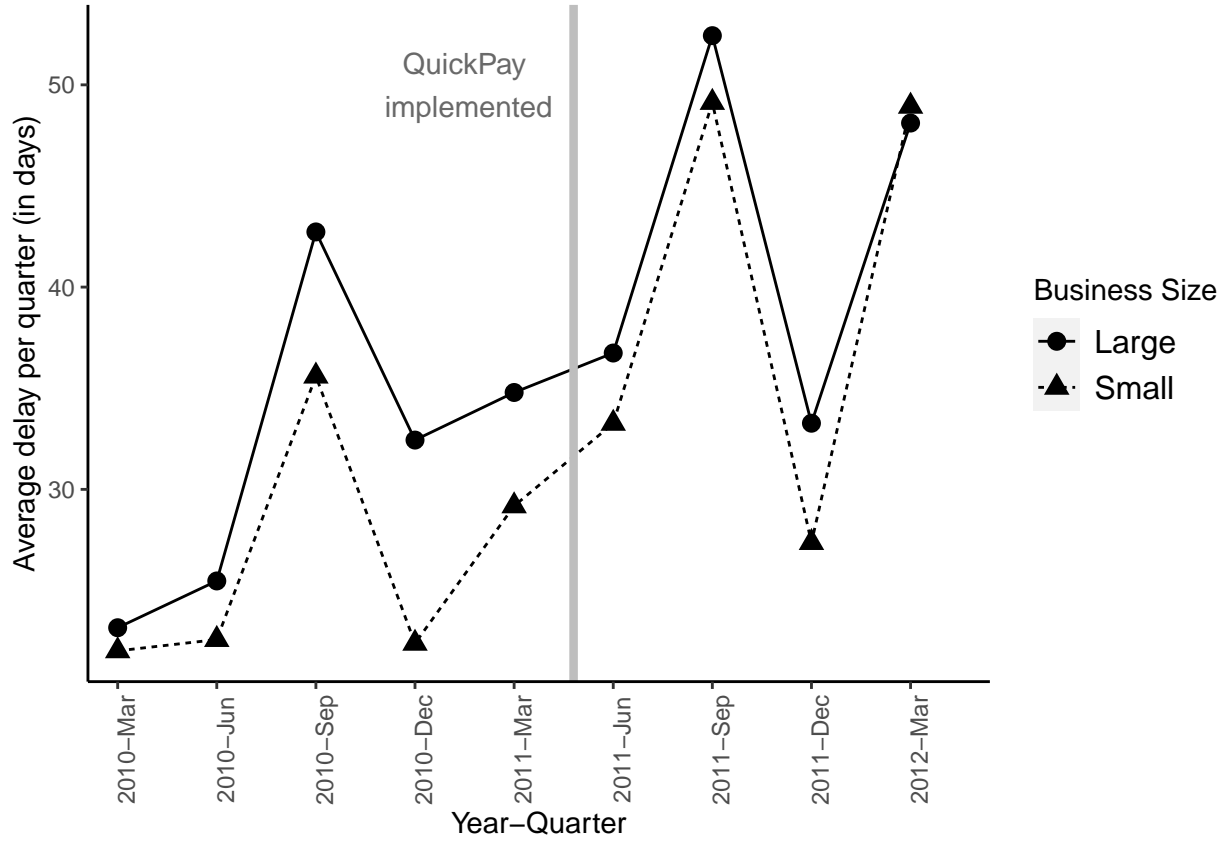


# First Implementation of QuickPay (2009-2012)

Mar 15, 2021

## 1 Delays over Time



## 2 Notation

- Project  $i$ , Year-Quarter  $t$
- $X_i$  denotes project level controls: initial duration, initial budget, number of offers received
- $\mu_t, \theta_{firm}, \lambda_{task}$ : Year-Quarter, Firm, and Product/Service code Fixed effects
- All continuous variables are winsorized at the 5% level

$$Treat_i = \begin{cases} 1, & \text{if project } i \text{ is a small business} \\ 0, & \text{otherwise} \end{cases}$$

$$Post_t = \begin{cases} 1, & \text{if year-quarter } t > \text{April 27, 2011} \\ 0, & \text{otherwise} \end{cases}$$

### 3 Parallel Trends Test

Let  $Time$  denote  $q$ -th quarter since the beginning of time horizon. For  $Post_t = 0$ , we run the following regression:

$$Delay_{it} = \alpha + \beta_0 Treat_i + \beta_1 (Treat_i \times Time) + \beta_2 X_i + \mu_t + \theta_{firm} + \lambda_{task} + \epsilon_{it}$$

The coefficient of interest is  $\beta_1$ . If this is significant, we would find evidence of a linear time trend before quickpay implementation – violating the parallel trends assumption.

Table 1: Linear Time Trend Before QuickPay

<i>Dependent variable:</i>	
<i>Delay<sub>it</sub> (in days)</i>	
<i>Treat<sub>i</sub></i>	−1.10 (2.98)
<i>Treat<sub>i</sub> × Time</i>	−0.01 (0.49)
Fixed effects	Firm, Task, and Year-Quarter
Controls	Budget, Duration, Bids
Observations	74,677
R <sup>2</sup>	0.14
Adjusted R <sup>2</sup>	0.03

*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.

### 4 Baseline Regressions

$$Delay_{it} = \alpha + \beta_0 Treat_i + \beta_1 Post_t + \beta_2 (Treat_i \times Post_t) + \epsilon_{it}$$

$$+ \alpha + \beta_0 Treat_i + \beta_1 Post_t + \beta_2 (Treat_i \times Post_t) + X_i + (Post_t \times X_i) + \mu_t + \theta_{firm} + \lambda_{task} + \epsilon_{it}$$

Table 2: Quickpay 2009-2011

	<i>Delay<sub>it</sub></i> (in days)		
	(1)	(2)	(3)
<i>Treat<sub>i</sub></i>	-6.19*** (0.50)	-3.58** (1.55)	-3.09* (1.59)
<i>Post<sub>t</sub></i>	13.04*** (0.52)		
<i>Treat<sub>i</sub> × Post<sub>t</sub></i>	3.35*** (0.73)	6.88*** (0.91)	6.83*** (0.92)
Constant	33.00*** (0.36)		
Year-Quarter Fixed Effects	No	Yes	Yes
Firm Fixed Effects	No	Yes	Yes
Task Fixed Effects	No	No	Yes
Duration, Budget, Bids	No	Yes	Yes
<i>Post<sub>t</sub> × (Duration, Budget, Bids)</i>	No	Yes	Yes
Observations	173,900	155,638	155,638
R <sup>2</sup>	0.01	0.11	0.12
Adjusted R <sup>2</sup>	0.01	0.05	0.05

*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.

## 5 Contract Financing

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

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

Table 3: Effect of Contract Financing: Quickpay 2009-2011

	<i>Delay<sub>it</sub></i> (in days)		
	(1)	(2)	(3)
<i>Treat<sub>i</sub></i>	-6.12*** (0.50)	-3.37** (1.55)	-2.89* (1.59)
<i>Post<sub>t</sub></i>	13.00*** (0.57)		
<i>Treat<sub>i</sub> × Post<sub>t</sub></i>	1.53** (0.78)	5.89*** (1.00)	5.90*** (1.01)
<i>CF<sub>i</sub></i>	-3.97*** (0.61)	-4.68*** (0.81)	-4.76*** (0.82)
<i>Post<sub>t</sub> × CF<sub>i</sub></i>	0.72 (1.13)	-0.20 (1.31)	-0.37 (1.32)
<i>Post<sub>t</sub> × CF<sub>i</sub> × Treat<sub>i</sub></i>	9.24*** (1.38)	3.94** (1.65)	3.70** (1.67)
Constant	33.64*** (0.38)		
Year-Quarter Fixed Effects	No	Yes	Yes
Firm Fixed Effects	No	Yes	Yes
Task Fixed Effects	No	No	Yes
Duration, Budget, Bids	No	Yes	Yes
<i>Post<sub>t</sub> × (Duration, Budget, Bids)</i>	No	Yes	Yes
Observations	173,900	155,638	155,638
R <sup>2</sup>	0.01	0.11	0.12
Adjusted R <sup>2</sup>	0.01	0.05	0.05

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.

## 6 Receives Financial Aid

$$FinancialAid = \begin{cases} 1, & \text{if firm receives grants or is a c8A participant} \\ 0, & \text{otherwise} \end{cases}$$

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

Table 4: Effect of Grants or C8A Participant: Quickpay 2009-2011

	<i>Delay<sub>it</sub></i> (in days)		
	(1)	(2)	(3)
<i>Treat<sub>i</sub></i>	-6.96*** (0.51)	-3.15** (1.55)	-2.63* (1.59)
<i>Post<sub>t</sub></i>	12.89*** (0.53)		
<i>Treat<sub>i</sub> × Post<sub>t</sub></i>	3.43*** (0.77)	5.65*** (0.98)	5.57*** (0.99)
<i>FinancialAid</i>	5.72*** (0.70)	1.36 (1.39)	0.45 (1.42)
<i>Post<sub>t</sub> × FinancialAid</i>	1.94 (1.61)	4.06* (2.10)	3.93* (2.12)
<i>Post<sub>t</sub> × FinancialAid × Treat<sub>i</sub></i>	-1.80 (1.73)	2.51 (2.46)	2.75 (2.50)
Constant	32.42*** (0.37)		
Year-Quarter Fixed Effects	No	Yes	Yes
Firm Fixed Effects	No	Yes	Yes
Task Fixed Effects	No	No	Yes
Duration, Budget, Bids	No	Yes	Yes
<i>Post<sub>t</sub> × (Duration, Budget, Bids)</i>	No	Yes	Yes
Observations	173,900	155,638	155,638
R <sup>2</sup>	0.01	0.11	0.12
Adjusted R <sup>2</sup>	0.01	0.05	0.05

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.

## 7 Receives Contracts and Financial Aid

$$CFA = \begin{cases} 1, & \text{if firm receives "contracts and grants"} \\ & \text{or grants or is a c8A participant} \\ 0, & \text{otherwise} \end{cases}$$

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

Table 5: Effect of Contracts, Grants, or C8A Participant: Quickpay 2009-2011

	<i>Delay<sub>it</sub></i> (in days)		
	(1)	(2)	(3)
<i>Treat<sub>i</sub></i>	-6.68*** (0.51)	-3.19** (1.55)	-2.71* (1.59)
<i>Post<sub>t</sub></i>	12.17*** (0.55)		
<i>Treat<sub>i</sub> × Post<sub>t</sub></i>	4.19*** (0.79)	5.71*** (1.02)	5.84*** (1.03)
<i>CFA</i>	4.90*** (0.62)	-5.44*** (1.78)	-5.92*** (1.80)
<i>Post<sub>t</sub> × CFA</i>	3.91*** (1.21)	5.00*** (1.60)	5.83*** (1.64)
<i>Post<sub>t</sub> × CFA × Treat<sub>i</sub></i>	-4.04*** (1.38)	2.60 (2.12)	1.61 (2.16)
Constant	32.18*** (0.37)		
Year-Quarter Fixed Effects	No	Yes	Yes
Firm Fixed Effects	No	Yes	Yes
Task Fixed Effects	No	No	Yes
Duration, Budget, Bids	No	Yes	Yes
<i>Post<sub>t</sub> × (Duration, Budget, Bids)</i>	No	Yes	Yes
Observations	173,900	155,638	155,638
R <sup>2</sup>	0.01	0.11	0.12
Adjusted R <sup>2</sup>	0.01	0.05	0.05

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.

## 8 Firm's rank order

- Consider a project  $i$  of firm  $f$  in quarter  $t$ .
- Let  $\Pi_{f,2010}$  denote all projects of firm  $f$  in Fiscal Year 2010.
- Define  $\rho_f = \sum_{i \in \Pi_{f,2010}} (Treat_i \times FAO_{if}) / Sales_{f,2010}$ .
- $\rho_f$  is the fraction of revenue a firm earned from small government projects in Fiscal Year 2010.
- Let  $Rank_f = r(\rho_f) / N$  where  $r(\rho_f)$  is the rank statistic of  $\rho_f$  and  $N$  = number of firms. For example,  $r(\rho_f) = 1$  if  $\rho_f = \min(\rho_1, \rho_2, \dots, \rho_N)$ .
- Put simply,  $Rank_f$  is a firm's rank order based on the fraction of revenue it earned from small government projects in FY 2010.

### 8.1 Portfolio Effects: Discrete

- See Jie's notes for details.
- Let  $Rank_f^{(k)}$  be an indicator for firm being in the  $k$ -th tercile of  $Rank$ . Define:

- $Medium_i = Treat_i * Rank_f^{(2)}$
- $High_i = Treat_i * Rank_f^{(3)}$

$$Delay_{it} = \beta_0 + \beta_1 Treat_i + \beta_2 Medium_i + \beta_3 High_i + \beta_4 Post_t + \beta_5 (Treat_i \times Post_t) + \beta_6 (Medium_i \times Post_t) + \beta_7 (High_i \times Post_t) + \epsilon_{it}$$

Table 6: Discrete Portfolio Effects: Quickpay 2009-2011

	<i>Delay<sub>it</sub></i> (in days)				
	(1)	(2)	(3)	(4)	(5)
<i>Treat<sub>i</sub></i>	2.85** (1.37)	−0.51 (1.54)	−0.37 (1.55)	0.38 (1.64)	−6.90 (4.47)
<i>Medium<sub>i</sub></i>	−2.92** (1.40)	−1.11 (1.56)	−1.32 (1.57)	−0.60 (1.63)	12.24** (6.17)
<i>High<sub>i</sub></i>	−3.26** (1.31)	0.09 (1.49)	−0.07 (1.50)	1.04 (1.58)	−3.11 (6.04)
<i>Post<sub>t</sub></i>	15.67*** (1.05)	6.87*** (1.83)			
<i>Treat<sub>i</sub> × Post<sub>t</sub></i>	−2.42 (2.04)	2.15 (2.36)	1.26 (2.39)	1.32 (2.43)	7.32** (3.16)
<i>Treat<sub>i</sub> × Post<sub>t</sub> × Medium<sub>i</sub></i>	4.28** (2.09)	1.54 (2.38)	2.31 (2.41)	2.45 (2.45)	0.10 (3.22)
<i>Treat<sub>i</sub> × Post<sub>t</sub> × High<sub>i</sub></i>	6.76*** (1.97)	3.46 (2.28)	4.16* (2.31)	3.58 (2.35)	−1.27 (3.07)
Constant	27.08*** (0.71)	46.30*** (1.16)			
Duration, Budget, Bids	No	Yes	Yes	Yes	Yes
<i>Post<sub>t</sub> × (Duration, Budget, Bids)</i>	No	Yes	Yes	Yes	Yes
Year-Quarter Fixed Effects	No	No	Yes	Yes	Yes
Task Fixed Effects	No	No	No	Yes	Yes
Firm Fixed Effects	No	No	No	No	Yes
Observations	71,753	63,216	63,216	63,216	63,216
R <sup>2</sup>	0.01	0.02	0.03	0.06	0.12
Adjusted R <sup>2</sup>	0.01	0.02	0.03	0.04	0.04

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.

## 8.2 Portfolio Effects: Continuous

- See Jie's notes for details.
- Define  $\theta_i = Treat_i * Rank_f$

$$Delay_{it} = \beta_0 + \beta_1 Treat_i + \beta_2 \theta_i + \beta_3 \theta_i^2 + \beta_4 Post_t + \beta_5 (Treat_i \times Post_t) + \beta_6 (\theta_i \times Post_t) + \beta_7 (\theta_i^2 \times Post_t) + \epsilon_{it}$$

Table 7: Continuous Portfolio Effects: Quickpay 2009-2011

	<i>Delay<sub>it</sub></i> (in days)				
	(1)	(2)	(3)	(4)	(5)
<i>Treat<sub>i</sub></i>	-1.44 (2.52)	-4.54 (2.79)	-4.12 (2.80)	-2.25 (2.88)	-19.01** (8.36)
<i>θ<sub>i</sub></i>	15.63* (8.14)	12.24 (8.85)	11.06 (8.89)	8.21 (9.06)	92.44*** (34.90)
<i>θ<sub>i</sub><sup>2</sup></i>	-16.17** (6.56)	-8.85 (7.11)	-8.10 (7.15)	-5.07 (7.30)	-88.48*** (31.25)
<i>Post<sub>t</sub></i>	15.67*** (1.05)	6.85*** (1.83)			
<i>Treat<sub>i</sub> × Post<sub>t</sub></i>	-3.83 (3.74)	2.64 (4.31)	1.05 (4.38)	0.34 (4.45)	9.39 (5.79)
<i>θ<sub>i</sub> × Post<sub>t</sub></i>	4.16 (12.19)	-3.40 (13.75)	-0.02 (13.98)	3.49 (14.13)	-4.73 (17.63)
<i>θ<sub>i</sub><sup>2</sup> × Post<sub>t</sub></i>	4.91 (9.87)	6.92 (11.09)	4.92 (11.27)	1.51 (11.38)	1.46 (13.78)
Constant	27.08*** (0.71)	46.30*** (1.16)			
Duration, Budget, Bids	No	Yes	Yes	Yes	Yes
<i>Post<sub>t</sub> × (Duration, Budget, Bids)</i>	No	Yes	Yes	Yes	Yes
Year-Quarter Fixed Effects	No	No	Yes	Yes	Yes
Task Fixed Effects	No	No	No	Yes	Yes
Firm Fixed Effects	No	No	No	No	Yes
Observations	71,753	63,216	63,216	63,216	63,216
R <sup>2</sup>	0.01	0.02	0.03	0.06	0.12
Adjusted R <sup>2</sup>	0.01	0.02	0.03	0.04	0.04

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.

## 9 Firm's rank order [Vibhuti]

### 9.1 Continuous model

- We have  $\theta_{if} = Treat_i * Rank_f$

$$Delay_{ift} = \beta_0 + \beta_1 \theta_{if} + \beta_2 (\theta_{if} \times Post_t) + \beta_3 Post_t + \beta_4 Rank_f + \epsilon_{ift}$$



- Consider a firm with  $Rank_f = k$ . Then, we have
  - Large + Before =  $\beta_0 + \beta_4 k$
  - Large + After =  $\beta_0 + \beta_3 + \beta_4 k$
  - Small + Before =  $\beta_0 + \beta_1 k + \beta_4 k$
  - Small + After =  $\beta_0 + \beta_1 k + \beta_2 k + \beta_3 + \beta_4 k$
  - Treatment effect:  $\beta_2 k$

**Interpretation:**

- Treatment effect is  $\beta_2 k$  for a firm that received a proportion  $k$  of its revenue from small projects.
- In other words, for a firm earning  $k$  proportion of revenue from small projects, Quickpay increased delays on small projects by  $\beta_3 k$  days.

**Assumption:** Parallel trends between large and small projects of the same firm.

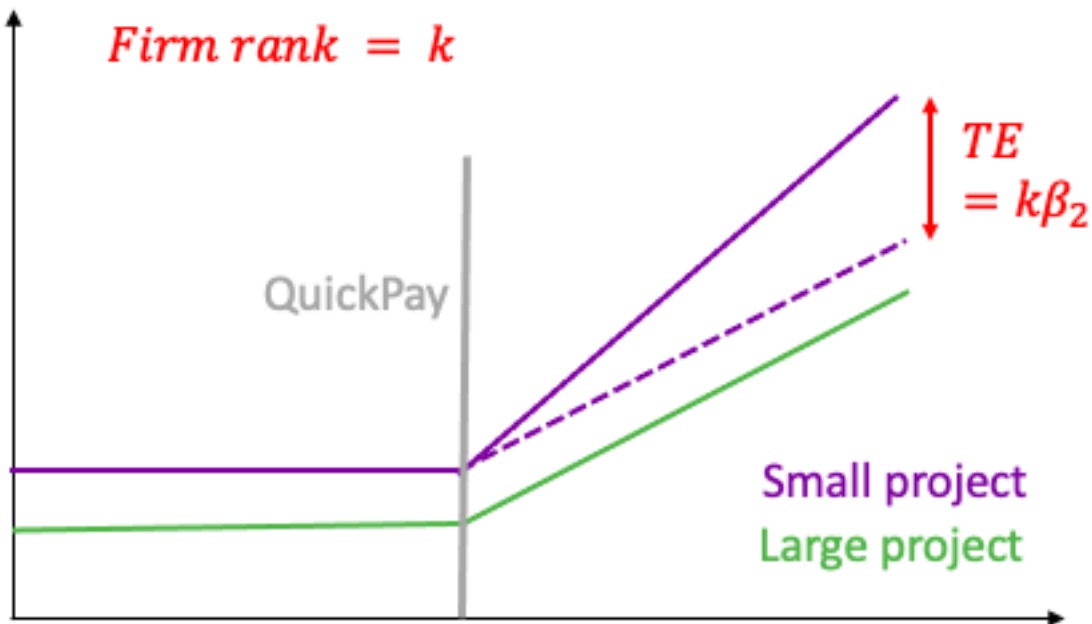


Table 8: Continuous Portfolio Effects: Quickpay 2009-2011

	<i>Delay<sub>it</sub></i> (in days)				
	(1)	(2)	(3)	(4)	(5)
$\theta_{if}$	-4.81* (2.60)	-6.34** (2.63)	-5.86** (2.64)	-3.31 (2.66)	-4.43 (3.59)
$Rank_f$	4.98* (2.93)	7.22** (2.95)	6.53** (2.97)	5.66* (2.99)	
$Post_t$	14.74*** (0.96)	6.92*** (1.68)			
$\theta_{if} \times Post_t$	4.91*** (1.40)	5.66*** (1.54)	5.60*** (1.56)	5.24*** (1.58)	6.23*** (1.75)
Constant	26.88*** (0.77)	44.82*** (1.14)			
Duration, Budget, Bids	No	Yes	Yes	Yes	Yes
$Post_t \times (\text{Duration, Budget, Bids})$	No	Yes	Yes	Yes	Yes
Year-Quarter Fixed Effects	No	No	Yes	Yes	Yes
Task Fixed Effects	No	No	No	Yes	Yes
Firm Fixed Effects	No	No	No	No	Yes
Observations	71,753	63,216	63,216	63,216	63,216
R <sup>2</sup>	0.01	0.02	0.03	0.06	0.12
Adjusted R <sup>2</sup>	0.01	0.02	0.03	0.04	0.04

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.

## 9.2 Continuous Quadratic Model

- We have  $\theta_{if} = Treat_i * Rank_f$

$$Delay_{ift} = \beta_0 + \beta_1\theta_{if} + \beta_2\theta_{if}^2 + \beta_3(\theta_{if} \times Post_t) + \beta_4(\theta_{if}^2 \times Post_t) + \beta_5Post_t + \beta_6Rank_f + \epsilon_{ift}$$

- Consider a firm with  $Rank_f = k$ . Then, we have
  - Large + Before =  $\beta_0 + \beta_6k$
  - Large + After =  $\beta_0 + \beta_5 + \beta_6k$
  - Small + Before =  $\beta_0 + \beta_1k + \beta_2k^2 + \beta_6k$
  - Small + After =  $\beta_0 + \beta_1k + \beta_2k^2 + \beta_3k + \beta_4k^2 + \beta_5 + \beta_6k$
  - Treatment effect:  $\beta_3k + \beta_4k^2$

**Interpretation:** \* One unit increase in rank  $k$  increases treatment effect by  $\beta_3 + 2k\beta_4$ .

**Assumption:** Parallel trends between large and small projects of the same firm.

Table 9: Continuous Portfolio Effects: Quickpay 2009-2011

	<i>Delay<sub>it</sub></i> (in days)				
	(1)	(2)	(3)	(4)	(5)
$\theta_{if}$	8.16* (4.51)	-3.96 (4.98)	-3.59 (5.02)	-0.81 (5.21)	26.72 (18.44)
$\theta_{if}^2$	-15.84*** (4.56)	-2.95 (5.11)	-2.68 (5.15)	-3.17 (5.38)	-38.43* (21.55)
$Rank_f$	7.00** (3.05)	7.62** (3.06)	6.76** (3.08)	6.19** (3.10)	
$Post_t$	15.33*** (1.01)	7.03*** (1.78)			
$\theta_{if} \times Post_t$	-6.42 (6.39)	4.03 (7.32)	2.96 (7.43)	4.50 (7.52)	20.71** (8.88)
$\theta_{if}^2 \times Post_t$	12.31* (6.73)	1.79 (7.75)	2.87 (7.87)	0.81 (7.96)	-15.74* (9.43)
Constant	25.79*** (0.84)	44.57*** (1.23)			
Duration, Budget, Bids	No	Yes	Yes	Yes	Yes
$Post_t \times$ (Duration, Budget, Bids)	No	Yes	Yes	Yes	Yes
Year-Quarter Fixed Effects	No	No	Yes	Yes	Yes
Task Fixed Effects	No	No	No	Yes	Yes
Firm Fixed Effects	No	No	No	No	Yes
Observations	71,753	63,216	63,216	63,216	63,216
R <sup>2</sup>	0.01	0.02	0.03	0.06	0.12
Adjusted R <sup>2</sup>	0.01	0.02	0.03	0.04	0.04

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.

## 10 Firm level analysis:

- Treatment is now defined at the firm level.
- There is variation in the portfolio of small projects held by each firm
- We compare what happens to delays of a *firm* holding too many versus too few small projects once quickpay was implemented.
- Drawback: We cannot distinguish the effects for a given firm's large and small projects because of multicollinearity.

### 10.1 Proxy 1: Revenue from small projects

- We defined  $\rho_f$  as the share of revenue a firm received from small projects in fiscal year 2010.
- The numerator of  $\rho_f$  is the sum of all federal obligations from small projects of a firm in fiscal year 2010. Because obligations can be negative, the sum can be zero or negative even if the firm held substantial number of small projects.

- In the previous section, we ranked the values of  $\rho_f$ . But this makes interpretation somewhat tricky. The minimum rank for each firm is now  $1/N$  and it is never zero. What does a unit increase in Rank mean?
- An alternative can be to simply scale the values of  $\rho_f$  to be between 0 and 1. That is, for a firm A, we define  $Share_A = (\rho_A - \min(\rho_f)) / (\max(\rho_f) - \min(\rho_f))$ .
  - Suppose  $\rho_A = -1, \max(\rho_f) = 3, \min(\rho_f) = -2$ . Then,  $Share_A = (-1 - (-2)) / (3 - (-2)) = 1/5$ .
  - The max share will be 1 and min share will be 0.
- Setting aside measurement issues described earlier, we have:
  - $Share_f = 0$  represents a firm getting no revenue from small projects.
  - $Share_f = 1$  represents a firm getting its entire revenue from small projects.

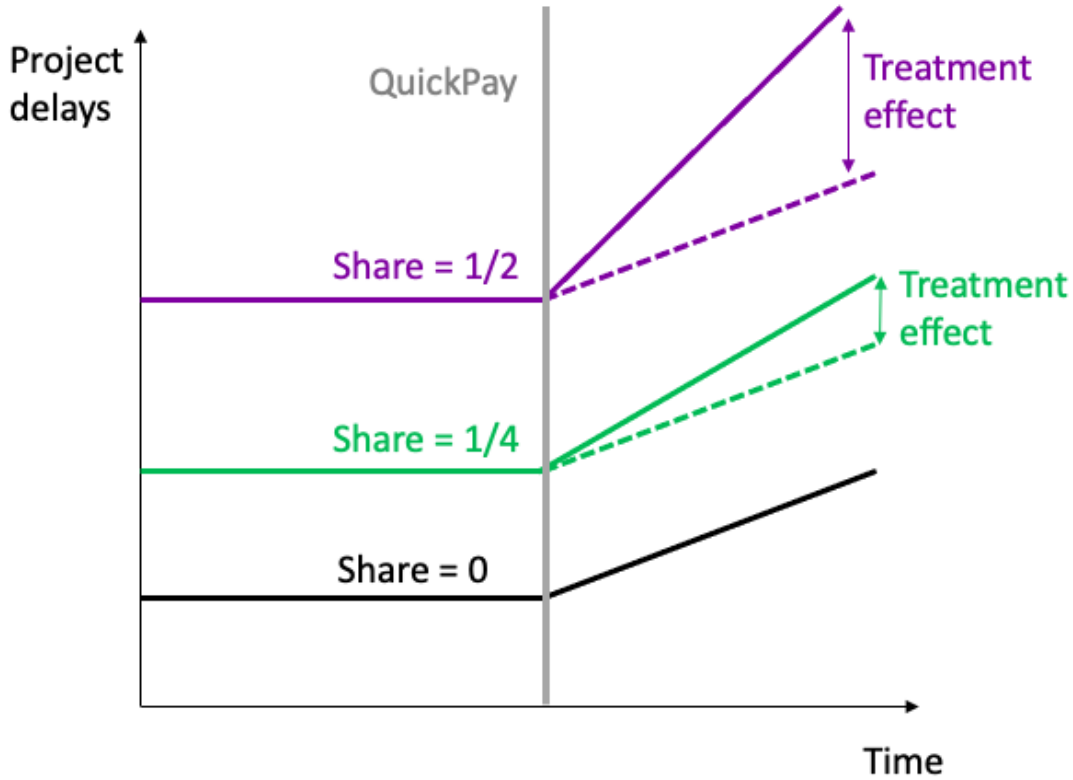
### 10.1.1 Continuous effect

$$Delay_{ift} = \beta_0 + \beta_1 Share_f + \beta_2 Post_t + \beta_3 (Share_f \times Post_t) + \epsilon_{ift}$$

- Control is firm with  $Share_f = 0$ :
  - Before =  $\beta_0$
  - After =  $\beta_0 + \beta_2$
- Treated firm with  $Share_f = j$ :
  - Before =  $\beta_0 + \beta_1 j$
  - After =  $\beta_0 + \beta_2 + \beta_1 j + \beta_3 j$
- Treatment effect:  $\beta_3 j$

**Interpretation:** For a firm that received a proportion  $j$  of its revenue from small projects, delays after quickpay increased by  $\beta_3 j$  days relative to a firm that received no revenue from small projects.

**Assumption:** Parallel trends for overall delays of treated and control firms.



- For better interpretation, in the regressions below,  $Share_f$  is scaled to be between 0 and 100.

- So we can interpret a one percentage point increase in  $Share_f$

Table 10: Discrete Portfolio Effects: Quickpay 2009-2011

	<i>Delay<sub>it</sub></i> (in days)				
	(1)	(2)	(3)	(4)	(5)
<i>Share<sub>f</sub></i>	−0.77*** (0.24)	−0.85** (0.37)	−0.89** (0.38)	−0.64** (0.30)	
<i>Post<sub>t</sub></i>	16.30*** (0.82)	8.88*** (1.53)			
<i>Share<sub>f</sub> × Post<sub>t</sub></i>	0.58** (0.27)	0.71** (0.33)	0.72** (0.35)	0.57* (0.31)	0.47 (0.34)
Constant	28.84*** (0.65)	47.33*** (1.14)			
Duration, Budget, Bids	No	Yes	Yes	Yes	Yes
<i>Post<sub>t</sub> × (Duration, Budget, Bids)</i>	No	Yes	Yes	Yes	Yes
Year-Quarter Fixed Effects	No	No	Yes	Yes	Yes
Task Fixed Effects	No	No	No	Yes	Yes
Firm Fixed Effects	No	No	No	No	Yes
Observations	71,753	63,216	63,216	63,216	63,216
R <sup>2</sup>	0.01	0.02	0.03	0.06	0.12
Adjusted R <sup>2</sup>	0.01	0.02	0.03	0.04	0.04

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.

### 10.1.2 Discrete effect

- Let  $Share_f^{(k)}$  denote k-th tercile of  $Share_f$ .

$$Delay_{ift} = \beta_0 + \beta_1 Share_f^{(2)} + \beta_2 Share_f^{(3)} + \beta_3 Post_t + \beta_4 (Share_f^{(2)} \times Post_t) + \beta_5 (Share_f^{(3)} \times Post_t) + \epsilon_{ift}$$

- Control is firms in first tercile:
  - Before =  $\beta_0$
  - After =  $\beta_0 + \beta_3$
- Treated firms in second tercile:
  - Before =  $\beta_0 + \beta_1$
  - After =  $\beta_0 + \beta_1 + \beta_3 + \beta_4$
  - Treatment effect:  $\beta_4$
- Treated firms in third tercile:
  - Before =  $\beta_0 + \beta_2$
  - After =  $\beta_0 + \beta_2 + \beta_3 + \beta_5$
  - Treatment effect:  $\beta_5$

**Interpretation:** For a firm in medium range of revenue from small projects, delays after quickpay increased by  $\beta_4$  days relative to a firm that received low revenue from small projects.

**Assumption:** Parallel trends for overall delays of treated and control firms.

Table 11: Discrete Portfolio Effects: Quickpay 2009-2011

	<i>Delay<sub>it</sub></i> (in days)				
	(1)	(2)	(3)	(4)	(5)
$Share_f^{(2)}$	-1.21 (0.97)	-1.53 (1.05)	-1.67 (1.06)	-0.45 (1.11)	
$Share_f^{(3)}$	-1.07 (0.85)	0.003 (0.91)	-0.09 (0.92)	1.59 (0.97)	
$Post_t$	14.68*** (0.93)	7.25*** (1.65)			
$Share_f^{(2)} \times Post_t$	3.09** (1.45)	3.68** (1.61)	3.69** (1.63)	3.82** (1.65)	6.00*** (1.93)
$Share_f^{(3)} \times Post_t$	5.24*** (1.29)	5.30*** (1.43)	5.33*** (1.45)	4.88*** (1.47)	4.79*** (1.65)
Constant	27.93*** (0.62)	46.06*** (1.05)			
Duration, Budget, Bids	No	Yes	Yes	Yes	Yes
$Post_t \times$ (Duration, Budget, Bids)	No	Yes	Yes	Yes	Yes
Year-Quarter Fixed Effects	No	No	Yes	Yes	Yes
Task Fixed Effects	No	No	No	Yes	Yes
Firm Fixed Effects	No	No	No	No	Yes
Observations	71,753	63,216	63,216	63,216	63,216
R <sup>2</sup>	0.01	0.02	0.03	0.06	0.12
Adjusted R <sup>2</sup>	0.01	0.02	0.03	0.04	0.04

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.

## 10.2 Proxy 2: Ratio of small projects

- For firm  $f$ , define  $Share_f = \frac{\text{Num of small projects in FY 2010}}{\text{Total num of projects in FY 2010}}$ .
- Same analysis as before but advantages:
  - Sample size: only firms excluded are new entrants to government projects.
  - No measurement problem.  $Share_f$  will be zero for firms with no small projects, and one for firms with only small projects.
  - We can control for differences across firms through fixed effects. This will be less of an issue here because we will have enough observations.