Marketplace Lending and Consumer Credit Outcomes: Evidence from Prosper

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Federal Reserve Board

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Views expressed as those of the authors and not the Board of Governors or its staff.
Motivation

- In 2016, marketplace lenders originated more than $21 billion in consumer loans, up from $7.6 billion in 2014
  - 176% growth
  - Total consumer debt only grew by 10% over the same period
- In 2005, Prosper launched first marketplace lending website in the US
  - Prosper originated $2b in 2016 and $10b since inception
- Little is known about the effects of this new source of credit on individuals or the financial system as a whole
Motivation

- We match application data from one lender - Prosper - to credit bureau data
- We then ask
  - What is the credit profile of consumers who apply for marketplace loans?
  - How does taking out one of these loans affect subsequent credit outcomes?
Results

- Relative to general population, applicants have moderate credit scores and low delinquency rates but high and increasing debt levels.
- Following loan origination, borrowers pay down revolving debt, credit scores increase, total debt increases due to increase in mortgage debt, and delinquency rates decrease.
Related Literature

- **Marketplace Lending and Consumer Outcomes**
- **Credit Access and Consumer Outcomes**
- **Marketplace Lending Investment Decisions**
  - Iyer et al. (2009), Lin et al. (2013), Paravisini et al. (2017)
Outline

- Introduction
- Marketplace Lending Background
- Data
- Characteristics of Borrowers Results
- Credit Outcome Results
- Conclusion
Marketplace Lending Background

- Marketplace lending (MPL) is a new form of disintermediated lending that matches borrowers and lenders through online platforms.
- Marketplaces also score loans and set the terms of loans and collect an origination and servicing fee.
- Lenders can be institutional investors or retail investors.
- Most common type of loan is an unsecured consumer loan.
- Perceived benefits are faster decision times and potentially lower rates.
Marketplace Lending Overview

How P2P lending works

1. Request for loan
2. Screening process
3. Gather lenders
4. Issue the loan
5. Follow-up management

- Borrower
- P2P platform
- Investors
- Lenders linked with P2P platforms

- Financial transaction
- Contract transaction
- Interest paid on investment
- Virtual accounts (issued by banks)
- Pay back the principle and interest
- Pay back the principle and interest
Prosper Loan Application Process

- Individual submits application for $2,000-$35,000 unsecured loan
- Prosper verifies identity and pulls credit report
- Assuming requirements are met, Prosper scores the loan and posts the application on marketplace for funding
  - Rates are 6%-36% and origination fees are 1%-5%
- Lenders choose to fund application or not and, if funded, loan is originated unless borrower or Prosper cancel application
  - For a subset of applications, Prosper verifies income/employment of applicant prior to origination
How Do Rates of Prosper Borrowers Compare to Rates Available on Credit Cards?

![Graph showing interest rates for Prosper loans vs credit card rates between Dec 2012 and Dec 2016. The graph includes lines for average Prosper rate, median Prosper rate, national average rate for bad credit, and national average rate.](image-url)
### Prosper Loan Offerings

<table>
<thead>
<tr>
<th>Rating</th>
<th>Listing ID</th>
<th>Loan Category</th>
<th>Amount</th>
<th>Yield</th>
<th>% Funded</th>
<th>Time Left</th>
<th>Select</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>7896381</td>
<td>Debt Consolidation</td>
<td>$15,000</td>
<td>9.39%</td>
<td>14.1%</td>
<td>13d 12h 29m</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>7894407</td>
<td>Debt Consolidation</td>
<td>$35,000</td>
<td>11.58%</td>
<td>36%</td>
<td>13d 12h 29m</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>7881982</td>
<td>Debt Consolidation</td>
<td>$10,500</td>
<td>14.45%</td>
<td>74%</td>
<td>13d 12h 29m</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>7880039</td>
<td>Auto / Motorcycle / RV / Boat</td>
<td>$25,000</td>
<td>7.69%</td>
<td>45%</td>
<td>13d 12h 29m</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>7380882</td>
<td>Debt Consolidation</td>
<td>$20,000</td>
<td>8.85%</td>
<td>85%</td>
<td>13d 12h 29m</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>7591888</td>
<td>Debt Consolidation</td>
<td>$15,000</td>
<td>10.99%</td>
<td>63%</td>
<td>11d 15h 29m</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>7591986</td>
<td>Debt Consolidation</td>
<td>$16,000</td>
<td>6.09%</td>
<td>32%</td>
<td>11d 15h 29m</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>7590942</td>
<td>Debt Consolidation</td>
<td>$20,000</td>
<td>9.39%</td>
<td>77%</td>
<td>11d 15h 29m</td>
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<tr>
<td>AA</td>
<td>7377227</td>
<td>Debt Consolidation</td>
<td>$30,000</td>
<td>4.31%</td>
<td>79%</td>
<td>11d 15h 29m</td>
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<tr>
<td>A</td>
<td>7573792</td>
<td>Debt Consolidation</td>
<td>$21,000</td>
<td>8.29%</td>
<td>35%</td>
<td>10d 15h 29m</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>7365328</td>
<td>Other</td>
<td>$35,000</td>
<td>10.99%</td>
<td>74%</td>
<td>10d 15h 29m</td>
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</tr>
<tr>
<td>A</td>
<td>7583974</td>
<td>Debt Consolidation</td>
<td>$25,000</td>
<td>7.39%</td>
<td>15%</td>
<td>9d 18h 29m</td>
<td></td>
</tr>
</tbody>
</table>
Prosper Loan Offerings: Details

Debt Consolidation
Listing #7596301

Verification Stage: 3
Borrower State: PA
Borrower Rate: 10.39%
Monthly Payment: $486.76
Lender Servicing Fee: 1%
Initial Status: F

$15,000 3 9.39%
Amount  Years  Yield

14% Funded  $12,952.61 Left

Effective Yield: 9.3%
Estimated Loss: 4.49%
Estimated Return: 4.81%

$ Between $25 and $12952.61

Add to Cart

Available Balance: $0.00

Borrower's Credit Profile
Prosper Rating: B
Prosper Score (FICO): 9
TU FICO Range: 720-739
Current Delinquencies: 0
Amount Delinquent: $0.00
Public Records Last 24m / 10y: Not available / 0
Delinquencies in Last 7y: 0

Inquiries Last 6 Months: 0
First Credit Line: Jul-2008
Current/Open Credit Lines: 10 / 10
Total Credit Lines: 11
Revolving Credit Balance: $10,099.00
Bankcard Utilization: 93%
Has Mortgage: No

Debt/Income Ratio: 38%
Employment Status: Self-employed
Length of Status: 1y 8m
Stated Income: $25,000 - $49,999
Occupation: Other

The borrower's credit and mortgage information displayed above has been obtained from their credit report. Please note: This information is awaiting verification. "Not available" indicates the information could not be obtained by the credit bureau.

The employment and income information displayed above has been provided by the borrower. This information may not be verified by Prosper, or may be awaiting verification.
Data

- All Prosper listings for 2013-2016
  - Data on borrower at time of listing: FICO bins, income, employment status, debt to income ratio, Experian credit data
  - Data on listing: listing outcome, listing amount, borrower rate, loan purpose, expected return

- Consumer Credit Panel
  - 5% random sample of population who have a credit report and SSN plus other individuals in household
  - Longitudinal, individual-level Equifax credit data on balances, limits, and payments for several loan types
Matching Procedure

- We match on:
  - county
  - age of oldest and newest accounts
  - bankruptcies
  - public records
  - real estate balances and payments
  - revolver limits
  - installment loan amounts
  - auto payments
  - delinquencies

- We match 49,981 applications, a match rate of 6.56%
### Results of Matching Procedure

<table>
<thead>
<tr>
<th></th>
<th>Non-Matched Applicants</th>
<th>Matched Applicants</th>
<th>Diff</th>
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</thead>
<tbody>
<tr>
<td>Observations</td>
<td>712,460</td>
<td>49,981</td>
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<tr>
<td>Loan Originated</td>
<td>0.74</td>
<td>0.75</td>
<td>0.01 ***</td>
</tr>
<tr>
<td>Percent Funded</td>
<td>0.99</td>
<td>0.99</td>
<td>0.00</td>
</tr>
<tr>
<td>Percent Fully Funded</td>
<td>0.98</td>
<td>0.98</td>
<td>0.00</td>
</tr>
<tr>
<td>Listing Amount</td>
<td>13,592.16</td>
<td>13,589.86</td>
<td>(2.30)</td>
</tr>
<tr>
<td>Monthly Payment</td>
<td>411.90</td>
<td>412.22</td>
<td>0.32</td>
</tr>
<tr>
<td>Listing Term = 36 Months</td>
<td>0.69</td>
<td>0.70</td>
<td>0.01</td>
</tr>
<tr>
<td>Borrower APR</td>
<td>0.18</td>
<td>0.17</td>
<td>(0.00)</td>
</tr>
<tr>
<td>Estimated Return</td>
<td>0.07</td>
<td>0.07</td>
<td>(0.00)</td>
</tr>
<tr>
<td>FICO: &lt; 700</td>
<td>0.54</td>
<td>0.53</td>
<td>(0.01) ***</td>
</tr>
<tr>
<td>FICO: 700-739</td>
<td>0.30</td>
<td>0.31</td>
<td>0.01 ***</td>
</tr>
<tr>
<td>FICO: 740+</td>
<td>0.16</td>
<td>0.16</td>
<td>0.00 ***</td>
</tr>
<tr>
<td>Annual Income</td>
<td>80,036.30</td>
<td>75,275.95</td>
<td>(4,760.35) **</td>
</tr>
<tr>
<td>Home Owner</td>
<td>0.47</td>
<td>0.47</td>
<td>(0.00)</td>
</tr>
<tr>
<td>Total Balance</td>
<td>139,938.90</td>
<td>139,228.20</td>
<td>(710.70)</td>
</tr>
<tr>
<td>Monthly Debt</td>
<td>1,060.43</td>
<td>1,068.71</td>
<td>8.28</td>
</tr>
<tr>
<td>Revolver Balance</td>
<td>20,175.93</td>
<td>19,986.70</td>
<td>(189.23)</td>
</tr>
</tbody>
</table>
## Summary Statistics

<table>
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<tr>
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<th>All</th>
<th>Origination</th>
<th>No Origination</th>
<th>Diff</th>
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</thead>
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<td>Loan Originated</td>
<td>0.75</td>
<td>1.00</td>
<td>0.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Percent Funded</td>
<td>0.99</td>
<td>1.00</td>
<td>0.97</td>
<td>0.03</td>
</tr>
<tr>
<td>Percent Fully Funded</td>
<td>1.00</td>
<td>1.00</td>
<td>0.94</td>
<td>0.06</td>
</tr>
<tr>
<td>Listing Amount</td>
<td>13,589.86</td>
<td>13,349.96</td>
<td>14,304.61</td>
<td>-954.65</td>
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<tr>
<td>Monthly Payment</td>
<td>412.22</td>
<td>404.14</td>
<td>436.30</td>
<td>-32.16</td>
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<tr>
<td>Listing Term = 36 Months</td>
<td>0.70</td>
<td>0.71</td>
<td>0.69</td>
<td>0.01</td>
</tr>
<tr>
<td>Borrower APR</td>
<td>0.17</td>
<td>0.17</td>
<td>0.18</td>
<td>0.00</td>
</tr>
<tr>
<td>Estimated Return</td>
<td>0.07</td>
<td>0.07</td>
<td>0.07</td>
<td>0.00</td>
</tr>
<tr>
<td>FICO: &lt; 700</td>
<td>0.53</td>
<td>0.53</td>
<td>0.52</td>
<td>0.01</td>
</tr>
<tr>
<td>FICO: 700-739</td>
<td>0.31</td>
<td>0.31</td>
<td>0.31</td>
<td>0.00</td>
</tr>
<tr>
<td>FICO: 740+</td>
<td>0.16</td>
<td>0.16</td>
<td>0.17</td>
<td>-0.02</td>
</tr>
<tr>
<td>Annual Income</td>
<td>75,275.95</td>
<td>73,211.72</td>
<td>81,426.07</td>
<td>-8,214.35</td>
</tr>
<tr>
<td>Home Owner</td>
<td>0.47</td>
<td>0.48</td>
<td>0.44</td>
<td>0.04</td>
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<tr>
<td>Total Balance</td>
<td>13,9228.20</td>
<td>143341.90</td>
<td>126970.70</td>
<td>16,371.20</td>
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<tr>
<td>Monthly Debt</td>
<td>1,068.71</td>
<td>1,093.87</td>
<td>993.73</td>
<td>100.14</td>
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<tr>
<td>Revolver Balance</td>
<td>19,986.70</td>
<td>20,117.26</td>
<td>19,597.65</td>
<td>519.61</td>
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<tr>
<td>Observations</td>
<td>49,981</td>
<td>37,421</td>
<td>12,560</td>
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</tr>
</tbody>
</table>
Credit Scores of Borrowers versus National Population

- We then match applicants to CCP population by county, age, and previous quarter’s credit score
- Credit score distribution:

<table>
<thead>
<tr>
<th>Credit Score</th>
<th>CCP Sample</th>
<th>All</th>
<th>Prosper Applicants</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Orig.</td>
<td>No Orig.</td>
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<tr>
<td>280-599</td>
<td>0.12</td>
<td>0.02</td>
<td>0.01</td>
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<tr>
<td>600-659</td>
<td>0.23</td>
<td>0.19</td>
<td>0.18</td>
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<tr>
<td>660-699</td>
<td>0.12</td>
<td>0.28</td>
<td>0.28</td>
</tr>
<tr>
<td>700-759</td>
<td>0.19</td>
<td>0.37</td>
<td>0.37</td>
</tr>
<tr>
<td>760-850</td>
<td>0.35</td>
<td>0.15</td>
<td>0.16</td>
</tr>
</tbody>
</table>

- Prosper applicants are much less likely to have very high or low credit scores
Age of Borrowers versus National Population

- Age distribution:

<table>
<thead>
<tr>
<th>Age</th>
<th>CCP Sample</th>
<th>All</th>
<th>Prosper Applicants</th>
<th>No Orig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>18-24</td>
<td>0.10</td>
<td>0.01</td>
<td>0.01</td>
<td>0.01</td>
</tr>
<tr>
<td>25-30</td>
<td>0.14</td>
<td>0.08</td>
<td>0.08</td>
<td>0.07</td>
</tr>
<tr>
<td>31-40</td>
<td>0.21</td>
<td>0.24</td>
<td>0.25</td>
<td>0.21</td>
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<tr>
<td>41-50</td>
<td>0.21</td>
<td>0.28</td>
<td>0.28</td>
<td>0.25</td>
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<tr>
<td>51-60</td>
<td>0.24</td>
<td>0.30</td>
<td>0.28</td>
<td>0.34</td>
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<tr>
<td>61-63</td>
<td>0.10</td>
<td>0.10</td>
<td>0.09</td>
<td>0.13</td>
</tr>
</tbody>
</table>

- Prosper applicants are more likely to be prime-aged
Characteristics of Borrowers versus Population

- By county, age, and previous quarter’s credit score:

<table>
<thead>
<tr>
<th></th>
<th>Prosper Applicants</th>
<th>Population Matched by:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All</td>
<td>Orig.</td>
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<tr>
<td>Credit Score</td>
<td>689.87</td>
<td>689.09</td>
</tr>
<tr>
<td>Total Debt</td>
<td>139,354.40</td>
<td>142,715.40</td>
</tr>
<tr>
<td>Credit Card Debt</td>
<td>12,558.71</td>
<td>12,678.99</td>
</tr>
<tr>
<td>Any Mortgage Debt</td>
<td>0.49</td>
<td>0.50</td>
</tr>
<tr>
<td>Mortgage Debt</td>
<td>99,093.13</td>
<td>101,821.20</td>
</tr>
<tr>
<td>Non-Mortgage Debt</td>
<td>40,261.27</td>
<td>40,894.20</td>
</tr>
<tr>
<td>Delinquency Rate</td>
<td>0.10</td>
<td>0.10</td>
</tr>
</tbody>
</table>

- Applicants have higher debt levels, are more likely to have home debt, lower delinquency rate
Characteristics of Borrowers: Trend in Total Debt Balances
Characteristics of Borrowers: Trend in Revolving Debt Balances
Empirical Specification

- We next test the effect of loans on credit outcomes.
- We estimate:

\[ Y_{i,t+k} = \alpha + \beta LoanOriginated_{it} + \gamma X_{it} + \sum_{l=1}^{4} \delta_l Z_{i,t-l} + \tau_t + \nu_{i,t+k} \]

- Dependent variables:
  - Revolver balance, monthly non-home debt payments, credit score, total debt balances, delinquency rates, home debt balances, new mortgage origination
Do our Data include the Prosper Loan?

- Marketplace lenders have not always reported loans to credit bureaus

- Results are qualitatively similar for full sample and for borrowers with reported loan
Outcome: Credit Card Utilization

![Graph showing Predicted Credit Card Utilization Rate over time for Loan Not Originated and Loan Originated categories. The graph displays a downward trend for Loan Not Originated from t-1 to t, followed by an upward trend from t to t+8. The Loan Originated category shows a more stable trend, with a slight increase from t to t+8.]
Outcome: Credit Score

![Graph showing predicted credit score over time for loan originated and not originated cases. The graph indicates a decrease in credit score over time, with a slight increase during the t=2 period. The blue line represents the loan originated cases, while the red line represents the loan not originated cases.]
Outcome: Total Debt
Outcome: Mortgage Debt
Outcome: Non-Mortgage Debt

![Graph showing predicted non-mortgage debt over time](image-url)
Outcome: Any Mortgage Debt, Non-Homeowners Only
Outcome: Mortgage Debt, Homeowners Only
Outcome: Delinquency Rate
Endogeneity

- Is endogeneity a concern?
  - 94% of applications without origination are fully funded
  - Borrowers have higher levels of debt and lower income but similar FICO scores and loan terms
  - Pre-application trends are broadly similar

  ⇒ Non-borrowers likely have cheaper sources of financing
  ⇒ Our estimates likely underestimate effects of MPL

- We’re exploring possible instruments that exploit pricing changes and discontinuities
Conclusion

- We match data on marketplace lending applicants to credit bureau data and study applicant credit profiles pre- and post-application.
- Applicants have relatively strong credit profiles but with high and increasing debt levels.
- Relative to applicants without an origination, borrowers see increases in their credit scores, increases in total debt, and decreases in delinquency rates.
- MPL doesn’t appear to lead to deterioration in household financial well-being but their increased leverage does expose these borrowers to significant risk to economic downturns.
Additional Results
Additional Results
Additional Results

Graph: Average Total Debt Balance

- **All**: Blue line
- **W/Cong**: Orange line
- **W/o Cong**: Gray line

Data points range from 10,000 to 190,000, with the x-axis representing time intervals from -4 to 8.
Additional Results

![Average Total Debt Balances Graph](graph.png)
Additional Results

![Average Revolver Balance Graph](image)
Additional Results
Additional Results
Additional Results

![Graph: Average Home Debt Balance - Home Owners Only]

**Graph Description:**
- **Title:** Average Home Debt Balance - Home Owners Only
- **Y-axis:** Average home debt balance range from 170000 to 235000
- **X-axis:** Time period from -4 to 8
- **Legend:**
  - Blue line: All
  - Orange line: W/Orig
  - Gray line: W/o Orig

**Graph Analysis:**
- The graph illustrates the average home debt balance over a period, distinguishing between all borrowers and those with and without original debt balances.
- The data shows a peak in the average debt balance around the origin, with subsequent declines over time.
Additional Results

![Graph: Share with Home Debt Balance - Non Home Owners Only]

- **All**: Blue line
- **W/Ctg**: Orange line
- **W/o Ctg**: Grey line

Dore and Mach | Marketplace Lending and Consumer Credit Outcomes
Outcome: Installment Balance

Predicted effect on installment loan balance

- Installment Loan Balance
- Lower
- Upper