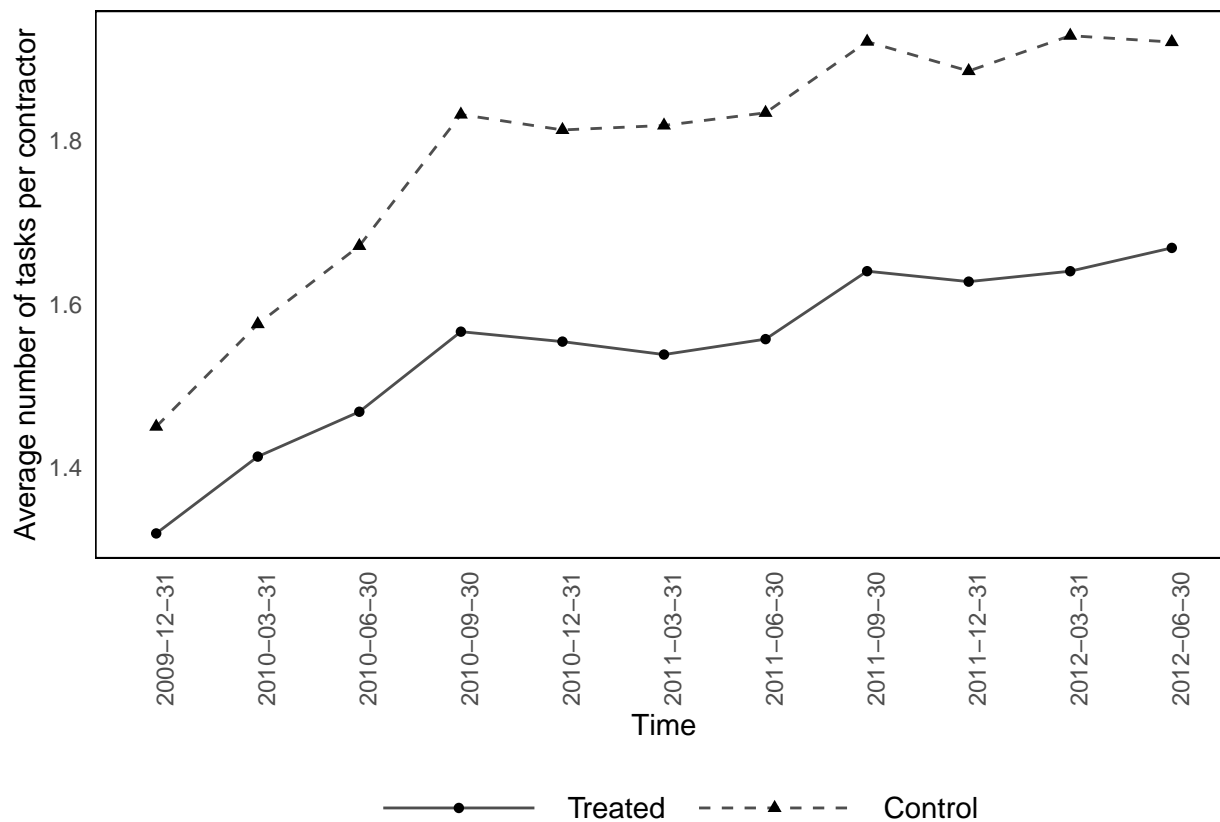### 16.3.1 Contractors holding only small or only large projects



Table 16: Contractor Project Tasks and QuickPay reform

|  | Number of tasks | |
| --- | --- | --- |
|  | (1) | (2) |
| $Treat_i$ | −0.23*** | −0.23*** |
|  | (0.04) | (0.04) |
| $Post_t$ | 0.17*** | |
|  | (0.02) | |
| $Treat_i \times Post_t$ | −0.04 | −0.04 |
|  | (0.03) | (0.03) |
| Constant | 1.73*** | |
|  | (0.04) | |
| Time fixed effects | No | Yes |
| Observations | 84,391 | 84,391 |
| $R^2$ | 0.01 | 0.01 |
| Adjusted $R^2$ | 0.01 | 0.01 |

| *Note:* | *p<0.1; **p<0.05; ***p<0.01 |
| --- | --- |
|  | Each observation is a contractor-quarter. |
|  | SEs are robust and clustered at the contractor level. |
|  | Sample restricted to contractors performing only one type of project. |

# 17 Project portfolio: Spillover effect

## 17.1 DID on large projects

- Parallel trends does not hold for this so not evaluating.
- Indirect Treat = 1 if Treat_i = 0 and number of small projects > 0
- Indirect_treat_intensity = Indirect Treat x log(1+number of small projects)
- Subset of large projects only

## 17.2 DID on small projects (Treatment Intensity)

Consider three groups based on contractor's portfolio:

- Group 1: Small projects (with concurrent large projects)
- Group 2: Only small projects
- Group 3: Only large projects

Define the following variables:

- Treat_Intensity_i = Treat_i x log(1 + number of small projects)
- Treat_Intensity_i (Small with large) = I(Contractor holds large projects) x Treat_i x log(1 + number of small projects)
- Treat_Intensity_Large_i = Treat_i x log(1 + number of large projects)

Table 17: Project Portfolio and QuickPay reform

| | $PercentDelay_{it}$ | | | | |
| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| $TreatIntensity_i$ (All Small) | $-0.22^{***}$ | $-0.27^{***}$ | $-0.29^{***}$ | $-0.22^{***}$ | $-0.23^{***}$ |
| | (0.03) | (0.03) | (0.03) | (0.03) | (0.03) |
| $TreatIntensity_i$ (Small with Large) | $-0.53^{***}$ | $-0.46^{***}$ | $-0.45^{***}$ | $-0.06^{**}$ | $-0.04$ |
| | (0.03) | (0.03) | (0.03) | (0.03) | (0.03) |
| $TreatIntensity_i$ (Large) | $0.25^{***}$ | $0.39^{***}$ | $0.40^{***}$ | $0.04$ | $0.03$ |
| | (0.06) | (0.05) | (0.05) | (0.05) | (0.05) |
| $Post_t$ | $0.08$ | $-5.34^{***}$ | | | |
| | (0.10) | (0.80) | | | |
| $TreatIntensity_i$ (Small with Large) $\times Post_t$ | $-0.19^{***}$ | $-0.17^{***}$ | $-0.18^{***}$ | $-0.13^{***}$ | $-0.14^{***}$ |
| | (0.04) | (0.04) | (0.04) | (0.04) | (0.04) |
| $TreatIntensity_i$ (All Small) $\times Post_t$ | $0.24^{***}$ | $0.26^{***}$ | $0.27^{***}$ | $0.26^{***}$ | $0.27^{***}$ |
| | (0.04) | (0.04) | (0.04) | (0.04) | (0.04) |
| $TreatIntensity_i$ (Large) $\times Post_t$ | $0.07$ | $0.07$ | $0.06$ | $-0.12^{*}$ | $-0.10$ |
| | (0.07) | (0.07) | (0.07) | (0.07) | (0.07) |
| Constant | $5.19^{***}$ | $44.60^{***}$ | | | |
| | (0.08) | (0.61) | | | |
| Duration, Budget, Bids | No | Yes | Yes | Yes | Yes |
| $Post_t \times$ (Duration, Budget, Bids) | No | Yes | Yes | Yes | Yes |
| Project stage | No | Yes | Yes | Yes | Yes |
| Time fixed effects | No | No | Yes | Yes | Yes |
| Task fixed effects | No | No | No | Yes | Yes |
| Industry fixed effects | No | No | No | No | Yes |
| Observations | 223,244 | 201,738 | 201,738 | 201,738 | 201,738 |
| R$^2$ | 0.01 | 0.18 | 0.18 | 0.21 | 0.21 |
| Adjusted R$^2$ | 0.01 | 0.18 | 0.18 | 0.21 | 0.21 |

*Note:* $^{*}$p<0.1; $^{**}$p<0.05; $^{***}$p<0.01
Each observation is a project-quarter.
SEs are robust and clustered at the project level.
Large projects whose contractor holds small projects are removed.

# 18 Project Stage

- $t$ indicates the end of the quarter
- We want to get stage of the project at the beginning of a given quarter (before any delays materialize)

$$Stage_{it} = \frac{ActionDate_{t-1} - StartDate_i}{Duration_{i,t-1}} \quad Stage_{it} = \frac{(t-1) - StartDate_i}{Duration_{i,t-1}}$$

## 18.1 Stage Quintile

## 18.2 Logged Stage Regressions

Table 18: Project Stage and QuickPay reform

| | $PercentDelay_{it}$ | | | | |
|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) |
| $Treat_i$ | −2.65*** | −1.65*** | −1.73*** | −1.34*** | −1.37*** |
| | (0.23) | (0.21) | (0.21) | (0.21) | (0.20) |
| Log(Stage) | 3.16*** | 2.51*** | 2.45*** | 2.53*** | 2.53*** |
| | (0.08) | (0.07) | (0.07) | (0.07) | (0.07) |
| $Post_t$ | −1.33*** | −5.06*** | | | |
| | (0.23) | (0.81) | | | |
| $Treat_i \times Post_t$ | 2.06*** | 1.74*** | 1.82*** | 1.85*** | 1.90*** |
| | (0.28) | (0.26) | (0.26) | (0.25) | (0.25) |
| $Treat_i \times$ Log(Stage) | −0.70*** | −0.20** | −0.23** | −0.27*** | −0.29*** |
| | (0.10) | (0.09) | (0.09) | (0.09) | (0.09) |
| $Post_t \times$ Log(Stage) | −0.06 | 0.48*** | 0.49*** | 0.23** | 0.22** |
| | (0.10) | (0.09) | (0.09) | (0.09) | (0.09) |
| $Treat_i \times Post_t \times$ Log(Stage) | 0.59*** | 0.54*** | 0.56*** | 0.62*** | 0.63*** |
| | (0.12) | (0.11) | (0.11) | (0.11) | (0.11) |
| Constant | 10.20*** | 43.10*** | | | |
| | (0.19) | (0.62) | | | |
| Duration, Budget, Bids | No | Yes | Yes | Yes | Yes |
| $Post_t \times$ (Duration, Budget, Bids) | No | Yes | Yes | Yes | Yes |
| Time fixed effects | No | No | Yes | Yes | Yes |
| Task fixed effects | No | No | No | Yes | Yes |
| Industry fixed effects | No | No | No | No | Yes |
| Observations | 223,213 | 201,738 | 201,738 | 201,738 | 201,738 |
| $R^2$ | 0.06 | 0.18 | 0.18 | 0.21 | 0.22 |
| Adjusted $R^2$ | 0.06 | 0.18 | 0.18 | 0.21 | 0.21 |

*Note:*       *p<0.1; **p<0.05; ***p<0.01
Each observation is a project-quarter.
SEs are robust and clustered at the project level.

# 19 Contract Financing (Projects active on/before June 2010)

- $CF = 1$ if project was receiving contract financing
- Sample restricted to projects that started on or before June 2010
- Jobs act was launched in Sept 2010
- Archived, no significant effect (even when we consider all projects)

# 20 Contract financing (All Projects & Contractor level)

- For a given contractor, Percentage projects receiving CF = (100 x Number of projects receiving CF)/(Number of projects)

Table 19: Contract Financing and QuickPay reform

| | $PercentDelay_{it}$ | | | | |
|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) |
| $Treat_i$ | −1.645*** | −1.328*** | −1.372*** | −0.966*** | −0.950*** |
| | (0.120) | (0.114) | (0.114) | (0.116) | (0.116) |
| $Post_t$ | −0.033 | −5.172*** | | | |
| | (0.125) | (0.787) | | | |
| Percentage projects receiving CF | 0.047*** | 0.042*** | 0.041*** | −0.003 | −0.004 |
| | (0.004) | (0.003) | (0.003) | (0.003) | (0.003) |
| $Treat_i \times Post_t$ | 0.812*** | 0.674*** | 0.704*** | 0.781*** | 0.817*** |
| | (0.148) | (0.146) | (0.146) | (0.144) | (0.144) |
| $Post_t \times$ Percentage projects receiving CF | −0.012*** | −0.023*** | −0.022*** | −0.009** | −0.009** |
| | (0.004) | (0.004) | (0.004) | (0.004) | (0.004) |
| $Treat_i \times$ Percentage projects receiving CF | 0.010* | 0.007* | 0.007* | 0.004 | 0.002 |
| | (0.005) | (0.004) | (0.004) | (0.004) | (0.004) |
| $Treat_i \times Post_t \times$ Percentage projects receiving CF | 0.018*** | 0.018*** | 0.018*** | 0.012** | 0.012** |
| | (0.006) | (0.005) | (0.005) | (0.005) | (0.005) |
| Constant | 4.491*** | 43.799*** | | | |
| | (0.104) | (0.606) | | | |
| Duration, Budget, Bids | No | Yes | Yes | Yes | Yes |
| $Post_t \times$ (Duration, Budget, Bids) | No | Yes | Yes | Yes | Yes |
| Project stage | No | Yes | Yes | Yes | Yes |
| Time fixed effects | No | No | Yes | Yes | Yes |
| Task fixed effects | No | No | No | Yes | Yes |
| Industry fixed effects | No | No | No | No | Yes |
| Observations | 223,244 | 201,738 | 201,738 | 201,738 | 201,738 |
| $R^2$ | 0.010 | 0.178 | 0.179 | 0.213 | 0.215 |
| Adjusted $R^2$ | 0.010 | 0.178 | 0.179 | 0.208 | 0.209 |

*Note:*                                                           *p<0.1; **p<0.05; ***p<0.01
Each observation is a project-quarter.
SEs are robust and clustered at the project level.

# 21    Competition

## 21.1 Impact on bidding metrics [All projects]

Table 20: Effect of Competition After QuickPay: Quickpay 2009-2011

|  | $NumberOfBids_{it}$ | $InitialDuration_{it}$ | $InitialBudget_{it}$ |
|---|---|---|---|
|  | (1) | (2) | (3) |
| $Treat_i$ | 1.08*** | $-7.27$*** | $-15,055.20$*** |
|  | (0.02) | (0.72) | (1,586.13) |
| $Treat_i \times Post_t$ | 0.09*** | $-3.38$*** | $-29,491.30$*** |
|  | (0.03) | (1.00) | (2,296.49) |
| Task fixed effects | Yes | Yes | Yes |
| Time fixed effects | Yes | Yes | Yes |
| Observations | 227,609 | 220,550 | 227,732 |
| $R^2$ | 0.20 | 0.20 | 0.24 |
| Adjusted $R^2$ | 0.19 | 0.19 | 0.24 |

*Note:*       *p<0.1; **p<0.05; ***p<0.01
Each observation is a project-quarter.
SEs are robust and clustered at the project level.
Sample restricted to fully competed projects.

## 21.2 Impact on delays

### 21.2.1 Subsample model II

Define

$$SA_i = \begin{cases} 1, & \text{if project was signed after QuickPay} \\ 0, & \text{otherwise} \end{cases}$$

$$SB_i = \begin{cases} 1, & \text{if project was signed before QuickPay} \\ 0, & \text{otherwise} \end{cases}$$

Table 21: Effect of QuickPay on competitively awarded projects

|  | $PercentDelay_{it}$ | | | | |
|---|---|---|---|---|---|
|  | (1) | (2) | (3) | (4) | (5) |
| $Treat_i$ | $-2.26^{***}$ | $-1.93^{***}$ | $-1.94^{***}$ | $-0.50^{***}$ | $-0.51^{***}$ |
|  | (0.13) | (0.12) | (0.12) | (0.12) | (0.12) |
| $SA_i$ | $-1.90^{***}$ | $0.87^{***}$ | $1.45^{***}$ | $1.52^{***}$ | $1.48^{***}$ |
|  | (0.17) | (0.16) | (0.18) | (0.18) | (0.18) |
| $Post_t$ | $1.18^{***}$ | $-1.16^{***}$ |  |  |  |
|  | (0.16) | (0.16) |  |  |  |
| $Treat_i \times Post_t$ | 0.23 | 0.28 | $0.30^{*}$ | 0.16 | 0.16 |
|  | (0.19) | (0.18) | (0.18) | (0.17) | (0.17) |
| $Treat_i \times Post_t \times SA_i$ | $0.98^{***}$ | $0.60^{***}$ | $0.58^{***}$ | $0.76^{***}$ | $0.76^{***}$ |
|  | (0.20) | (0.19) | (0.19) | (0.19) | (0.19) |
| Constant | $5.48^{***}$ | $10.06^{***}$ |  |  |  |
|  | (0.11) | (0.13) |  |  |  |
| Project stage | No | Yes | Yes | Yes | Yes |
| Time fixed effects | No | No | Yes | Yes | Yes |
| Task fixed effects | No | No | No | Yes | Yes |
| Industry fixed effects | No | No | No | No | Yes |
| Observations | 184,911 | 184,885 | 184,885 | 184,885 | 184,885 |
| $R^2$ | 0.01 | 0.06 | 0.06 | 0.12 | 0.13 |
| Adjusted $R^2$ | 0.01 | 0.06 | 0.06 | 0.12 | 0.12 |

*Note:* $^{*}$p<0.1; $^{**}$p<0.05; $^{***}$p<0.01
Each observation is a project-quarter.
SEs are robust and clustered at the project level.
Sample restricted to fully competed projects.

Table 22: Effect of QuickPay on non-competitively awarded projects

| | $PercentDelay_{it}$ | | | | |
| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| $Treat_i$ | 1.16*** | 0.96*** | 0.89*** | −0.17 | −0.11 |
| | (0.28) | (0.27) | (0.27) | (0.29) | (0.28) |
| $SA_i$ | −0.61*** | 1.94*** | 3.19*** | 2.82*** | 2.74*** |
| | (0.22) | (0.22) | (0.26) | (0.26) | (0.26) |
| $Post_t$ | −0.79*** | −3.11*** | | | |
| | (0.24) | (0.25) | | | |
| $Treat_i \times Post_t$ | 2.69*** | 2.44*** | 2.34*** | 1.85*** | 1.76*** |
| | (0.40) | (0.38) | (0.39) | (0.38) | (0.39) |
| $Treat_i \times Post_t \times SA_i$ | −1.89*** | −1.67*** | −1.63*** | −1.87*** | −1.75*** |
| | (0.39) | (0.37) | (0.37) | (0.37) | (0.37) |
| Constant | 4.40*** | 9.65*** | | | |
| | (0.20) | (0.25) | | | |
| Project stage | No | Yes | Yes | Yes | Yes |
| Time fixed effects | No | No | Yes | Yes | Yes |
| Task fixed effects | No | No | No | Yes | Yes |
| Industry fixed effects | No | No | No | No | Yes |
| Observations | 38,175 | 38,170 | 38,170 | 38,170 | 38,170 |
| $R^2$ | 0.01 | 0.06 | 0.07 | 0.15 | 0.15 |
| Adjusted $R^2$ | 0.01 | 0.06 | 0.07 | 0.13 | 0.13 |

*Note:* *p<0.1; **p<0.05; ***p<0.01
Each observation is a project-quarter.
SEs are robust and clustered at the project level.
Sample restricted to non-competed projects.

### 21.2.2 Four-way interaction

We run the following model:

$$
\begin{aligned}
PercentDelay_{it} = \quad & \beta_0 + \beta_1 Treat_i + \beta_2 StartedAfterQP_i + \beta_3 Post_t + \beta_4 Competitive_i \\
& + \beta_5(Treat_i \times Competitive_i) + \beta_6(Post_t \times Competitive_i) \\
& + \beta_7(StartedAfterQP_i \times Competitive_i) + \beta_8(Treat_i \times Post_t) \\
& + \beta_9(Treat_i \times Post_t \times Competitive_i) \\
& + \beta_{10}(Treat_i \times Post_t \times StartedAfterQP_i) \\
& + \beta_{11}(Treat_i \times Post_t \times StartedAfterQP_i \times Competitive_i) + e_{it}
\end{aligned}
$$

**Interpretation:**

- $\beta_9$ is the difference between treatment effect for competitive and non-competitive projects signed before quickpay.
- $\beta_9 + \beta_{11}$ is the difference between treatment effect for competitive and non-competitive projects signed *after* quickpay.
- $\beta_{11}$ is our coefficient of interest because it tells us how much of the difference is there due to "aggressive bidding" after the policy.

Table 23: Effect of Competition After QuickPay: Quickpay 2009-2011

| | $PercentDelay_{it}$ | | | | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| $Treat_i$ | 1.16*** | 1.16*** | 0.97*** | 0.92*** | −0.26 | −0.28 |
| | (0.28) | (0.28) | (0.27) | (0.27) | (0.27) | (0.27) |
| $SA_i$ | −0.61*** | −0.61*** | 1.79*** | 2.50*** | 2.32*** | 2.26*** |
| | (0.22) | (0.22) | (0.21) | (0.22) | (0.21) | (0.21) |
| $Competitive_i$ | 1.08*** | 1.08*** | 0.79*** | 0.77*** | −0.74*** | −0.69*** |
| | (0.23) | (0.23) | (0.22) | (0.22) | (0.23) | (0.23) |
| $Post_t$ | −0.79*** | −0.79*** | −2.97*** | | | |
| | (0.24) | (0.24) | (0.24) | | | |
| $Treat_i \times Competitive_i$ | −3.42*** | −3.42*** | −2.90*** | −2.85*** | −0.27 | −0.25 |
| | (0.31) | (0.31) | (0.29) | (0.29) | (0.30) | (0.30) |
| $Post_t \times Competitive_i$ | 1.97*** | 1.97*** | 1.78*** | 1.74*** | 0.73*** | 0.64** |
| | (0.29) | (0.29) | (0.28) | (0.28) | (0.28) | (0.28) |
| $SA_i \times Competitive_i$ | −1.29*** | −1.29*** | −0.88*** | −0.89*** | −0.72*** | −0.71*** |
| | (0.28) | (0.28) | (0.26) | (0.26) | (0.26) | (0.26) |
| $Treat_i \times Post_t$ | 2.69*** | 2.69*** | 2.45*** | 2.42*** | 1.66*** | 1.59*** |
| | (0.40) | (0.40) | (0.38) | (0.38) | (0.38) | (0.38) |
| $Treat_i \times Post_t \times Competitive_i$ | −2.45*** | −2.45*** | −2.17*** | −2.13*** | −1.48*** | −1.41*** |
| | (0.44) | (0.44) | (0.42) | (0.42) | (0.42) | (0.42) |
| $Treat_i \times Post_t \times SA_i$ | −1.89*** | −1.89*** | −1.68*** | −1.68*** | −1.44*** | −1.44*** |
| | (0.39) | (0.39) | (0.37) | (0.37) | (0.36) | (0.36) |
| $Treat_i \times Post_t \times SA_i \times Competitive_i$ | 2.87*** | 2.87*** | 2.28*** | 2.25*** | 2.19*** | 2.21*** |
| | (0.44) | (0.44) | (0.42) | (0.42) | (0.41) | (0.41) |
| Constant | 4.40*** | 4.40*** | 9.33*** | | | |
| | (0.20) | (0.20) | (0.20) | | | |
| Project stage | No | No | Yes | Yes | Yes | Yes |
| Time fixed effects | No | No | No | Yes | Yes | Yes |
| Task fixed effects | No | No | No | No | Yes | Yes |
| Industry fixed effects | No | No | No | No | No | Yes |
| Observations | 223,086 | 223,086 | 223,055 | 223,055 | 223,055 | 223,055 |
| $R^2$ | 0.01 | 0.01 | 0.06 | 0.06 | 0.12 | 0.12 |
| Adjusted $R^2$ | 0.01 | 0.01 | 0.06 | 0.06 | 0.11 | 0.12 |

*Note:*                                                   *p<0.1; **p<0.05; ***p<0.01
Each observation is a project-quarter.
SEs are robust and clustered at the project level.