The Real Impact of FinTech: Evidence from Mobile Payment Technology

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FinTech and the Real Economy

- Technology in providing financial services
  - Investment, lending, payment
  - ...

- Transforms consumer behavior and business practice
  - Improved convenience for consumers
  - Enhanced productivity and efficiency for business

- Exemplary role: mobile payment technology
  - China: transaction amount reaches 42 billion USD in 2018
  - Similar trend in other countries

- Reshapes the economy in multiple aspects
Mobile Payment vs. Cash

• Businesses
  – Lower the operating cost of cash-handling
  – Lower the cost of employee theft via cash
    • 2.5% of revenue (ACFE 2014; Kennedy 2014)

• Consumers
  – Removing the need to carry cash; facilitating tech adoption
  – Lowered transaction cost → increases consumer demand

• Reduced costs and boosted consumer demand can stimulate business growth
  – Especially for small businesses
  – Small businesses: >90% of firms; 35%-70% of total employment in major countries
The Role of Financial Intermediary

• More nuanced when other cashless payment methods are provided by financial intermediaries
  – E.g., credit cards

• (Small) merchants: mobile likely preferred to card

• Consumers
  – Mobile payment technology is safer
  – Credit card provides liquidity

• Banks
  – Mobile payment helps replace costly cash-based services
  – Do not want to crowd out revenue-generating credit cards
  – Endogenous response to maximize their profits
This Paper

- How does the introduction of mobile payment technology affect the real economy?
  - (Small) business creation

- We use the (unexpected) introduction of new mobile payment technology in April 2017 in Singapore

- Investigate the response of multiple economic sectors
  - Merchants
  - Consumers
  - Banks

- Structural model to rationalize the responses
Payment System in Singapore

• As many developed economy, Singapore is…
  – Cash-dominant society, with credit cards as a popular alternative
    • Cash usage accounts for 43% of total monthly spending
    • Credit card accounts for 16% of total monthly spending

• April 2017: Introduction of QR code by a large bank

• July 2017: Allowing for inter-bank transfer on phones

• Pay/receive entirely on phones, by scanning/displaying QR codes or inputting the recipients' phone number

• Can pay both consumers and merchants

• straightforward, efficient, and secure
Illustration of the Technology

1. PICK
   PICK and launch your preferred payment app

2. SCAN
   SCAN the SGQR and check the merchant name

3. PAY
   Enter the amount and PAY

ABC STORE

SCAN TO PAY

ASIA’S GLOBAL BUSINESS SCHOOL
Post-shock Mobile Payment Use

Based on the transaction records of a large, random sample of consumers from a leading bank in Singapore

- By 2018, 56.6% (49.1%) consumers in sample signed up (used) mobile payment
- By 2018, total amount of mobile payment from our bank: ~ 770 million SGD
Preview of Findings

• After the introduction of mobile payment technology, affected industries show higher growth rate of business creation by 8.9%,
  – Effect entirely driven by small businesses
  – Effect stronger among industries facing higher cost of cash handling

• Consumers:
  – mobile payment increased
  – ATM cash withdrawal decreased
  – Total spending increased

• Bank:
  – Closure of ATM machines
  – Mobile payment users experience increase in credit limit
  – Consistent with bank’s endogenous response
Data

• Business creation
  – ACRA (Accounting and Corporate Regulatory Authority)
  – Registry data of the universe of firms in Singapore
  – Firm name, industry, registry date, location, legal entity type

• Financial data from the largest bank in Singapore (DBS)
  – 5 million retail customers ~ 82% of the country’s population
  – Random sample of 250K consumers from 2016-2018
    • Disaggregated transaction records of mobile payment, bank account and debit/credit card
    • Consumer characteristics: e.g., age, gender, occupation
  – Population of ATM transactions
    • Location, transaction amount and time
Raw Data: # Business Creation
Regression Result

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
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<tbody>
<tr>
<td>Dependent Var. = Log(1+# of new businesses)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full sample</td>
<td>0.089***</td>
<td>0.123***</td>
<td>-0.065</td>
</tr>
<tr>
<td></td>
<td>(0.034)</td>
<td>(0.038)</td>
<td>(0.058)</td>
</tr>
<tr>
<td>Non-company</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Company</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fixed effects</td>
<td>Industry, year-month, Industry-division×year</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Observations</td>
<td>9,226</td>
<td>9,226</td>
<td>9,226</td>
</tr>
<tr>
<td>Adj $R^2$</td>
<td>0.898</td>
<td>0.861</td>
<td>0.836</td>
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</tbody>
</table>

- Mobile payment increased the number of business created by 156 per month
  - Parallel trend holds: no effect in the months before
  - No effect in tourist areas: less domestic consumer→less shocked
  - Persistent effect
  - Stronger effect in the less wealthy areas: promote inclusive growth
Delineating Economic Channels

• For merchants:
  – Lowers the cost of handling cash

• For consumers:
  – Lowers the transaction cost and improves convenience
    • Facilitates adoption
    • Increases demand

• For banks:
  – Endogenous response to maximize profits
    • Cut cost
    • Maintain its revenue generating business line (e.g., cc)
Cash Cost of Merchants

- Retail & food industries facing differential levels of cash-handling cost (Arango and Taylor, 2008)

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Log(1+# of non-company new businesses)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High cash-transaction cost industries</td>
<td>0.437***</td>
<td>0.113</td>
</tr>
<tr>
<td>Low cash-transaction cost industries</td>
<td></td>
<td>(0.071)</td>
</tr>
<tr>
<td>Treated*Post</td>
<td>0.437***</td>
<td>0.113</td>
</tr>
<tr>
<td>Fixed effects</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Industry, year-month, Industry-division × year</td>
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</tr>
<tr>
<td>Observations</td>
<td>6,856</td>
<td>7,256</td>
</tr>
<tr>
<td>Adj $R^2$</td>
<td>0.859</td>
<td>0.855</td>
</tr>
</tbody>
</table>

**Diff: p=0.026**
Delineating Economic Channels

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Mobile Payment Response

(1)  
Log(1+ mobile payment)  

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<tbody>
<tr>
<td>Treated*Post</td>
<td>0.254***</td>
</tr>
<tr>
<td></td>
<td>(0.006)</td>
</tr>
<tr>
<td>Observations</td>
<td>2,696,557</td>
</tr>
<tr>
<td>Adj $R^2$</td>
<td>0.382</td>
</tr>
</tbody>
</table>

- Treatment: consumers ex ante more receptive to mobile payment (i.e., signed up for mobile wallet before shock)

- Bank’s aggregate ↑ in mobile payment: SGD 4.5 million per month
Cash Usage Response

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<tr>
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<tbody>
<tr>
<td></td>
<td>Log(1+Cash withdrawal)</td>
<td>Log(1+ATM cash withdrawal)</td>
<td>Log(1+OTC cash withdrawal)</td>
</tr>
<tr>
<td>Treated*Post</td>
<td>-0.027*** (0.008)</td>
<td>-0.029*** (0.008)</td>
<td>0.002 (0.003)</td>
</tr>
<tr>
<td>Observations</td>
<td>2,696,557</td>
<td>2,696,557</td>
<td>2,696,557</td>
</tr>
<tr>
<td>Adj $R^2$</td>
<td>0.641</td>
<td>0.500</td>
<td>0.162</td>
</tr>
</tbody>
</table>

- Significant decrease in cash, which is entirely driven by ATM cash withdrawal
Delineating Economic Channels

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## Spending Response

<table>
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<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Log(1+Total spending)</td>
<td>0.042***</td>
<td>0.254***</td>
<td>0.033***</td>
<td>0.012*</td>
<td>-0.002</td>
</tr>
<tr>
<td>Log(1+mobile payment)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(0.005)</td>
<td>(0.006)</td>
<td>(0.007)</td>
<td>(0.007)</td>
<td>(0.007)</td>
<td></td>
</tr>
<tr>
<td>Log(1+credit card spending)</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>(0.007)</td>
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<tr>
<td>Log(1+debit card spending)</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>(0.007)</td>
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<tr>
<td>Log(1+bill payment)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(0.007)</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Observations</td>
<td>2,696,557</td>
<td>2,696,557</td>
<td>2,696,557</td>
<td>2,696,557</td>
<td>2,696,557</td>
</tr>
<tr>
<td>Adj $R^2$</td>
<td>0.608</td>
<td>0.382</td>
<td>0.686</td>
<td>0.611</td>
<td>0.754</td>
</tr>
</tbody>
</table>
Delineating Economic Channels

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• For banks:
  – Endogenous response to maximize profits
    • **Cut cost**
    • Maintain its revenue generating business line (e.g., cc)
Firm Creation and ATM Closure

- Acceleration of ATM closure after QR-payment introduction
  - 11.9 ATM closure per month during the pre-event period
  - 16.6 ATM closure per month after the event

- One std increase in the growth rate of small business creation can explain 0.33 std of the increase of monthly ATM closure rate (p<0.05)
Delineating Economic Channels

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Credit Response

<table>
<thead>
<tr>
<th></th>
<th>(1) Having credit card</th>
<th>(2) # of credit cards</th>
<th>(3) Log(credit limit)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treated*Post</td>
<td>0.016***</td>
<td>0.093***</td>
<td>0.047***</td>
</tr>
<tr>
<td></td>
<td>(0.001)</td>
<td>(0.003)</td>
<td>(0.002)</td>
</tr>
<tr>
<td>Observations</td>
<td>6,623,455</td>
<td>4,169,090</td>
<td>4,169,090</td>
</tr>
<tr>
<td>Adj $R^2$</td>
<td>0.934</td>
<td>0.965</td>
<td>0.940</td>
</tr>
</tbody>
</table>

- Consistent with the bank increasing credit provision to mobile payment users
- Consistent with the large credit card spending increase
  - Credit cards remain unpopular for small merchants: increase in consumer demands not fully accrued to small merchants
- Same pattern in the aggregate: salient jump in credit provision after the shock
Performance of Businesses

- Use change in income and spending of the self-employed from our bank data to assess the business performance aspect

<table>
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<tr>
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</thead>
<tbody>
<tr>
<td></td>
<td>Log(1+Bank account inflow)</td>
<td>Log(1+Total spending)</td>
</tr>
<tr>
<td>Self-employed*Post</td>
<td>0.069***</td>
<td>0.030***</td>
</tr>
<tr>
<td></td>
<td>(0.016)</td>
<td>(0.012)</td>
</tr>
<tr>
<td>Observations</td>
<td>3,803,186</td>
<td>3,803,186</td>
</tr>
<tr>
<td>Adj $R^2$</td>
<td>0.720</td>
<td>0.608</td>
</tr>
</tbody>
</table>
Model Ingredients

• Consumers
  – Utility depends on preference which differs by payment method
  – Utility of cash depends on the number of ATMs, utility of card depends on banks’ credit supply
  – Choose a payment method (cash, mobile, card, or no transaction)

• Merchants
  – Different payment instrument implies different net profit
  – Merchants make entry decisions based on the expected profit

• Banks
  – Different profit margins for each payment method
  – Incur costs for providing ATMs and credit supply
  – Choose the number of ATMs and credit supply to maximize profits
Estimation and Prediction

- Use empirical moments of business entry, transactions of different payment methods, ATM and credit supply over time
- Estimate structural parameters that rationalize the empirical responses by consumers, merchants, and banks
  - Consumer preferences
    - Preference for mobile payment increases after the shock → mobile payment increased & cash withdrawal decreased (substitution)
  - Net Profit of each payment method for merchants
    - Higher net profit of mobile payment than cash → more small business entries after the shock
  - Profit margin of each payment method for banks
    - Low margin of cash and high margin of credit cards → closure of ATMs and increase in credit supply
- Predicted magnitude of total spending increases by 4.2%.
  - Convenient spending stimulates demand
  - More entries from small merchants
Counterfactual: Credit Card Margin

Mobile Payment Adoption

Small Business Creation

- Perturb the bank’s profit margin for credit cards
  - The adoption in mobile payment and creation in small business decrease as the profit margin of credit cards increases

- Highlight the role of financial intermediaries on the impact of mobile payment
Counterfactual: Credit Card Preference

- Perturb consumer preference for credit cards
  - The adoption in mobile payment and creation in small business decrease as the preference for credit cards increases

- Consistent with the evidence as casually observed in the US
  - The impact of mobile payment hinges on the profitability and prevalence of other (cashless) payment methods
Concluding Remarks

• The introduction of the mobile payment technology reshapes economic activities in multiple sectors

• Stimulates small business creation, through
  – Lower (small) merchants’ transaction cost
  – Improve consumers’ convenience
    • Facilitating adoption
    • Boosting demand

• Banks’ response to maintain its credit card business
  – Dampens the effect on small business