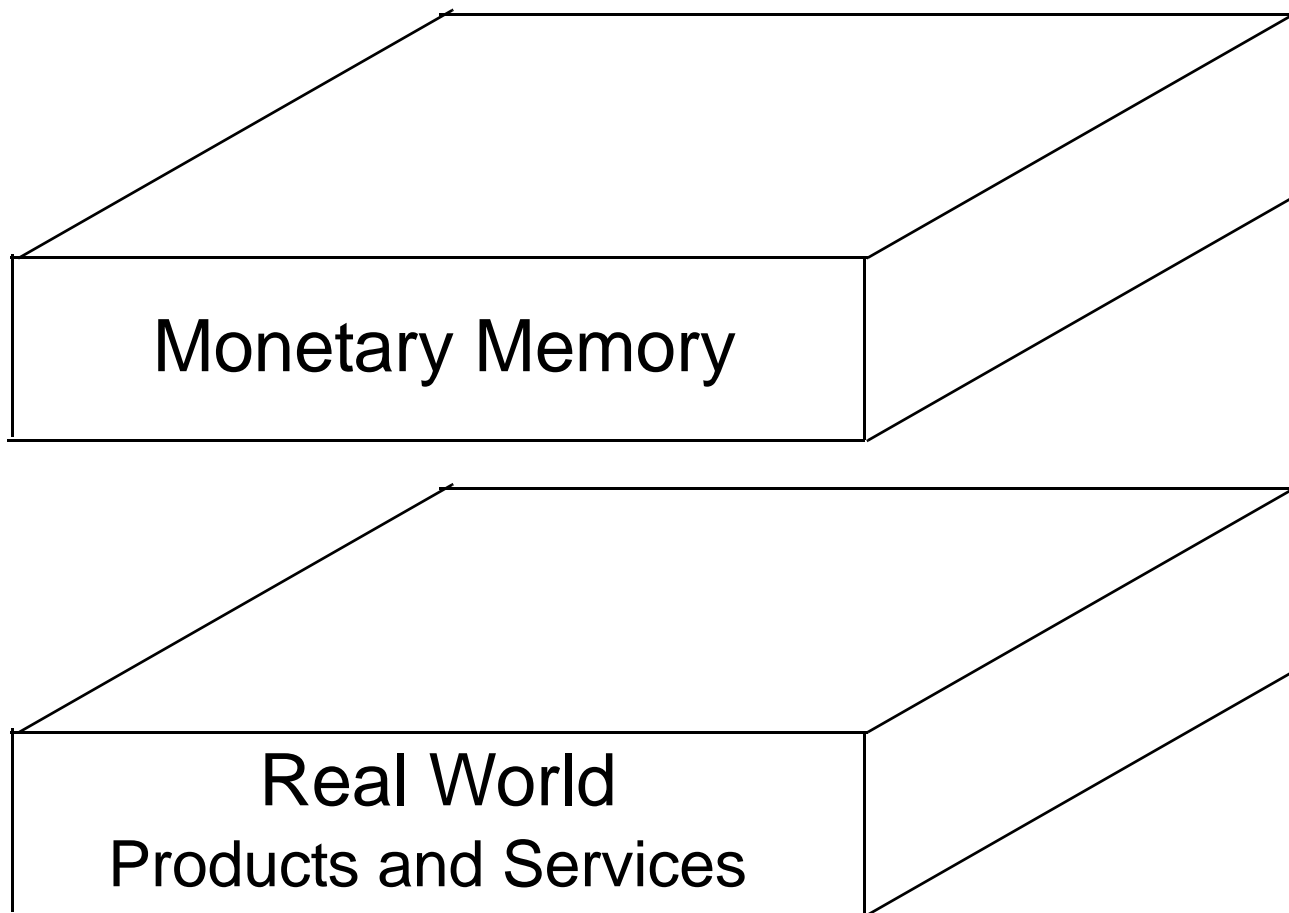


Noether Theorem of Monetary Systems

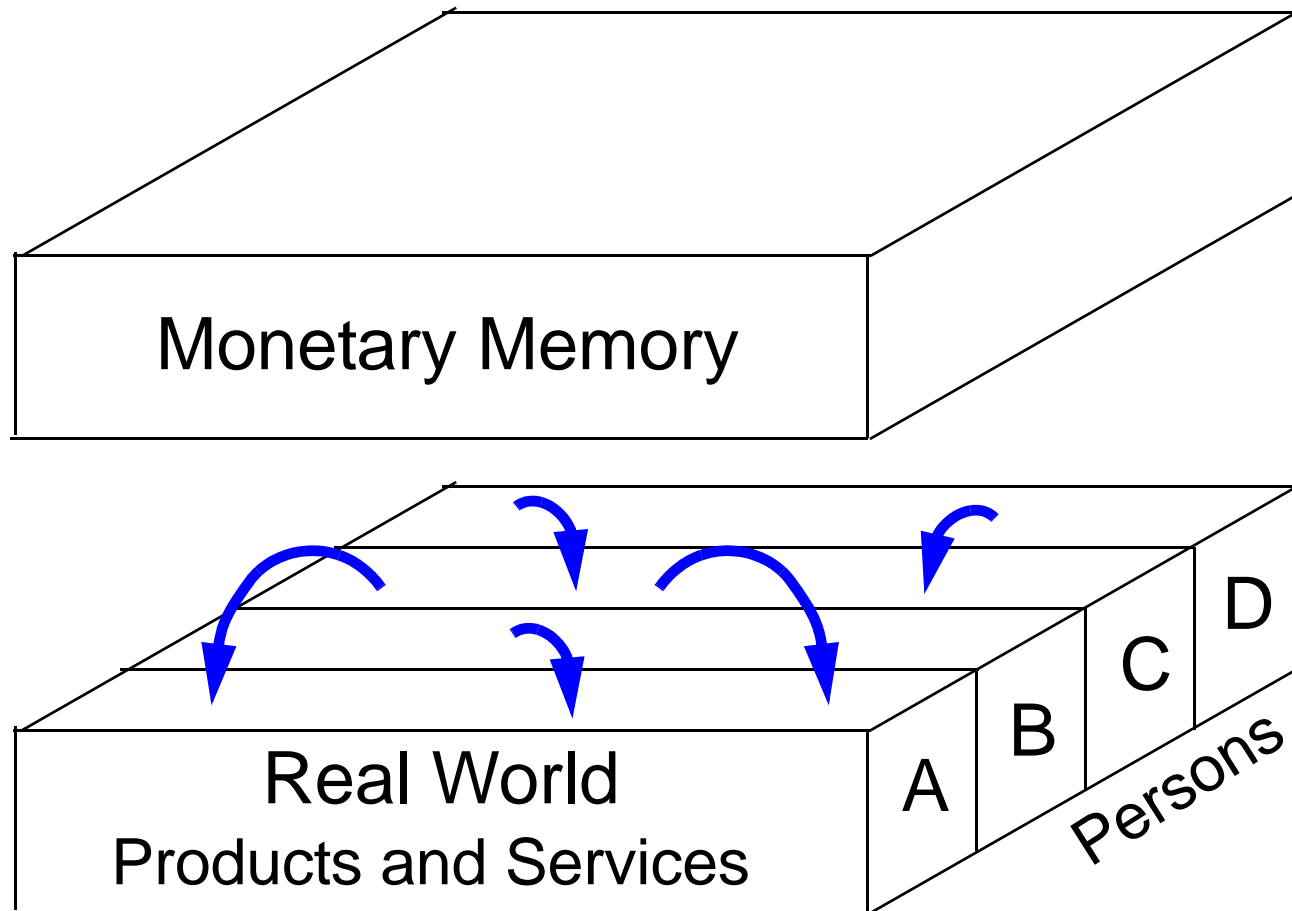
Dieter Braun
Noether Group on Biophysics
LMU München

www.biophysik.physik.lmu.de/Braun
www.bookkeepingmechanics.com

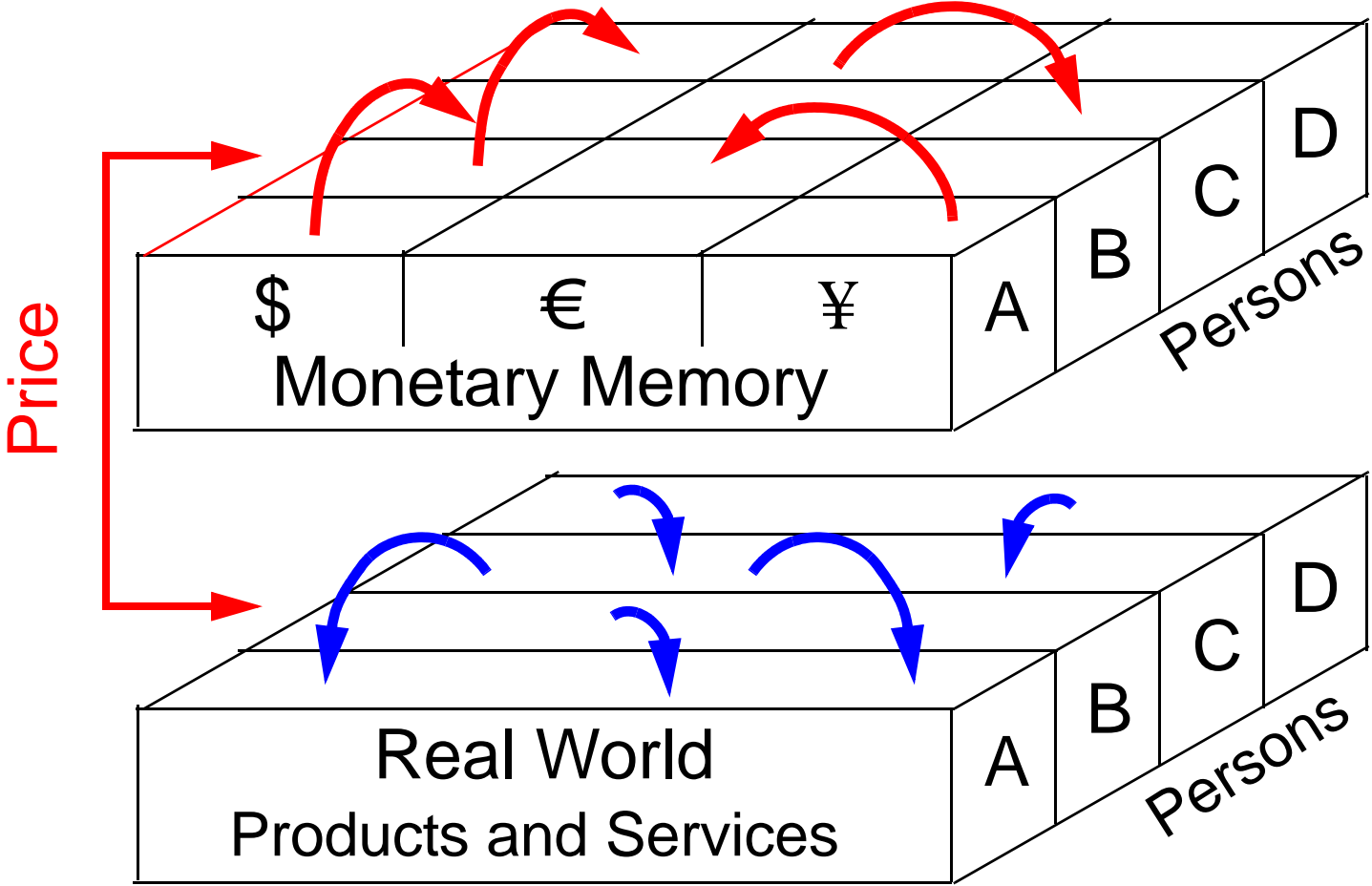
Monetary Systems



Monetary Systems



Monetary Systems



Noether Theorem

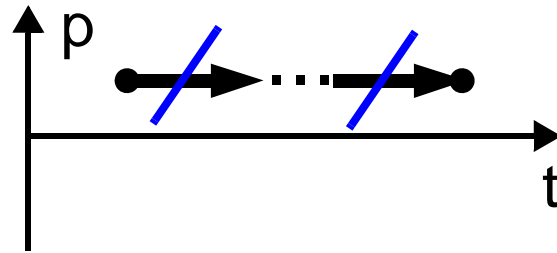
Momentum
Conservation
Symmetry of Space

Energy
Conservation
Symmetry of Time

Current
Conservation
Charge Symmetry

Noether Theorem

Momentum
Conservation
Symmetry of Space

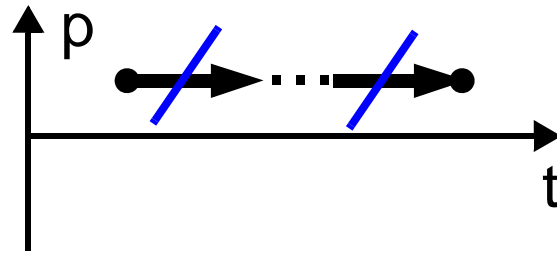


Energy
Conservation
Symmetry of Time

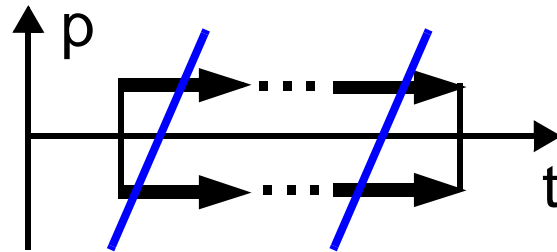
Current
Conservation
Charge Symmetry

Noether Theorem

Momentum
Conservation
Symmetry of Space



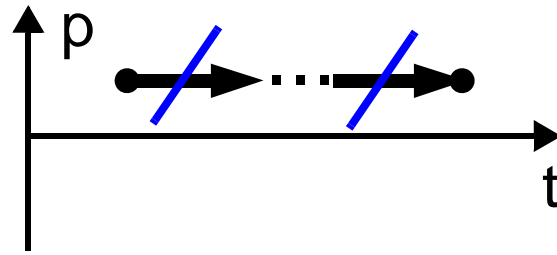
Energy
Conservation
Symmetry of Time



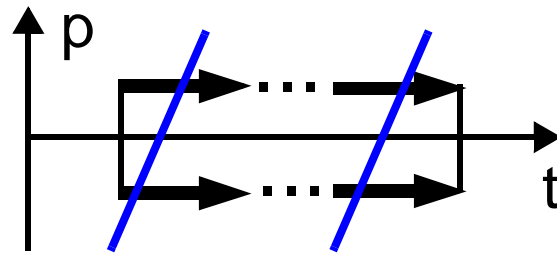
Current
Conservation
Charge Symmetry

Noether Theorem

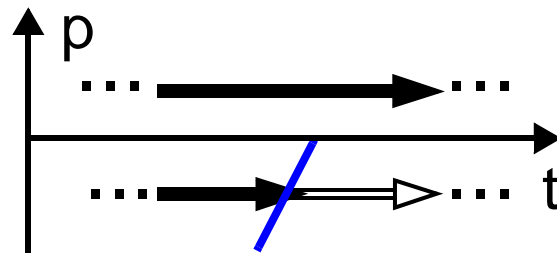
Momentum
Conservation
Symmetry of Space



Energy
Conservation
Symmetry of Time

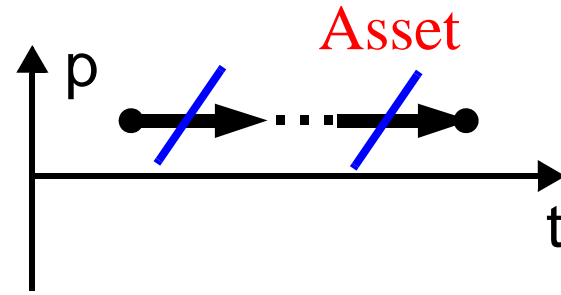


Current
Conservation
Charge Symmetry

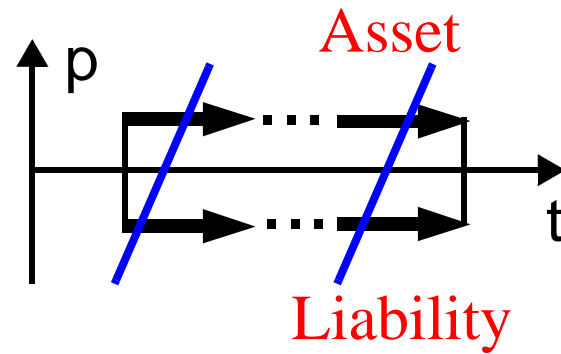


Noether Theorem of Monetary Systems

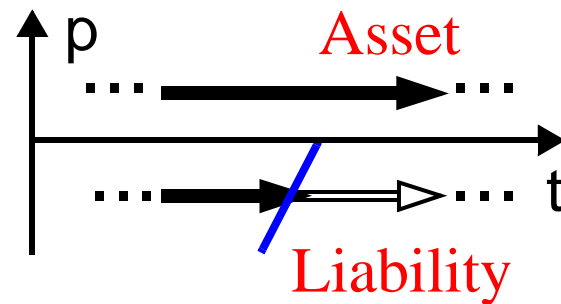
Momentum
Conservation
Symmetry of Space



Energy
Conservation
Symmetry of Time



Current
Conservation
Charge Symmetry



Bijjective Mapping

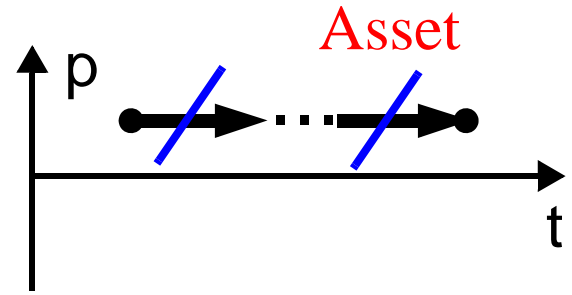
Momentum — Value
 $p > 0$ — Asset
 $p < 0$ — Liability
 Force dp/dt — Profit
 Energy — Quantity

Physica A 290:491-500 (2001)

Physica A 324:266-271 (2003)

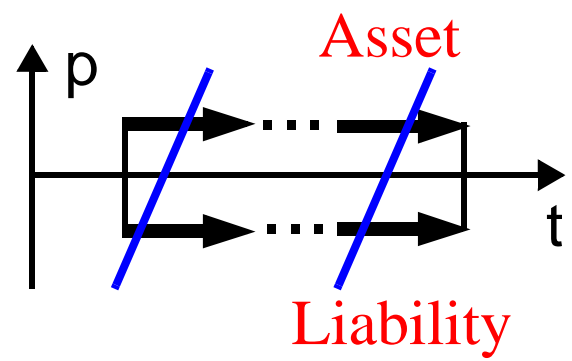
Noether Theorem of Monetary Systems

Momentum
Conservation
Symmetry of Space

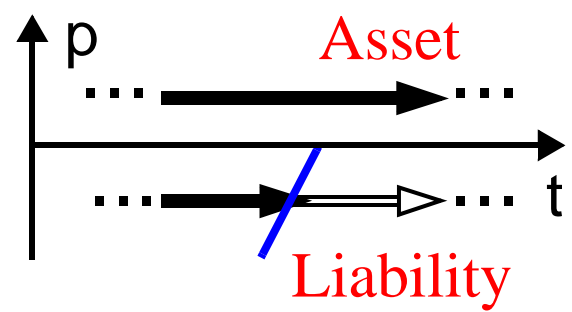


Asset - Liability
Conservation
Symmetry of Persons

Energy
Conservation
Symmetry of Time

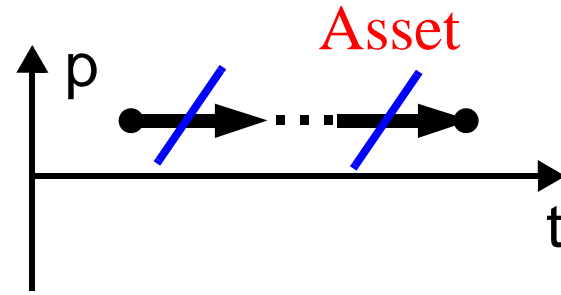


Current
Conservation
Charge Symmetry



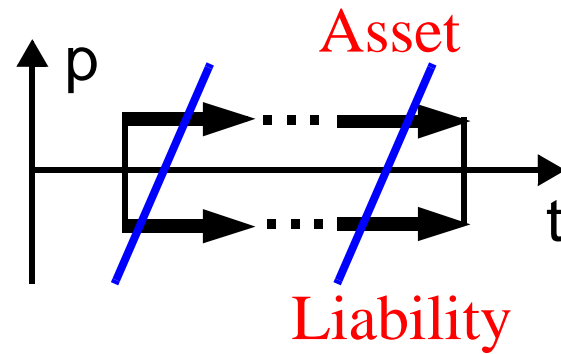
Noether Theorem of Monetary Systems

Momentum
Conservation
Symmetry of Space



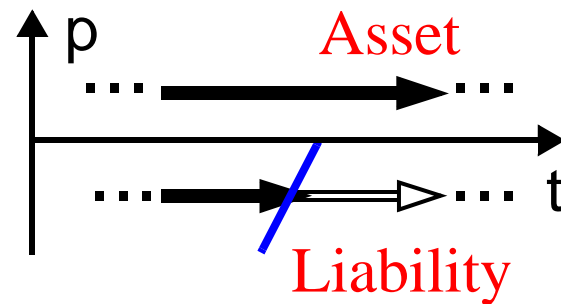
Asset - Liability
Conservation
Symmetry of Persons

Energy
Conservation
Symmetry of Time



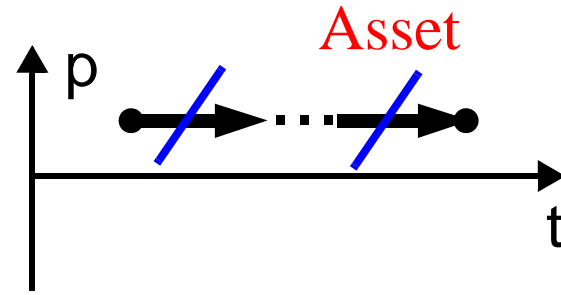
Asset + Liability
Conservation
Symmetry of Time

Current
Conservation
Charge Symmetry



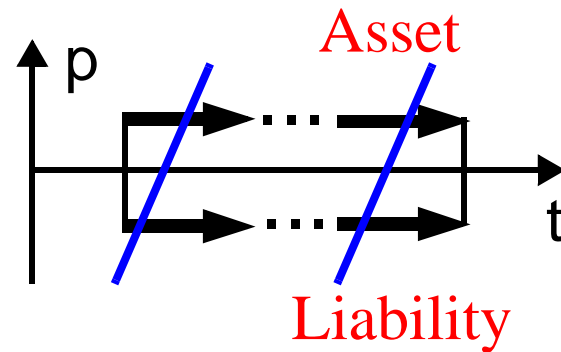
Noether Theorem of Monetary Systems

Momentum
Conservation
Symmetry of Space



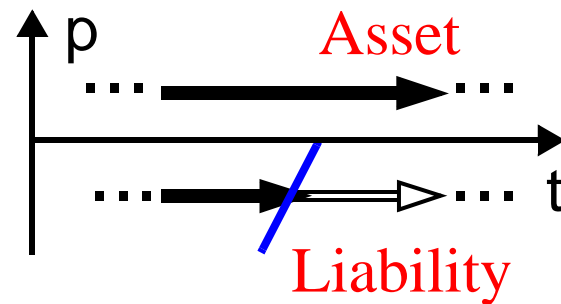
Asset - Liability
Conservation
Symmetry of Persons

Energy
Conservation
Symmetry of Time



Asset + Liability
Conservation
Symmetry of Time

Current
Conservation
Charge Symmetry

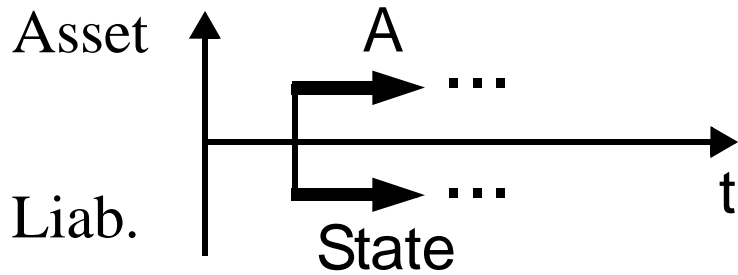


Asset/Liability Pairing
Conservation
Symmetry of Currency

A short History of Money
(Noether Viewpoint)

Money is Liability of State/Religion (>6000 BC)

Issuance/Donation...



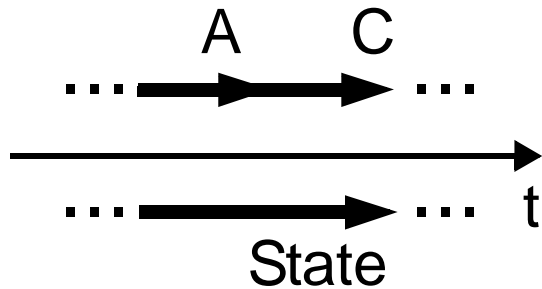
Symmetries

Persons

Time

Currency

...Transfers...

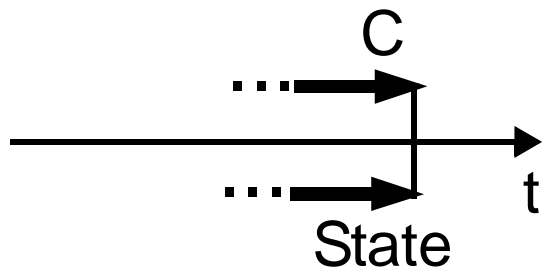


Persons

Time

Currency

...Taxation/Sacrifice



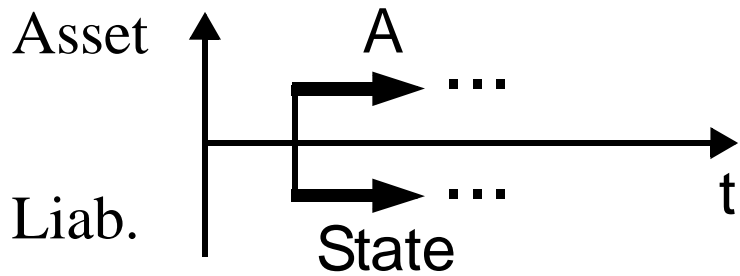
Persons

Time

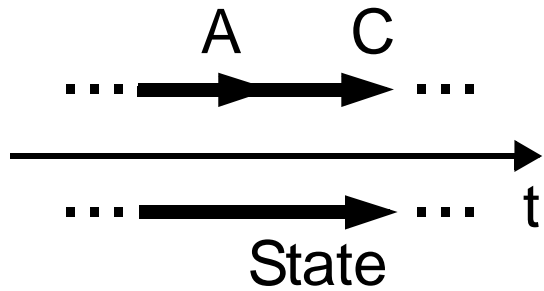
Currency

Money is Liability of State/Religion (>6000 BC)

Issuance/Donation...

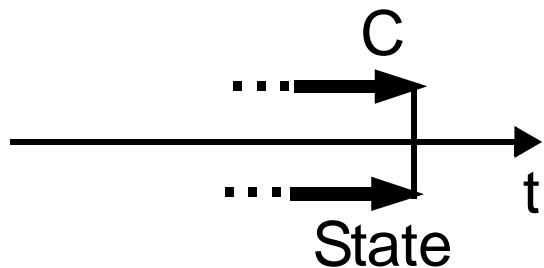


...Transfers...



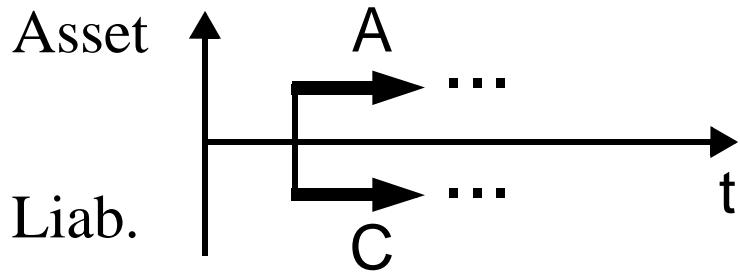
Movie State
Money

...Taxation/Sacrifice



Money is Debt Relation (>500 AD)

Creation Transfer...



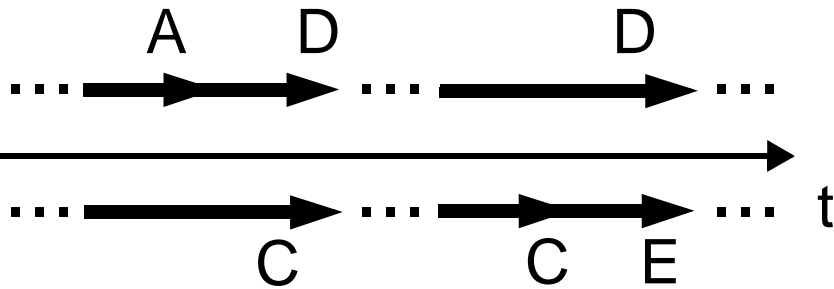
Symmetries

Persons

Time

Currency

...Transfers...

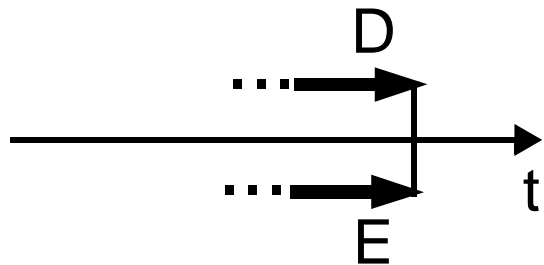


Persons

Time

Currency

...Termination Transfer



Persons

Time

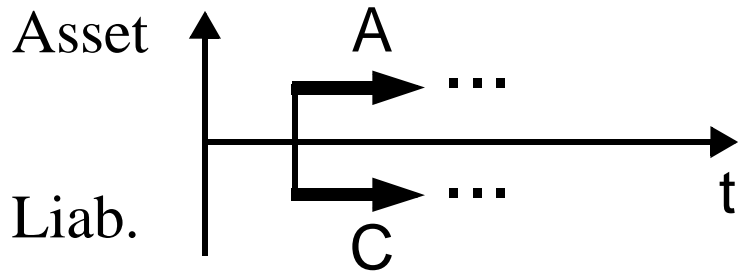
Currency

Tally Sticks

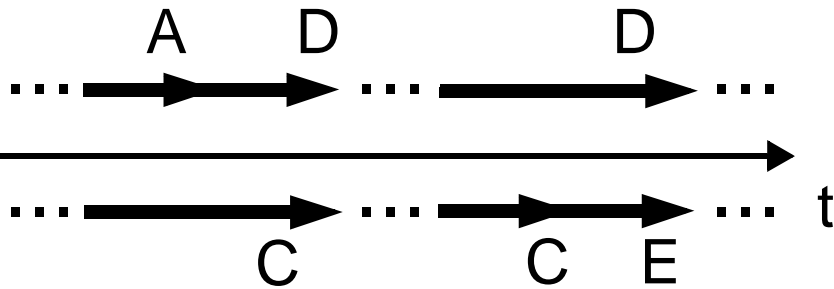


Money is Debt Relation (>500 AD)

Creation Transfer...

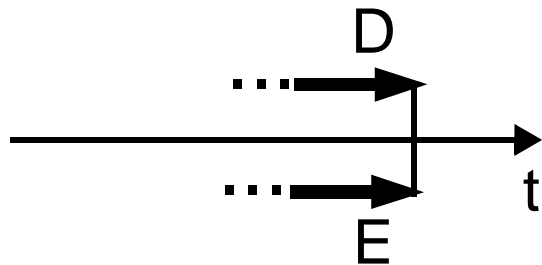


...Transfers...



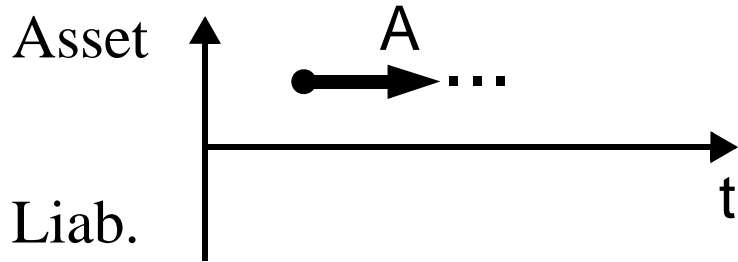
Movie debt
between all

...Termination Transfer



Money is a Commodity such as Gold (>1400 AD)

Mining...



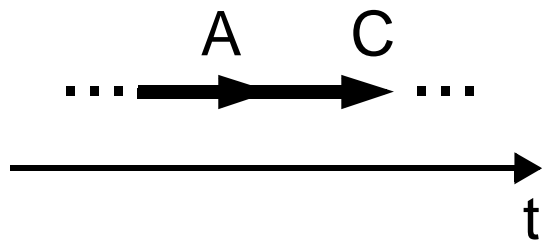
Symmetries

Persons

Time

Currency

...Transferring...

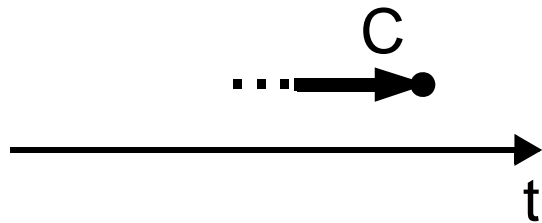


Persons

Time

Currency

...Discarding



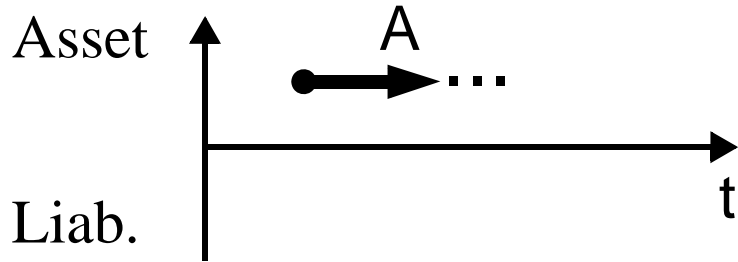
Persons

Time

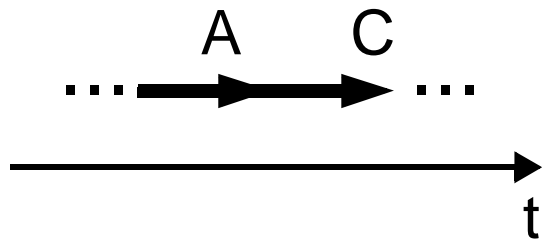
Currency

Money is a Commodity such as Gold (>1400 AD)

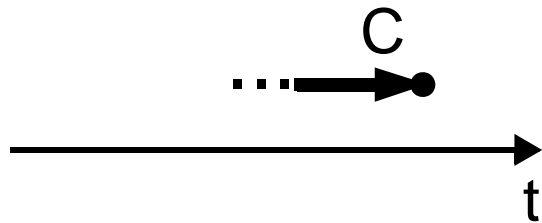
Mining...



...Transferring...



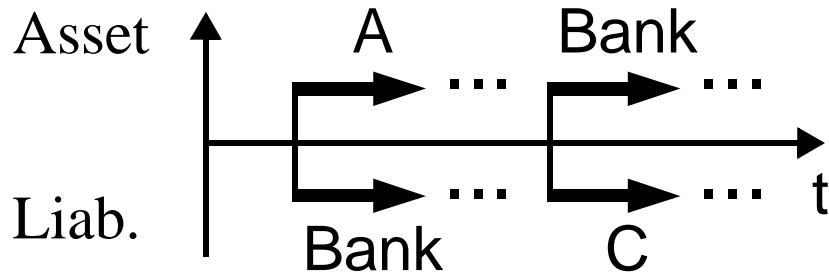
...Discarding



Money as Gold

Money is Debt Relation with a Bank (>1100 AD)

Creation Transfers...



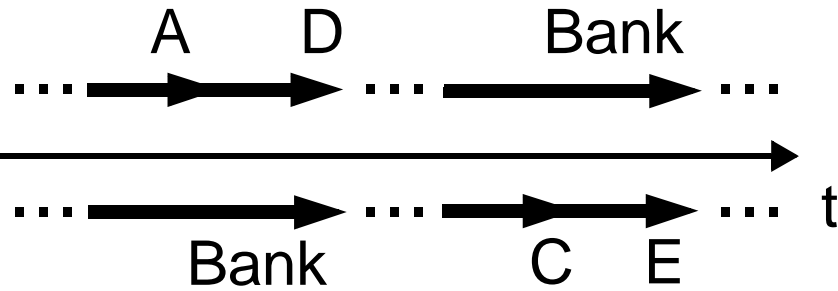
Symmetries

Persons

Time

Currency

...Transfers...

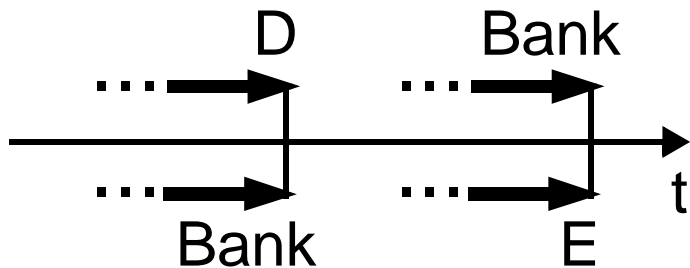


Persons

Time

Currency

...Termination Transfers



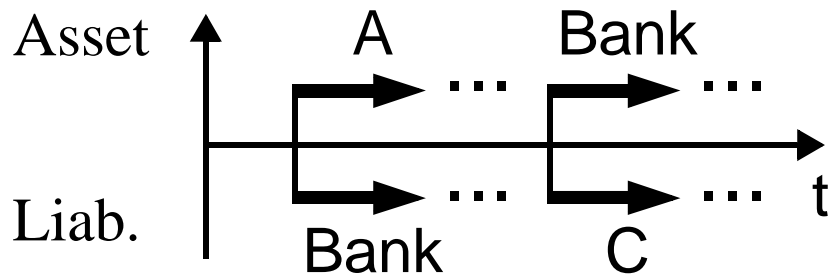
Persons

Time

Currency

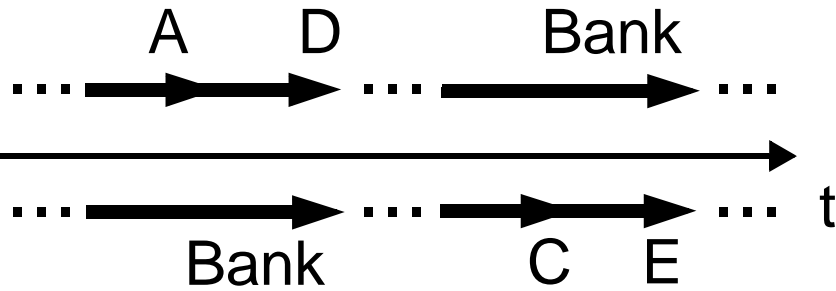
Money is Debt Relation with a Bank (>1100 AD)

Creation Transfers...

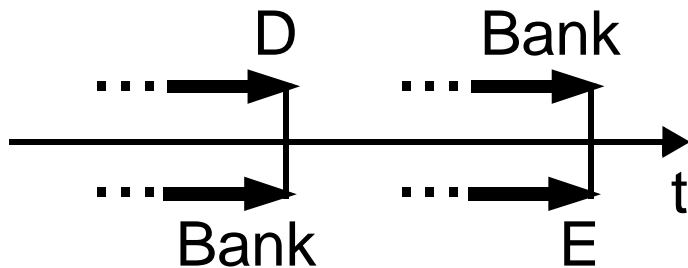


...Transfers...

Movie one
Bank

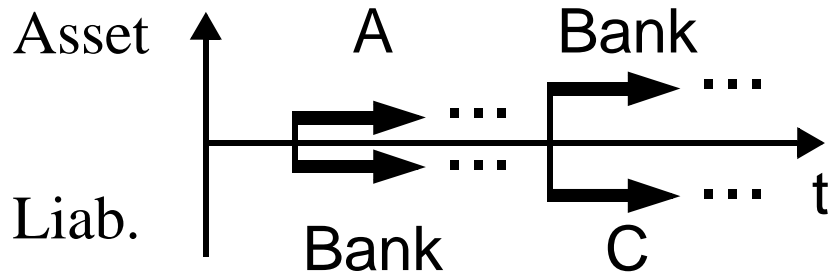


...Termination Transfers

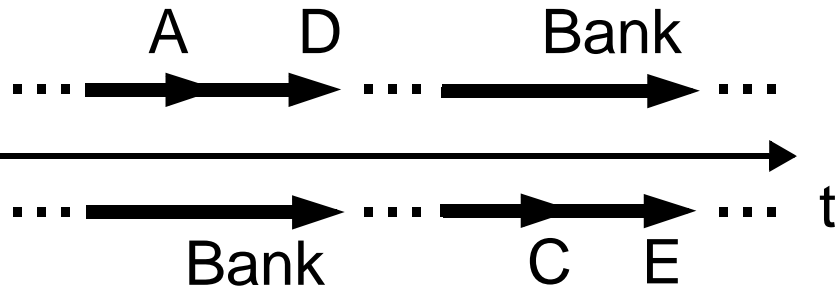


Interest and Default

Interest Transfers...

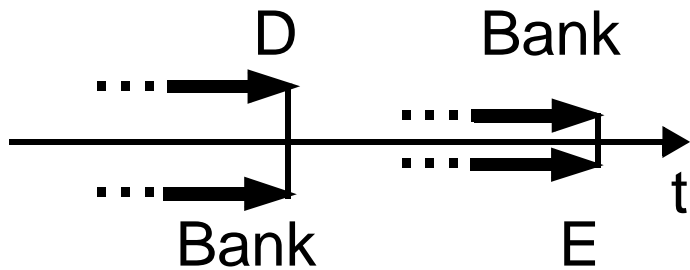


...Transfers...



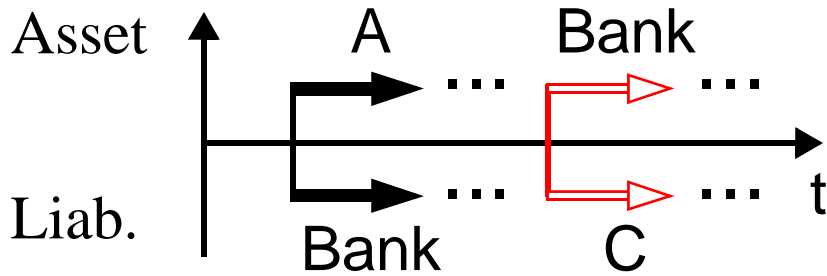
Movie Interest
one Currency

...Credit Default



Money is Credit and Debit Relation with a Bank

Creation Transfers...



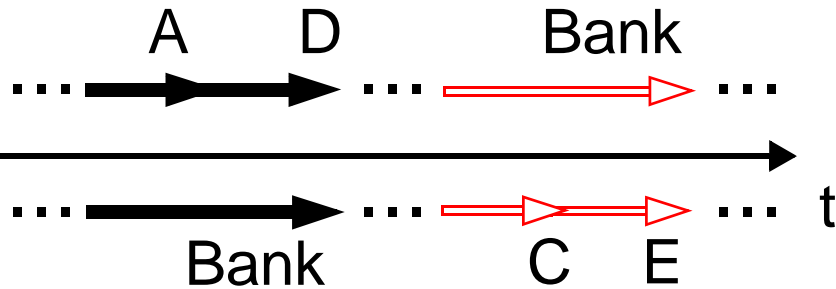
Symmetries

Persons

Time

Currency

...Transfers...

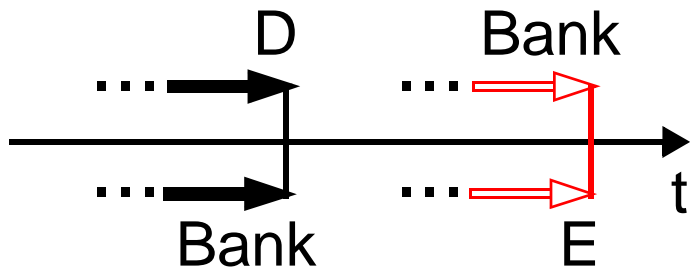


Persons

Time

Currency

...Termination Transfers



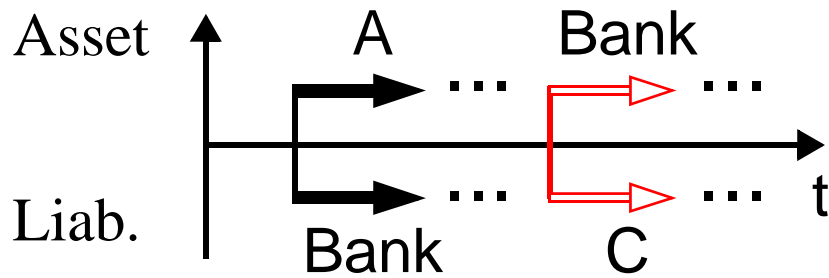
Persons

Time

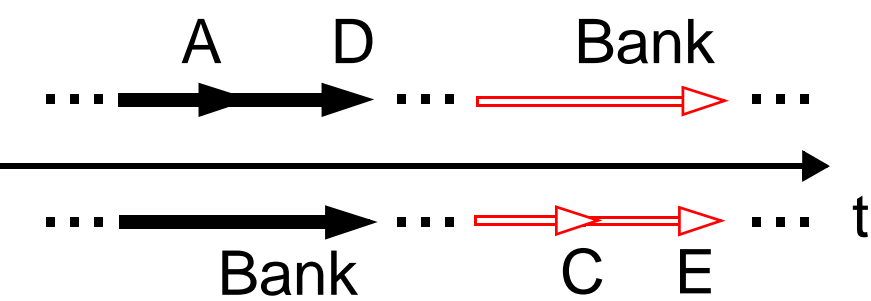
Currency

Money is Credit and Debit Relation with a Bank

Creation Transfers...

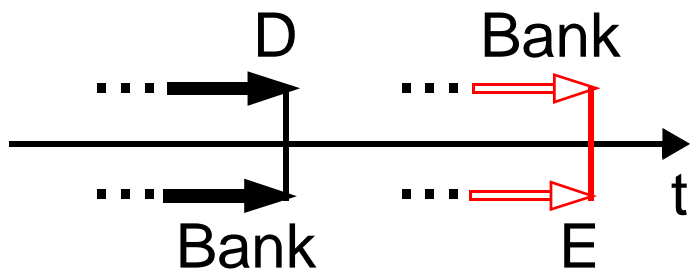


...Transfers...



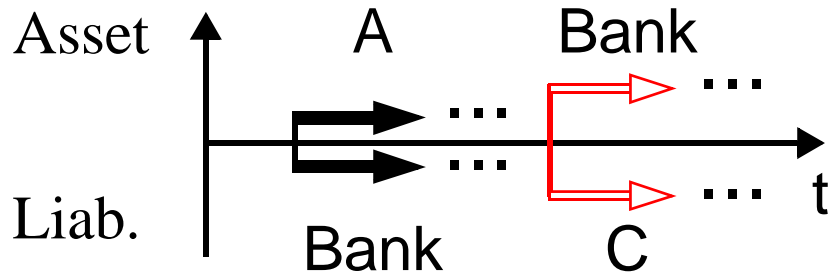
Movie Credit
and Debit Transfers

...Termination Transfers

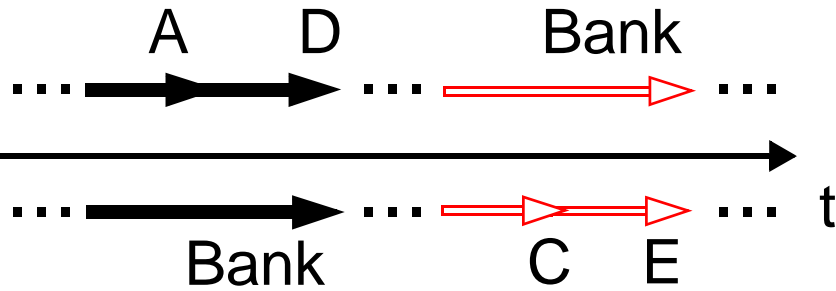


Interest and Default

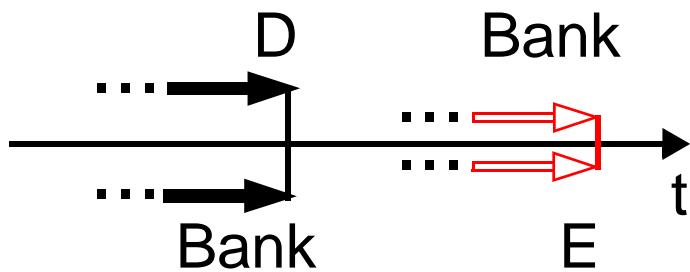
Interest Transfers...



...Transfers...



...Credit Default



Movie Interest
Credit and Debit

Credit-Debit Equilibrium with a Twofold-Debt Relatio

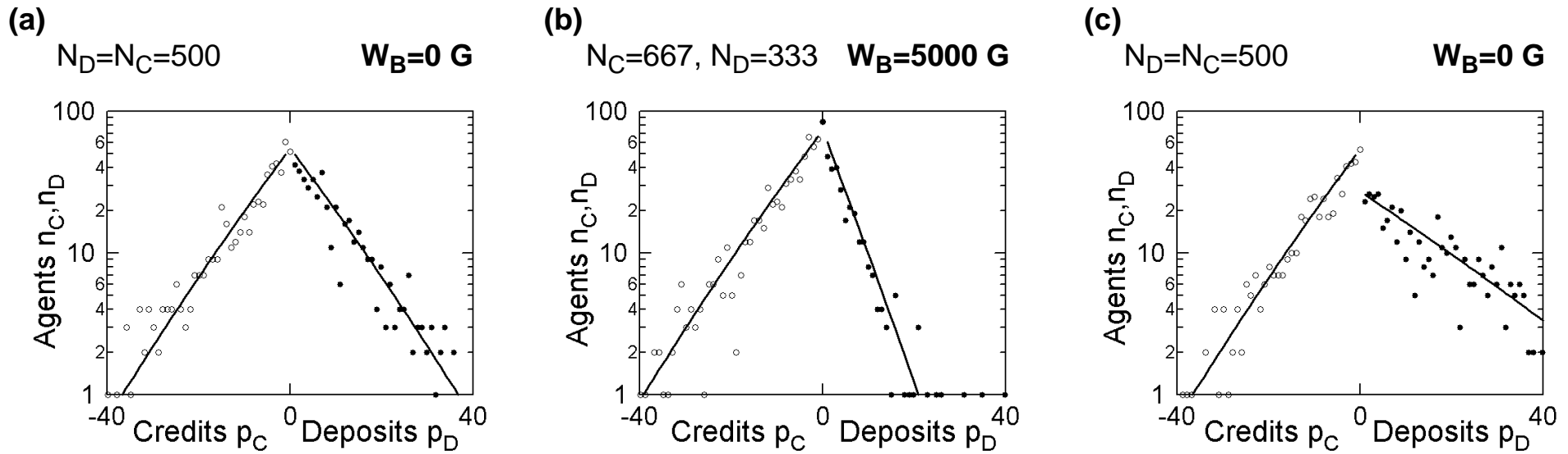
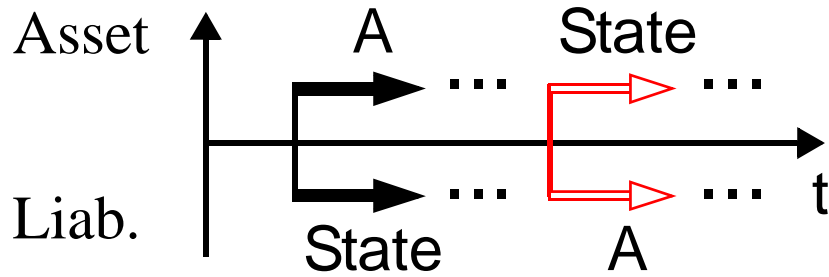


Fig. 1. Feedback cycle with new exchange rate in banking. (a) We simulate a random economy that is equilibrated with a deposit and credit fee F_D, F_C . (b) Increasing the deposit fee F_D allows banks to make profit if they only run classically with one currency. (c) However with a free floating exchange rate between deposits and credits, as proposed by this paper, the price level can adapt. Most probably, the non-banks will double the deposit price level P_D to compensate the doubled deposit fee F_D . This, however, results again in zero bank wealth W_B .

Symmetry Money

Birth of Persons...



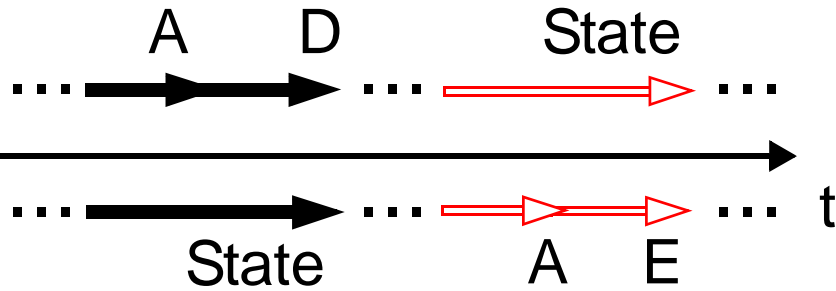
Symmetries

Persons

Time

Currency

...Transfers...

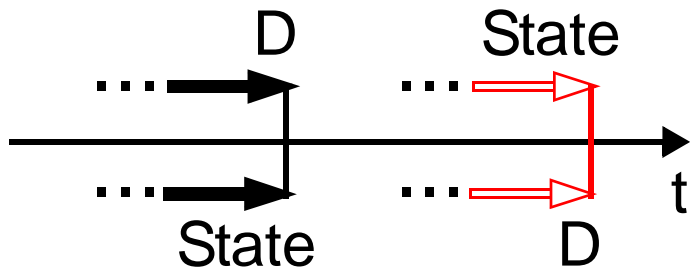


Persons

Time

Currency

...Death of Persons



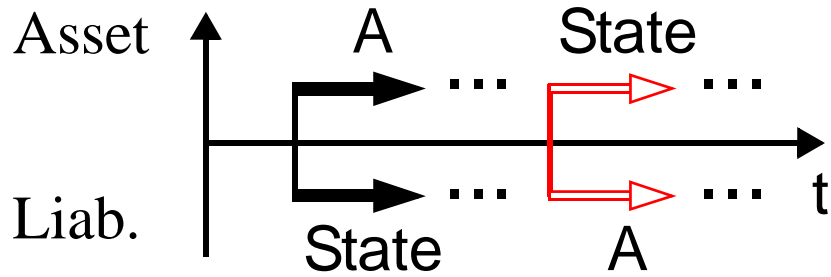
Persons

Time

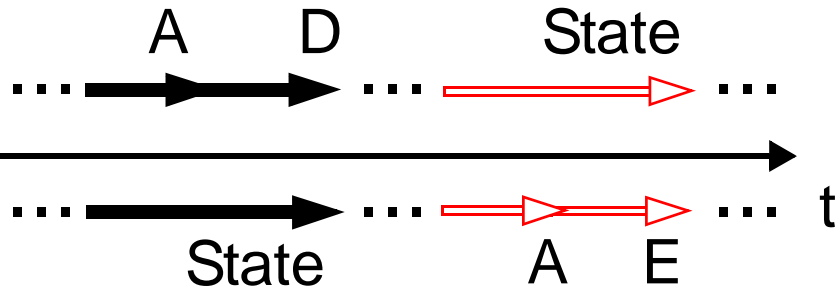
Currency

Symmetry Money

Birth of Persons...

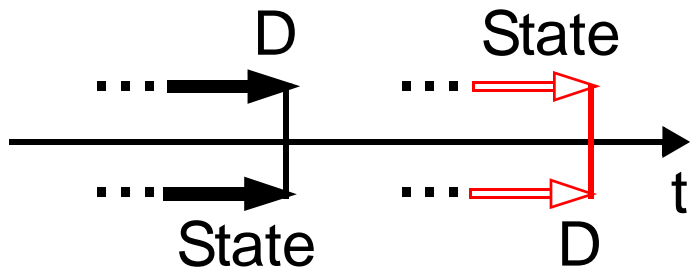


...Transfers...



Movie Symmetry
Money

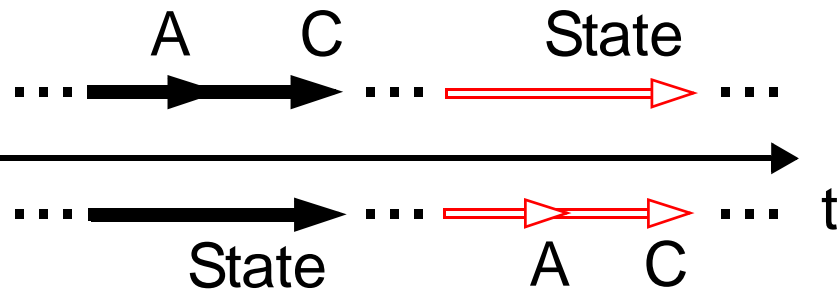
...Death of Persons



Credit in Symmetry Money

Instead of Credit Creation:

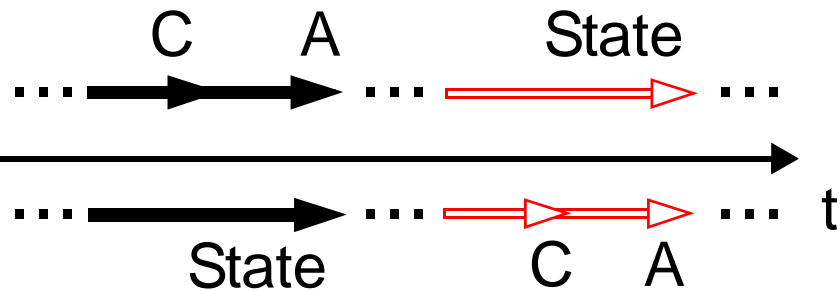
Liquidity transfer from A to C



Wealth of C strongly depends on exchange rate between black and white

Instead of Credit Termination:

Liquidity transfer from C to A



Wealth of C weakly depends on exchange rate between black and white

Exchange rate balances value of past with value of future

Conclusion

- o Start from a bijective map between Mechanics and Bookkeeping
- o Transform Noether Theorem to Bookkeeping
- o Find symmetry violations in contemporary and past Monetary Systems
- o Apply Renormalization and find fully Symmetric Monetary System

Thanks to:

Robert Fischer, Benjamin Franksen
Ernst Dorfner and Stephen Zarlenga

www.biophysik.physik.lmu.de/braun
www.bookkeepingmechanics.com