Buying Cures Versus Renting Health:

Financing Health Care with Consumer Loans

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(2016)

Overview

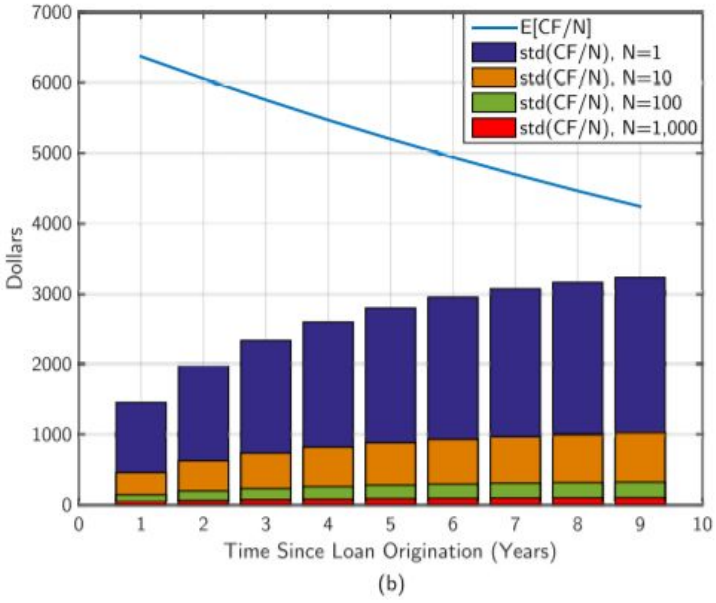
This is the first paper to propose specific methods for implementing a Health Care Loan (HCL) market and to assess one's financial viability

Goals:

- Create a market which is attractive to both high-risk and low-risk investors
- Create a market which can finance expensive drug costs
- Correctly model loan default rates - crucial to estimating the financial viability of HCLs

Solutions

- Use Diversification and Securitization to attract both low-risk and high risk investors
- Estimate loan defaults probabilities using student loan and U.S. Census data
- Run Monte Carlo simulations which can be used to estimate financial viability of HCL markets



Estimating Probability of Loan Default

Create 3 separate models for default probability

$$E[\mathrm{PD}] = (1 + \exp(-\beta\Phi^{-1}(\mathrm{DPI}) + \alpha))^{-1}, \quad \text{for } 0 \le \mathrm{DPI} \le 1,$$

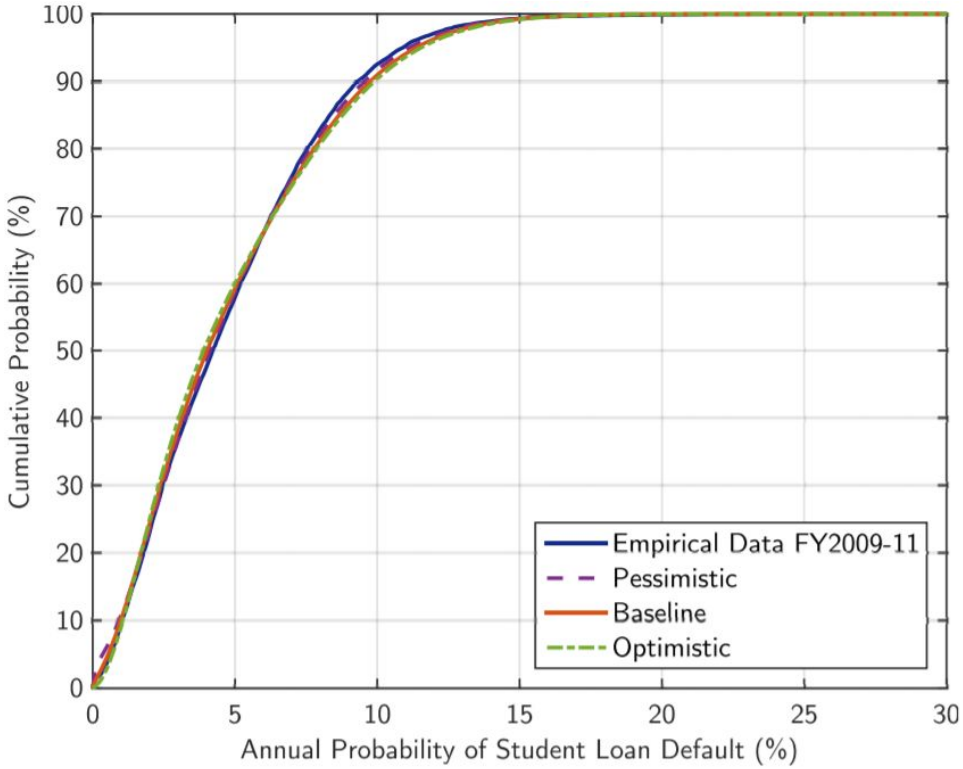
$$E[\mathrm{PD}] = \exp\left(-\left(\frac{\mathrm{DPI}^{-1}-1}{\beta}\right)^{\alpha}\right), \quad \text{for } 0 \le \mathrm{DPI} \le 1.$$

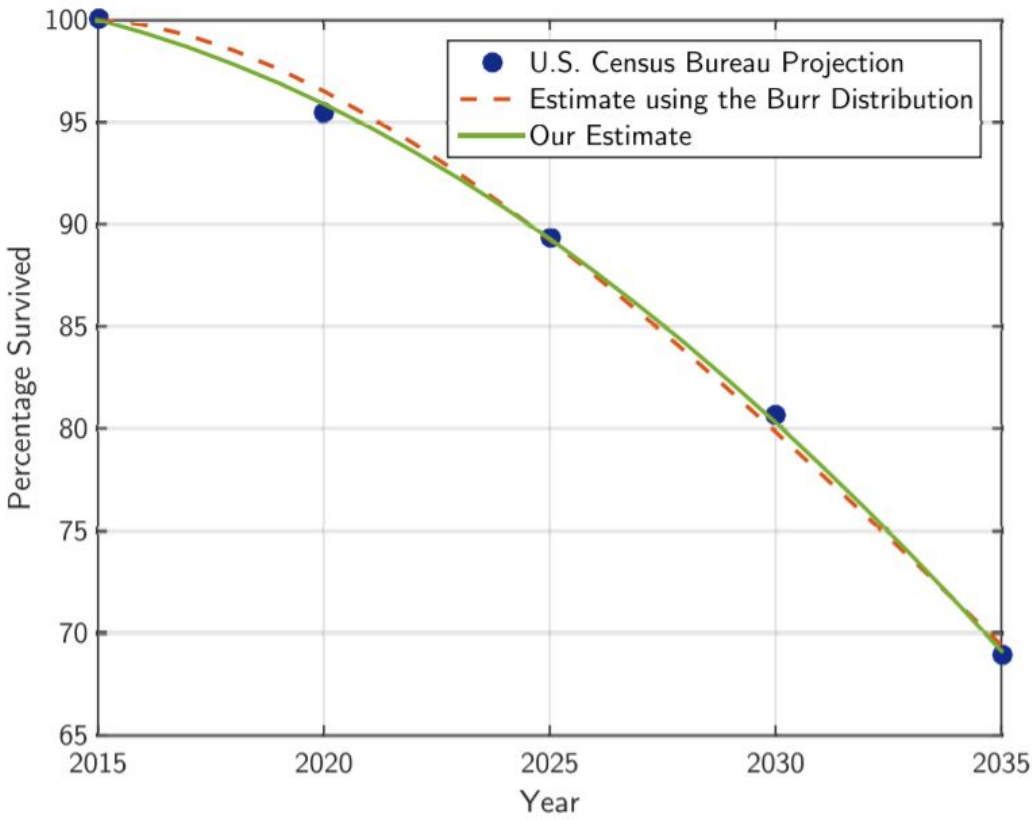
$$E[\mathrm{PD}] = \exp\left(-\left(\frac{1-\mathrm{DPI}}{\beta}\right)^{\alpha}\right), \quad \text{for } 0 \le \mathrm{DPI} \le 1.$$

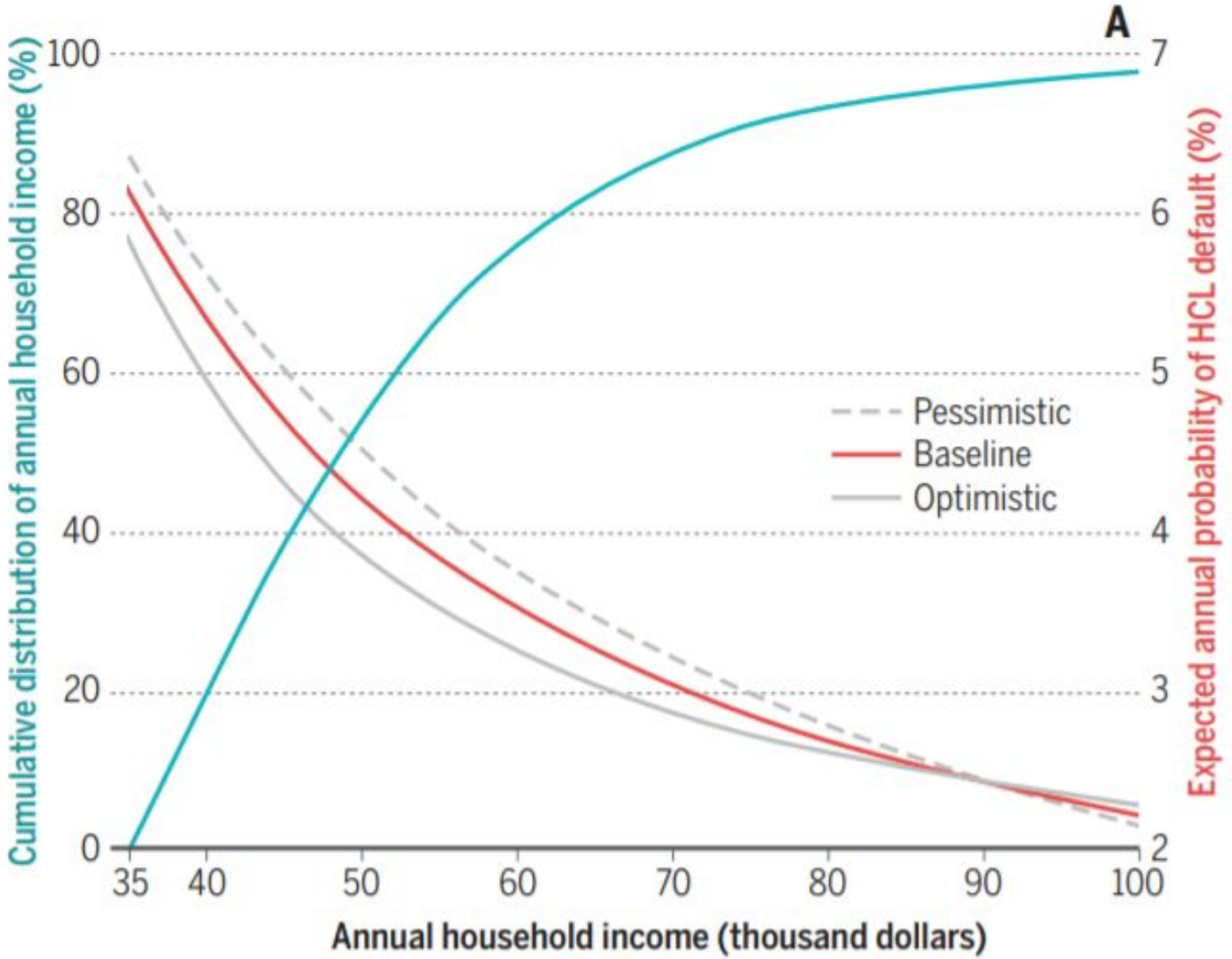
DPI: debt-payment-to-income ratio (a random variable)

$\boldsymbol{\alpha}$ and $\boldsymbol{\beta}$: model parameters

$\boldsymbol{\phi}$: CDF of the normal distribution

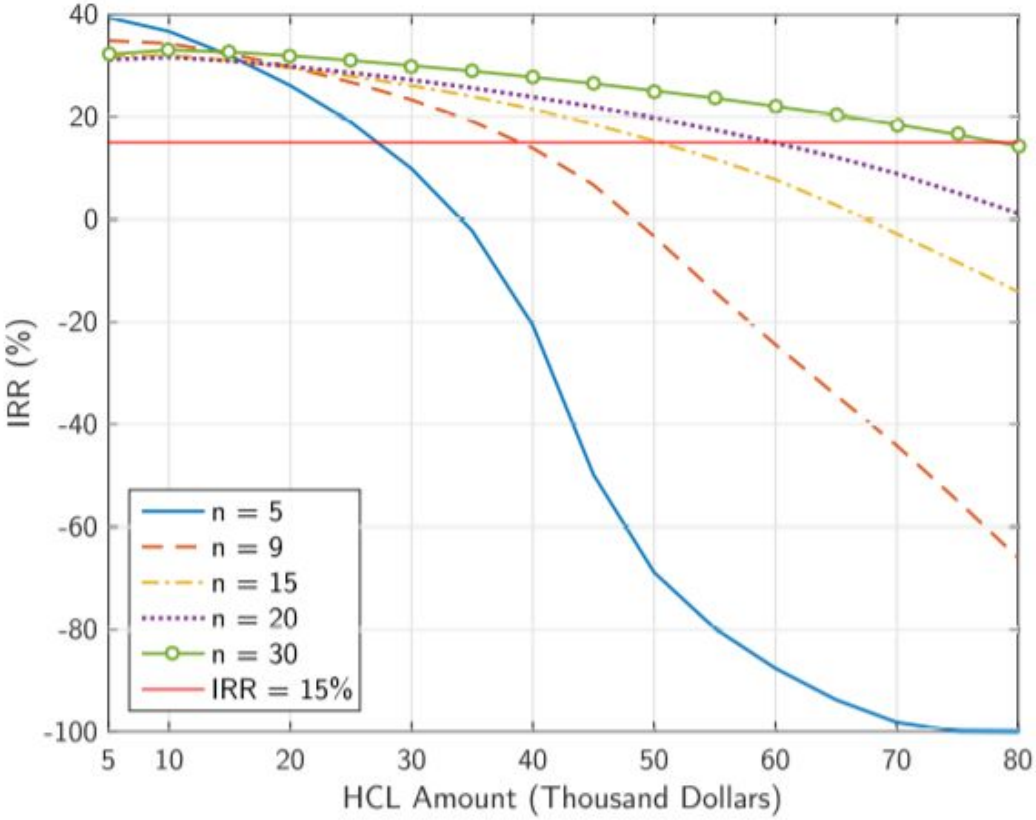

Cumulative Probability (%)
Annual Probability of Student Loan Default (%)
Empirical Data FY2009-11
Pessimistic
Baseline
Optimistic

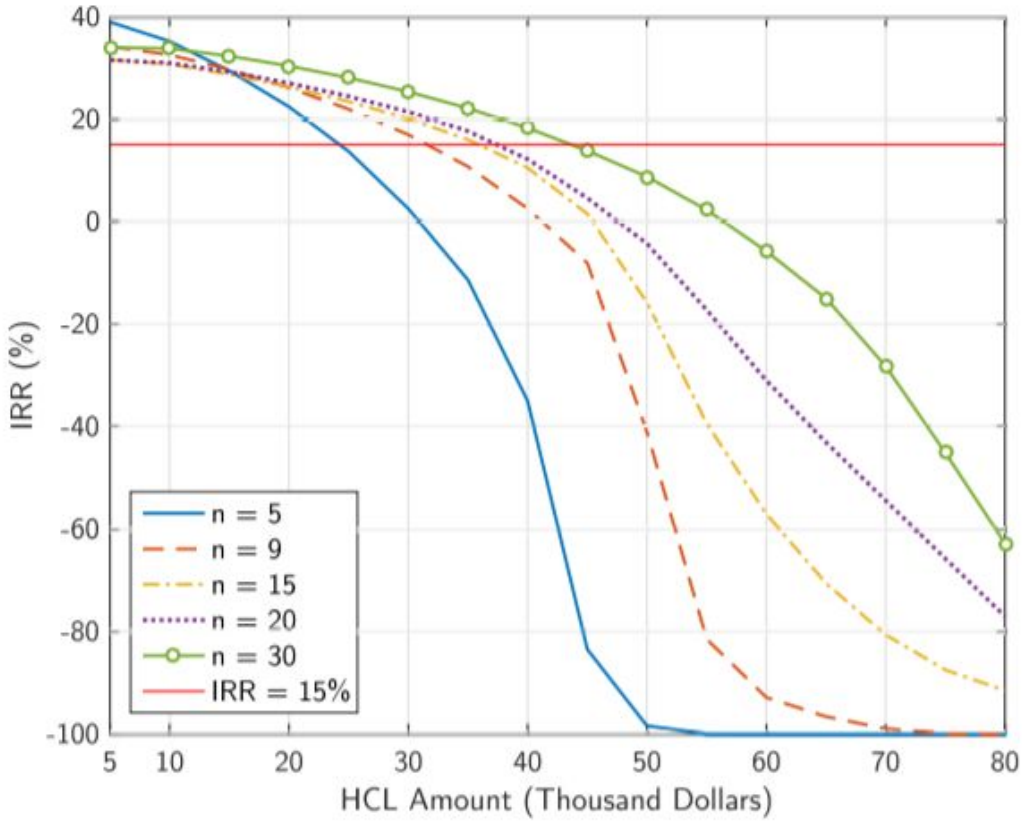

Percentage Survived
Year
U.S. Census Bureau Projection
Estimate using the Burr Distribution
Our Estimate


A
Cumulative distribution of annual household income (%)
Expected annual probability of HCL default (%)
100
80
60
40
20
0
7
6
5
4
3
2
35
40
50
60
70
80
90
100
Pessimistic
Baseline
Optimistic
Annual household income (thousand dollars)

Simulation: Structure and Assumptions

- Run 10 million Monte Carlo simulations under each default probability function
- Assumptions
  - 12,500 patients (arbitrary)
  - $84,000 cost per drug and $40,000 loan (based on HCV cure cost)
  - 9.1% interest rate (aims for at least 15% return rate guarantee)
  - 9 year repayment terms (maximum term for which $40,000 loan is viable)


40
20
0
-20
-40
-60
-80
-100
IRR (%)
5
10
20
30
40
50
60
70
80
HCL Amount (Thousand Dollars)
n = 5
n = 9
n = 15
n = 20
n = 30
IRR = 15%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20
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HCL Amount (Thousand Dollars)
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	Pessimistic[a,b]	Baseline[a,c]	Optimistic[a,d]
Equity tranche performance			
Expected IRR (%)	9.4	12.5	15.8
Median IRR (%)	9.6	12.7	15.9
Standard deviation of IRR (%)	3.7	3.1	2.6
Pr(IRR $<$ 0) (%)	1.1	$<$ 0.1	0
Pr(IRR $\geq$ 5%) (%)	87.3	98.7	100.0
Pr(IRR $\geq$ 10%) (%)	46.3	79.6	98.4
Pr(IRR $\geq$ 15%) (%)	5.2	22.5	63.6
Pr(IRR $\geq$ 20%) (%)	$<$ 0.1	0.2	4.0

Challenges and Limitations

- Is it realistic to assume health insurers will pay high up front costs?
- High U.S. drug prices
- Can’t help with truly expensive drugs like gene therapies ($1 million cost)
- Still not well suited for lower income households
- Was it right to make default estimates based on student loan data?
- Securitization is risky left unregulated