

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 $\lambda \leq 1$

- investment opportunities

- Money market borrowers = investors
- **safe/risky**: payoff $A \leq \theta$ from investment I
- **individual success probability** p for risky investment
- **external effects**: θ 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	
Π_B^s (safe) =		$A - R^s I$		Π_B^u (safe) =	$A - R^u I$
Π_B^s (risky) =		$(\theta - R^s I)p_i$ $+ (-R^s I)(1 - p_i)$		Π_B^u (risky) =	$(\theta - R^u I)p_i$ $+ (1 - p_i)0$

2. Borrower under collateral constraints

Lenders

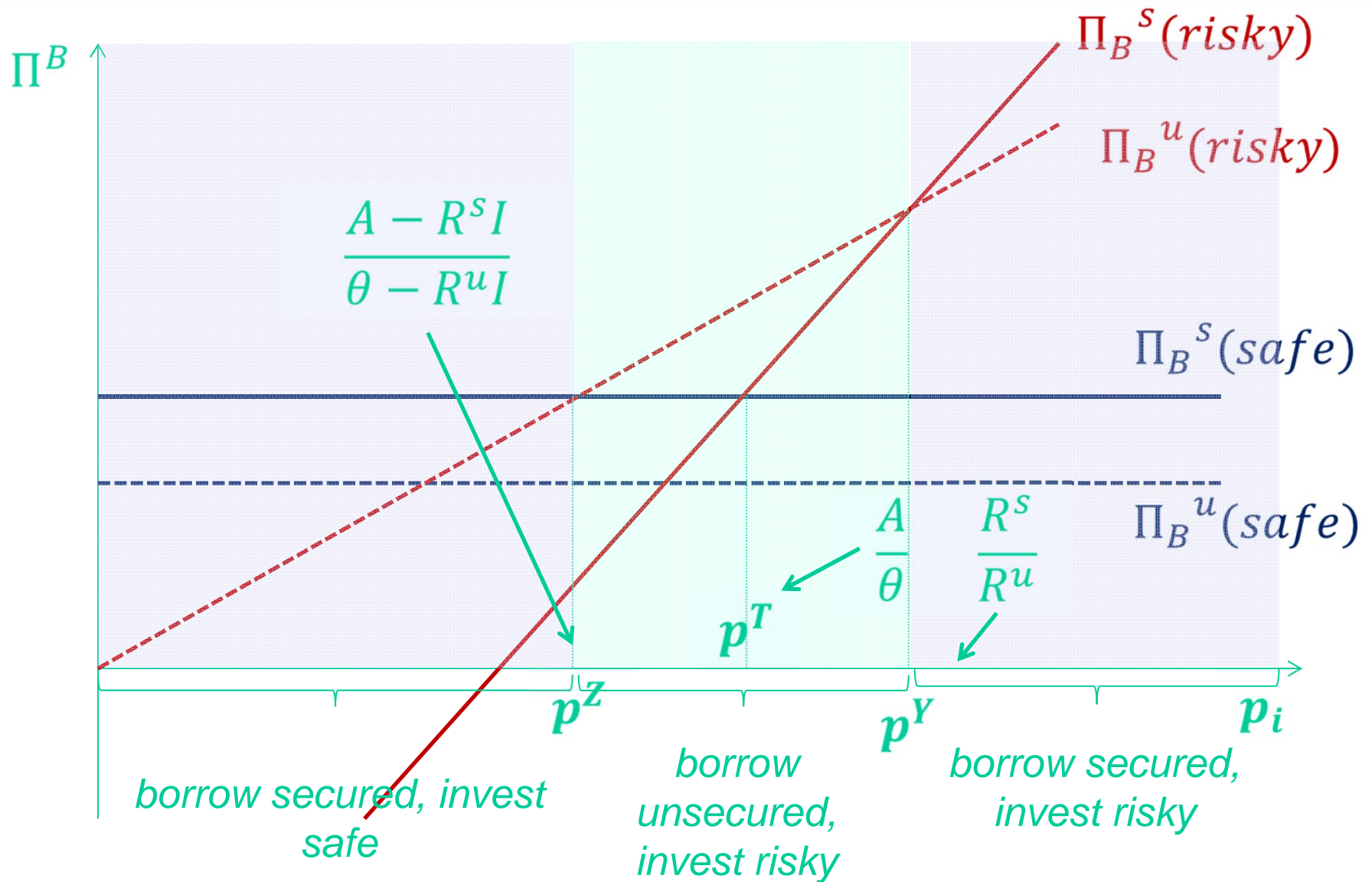
Interbank Market

I

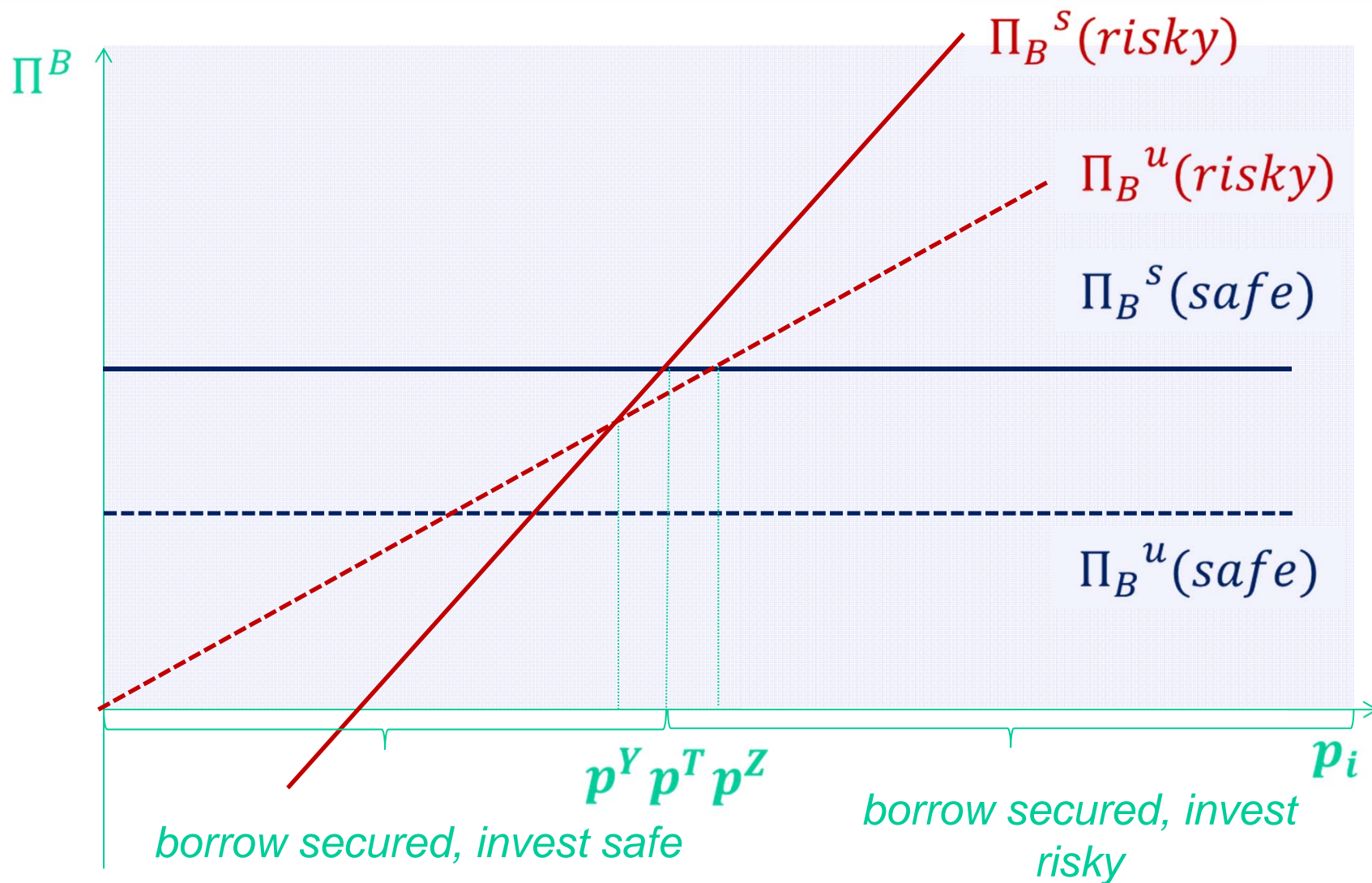
Borrowers
= investors

		Interbank Market	
		secured	unsecured
Π_B^s (safe) =	$A - (R^s \lambda + R^u(1 - \lambda))I$	Π_B^u (safe) =	$A - R^u I$
Π_B^s (risky) =	$(\theta - (R^s \lambda + R^u(1 - \lambda))I)p_i + (-R^s \lambda I)(1 - p_i)$	Π_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“:

$$- \Pi_L = R^u \frac{\int_0^{p^Z} (1-\lambda) f dp + \int_{p^Z}^{p^Y} p f dp + \int_{p^Y}^1 (1-\lambda) p f dp}{\int_0^{p^Z} (1-\lambda) f dp + \int_{p^Z}^{p^Y} f dp + \int_{p^Y}^1 (1-\lambda) f dp}$$

– Else:

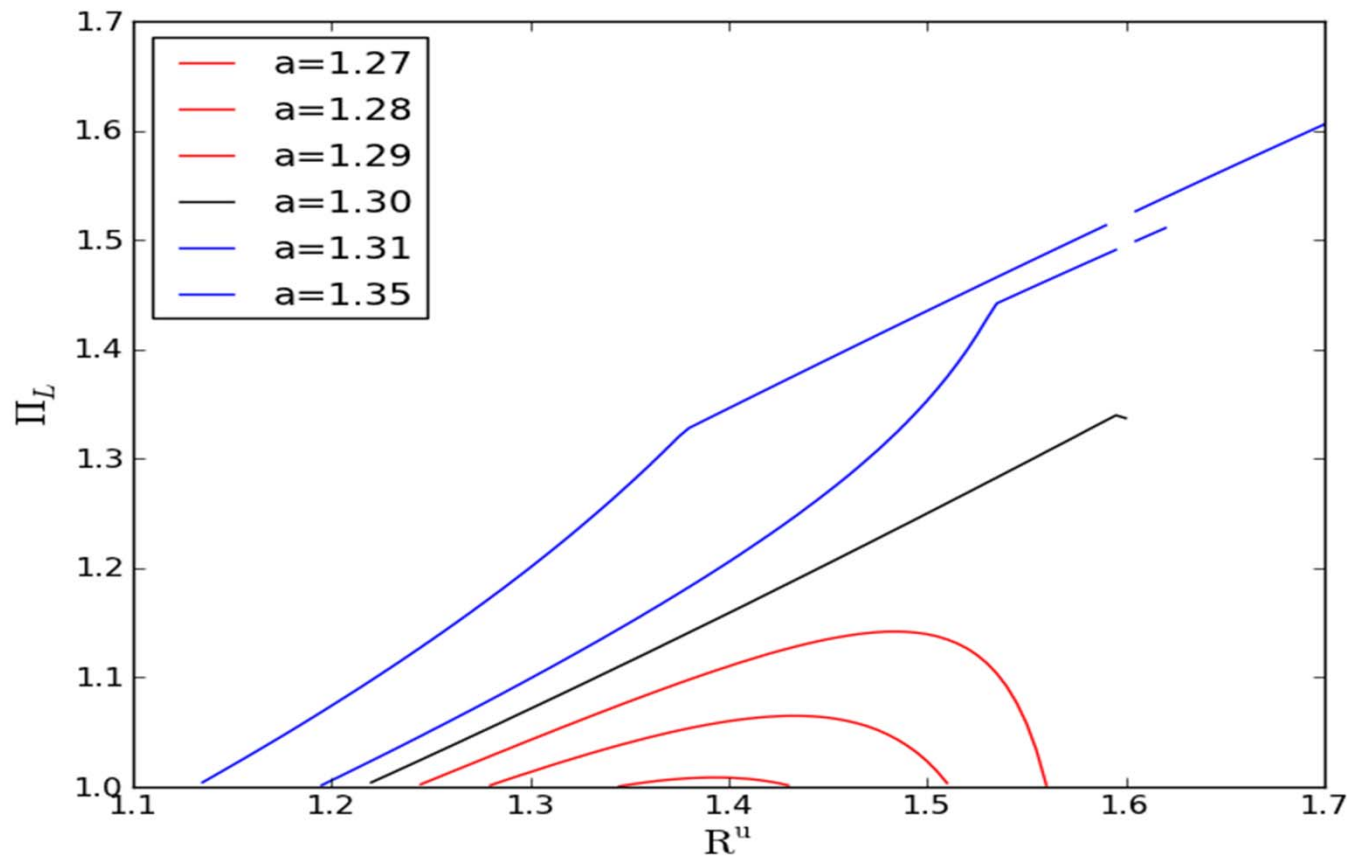
$$- \Pi_L = R^u \frac{\int_0^{p^T} (1-\lambda) f dp + \int_{p^T}^1 (1-\lambda) p f dp}{(1-\lambda)} = R^u \left(\int_0^{p^T} f dp + \int_{p^T}^1 p f dp \right)$$

– should be greater than 1

2. Equilibrium determination

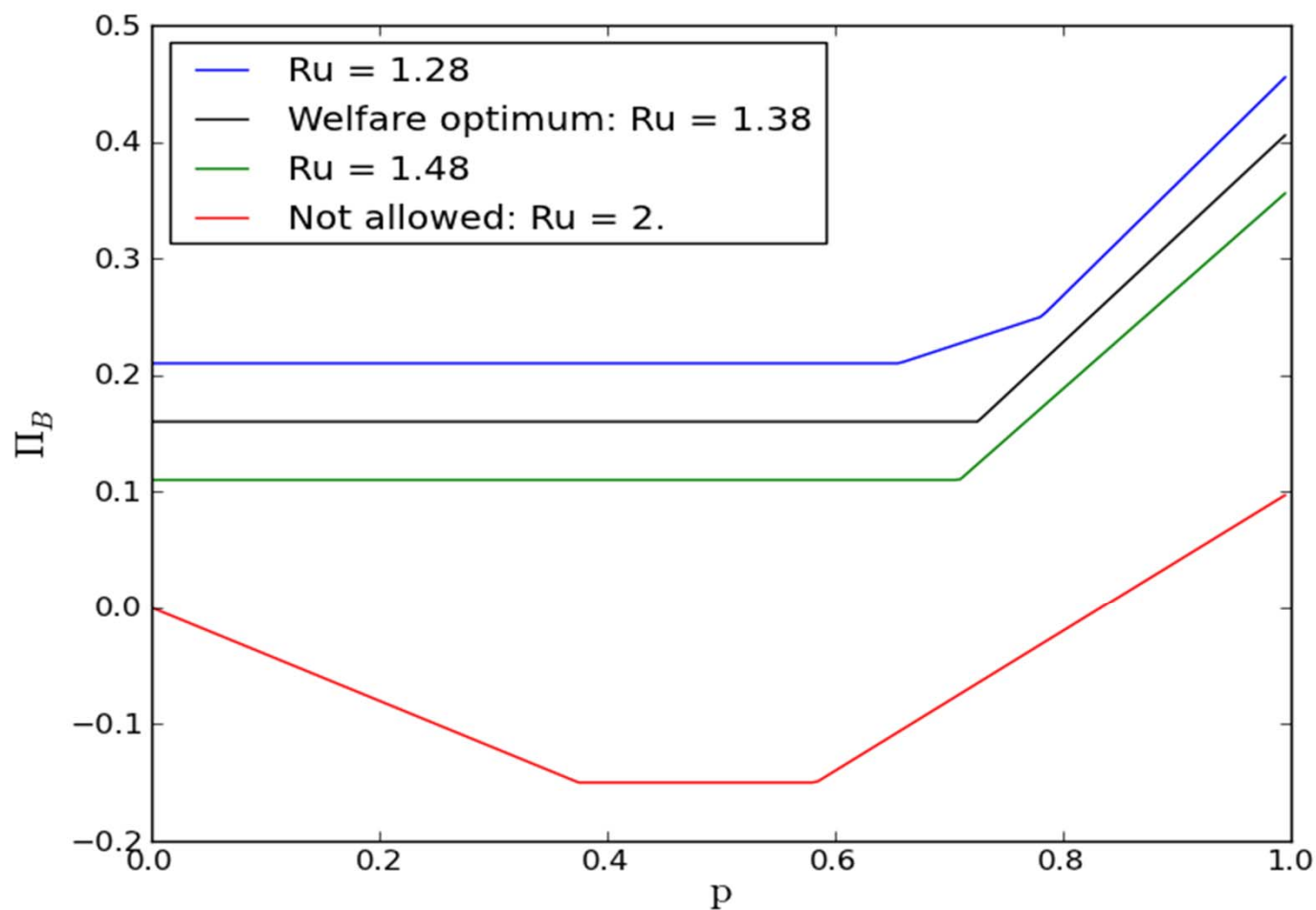
- Endogenous definition of equilibrium makes analytical solution difficult → numerical approach
- Additional assumptions: uniform distribution f of p ; specific functional form for risky payoff θ to yield external effects
- To visualise: Start with specific equilibrium, e.g.
 - $\lambda = 0.5$
 - $a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

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 \rightarrow no investment

3. Welfare analysis – I

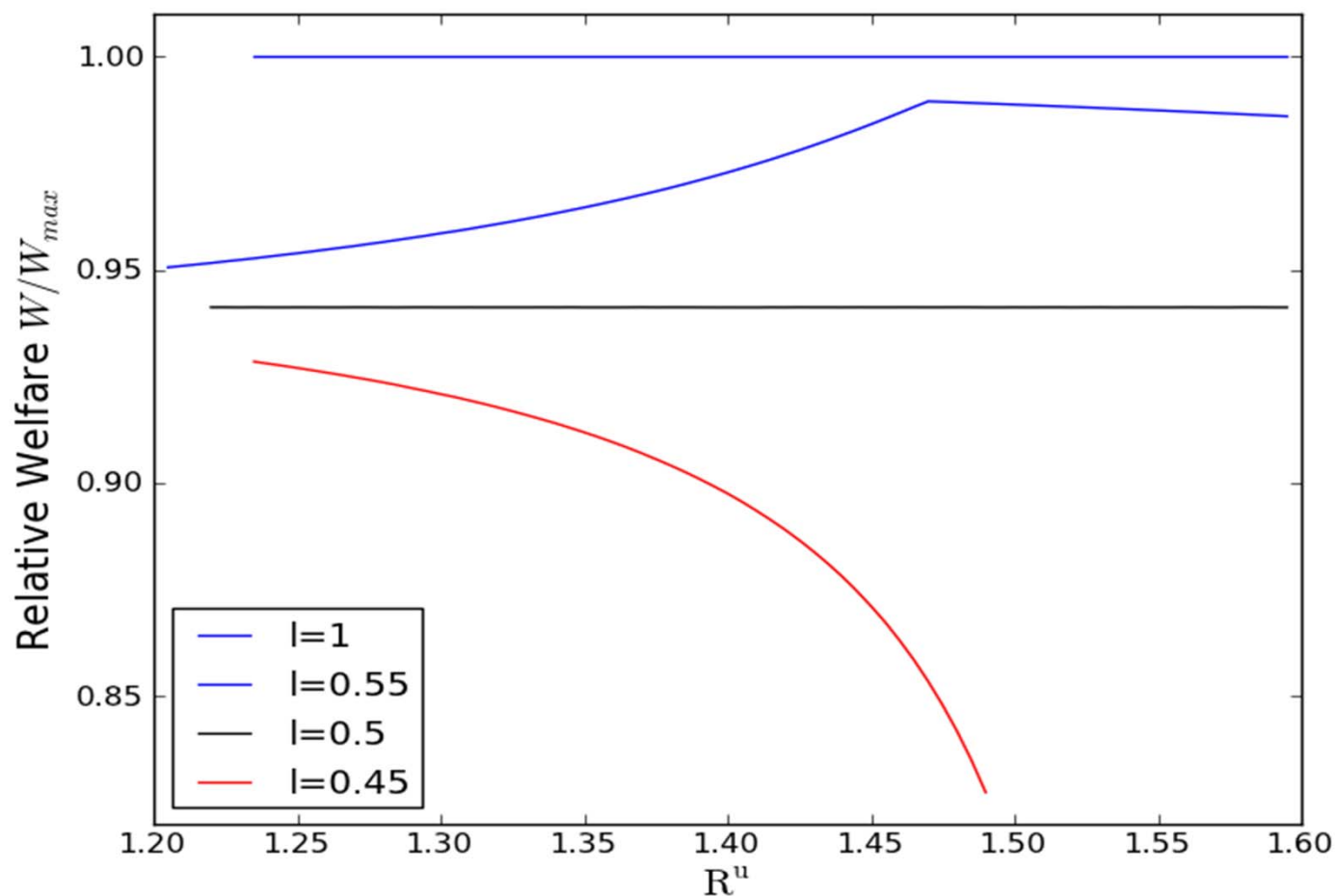
Social welfare:

- 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 \rightarrow optimal welfare with $\lambda=1$

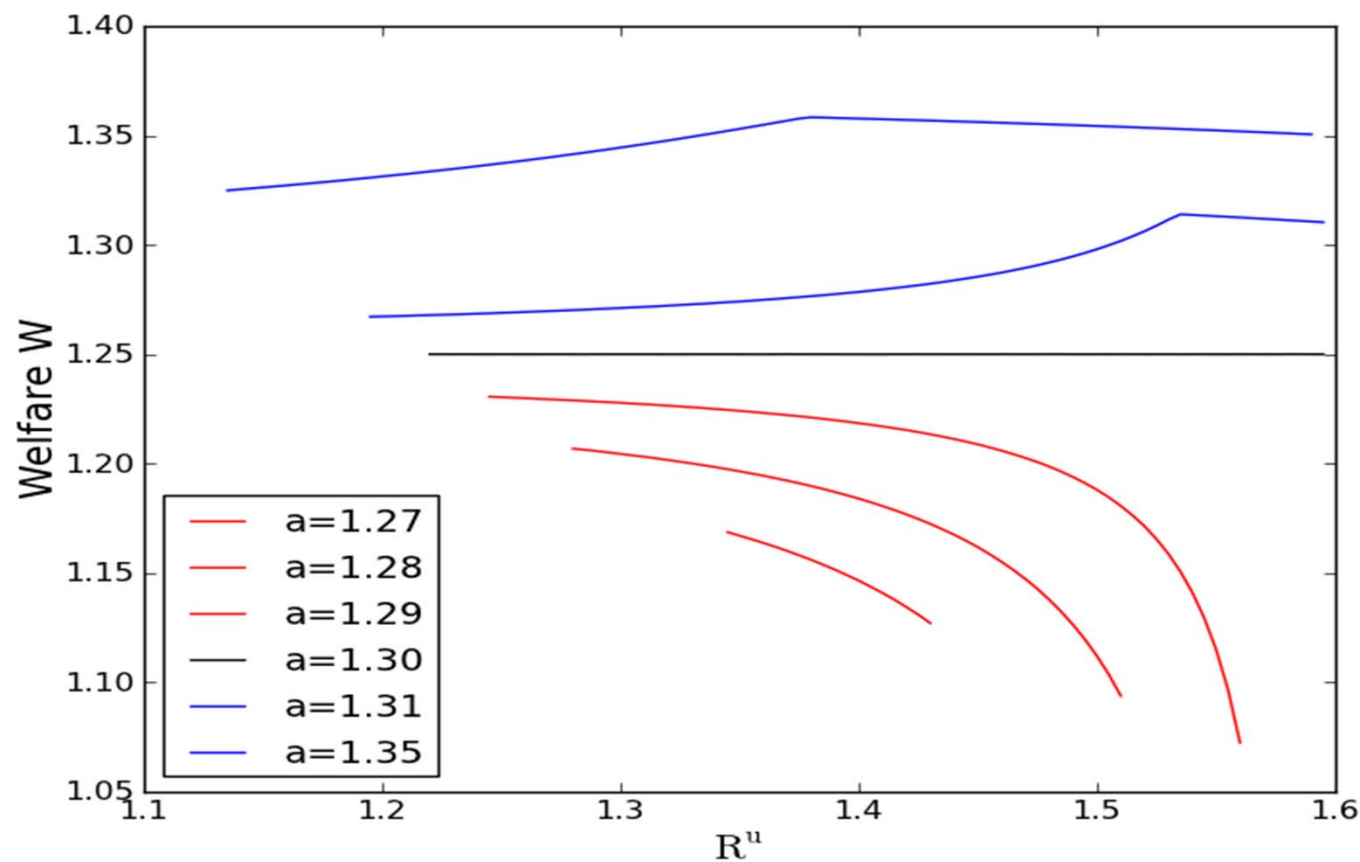
4. The central bank

- **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 , θ
 - Subsidise safe asset (increase A)
 - Tax risky asset (decrease θ)

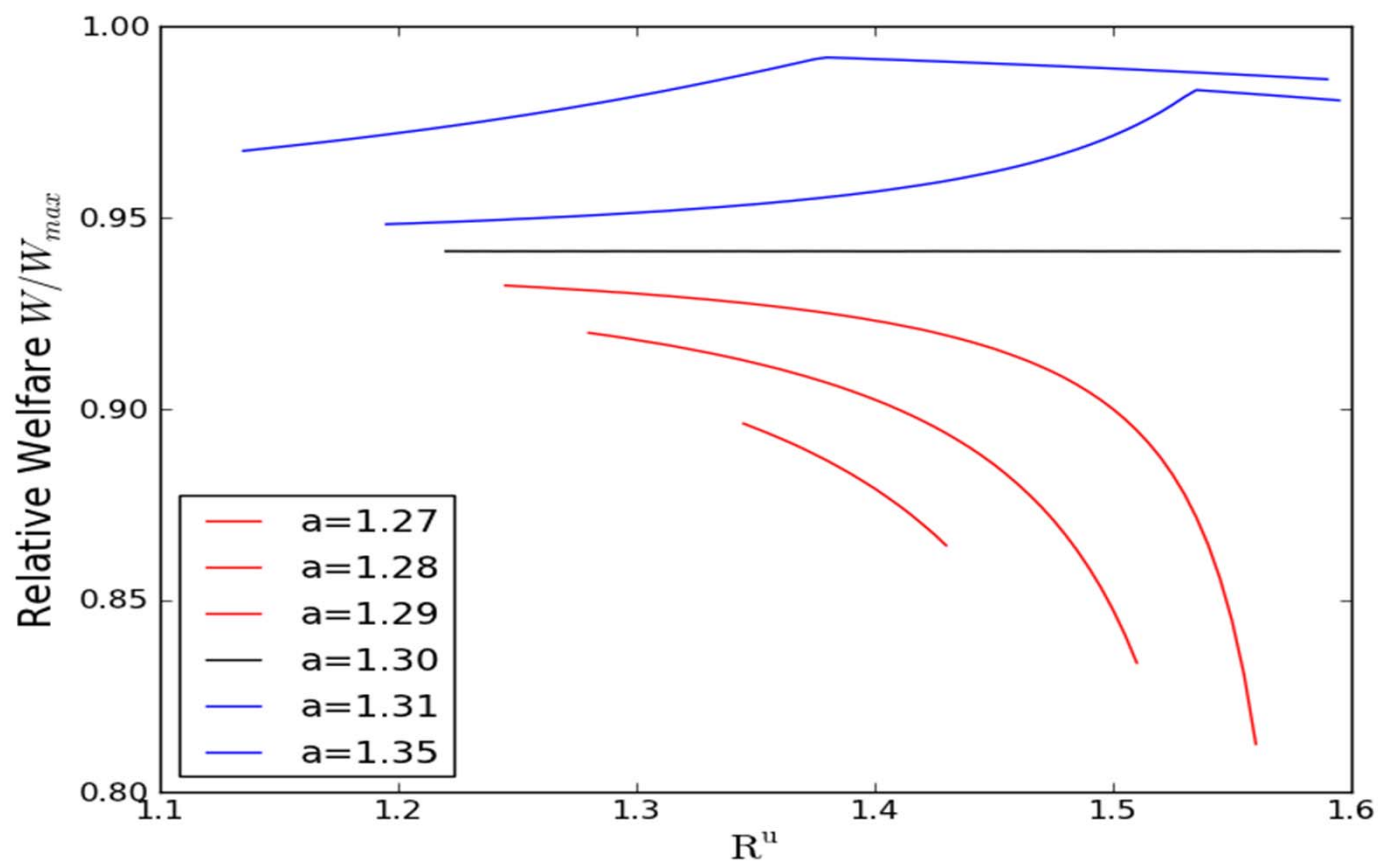
4. Welfare impact of central bank and regulator: Subsidising safe asset increases welfare...



Points on curve: possible equilibria

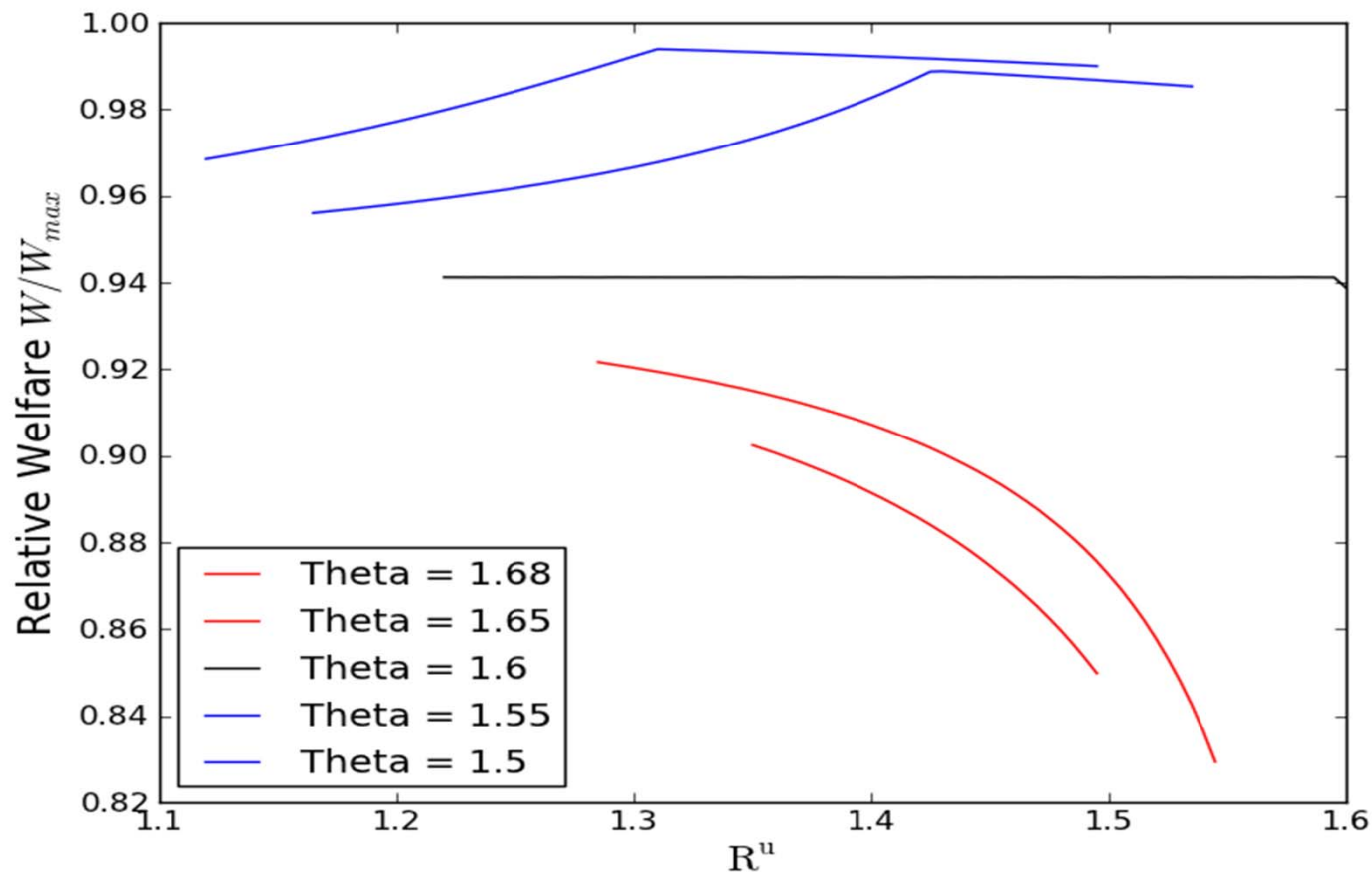
Again: „curvy“ part „moral hazard“

4. ... also in relative terms. Impact of limiting R^u depends on context \rightarrow 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!