Crowdfunding and Risk

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Disclaimer

The views expressed in this paper are those of the author and do not necessarily reflect those of the Bank of Canada.

Many Types of Crowdfunding

- **Rewards Based Crowdfunding (Focus of this paper)**
  - Similar in many respects to a pre-order system
  - Second largest type by dollar volume
- Peer to Peer Lending
  - Similar in many respects to conventional loans, but with many small lenders
  - Estimated to be over 70% of all crowdfunding dollar volume (2015 Massolution Industry Report)
- Equity Crowdfunding
  - Small compared to other types
  - Regulatory environment difficult for many entrepreneurs

The "Rewards Based" Crowdfunding Process

- Consumers receive "rewards" in exchange for funding projects
- Rewards generally take the form of a goods purchase
- "Goal-Based" Projects:
  - Projects set a committed, publicly visible, minimum revenue goal.
  - If goal is not reached, all funds returned and project canceled.
  - Key mechanism is crowdfunding process

Crowdfunding Example: The Pebble Smartwatch

KICKSTARTER Discover Start Search Projects Sign up Log in

Pebble Time - Awesome Smartwatch, No Compromises

by **Pebble Technology**

76,078
backers

$19,612,163
pledged of $500,000 goal

3
days to go

Back This Project ★ Remind me

Existing Theoretical Literature

- Existing theoretical work on crowdfunding highlights non-consumption motives.
- Rubinton (2011): Crowdfunding allows investors to take various roles and steer projects.
  - Investment motives drive crowdfunding.
- Belleflamme et al. (2014): Different incentives for consumers in crowdfunding projects.
  - Consumers have community participation motivate in helping small projects.
  - Different prices between crowdfunding stage and retail stage.

Research Objective

- Construct a theoretical model of crowdfunding for consumer products.
- (1) Can we explain success of "goal based" crowdfunding?
- (2) Under what circumstances should crowdfunding succeed or fail?
- (3) Should crowdfunding compete with or complement existing funding methods?

Contribution

- Crowdfunding is a distinct technology, with a payoff similar to that of a call option.
- Crowdfunding can exist for purely commercial reasons with no investment or charitable motives.
- Debt financing should remain the preferred technology for large projects with low degree of uncertainty.
- Crowdfunding's success depends on the type of risk:
  - Crowdfunding passes no additional risk to consumers with uncertain demand
  - Crowdfunding does pass additional risk to consumers with uncertainty in production and the crowdfunding market may break down

Entrepreneur

- An entrepreneur has exclusive access to a production technology for a consumer good.
- Project has a fixed cost F to begin production and constant marginal cost c.
- Requires cash in advance to pay fixed costs before producing.
- If funds received are insufficient to cover production, entrepreneur defaults during production and all funds are lost.

Demand

- Consumers have a total demand for the project $Q = \Phi - BP$ where Φ is initially unknown.
- All agents view an identical, public signal ϕ of the true value Φ, such that:
  - $\Phi = \phi + \sigma$ with Probability γ
  - $\Phi = \phi - \sigma$ with Probability $1 - \gamma$
- Consumers discount their willingness to pay if they pay money for a consumption good and receive nothing, with some probability.

Funding Options: Crowdfunding

- The entrepreneur selects a price P_{CF} and minimum revenue R_{MIN}, before learning Φ.
- After posting the price and minimum revenue, Φ is realized and the entrepreneur receives orders
- If orders are below minimum revenue, funds are returned to consumers and no production occurs.
- The crowdfunding venue charges a percentage fee $f > 0$ on all revenue.

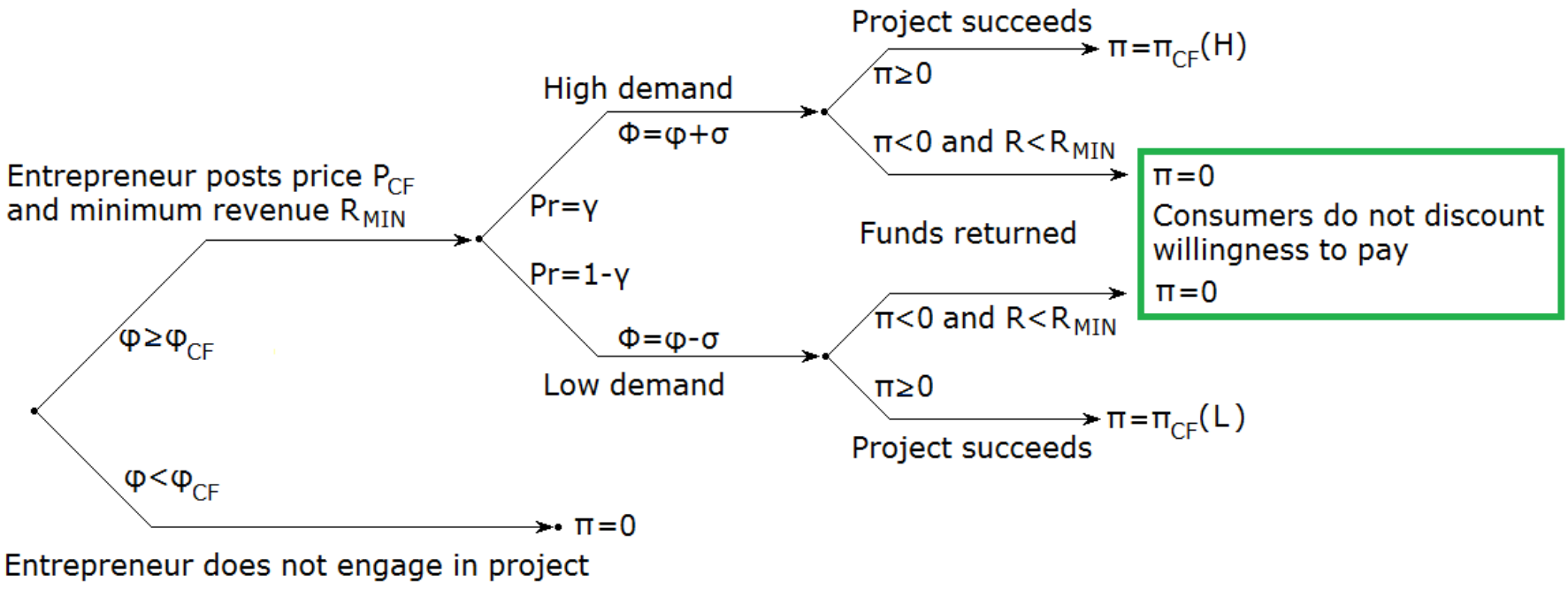
Outside Option: Banking

- Bank can loan an entrepreneur an initial amount to finance fixed costs F and learn Φ
- After Φ realized,bank can extend loan to finance variable costs
- The bank offers a loan if it is profitable in expectation
  - Bank charges entrepreneur an exogenous rate r_B on loan
- If the Entrepreneur receives a loan, she produces at state-dependent monopoly price $P_B(\Phi)$

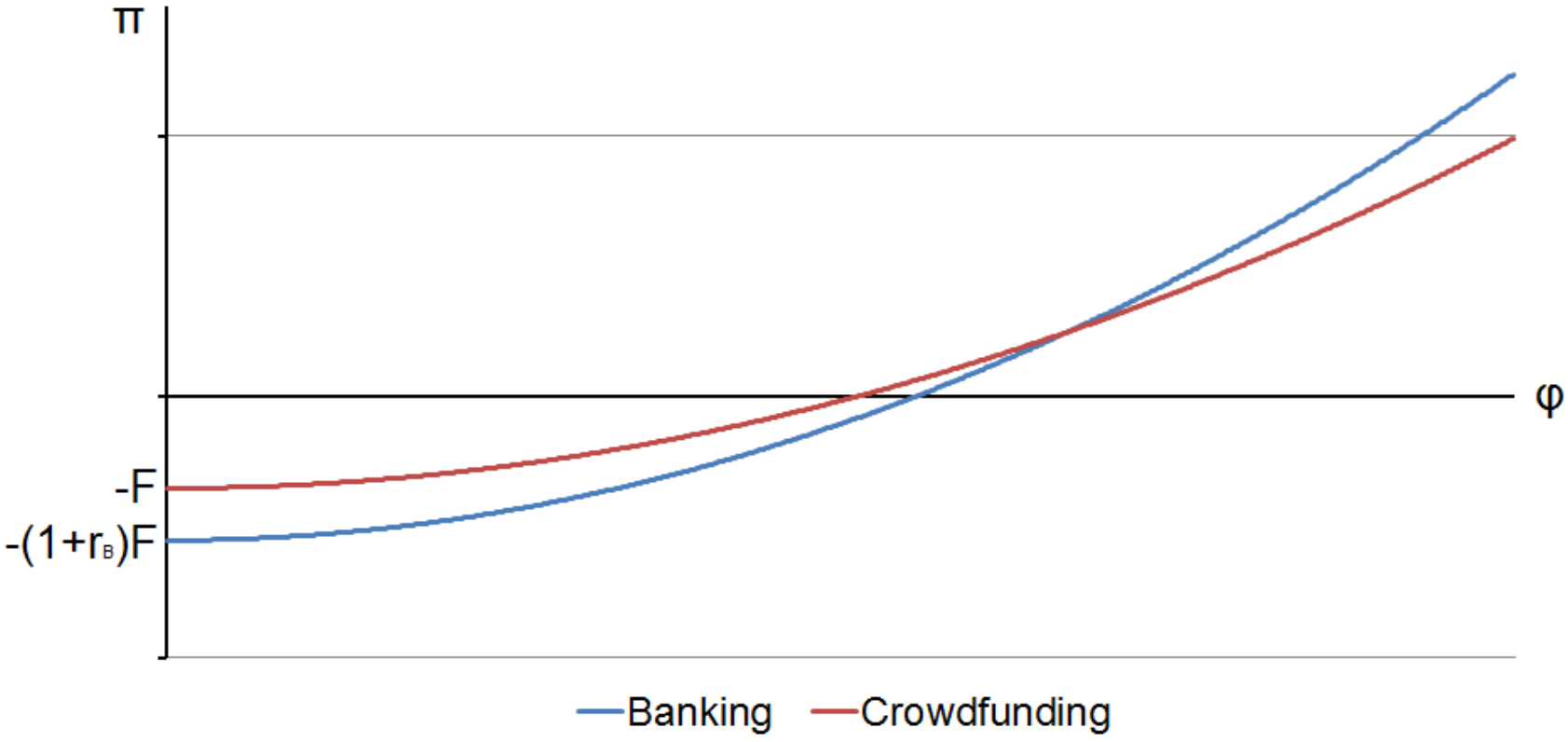
Equilibrium: Crowdfunding

- Entrepreneurs set a single price P_{CF} and minimum revenue R_{MIN}
- In equilibrium, if $\phi \geq \phi_{CF}$ crowdfunding is profitable in expectation
- Price Setting:
  - P_{CF} is a weighted average of monopoly price in each state
- Minimum Revenue: set R_{MIN} such that:
  - If $R \geq R_{MIN}$, $\pi_{CF} \geq 0$
  - Removes all unprofitable states

Crowdfunding: Backward Induction



Why Crowdfunding Works: Optionality



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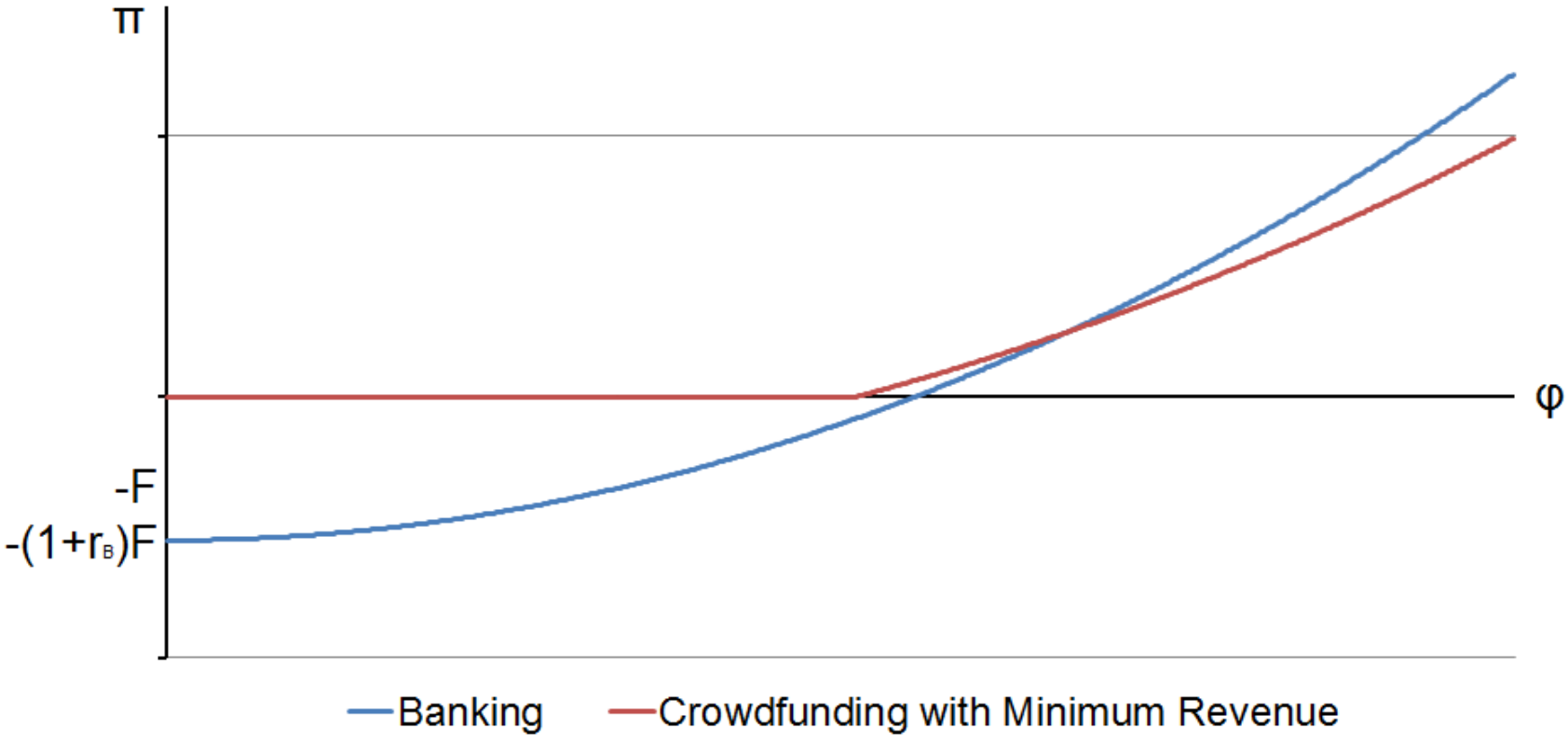

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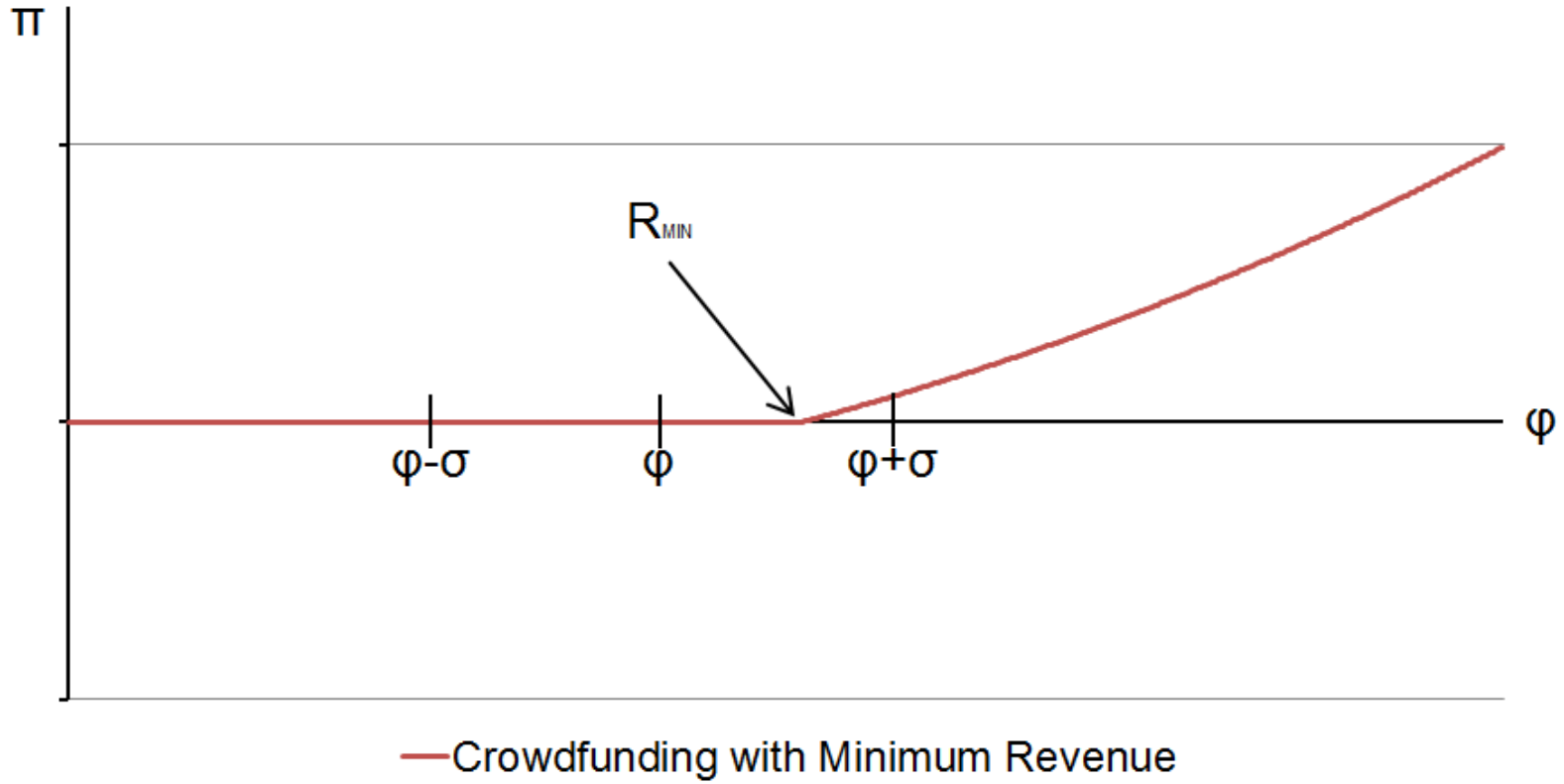

Crowdfunding and Risk

- Increasing the magnitude of crowdfunding risk σ decreases the minimum viable project size ϕ_{CF} under crowdfunding.
  - Projects with a high standard deviation in returns benefit from crowdfunding technology
- Decreasing the likelihood of high demand γ does not increase the minimum viable project size ϕ_{CF} under crowdfunding.
  - Projects which are very unlikely to succeed are equally viable under crowdfunding.

Crowdfunding without Minimum Revenue

- Without minimum revenue commitment, crowdfunding loses optionality
- If project defaults in low-demand state consumers do not recover funds.
  - Consumers must be compensated through lower prices.
  - Lower price may render-project unprofitable in high-demand state.
- Implications:
  - Minimum project size ϕ_{CF} rises when when entrepreneurs unable to set a minimum revenue commitment.
  - Minimum project size becomes sensitive to likelihood of high/low demands states, γ.

Funding Selection

- For projects above a sufficient size, banking remains optimal choice of funding:
  - Banking allows price-setting after demand is realized, entrepreneur can produce at monopoly price
  - Banks charge interest based on costs, crowdfunding charges fees based on revenue
- Crowdfunding optimal for projects where:
  - Probability of profitable demand states is very low
  - Size of risk σ is high
  - Fixed costs are relatively high compared to variable costs

Cost Uncertainty

- **Assume:** Variable costs are initially uncertain to all agents
- Entrepreneur views signal c of true variable cost C, such that:
  - $C = c + \zeta$ with Probability δ
  - $C = c - \zeta$ with Probability $1 - \delta$
- True cost realized after entrepreneur pays known fixed cost F
- Banking equilibrium remains similar to baseline model:
  - Banks evaluate probability of default over both dimensions of uncertainty
  - Risk to bank increases but consumers unaffected

Cost Uncertainty Under Crowdfunding

- Consumers purchase project before production occurs, assume risk.
- Minimum goals do not protect consumers as they do with demand uncertainty
- If revenue below costs to complete, entrepreneur unable to fill orders.
  - Compensating consumers for risk by lowering price increases default prob.
  - Market may break down as with pre-ordering

Viability of Crowdfunding with Cost Uncertainty

- For otherwise identical projects, except:
  - One has an uncertain cost signal c
  - One has a known cost c
- ϕ_{CF} is strictly higher for the project with uncertain costs
- Fewer crowdfunding projects are viable when costs are uncertain
- Market can break down if even one combination of states is unprofitable

Conclusion

- Rewards based crowdfunding is a distinct technology from existing pre-ordering systems
- Crowdfunding works best for small projects and projects with a high level of demand-side risk
  - Option-like nature allows projects with high risk to proceed
  - Can exist as a purely commercial funding method with no charitable motives
- Crowdfunding may compete with existing funding methods or but mainly exist in a separate niche.
- Consumers resolve demand risk but suffer from taking on other risks
  - Production risk can cause breakdown of market, as it affects consumers' willingness to pay