Card-Sales Response to Merchant Contactless Payment Acceptance

David Bounie and **Youssouf Camara**

i3, CNRS, Telecom Paris, Institut Polytechnique de Paris

ESCoE Conference on Economic Measurement 2020

Outline

Background

- Disruptive innovations in digital payments are happening in a large number of countries around the world, especially in Asia and Europe
- Accepting a new payment technology is however risky and not necessarily profitable for businesses
- But accepting a new payment technology may also allow merchants to attract new customers and to increase payments from loyal customers

Background

- Disruptive innovations in digital payments are happening in a large number of countries around the world, especially in Asia and Europe
- Accepting a new payment technology is however risky and not necessarily profitable for businesses
- But accepting a new payment technology may also allow merchants to attract new customers and to increase payments from loyal customers
- Given the increasing number of innovations in payments, a natural question arises: Does accepting a new payment technology allow merchants increasing their business sales?

Background: French market

In 2012, the French major banks massively launched contactless technology

- In 2018, 76% of CB cards and 59% of CB merchants were equipped

(a) Contact payment

(b) Contactless payment

Research Questions

What is the impact of contactless payments on merchant card sales?

- Do accepting a new payment technology allow merchants increasing their business sales?
- Is the impact the same according to sectors (e.g. restaurants, hotels), and the size of business (small versus large merchants)?
- What is the effect on the use of other accepted payment methods (spillover effects)?

Data and Sample Design

- From Groupement des Cartes Bancaires CB
- Card transactions data is available from 2015 to 2018
- Variables available by merchant:
  - Business identification number, business sector, creation date, type of activity, geographical location, card-sales amount and count
- We focus the analysis on:
  - Offline merchants who decided to accept contactless payments in 2018
  - Offline merchants who did not still accept contactless payments in 2018
  - All the businesses that have existed since at least 2015
- We are left with 275,580 businesses: 57,830 in the treatment group and 217,750 in the control group

Data and Sample Design

- From Groupement des Cartes Bancaires CB
- Card transactions data is available from 2015 to 2018
- Variables available by merchant:
  - Business identification number, business sector, creation date, type of activity, geographical location, card-sales amount and count
- We focus the analysis on:
  - Offline merchants who decided to accept contactless payments in 2018
  - Offline merchants who did not still accept contactless payments in 2018
  - All the businesses that have existed since at least 2015
- We are left with 275,580 businesses: 57,830 in the treatment group and 217,750 in the control group
- Is there self-selection?
  - Are the treatment group and the non-treatment group comparable?

Estimation Strategy (1/2)

Propensity Score Matching (PSM)

- The acceptance of contactless payments is not random. To avoid possible selection bias, we first use the PSM (Rosenbaum et al., 1983):
  - $Score_i = P(Treated_i = 1|X_i) = \frac{exp(f(X_i))}{1+exp(f(X_i))}$

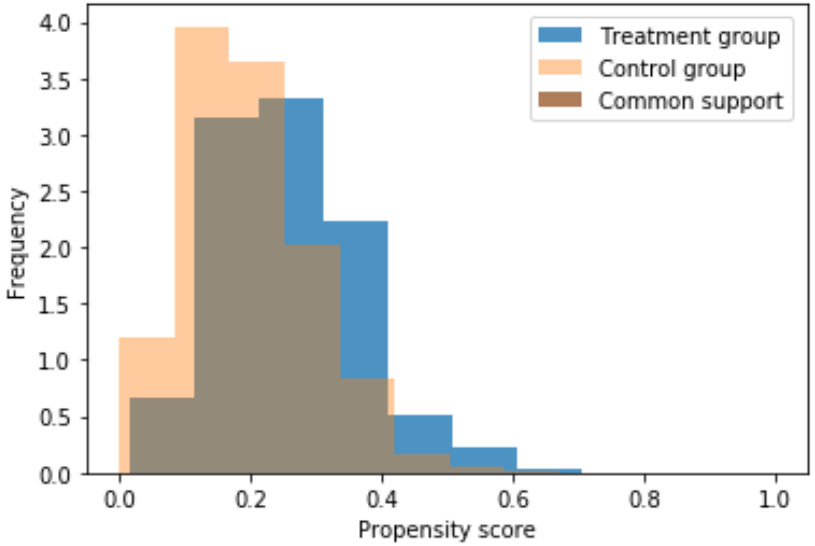
    X_i the vector of merchant and its city observable characteristics
  - Caliper matching: $\min_j |Score_i - Score_j| < h$

Estimation Strategy (1/2)

Propensity Score Matching (PSM)

- The acceptance of contactless payments is not random. To avoid possible selection bias, we first use the PSM (Rosenbaum et al., 1983):
  - $Score_i = P(Treated_i = 1|X_i) = \frac{exp(f(X_i))}{1+exp(f(X_i))}$

    X_i the vector of merchant and its city observable characteristics
  - Caliper matching: $\min_j |Score_i - Score_j| < h$
- The region of common support (p.17)



Estimation Strategy (2/2)

Difference-In-Difference Method (DID)

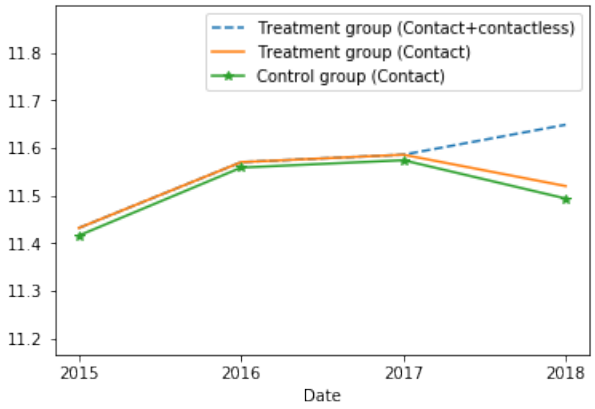
- To difference out remaining heterogeneity, we second use, on the matched sample, the DID estimation strategy (Heckman et al., 1997):
  - $log(Y_{i,t}) = \beta_0 + \beta_1 * \mathbb{1}(T = 1) + \beta_2 * \mathbb{1}(t = 2018) + \beta_3 * \mathbb{1}(t = 2018) * \mathbb{1}(T = 1) + \epsilon$
  - Where $log(Y_{i,t})$ is log card-sales amount or count
  - β_3=ATT with OLS regression or QTT with quantile regression (Firpo)

Estimation Strategy (2/2)

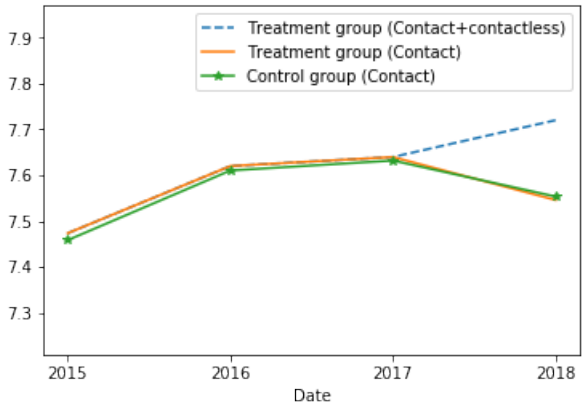
Difference-In-Difference Method (DID)

- To difference out remaining heterogeneity, we second use, on the matched sample, the DID estimation strategy (Heckman et al., 1997):
  - $log(Y_{i,t}) = \beta_0 + \beta_1 * \mathbb{1}(T = 1) + \beta_2 * \mathbb{1}(t = 2018) + \beta_3 * \mathbb{1}(t = 2018) * \mathbb{1}(T = 1) + \epsilon$
  - Where $log(Y_{i,t})$ is log card-sales amount or count
  - β_3=ATT with OLS regression or QTT with quantile regression (Firpo)
- Common trend assumption
  - Both groups have the same evolution in absence of treatment

(a) log (total sales amount)



(b) log (total sales count)



Estimation Results (1/4)

Causal Impact of accepting contactless payment

- Merchants who decided to accept contactless payments in 2018 compared to those who still do not increase their average annual card-sales amount by 15.3 percent (=exp(0.42)-1)
- The impact is higher on smaller parts of card sales distribution
  - The benefits of contactless acceptance are larger for small merchants

		Log(Sales amount)	Log(Sales count)	Log(Amount per transaction)
		(1)	(2)	(3)
ATT		0.142***	0.158***	-0.016***
		(0.004)	(0.004)	(0.001)
	q=10	0.227***	0.215***	-0.023**
		(0.025)	(0.03)	(0.01)
	q=25	0.128***	0.144***	-0.016*
		(0.017)	(0.023)	(0.009)
QTT	q=50	0.094***	0.119***	-0.013**
		(0.016)	(0.02)	(0.007)
	q=75	0.083***	0.121***	-0.018*
		(0.019)	(0.022)	(0.01)
	q=90	0.061**	0.084***	-0.02*
		(0.024)	(0.025)	(0.011)
Observations			231,252	

Estimation Results (2/4)

Contact Cards Spillover Effects

- Merchants who accept contactless payments compared to those who still do not increase their contact card-sales amount by 1.3%
  - The amount per contact card payment increases by 3%
- Negative spillover effect on the upper parts of the distribution

		Log(Sales amount) (1)	Log(Sales count) (2)	Log(Amount per transaction) (3)
ATT		0.013***	-0.016***	0.029***
		(0.004)	(0.004)	(0.001)
	q=10	0.075***	0.083***	0.038***
		(0.026)	(0.031)	(0.01)
	q=25	0.013	0.026	0.055***
		(0.017)	(0.022)	(0.009)
QTT	q=50	-0.026	-0.046**	0.043***
		(0.016)	(0.02)	(0.006)
	q=75	-0.042**	-0.101***	0.008
		(0.019)	(0.021)	(0.01)
	q=90	-0.061**	-0.133***	-0.01
		(0.024)	(0.025)	(0.011)
Observations			231,252	

Estimation Results (3/4)

Card-Sales Response by Business Sector

- Unsurprisingly, the benefits of accepting contactless payments are the largest for bakeries (33%)
  - But, negative externality on contact card sales
- Surprisingly, a large and significant average benefit for retailers in the Leisure sector (28%), as well as for taxis (26%)
  - Cannibalisation effect occurs on contact card for taxis

	Bakery	Food	Health	Hotel	Leisure	Personal_care	Restaurant	Supermarket	Taxi
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
					Log(Sales amount)				
ATT	0.284***	0.148***	0.073***	0.18***	0.244***	0.08***	0.204***	0.189***	0.233***
	(0.029)	(0.02)	(0.007)	(0.038)	(0.025)	(0.009)	(0.01)	(0.025)	(0.038)
					Log(Sales count)				
ATT	0.372***	0.158***	0.085***	0.232***	0.251***	0.083***	0.217***	0.223***	0.272***
	(0.031)	(0.019)	(0.006)	(0.038)	(0.024)	(0.009)	(0.01)	(0.025)	(0.036)
					Log(Amount per transaction)				
ATT	-0.088***	-0.01***	-0.012***	-0.052***	-0.007	-0.003**	-0.013***	-0.034***	-0.039***
	(0.006)	(0.003)	(0.002)	(0.015)	(0.006)	(0.001)	(0.002)	(0.005)	(0.012)
Observations	5,436	7,950	29,994	1,838	8,552	19,926	36,086	6,902	3,324

Estimation Results (4/4)

Card-Sales Response of New Entrepreneurs

- Created businesses in 2016 that have adopted contactless technology in 2018 have higher card sales than new entrepreneurs who do not still accept the contactless payments technology
  - They increase their annual card-sales amount by 27 percent
  - The spillover effect on contact card sales is much stronger (9 percent)

	Merchants whose age is between			
	1 year	2-5 years	6-10 years	> 10 years
	(1)	(2)	(3)	(4)
	Log(Sales amount)			
ATT	0.24***	0.168***	0.145***	0.121***
	(0.016)	(0.011)	(0.01)	(0.009)
	Log(Sales count)			
ATT	0.265***	0.187***	0.156***	0.135***
	(0.016)	(0.01)	(0.01)	(0.009)
	Log(Amount per transaction)			
ATT	-0.025***	-0.02***	-0.011***	-0.015***
	(0.005)	(0.002)	(0.002)	(0.002)
Observations	21,616	101,086	85,580	122,462

Robustness Checks

- Alternative specifications
  - Different types of matching methods, with or without replacement
  - Nearest Neighbor Matching ; Caliper Radius Matching
- Placebo test

Conclusion

- Our results suggest that the introduction of contactless payments promotes business growth, especially the small merchants, new entrepreneurs and businesses that make small amount per purchase, such as bakeries, restaurants

- Another relevant consideration is that the acceptance of contactless payments technology has strong positive spillover effects on old payment methods and is a tool to attract more consumers

- These results could fruitfully be used to provide policy recommendations for banks decision-makers and fintech companies interested in promoting efficient payment technologies

Conclusion

- Our results suggest that the introduction of contactless payments promotes business growth, especially the small merchants, new entrepreneurs and businesses that make small amount per purchase, such as bakeries, restaurants
- Another relevant consideration is that the acceptance of contactless payments technology has strong positive spillover effects on old payment methods and is a tool to attract more consumers
- These results could fruitfully be used to provide policy recommendations for banks decision-makers and fintech companies interested in promoting efficient payment technologies
- This research can be extended in two directions:
  - Investigating the impact of contactless payments by mobile phones
  - Estimating the substitution between contactless and cash payments

Thank you for your attention !

References

- Agarwal, S., Qian, W., Yeung, B. Y., and Zou, X. (2019). Mobile Wallet and Entrepreneurial Growth. AEA Papers and Proceedings
- Fan and Yu (2012). Partial identification of distributional and quantile treatment effect in difference-in-differences models. Economics Letters
- Firpo, S. (2007). Efficient semiparametric estimation of quantile treatment effects. Econometrica
- Heckman, J. J., Ichimura, H., and Todd, P. E. (1997). Matching As An Econometric Evaluation Estimator: Evidence from Evaluating a Job Training Programme. The Review of Economic Studies
- Rosenbaum, P. R. and Rubin, D. B. (1983). The central role of the propensity score in observational studies for causal effects. Biometrika

Appendix

Summary statistics (p.7)

	Treatment group		Control group			Matched treatment group		Matched control group		
	Mean	SD	Mean	SD	Diff.	Mean	SD	Mean	SD	Diff.
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Merchant characteristics										
Age	9.17	5.25	8.76	5.29	-0.41***	9.17	5.25	9.16	5.26	-0.01
Number of bank accounts	1.22	0.47	1.16	0.41	-0.06***	1.22	0.47	1.22	0.5	0.0
Growth rate	0.02	0.38	0.0	0.4	-0.02***	0.02	0.38	0.02	0.32	0.0
Transaction volume	7654.43	38377.3	3667.74	17643.2	-3986.69***	7612.82	37644.5	7468.19	41382.8	-144.63
Average transaction value	77.29	100.44	124.47	322.88	47.18***	77.29	100.45	79.29	118.36	2.0***
Business sectors										
Bakery	0.02	0.02	0.01	0.01	-0.01***	0.02	0.02	0.02	0.02	0.0
Food	0.03	0.03	0.02	0.02	-0.01***	0.03	0.03	0.03	0.03	0.0
Health	0.13	0.11	0.18	0.15	0.05***	0.13	0.11	0.13	0.11	0.0
Hotel	0.01	0.01	0.01	0.01	0.0	0.01	0.01	0.01	0.01	0.0
Leisure	0.04	0.04	0.03	0.02	-0.01***	0.04	0.04	0.04	0.04	0.0
Personal_care	0.09	0.08	0.07	0.07	-0.02***	0.09	0.08	0.08	0.08	-0.01***
Restaurant	0.16	0.13	0.09	0.08	-0.07***	0.16	0.13	0.15	0.13	-0.01***
Supermarket	0.03	0.03	0.02	0.02	-0.01***	0.03	0.03	0.03	0.03	0.0
Taxi	0.01	0.01	0.02	0.02	0.01***	0.01	0.01	0.01	0.01	0.0
Hiring=Yes	0.75	0.19	0.64	0.23	-0.11***	0.75	0.19	0.75	0.19	0.0
Number of employees										
1 to 2 employees	0.32	0.22	0.31	0.21	-0.01***	0.32	0.22	0.32	0.22	0.0
3 to 5 employees	0.21	0.17	0.17	0.14	-0.04***	0.21	0.17	0.21	0.17	0.0
6 to 9 employees	0.11	0.1	0.08	0.07	-0.03***	0.11	0.1	0.11	0.1	0.0
10 to 19 employees	0.06	0.06	0.04	0.04	-0.02***	0.06	0.06	0.06	0.06	0.0
20 to 49 employees	0.02	0.02	0.02	0.02	0.0	0.02	0.02	0.02	0.02	0.0
50 to 99 employees	0.0	0.0	0.01	0.01	0.01***	0.0	0.0	0.01	0.01	0.01***
More than 100 employees	0.01	0.01	0.01	0.01	0.0	0.01	0.01	0.01	0.01	0.0
Merchant city characteristics										
Localisation										
Longitude	2.54	8.46	1.64	13.55	-0.9***	2.54	8.46	2.55	8.55	0.01
Latitude	45.85	7.43	44.44	10.85	-1.41***	45.85	7.43	45.9	7.47	0.05
Population	45173.2	64847.4	47591.4	65040	2418.22***	45166.3	64824.9	44432.1	62676.3	-734.17*
Share of contactless payment	0.13	0.05	0.13	0.06	0.0	0.13	0.05	0.13	0.05	0.0