



EUROPEAN CENTRAL BANK

EUROSYSTEM

Francis Gross

Senior Advisor
DG Statistics

Eurofiling

7 June 2017, Frankfurt

Artificial Senses

Measuring finance and the economy

at the relevant speed and scale in the digital age

—

Vision: towards a digital infrastructure

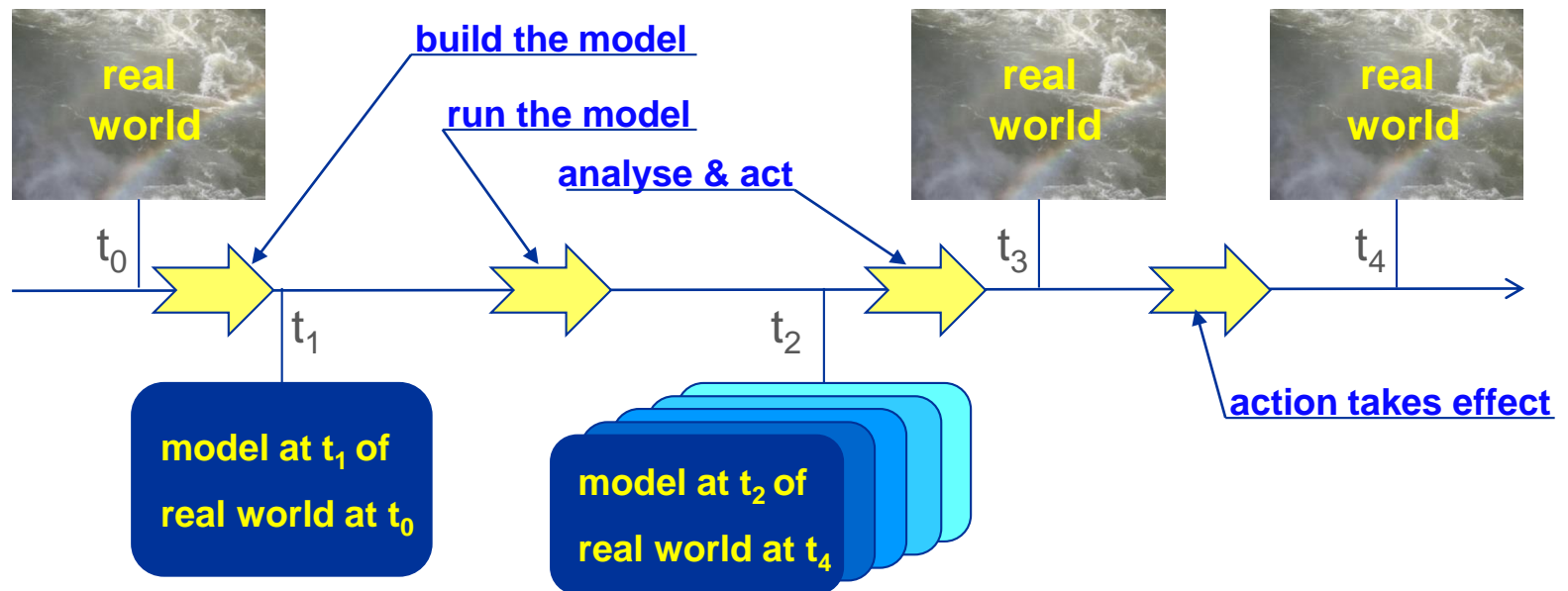
Chapters

1. A systems vision of the economy and finance suited to measurement and analysis in the digital age
2. A conceptual architecture of the measurement system and its necessary infrastructures, including LEI and ACTUS
3. An attempt at generalising ACTUS to all types of contracts, beyond finance

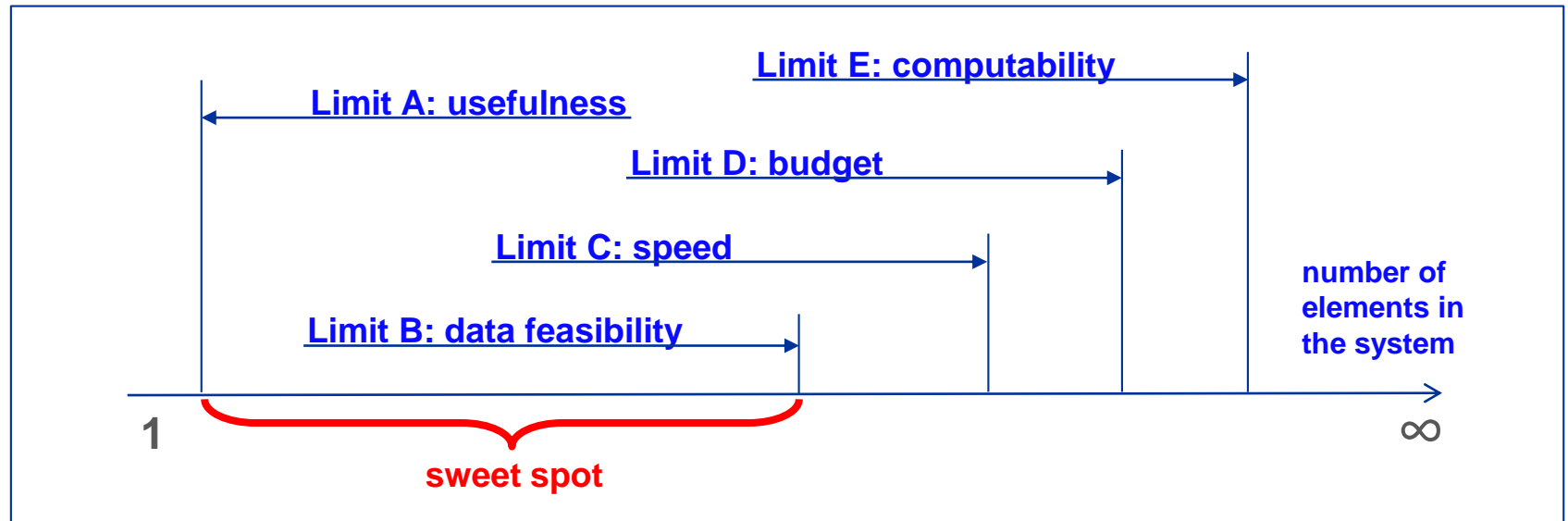
Chapter

1. A systems vision of the economy and finance suited to measurement and analysis in the digital age

- If simulation is fast enough, prediction is possible
- If prediction is possible, analysis and control are possible.



- Design of a system / model selects detail / granularity that best serves the use
- There are limits to design re. number of elements in the system /model



- A system / model in the sweet spot can satisfy demand
- The sweet spot can be void if feasible size is lower than usefulness demands

The San hunter shoots his arrow, kills the prey.

His senses are sufficient.

He doesn't need measurement.

The pilot of a night flight sees airport lights,

Yet he needs measurement of altitude, speed, etc. to land safely.

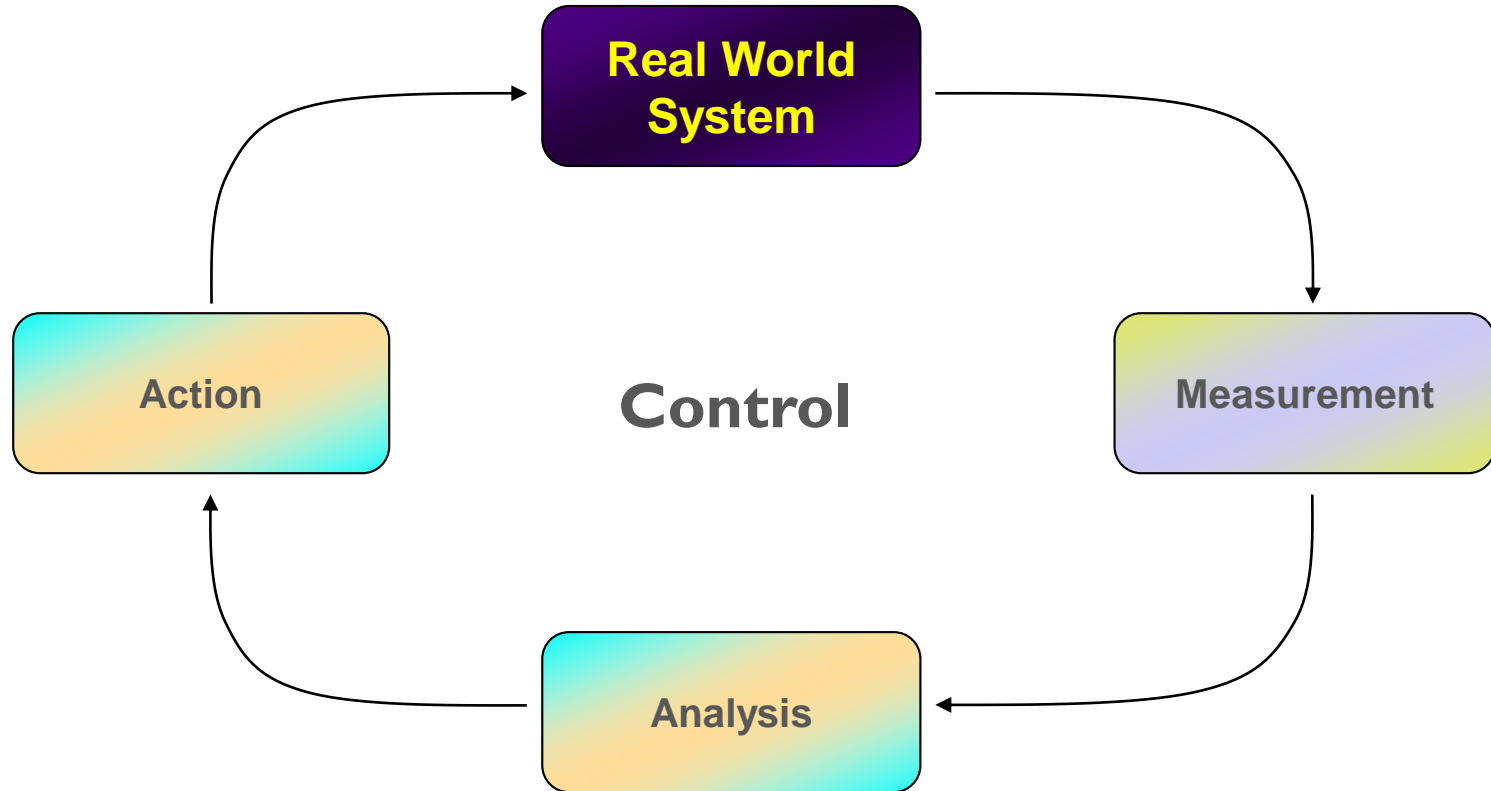
His senses need to be augmented through measurement.

Our senses don't perceive finance at all,

We need artificial senses.

We need measurement, i.e. statistics, and more.

- Measurement augments our senses where they don't suffice for the purpose
- Measurement is the production of information that augments our senses
- Simulation through a system / model is measurement of a more complex type



- Measurement is a necessary condition for control
- Effective measurement must be at a scale relevant to the system measured
- For modern finance, the relevant scale is global, relevant speed is real time.
- Control and Risk are sides of the same coin. Control suits engineering better.

Artificial senses should work at the speed and scale of the system observed

- Ultimately, for critical ones in finance: global scale, real time. And flexible

Traditional goals and specifications of statistics remain valid

- Adequate information for analysis and decision

Four additional specifications for statistics, for reflection:

- Global integration of measurement
- Speed of measurement near real time
- Flexibility, to remain effective when surprises happen
- Drill-down to specifics, fast, to enable fine diagnostics and surgical intervention

Existing means might not be able to stretch far enough.

Radical departure from some statistical practices might be needed.

The new specifications could have collateral benefits

- E.g. businesses gain operational efficiency, reduce their operational risk and, indirectly, systemic risk

What systems
to
represent finance and the economy
for
measurement and analysis
?

Real-world
Heterogeneity

in

Languages

Data practices

Technical systems

Legal systems

Cultures

VS.

Technology-driven
Need for Homogeneity

in

Language

Data practices

Technical systems

Vision 1

A set of

Closed Systems

(national economies)

with

Perturbations

(international trade and
investment)

VS.

Vision 2

A Global Network

of

Contracts

among a

Global Population

of

Agents

Chapter

2. A conceptual architecture of the measurement system and its necessary infrastructures, including LEI and ACTUS

Vision 1

A set of

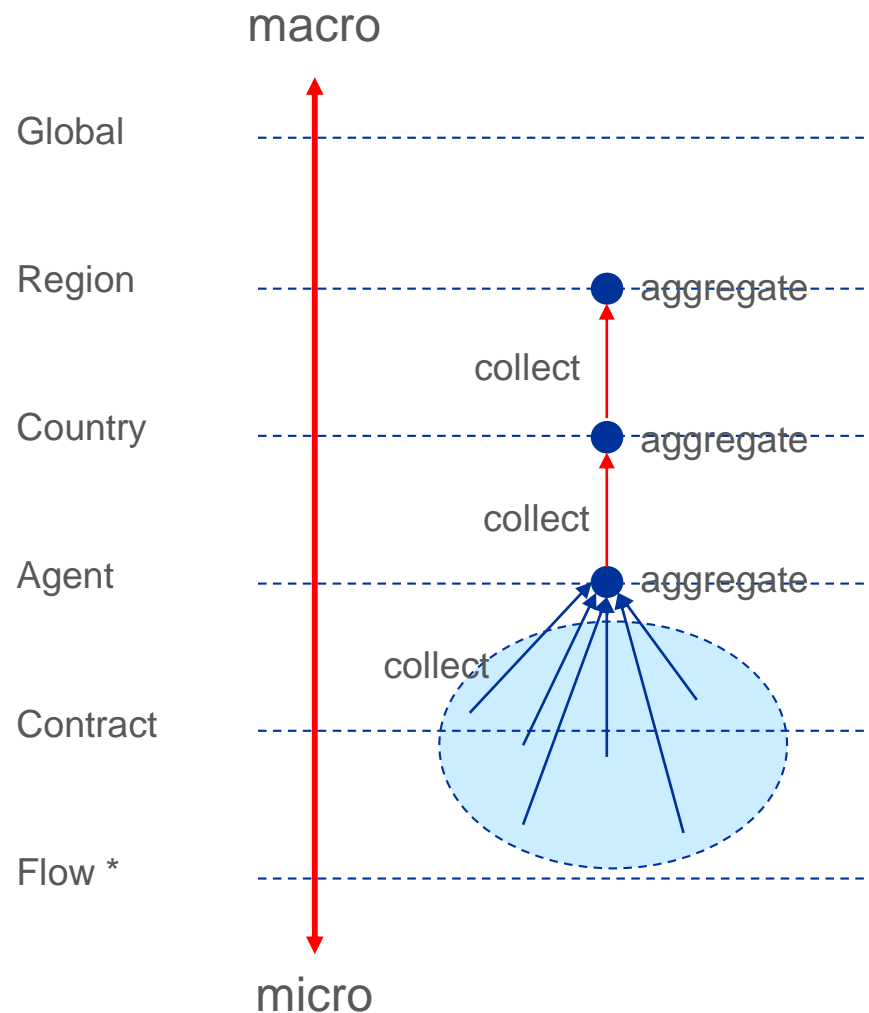
Closed Systems

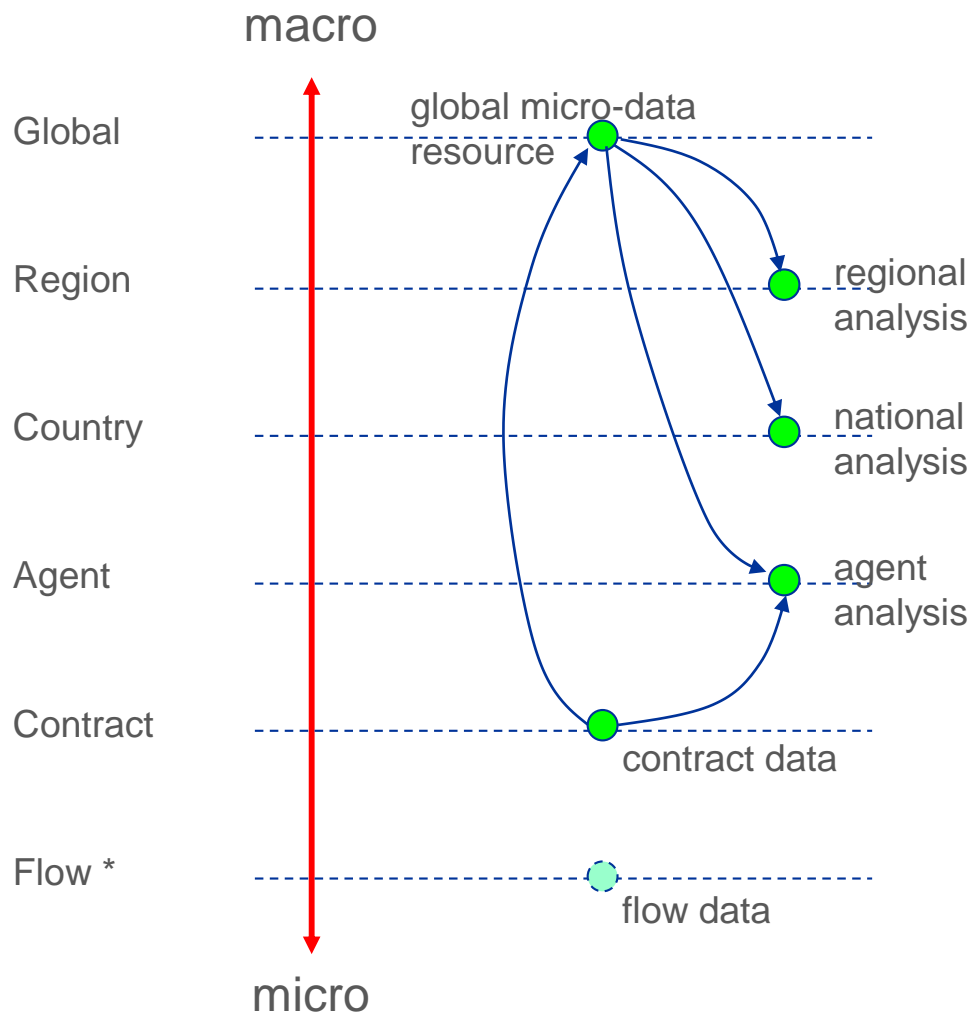
(national economies)

with

Perturbations

(international trade and investment)





Vision 2

A Global Network

of

Contracts

among a

Global Population

of

Agents

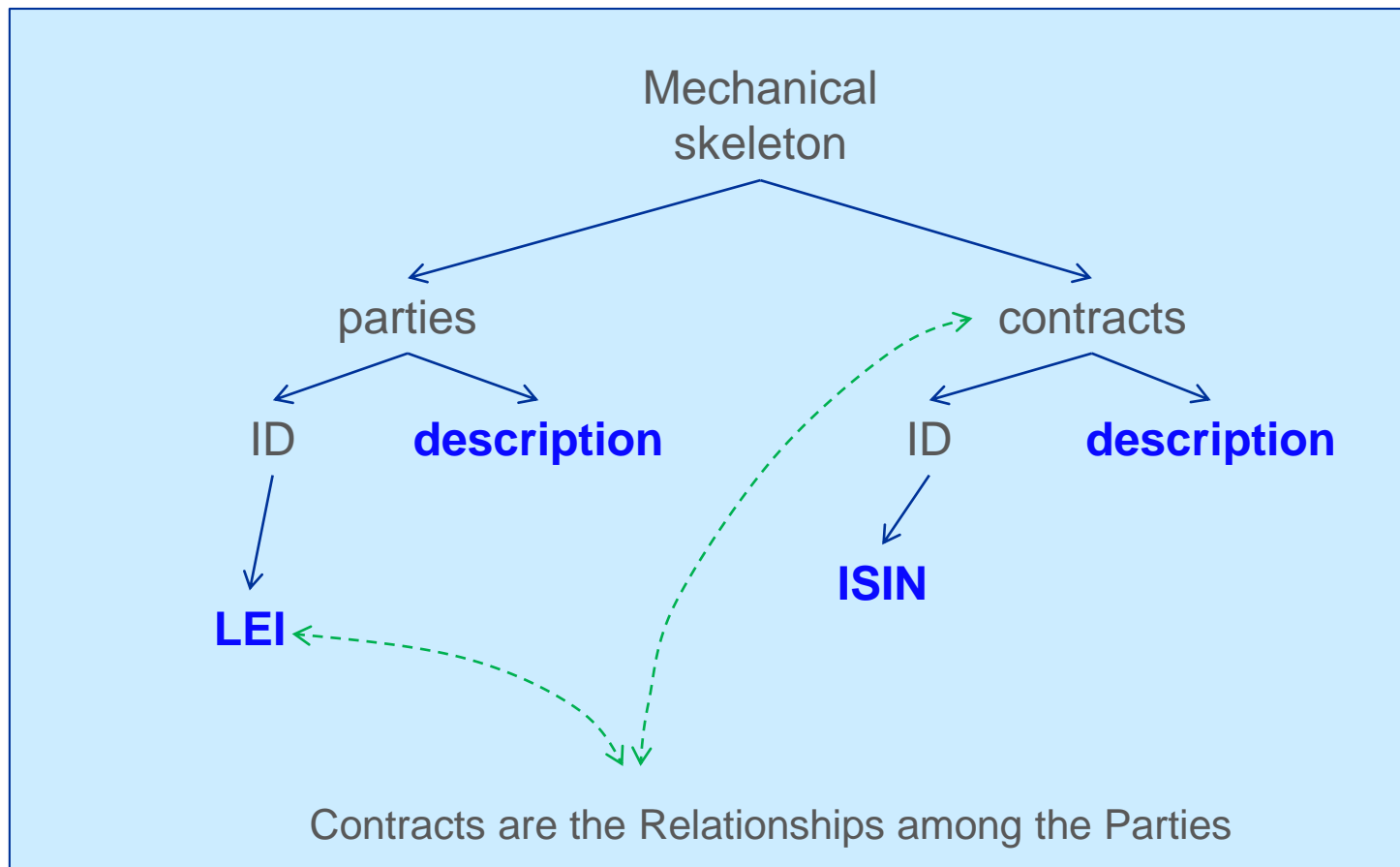
- Ideally, global micro-data resource built from standardised operational data
- All macro data derived from same global micro-data resource gives consistency

* cash, goods, services

Core system: the “mechanical skeleton”

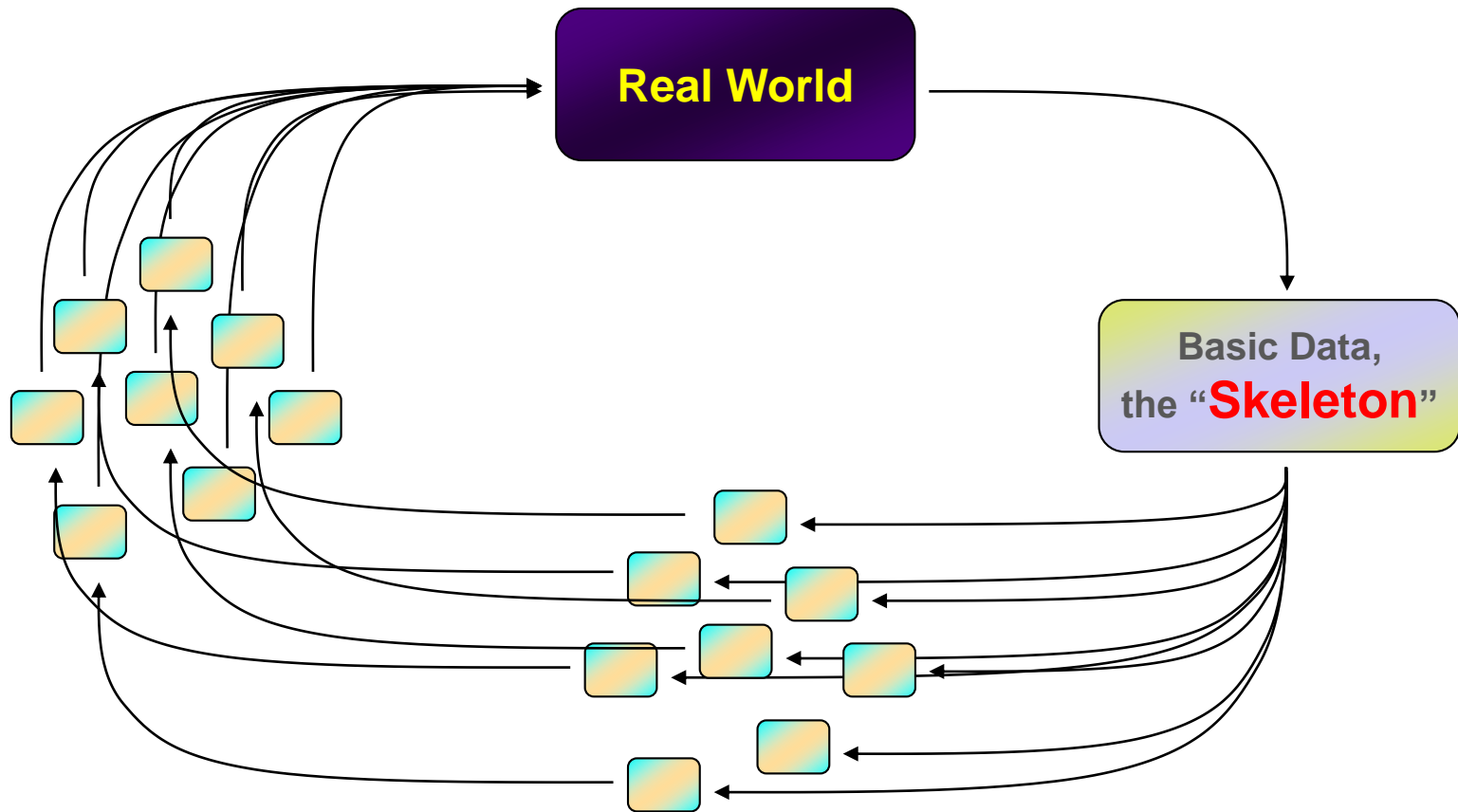
Formal social consensus is established by law:

Abstract objects anchored in law are socially real. They are facts.



G20-backed, publicly governed, privately operated Global LEI System is a start.

All control cycles share the same real world
They should share the same basic object-level data



Goal should be that the same basic “skeleton” of object-level data is used by all, be it in operations, administration or measurement.

- **LEI**
 - The Global Legal Entity Identifier System is a reality
 - Over 500.000 entities registered worldwide
 - Registers entities and, soon, relationships among them
- **ACTUS**
 - Algorithmic Contract Types Unified Standard
 - Describes financial contracts in a rigorous language
 - Computes contract cash flows, driven by event scenarios
- **Where next? “Every contract is a relationship among parties”**
 - LEI has potential to picture the “mechanical skeleton”
 - ACTUS has potential to extend it a level deeper: to flows
 - Both LEI and ACTUS must find their way into mainstream

*“The current situation is very costly for market participants. The many different proprietary identifiers and local identifiers cause difficulties as they are incomplete, overlapping, and insufficiently accurate and do not guarantee a level playing field. While the drawbacks of the current situation are known and undisputed, resistance to change by the markets is due to the fact that **unique identifiers are a public good. They need to be introduced and maintained by legislation.** The mandatory requirement to use the LEI should be extended to all financial instruments and not only to specific market segments.”*

Keynote by Vítor Constâncio, Vice-President of the ECB, at the joint conference of the EU Commission and ECB on European Financial Integration, Brussels, 19 May 2017

http://www.ecb.europa.eu/press/key/date/2017/html/ecb.sp170519_1.en.html

Infrastructures such as

LEI and ACTUS

could unfold

TRANSFORMATIONAL POWER

Improve measurement by:

- Moving data reduction closer to the measurement output
- Using micro-data in much larger volumes and
- Using large-scale IT and increasing automation

As immediate enabling steps, move upstream to better basic data by:

- Forging alliances across stakeholder groups to
- Create standards for reference and other basic data and to
- Build a globally shared data infrastructure
- Backed by a public sector digital infrastructure strategy
- Including legislation for a digital infrastructure

A new positioning for measurement?

From “HUNTER-GATHERERS” of data
To interdisciplinary “DATA FARMERS”

Make the world more measurable
and

Help it to work better!

Sophisticated Data

high-level concepts

- Harmonised language
- Broad standards (e.g. accounting, statistical standards, dictionaries)

Skeleton-derived Data

- Standardised language
- Standardised calculation formulae
- Embedded in regulatory reporting

Skeleton Data

socially agreed “facts”

- Objects anchored in law
- Globally standardised data
- Stored in a public-good Utility
- Mandated by law

Is it ethically acceptable to influence the system we measure to make it more measurable?

Classical wisdom says:

- Measurement should not influence the phenomenon measured.

But in reality it always does:

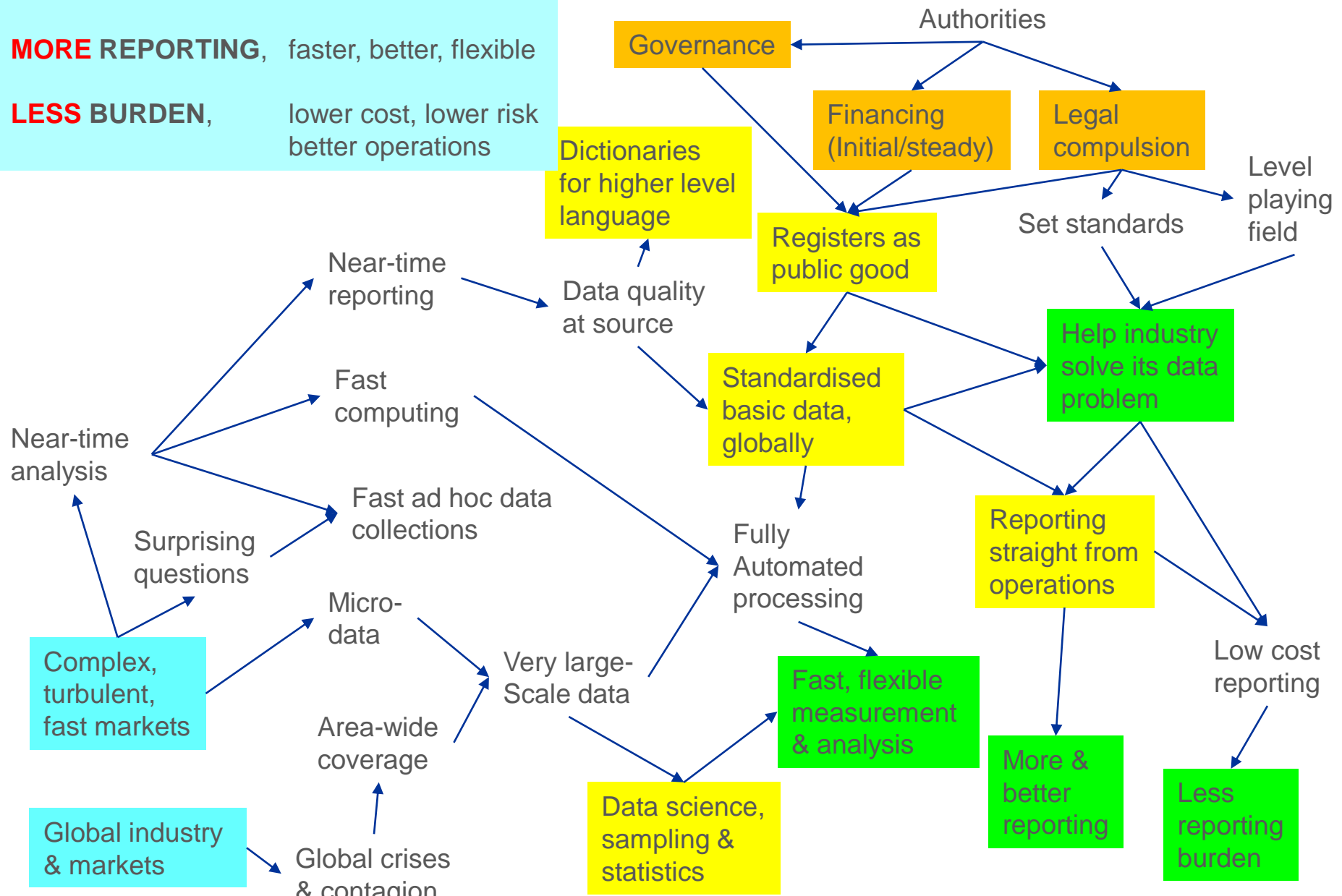
- ‘Observer effect’ in physical systems.
- Measurement guides key decisions, shapes our world. For good or bad!

It seems perfectly legitimate to consider strategies that influence the system measured to make it more measurable.

Authorities as Architects of the Data Ecosystem

MORE REPORTING, faster, better, flexible

LESS BURDEN, lower cost, lower risk better operations

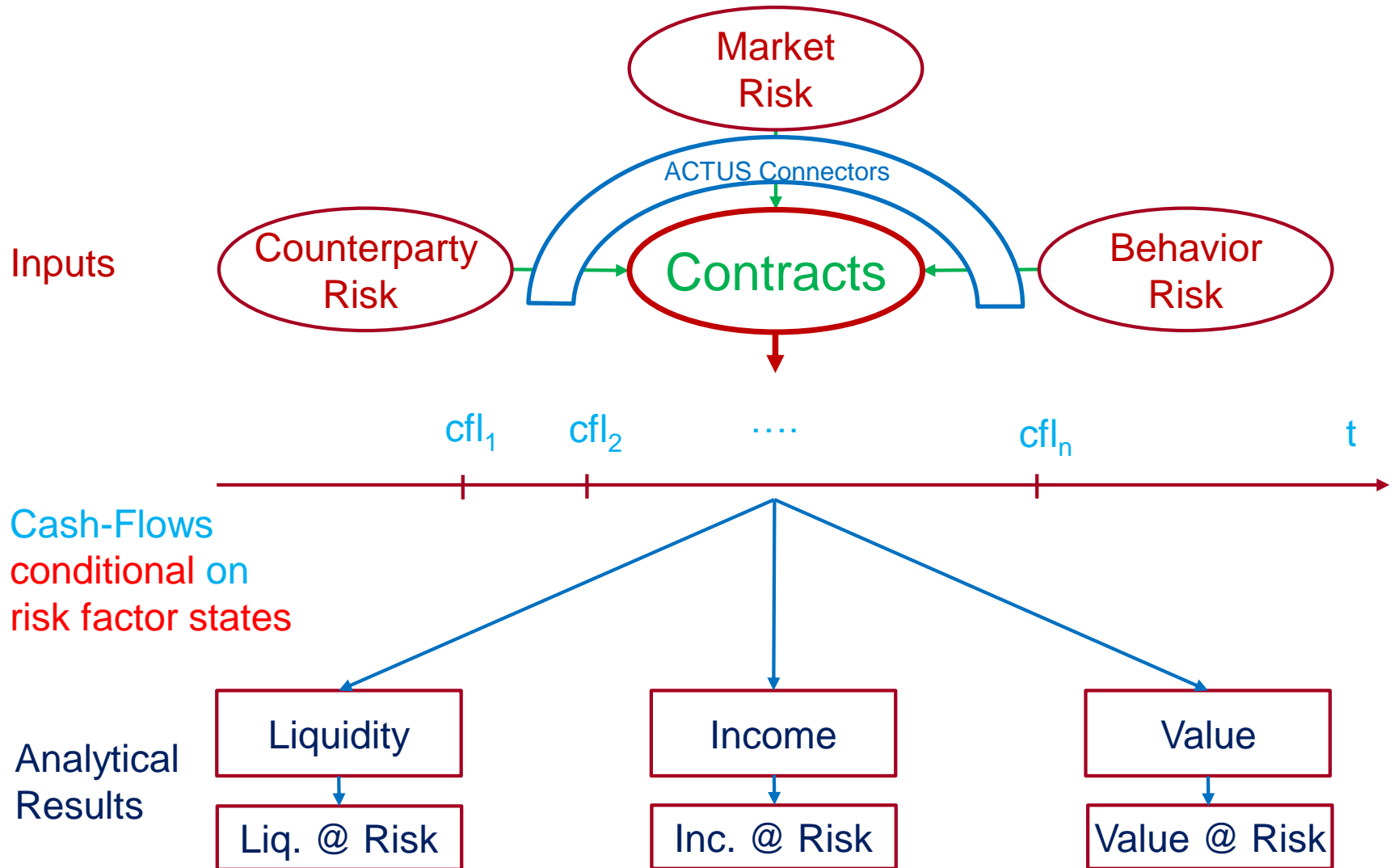


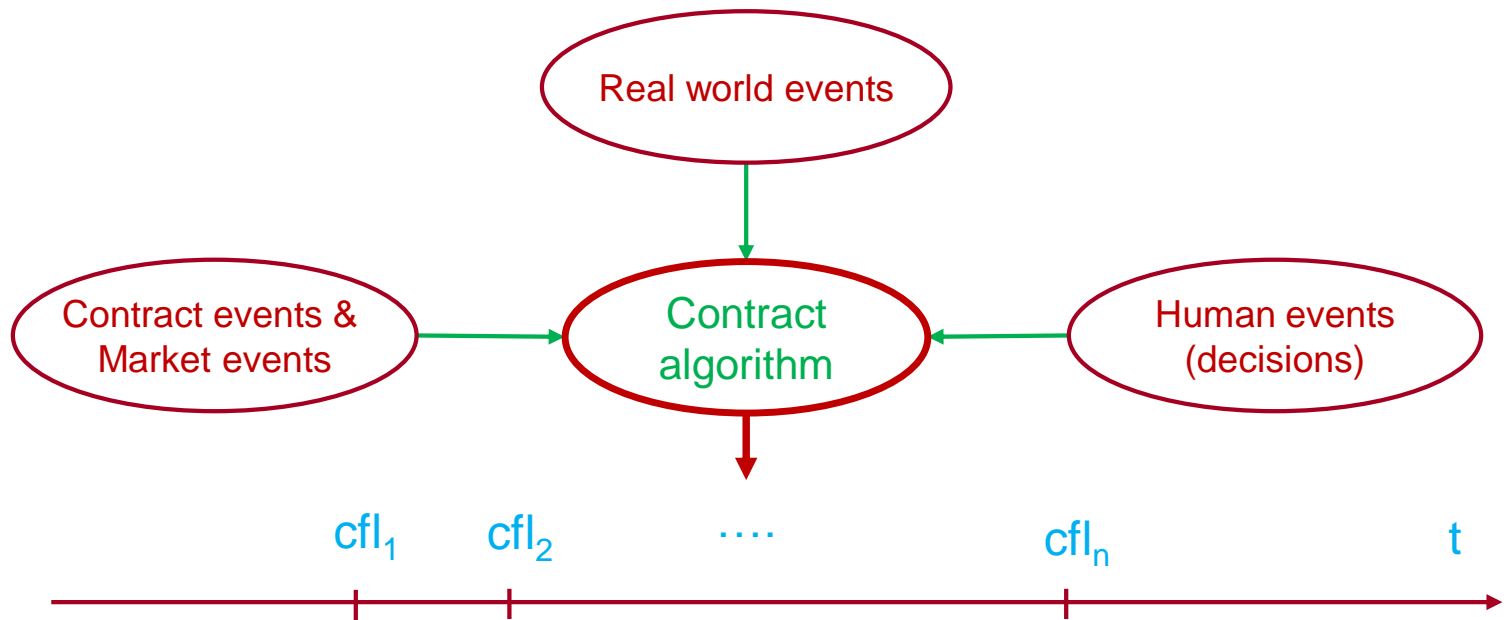
Chapters

3. An attempt at generalising ACTUS to all types of contracts, beyond finance

ACTUS Concept: Modeling Logic

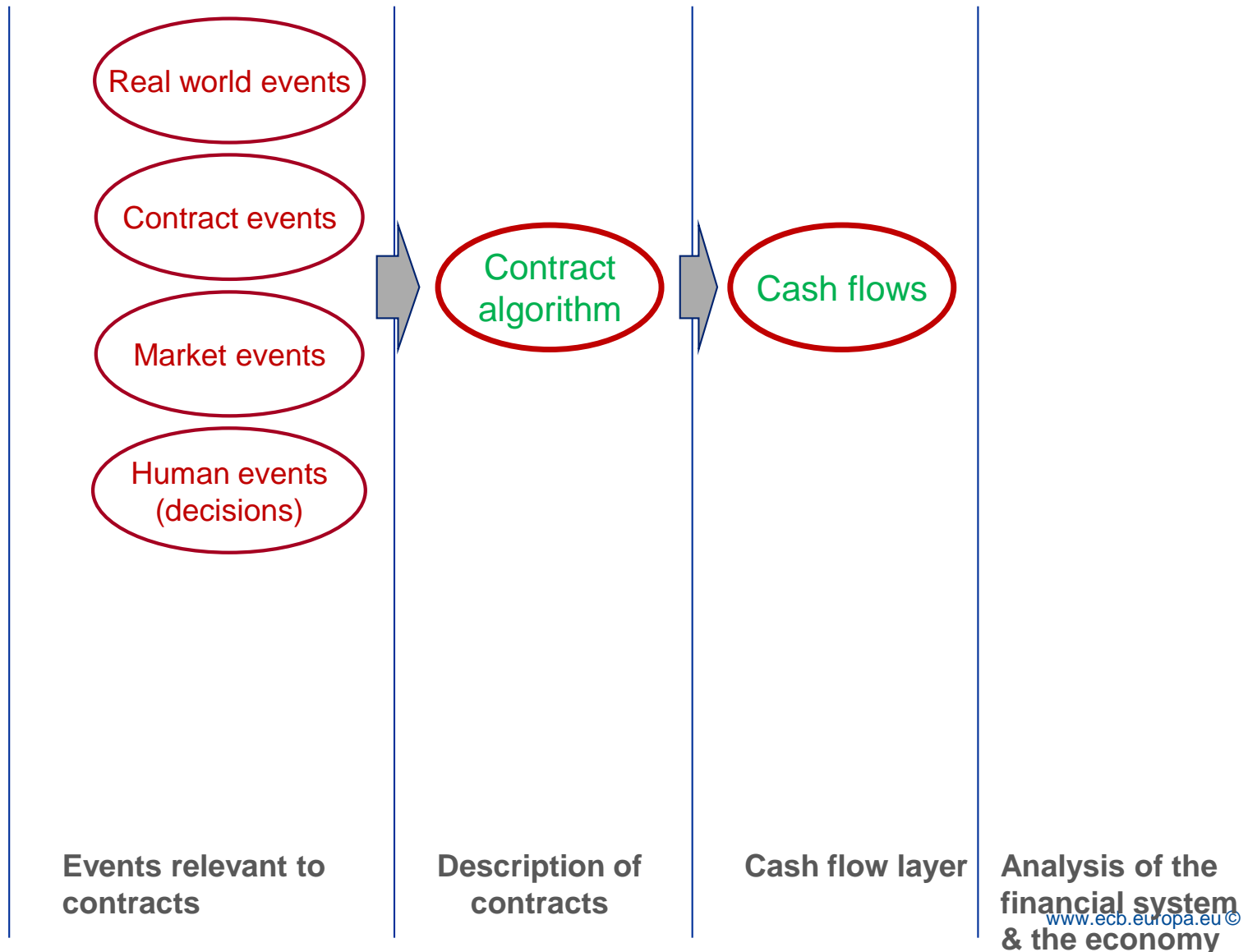
Brammertz, Akkizidis, Breymann, Entin, Rustmann, *Unified Financial Analysis*. Wiley, Chichester, 2009.





The contract algorithm is executed as a string of cash-flows, conditional on events

Inspired from: Brammertz, Akkizidis, Breyman, Entin, Rustmann, *Unified Financial Analysis*. Wiley, Chichester, 2009.

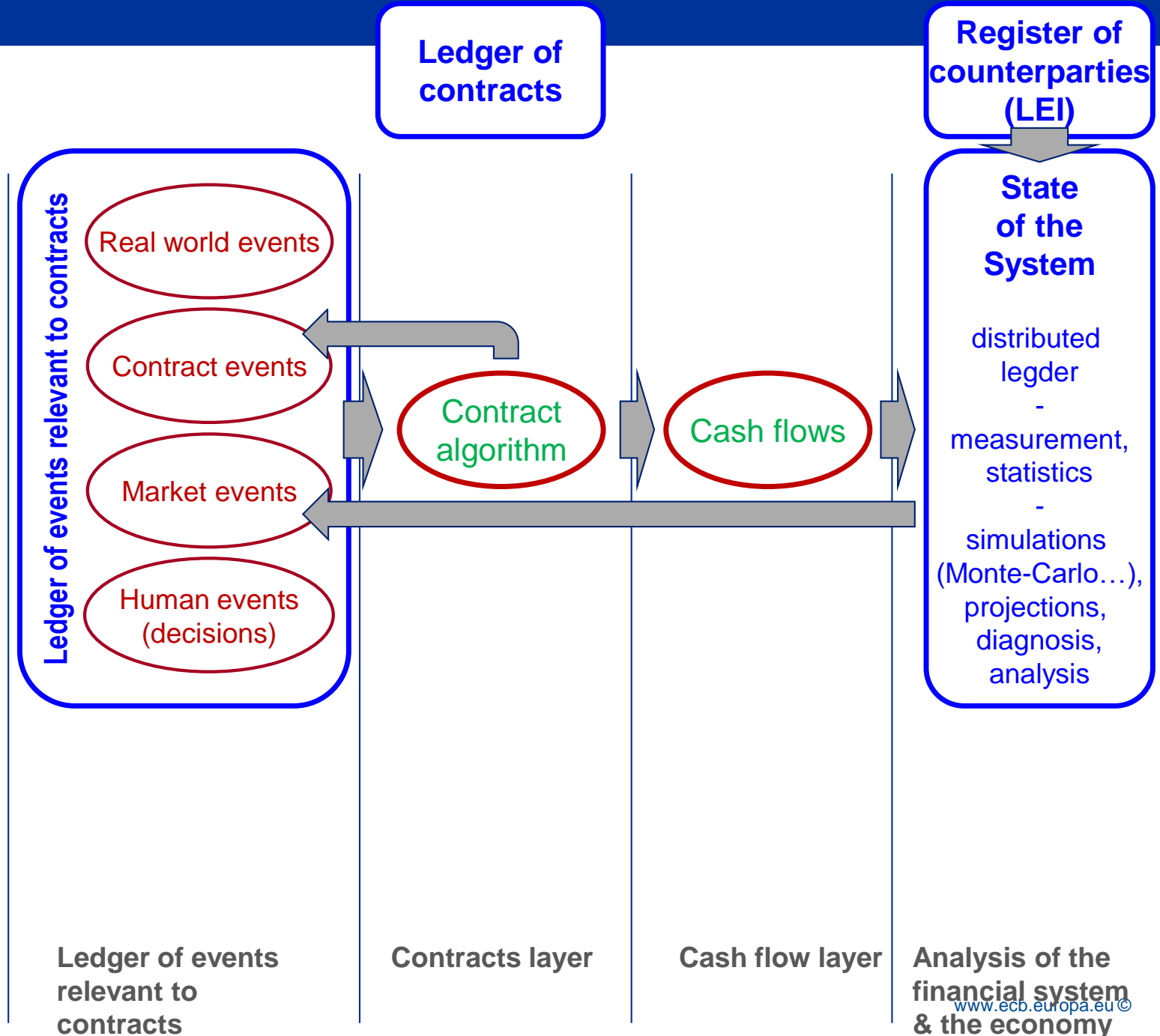


Events relevant to contracts

Description of contracts

Cash flow layer

Analysis of the financial system & the economy
www.ecb.europa.eu ©



Ledger of contracts

Register of counterparties (LEI)

Ledger of events relevant to contracts

- Real world events
- Contract events
- Market events
- Human events (decisions)

Contract algorithm

Cash flows

State of the System

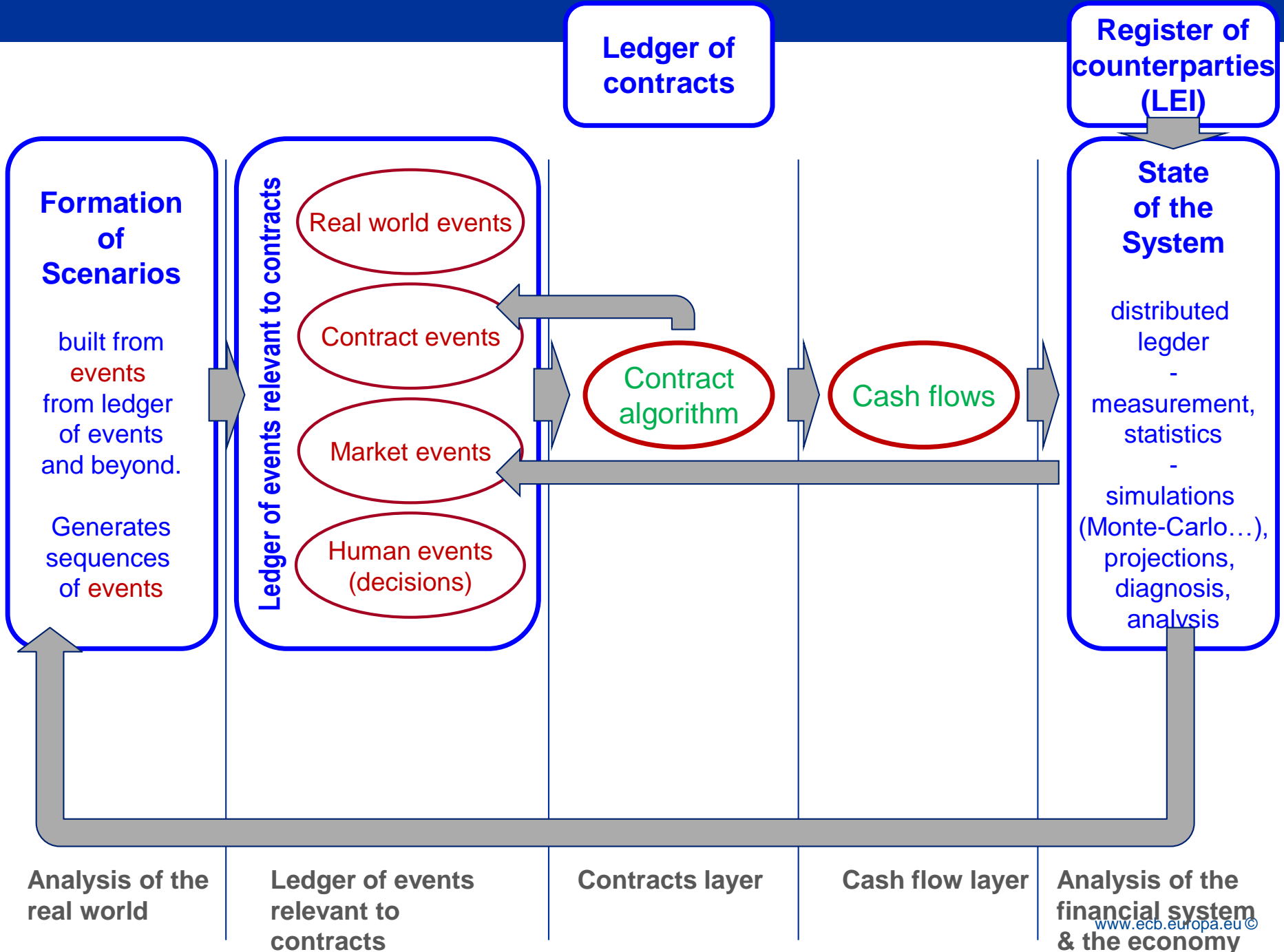
- distributed ledger
- measurement, statistics
- simulations (Monte-Carlo...), projections, diagnosis, analysis

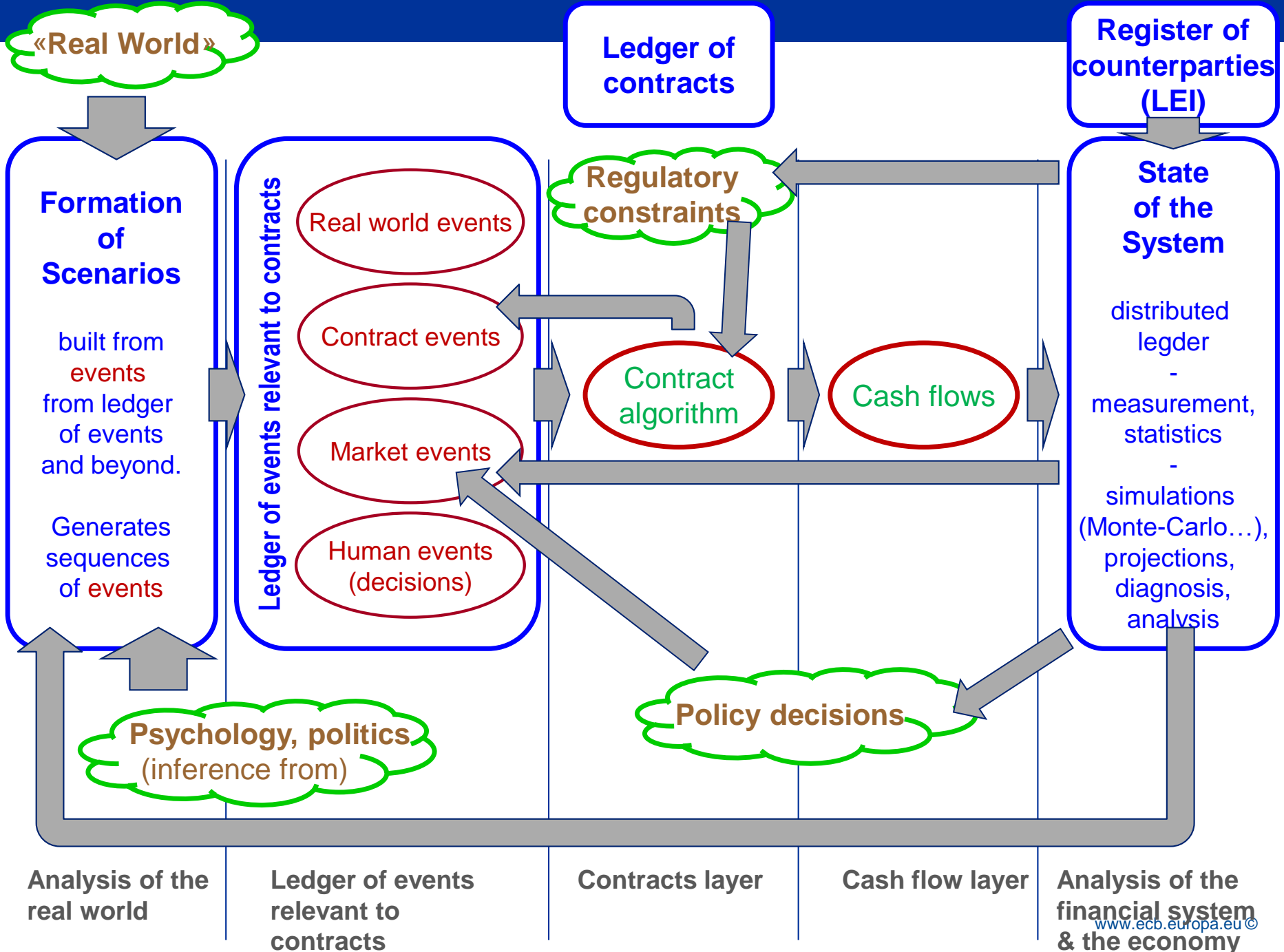
Ledger of events relevant to contracts

Contracts layer

Cash flow layer

Analysis of the financial system & the economy





«Real World»

Ledger of contracts

Register of counterparties (LEI)

Formation of Scenarios

built from events from ledger of events and beyond.
Generates sequences of events

Ledger of events relevant to contracts

- Real world events
- Contract events
- Market events
- Human events (decisions)

Regulatory constraints

Contract algorithm

Cash flows

State of the System

- distributed ledger
- measurement, statistics
- simulations (Monte-Carlo...), projections, diagnosis, analysis

Psychology, politics (inference from)

Policy decisions

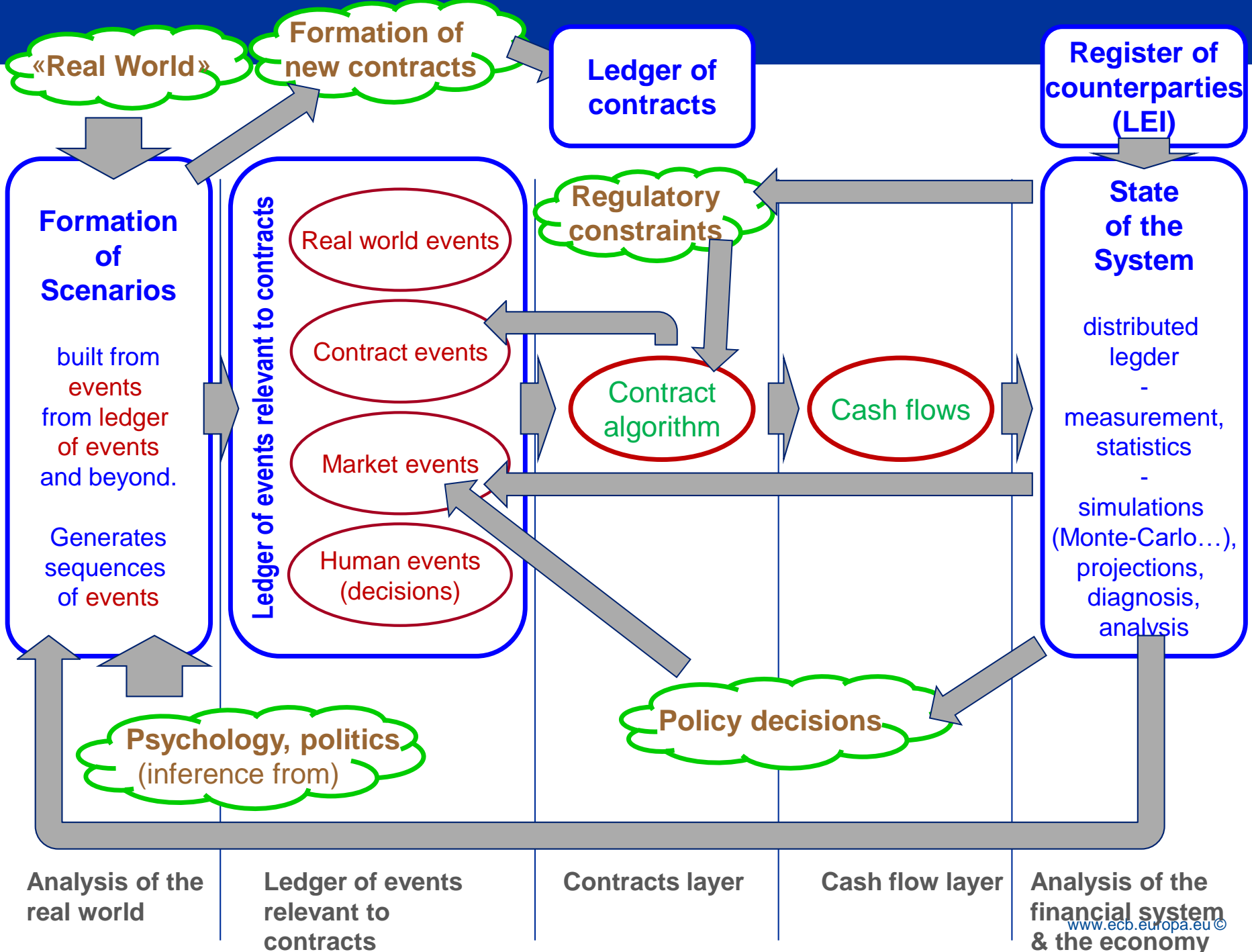
Analysis of the real world

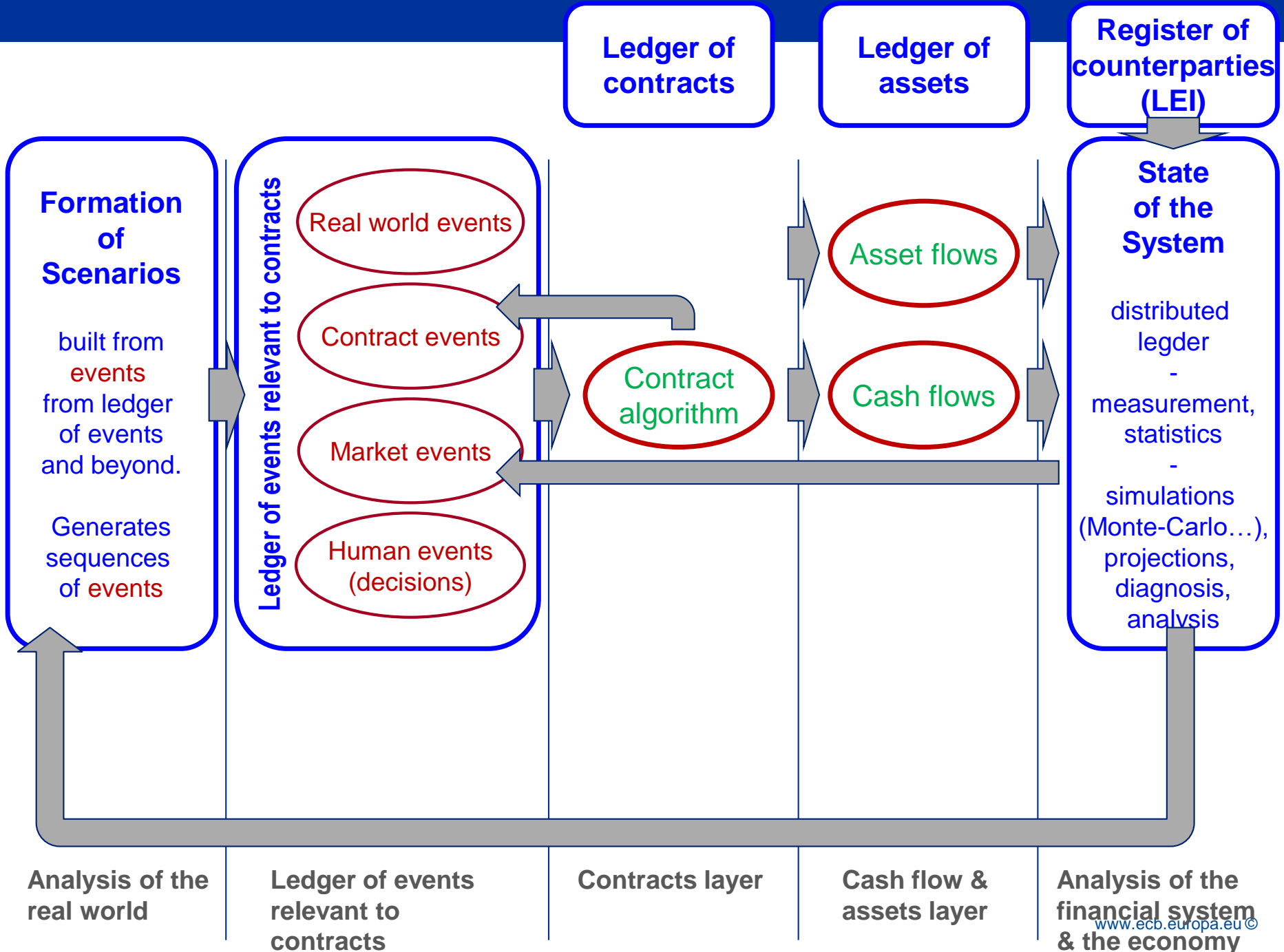
Ledger of events relevant to contracts

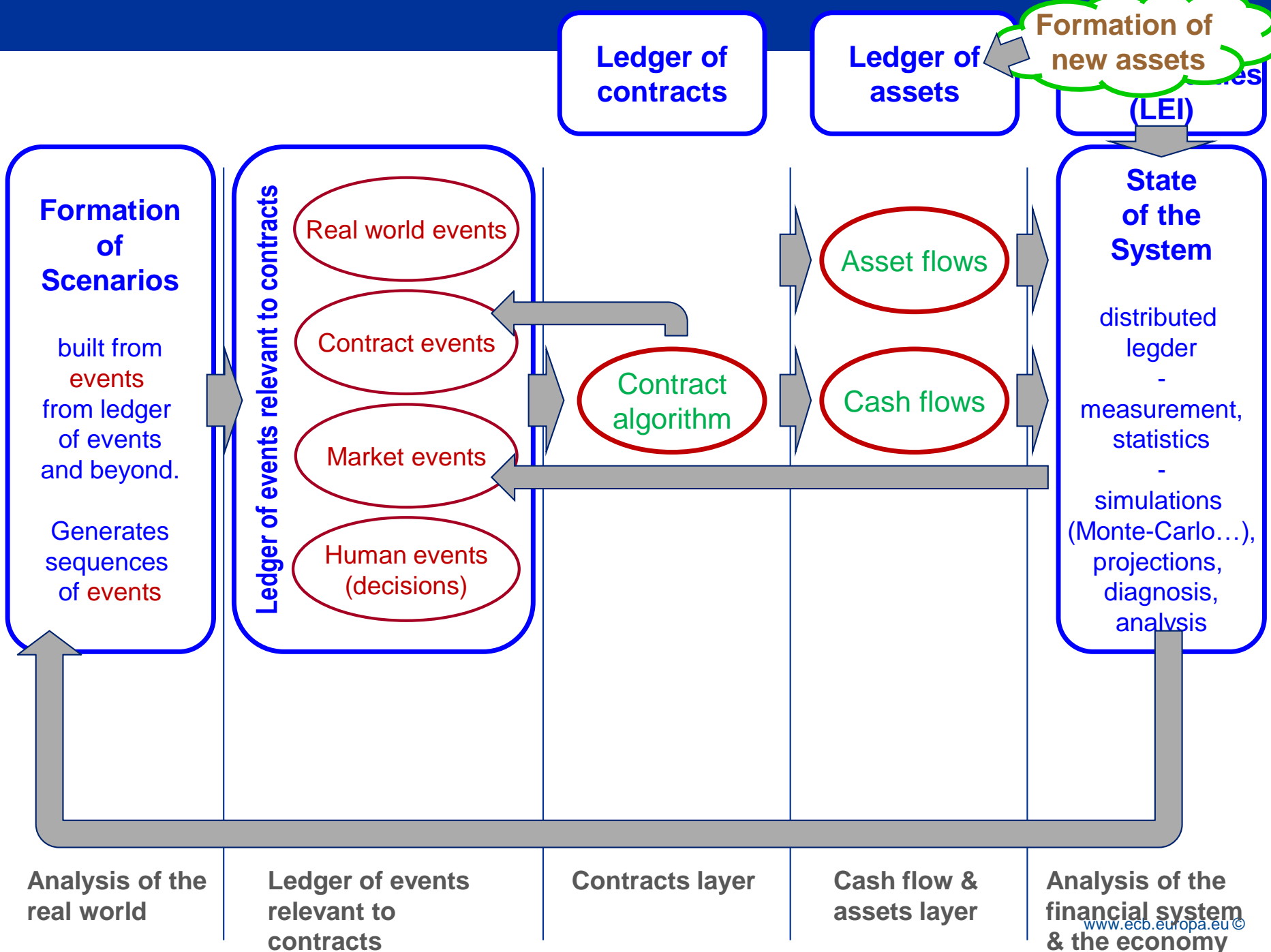
Contracts layer

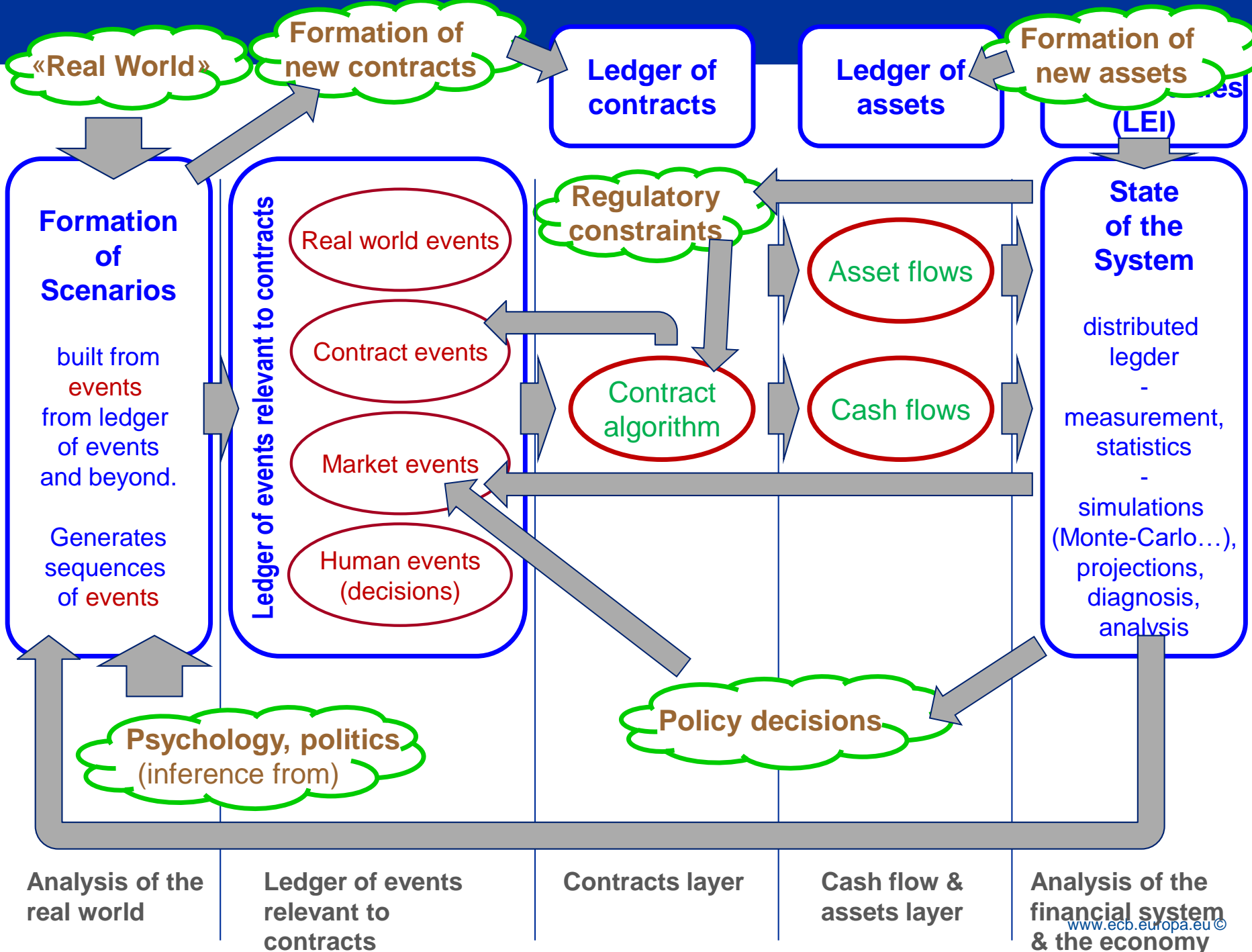
Cash flow layer

Analysis of the financial system & the economy









Analysis of the real world

Ledger of events relevant to contracts

Contracts layer

Cash flow & assets layer

Analysis of the financial system & the economy



EUROPEAN CENTRAL BANK

EUROSYSTEM

Francis Gross

Senior Adviser

Directorate General Statistics

European Central Bank

Sonnemannstrasse 22, D-60314 Frankfurt am Main

off: +49 69 1344 7513

mob: +49 160 746 84 82

fax: +49 69 1344 7056

email: francis.gross@ecb.int