# Selling Dreams: Endogenous Optimism in Lending Markets

Luc Bridet
University of Saint Andrews

Peter Schwardmann
University of Munich (LMU)

Carnegie Mellon Belief-Based Utility Conference, 13 June 2017

# Motivation

- Theories of motivated cognition stress trade-off between affective benefits and material costs of becoming optimistic (e.g. Kunda 1990, Brunnermeier & Parker 2005, Köszegi 2006, Bénabou 2013)
- Substantial optimism documented in entrepreneurs, CEOs, financial traders and prospective home owners (e.g. Cooper et al. 1988, Landier & Thesmar 2009, Malmendier & Tate 2005, Barber & Odeon 2001, Pancrazi & Pietrunti 2014)
- Why is optimism or motivated cognition not driven out of markets?
  - People self-deceive for instrumental reasons (e.g. Bénabou & Tirole 2002, von Hippel & Trivers 2011, Schwardmann & van der Weele 2017)
  - This paper: some market settings reward wishful thinking

# Overview

- A model of why optimism arises in competitive lending markets
  - Borrower has anticipatory utility concerns and may self-deceive about the quality of her project (as in Brunnermeier & Parker 2005, and Bénabou 2013)
  - Lenders' contract offers shape borrowers' incentives to self-deceive
- Key results:
  - Adaptiveness: Motivated cognition leads to higher material payoffs, regardless of whether or not borrowers are optimistic in equilibrium
  - Pre-crisis lending: Lending markets give rise to optimism and widespread collateralization during booms and when the cost of lending is low
  - Policy relevance: Collateral requirements may be inefficiently high

# The model: setup

- Borrower needs $G$ to invest in project that yields $y$ or 0
- Lending contract specifies repayment $R$ and collateral $C$
- Borrower privately learns risk of failure $\theta \in \{\theta_L, \theta_H\}$, w. $P(\theta = \theta_H) = \nu$,
- She then chooses a belief $\tilde{\theta} \in \{\theta_L, \theta_H\}$ to maximize

$$U\left(\theta, \tilde{R}, \tilde{C}\right) + sU\left(\tilde{\theta}, \tilde{R}, \tilde{C}\right) = \underbrace{(1-\theta)(y-\tilde{R}) - \theta \tilde{C}}_{\text{material payoffs}} \quad + \quad s\underbrace{((1-\tilde{\theta})(y-\tilde{R}) - \tilde{\theta}\tilde{C})}_{\text{anticipatory payoffs}}$$

- A lender's profit from contract $(\tilde{R}, \tilde{C})$ is

$$\Pi\left(\theta, \tilde{R}, \tilde{C}\right) = (1-\theta)\tilde{R} + \theta \underbrace{(1-\chi\tilde{C})}_{\text{rate of value recovery}} \tilde{C} - G$$

# The model: timing

$t = 0$

- Multiple lenders offer menus of contracts

$t = 1$

- Borrower privately observes her type $\theta$
- She chooses belief $\tilde{\theta}$ to maximize $U(\theta, \tilde{R}, \tilde{C}) + sU(\tilde{\theta}, \tilde{R}, \tilde{C})$

$t = 2$

- Borrower chooses her favored contract based on $\tilde{\theta}$ $\rightarrow$ material costs
- She receives anticipatory utility $sU(\tilde{\theta}, \tilde{R}, \tilde{C})$ $\rightarrow$ anticipatory benefits

$t = 3$

- Material payoffs $U(\theta, \tilde{R}, \tilde{C})$ and $\Pi(\theta, \tilde{R}, \tilde{C})$ are realized

# Rational benchmark (s=0)

- We use the Wilson-Miyazaki-Spence (WMS) equilibrium concept
  MORE

- When $s = 0$, the WMS equilibrium allocation solves

$$\underset{\{C_H, C_L, R_H, R_L\}}{Max} \quad U(\theta_L, R_L, C_L)$$

$$s.t. \quad \begin{cases} U(\theta_H, R_H, C_H) - U(\theta_H, R_L, C_L) \geq 0 & \langle IC_H \rangle \\ U(\theta_L, R_L, C_L) - U(\theta_L, R_H, C_H) \geq 0 & \langle IC_L \rangle \\ \nu \Pi(\theta_H, R_H, C_H) + (1-\nu) \Pi(\theta_L, R_L, C_L) \geq 0 & \langle P \rangle \\ \Pi(\theta_H, R_H, C_H) \geq 0 & \langle P_H \rangle \end{cases}$$

- Similar to Bester (1985)

# Rational benchmark (s=0)

- We use the Wilson-Miyazaki-Spence (WMS) equilibrium concept
- When $s = 0$, the WMS equilibrium allocation solves

$$\underset{\{C_H, C_L, R_H, R_L\}}{Max} \quad U(\theta_L, R_L, C_L)$$

$$s.t. \quad \begin{cases} U(\theta_H, R_H, C_H) - U(\theta_H, R_L, C_L) \geq 0 & \langle IC_H \rangle \\ U(\theta_L, R_L, C_L) - U(\theta_L, R_H, C_H) \geq 0 & \langle IC_L \rangle \\ \nu \Pi(\theta_H, R_H, C_H) + (1-\nu) \Pi(\theta_L, R_L, C_L) \geq 0 & \langle P \rangle \\ \Pi(\theta_H, R_H, C_H) \geq 0 & \langle P_H \rangle \end{cases}$$

# Rational benchmark (s=0)

- We use the Wilson-Miyazaki-Spence (WMS) equilibrium concept
- When $s = 0$, the WMS equilibrium allocation solves

$$\underset{\{C_H, C_L, R_H, R_L\}}{Max} \quad U(\theta_L, R_L, C_L)$$

$$s.t. \quad \begin{cases} U(\theta_H, R_H, C_H) - U(\theta_H, R_L, C_L) \geq 0 & \langle IC_H \rangle \\ U(\theta_L, R_L, C_L) - U(\theta_L, R_H, C_H) \geq 0 & \langle IC_L \rangle \\ \nu\,\Pi(\theta_H, R_H, C_H) + (1-\nu)\,\Pi(\theta_L, R_L, C_L) \geq 0 & \langle P \rangle \\ \Pi(\theta_H, R_H, C_H) \geq 0 & \langle P_H \rangle \end{cases}$$

- In equilibrium, $C_H^* = 0$ and $C_L^* \geq 0$ and $\lim_{\nu \to 0} C_L^* = 0$.

# Candidate equilibrium allocations ($s \geq 0$)

Definition: The realism contracts are the solution to the following program

$$\underset{\{C_H, C_L, R_H, R_L\}}{Max} \quad (1+s)U(\theta_L, R_L, C_L)$$

$$s.t. \quad \begin{cases} (1+s)\,U(\theta_H, R_H, C_H) - U(\theta_H, R_L, C_L) - sU(\theta_L, R_L, C_L) \geq 0 & \langle OE_{H,H} \rangle \\ (1+s)\,U(\theta_L, R_L, C_L) - U(\theta_L, R_H, C_H) - sU(\theta_H, R_H, C_H) \geq 0 & \langle OE_{L,L} \rangle \\ U(\theta_H, R_H, C_H) - U(\theta_H, R_L, C_L) \geq 0 & \langle IC_H \rangle \\ U(\theta_L, R_L, C_L) - U(\theta_L, R_H, C_H) \geq 0 & \langle IC_L \rangle \\ \nu\,\Pi(\theta_H, R_H, C_H) + (1-\nu)\,\Pi(\theta_L, R_L, C_L) \geq 0 & \langle P \rangle \\ \Pi(\theta_H, R_H, C_H) \geq 0 & \langle P_H \rangle \end{cases}$$

# Candidate equilibrium allocations ($s \geq 0$)

Definition: The realism contracts are the solution to the following program

$$\underset{\{C_H, C_L, R_H, R_L\}}{Max} \quad (1+s)U(\theta_L, R_L, C_L)$$

$$s.t. \quad \begin{cases} (1+s)\,U(\theta_H, R_H, C_H) - U(\theta_H, R_L, C_L) - sU(\theta_L, R_L, C_L) \geq 0 & \langle OE_{H,H} \rangle \\ (1+s)\,U(\theta_L, R_L, C_L) - U(\theta_L, R_H, C_H) - sU(\theta_H, R_H, C_H) \geq 0 & \langle OE_{L,L} \rangle \\ U(\theta_H, R_H, C_H) - U(\theta_H, R_L, C_L) \geq 0 & \langle IC_H \rangle \\ U(\theta_L, R_L, C_L) - U(\theta_L, R_H, C_H) \geq 0 & \langle IC_L \rangle \\ \nu\,\Pi(\theta_H, R_H, C_H) + (1-\nu)\,\Pi(\theta_L, R_L, C_L) \geq 0 & \langle P \rangle \\ \Pi(\theta_H, R_H, C_H) \geq 0 & \langle P_H \rangle \end{cases}$$

- The optimial expectations constraint is a stricter requirement than incentive compatibility, i.e. $OE_{H,H} \implies IC_H$

# Candidate equilibrium allocations ($s \geq 0$)

Definition: The realism contracts are the solution to the following program

$$\underset{\{C_H, C_L, R_H, R_L\}}{Max} \quad (1+s)U(\theta_L, R_L, C_L)$$

$$s.t. \quad \begin{cases} (1+s)\,U(\theta_H, R_H, C_H) - U(\theta_H, R_L, C_L) - sU(\theta_L, R_L, C_L) \geq 0 & \langle OE_{H,H} \rangle \\ \nu\,\Pi(\theta_H, R_H, C_H) + (1-\nu)\,\Pi(\theta_L, R_L, C_L) \geq 0 & \langle P \rangle \\ \Pi(\theta_H, R_H, C_H) \geq 0 & \langle P_H \rangle \end{cases}$$

Definition: The dreaming contract is the solution to the following program

$$\underset{\{C,R\}}{Max} \quad (1+s)U(\theta_L, R, C)$$

$$s.t. \quad \Pi(E(\theta), R, C) \geq 0 \quad \langle P \rangle$$

# Competitive equilibrium ($s \geq 0$)

## Proposition 1: competitive equilibrium allocation (for small $\nu$)

There exists a threshold $s^* > 0$ such that

- for $0 \leq s < s^*$ the realism contracts are the unique equ. allocation

$$C_L{}^* = \frac{1}{2(1+s)} \frac{(\theta_H - \theta_L)\,\nu}{\theta_L \chi\,(1-\theta_L)\,(1-\nu)} \quad \textit{and} \quad C_H{}^* = 0$$

- for $s > s^*$ the dreaming contract is the unique equilibrium allocation

$$C_P{}^* = \frac{1}{2} \frac{(\theta_H - \theta_L)\,\nu}{\chi\,(1-\theta_L)\,E[\theta]}$$

- Consistent with mixed evidence on the correlation of ex-ante credit risk and collateral use. I.e. negative correlation in Comeig et al. 2013, no correlation and ubiquitous collateral use in Berger & Udell 1990.

# Competitive equilibrium: adaptiveness

## Proposition 2: adaptiveness

The high risks material payoffs $U(\theta_H, R_H, C_H)$ are higher when she has anticipatory utility concerns ($s > 0$). For $s \leq s^*$ her material payoffs are increasing in $s$.

Intuition for the case of realism contracts:

- As $s$ increases, more incentives are needed to keep high risks realistic
- This can be achieved by raising $C_L$ (stick) or by reducing $R_H$ (carrot)
- But the higher weight on psychological payoffs, which are evaluated at $\tilde{\theta} = \theta_L$, makes increasing $C_L$ less potent
- I.e. sticks don't work on the (self-perceived) mighty

# Competitive equilibrium: pre-crisis lending

- In a 2009 speech, Ben Bernanke describes pre-crisis conditions in the US lending market:

  Financial institutions reacted to the surplus of available funds due to a savings inflow from abroad by competing aggressively for borrowers, and, in the years leading up to the crisis, credit to both households and businesses became relatively cheap and easy to obtain. One important consequence was a housing boom in the United States, a boom that was fuelled in large part by a rapid expansion of mortgage lending. Unfortunately, much of this lending was poorly done, involving, for example, little or no down payment by the borrower or insufficient consideration by the lender of the borrower's ability to make the monthly payments.

# Competitive equilibrium: pre-crisis lending

- In a 2009 speech, Ben Bernanke describes pre-crisis conditions in the US lending market:

  Financial institutions reacted to the **surplus of available funds** due to a savings inflow from abroad by **competing aggressively** for borrowers, and, in the years leading up to the crisis, **credit to both households and businesses became relatively cheap and easy to obtain**. One important consequence was a housing boom in the United States, a boom that was fuelled in large part by a **rapid expansion of mortgage lending**. Unfortunately, much of this lending was poorly done, involving, for example, little or no down payment by the borrower or **insufficient consideration by the lender of the borrower's ability to make the monthly payments**.

# Competitive equilibrium: pre-crisis lending

Bernanke about pre-crisis lending:

- there was a surplus of available funds due to an inflow of foreign savings
- lenders competed aggressively
- rapid expansion of mortgage (i.e. collateralized) lending
- insufficient consideration by the lenders of the borrower's ability to make the monthly payments.
- Widespread optimism before the crisis

# Competitive equilibrium: pre-crisis lending

## Proposition 3: pre-crisis lending

The prevalence of collateral use and overoptimism (the value of $-s^*$) are

- decreasing in the cost of lending $G$
- increasing in the returns of projects $y$

Intuition: As the spoils of being a successful entrepreneur increase, so does the desirability of the dream of being successful. This makes screening borrowers increasingly costly, until it is relinquished

- Also consistent with evidence in Jimenez et al. (2006) that a decrease in the risk-free rate leads to an increase in the prevalence of collateral use in loans to Spanish firms

# Conclusion

- We propose a simple model of wishful thinking in lending markets
  - Markets may help explain prevalence of motivated cognition
  - Motivated cognition may help explain market outcomes
- Omitted results:
  - Welfare GO
  - Extensions and robustness GO
- Avenues for future research:
  - Theory: enrich current model; study other market settings
  - Experiments: supply of motivated beliefs
  - Field data: beliefs as outcome variable (e.g. Oster et al. 2013)

*Thank you.*

Comments welcome: pschwardmann@gmail.com

# Equilibrium concept

- Equilibrium concept due to Wilson (1977), Miyazaki (1977) and Spence (1978) (WMS):

  A menu of contracts is a **WMS equilibrium** if no lender can offer a different menu that earns positive profits right away and continues to be profitable after competitors have dropped all unprofitable policies in response to the original lender's move.

- The WMS equilibrium coincides with the Rothschild & Stiglitz (1976) equilibrium where the latter exists.

- Netzer and Scheuer (2014) and Mimra and Wambach (2016) provide game theoretic foundations for the WMS equilibrium.

BACK

# Welfare

- Welfare is maximized at modest collateral for high risks and none for low risks $\rightarrow$ this allocation cannot be implemented

- Instead, consider the highest welfare achieved with a pooling allocation

$$\begin{aligned} \underset{\{C_P, R_P\}}{Max} \quad & \nu U(\theta_H, R_P, C_P) + (1-\nu) U(\theta_L, R_P, C_P) + sU(\theta_L, R_P, C_P) \\ s.t. \quad & \{(1+s)\nu\Pi(\theta_H, R_P, C_P) + (1+s)(1-\nu)\Pi(\theta_L, R_P, C_P) \geq 0 \end{aligned}$$

- Resulting collateral requirements $C_P^W = \frac{s\nu(\theta_H - \theta_L)}{2\chi\theta((1-\theta_L)(1+s) - \nu(\theta_H - \theta_L))} < C_P^*$

## Proposition 4: policy relevance

Collateral requirements in the dreaming allocation are inefficiently high and a tax or cap on collateral may be welfare improving.

BACK

# Extensions and robustness

- Monopoly:
  - Adaptiveness under type-dependent outside options and predatory lending otherwise
  - No pre-crisis lending
- Different supply side assumptions:
  - Less restrictive belief choice, i.e. $\tilde{\theta} \in [\theta_L, \theta_H]$: difficult, but qualitatively similar results
  - Bayesian self-doubt as in Bénabou and Tirole 2002: different policy implications (work in progress)
- Rothshild-Stiglitz: no problem
- Complete information: adaptiveness is driven by information assymmetry

BACK