

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

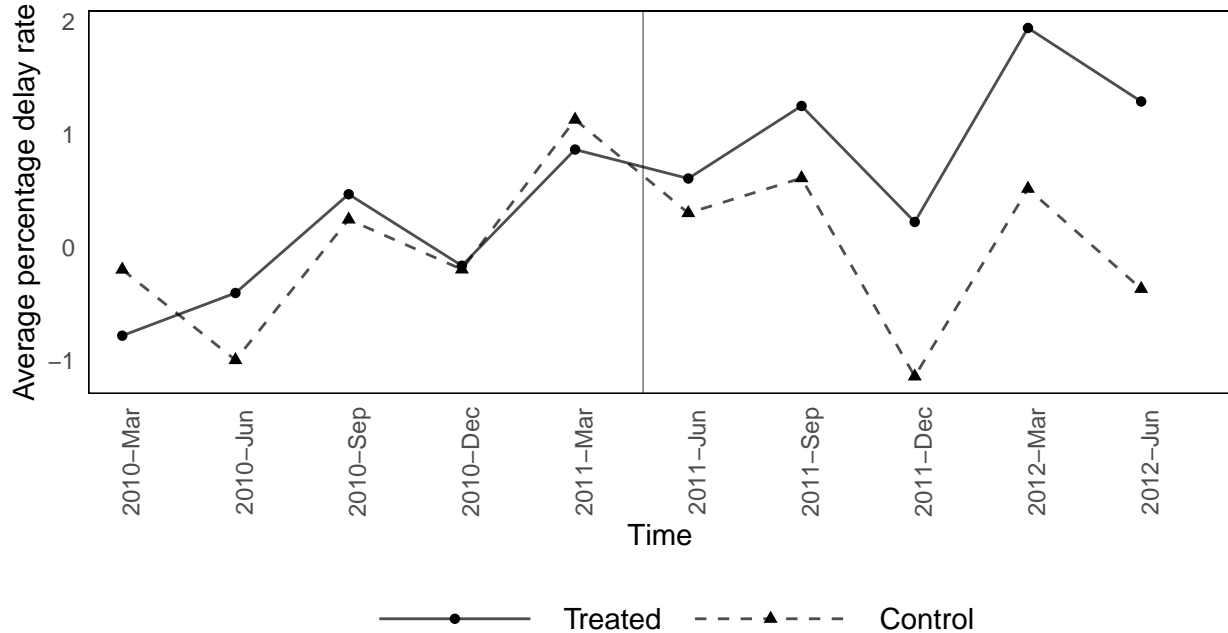
Mar 18, 2023

- 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

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

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

	<i>PercentDelay<sub>it</sub></i>				
	(1)	(2)	(3)	(4)	(5)
<i>Treat<sub>i</sub></i>	-1.76*** (0.11)	-1.30*** (0.11)	-1.35*** (0.11)	-0.90*** (0.11)	-0.91*** (0.11)
<i>Post<sub>t</sub></i>	-0.21* (0.12)	-5.57*** (0.78)			
<i>Treat<sub>i</sub> × Post<sub>t</sub></i>	1.10*** (0.14)	0.97*** (0.14)	1.01*** (0.14)	0.99*** (0.13)	1.01*** (0.13)
Constant	5.27*** (0.10)	43.19*** (0.61)			
Duration, Budget, Bids	No	Yes	Yes	Yes	Yes
<i>Post<sub>t</sub></i> × (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 <sup>2</sup>	0.002	0.17	0.18	0.21	0.21
Adjusted R <sup>2</sup>	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

	<i>RelativeDelay<sub>it</sub></i>				
	(1)	(2)	(3)	(4)	(5)
<i>Treat<sub>i</sub></i>	-1.98*** (0.16)	-1.73*** (0.14)	-1.79*** (0.14)	-1.17*** (0.14)	-1.17*** (0.14)
<i>Post<sub>t</sub></i>	0.09 (0.16)	-4.20*** (1.08)			
<i>Treat<sub>i</sub> × Post<sub>t</sub></i>	1.65*** (0.19)	1.17*** (0.18)	1.23*** (0.18)	1.20*** (0.17)	1.23*** (0.17)
Constant	6.72*** (0.13)	56.90*** (0.83)			
Duration, Budget, Bids	No	Yes	Yes	Yes	Yes
<i>Post<sub>t</sub> × (Duration, Budget, Bids)</i>	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 <sup>2</sup>	0.002	0.17	0.18	0.21	0.22
Adjusted R <sup>2</sup>	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

	<i>DelayDays<sub>it</sub></i>				
	(1)	(2)	(3)	(4)	(5)
<i>Treat<sub>i</sub></i>	-3.44*** (0.19)	-2.28*** (0.18)	-2.38*** (0.18)	-1.81*** (0.18)	-1.84*** (0.18)
<i>Post<sub>t</sub></i>	1.24*** (0.20)	-5.79*** (1.23)			
<i>Treat<sub>i</sub> × Post<sub>t</sub></i>	1.51*** (0.24)	1.69*** (0.24)	1.78*** (0.24)	1.72*** (0.24)	1.74*** (0.24)
Constant	8.80*** (0.16)	53.07*** (0.92)			
Duration, Budget, Bids	No	Yes	Yes	Yes	Yes
<i>Post<sub>t</sub></i> × (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 <sup>2</sup>	0.004	0.14	0.14	0.18	0.18
Adjusted R <sup>2</sup>	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

	<i>DelayRate<sub>it</sub></i>				
	(1)	(2)	(3)	(4)	(5)
<i>Treat<sub>i</sub></i>	-8.52*** (0.52)	-5.20*** (0.53)	-5.37*** (0.53)	-3.93*** (0.55)	-3.77*** (0.55)
<i>Post<sub>t</sub></i>	4.43*** (0.59)	-18.77*** (3.66)			
<i>Treat<sub>i</sub> × Post<sub>t</sub></i>	3.17*** (0.70)	3.58*** (0.73)	3.75*** (0.73)	3.89*** (0.74)	3.87*** (0.74)
Constant	21.06*** (0.45)	116.48*** (2.67)			
Duration, Budget, Bids	No	Yes	Yes	Yes	Yes
<i>Post<sub>t</sub> × (Duration, Budget, Bids)</i>	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 <sup>2</sup>	0.01	0.17	0.17	0.22	0.22
Adjusted R <sup>2</sup>	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)
<i>Variables</i>					
Constant	-1.99*** (0.02)	3.22*** (0.13)			
$Treat_i$	-0.44*** (0.03)	-0.22*** (0.03)	-0.24*** (0.03)	-0.21*** (0.03)	-0.23*** (0.03)
$Post_t$	0.10*** (0.02)	-1.42*** (0.15)			
$Treat_i \times Post_t$	0.21*** (0.03)	0.21*** (0.04)	0.23*** (0.04)	0.23*** (0.04)	0.23*** (0.04)
Controls		Yes	Yes	Yes	Yes
Controls $\times Post_t$		Yes	Yes	Yes	Yes
<i>Fixed-effects</i>					
Time			Yes	Yes	Yes
Task code				Yes	Yes
NAICS code					Yes
<i>Fit statistics</i>					
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

	<i>PercentDelay<sub>it</sub>(conditional on positive)</i>				
	(1)	(2)	(3)	(4)	(5)
<i>Treat<sub>i</sub></i>	-5.87 (5.42)	-22.68*** (4.28)	-22.85*** (4.28)	-25.17*** (4.59)	-25.24*** (4.64)
<i>Post<sub>t</sub></i>	-51.73*** (4.68)	-36.01* (19.74)			
<i>Treat<sub>i</sub> × Post<sub>t</sub></i>	15.61** (6.20)	22.58*** (4.98)	22.77*** (4.99)	26.76*** (5.03)	28.25*** (5.03)
Constant	160.76*** (4.08)	694.17*** (15.55)			
Duration, Budget, Bids	No	Yes	Yes	Yes	Yes
<i>Post<sub>t</sub> × (Duration, Budget, Bids)</i>	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 <sup>2</sup>	0.01	0.39	0.39	0.46	0.47
Adjusted R <sup>2</sup>	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)
<i>Variables</i>					
Constant	-4.61*** (0.06)	-10.07*** (0.44)			
$Treat_i$	-0.29*** (0.08)	0.13 (0.09)	0.14* (0.09)	0.02 (0.09)	0.02 (0.09)
$Post_t$	0.07 (0.07)	1.50*** (0.56)			
$Treat_i \times Post_t$	-0.24** (0.10)	-0.31*** (0.11)	-0.32*** (0.11)	-0.29*** (0.10)	-0.29*** (0.10)
Controls		Yes	Yes	Yes	Yes
Controls $\times Post_t$		Yes	Yes	Yes	Yes
<i>Fixed-effects</i>					
Time			Yes	Yes	Yes
Task code				Yes	Yes
NAICS code					Yes
<i>Fit statistics</i>					
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 <sup>2</sup>	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)

	<i>PercentDelay<sub>it</sub></i>				
	(1)	(2)	(3)	(4)	(5)
<i>Treat<sub>i</sub></i>	3.72* (2.15)	2.28 (1.98)	2.27 (2.00)	0.74 (2.43)	1.06 (2.47)
<i>Post<sub>t</sub></i>	8.13*** (2.01)	-2.26 (9.66)			
<i>Treat<sub>i</sub> × Post<sub>t</sub></i>	-8.74*** (2.72)	-5.62** (2.47)	-5.44** (2.48)	-2.87 (3.00)	-3.55 (3.03)
Constant	-35.47*** (1.66)	7.39 (8.06)			
Duration, Budget, Bids	No	Yes	Yes	Yes	Yes
<i>Post<sub>t</sub> × (Duration, Budget, Bids)</i>	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 <sup>2</sup>	0.01	0.22	0.23	0.39	0.43
Adjusted R <sup>2</sup>	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.

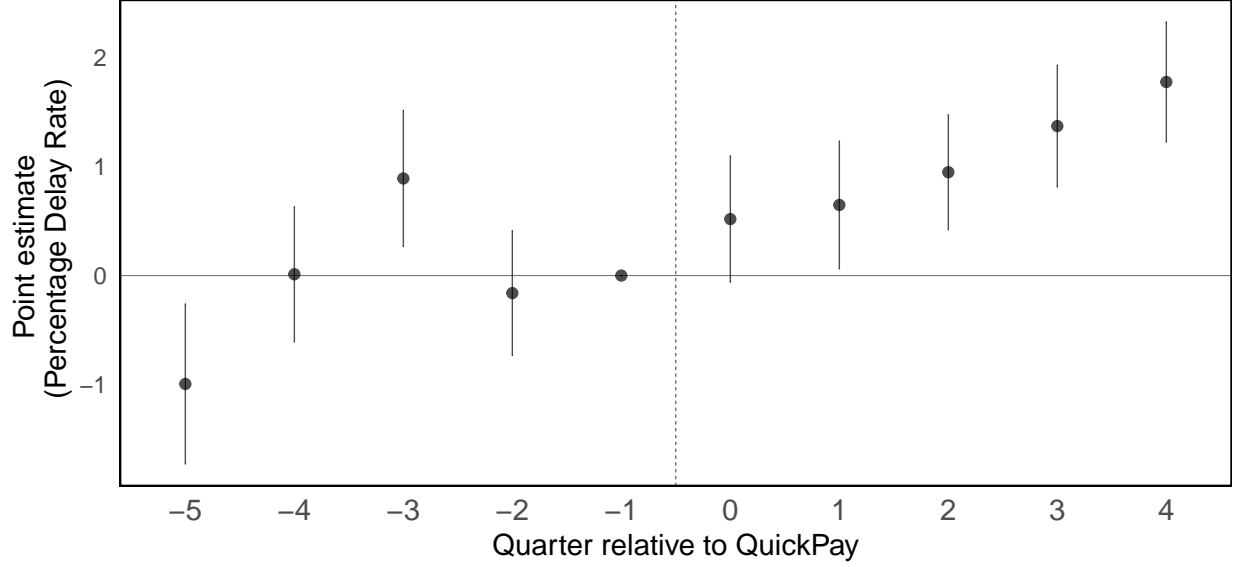
SEs are robust and clustered at the project level.

## 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.



### 13 Parallel Trends Test

Table 11: Linear Time Trend Before QuickPay

	<i>PercentDelay<sub>it</sub></i>				
	(1)	(2)	(3)	(4)	(5)
<i>Treat<sub>i</sub></i>	-1.37*** (0.41)	-0.65 (0.41)	-0.65 (0.41)	-0.44 (0.41)	-0.52 (0.41)
<i>QuarterNum</i>	0.42*** (0.08)	-1.16** (0.50)			
<i>Treat<sub>i</sub> × QuarterNum</i>	-0.09 (0.09)	-0.17* (0.09)	-0.17* (0.09)	-0.03 (0.09)	-0.03 (0.09)
Constant	3.36*** (0.35)	48.76*** (2.32)			
Duration, Budget, Bids	No	Yes	Yes	Yes	Yes
<i>Post<sub>t</sub> × (Duration, Budget, Bids)</i>	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 <sup>2</sup>	0.005	0.20	0.20	0.26	0.27
Adjusted R <sup>2</sup>	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

	<i>PercentDelay<sub>it</sub></i>				
	(1)	(2)	(3)	(4)	(5)
$Treat_i$	-1.62*** (0.22)	-1.56*** (0.22)	-1.57*** (0.22)	-0.80*** (0.22)	-0.85*** (0.22)
$Post$	1.12*** (0.21)	-5.03*** (1.50)			
$Treat_i \times Post$	-0.20 (0.25)	0.23 (0.25)	0.23 (0.25)	0.31 (0.25)	0.32 (0.25)
Constant	4.45*** (0.19)	48.36*** (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 <sup>2</sup>	0.004	0.20	0.20	0.26	0.27
Adjusted R <sup>2</sup>	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

	<i>PercentDelay<sub>it</sub></i>				
	(1)	(2)	(3)	(4)	(5)
<i>Treat<sub>i</sub></i>	0.03 (0.10)	-0.02 (0.09)	-0.01 (0.09)	0.01 (0.09)	0.004 (0.09)
<i>Post<sub>t</sub></i>	0.59*** (0.09)	-4.34*** (0.75)			
<i>Treat<sub>i</sub> × Post<sub>t</sub></i>	-0.13 (0.13)	-0.12 (0.12)	-0.13 (0.12)	-0.12 (0.11)	-0.11 (0.11)
Constant	4.10*** (0.07)	41.64*** (0.58)			
Duration, Budget, Bids	No	Yes	Yes	Yes	Yes
<i>Post<sub>t</sub> × (Duration, Budget, Bids)</i>	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 <sup>2</sup>	0.0003	0.17	0.17	0.21	0.21
Adjusted R <sup>2</sup>	0.0003	0.17	0.17	0.21	0.21

*Note:*

\*p&lt;0.1; \*\*p&lt;0.05; \*\*\*p&lt;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

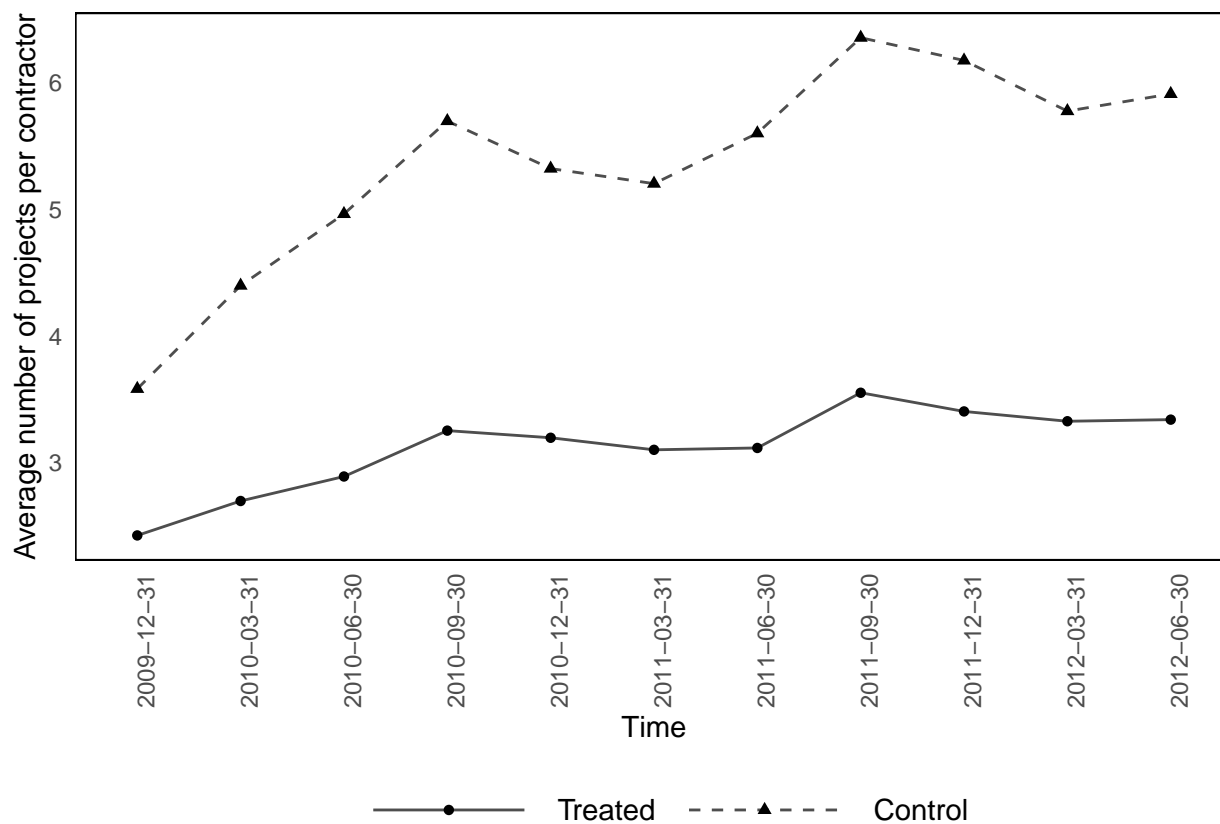


Table 14: Num Contractor Projects and QuickPay reform

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

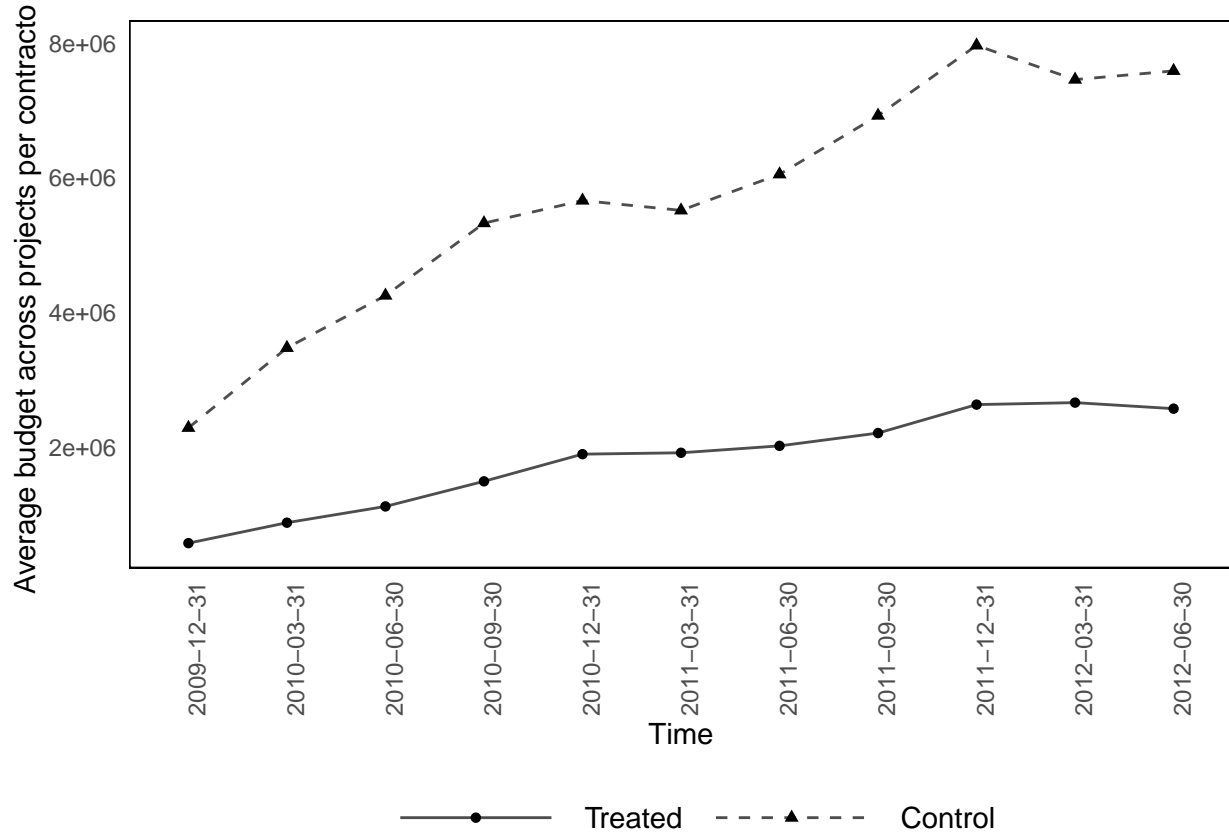


Table 15: Contractor Project Budget and QuickPay reform

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

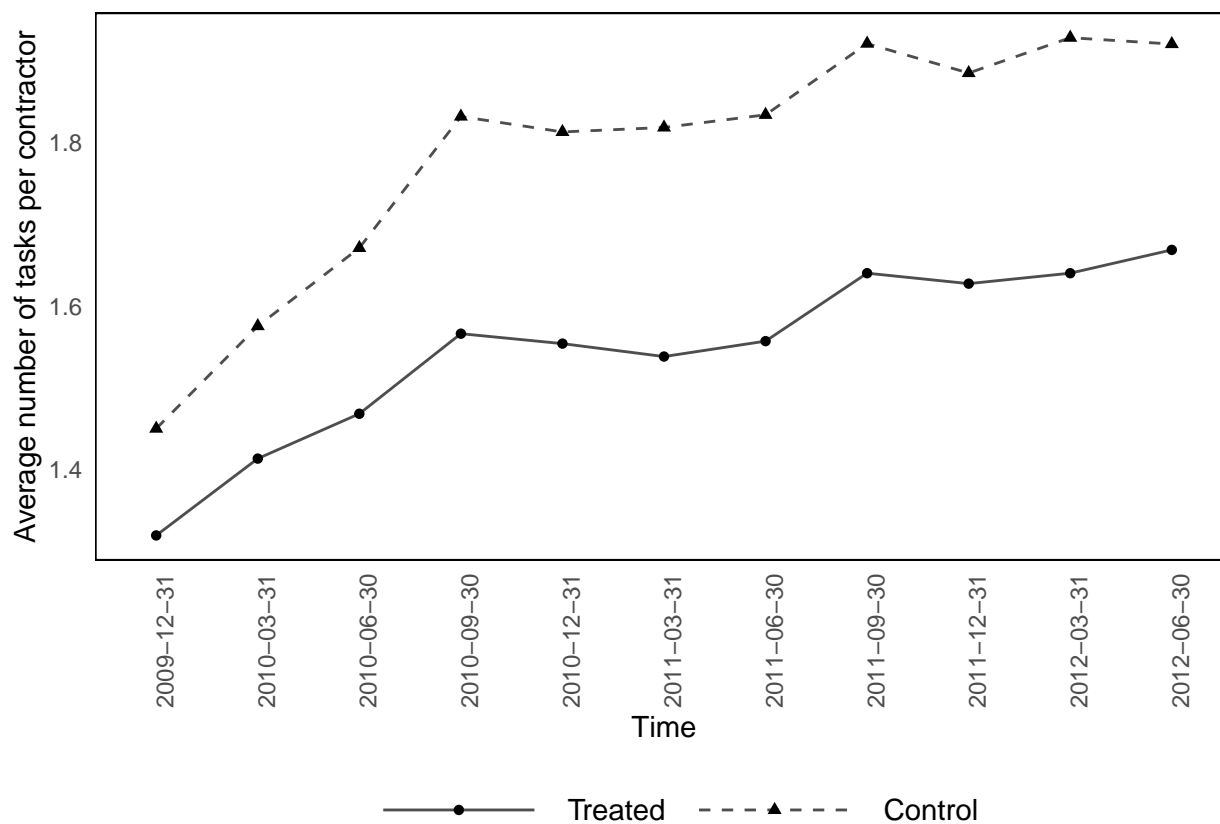


Table 16: Contractor Project Tasks and QuickPay reform

	Number of tasks	
	(1)	(2)
$Treat_i$	-0.23*** (0.04)	-0.23*** (0.04)
$Post_t$	0.17*** (0.02)	
$Treat_i \times Post_t$	-0.04 (0.03)	-0.04 (0.03)
Constant	1.73*** (0.04)	
Time fixed effects	No	Yes
Observations	84,391	84,391
R <sup>2</sup>	0.01	0.01
Adjusted R <sup>2</sup>	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 Treatment Intensity

- $Treat\_Intensity\_i = Treat\_i \times \log(\text{Budget of project } i)$
- This measures how much a contractor is affected by QuickPay
- The interaction term roughly tells us the additional delay on a given project for every dollar that the contractor earns the small project.
- Sample restricted to projects that started before QP

Table 17: Project Portfolio and QuickPay reform

	<i>PercentDelay<sub>it</sub></i>				
	(1)	(2)	(3)	(4)	(5)
<i>TreatIntensity<sub>i</sub></i> (Budget)	-0.11*** (0.01)	-0.07*** (0.01)	-0.08*** (0.01)	-0.04*** (0.01)	-0.05*** (0.01)
<i>Post<sub>t</sub></i>	0.64*** (0.13)	-5.24*** (1.06)			
<i>TreatIntensity<sub>i</sub></i> (Budget) $\times$ <i>Post<sub>t</sub></i>	0.09*** (0.01)	0.13*** (0.01)	0.15*** (0.01)	0.12*** (0.01)	0.12*** (0.01)
Constant	4.88*** (0.09)	48.64*** (0.61)			
Duration, Bids	No	Yes	Yes	Yes	Yes
<i>Post<sub>t</sub></i> $\times$ (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	147,983	130,615	130,615	130,615	130,615
R <sup>2</sup>	0.003	0.15	0.16	0.21	0.21
Adjusted R <sup>2</sup>	0.003	0.15	0.16	0.20	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.

Sample restricted to projects that started before QP.

## 18 Project portfolio: Spillover effect

### 18.1 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  $treat\_intensity = Indirect\ Treat \times \log(1 + \text{number of small projects})$
- Subset of large projects only

### 18.2 DID on small projects (Portfolio Treat)

- Portfolio  $Treat\_i = 1$  if small project  $i$  has a concurrent large project.
- $Treat\_i = 1$  if project  $i$  is a small project.

Table 18: Project Portfolio and QuickPay reform

	<i>PercentDelay<sub>it</sub></i>				
	(1)	(2)	(3)	(4)	(5)
<i>Treat<sub>i</sub></i> (All Small)	-0.79*** (0.13)	-0.48*** (0.11)	-0.54*** (0.11)	-0.68*** (0.12)	-0.71*** (0.12)
<i>PortfolioTreat<sub>i</sub></i> (Small with Large)	-2.74*** (0.11)	-2.46*** (0.10)	-2.41*** (0.10)	-0.72*** (0.10)	-0.64*** (0.10)
<i>Post<sub>t</sub></i>	-0.21* (0.12)	-5.41*** (0.79)			
<i>Treat<sub>i</sub></i> (All Small) $\times$ <i>Post<sub>t</sub></i>	1.22*** (0.15)	1.04*** (0.15)	1.09*** (0.15)	1.11*** (0.15)	1.13*** (0.15)
<i>PortfolioTreat<sub>i</sub></i> (Small with Large) $\times$ <i>Post<sub>t</sub></i>	-0.48*** (0.14)	-0.28** (0.14)	-0.33** (0.14)	-0.38*** (0.14)	-0.38*** (0.14)
Constant	5.27*** (0.10)	43.79*** (0.61)			
Duration, Budget, Bids	No	Yes	Yes	Yes	Yes
<i>Post<sub>t</sub></i> $\times$ (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 <sup>2</sup>	0.01	0.18	0.18	0.21	0.21
Adjusted R <sup>2</sup>	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.

### 18.3 DID on small projects (Treatment Intensity)

- Archived as not putting in paper

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:

- $Treat\_Intensity\_i = Treat\_i \times \log(1 + \text{number of small projects})$
- $Treat\_Intensity\_i \text{ (Small with large)} = I(\text{Contractor holds large projects}) \times Treat\_i \times \log(1 + \text{number of small projects})$
- $Treat\_Intensity\_Large\_i = Treat\_i \times \log(1 + \text{number of large projects})$

## 19 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)

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

### 19.1 Stage Quintile

### 19.2 Logged Stage Regressions

Table 19: Project Stage and QuickPay reform

	<i>PercentDelay<sub>it</sub></i>				
	(1)	(2)	(3)	(4)	(5)
<i>Treat<sub>i</sub></i>	-2.65*** (0.23)	-1.65*** (0.21)	-1.73*** (0.21)	-1.34*** (0.21)	-1.37*** (0.20)
Log(Stage)	3.16*** (0.08)	2.51*** (0.07)	2.45*** (0.07)	2.53*** (0.07)	2.53*** (0.07)
<i>Post<sub>t</sub></i>	-1.33*** (0.23)	-5.06*** (0.81)			
<i>Treat<sub>i</sub> × Post<sub>t</sub></i>	2.06*** (0.28)	1.74*** (0.26)	1.82*** (0.26)	1.85*** (0.25)	1.90*** (0.25)
<i>Treat<sub>i</sub> × Log(Stage)</i>	-0.70*** (0.10)	-0.20** (0.09)	-0.23** (0.09)	-0.27*** (0.09)	-0.29*** (0.09)
<i>Post<sub>t</sub> × Log(Stage)</i>	-0.06 (0.10)	0.48*** (0.09)	0.49*** (0.09)	0.23** (0.09)	0.22** (0.09)
<i>Treat<sub>i</sub> × Post<sub>t</sub> × Log(Stage)</i>	0.59*** (0.12)	0.54*** (0.11)	0.56*** (0.11)	0.62*** (0.11)	0.63*** (0.11)
Constant	10.20*** (0.19)	43.10*** (0.62)			
Duration, Budget, Bids	No	Yes	Yes	Yes	Yes
<i>Post<sub>t</sub> × (Duration, Budget, Bids)</i>	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 <sup>2</sup>	0.06	0.18	0.18	0.21	0.22
Adjusted R <sup>2</sup>	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.

## 20 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)

## 21 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 20: Contract Financing and QuickPay reform

	<i>PercentDelay<sub>it</sub></i>				
	(1)	(2)	(3)	(4)	(5)
<i>Treat<sub>i</sub></i>	-1.645*** (0.120)	-1.328*** (0.114)	-1.372*** (0.114)	-0.966*** (0.116)	-0.950*** (0.116)
<i>Post<sub>t</sub></i>	-0.033 (0.125)	-5.172*** (0.787)			
Percentage projects receiving CF	0.047*** (0.004)	0.042*** (0.003)	0.041*** (0.003)	-0.003 (0.003)	-0.004 (0.003)
<i>Treat<sub>i</sub> × Post<sub>t</sub></i>	0.812*** (0.148)	0.674*** (0.146)	0.704*** (0.146)	0.781*** (0.144)	0.817*** (0.144)
<i>Post<sub>t</sub> × Percentage projects receiving CF</i>	-0.012*** (0.004)	-0.023*** (0.004)	-0.022*** (0.004)	-0.009** (0.004)	-0.009** (0.004)
<i>Treat<sub>i</sub> × Percentage projects receiving CF</i>	0.010* (0.005)	0.007* (0.004)	0.007* (0.004)	0.004 (0.004)	0.002 (0.004)
<i>Treat<sub>i</sub> × Post<sub>t</sub> × Percentage projects receiving CF</i>	0.018*** (0.006)	0.018*** (0.005)	0.018*** (0.005)	0.012** (0.005)	0.012** (0.005)
Constant	4.491*** (0.104)	43.799*** (0.606)			
Duration, Budget, Bids	No	Yes	Yes	Yes	Yes
<i>Post<sub>t</sub> × (Duration, Budget, Bids)</i>	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 <sup>2</sup>	0.010	0.178	0.179	0.213	0.215
Adjusted R <sup>2</sup>	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.

## 22 Competition

## 22.1 Impact on bidding metrics [All projects]

Table 21: Effect of Competition After QuickPay: Quickpay 2009-2011

	<i>NumberOfBids<sub>it</sub></i>	<i>InitialDuration<sub>it</sub></i>	<i>InitialBudget<sub>it</sub></i>
	(1)	(2)	(3)
<i>Treat<sub>i</sub></i>	1.08*** (0.02)	-7.27*** (0.72)	-15,055.20*** (1,586.13)
<i>Treat<sub>i</sub> × Post<sub>t</sub></i>	0.09*** (0.03)	-3.38*** (1.00)	-29,491.30*** (2,296.49)
Task fixed effects	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes
Observations	227,609	220,550	227,732
R <sup>2</sup>	0.20	0.20	0.24
Adjusted R <sup>2</sup>	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.

## 22.2 Impact on delays

### 22.2.1 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 22: Effect of QuickPay on competitively awarded projects

	<i>PercentDelay<sub>it</sub></i>				
	(1)	(2)	(3)	(4)	(5)
<i>Treat<sub>i</sub></i>	-2.26*** (0.13)	-1.93*** (0.12)	-1.94*** (0.12)	-0.50*** (0.12)	-0.51*** (0.12)
<i>SA<sub>i</sub></i>	-1.90*** (0.17)	0.87*** (0.16)	1.45*** (0.18)	1.52*** (0.18)	1.48*** (0.18)
<i>Post<sub>t</sub></i>	1.18*** (0.16)	-1.16*** (0.16)			
<i>Treat<sub>i</sub> × Post<sub>t</sub></i>	0.23 (0.19)	0.28 (0.18)	0.30* (0.18)	0.16 (0.17)	0.16 (0.17)
<i>Treat<sub>i</sub> × Post<sub>t</sub> × SA<sub>i</sub></i>	0.98*** (0.20)	0.60*** (0.19)	0.58*** (0.19)	0.76*** (0.19)	0.76*** (0.19)
Constant	5.48*** (0.11)	10.06*** (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 <sup>2</sup>	0.01	0.06	0.06	0.12	0.13
Adjusted R <sup>2</sup>	0.01	0.06	0.06	0.12	0.12

Note:

\*p&lt;0.1; \*\*p&lt;0.05; \*\*\*p&lt;0.01

Each observation is a project-quarter.

SEs are robust and clustered at the project level.

Sample restricted to fully competed projects.

Table 23: Effect of QuickPay on non-competitively awarded projects

	<i>PercentDelay<sub>it</sub></i>				
	(1)	(2)	(3)	(4)	(5)
<i>Treat<sub>i</sub></i>	1.16*** (0.28)	0.96*** (0.27)	0.89*** (0.27)	-0.17 (0.29)	-0.11 (0.28)
<i>SA<sub>i</sub></i>	-0.61*** (0.22)	1.94*** (0.22)	3.19*** (0.26)	2.82*** (0.26)	2.74*** (0.26)
<i>Post<sub>t</sub></i>	-0.79*** (0.24)	-3.11*** (0.25)			
<i>Treat<sub>i</sub> × Post<sub>t</sub></i>	2.69*** (0.40)	2.44*** (0.38)	2.34*** (0.39)	1.85*** (0.38)	1.76*** (0.39)
<i>Treat<sub>i</sub> × Post<sub>t</sub> × SA<sub>i</sub></i>	-1.89*** (0.39)	-1.67*** (0.37)	-1.63*** (0.37)	-1.87*** (0.37)	-1.75*** (0.37)
Constant	4.40*** (0.20)	9.65*** (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 <sup>2</sup>	0.01	0.06	0.07	0.15	0.15
Adjusted R <sup>2</sup>	0.01	0.06	0.07	0.13	0.13

Note:

\*p&lt;0.1; \*\*p&lt;0.05; \*\*\*p&lt;0.01

Each observation is a project-quarter.

SEs are robust and clustered at the project level.

Sample restricted to non-competed projects.

### 22.2.2 Four-way interaction

We run the following model:

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

#### 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 24: Effect of Competition After QuickPay: Quickpay 2009-2011

	<i>PercentDelay<sub>it</sub></i>					
	(1)	(2)	(3)	(4)	(5)	(6)
<i>Treat<sub>i</sub></i>	1.16*** (0.28)	1.16*** (0.28)	0.97*** (0.27)	0.92*** (0.27)	-0.26 (0.27)	-0.28 (0.27)
<i>SA<sub>i</sub></i>	-0.61*** (0.22)	-0.61*** (0.22)	1.79*** (0.21)	2.50*** (0.22)	2.32*** (0.21)	2.26*** (0.21)
<i>Competitive<sub>i</sub></i>	1.08*** (0.23)	1.08*** (0.23)	0.79*** (0.22)	0.77*** (0.22)	-0.74*** (0.23)	-0.69*** (0.23)
<i>Post<sub>t</sub></i>	-0.79*** (0.24)	-0.79*** (0.24)	-2.97*** (0.24)			
<i>Treat<sub>i</sub> × Competitive<sub>i</sub></i>	-3.42*** (0.31)	-3.42*** (0.31)	-2.90*** (0.29)	-2.85*** (0.29)	-0.27 (0.30)	-0.25 (0.30)
<i>Post<sub>t</sub> × Competitive<sub>i</sub></i>	1.97*** (0.29)	1.97*** (0.29)	1.78*** (0.28)	1.74*** (0.28)	0.73*** (0.28)	0.64** (0.28)
<i>SA<sub>i</sub> × Competitive<sub>i</sub></i>	-1.29*** (0.28)	-1.29*** (0.28)	-0.88*** (0.26)	-0.89*** (0.26)	-0.72*** (0.26)	-0.71*** (0.26)
<i>Treat<sub>i</sub> × Post<sub>t</sub></i>	2.69*** (0.40)	2.69*** (0.40)	2.45*** (0.38)	2.42*** (0.38)	1.66*** (0.38)	1.59*** (0.38)
<i>Treat<sub>i</sub> × Post<sub>t</sub> × Competitive<sub>i</sub></i>	-2.45*** (0.44)	-2.45*** (0.44)	-2.17*** (0.42)	-2.13*** (0.42)	-1.48*** (0.42)	-1.41*** (0.42)
<i>Treat<sub>i</sub> × Post<sub>t</sub> × SA<sub>i</sub></i>	-1.89*** (0.39)	-1.89*** (0.39)	-1.68*** (0.37)	-1.68*** (0.37)	-1.44*** (0.36)	-1.44*** (0.36)
<i>Treat<sub>i</sub> × Post<sub>t</sub> × SA<sub>i</sub> × Competitive<sub>i</sub></i>	2.87*** (0.44)	2.87*** (0.44)	2.28*** (0.42)	2.25*** (0.42)	2.19*** (0.41)	2.21*** (0.41)
Constant	4.40*** (0.20)	4.40*** (0.20)	9.33*** (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 <sup>2</sup>	0.01	0.01	0.06	0.06	0.12	0.12
Adjusted R <sup>2</sup>	0.01	0.01	0.06	0.06	0.11	0.12

Note:

\*p&lt;0.1; \*\*p&lt;0.05; \*\*\*p&lt;0.01

Each observation is a project-quarter.

SEs are robust and clustered at the project level.