EUROPEAN CENTRAL BANK

EUROSYSTEM

Liquidity Regulation, the Central Bank, and the Money Market

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Outline

1. Motivation and related literature
2. Model setup
   - Borrower/lender behaviour, equilibrium
3. Welfare analysis
4. Impact of central bank and regulator
5. Conclusion

1. Motivation and related literature – I

Question:

- Regulatory and central bank action affecting money market functioning to increase welfare – complementary or conflicting?

Related literature:

- Risky behaviour is related to asymmetric information on the money market (Flannery 1986, Diamond 1991)
- Pre-crisis demand for short-term wholesale funding (Taylor and Williams 2008, Eisenschmidt and Tapking 2009, Brunnermeier and Oehmke 2010)
- Credit risk and collateral availability (Heider and Hoerova 2009)

1. Motivation and related literature – II

Related literature (cont.):

- Liquidity requirements (Calomiris et al. 2012)
- Interaction between Basel III liquidity regulation and monetary policy implementation (Bindseil and Lamoot 2011)
- Central bank can improve market outcome when there is asymmetric information (Allen et al. 2009, Hoerova and Monnet 2010)
- Challenges for central bank corridor system when there is a liquidity requirement (Bech and Keister 2012)

2. Model set-up – I

Theoretical model

- **money market**
  - Borrowers/lenders (**asymmetric information**) **secured/unsecured** segment: interest rates $R^s \leq R^u$
  - **collateral constraints**: max secured share $\boldsymbol{\lambda} \leq 1$
- **investment opportunities**
  - Money market borrowers = investors
  - **safe/risky**: payoff $\mathrm{A} \leq \theta$ from investment I
  - **individual success probability p** for risky investment
  - **external effects**: $\boldsymbol{\theta}$ depends on share of risky investors; individual investor does not take into account the effect his investment has on the other risky investors

2. Model set-up: borrower optimisation behaviour

Given individual success probability p,

- choose investment (**safe or risky**) and
- choose funding market (**secured or unsecured**) to
- **maximise expected payoff** (i.e. risk-neutral)

- Key point:
  - Secured loan: always pay back
  - Unsecured loan: only pay back if investment successful
- **Incentive for „moral hazard“ behaviour**
  - invest risky and borrow unsecured
    - Successful -> profit
    - Unsuccessful -> losses passed to lender

2. Borrower – four possible payoff functions

Lenders

Interbank Market

I

Borrowers = investors

secured		**unsecured**	
$\Pi_B{}^s$ $(safe)$ $=$	$A - R^s I$	$\Pi_B{}^u$ $(safe)$ $=$	$A - R^u I$
$\Pi_B{}^s$ $(risky)$ $=$	$(\theta - R^s I)p_i + (-R^s I)(1 - p_i)$	$\Pi_B{}^u$ $(risky)$ $=$	$(\theta - R^u I)p_i + (1 - p_i)0$

2. Borrower under collateral constraints

Lenders

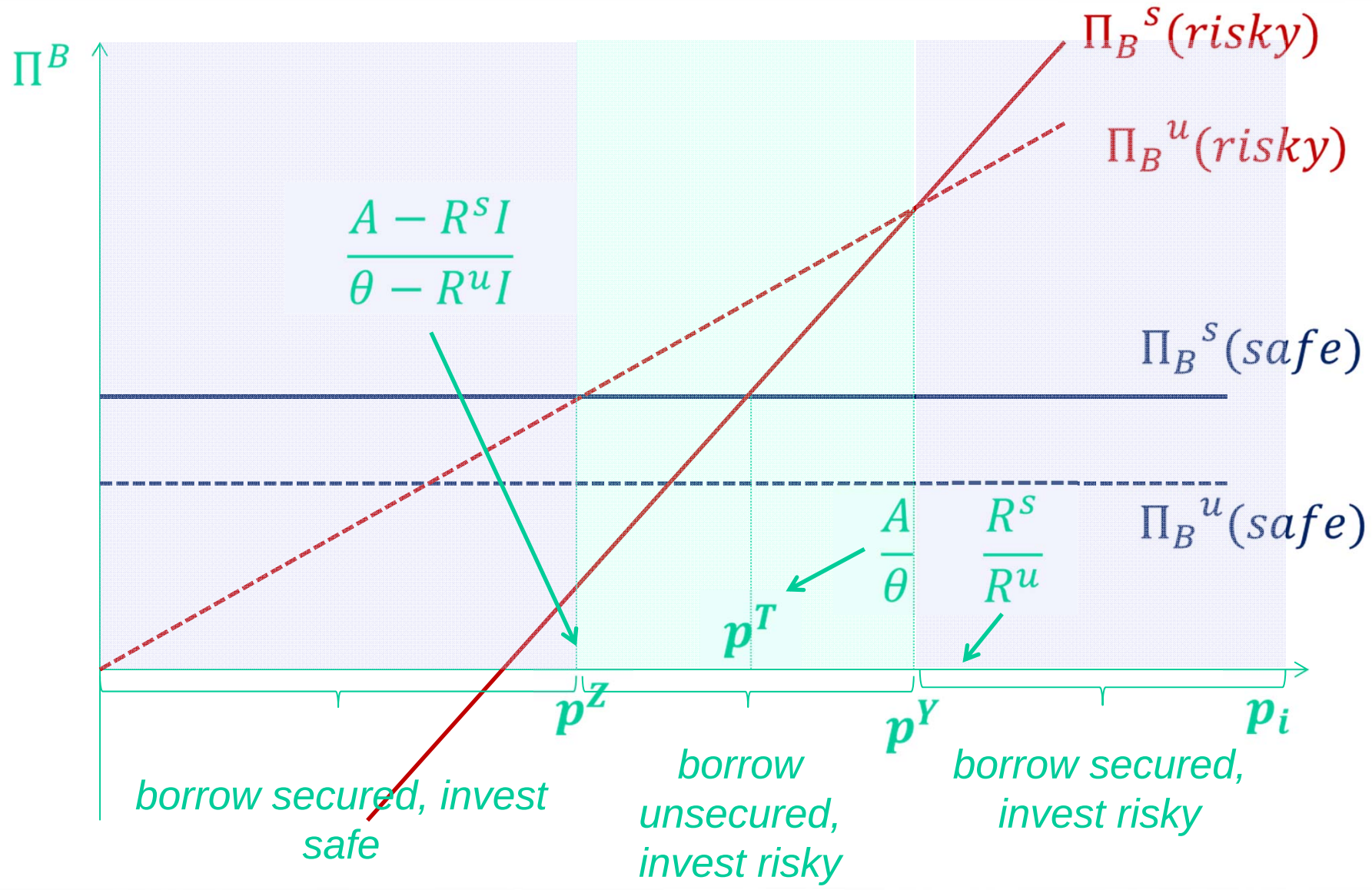
Interbank Market

I

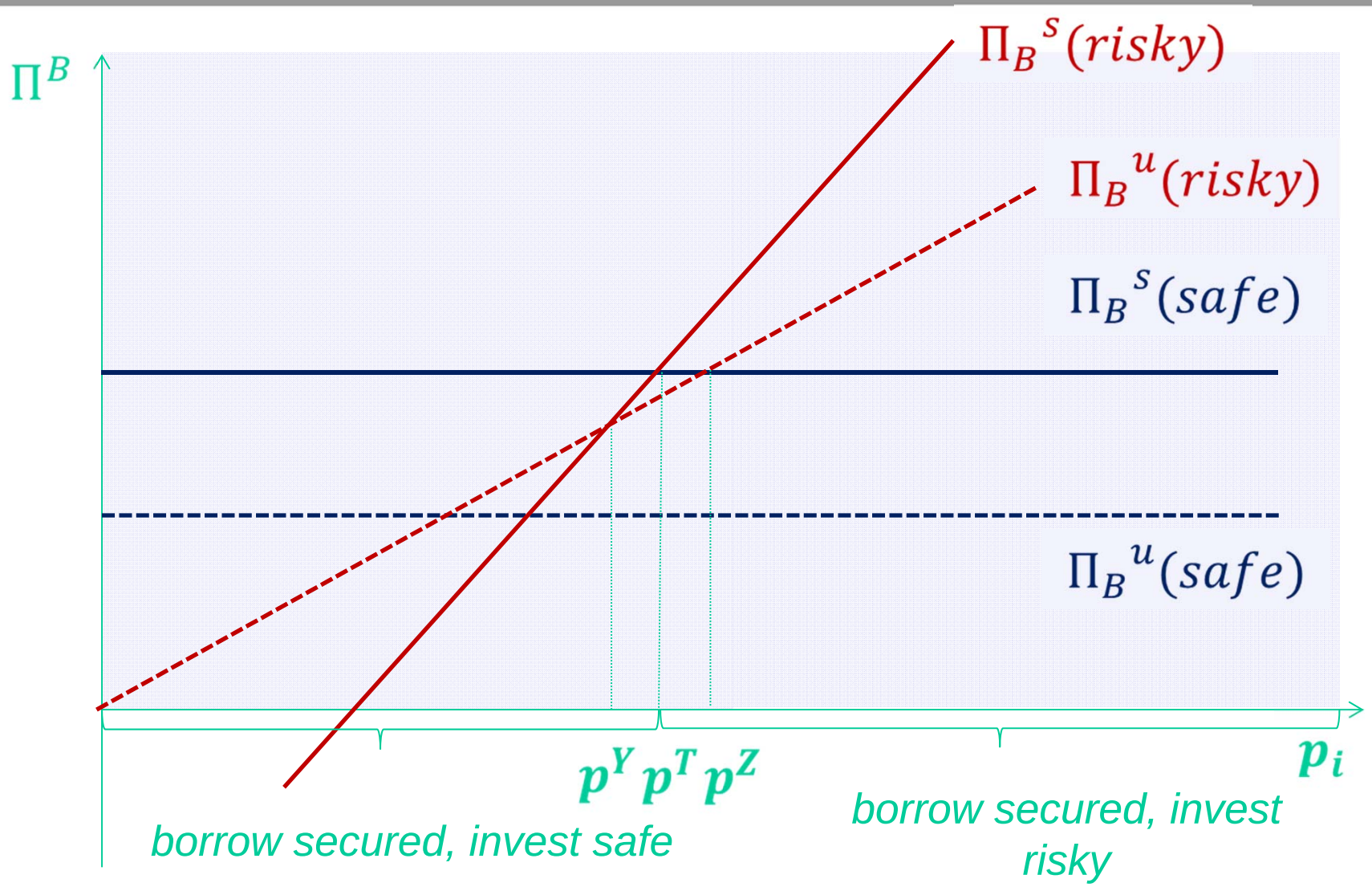
Borrowers = investors

secured		**unsecured**	
$\Pi_B{}^s(safe) =$	$A - (R^s\lambda + R^u(1-\lambda))I$	$\Pi_B{}^u(safe) =$	$A - R^u I$
$\Pi_B{}^s(risky) =$	$(\theta - (R^s\lambda + R^u(1-\lambda)I)p_i + (-R^s\lambda I)(1-p_i)$	$\Pi_B{}^u(risky) =$	$(\theta - R^u I)p_i + (1-p_i)0$

2. Borrower - optimal investment/funding strategy: Can have equilibrium with “moral hazard” area…



… or (pooling) equilibrium w/o “moral hazard” area



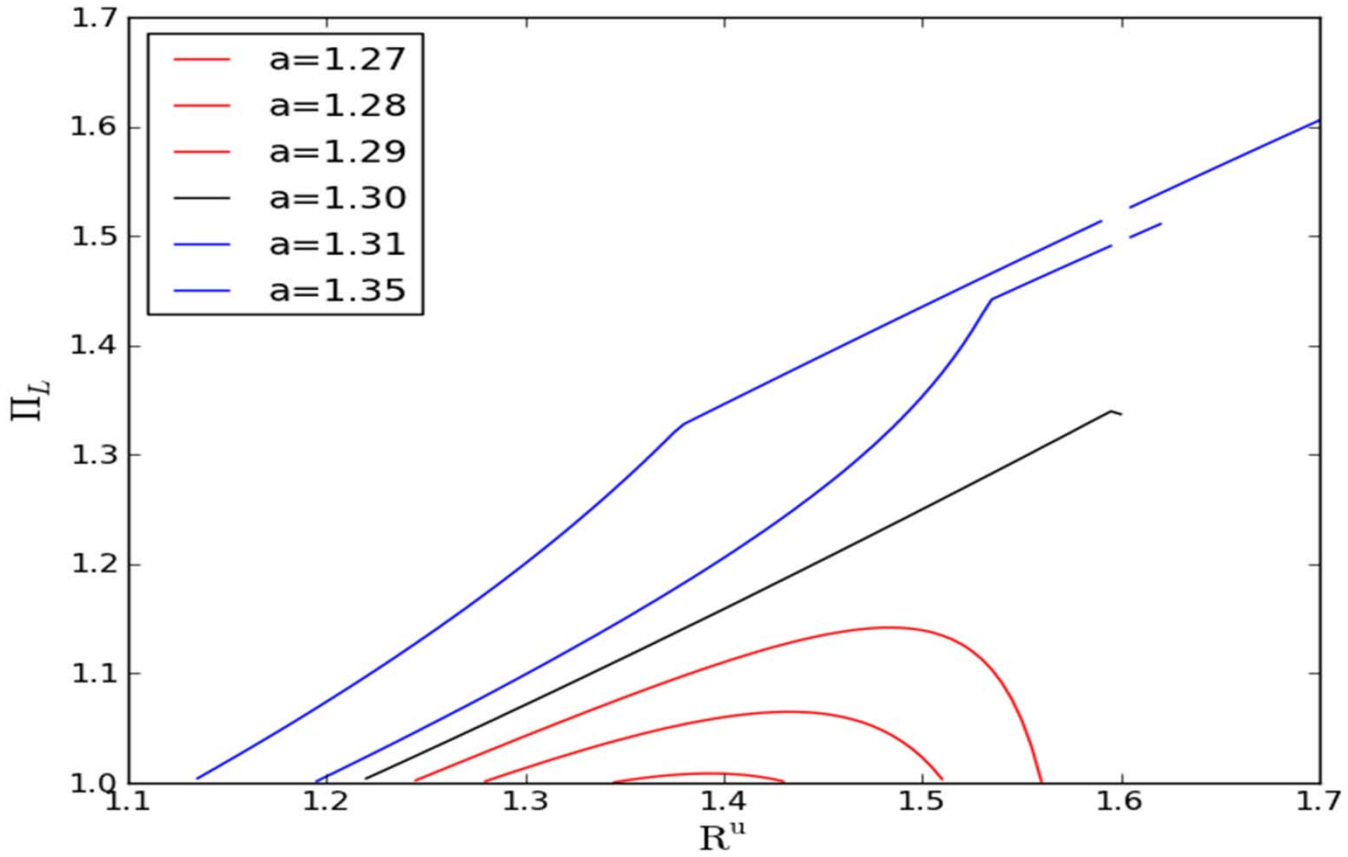
2. Lenders set unsecured rate, want profit

- Lenders
  - Do not know individual borrower p, only distribution f
  - form belief on aggregate borrower behaviour
  - set R^u to make profit (expected, i.e. risk-neutral)
  - If „moral hazard area“:
  - $\boldsymbol{\Pi}_L = R^u \frac{\int_0^{p^Z}(1-\boldsymbol{\lambda})f\,dp+\int_{p^Z}^{p^Y} pf\,dp+\int_{p^Y}^{1}(1-\boldsymbol{\lambda})pf\,dp}{\int_0^{p^Z}(1-\boldsymbol{\lambda})f\,dp+\int_{p^Z}^{p^Y} f\,dp+\int_{p^Y}^{1}(1-\boldsymbol{\lambda})f\,dp}$
  - Else:
  - $\boldsymbol{\Pi}_L = R^u \frac{\int_0^{p^T}(1-\boldsymbol{\lambda})f\,dp+\int_{p^T}^{1}(1-\boldsymbol{\lambda})pf\,dp}{(1-\boldsymbol{\lambda})} = R^u\left(\int_0^{p^T} f\,dp + \int_{p^T}^{1} pf\,dp\right)$
  - should be greater than 1

2. Equilibrium determination

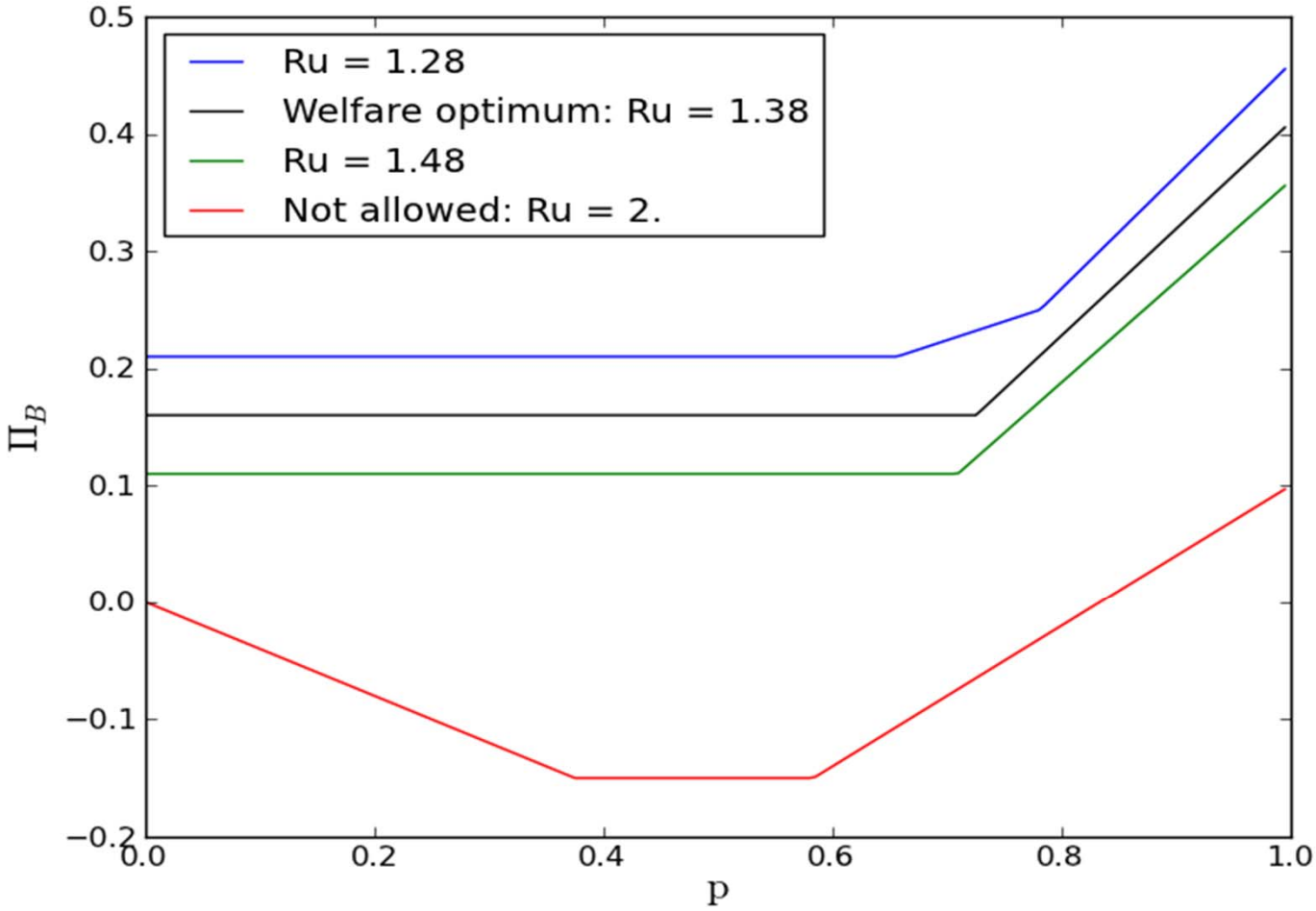
- Endogenous definition of equilibrium makes analytical solution difficult → numerical approach
- Additional assumptions: uniform distribution f of p; specific functional form for risky payoff **ϴ** to yield external effects
- To visualise: Start with specific equilibrium, e.g.
  - $\boldsymbol{\lambda} = 0.5$
  - $\mathrm{a} = \frac{A}{I} = 1.3$
  - $\boldsymbol{\Theta} = \frac{\boldsymbol{\theta}}{I} = 1.6$
  - $R^s = 1$
  - $R^u = 1.38$

2. Lender profit and possible unsecured rates R^u



Data inspection shows: „curvy“ part yields „moral hazard“ equilibria, linear part „non-moral hazard“ equilibria

2. Borrower payoff under different R^u



Negative profits if R^u too high → no investment

3. Welfare analysis – I

Social welfare:

- Defined as sum of borrower and lender payoff
- Interest payments cancel out, investment behaviour crucial
- $W = \int_0^q a\ f\ dp + \int_q^1 \theta(q)\ p\ f\ dp$
  - If borrowers with $p \leq q$ invest safe, the others risky
- Get social optimum by choosing q to maximise W

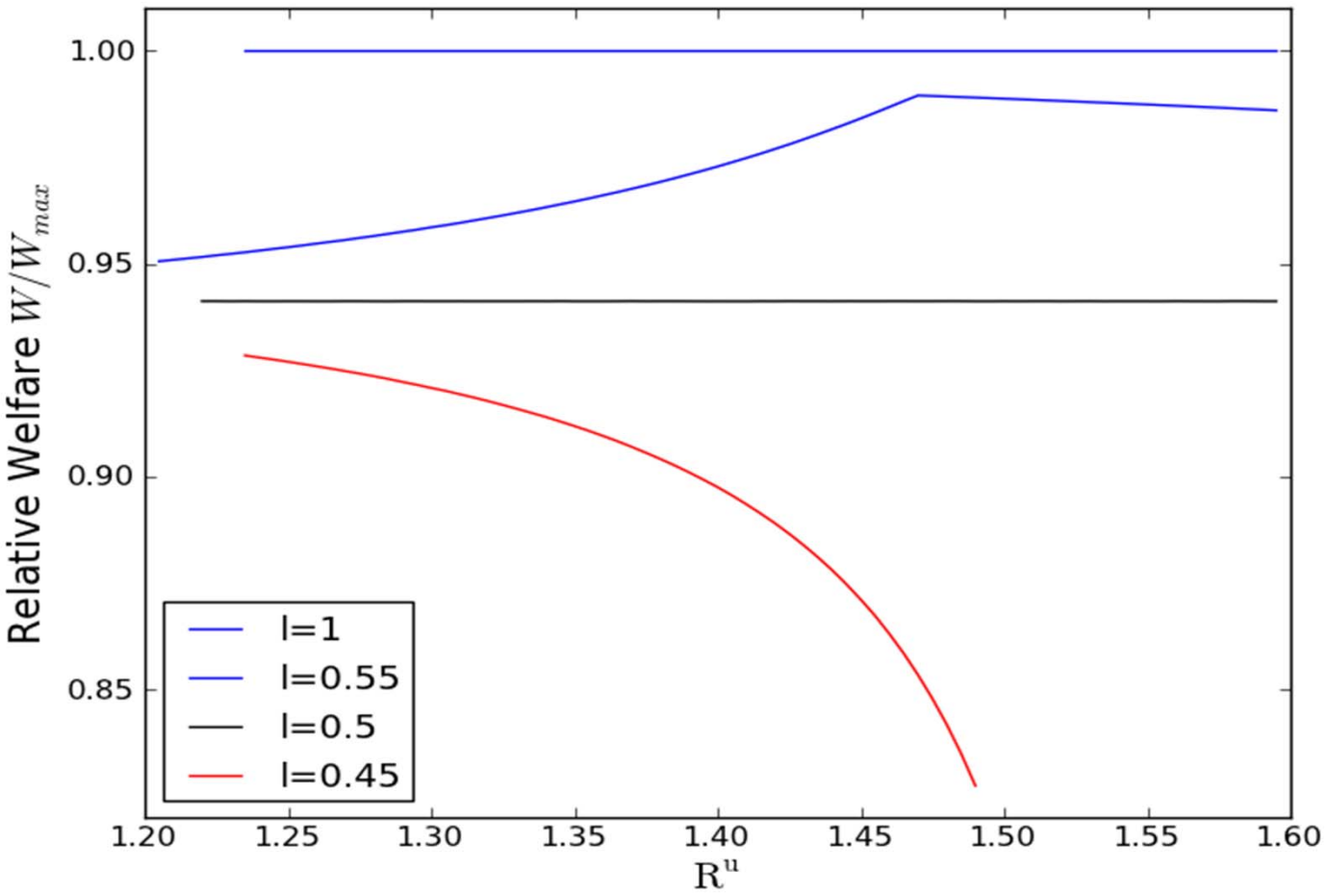
3. Welfare analysis – II

- 2 key sources of suboptimal welfare:
  - „moral hazard“ behaviour of borrowers → overly risky
  - External effects → overly risky

- Note: without collateral constraints, no „moral hazard“ area
  - $\lambda < 1$: cross-subsidy effects compensate lenders for loss from „moral hazard“ borrowers
  - $\lambda = 1$: no equilibrium, no unsecured market

- To address „moral hazard“: address collateral constraints, unsecured rate determination
- To address external effects: change investment payoffs

3. Without collateral constraints, no “moral hazard” area, higher welfare



No external effects → optimal welfare with λ=1

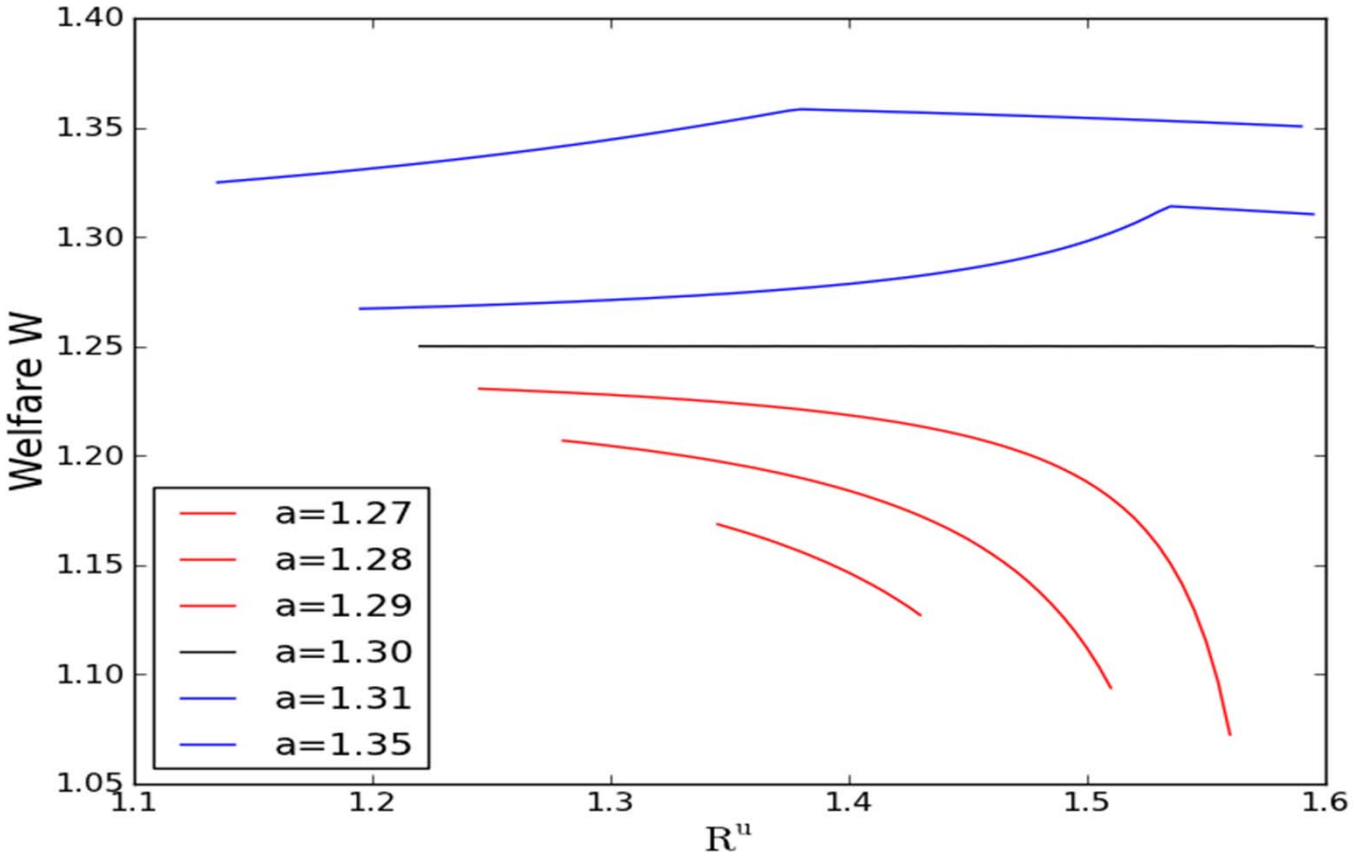
4. The central bank

- **Wide set of collateral,** no collateral constraints
- **Corridor system** $R^{DF} \leq R^{LF}$ to steer money market rates
  - Deposit facility rate R^{DF} : lower bound for R^{s}
  - Lending facility rate R^{LF} : upper bound for R^{u}
- Central bank intermediation can replace unsecured market
  - $R^{DF} < R^{LF}$: two possibilities:
    - market equilibrium with $R^{u} < R^{LF}$
    - no market equilibrium → replace unsecured market
  - $R^{DF} = R^{LF}$: always replace unsecured market
- **Trade-off** between market activity and welfare optimisation

4. The regulator

- Regulator can influence many different parameters
- Focus here: price action on A, $\boldsymbol{\theta}$
  - Subsidise safe asset (increase A)
  - Tax risky asset (decrease $\boldsymbol{\theta}$)

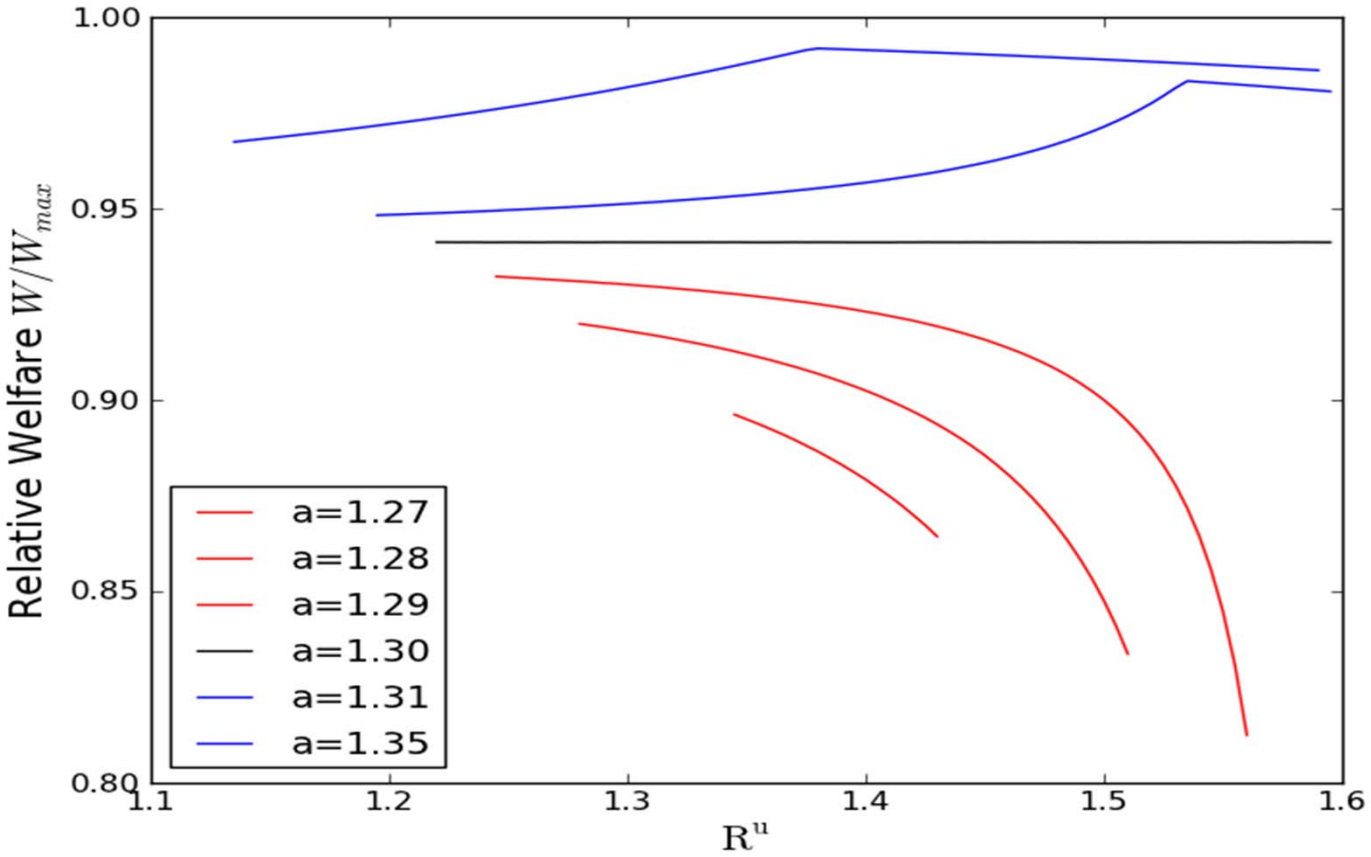
4. Welfare impact of central bank and regulator: Subsidising safe asset increases welfare…



Points on curve: possible equilibria

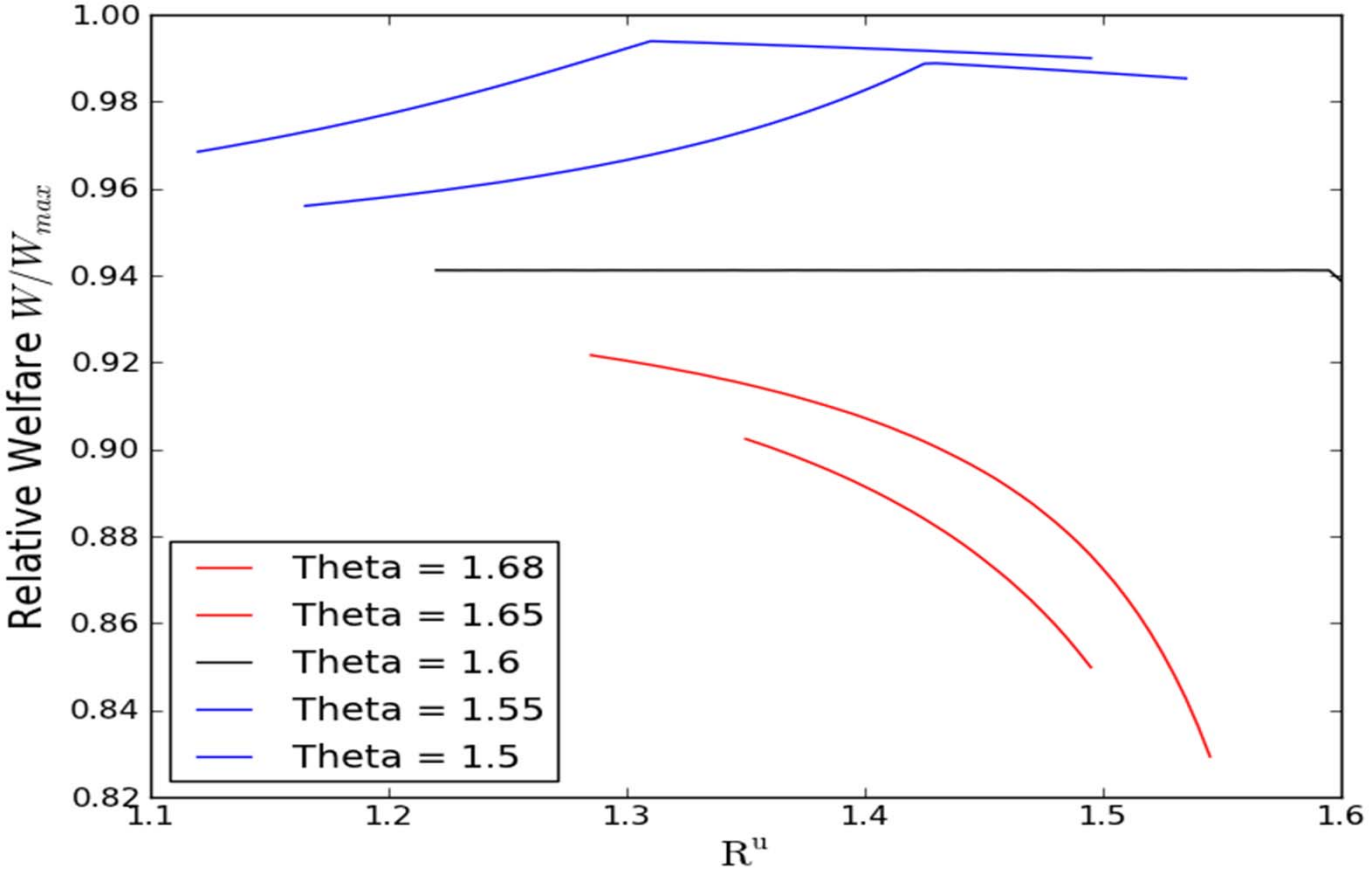
Again: „curvy“ part „moral hazard“

4. … also in relative terms. Impact of limiting R^u depends on context → possible conflict



Blue region better, welfare maximum reached for specific R^u, but lender can increase profit by increasing R^u further

4. Effect of taxing ϴ similar to subsidising A



Regulatory action welfare-increasing, again conflict with central bank possible

4. Interaction between central bank and regulator

Summary:

Can have complementarity…

- E.g.: central bank addresses collateral constraints, regulator addresses external effects

…but also conflict:

- E.g., starting with downward-sloping suboptimal curve:
  - Central bank introduces welfare-improving cap on R^u,
  - Regulator subsidises a, shifts curve up
  - Suddenly, cap on R^u is negative for welfare!

5. Conclusion

Theoretical money market model to address question:

- Regulatory and central bank action – complementary or conflicting?

Outcome:

- Can have both, depending on constellation
  - Central bank can address „moral hazard“ stemming from collateral constraints, regulator external effects
  - Welfare-improving central bank action can be counterproductive if there is also regulatory action
- Implies need for coordination!

Thank you!