Percentage Delay Rate: QuickPay (2009-2012)
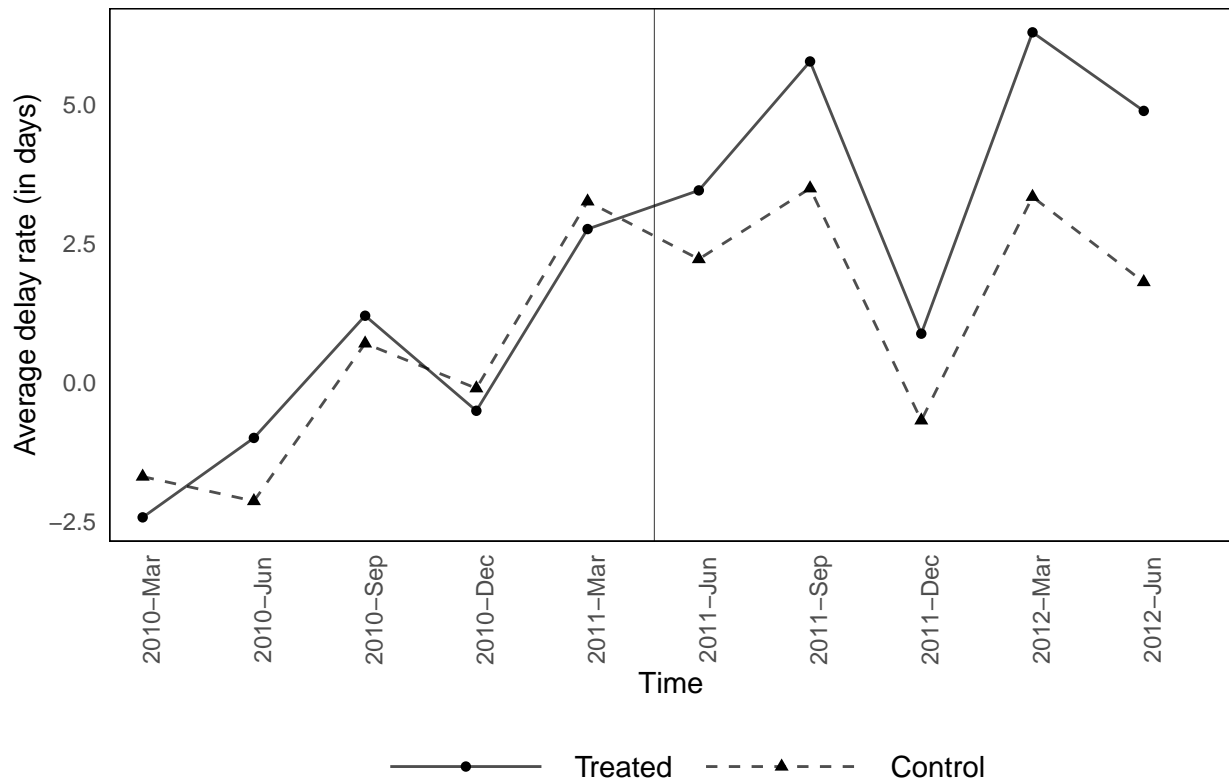
Jan 18, 2023

1 Setup

2 Delay days over time [Archived]

3 Delay days over time (de-meaned) [Archived]

4 Delay days over time (de-meaned) – One type of contractor

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


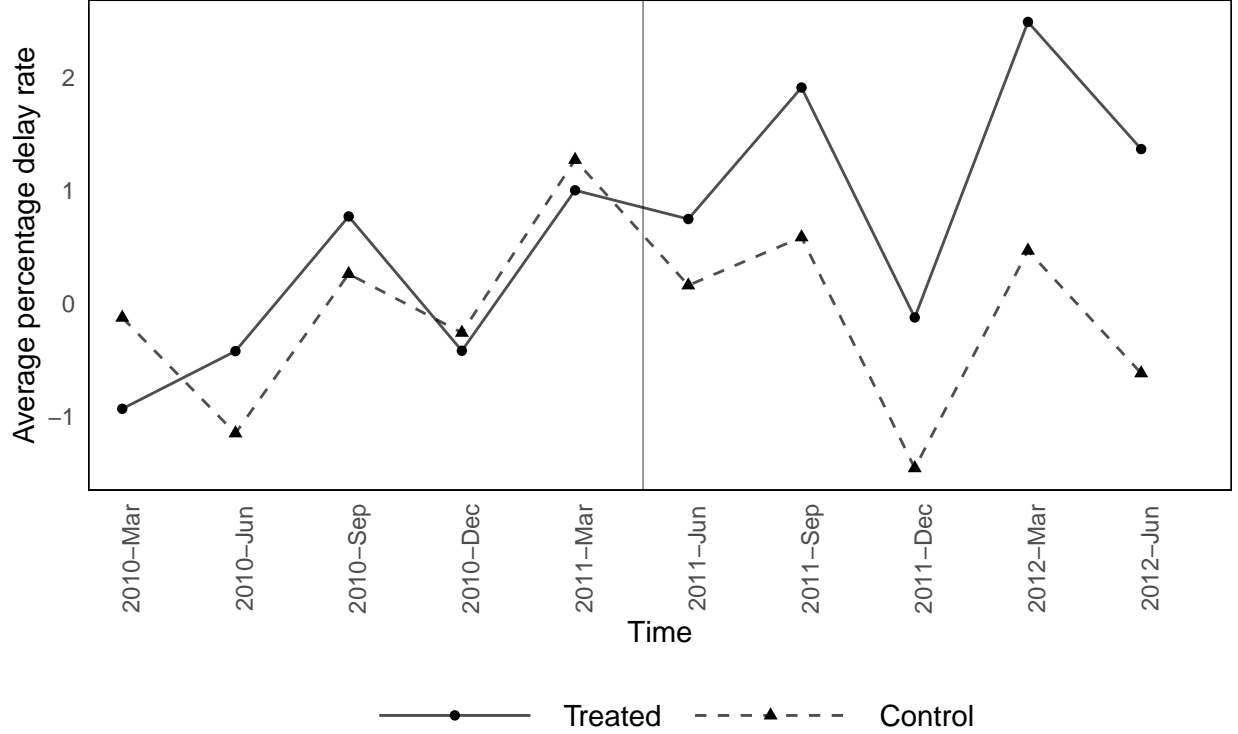# 5 Percentage delays over time [Archived]

- Sample restricted to projects for which start dates matches the one in API
  - This is done by using first reported "action_date" and "date_signed"
- $PercentDelay_{it} = 100 \times Delay_{it} / Duration_{i,t-1}$
  - $Duration_{i,t-1} = Deadline_{i,t-1} - StartDate_i$

6 Demeaned delay rate (in percentage) [Archived]

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

7 Demeaned delay rate (in percentage) – One type contractor

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

8 Normalized delay rate (in percentage) [Archived]

9 Normalized percentage delay: Four groups [Archived]

10 Baseline Regressions

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

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

Table 1: Effect of QuickPay on project delay rates

| | $PercentDelay_{it}$ | | | | |
	(1)	(2)	(3)	(4)	(5)
$Treat_i$	−2.48***	−1.59***	−1.62***	−1.31***	−1.33***
	(0.12)	(0.10)	(0.10)	(0.10)	(0.10)
$Post_t$	−0.32***	−8.32***			
	(0.12)	(0.81)			
$Treat_i \times Post_t$	1.27***	1.10***	1.13***	1.18***	1.23***
	(0.14)	(0.13)	(0.13)	(0.13)	(0.13)
Constant	6.44***	53.81***			
	(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	260,056	235,960	235,960	235,960	235,960
R^2	0.003	0.22	0.22	0.25	0.26
Adjusted R^2	0.003	0.22	0.22	0.25	0.25

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.

10.1 Contractors performing only one type of project (Restricted sample)

Table 2: Effect of QuickPay on project delay rates

	$PercentDelay_{it}$				
	(1)	(2)	(3)	(4)	(5)
$Treat_i$	-0.94^{***}	-0.80^{***}	-0.88^{***}	-0.89^{***}	-0.92^{***}
	(0.15)	(0.13)	(0.13)	(0.14)	(0.14)
$Post_t$	-0.38^{***}	-6.94^{***}			
	(0.14)	(1.06)			
$Treat_i \times Post_t$	1.45^{***}	1.31^{***}	1.39^{***}	1.38^{***}	1.42^{***}
	(0.18)	(0.17)	(0.17)	(0.17)	(0.17)
Constant	6.12^{***}	55.77^{***}			
	(0.11)	(0.81)			
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	174,197	157,166	157,166	157,166	157,166
R^2	0.0005	0.18	0.19	0.22	0.22
Adjusted R^2	0.0005	0.18	0.18	0.21	0.21

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

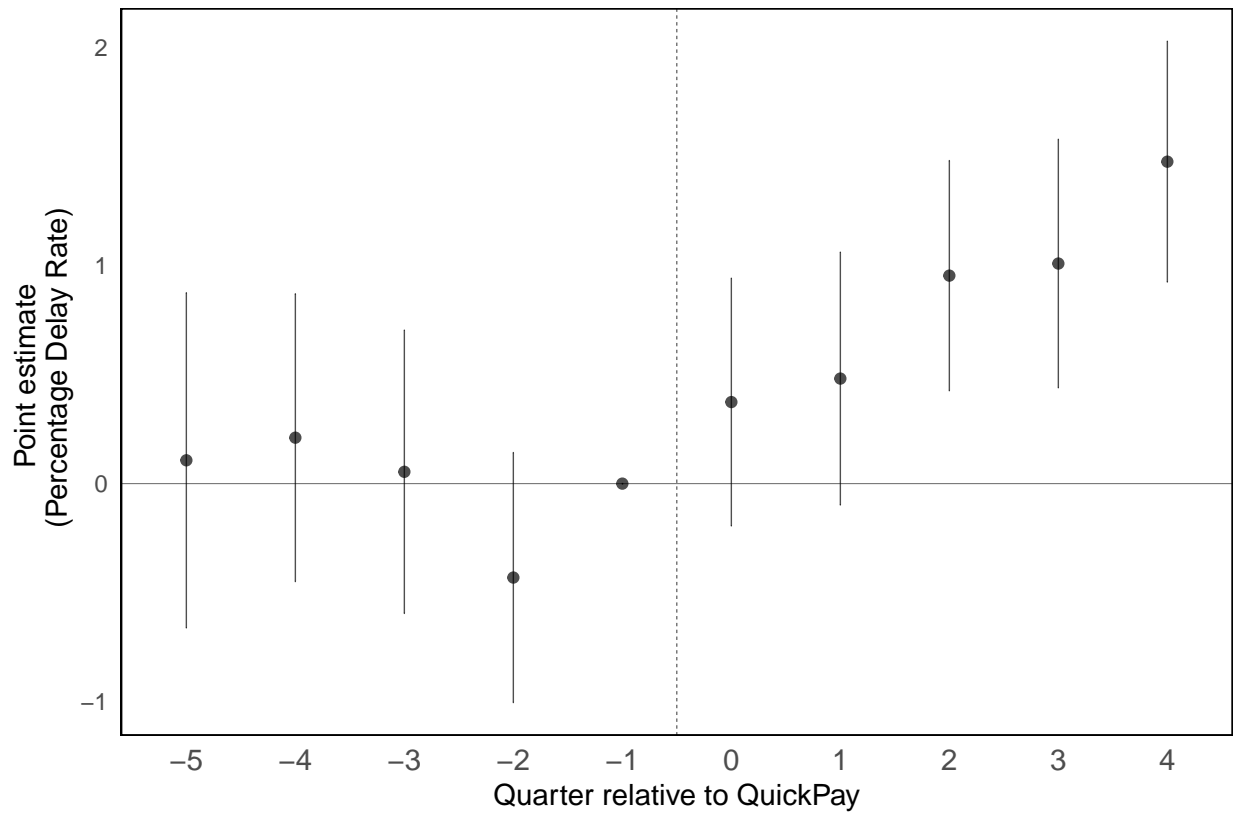Each observation is a project-quarter.

SEs are robust and clustered at the project level.

Sample restricted to contractors performing only one type of project.

11   Event study
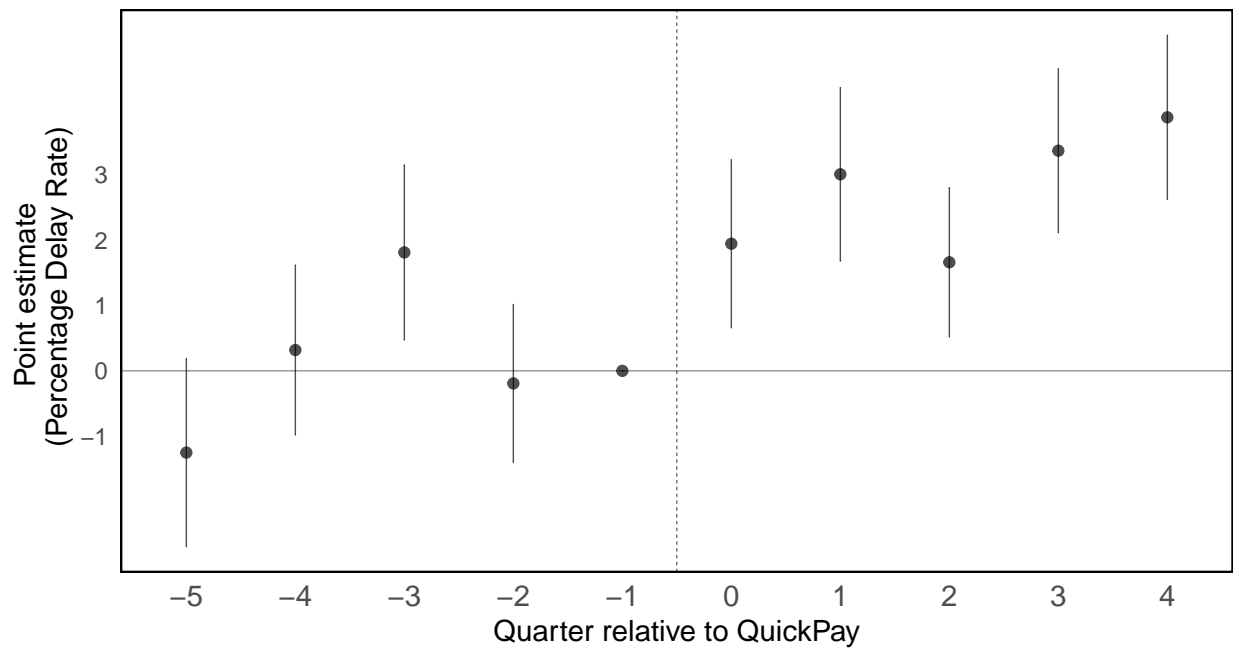
$$PercentDelay_{it} = \beta_0 + \beta_1 Treat_i + \beta_2 Treat_i \times Quarter_t + \gamma_{task} + \theta_{naics} + \lambda_{quarter} + \nu_{sub-agency} + \epsilon_{it}$$

```
## NOTE: 242,843 observations removed because of NA values (LHS: 242,843, RHS: 9,862).
```

11.1   Event Study – One Type

NOTE: 171,267 observations removed because of NA values (LHS: 154,236, RHS: 171,267).

12 Parallel Trends Test – One Type

Table 3: Linear Time Trend Before QuickPay

	$PercentDelay_{it}$				
	(1)	(2)	(3)	(4)	(5)
$Treat_i$	−0.44	−0.35	−0.34	−0.57	−0.72
	(0.55)	(0.52)	(0.52)	(0.54)	(0.54)
$QuarterNum$	0.47***	−1.68**			
	(0.09)	(0.66)			
$Treat_i \times QuarterNum$	−0.12	−0.13	−0.13	0.02	0.04
	(0.12)	(0.11)	(0.11)	(0.11)	(0.11)
Constant	4.02***	63.83***			
	(0.42)	(3.10)			
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	64,786	59,707	59,707	59,707	59,707
R^2	0.001	0.21	0.21	0.27	0.27
Adjusted R^2	0.001	0.21	0.21	0.26	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.

13 Placebo Test – One type

13.1 Placebo Regression Tables – One type

[1] 4

Table 4: Placebo test: Treatment Time 2010-09-30

	PercentDelay$_{it}$				
	(1)	(2)	(3)	(4)	(5)
$Treat_i$	−1.03*	−2.49***	−2.50***	−1.51***	−1.72***
	(0.54)	(0.51)	(0.51)	(0.54)	(0.54)
$Post$	1.81***	−13.64***			
	(0.46)	(3.92)			
$Treat_i \times Post$	−0.95	0.50	0.48	0.61	0.71
	(0.61)	(0.59)	(0.59)	(0.59)	(0.59)
Constant	8.66***	112.74***			
	(0.40)	(3.41)			
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	64,786	59,707	59,707	59,707	59,707
R^2	0.001	0.22	0.22	0.27	0.28
Adjusted R^2	0.001	0.22	0.22	0.26	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.

[1] 5

Table 5: Placebo test: Treatment Time 2010-12-31

	$PercentDelay_{it}$				
	(1)	(2)	(3)	(4)	(5)
$Treat_i$	-1.00^{**}	-1.14^{***}	-1.18^{***}	-0.36	-0.55
	(0.41)	(0.39)	(0.39)	(0.44)	(0.44)
$Post$	1.00^{**}	-20.67^{***}			
	(0.42)	(3.38)			
$Treat_i \times Post$	-1.31^{**}	-1.73^{***}	-1.66^{***}	-1.08^{**}	-0.99^{*}
	(0.54)	(0.53)	(0.52)	(0.55)	(0.55)
Constant	9.48^{***}	114.18^{***}			
	(0.31)	(2.60)			
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	64,786	59,707	59,707	59,707	59,707
R^2	0.001	0.22	0.22	0.27	0.28
Adjusted R^2	0.001	0.22	0.22	0.26	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.
Observations are for quarters before quickpay.

14 Summary statistics

15 Congestion Effect

15.1 Number of projects per contractor

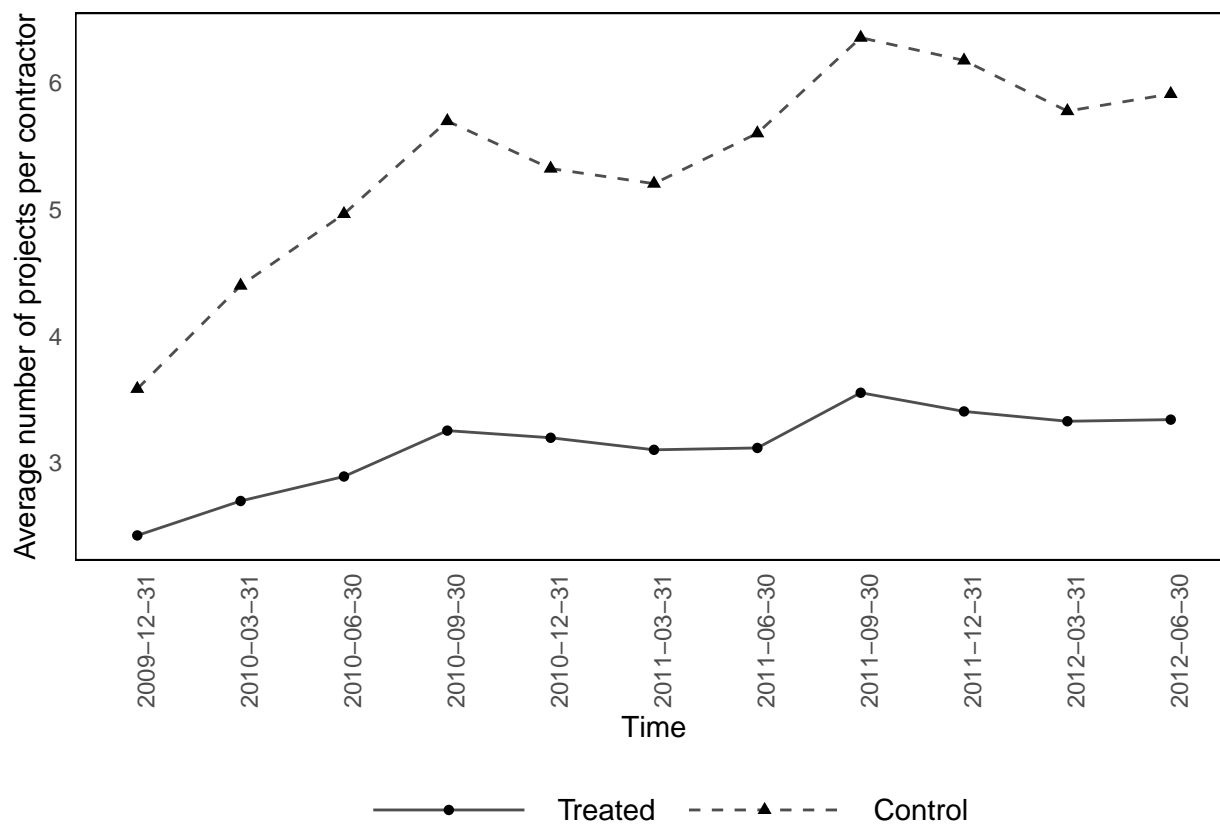### 15.1.1 Contractors holding only small or only large projects

Table 6: 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.

15.1.2 Contractors holding at least one small project are "treated"

15.2 Total budget

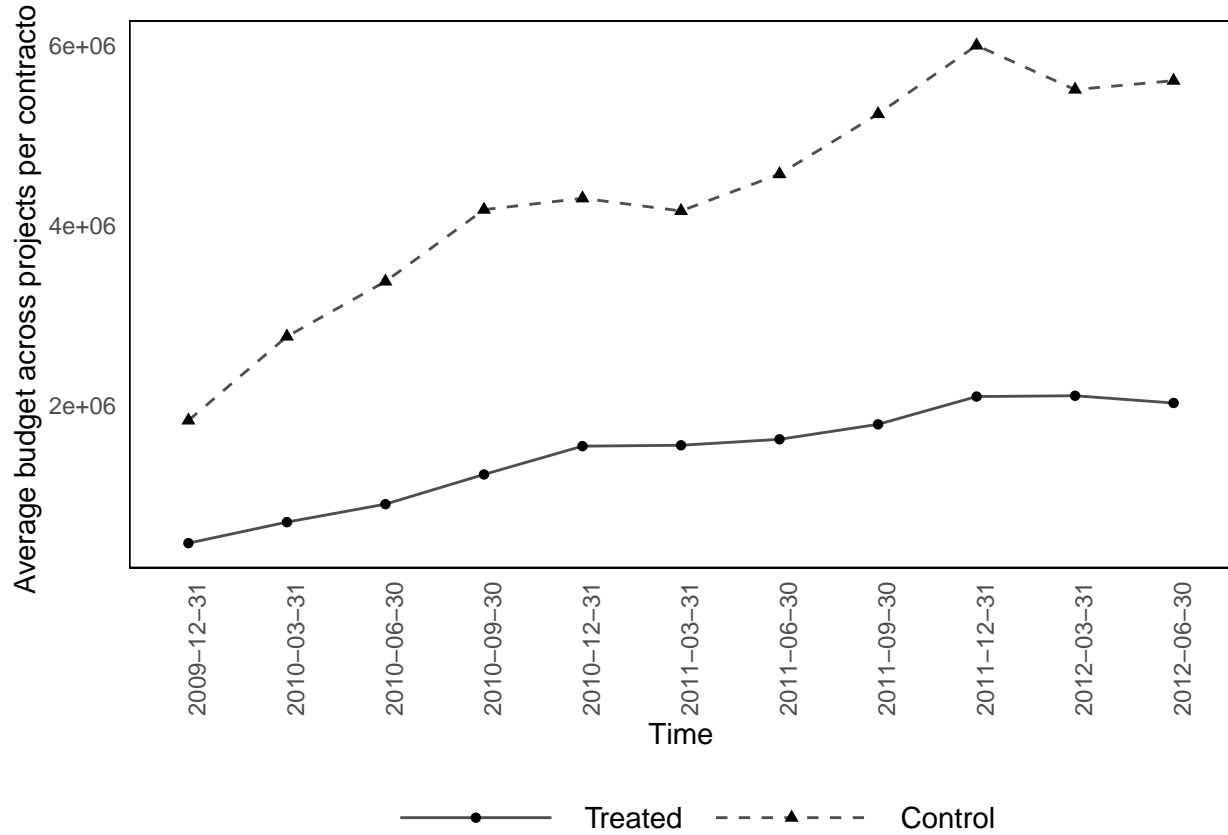### 15.2.1 Contractors holding only small or only large projects

Table 7: Contractor Project Budget and QuickPay reform

| | Total budget | |
	(1)	(2)
$Treat_i$	−2,503,033.00***	−2,497,737.00***
	(454,885.70)	(456,972.80)
$Post_t$	1,715,503.00***	
	(229,333.50)	
$Treat_i \times Post_t$	−953,041.30***	−955,237.70***
	(231,908.60)	(233,131.80)
Constant	3,666,740.00***	
	(453,287.80)	
Time fixed effects	No	Yes
Observations	84,391	84,391
R^2	0.01	0.02
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.

15.3 Number of tasks

15.3.1 Contractors holding only small or only large projects
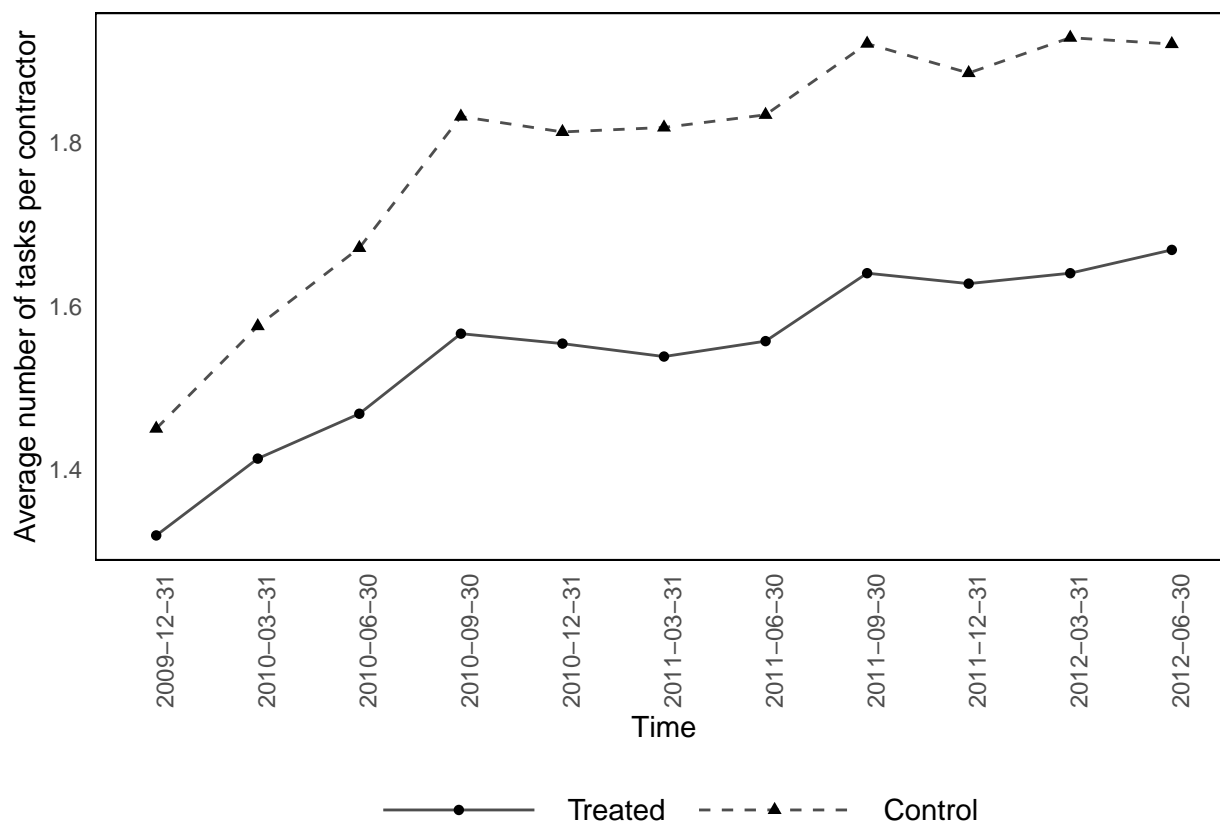
Table 8: Contractor Project Tasks and QuickPay reform

	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.

16 Project portfolio: Spillover effect

16.1 Regression 1: DID on large projects

- Sample restricted to large projects only.
- Treat is an indicator that equals one for LARGE projects that have at least one parallel small project in the same quarter, and is zero otherwise.

Table 9: Project Portfolio and QuickPay reform

	$PercentDelay_{it}$				
	(1)	(2)	(3)	(4)	(5)
$Treat_i$	4.41***	0.70***	0.64***	1.15***	1.16***
	(0.31)	(0.20)	(0.20)	(0.20)	(0.20)
$Post_t$	−0.10	−13.38***			
	(0.12)	(1.17)			
$Treat_i \times Post_t$	−1.17***	0.02	0.03	−0.65**	−0.56**
	(0.36)	(0.26)	(0.26)	(0.26)	(0.26)
Constant	5.59***	63.76***			
	(0.10)	(0.89)			
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	117,787	110,601	110,601	110,601	110,601
R^2	0.01	0.26	0.26	0.30	0.30
Adjusted R^2	0.01	0.26	0.26	0.29	0.29

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 large projects only.

16.1.1 Intensity with Number of Small Projects [Archived]

16.2 Regression 2 [Archived]

- Treat equals one for small projects with at least one large project in the same quarter.
- Treat is zero for large projects with NO small project in the same quarter.
- Treat is not defined for other cases i.e, only small projects or large projects with small projects are excluded.

16.3 Regression 3: Indicator for small project with existing large project

- $Treat_{i,l}$ is an indicator that equals 1 for small projects with co-existing large projects, and is zero otherwise.
- $Treat_{i,l} = 1 \implies Treat_i = 1$. This means we have:
    - $Treat_{i,l} \times Post_t = Treat_i \times Treat_{i,l} \times Post_t$
    - $Treat_{i,l} \times Treat_i = Treat_{i,l}$

- Large projects with parallel small projects are removed to get a clean control group.

Table 10: Project Portfolio and QuickPay reform

	$PercentDelay_{it}$				
	(1)	(2)	(3)	(4)	(5)
$Treat_i$	−1.04***	−0.96***	−1.00***	−0.80***	−0.82***
	(0.11)	(0.10)	(0.10)	(0.10)	(0.10)
$Treat_{i,l}$	−2.14***	−1.26***	−1.29***	−0.37***	−0.32***
	(0.12)	(0.12)	(0.12)	(0.11)	(0.11)
$Post_t$	−0.002	−5.37***			
	(0.10)	(0.76)			
$Treat_i \times Post_t$	1.04***	1.08***	1.11***	1.03***	1.04***
	(0.13)	(0.13)	(0.13)	(0.13)	(0.13)
$Treat_{i,l} \times Post_t$	−0.63***	−0.62***	−0.61***	−0.64***	−0.58***
	(0.15)	(0.15)	(0.15)	(0.15)	(0.15)
Constant	4.90***	41.79***			
	(0.09)	(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	237,093	212,627	212,627	212,627	212,627
R^2	0.004	0.17	0.18	0.21	0.21
Adjusted R^2	0.004	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.
Large projects with parallel small projects are removed.

16.4 Regression 4A: Indicator for Parallel Large Project [Archived]

- Concurrent Large Project$_{i,t}$ is an indicator that equals one if the contractor has at least one other large project in the same quarter.
- Large projects with parallel small projects are removed to get a clean control group.

16.5 Regression 4B: Number of Large Projects [Archived]

16.5.1 [ARCHIVED] Mediator: Total Projects

17 [Archived] Project portfolio: Num Large Projects/Total Projects

17.1 Continuous

17.1.1 Total Number of Projects

17.2 Discrete

17.2.1 Pre-defined proportions

17.2.2 Proportions based on Quintiles

18 [Archived] Project portfolio: Budget Large Projects/Total Budget Across 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)

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

Table 11: Project Stage and QuickPay reform

	$PercentDelay_{it}$				
	(1)	(2)	(3)	(4)	(5)
$Treat_i$	−0.40***	−1.21***	−1.18***	−0.88***	−0.87***
	(0.09)	(0.11)	(0.11)	(0.12)	(0.12)
Medium Stage	0.93***	0.52***	0.38***	0.69***	0.68***
	(0.12)	(0.13)	(0.13)	(0.13)	(0.13)
Late Stage	16.93***	11.90***	11.75***	11.42***	11.40***
	(0.28)	(0.23)	(0.23)	(0.23)	(0.23)
$Post_t$	−0.15	−6.48***			
	(0.09)	(0.79)			
$Treat_i \times Post_t$	0.19*	0.10	0.09	0.08	0.13
	(0.12)	(0.15)	(0.15)	(0.15)	(0.15)
$Treat_i \times$ Medium Stage	−0.48***	0.32**	0.30*	0.24	0.24
	(0.15)	(0.16)	(0.16)	(0.16)	(0.16)
$Treat_i \times$ Late Stage	−5.01***	−1.68***	−1.75***	−1.88***	−1.96***
	(0.36)	(0.31)	(0.31)	(0.30)	(0.30)
$Post_t \times$ Medium Stage	−0.80***	0.37**	0.25	−0.04	−0.05
	(0.15)	(0.16)	(0.16)	(0.16)	(0.16)
$Post_t \times$ Late Stage	−5.50***	−1.93***	−1.99***	−2.45***	−2.46***
	(0.32)	(0.27)	(0.27)	(0.27)	(0.27)
$Treat_i \times Post_t \times$ Medium Stage	0.39**	−0.01	−0.02	0.15	0.15
	(0.18)	(0.21)	(0.21)	(0.20)	(0.20)
$Treat_i \times Post_t \times$ Late Stage	3.80***	2.81***	2.86***	3.04***	3.09***
	(0.41)	(0.37)	(0.37)	(0.36)	(0.36)
Constant	1.51***	44.16***			
	(0.07)	(0.60)			
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	260,000	235,960	235,960	235,960	235,960
R^2	0.11	0.24	0.24	0.27	0.27
Adjusted R^2	0.11	0.24	0.24	0.27	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.

19.1 Stage decile Regression Plots

19.2 Stage Quintile

19.3 Logged Stage Regressions

Table 12: Project Stage and QuickPay reform

	$PercentDelay_{it}$				
	(1)	(2)	(3)	(4)	(5)
$Treat_i$	-4.72^{***}	-2.45^{***}	-2.50^{***}	-2.14^{***}	-2.19^{***}
	(0.25)	(0.21)	(0.21)	(0.20)	(0.20)
Log(Stage)	4.50^{***}	3.17^{***}	3.12^{***}	3.14^{***}	3.14^{***}
	(0.08)	(0.07)	(0.07)	(0.07)	(0.07)
$Post_t$	-2.20^{***}	-7.92^{***}			
	(0.23)	(0.83)			
$Treat_i \times Post_t$	2.88^{***}	2.10^{***}	2.14^{***}	2.25^{***}	2.33^{***}
	(0.30)	(0.26)	(0.26)	(0.25)	(0.25)
$Treat_i \times$ Log(Stage)	-1.65^{***}	-0.54^{***}	-0.55^{***}	-0.52^{***}	-0.55^{***}
	(0.11)	(0.09)	(0.09)	(0.09)	(0.09)
$Post_t \times$ Log(Stage)	-0.36^{***}	0.53^{***}	0.53^{***}	0.23^{***}	0.22^{**}
	(0.10)	(0.09)	(0.09)	(0.09)	(0.09)
$Treat_i \times Post_t \times$ Log(Stage)	0.93^{***}	0.64^{***}	0.65^{***}	0.71^{***}	0.73^{***}
	(0.13)	(0.12)	(0.12)	(0.12)	(0.12)
Constant	13.35^{***}	53.91^{***}			
	(0.20)	(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	260,000	235,960	235,960	235,960	235,960
R^2	0.06	0.22	0.22	0.25	0.26
Adjusted R^2	0.06	0.22	0.22	0.25	0.25

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.

19.3.1 Restricted sample: One type

Table 13: Project Stage and QuickPay reform

|			$PercentDelay_{it}$		
	(1)	(2)	(3)	(4)	(5)
$Treat_i$	-0.93^{***}	-0.44^{*}	-0.58^{**}	-0.66^{**}	-0.73^{***}
	(0.31)	(0.27)	(0.27)	(0.27)	(0.27)
Log(Stage)	3.70^{***}	2.86^{***}	2.81^{***}	2.92^{***}	2.93^{***}
	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)
$Post_t$	-1.81^{***}	-6.40^{***}			
	(0.27)	(1.08)			
$Treat_i \times Post_t$	2.09^{***}	2.11^{***}	2.22^{***}	2.35^{***}	2.41^{***}
	(0.36)	(0.33)	(0.33)	(0.33)	(0.33)
$Treat_i \times$ Log(Stage)	-0.23^{*}	0.26^{**}	0.22^{*}	0.16	0.13
	(0.12)	(0.12)	(0.12)	(0.12)	(0.11)
$Post_t \times$ Log(Stage)	-0.15	0.56^{***}	0.56^{***}	0.24^{**}	0.23^{**}
	(0.11)	(0.11)	(0.11)	(0.11)	(0.11)
$Treat_i \times Post_t \times$ Log(Stage)	0.65^{***}	0.68^{***}	0.70^{***}	0.83^{***}	0.84^{***}
	(0.16)	(0.15)	(0.15)	(0.15)	(0.15)
Constant	11.91^{***}	55.41^{***}			
	(0.23)	(0.82)			
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	174,169	157,166	157,166	157,166	157,166
R^2	0.06	0.19	0.19	0.22	0.22
Adjusted R^2	0.06	0.19	0.19	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.
Sample restricted to contractors holding only one type of project.

19.4   Stage Quintile – One Type
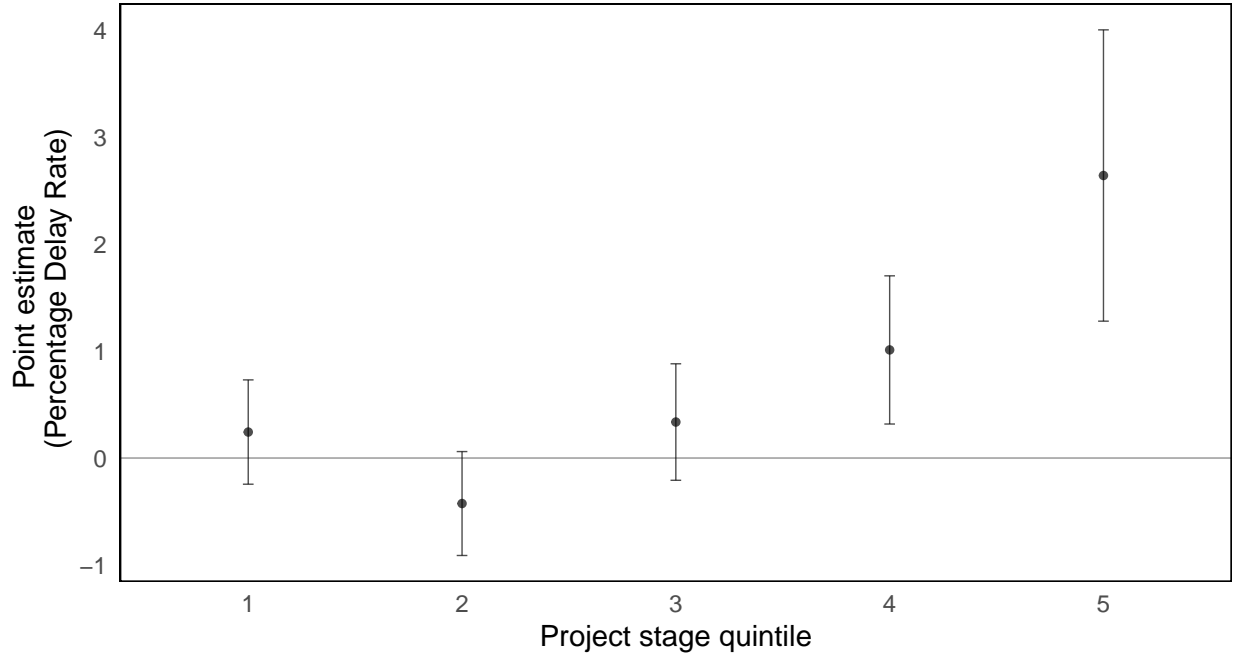
stage_quintile Min stage Max stage 1: 1 0.00 0.11 2: 2 0.11 0.27 3: 3 0.27 0.45 4: 4 0.45 0.66 5: 5 0.66 1.00

19.5   Aliter: Stage definition [Archived]

- t indicates the end of the quarter

$$Stage_{it} = \frac{ActionDate_t - StartDate_i}{Duration_{i,t}} \quad Stage_{it} = \frac{t - StartDate_i}{Duration_{i,t}}$$

20   Contract Financing [Archived]

$$CF_i = \begin{cases} 1, & \text{if project } i \text{ receives contract financing} \\ 0, & \text{otherwise} \end{cases}$$

$$
\begin{aligned}
PercentDelay_{it} = \quad & \beta_0 + \beta_1 Treat_i + \beta_2 Post_t + \beta_3(Treat_i \times Post_t) \\
+ \quad & \beta_4 CF_i + \beta_5(CF_i \times Post_t) + \beta_6(Treat_i \times Post_t \times CF_i) \\
+ \quad & X_i + (Post_t \times X_i) + \mu_t + \theta_{firm} + \lambda_{task} + \epsilon_{it}
\end{aligned}
$$

20.1   With Treat x CF term

20.2   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

20.3   Firm level financial Constraints (on/before June 2010)

- $CF = 1$ if contractor was receiving financing on any project prior on or before June 2010
- Jobs act was launched in Sept 2010

20.4 Plots

21 Receives Grants/Financial Assistance

- $CF = 1$ if receives_grants=='t'
- The variable "receives_grants" used to be called "receives financial assistance"

21.1 All projects [Archived]

21.2 Projects active on/before June 2010

Table 14: Financial constraints and QuickPay reform

	$PercentDelay_{it}$				
	(1)	(2)	(3)	(4)	(5)
$Treat_i$	-2.14^{***}	-1.08^{***}	-1.17^{***}	-0.67^{***}	-0.74^{***}
	(0.15)	(0.14)	(0.14)	(0.14)	(0.14)
$Post_t$	1.90^{***}	-17.47^{***}			
	(0.26)	(2.36)			
CF_i	13.75^{***}	6.69^{***}	6.18^{***}	4.62^{***}	4.67^{***}
	(1.00)	(0.58)	(0.58)	(0.59)	(0.59)
$Treat_i \times Post_t$	-0.24	1.97^{***}	2.05^{***}	2.19^{***}	2.17^{***}
	(0.33)	(0.41)	(0.41)	(0.42)	(0.42)
$Post_t \times CF_i$	-9.66^{***}	-7.56^{***}	-6.98^{***}	-5.33^{***}	-5.28^{***}
	(1.29)	(1.28)	(1.27)	(1.29)	(1.28)
$Treat_i \times CF_i$	-10.08^{***}	-2.88^{***}	-2.50^{***}	-2.83^{***}	-2.91^{***}
	(1.18)	(0.81)	(0.80)	(0.80)	(0.81)
$Treat_i \times Post_t \times CF_i$	8.20^{***}	5.50^{***}	5.12^{***}	5.21^{***}	5.42^{***}
	(1.62)	(1.83)	(1.82)	(1.84)	(1.83)
Constant	6.03^{***}	56.28^{***}			
	(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	75,119	64,292	64,292	64,292	64,292
R^2	0.02	0.23	0.23	0.27	0.28
Adjusted R^2	0.02	0.23	0.23	0.26	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.

21.3   Projects active on/before June 2010 – One type

Table 15: Financial constraints and QuickPay reform

	$PercentDelay_{it}$				
	(1)	(2)	(3)	(4)	(5)
$Treat_i$	-1.18^{***}	-0.33^{*}	-0.51^{***}	-0.27	-0.37^{*}
	(0.20)	(0.18)	(0.18)	(0.21)	(0.21)
$Post_t$	1.34^{***}	-13.60^{***}			
	(0.30)	(3.40)			
CF_i	0.74	2.34^{***}	2.06^{**}	1.61^{**}	1.63^{**}
	(0.90)	(0.83)	(0.82)	(0.80)	(0.80)
$Treat_i \times Post_t$	-0.50	1.97^{***}	2.15^{***}	2.56^{***}	2.56^{***}
	(0.38)	(0.48)	(0.48)	(0.50)	(0.50)
$Post_t \times CF_i$	-1.06	-2.06	-1.70	-0.43	-0.35
	(1.33)	(1.59)	(1.58)	(1.65)	(1.64)
$Treat_i \times CF_i$	2.78^{**}	1.29	1.44	0.38	0.42
	(1.19)	(1.06)	(1.05)	(1.04)	(1.05)
$Treat_i \times Post_t \times CF_i$	-0.06	0.47	0.33	0.63	0.78
	(1.77)	(2.18)	(2.17)	(2.23)	(2.22)
Constant	6.38^{***}	59.58^{***}			
	(0.15)	(1.10)			
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	51,465	43,519	43,519	43,519	43,519
R^2	0.002	0.18	0.19	0.23	0.24
Adjusted R^2	0.002	0.18	0.19	0.22	0.22

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 contractors holding only one type of project.

21.4   Firm level financial constraints (on/before June 2010) [Archived]

21.5   Plots [Archived]

22   Competition

22.1 Impact on bidding metrics

Table 16: Effect of Competition After QuickPay: Quickpay 2009-2011

	$NumberOfBids_{it}$	$InitialDuration_{it}$	$InitialBudget_{it}$
	(1)	(2)	(3)
$Treat_i$	0.88***	−7.27***	−15,055.20***
	(0.09)	(0.72)	(1,586.13)
$Treat_i \times Post_t$	0.27**	−3.38***	−29,491.30***
	(0.12)	(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	0.25	0.20	0.24
Adjusted R^2	0.24	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

Define

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

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

22.2.1 Subsample model [**Archived**]

For a subsample of competitive or noncompetitive projects:

$$PercentDelay_{it} = \beta_0 + \beta_1 Treat_i + \beta_2 SA_i + \beta_3 Post_t$$
$$+ \quad \beta_4(Treat_i \times Post_t \times SA_i) + \beta_5(Treat_i \times Post_t \times SB_i) + e_{it}$$

- According to our hypothesis, β_4 should be positive and significant for competitive projects, and insignificant for non-competitive projects.

- In the following regressions, we also control for the project's age. Project's age is defined as the number of quarters since it first showed up in the sample. We include the terciles of project's age as a control variable.

22.2.2 Subsample model II

Table 17: Effect of QuickPay on competitively awarded projects

	$PercentDelay_{it}$			
	(1)	(2)	(3)	(4)	(5)
$Treat_i$	-3.17^{***}	-2.67^{***}	-2.68^{***}	-1.53^{***}	-1.52^{***}
	(0.13)	(0.12)	(0.12)	(0.12)	(0.12)
SA_i	-2.22^{***}	1.22^{***}	2.16^{***}	2.55^{***}	2.52^{***}
	(0.17)	(0.16)	(0.18)	(0.18)	(0.17)
$Post_t$	1.10^{***}	-1.84^{***}			
	(0.16)	(0.16)			
$Treat_i \times Post_t$	0.41^{**}	0.40^{**}	0.42^{**}	0.60^{***}	0.62^{***}
	(0.19)	(0.18)	(0.18)	(0.18)	(0.18)
$Treat_i \times Post_t \times SA_i$	1.24^{***}	0.87^{***}	0.83^{***}	0.69^{***}	0.69^{***}
	(0.20)	(0.19)	(0.19)	(0.19)	(0.19)
Constant	6.79^{***}	12.63^{***}			
	(0.11)	(0.14)			
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	214,198	214,151	214,151	214,151	214,151
R^2	0.01	0.07	0.07	0.14	0.14
Adjusted R^2	0.01	0.07	0.07	0.13	0.14

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 18: Effect of QuickPay on non-competitively awarded projects

			$PercentDelay_{it}$		
	(1)	(2)	(3)	(4)	(5)
$Treat_i$	1.42***	1.35***	1.27***	−0.23	−0.09
	(0.30)	(0.28)	(0.29)	(0.30)	(0.30)
SA_i	−0.67***	2.20***	3.63***	3.05***	3.03***
	(0.23)	(0.22)	(0.27)	(0.28)	(0.28)
$Post_t$	−0.36	−3.00***			
	(0.24)	(0.25)			
$Treat_i \times Post_t$	2.35***	1.94***	1.86***	1.64***	1.55***
	(0.43)	(0.42)	(0.42)	(0.42)	(0.42)
$Treat_i \times Post_t \times SA_i$	−2.04***	−1.63***	−1.60***	−1.78***	−1.69***
	(0.44)	(0.41)	(0.41)	(0.41)	(0.41)
Constant	4.91***	10.96***			
	(0.19)	(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	45,696	45,687	45,687	45,687	45,687
R^2	0.01	0.06	0.07	0.14	0.14
Adjusted R^2	0.01	0.06	0.07	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 non-competed projects.

22.2.3 Subsample Model II: One type

Table 19: Effect of QuickPay on competitively awarded projects

	$PercentDelay_{it}$				
	(1)	(2)	(3)	(4)	(5)
$Treat_i$	-1.49^{***}	-0.98^{***}	-0.99^{***}	-0.26	-0.34^{**}
	(0.16)	(0.15)	(0.15)	(0.16)	(0.16)
SA_i	-2.00^{***}	1.68^{***}	2.93^{***}	2.96^{***}	2.89^{***}
	(0.20)	(0.19)	(0.21)	(0.21)	(0.21)
$Post_t$	1.11^{***}	-2.00^{***}			
	(0.18)	(0.18)			
$Treat_i \times Post_t$	0.30	0.13	0.21	0.22	0.24
	(0.24)	(0.23)	(0.23)	(0.22)	(0.22)
$Treat_i \times Post_t \times SA_i$	1.36^{***}	1.06^{***}	0.97^{***}	0.84^{***}	0.88^{***}
	(0.26)	(0.24)	(0.24)	(0.24)	(0.24)
Constant	6.36^{***}	12.41^{***}			
	(0.13)	(0.16)			
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	140,496	140,472	140,472	140,472	140,472
R^2	0.002	0.06	0.06	0.12	0.12
Adjusted R^2	0.002	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.
Sample restricted to fully competed projects.
Sample restricted to contractors holding only one type of project.

Table 20: Effect of QuickPay on non-competitively awarded projects

	$PercentDelay_{it}$				
	(1)	(2)	(3)	(4)	(5)
$Treat_i$	1.96***	1.91***	1.79***	−0.17	−0.02
	(0.37)	(0.35)	(0.36)	(0.39)	(0.39)
SA_i	−0.65**	2.39***	4.18***	3.65***	3.58***
	(0.26)	(0.25)	(0.31)	(0.32)	(0.32)
$Post_t$	−1.04***	−3.80***			
	(0.29)	(0.29)			
$Treat_i \times Post_t$	3.46***	2.78***	2.70***	2.43***	2.31***
	(0.53)	(0.51)	(0.51)	(0.52)	(0.52)
$Treat_i \times Post_t \times SA_i$	−2.32***	−1.73***	−1.68***	−2.43***	−2.29***
	(0.53)	(0.50)	(0.50)	(0.50)	(0.50)
Constant	5.16***	11.39***			
	(0.24)	(0.31)			
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	33,557	33,553	33,553	33,553	33,553
R^2	0.01	0.07	0.07	0.15	0.15
Adjusted R^2	0.01	0.07	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.

22.2.4 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:

- β_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.
- β_{11} is our coefficient of interest because it tells us how much of the difference is there due to "aggressive bidding" after the policy.

26

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

	$PercentDelay_{it}$					
	(1)	(2)	(3)	(4)	(5)	(6)
$Treat_i$	1.42***	1.42***	1.35***	1.26***	−0.40	−0.47
	(0.30)	(0.30)	(0.28)	(0.28)	(0.28)	(0.28)
SA_i	−0.67***	−0.67***	2.22***	3.27***	3.19***	3.15***
	(0.23)	(0.23)	(0.22)	(0.23)	(0.23)	(0.23)
$Competitive_i$	1.88***	1.88***	1.62***	1.58***	0.03	0.09
	(0.22)	(0.22)	(0.21)	(0.21)	(0.21)	(0.21)
$Post_t$	−0.36	−0.36	−3.02***			
	(0.24)	(0.24)	(0.24)			
$Treat_i \times Competitive_i$	−4.59***	−4.59***	−4.03***	−3.94***	−1.17***	−1.10***
	(0.33)	(0.33)	(0.31)	(0.31)	(0.31)	(0.31)
$Post_t \times Competitive_i$	1.46***	1.46***	1.18***	1.15***	0.03	−0.04
	(0.29)	(0.29)	(0.28)	(0.28)	(0.28)	(0.28)
$SA_i \times Competitive_i$	−1.54***	−1.54***	−1.01***	−1.03***	−0.65**	−0.64**
	(0.28)	(0.28)	(0.26)	(0.26)	(0.26)	(0.26)
$Treat_i \times Post_t$	2.35***	2.35***	1.94***	1.92***	1.43***	1.43***
	(0.43)	(0.43)	(0.42)	(0.42)	(0.41)	(0.42)
$Treat_i \times Post_t \times Competitive_i$	−1.94***	−1.94***	−1.54***	−1.50***	−0.81*	−0.79*
	(0.48)	(0.48)	(0.45)	(0.46)	(0.45)	(0.45)
$Treat_i \times Post_t \times SA_i$	−2.04***	−2.04***	−1.62***	−1.63***	−1.50***	−1.54***
	(0.44)	(0.44)	(0.41)	(0.41)	(0.40)	(0.40)
$Treat_i \times Post_t \times SA_i \times Competitive_i$	3.27***	3.27***	2.49***	2.46***	2.19***	2.23***
	(0.48)	(0.48)	(0.45)	(0.45)	(0.45)	(0.45)
Constant	4.91***	4.91***	11.00***			
	(0.19)	(0.19)	(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	259,894	259,894	259,838	259,838	259,838	259,838
R^2	0.01	0.01	0.07	0.07	0.13	0.14
Adjusted R^2	0.01	0.01	0.07	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.

Table 22: Effect of Competition After QuickPay: Quickpay 2009-2011

	$PercentDelay_{it}$					
	(1)	(2)	(3)	(4)	(5)	(6)
$Treat_i$	1.96***	1.96***	1.91***	1.80***	−0.32	−0.31
	(0.37)	(0.37)	(0.35)	(0.35)	(0.36)	(0.36)
SA_i	−0.65**	−0.65**	2.47***	3.85***	3.60***	3.54***
	(0.26)	(0.26)	(0.25)	(0.26)	(0.26)	(0.26)
$Competitive_i$	1.19***	1.19***	0.82***	0.77***	−0.86***	−0.76***
	(0.27)	(0.27)	(0.26)	(0.26)	(0.27)	(0.27)
$Post_t$	−1.04***	−1.04***	−3.88***			
	(0.29)	(0.29)	(0.28)			
$Treat_i \times Competitive_i$	−3.45***	−3.45***	−2.89***	−2.79***	0.04	−0.05
	(0.41)	(0.41)	(0.38)	(0.38)	(0.39)	(0.39)
$Post_t \times Competitive_i$	2.15***	2.15***	1.90***	1.83***	0.74**	0.64*
	(0.34)	(0.34)	(0.33)	(0.33)	(0.33)	(0.33)
$SA_i \times Competitive_i$	−1.34***	−1.34***	−0.82***	−0.83***	−0.66**	−0.68**
	(0.32)	(0.32)	(0.30)	(0.31)	(0.30)	(0.30)
$Treat_i \times Post_t$	3.46***	3.46***	2.76***	2.72***	2.09***	2.00***
	(0.53)	(0.53)	(0.51)	(0.51)	(0.51)	(0.51)
$Treat_i \times Post_t \times Competitive_i$	−3.16***	−3.16***	−2.63***	−2.51***	−1.86***	−1.76***
	(0.58)	(0.58)	(0.56)	(0.56)	(0.55)	(0.56)
$Treat_i \times Post_t \times SA_i$	−2.32***	−2.32***	−1.71***	−1.70***	−1.85***	−1.86***
	(0.53)	(0.53)	(0.49)	(0.50)	(0.49)	(0.49)
$Treat_i \times Post_t \times SA_i \times Competitive_i$	3.68***	3.68***	2.77***	2.67***	2.69***	2.75***
	(0.59)	(0.59)	(0.55)	(0.55)	(0.55)	(0.55)
Constant	5.16***	5.16***	11.56***			
	(0.24)	(0.24)	(0.24)			
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	174,053	174,053	174,025	174,025	174,025	174,025
R^2	0.004	0.004	0.06	0.06	0.12	0.12
Adjusted R^2	0.004	0.004	0.06	0.06	0.11	0.11

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 contractors holding only one type of project.