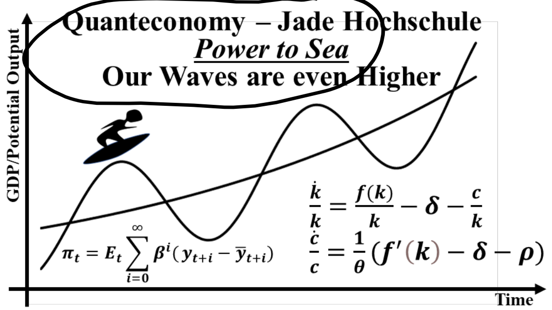
Nobelprize 2022

The Bank Run Model of Diamond and Dybvig




Ill. Niklas Elmehed © Nobel Prize Outreach

Philip H. Dybvig
The Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel 2022

Born: 22 May 1955

Affiliation at the time of the award: Washington University, St. Louis, MO, USA

Prize motivation: “for research on banks and financial crises”

Prize share: 1/3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Douglas W. Diamond
The Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel 2022

Born: 1953

Affiliation at the time of the award: University of Chicago, Chicago, IL, USA

Prize motivation: “for research on banks and financial crises”

Prize share: 1/3

!!!Be careful!!!
It will be complicated

Prof. Dr. Bernhard Köster
Jade-Hochschule Wilhelmshaven
30.10.2022
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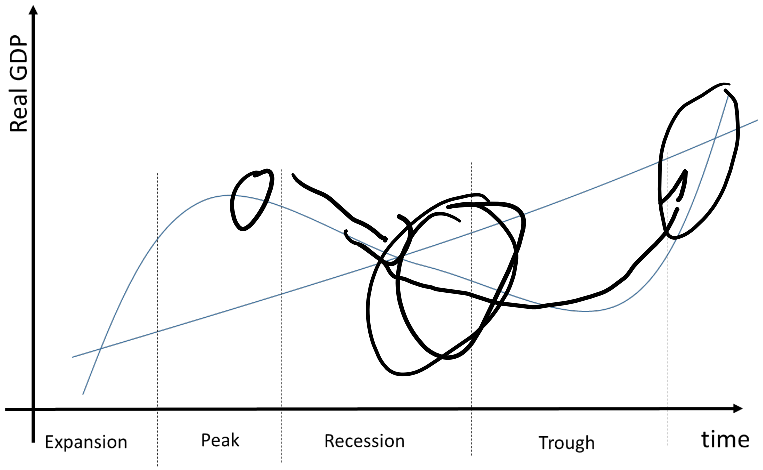
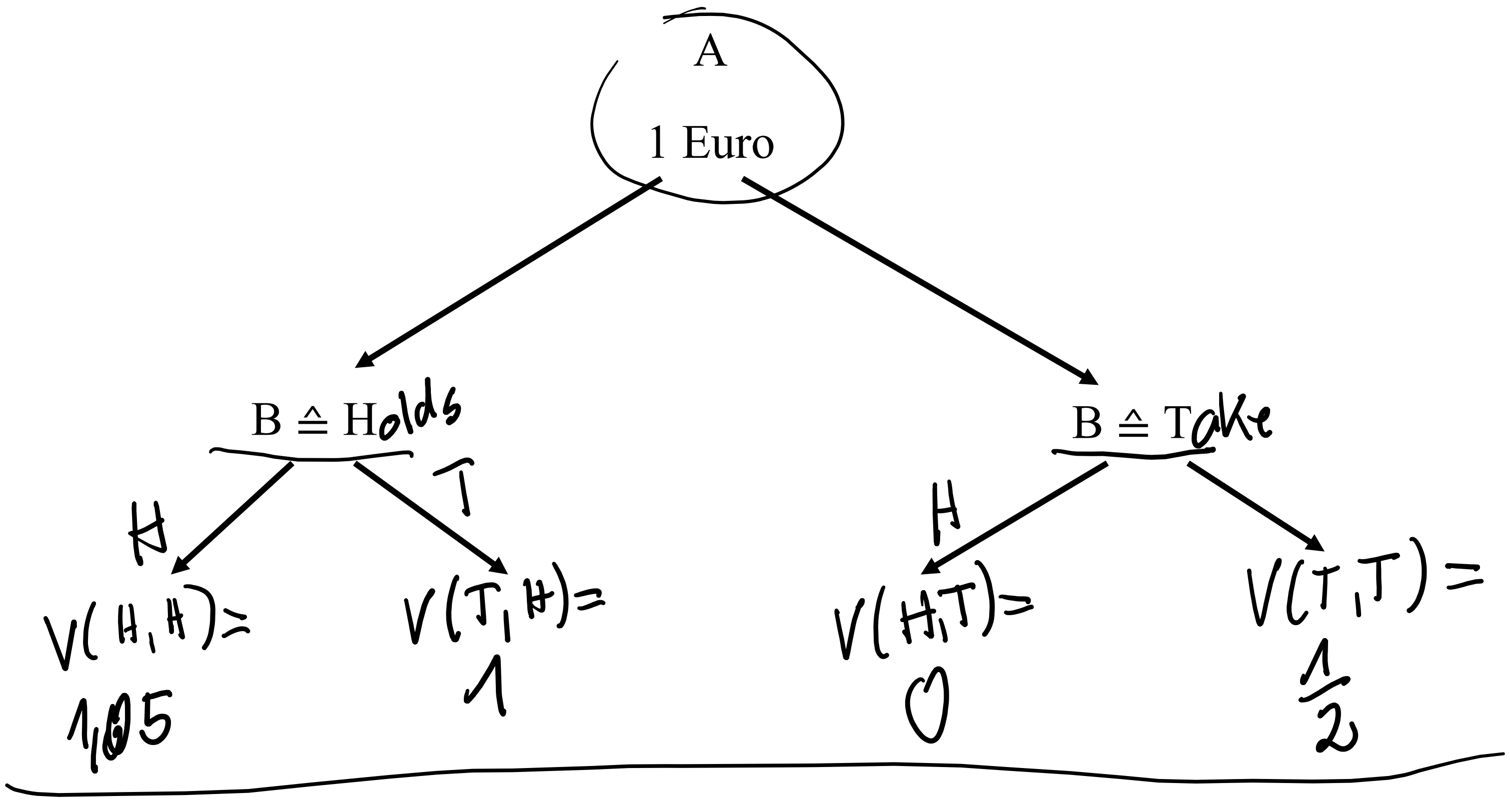
Two agents	A and B
Deposit	1 Euro
Interest rate	$i = 5\%$

Liquidity crisis

with 50% I will get my money back!





Nash equilibria in pure Strategies game is totally symmetric

		B	
		H	T
A	H	1+i , 1+i	0 , 1
	T	1 , 0	1/2 , 1/2

A: given $B \hat{=} H \Rightarrow H \hat{=} 1+i > T \hat{=} 1 \Rightarrow H$

" $B \hat{=} T \Rightarrow H \hat{=} 0 < T \hat{=} \frac{1}{2} \Rightarrow T$

B: given $A \hat{=} H \Rightarrow \Rightarrow H$

" $A \hat{=} T \Rightarrow T$

$\Rightarrow (H,H)$ and (T,T) are Nash equilibria pure strategies

$a \hat{=}$ probability that a plays H

Nash equilibria in mixed Strategies → Strategy a.

V(H,a) = $a\,V(H,H) + (1-a)V(H,T) = a(1+i) + (1-a)\cdot 0 = a(1+i)$

V(T,a) = $a\,V(T,H) + (1-a)V(T,T) = a \cdot 1 + (1-a)\cdot\frac{1}{2} = \frac{1}{2}(1+a)$

$\exists$a possible Nash equilibrium in mixed strategies we have the condition $V(H,a) = V(T,a) \Rightarrow a(1+i) = \frac{1}{2}(1+a) \quad | \cdot 2$

$\cancel{2}a + 2ai = 1 + \cancel{a}$

$a(1+2i) = 1$

$\Rightarrow 0 < \boxed{a^* = \frac{1}{1+2i}} < 1$ if $i > 0$

Evolutionary Game theory

Difference equation shows the evolution of a_t over time

Learning process over time:

$V(\cancel{H,}a_{t+1}) = a_t \cdot [V(H, a_t) - V(a_t, a_t)] + a_t =$

a_{t+1}

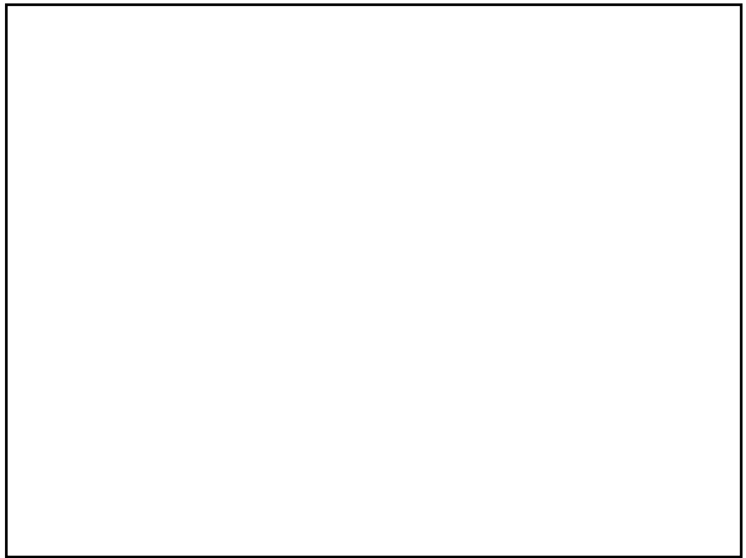
weight in the learning process of increasing $[\ ]^{>0}$ or decreasing $[\ ]^{<0}$ the probability a_t to hold the money over time

$a_{t+1} = a_t(V(H, a_t) - [a_t V(H, a_t) + (1-a_t)V(T, a_t)] + a_t$

$= a_t((1-a_t)V(H, a_t) - (1-a_t)V(T, a_t)] + a_t$

$= a_t(1-a_t)[V(H, a_t) - V(T, a_t)] + a_t$

$a_t(1+i) \quad - \frac{1}{2}(1+a_t)$

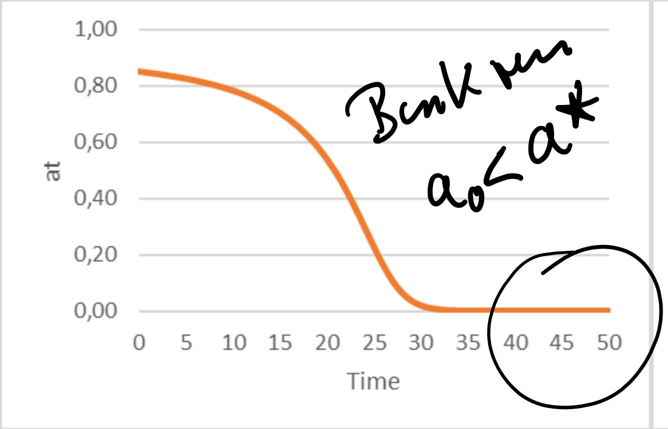


The Bank Run Model of Diamond and Dybvig – Summary

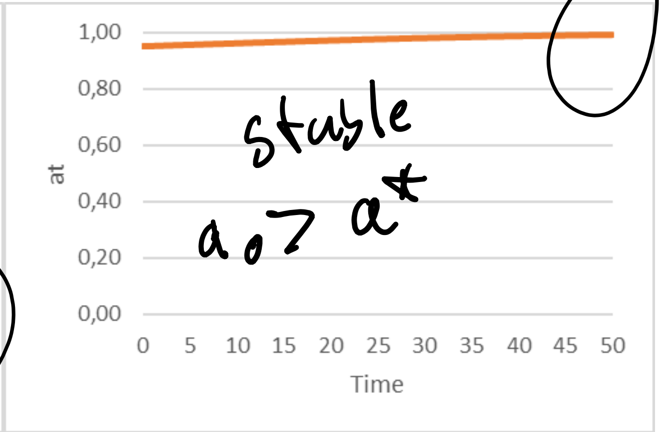
		B	
		I H	T
A	H	1+i , 1+i	0 , 1 II
	T	1 , 0	1/2 , 1/2

Nash equilibria in mixed Strategies

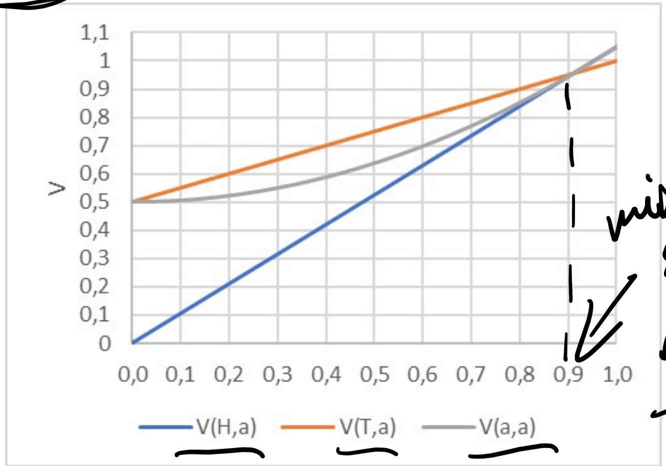
→ $a^*=1/(1+2i)$ III



Bank run
$a_0 < a^*$



stable
$a_0 > a^*$



mixed strategy equilibrium

I – III Nash equilibria I and II are evolutionary stable