

# Discount Window Stigma: An Experimental Investigation

Olivier Armantier (NY Fed)

Charlie Holt (University of Virginia)



# Disclaimer

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“The views expressed here do not necessarily reflect those of the Federal Reserve Bank of New York, or those of the Federal Reserve System.”

# Banks need short-term funding

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- Why?
  - Reserve requirement at the Central Bank
  - Combined with
    - Negative liquidity shock
    - Standard management practice
    - Arbitrage opportunities
- Where?
  - Private interbank markets
  - E.g. Federal Funds Market:
    - Mostly overnight
    - Over the counter
    - Unsecured
    - Operates from 8am to 6pm

# Do banks always obtain funding on private market?

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- Answer: No
- Why?
  - Exogenous reasons:
    - Timing of liquidity shock
    - Market disruptions
  - Endogenous Reasons:
    - Confidence issues (counterparty risk)
    - Dysfunctional market

# Why be reluctant to lend to another bank?

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- Answer is rooted in asymmetric information
- Two key concepts:
  - **Insolvent:** Liabilities > Assets
  - **Illiquid:** unable to meet short-term liquidity obligation
- Ok to lend to illiquid. Not OK to lend to insolvent
- Difficult to separate the two, especially in time of crisis

Thus, sound but illiquid institutions may not find private funding

# Consequences of not lending to illiquid banks

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- To the illiquid bank:
  - Fire sale of assets
  - Borrowing at high rates
  - May lead to bank run, insolvency and ultimately, failure
- To the financial system:
  - Assets depreciation
  - Exposure
    - => Domino / contagion effect
  - Excessive self-insurance (ex ante effect)
  - Ultimately, may lead to a contraction in economic activity

Thus, not lending to illiquid banks may have negative externalities and social costs

# Benefits of Lender-of-Last-Resort

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- A “Lender-of-Last-Resort” for illiquid banks can provide social benefits
- Why a public LLR?
  - Better able to internalize negative externalities
  - No strategic consideration
  - Central Bank has unique ability to create (“unlimited”) liquidity
  - Bank supervisor better able to distinguish illiquid from insolvent
- This is one of the core responsibilities of Central Banks
- In the U.S. the Fed uses the “Discount Window” (DW) to fulfill this task

# Possible costs of the LLR

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- Direct costs : Default risk
- Indirect costs : Moral hazard
- How to contain direct costs?
  - Do not lend to insolvent
  - Lend against good collateral
  - Lend at high rate
- How to contain indirect costs?
  - Lend at penalty rate
  - “Constructive ambiguity”
  - Moral suasion / shame
  - Co-insurance



# How to operate as a LLR?

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- Bagehot (1873) dictum:

***To avert panic, the Central Bank should lend early and freely to solvent institutions against good collateral at high rates***

- Historically, the Fed did not always adhere strictly to Bagehot
- Since 2003, and especially during the crisis, the Fed argued it essentially followed Bagehot

# The LLR in practice: Stigma

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- Historically, the DW has been little used
- E.g., at the onset of the 2007 financial crisis
- The reason most commonly invoked is “**Stigma**”

*“In August 2007,... banks were reluctant to rely on discount window credit to address their funding needs. The banks’ concern was that their recourse to the discount window, if it became known, might lead market participants to infer weakness -the so-called stigma problem.” Bernanke (2009)*

# Consequences of DW Stigma

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- Prevent Fed from being effective LLR, especially in time of crisis
- Impede effective implementation of monetary policy
  - Many Central Banks set a “corridor” around target rate
  - The floor is the interest rate on excess reserves (for Fed)
  - The ceiling is the DW rate
  - With DW stigma:
    - The ceiling becomes “leaky”
    - Ability to moderate rates within corridor is lost
- Thus, it is important to understand and eliminate DW stigma

# What do we know about DW stigma?

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- Answer: Remarkably little
- In press and central bank circles, DW stigma is often seen as a fact
- However,
  - There is little empirical evidence of DW stigma
  - The phenomenon is not well understood
- Why?
  - Lack of data

Objectives of this research program:

- Use experimental method to generate data on DW borrowing
- Understand DW stigma and how to eliminate it

# Necessary conditions for DW stigma to emerge

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- DW borrowing can be observed
  - In principle, DW borrowing is anonymous
  - However,
    - The information has leaked in the media on occasion
    - Possible inferences from Fed Funds market behavior
    - Possible inferences from Fed weekly public releases
- DW borrowing is informative about solvency
  - Fed cannot separate perfectly insolvent from illiquid
  - No possible inferences from alternatives to DW

IMO, DW stigma is difficult to rationalize in a standard model

# Simple Model

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- Two populations of players: banks and investors
- A bank is matched randomly with an investor
- 2 Periods. The bank moves in period 1, the investor in period 2
- Players are risk neutral and do not discount the future
- Focus only on pure strategies

# The investor

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- The investor has a stake in the bank in the form of an asset
- The value of the asset to the investor is either **V** or **0**
- The bank is insolvent when the asset is worth 0
- Asymmetric information: The value of the asset is
  - Known to the bank at the beginning of the game
  - Revealed to the investor only at the end of the game

# The Bank

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- At the beginning of the game, a bank may receive a negative liquidity shock, in which case it is said to be illiquid
- An illiquid bank must choose between
  - Borrowing 1 unit of liquidity at the DW at a cost  $dw$
  - Incurring a loss  $c > dw$
- A bank may also be insolvent
- To simplify, we assume that all insolvent banks are illiquid
- There are three types of banks:
  - Solvent-liquid with probability  $P_S$
  - Solvent-illiquid with probability  $P_{IL}$
  - Insolvent-illiquid with probability  $P_{IN}$



# The Payoffs

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- Period 1 : Illiquid bank decides whether or not to borrow at DW
  - Illiquid bank's payoff in period 1:
    - $k - dw$  if borrow at DW
    - $k - c$  otherwise
- Period 2 : Investor decides whether or not to keep stake in bank
  - When investor funds the bank,
    - Investor gets the value of the asset (i.e.  $0$  or  $V$ )
    - Bank gets  $k$  in period 2
  - When the investor does not fund the bank,
    - Investor gets a termination value  $v < V$
    - The bank gets  $0$  in period 2

# Detection Probability

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- $\theta$  is the probability that a bank's DW borrowing is observed
- This information is then used by the investor to update its beliefs about the value of the bank's asset
- Thus, there is an indirect cost to DW borrowing

# Constraints on parameters

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- $dw < c$  : DW borrowing is not dominated
- $v < V$  : funding the bank is not dominated
- $k > c$  : It is always profitable for a bank to operate in period 2
- $k \leq v$  : it is socially inefficient to fund an insolvent bank
- $v < V * (1 - P_{IN})$  : The investor funds a random bank
- $v > V * P_{IN} / (P_{IL} + P_{IN})$  : The investor does not fund an illiquid bank

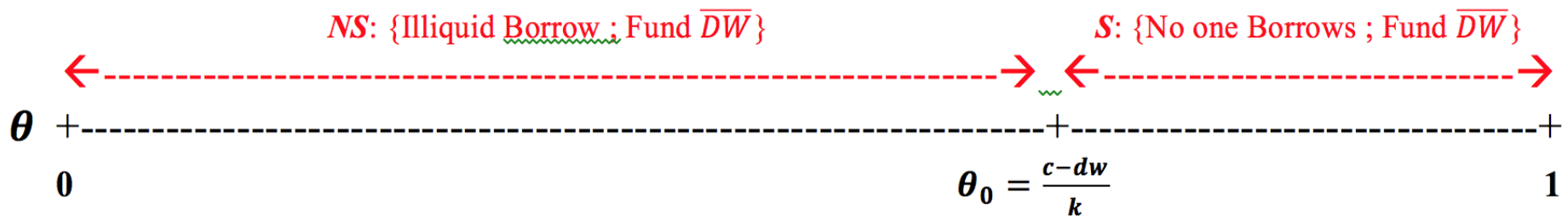
# Equilibrium

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- Two pairs of strategies:
  - **S** = {No bank borrows at the DW; Investors fund only banks not seen borrowing at the DW}
  - **NS** = {Illiquid banks borrow at the DW; Investors fund only banks not seen borrowing at the DW}
- **Proposition 1**: When  $\theta < \theta_0 = (c - dw) / k$ , the unique equilibrium is **NS**, otherwise the unique equilibrium is **S**.

# Equilibrium

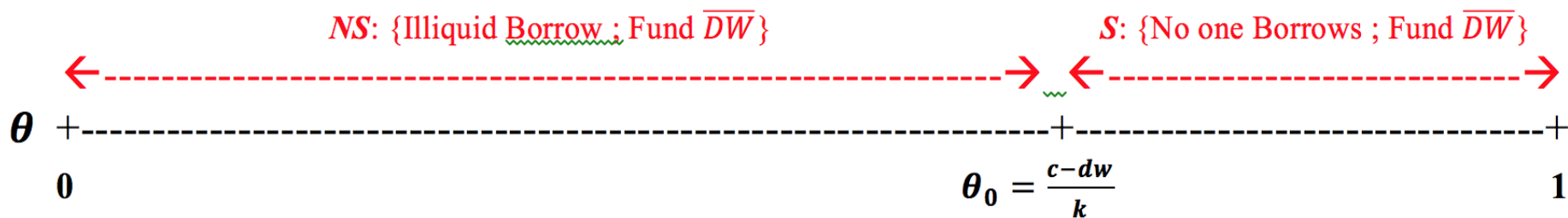
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Note:  $\overline{DW}$  means a bank not seen borrowing at the DW

# Comparative Statics

- As  $\theta$  increases, the equilibrium switches from **NS** to **S**
  - Consistent with policy makers views
- All else equal, DW stigma more likely when
  - $dw$  is higher
  - $c$  is lower
  - $k$  is higher



Note:  $\overline{DW}$  means a bank not seen borrowing at the DW

- As long as the parameters constraints are satisfied, changes in  $v$ ,  $V$ ,  $P_S$ ,  $P_{IL}$  and  $P_{IN}$  do not affect the equilibrium

# Social Welfare

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- $W^*$  = Social optimum
- $W_{DW}$  = Social welfare when no DW  
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- $W_{NS}$  = Social welfare under no stigma equilibrium
- $W_S$  = Social welfare under stigma equilibrium  
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- Result :  $W_{DW} = W_S < W_S < W^*$

# Endogenous probability of detection

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- Practitioners often argue that  $\theta'(n) < 0$ , where  $n$  is the number of banks that borrow at the DW
- There are two pure strategy equilibria
  - **S** : bad equilibrium with DW stigma
  - **NS** : good equilibrium without DW stigma



# Experimental design

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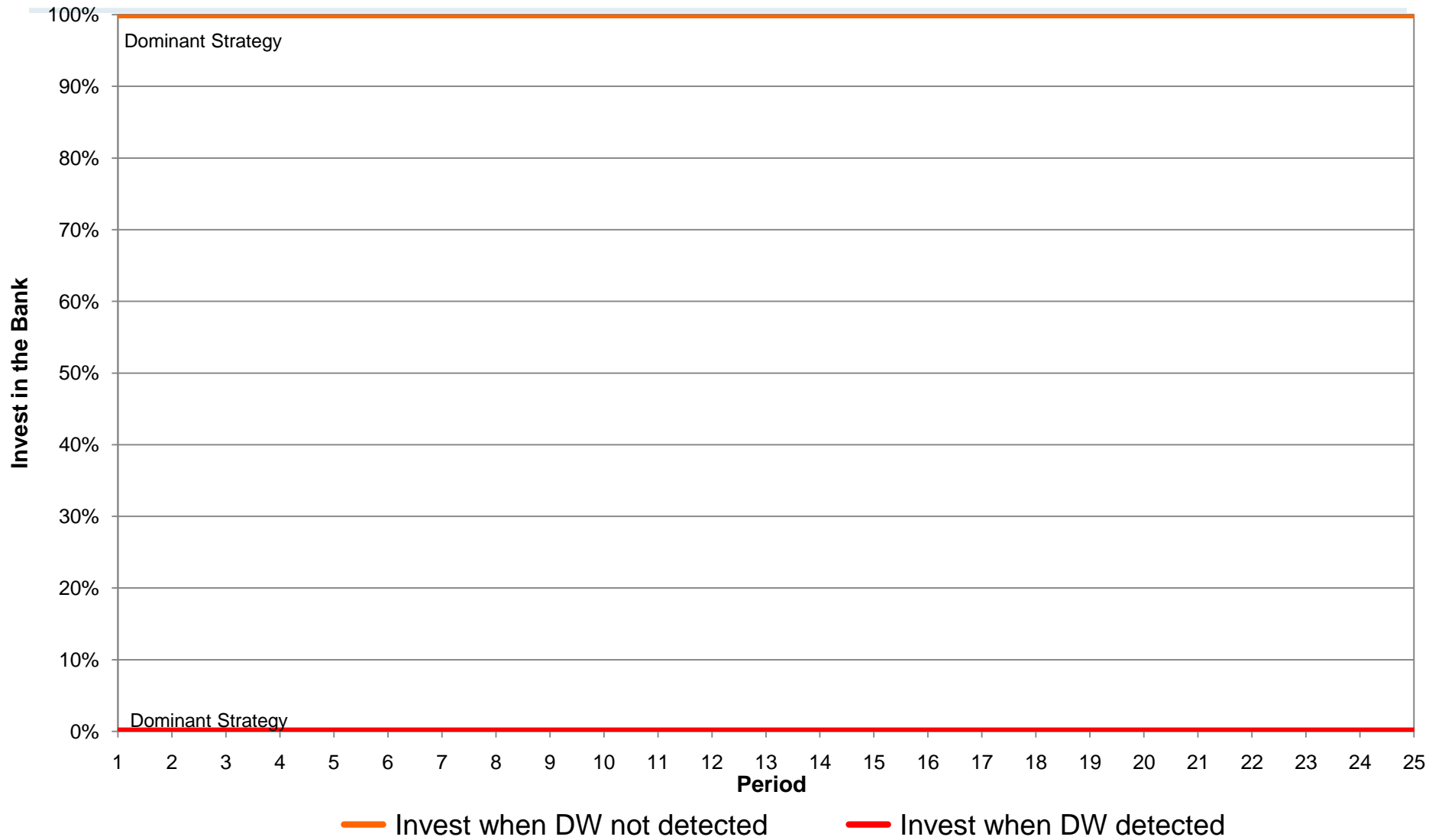
- Conducted at UVA and Toulouse
- 12 subjects per session. 6 banks and 6 Investors
- 25 rounds per session
- Loaded instructions
- Game is played in strategic form
  - Bank selects
    - Borrow at DW if illiquid?
    - Borrow at DW if insolvent?
  - Investor selects
    - Fund banks seen at DW?
    - Fund banks not seen at DW?

# Experimental Parameters: Endogenous Treatment

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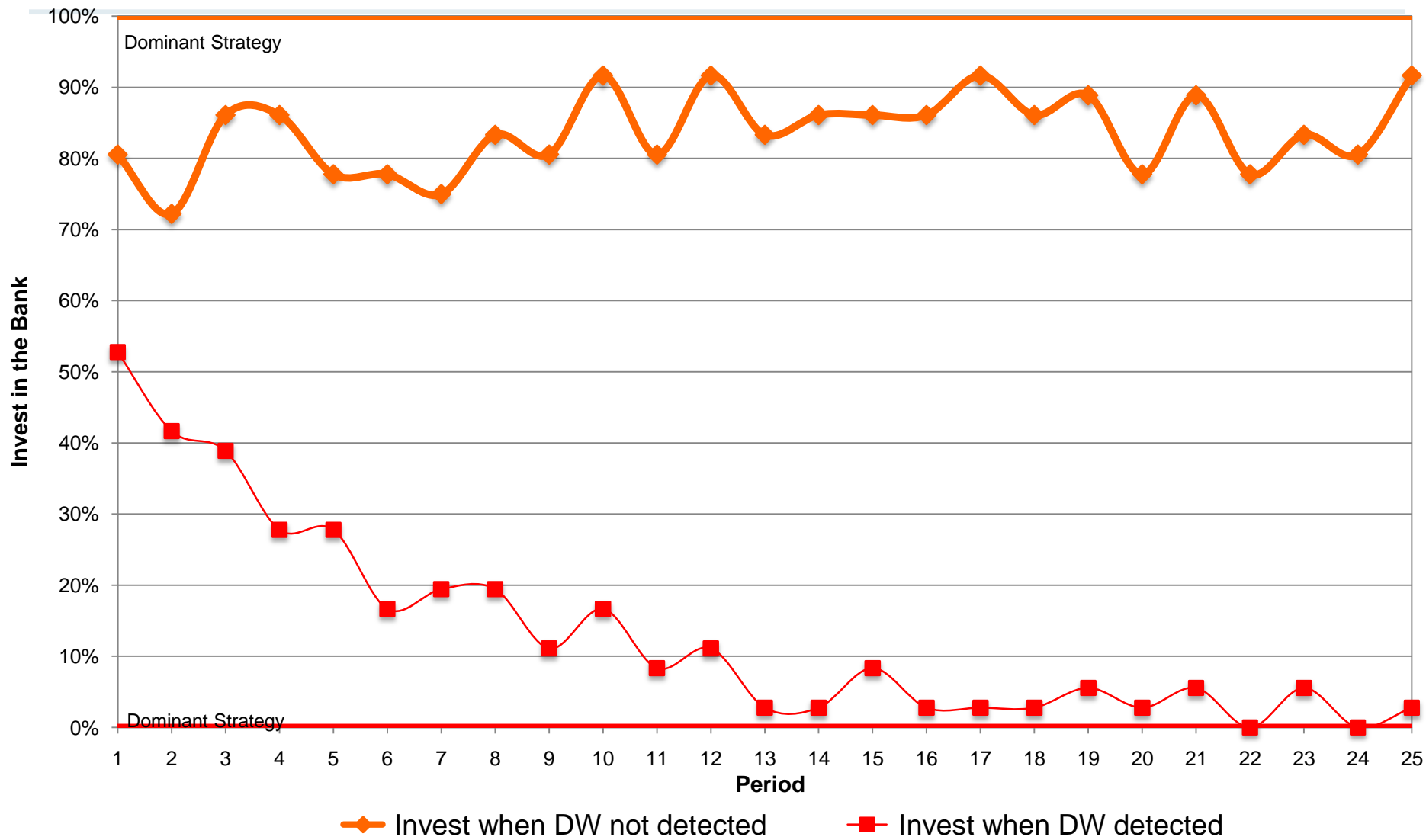
- $P_L = 1/2$  ,  $P_{IL} = 1/6$  and  $P_{IN} = 1/3$ , so
  - Unconditional probability of being solvent  $1 - P_{IN} = 2/3$
  - Probability of solvent conditional illiquid  $P_{IL} / ( P_{IL} + P_{IN} ) = 1/3$
- $k = 50$ ,  $c = 40$ , and  $dw = 20 \Rightarrow \theta_0 = 40\%$
- Endogenous treatment :  $\theta(1) = 75\%$ ,  $\theta(2) = 50\%$ ,  $\theta(3+) = 25\%$
- Thus, 3 borrowers are necessary to sustain the good equilibrium

# Endogenous Treatment Investors Behavior\*



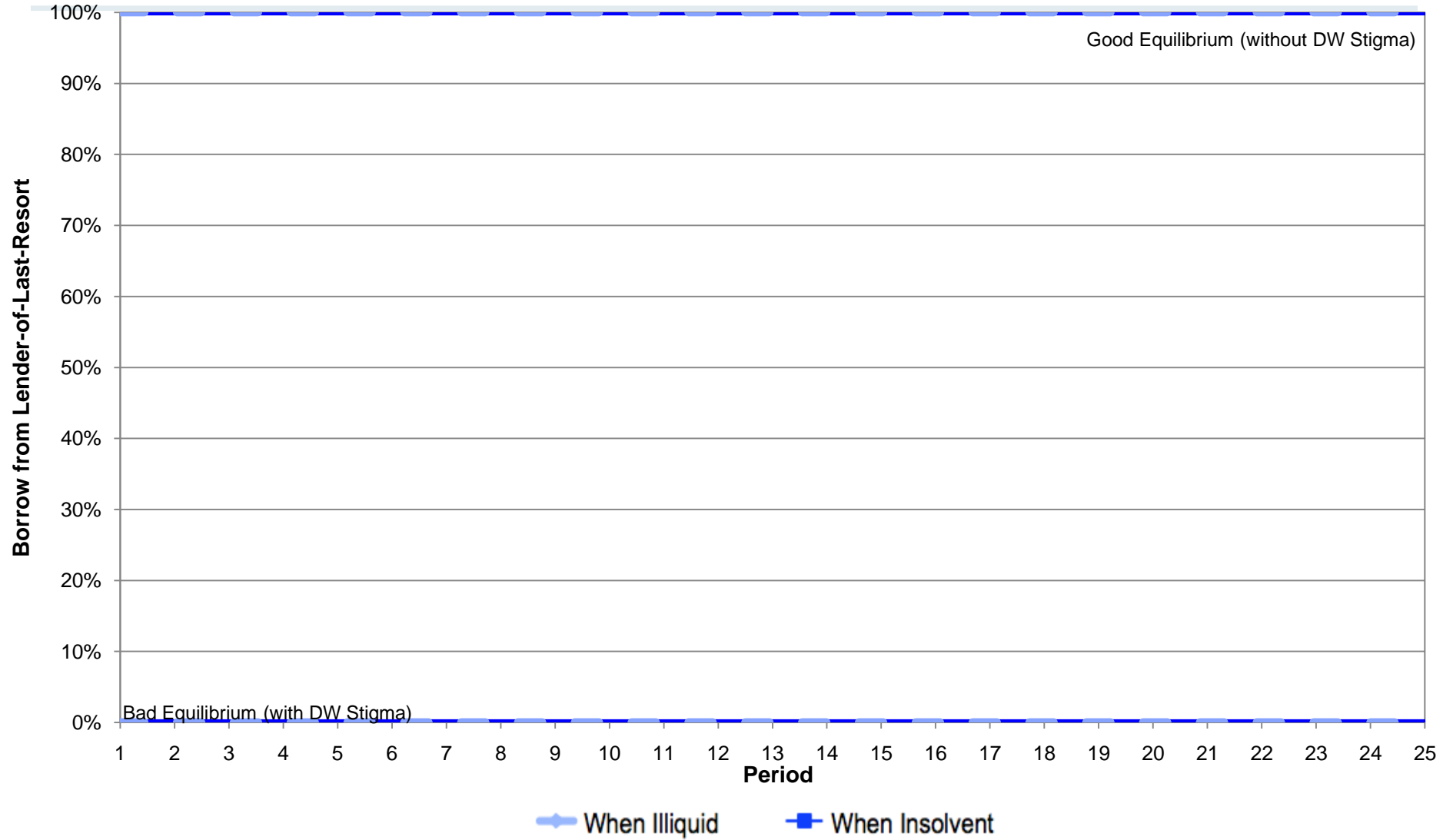
\*  $\theta(1)=75\%$ ,  $\theta(2)=50\%$ ,  $\theta(3+)=25\%$ . Average Across 6 Sessions.

# Endogenous Treatment Investors Behavior\*



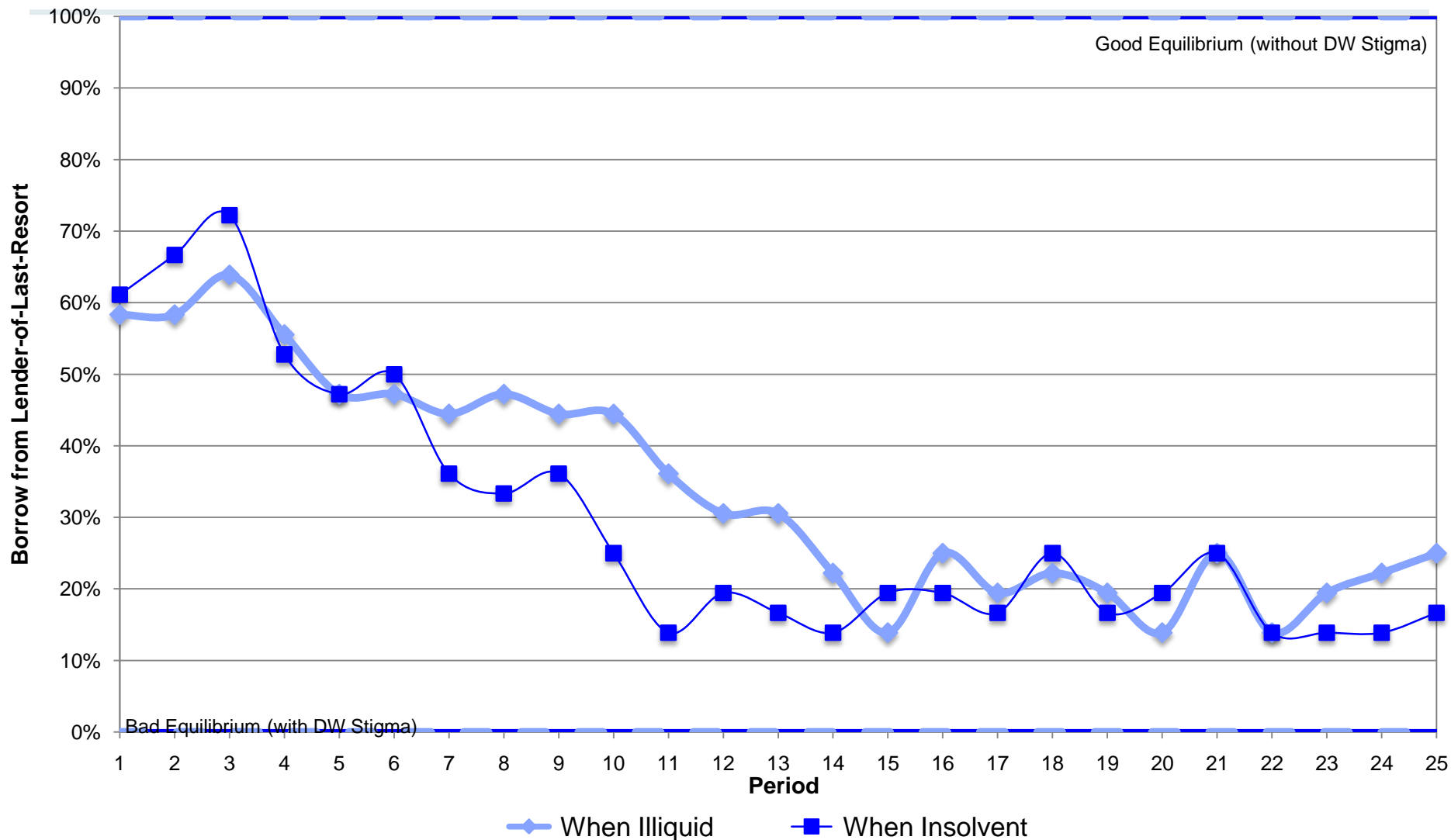
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# Endogenous Treatment Banks Behavior\*



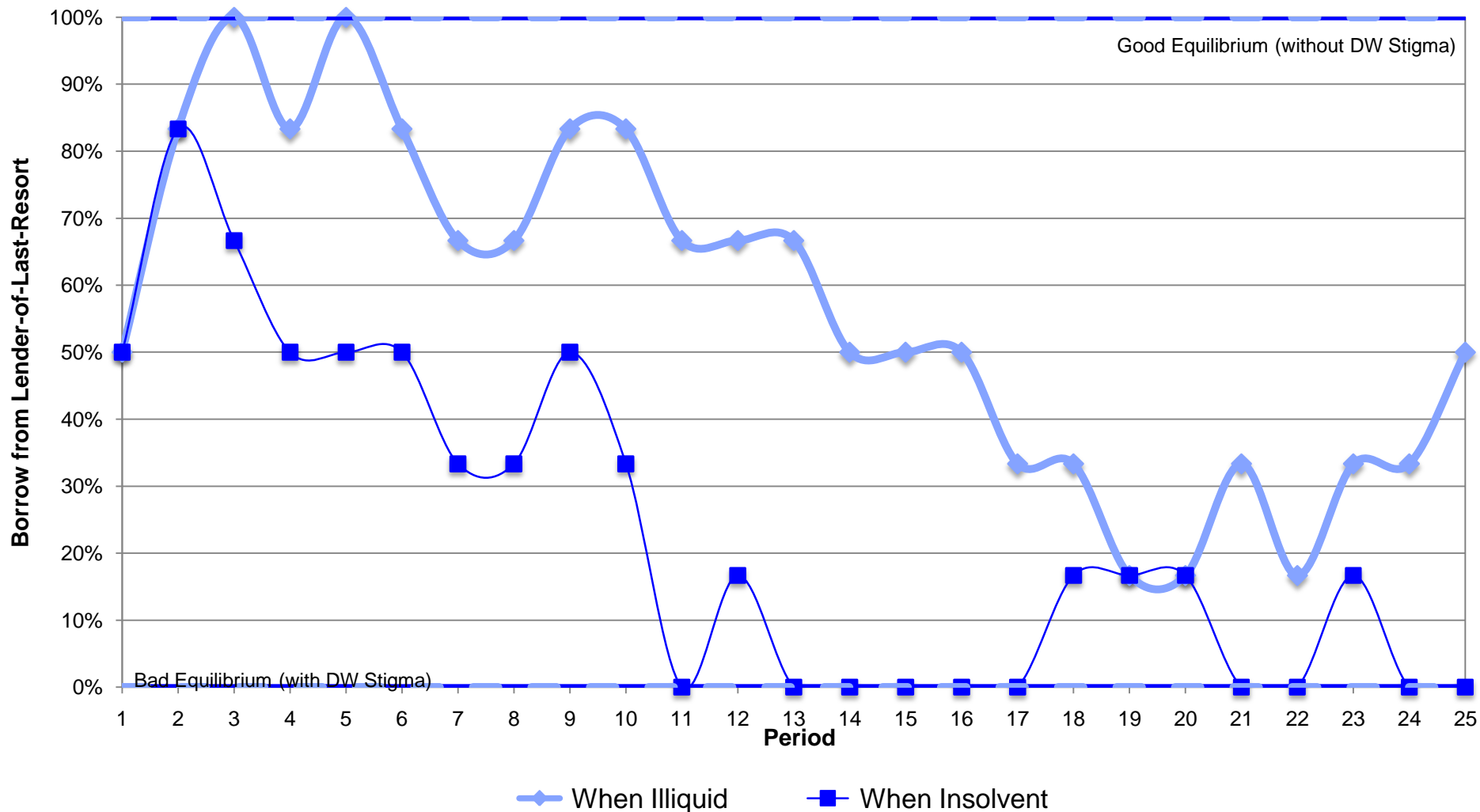
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# Endogenous Treatment Banks Behavior\*



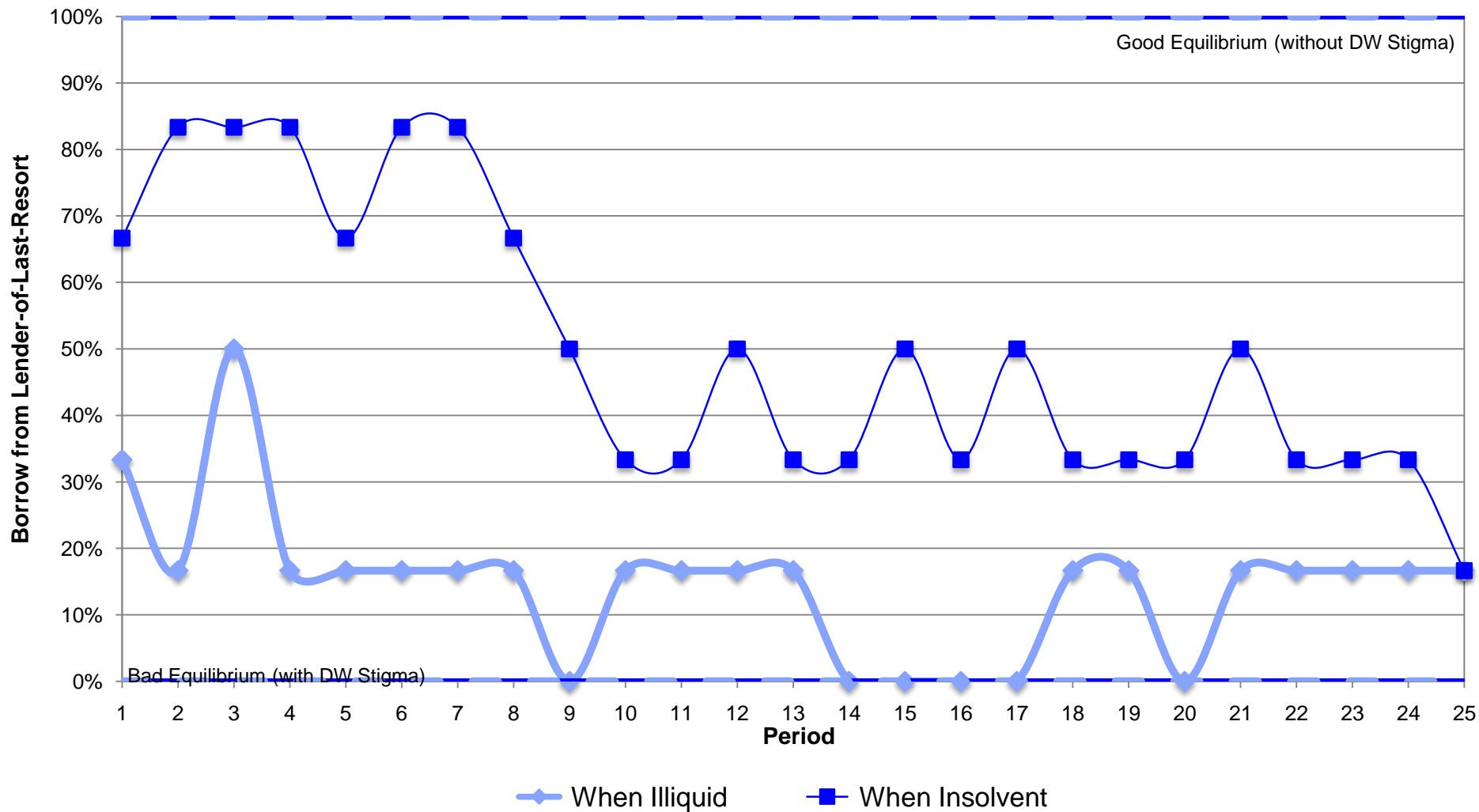
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# Endogenous Treatment Banks Behavior Session 5\*



\*  $\theta(1)=75\%$ ,  $\theta(2)=50\%$ ,  $\theta(3+)=25\%$ . Average Across 6 Sessions.

# Endogenous Treatment Banks Behavior Session 6\*



\*  $\theta(1)=75\%$ ,  $\theta(2)=50\%$ ,  $\theta(3+)=25\%$ . Average Across 6 Sessions.

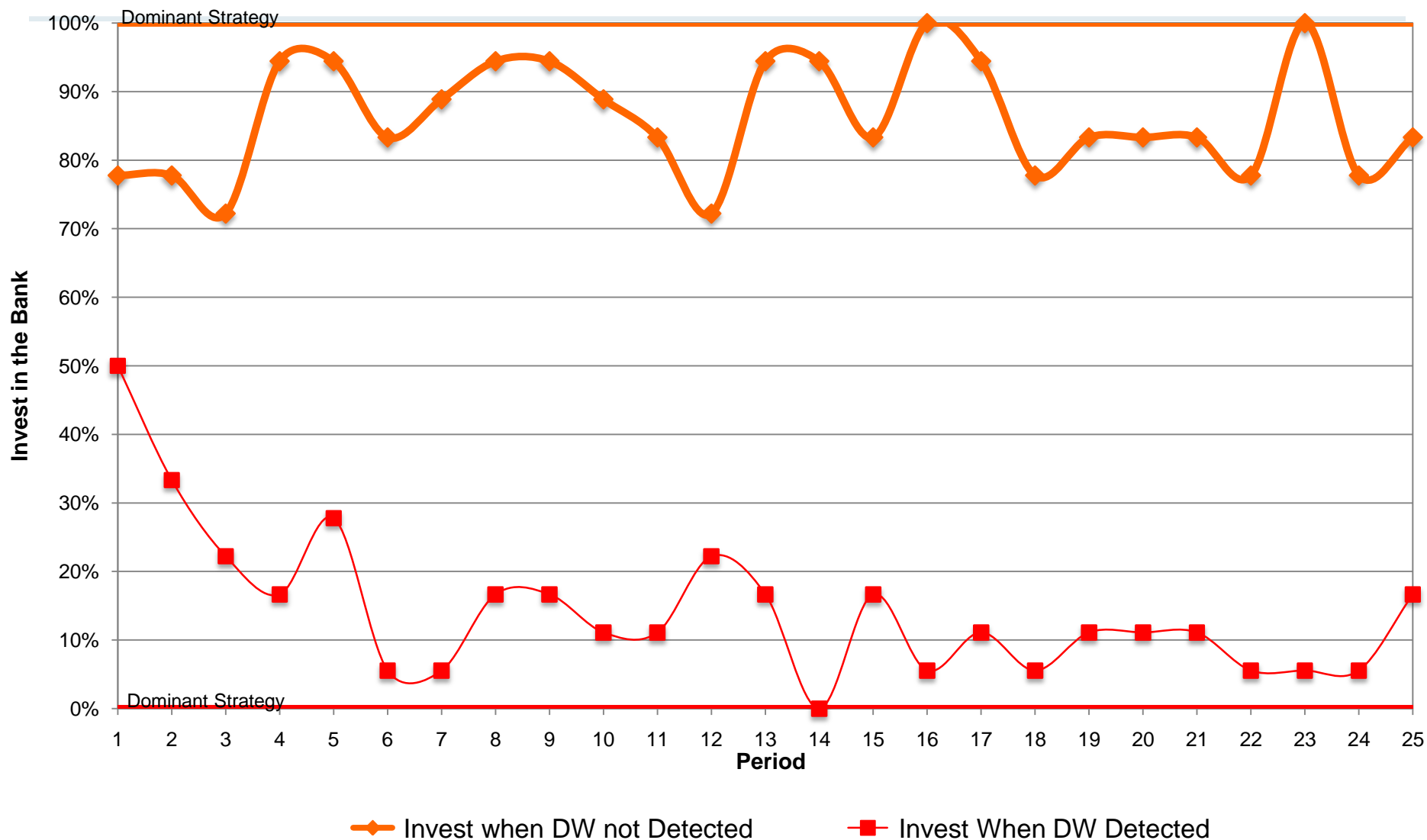


# Solving the coordination problem

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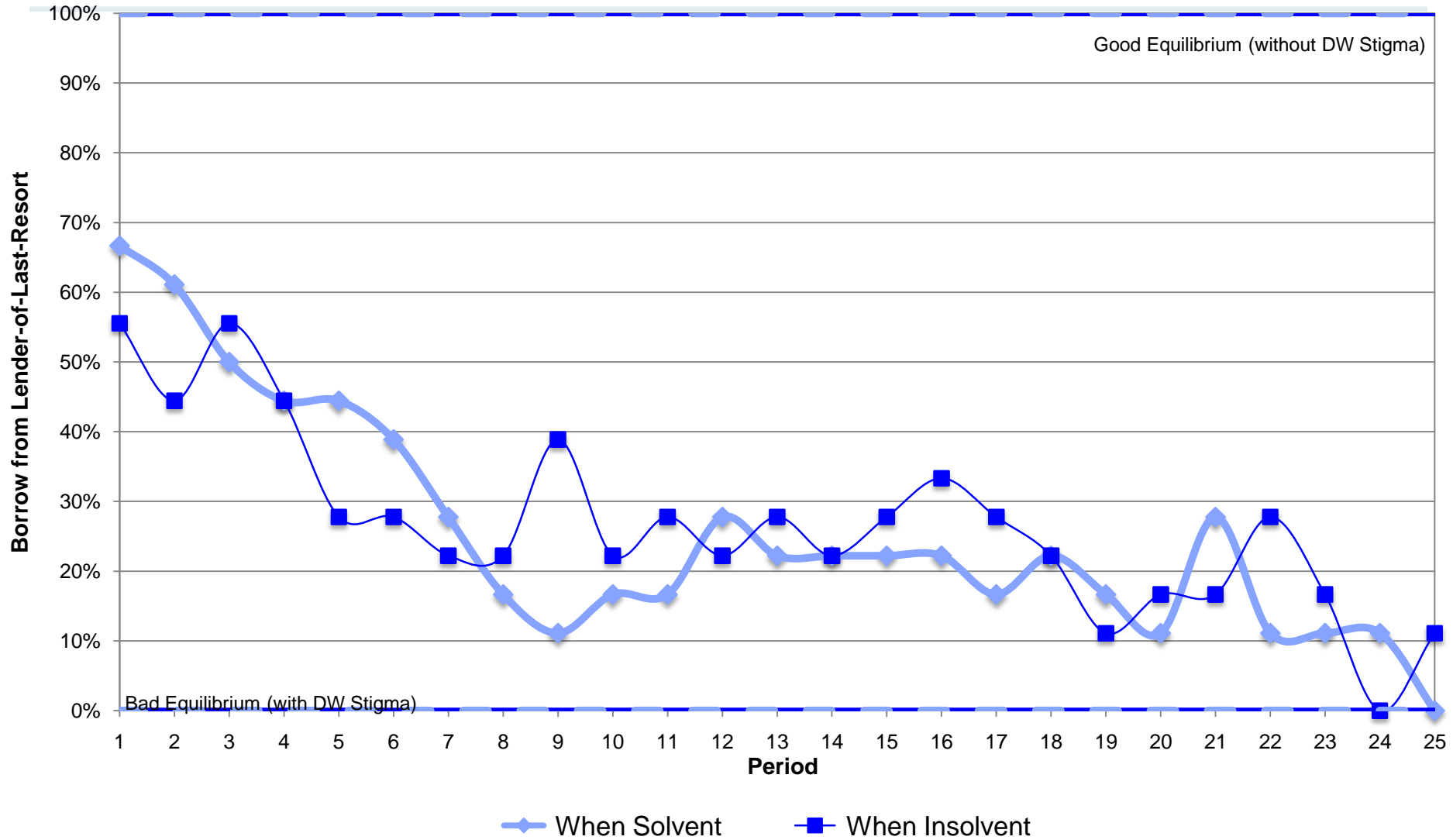
- What can be done to get subjects to switch to the good equilibrium?
- Possible solution: Lower cost of DW,  $dw$
- Policy actually implemented by the Fed in 2007 (without success)
- Lower  $dw$  from 20 to 10  $\Rightarrow \theta_0$  increases from 40% to 60%
- With  $\theta(1) = 75\%$ ,  $\theta(2) = 50\%$ ,  $\theta(3+) = 25\%$ , we need 2 DW borrowers to sustain the good equilibrium

# Endogenous Treatment with Low DW Rate Investors Behavior\*



\*  $\theta(1)=75\%$ ,  $\theta(2)=50\%$ ,  $\theta(3+)=25\%$ . Average Across 6 Sessions.

# Endogenous Treatment with Low DW Rate Banks Behavior\*



\*  $\theta(1)=75\%$ ,  $\theta(2)=50\%$ ,  $\theta(3+)=25\%$ . Average Across 6 Sessions.

# Future work

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- Solving the coordination problem:
  - “Forced” participation
  - Moral suasion
  - Unloaded instructions
  - Communication
  - ???
- Is DW stigma a behavioral phenomenon?
- Stigma proof ways to implement lender-of-last-resort?
  - Auction
  - Insurance
  - Options