Search for Yield

David Martinez-Miera                      Rafael Repullo
U. Carlos III de Madrid                  CEMFI

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Motivation (i)

“Over the past decade a combination of diverse forces has created a significant increase in the global supply of saving, a global saving glut, which helps to explain both the increase in the U.S. current account deficit and the relatively low level of long-term real interest rates in the world today.”

Ben Bernanke (2005)
Motivation (ii)

“An environment of low interest rates following a period of high rates is particularly problematic, for not only does the incentive of some participants to ‘search for yield’ go up, but also asset prices are given the initial impetus, which can lead to an upward spiral, creating the conditions for a sharp and messy realignment.”

Raghu Rajan (2005)
Summing up

Global savings glut

Low interest rates

Search for yield

Higher risk-taking
Summing up

Bernanke \{ 
\text{Global savings glut} \\
\text{Low interest rates} \\
\text{Search for yield} \\
\text{Higher risk-taking} 
\}
Summing up

Global savings glut

Low interest rates

Search for yield

Higher risk-taking

Rajan
Summing up

- Global savings glut
- Low interest rates
- Search for yield
- Higher risk-taking

This paper
Overview of model

• Three types of agents
  → **Entrepreneurs** require funds for their risky projects
  → **Banks** fund entrepreneurs’ projects
  → **Investors** provide funds to the banks

• Banks monitor entrepreneur’s projects
  → Reduces probability of failure

• Monitoring is costly and not observed by investors
  → Moral hazard problem
Two types of contracts

• Contracts with positive monitoring
  → Banks that \textit{originate-to-hold}
  → Traditional banking system

• Contracts with zero monitoring
  → Market finance or banks that \textit{originate-to-distribute}
  → Shadow banking system
Main results

• Equilibrium allocation of savings features
  → Zero monitoring for safer entrepreneurs
  → Positive monitoring for riskier entrepreneurs

• An increase in the supply of savings
  → Reduces interest rates and interest rate spreads
  → Reduces monitoring incentives
  → Increases probability of failure of traditional banks
  → Expands relative size of shadow banking system
Roadmap

• A model of bank finance

• Search for yield

• Extensions
  → Short- vs long-run effects of savings glut
  → Risk-averse investors
  → Endogenous booms and busts

• Concluding remarks
Part 1

A model of bank finance
Model setup

• Two dates \((t = 0, 1)\)

• Agents: \(\rightarrow\) Set of potential entrepreneurs
  \(\rightarrow\) Set of risk-neutral investors
  \(\rightarrow\) Single risk-neutral bank

• Entrepreneurs have projects that require bank finance

• Bank has to raise funds from investors

• Investors require expected return \(R_0\)
Entrepreneurs

• Each entrepreneur has risky project

Unit investment  →  Return = \begin{cases} R, \text{ with prob. } 1 - p + m \\ 0, \text{ with prob. } p - m \end{cases}

where $m \in [0, p]$ is monitoring by lending bank

→ Monitoring reduces probability of failure
Bank monitoring

• Monitoring is not observed by investors
  → Moral hazard problem

• Monitoring entails cost $c(m)$
  → For numerical results assume

  $$c(m) = \frac{\gamma}{2} m^2, \text{ with } \gamma > 0$$
Bank

• Bank can only fund one project
  → Short side of the market
  → Loan rate equal to success return $R$

• Bank raises funds from investors
  → Limited liability
  → Borrowing rate denoted $B$
Optimal contract between bank and investors

\[(B^*, m^*) = \arg \max_{(B, m)} \left[ (1 - p + m)(R - B) - c(m) \right] \]

→ subject to bank’s incentive compatibility constraint (IC)

\[m^* = \arg \max_m \left[ (1 - p + m)(R - B^*) - c(m) \right] \]

→ bank’s participation constraint (PCB)

\[(1 - p + m^*)(R - B^*) - c(m^*) \geq 0\]

→ and investors’ participation constraint (PCI)

\[(1 - p + m^*)B^* = R_0\]
Characterization of optimal contract (i)

- Bank’s IC constraint

\[ m^* = \arg \max_m \left[ (1 - p + m)(R - B^*) - c(m) \right] \]

→ Interior solution characterized by FOC

\[ R - B^* = c'(m^*) \]

→ Marginal revenue (intermediation margin) = marginal cost
Characterization of optimal contract (ii)

• Investors’ PC

\[(1 - p + m^*)B^* = R_0\]

→ Substituting it into FOC

\[R - B^* = c'(m^*) \quad \rightarrow \quad c'(m^*) + B^* = R\]

→ Key equation

\[c'(m^*) + \frac{R_0}{1 - p + m^*} = R\]
Proposition 1

• Bank finance is feasible if loan rate $R$ satisfies

$$R \geq R = \min_{m \in [0, p]} \left(c'(m) + \frac{R_0}{1 - p + m}\right)$$

• Optimal monitoring $m^*$ given by highest value of $m$ that satisfies

$$c'(m) + \frac{R_0}{1 - p + m} \leq R$$
A case with positive monitoring

\[ c'(m) + \frac{R_0}{1 - p + m} \]
Another case with positive monitoring

\[ c'(m) + \frac{R_0}{1 - p + m} \]
Proposition 2

• If bank finance is feasible and we have interior solution
  → Monitoring is decreasing in funding cost $R_0$
  → Monitoring is increasing in loan rate $R$
  → Monitoring is increasing in spread $R - R_0$
Effect of a decrease in loan rate $R$

\[ c'(m) + \frac{R_0}{1 - p + m} \]
Effect of a decrease in loan rate $R$

$$
c'(m) + \frac{R_0}{1 - p + m}
$$

$$
R_1
$$

$$
R_2 = R
$$

$$
m_2^* = 0
$$

$$
m_1^*
$$
Summing up

• Monitoring $m^*$ depends on interest rate spread $R - R_0$

• Lower spreads lead to
  → Lower monitoring and higher default risk
  → Possible switch from positive to zero monitoring
  → Form originate-to-hold to originate-to-distribute

• Results assume exogenous interest rates
  → General equilibrium model
Part 2
Search for yield
Model setup

• Two dates \((t = 0, 1)\)

• Agents:  → Set of potential entrepreneurs
  → Set of risk-neutral investors
  → Set of risk-neutral banks

• Entrepreneurs have projects that require bank finance

• Banks have to raise funds from investors

• Investors have a **fixed aggregate supply of savings** \(w\)
Entrepreneurs

• Continuum of entrepreneurs of observable types $p \in [0,1]$

• Each entrepreneur of type $p$ has risky project

  Unit investment $\rightarrow$ Return = $\begin{cases} R_p, \text{ with prob. } 1 - p + m \\ 0, \text{ with prob. } p - m \end{cases}$

where $m \in [0, p]$ is monitoring by lending bank
Entrepreneurs and banks

• Single bank for each type of entrepreneur
  → All entrepreneurs of type $p$ borrow from this bank

• Loan market is contestable
  → Equilibrium loan rate is lowest feasible rate

• Returns of entrepreneurs of type $p$ are perfectly correlated
  → Portfolio return coincides with single project return
Equilibrium loan rates

• These assumptions imply

\[ R_p^* = R_p = \min_{m \in [0, p]} \left( c'(m) + \frac{R_0}{1 - p + m} \right) \]

→ Entrepreneurs of type \( p \) borrow at the lowest feasible rate

→ Otherwise another bank would undercut incumbent
Equilibrium with positive monitoring

\[ R_p^* = \frac{R_p}{R_{cm} + \frac{R_0}{1 - p + m}} \]
Equilibrium with zero monitoring

\[ R = c'(m) + \frac{R_0}{1 - p + m} \]

\[ R_p^* = R_p \]

\[ m_p^* = 0 \]
Investment returns

- Success return $R_p$ is a decreasing function of investment $x_p$

  $$R_p = R(x_p), \text{ with } R'(x_p) < 0$$

  → For numerical results assume

  $$R(x_p) = (x_p)^{-1/\sigma}, \text{ with } \sigma > 1$$
Equilibrium

An equilibrium is investment allocation \( \{x_p^*\} \) such that

1. Interest rates satisfy

\[ R_p^* = R(x_p^*) = R_p, \text{ for all } p \in [0,1] \]

2. The market clears

\[ \int_0^1 x_p^* \, dp = w \]
Proposition 3

- There is a marginal type

\[ p^* = 1 - \sqrt{R_0^* / c''(0)} \]

\[ \rightarrow \text{Banks lending to types } p \leq p^* \text{ will choose } m_p^* = 0 \]

\[ \rightarrow \text{Banks lending to types } p > p^* \text{ will choose } m_p^* > 0 \]
Comment on Proposition 3 (i)

- Loan rate for riskier types $p > p^*$ satisfies

$$R^*_p = R_{-p} = \min_{m \in [0, p]} \left( c'(m) + \frac{R^*_0}{1 - p + m} \right)$$

→ which implies

$$c''(m^*_p) - \frac{R^*_0}{(1 - p + m^*_p)^2} = 0$$
Comment on Proposition 3 (ii)

- If monitoring cost function is quadratic this condition becomes

\[ c''(m_p^*) - \frac{R_0^*}{(1 - p + m_p^*)^2} = \gamma - \frac{R_0^*}{(1 - p + m_p^*)^2} = 0 \]

\[ \downarrow \]

\[ p - m_p^* = 1 - \sqrt{\frac{R_0^*}{\gamma}} = p^* \]

→ Originate-to-hold banks have same probability of failure

→ Equal to the type \( p^* \) of marginal entrepreneur
Equilibrium investment allocation

\[ x = \frac{p^*}{p} \]

- Originate-to-distribute
- Originate-to-hold

\[ x_p \]
Equilibrium loan rates

$R^*$

$R_p$

$R_0^*$

$0$

$p^*$

$p$

Originate-to-distribute

Originate-to-hold
Equilibrium probabilities of bank failure

\[ p - m \]

\[ p - m^*_p \]

Originate-to-distribute

\( p^* \)

Originate-to-hold

\( p \)
Proposition 4

- Increase in aggregate supply of savings $w$ leads to
  - Reduction in interest rates $R_p^*$
  - Reduction in interest rate spreads $R_p^* - R_0^*$
  - Increase in bank lending and bank size $x_p^*$
  - Expansion of originate-to-distribute region $[0, p^*]$
  - Increase in probability of failure of originate-to-hold banks
Equilibrium investment allocation
Equilibrium loan rates
Equilibrium probabilities of bank failure

\[ p - m \]

\[ p - m^* \]

\[ p - m_p \]

\[ p^* \]

\[ p^* \]
Two effects of savings glut

• **Extensive margin** effect
  
  → Originate-to-hold banks lend to riskier borrowers
  \[ p^* \rightarrow p^{**} > p^* \]

• **Intensive margin** effect
  
  → Originate-to-hold banks take more risk
  \[ p - m^*_p = p^* \rightarrow p - m^{**}_p = p^{**} > p^* \]
Co-movement of spreads and monitoring

- Effects on spreads of change in $R_0^*$
  
  → By envelope theorem
  
  $$\frac{dR_p^*}{dR_0^*} = \frac{d}{dR_0^*} \left( c'(m_p^*) + \frac{R_0^*}{1 - p + m_p^*} \right) = \frac{1}{1 - p + m_p^*}$$

  → Hence we have
  
  $$\frac{d(R_p^* - R_0^*)}{dR_0^*} = \frac{1}{1 - p + m_p^*} - 1 > 0$$

- Savings glut leads to a reduction in safe rate $R_0^*$
  
  → which implies a reduction in spreads $R_p^* - R_0^*$
Co-movement of spreads and monitoring

• Effects on monitoring of change in $R_0^*$
  → Zero slope condition at $m_p^*$
  \[ c''(m_p^*) - \frac{R_0^*}{(1 - p + m_p^*)^2} = 0 \]

  → Differentiating this condition gives
  \[ \frac{d m_p^*}{d R_0^*} > 0 \]

• Savings glut leads to a reduction in safe rate $R_0^*$
  → which implies a reduction in monitoring $m_p^*$
  → which could go to the corner $m_p^* = 0$
Effect of a reduction in safe rate

\[
R_p^* = \frac{R_0}{1 - p} + c'(m) + \frac{R_0}{1 - p + m}
\]
Effect of a reduction in safe rate

\[ R \]

\[ R^* = \frac{R}{r} \]
Effect of a reduction in safe rate
Summing up

• Model of the effects of savings glut
  → Partial equilibrium (moral hazard) model of bank finance
  → General equilibrium model of interest rates

• Results show link between savings glut and
  → Interest rates and interest rate spreads
  → Increases probability of failure of traditional banks
  → Increase in relative size of shadow banking system
Part 3

Extensions
Part 3 (i)

Short- vs long-run effects of savings glut
Short-run effects of savings glut

• Suppose that originate-to-hold banks cannot increase $x^*_p$
  → Due to some capacity constraint (e.g. capital requirements)
Results

• If traditional banks cannot expand
  → Greater increase in shadow banking system
  → Greater reduction in safe rate
  → Wider spreads for traditional banks
  → They become safer!

• The effect will only be temporary
  → They become riskier as soon as constraint is relaxed
Connection with Shin (2012)

- Key role of European global banks intermediating dollar funds
  → Tapping the wholesale funding market in the US
  
  “The culprit of the easy credit conditions in the US up to 2007 may have been the global banking glut rather than the global savings glut.”
Part 3 (ii)
Risk-averse investors
Risk-averse investors

• Continuum of risk-averse investors of mass \( w \)
  → Unit wealth
  → Utility function

\[
u(c) = c^\alpha, \text{ with } 0 < \alpha < 1
\]

• Assume that they can only invest in one asset
  → Indifferent between funding all types of banks

• Look at effects of a reduction in risk aversion
Results

• If investors are less risk-averse
  → Higher loan rates for safer entrepreneurs
  → Lower loan rates for riskier entrepreneurs
  → Narrower spreads for traditional banks
  → They become riskier

• Key difference with effect of savings glut
  → The safe rate $R_0^*$ goes up (instead of down)
Part 3 (iii)

Endogenous booms and busts
A simple dynamic model

• Suppose that supply of funds $w_{t+1}$ at date $t + 1$ is the outcome of
  → Investment of funds $w_t$ at date $t$
  → Realization of a systematic risk factor $z_t$

• Single risk factor of Vasicek (2002)
  → Effect of shocks determined by correlation across types
  → Correlation parameter $\rho \in (0,1)$
Endogenous booms and busts

• Good realizations of systematic risk factor lead to
  → Accumulation of savings (boom state)
  → Reduction in spreads & higher probabilities of failure
  → Banking system vulnerable to bad realization of risk factor

• Bad realizations of systematic risk factor lead to
  → Reduction in savings (bust state)
  → Increase in spreads & lower probabilities of failure
  → Restart process that generates another boom
Two sample paths of savings

\[ \rho = 0.2 \]

\[ \rho = 0.7 \]
Concluding remarks
Summing up

- Simple model to explain effects of savings glut
  → Focus on key role of bank intermediation
- Main result: If savings glut is accompanied by banking glut
  → Higher risk-taking by banks
- Results consistent with a number of stylized facts
  → More work needs to be done!
Role of macro-prudential policy

- Macroeconomic variables can have effects on systemic risk
  → Macro-prudential policy may play significant role

- Policy should not focus narrowly on credit growth
  → As in latest regulation of Basel Committee (Basel III)

- Broader macro-finance perspective would be required
  → More work needs to be done!
What about monetary policy?

• Our story has nothing to do with monetary policy
  → Real model

• Interestingly, we show that build-up of risk may take some time
  → Interest rates have to be “too low for too long”
  → As noted by many critics of Fed policy

• Broader money-macro-finance perspective would be required
  → More work needs to be done also here!
References


