

Prototype Environment for Financial Risk Modeling

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Artificial Intelligence in Industry and Finance
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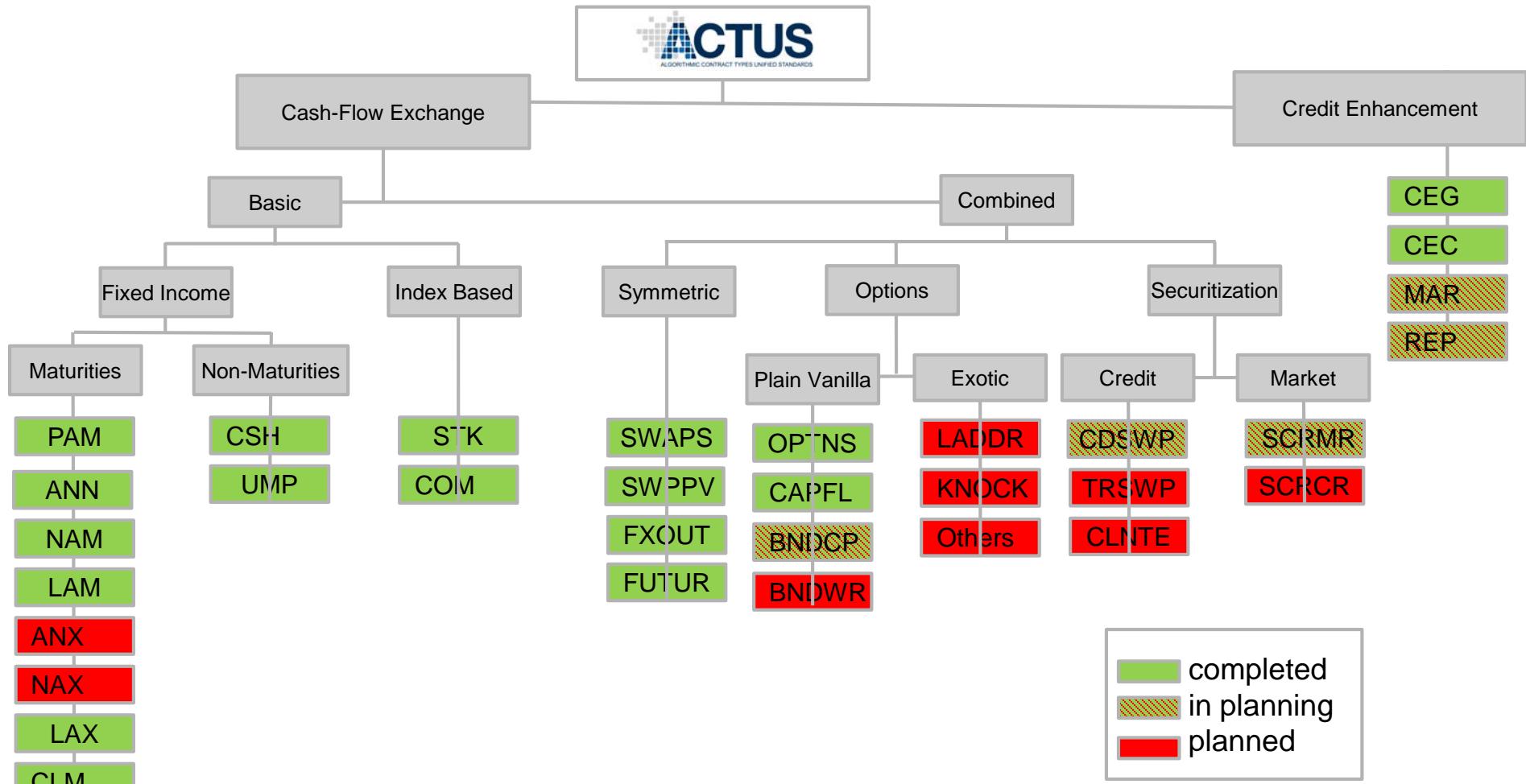
Outline

- Introduction:
Why an R – ACTUS interface and why a visual demonstrator
- The R – ACTUS interface
- A proof of concept using the R – ACTUS interface
- An ACTUS-based visual demonstrator for stress testing and systemic analysis
- Summary – Conclusion

Introduction

- Up to now:
 - The economy as a network of contracts
 - ACTUS: concepts
 - Smart contracts
 - Requirements for stress testing
 - Automated reporting: concept and demo
- Here something to play around with ACTUS-based modeling:
 - R-packages targeted to the technically savvy
 - An interactive demonstrator for visualization

ACTUS Contract Types



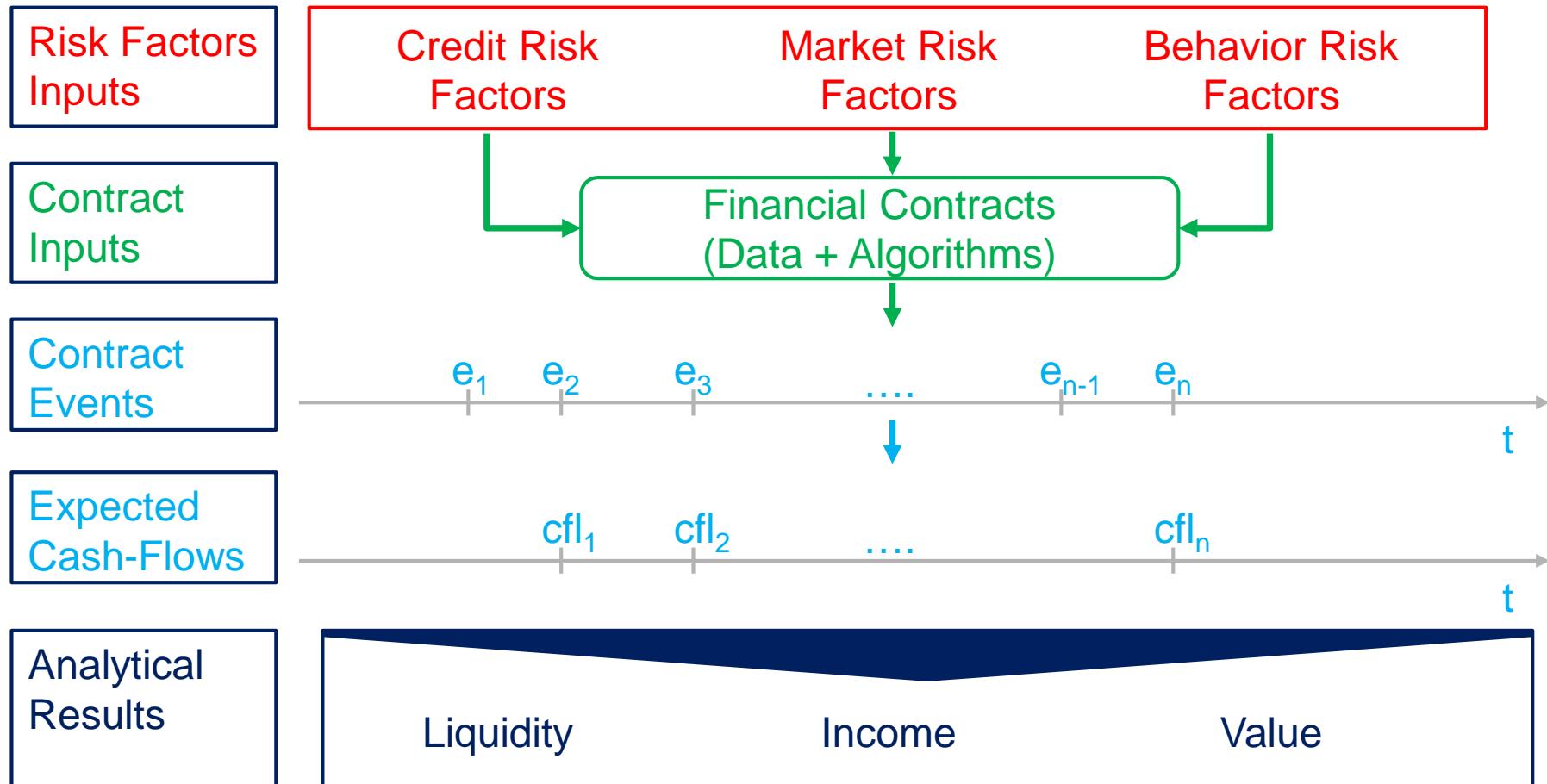
* Definitions and explanations to the Contract Types may be found in the «CT-Description» Excel sheet.

The ACTUS – R Interface: The Philosophy

- Provide the means for using ACTUS contract types on a prototyping level to the mathematically educated user
- Add the analytical power of R to enable rapid prototyping of sophisticated models



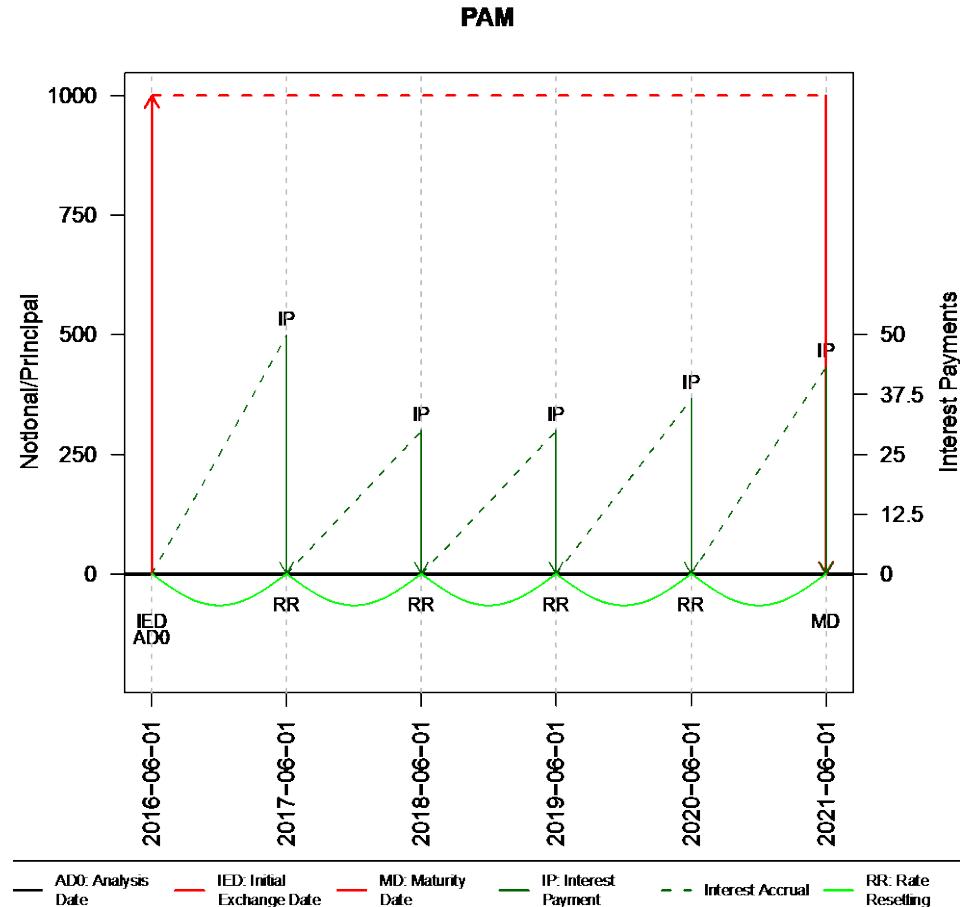
The ACTUS Logic



The ACTUS – R Interface: The R-Packages

- rActus
 - R-Interface to the ACTUS Java library
 - Gives access to contract types
 - PAM
 - ANN
 - LAM
 - SWAPS
 - STK
 - User can create contract, define market environment, create the contract events and visualize the cash flows
 - No analytics
- A simple example

The R-Packages: Examples



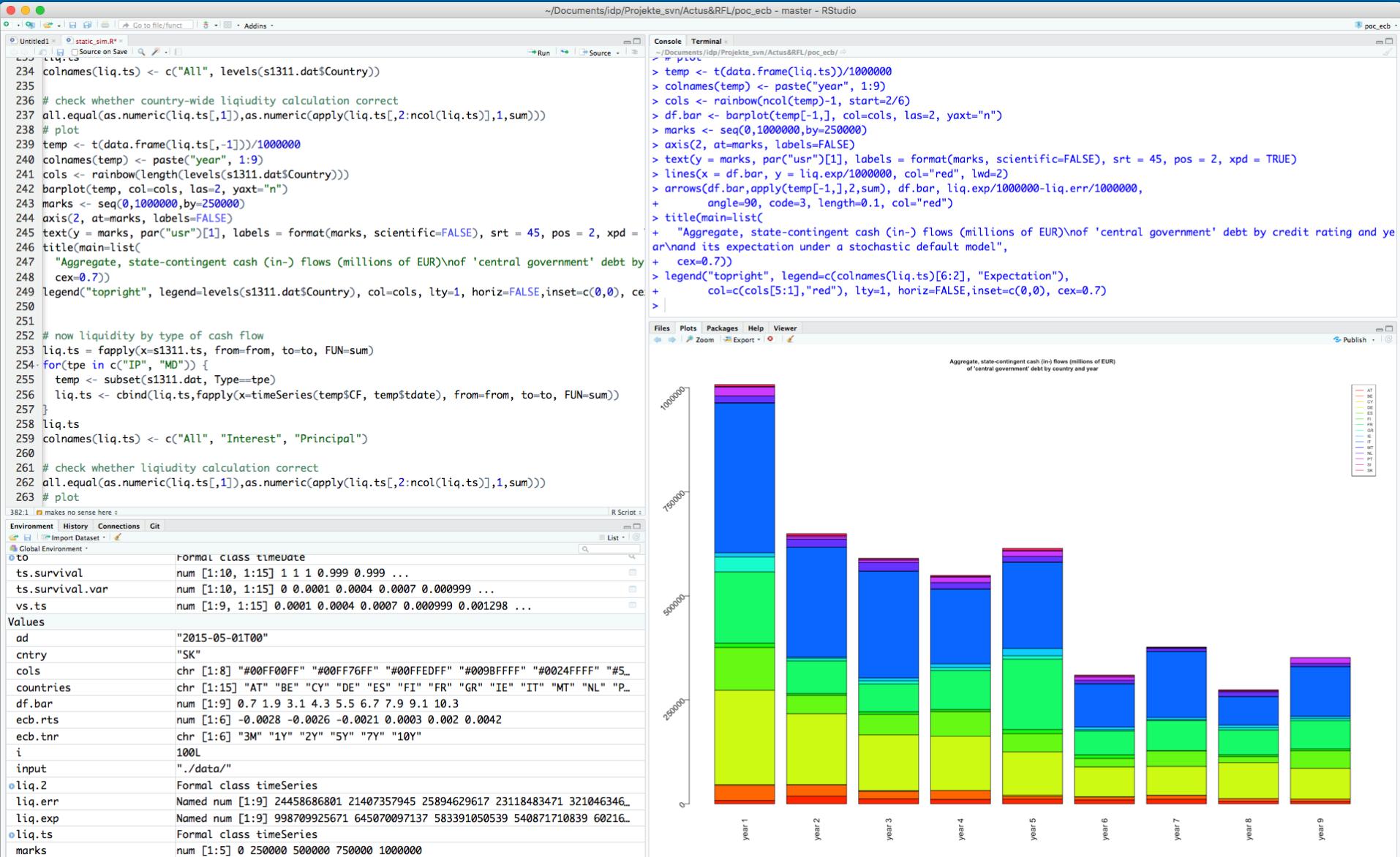
The ACTUS – R Interface: The R-Packages

- `rflPortfolio`
 - Supports analysis of whole portfolios
- `rflContracts`
 - Supports demonstration of single contracts
- Parallel execution at R-level possible with
 - SparkR -> Bachelor thesis
 - Directly in R (example?)

The ACTUS – R Interface: The Bottleneck

- The bottleneck:
R – Java communication
 - R is written in C/C++
 - Java and C/C++ are “disjunct worlds”
 - The communication passes through the Java Native Interface (JNI),
 - The JNI is slow
 - rActus requires a lot of communication between R and Java, which makes it slow
 - Can only be used for a handful of contracts
- Work-around:
 - Pass a whole portfolio in one chunk to the java library
 - Use parallel computing, directly in R or through SparkR
- This bottleneck can only be overcome through transferring the source code to C++.

Proof of Concept with a Portfolio of Real Bonds



Proof of Concept: The Portfolio

Sample overview: Number of Observations =3809

Sector (according to European System of Accounts 2010 issued by the European Union)

All observations of the General Government (S_13) sector which is subdivided into

Central Govt. (S_1311) | State Govt. (S_1312) | Local Govt. (S_1313) | Social security funds (S_1314)

N-Obs:	1290	1944	491	84
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Country (according to ISO 3166-1 system)

AT	BE	CY	DE	ES	FI	FR	GR	IE	IT	MT	NL	PT	SI	SK
149	413	46	1712	346	31	478	102	29	219	81	108	42	33	20

Contract Deal Date		Maturity Date		Cycle Of Interest Payment				
Earliest	Latest	Earliest	Latest	1M-	1Q-	1Y-	6M-	NULL ⁽³⁾
1986-06-20	2015-03-31	2015-04-01 ⁽¹⁾	2090-11-08 ⁽²⁾	4	391	2237	474	703

Notional Principal (note, different currencies)

Min	Median	Max
0.0 ⁽⁴⁾	76,690,000.0	38,530,000,000.0

Nominal Interest Rate

Min	Mean	Max
0.0 ⁽³⁾	0.0155	0.2319

⁽¹⁾ Matured bonds, ⁽²⁾ Data quality issue, ⁽³⁾ Zero coupon bonds, ⁽⁴⁾ Data quality issue

Proof of Concept: Cash Flow Evaluation

Sample contract events with cash flows per 5/1/15

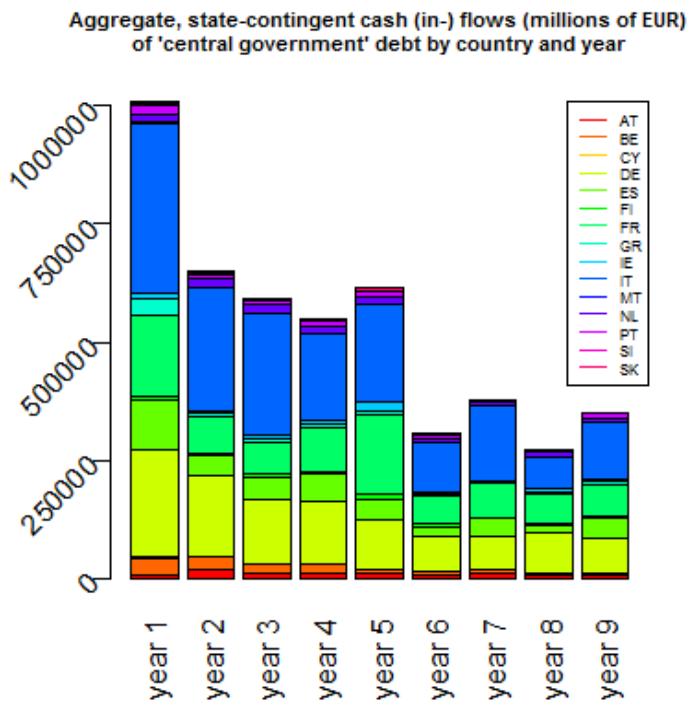
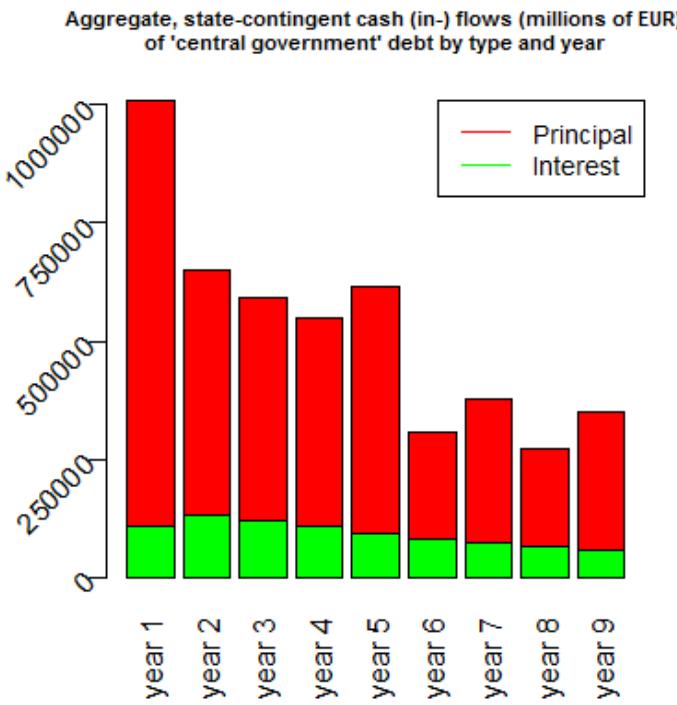
Contract ID	Event Date	Event Type	Event Value	Time (in years)	Nominal Value	Nominal Rate	Nominal Accrued	Currency	Country	Sector
DE00000000001	2015-05-01T00:00Z[UTC]	AD0		0.0	0.086111	50000000.0	0.0352	151555.6 EUR	DE	S_1312
DE00000000001	2015-12-02T00:00Z[UTC]	IP	1183111.0	0.586111	50000000.0	0.0352	0	EUR	DE	S_1312
DE00000000001	2016-12-02T00:00Z[UTC]	IP	1760000.0	1	50000000.0	0.0352	0	EUR	DE	S_1312
DE00000000001	2017-12-04T00:00Z[UTC]	IP	1769778.0	1.05556	50000000.0	0.0352	0	EUR	DE	S_1312
DE00000000001	2018-12-03T00:00Z[UTC]	IP	1755111.0	0.997222	50000000.0	0.0352	0	EUR	DE	S_1312
DE00000000001	2019-12-02T00:00Z[UTC]	IP	1755111.0	0.997222	50000000.0	0.0352	0	EUR	DE	S_1312
DE00000000001	2019-12-02T00:00Z[UTC]	MD	50000000.0	0	0.0	0	0	EUR	DE	S_1312
GR00000000001	2015-05-01T00:00Z[UTC]	AD0		0.0	0.038889	30000000000.0	0.0475	5541667 EUR	GR	S_1311
GR00000000001	2016-04-18T00:00Z[UTC]	IP	142895833.0	0.963889	30000000000.0	0.0475	0	EUR	GR	S_1311
GR00000000001	2017-04-17T00:00Z[UTC]	IP	142104167.0	0.997222	30000000000.0	0.0475	0	EUR	GR	S_1311
GR00000000001	2018-04-17T00:00Z[UTC]	IP	142500000.0	1	30000000000.0	0.0475	0	EUR	GR	S_1311
GR00000000001	2019-04-17T00:00Z[UTC]	IP	142500000	1	30000000000.0	0.0475	0	EUR	GR	S_1311
GR00000000001	2019-04-17T00:00Z[UTC]	MD	30000000000	0	0.0	0	0	EUR	GR	S_1311

The 4,000 bonds generate a total of 3,866,785 contract events.

Processes ca. 4000 contracts/sec on MBP with 2.5GHz Intel Core i7.

Proof of Concept: Liquidity Analysis

Aggregate liquidity (i.e. state-contingent cash flows) from central government issued bonds expected over the next years:
by cash flow type (interest or principal) by country of issuance



Proof of Concept: Market Exposure Stress Testing

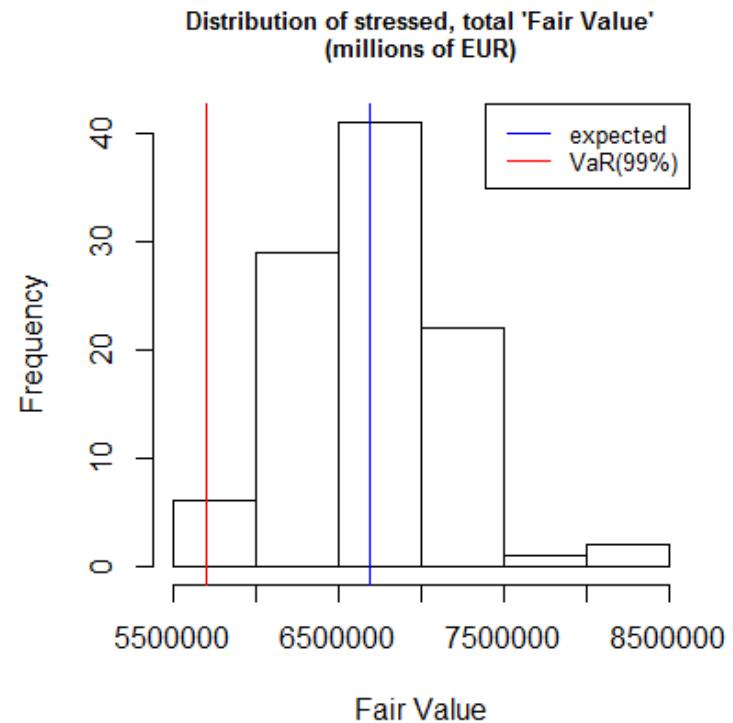
Stress testing 1: Market exposures

Base scenario:

Use Euro-area yield curve
observed on 5/1/15 for
discounting

Stress scenarios:

We apply 100 yield curve “shocks”
(shift, steepening, bending, etc.)
in order to assess the **impact on**
“Fair value”



Proof of Concept: Credit Exposure

Analysis of central government credit exposures:

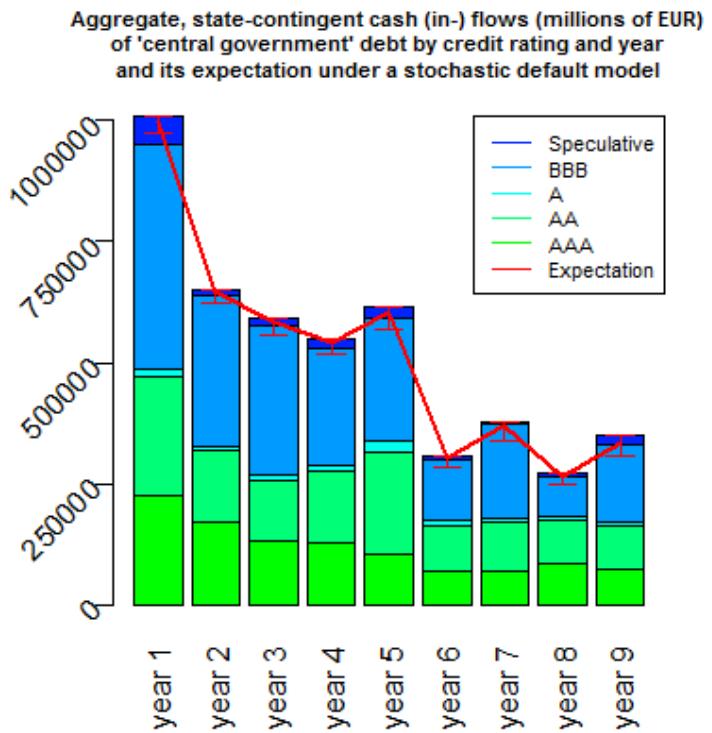
We show the aggregate, yearly cash flows by central government's credit rating (S&P).

Stress testing:

Assuming default of e.g. all “speculative” bonds in year 1 will lead to a **loss of the dark blue colored aggregate cash flows** (no recovery).

Monte-Carlo:

Simulation of defaults based on a **stochastic credit rating migration matrix model** provides an expected value for liquidity (no recovery).

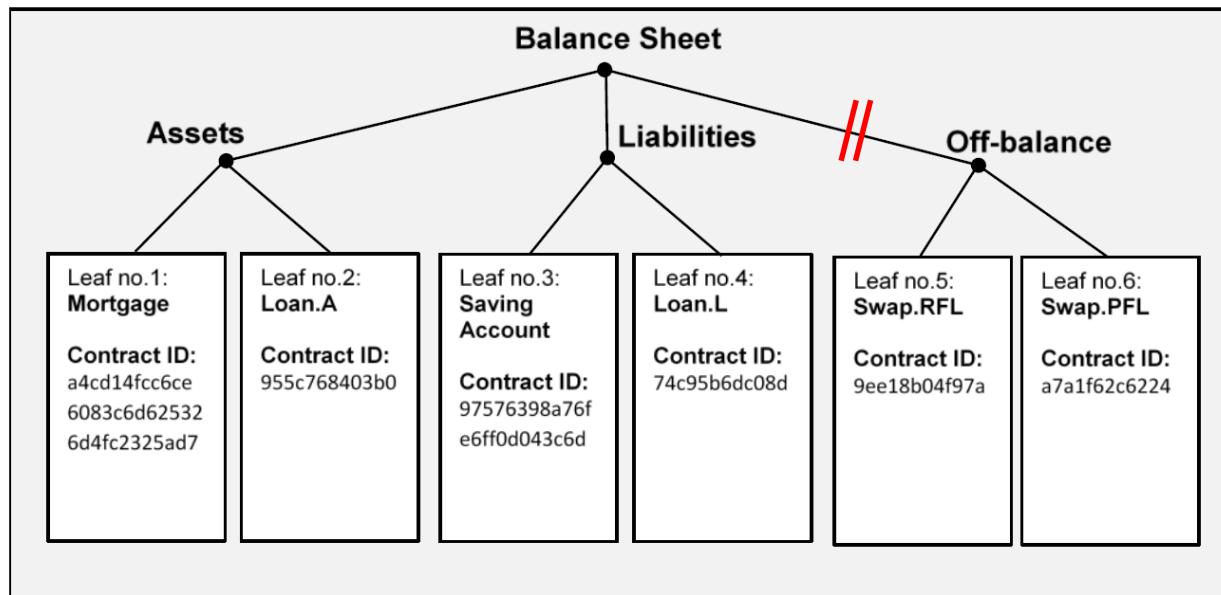


Interactive Graphical Financial Risk Demonstrator

- **Philosophy**
 - To provide a graphical, interactive tool for demonstration purposes using the ACTUS contracts.
 - The tool should be extendable in a simple way.
 - Programming the tool should not require extensive resources.
- **The solution**
 - R is used at rapid prototyping platform.
 - A simulation and analysis engine has been built using the R – ACTUS interface.
 - A graphical frontend has been build using the R-Shiny package.
 - This work was the contents of a Bachelor's thesis:
Denis Iseli, Dominique Neff: *Real-Time Monitoring of Financial Systems with ACTUS*, Winterthur, June 2018, unpublished.

Financial Risk Demonstrator: Key Points

- Models different banks (currently 8 banks)
- Has a database of ACTUS contracts
- At present restricted to the contracts types PAM, ANN, LAM, SWAPS
- Banks modeled by a simple balance sheet:



Financial Risk Demonstrator: Key Points

- Key performance indicators:
 - Liquidity
 - Nominal value
 - Fair value (net present value)
 - Interest income
 - Equity ratio
- Stress testing:
 - 4 interest rate scenarios:
Parallel shift, steepening/flattening, user defined, stochastic
- Systemic analysis:
 - Representation of the interdependencies of the system of banks
 - Simple illustration of contagion by computing the effect on solvency if one bank goes bankrupt

Financial Risk Demonstrator: The Tool

- Can be run locally
- In principle accessible through the internet:
http://finlab.engineering.zhaw.ch/shiny/BA_FS2018/
(at the moment not operational)
- Because of R – Java bottleneck, slow performance
 - Screenshots

Financial Risk Demonstrator: Screenshots

The screenshot shows a web-based application titled "Real-Time Monitoring of Financial Systems with ACTUS". The interface includes a sidebar with navigation links for Home, Network, Bank information, and Stresstests, along with date input and update buttons. The main content area displays a detailed description of the project's purpose and methodology.

~ /Documents/idp/Lehre.local/2018FS/BA/System/CD/Shiny-App - Shiny
http://127.0.0.1:6044 | Open in Browser | Publish | zhaw

BA_FS2018 ≡

Date input
2018-06-14
Update all data
Update Stresstest

Betreuer: Wolfgang Breymann
Nebenbetreuer: Nils Andri Bundi

Home Network Bank infomation Contracts Market Stresstests zhaw

Real-Time Monitoring of Financial Systems with ACTUS

Financial systems are complex networks of banks (as network nodes) and payment obligations among these banks (as network edges). In such a system, two main sources of risk are considered; (1) the risk of banks to default individually due to some exogenous shock to their capital buffer, and (2) the risk of default contagion or, in other words, the risk of the default of one bank spreading to another bank in the network due to shared network links. The last financial crisis has shown that the latter risk can be considerable, yet current regulations such as capital requirements or the liquidity coverage ratio focus on assessing the health of banks individually and thereby disregard network effects. In this Bachelor Thesis, we aim at developing a graphical interface that allows to dynamically specify simple toy bank networks with nodes consisting of a set of ACTUS contracts that give rise to payment obligations among banks. These obligations may be dependent upon some market risk factors (e.g. interest payments in variable rate bonds) which build the source for exogenous shocks to the toy bank network. Based on such a set-up the students should develop and implement meaningful monitoring and visualization tools such as total payment obligations between any two banks (net liquidity) that allows the regulator to assess in real-time the financial health of the network. Finally, the effect of adding new ACTUS contracts among any two banks in the network should be analyzed.

by Denis Iseli und Dominique Neff, WI15b, ZHAW

Financial Risk Demonstrator: Screenshots

The screenshot shows a Shiny application window titled "BA_FS2018". The left sidebar contains a "Date input" section with the date "2018-06-14" and buttons for "Update all data" and "Update Stresstest". Below these are navigation links for "Home", "Network", "Bank information", and "Stresstests". The main content area features a table with the following columns: BankName, LegalEntityID, Street, Number, ZipCode, City, and Country. The table displays 8 entries of bank data. At the bottom of the table, it says "Showing 1 to 8 of 8 entries" and includes navigation buttons for "Previous", "1", and "Next". The footer of the application credits "by Denis Iseli und Dominique Neff, WI15b, ZHAW".

	BankName	LegalEntityID	Street	Number	ZipCode	City	Country
1	Judocus Bank	213800QILIUUD4ROSU003	Musterstrasse	1	60306	Frankfurt am Main	Germany
2	Aquila Bank	391200BODWBDLTH1TS43	Musterstrasse	1	10115	Berlin	Germany
3	Hometown Bank	529900HNOAA1KXQJUQ27	Musterstrasse	1	80331	Munich	Germany
4	Banca Roma	4FDA8DF739BE97A109EA	Musterstrasse	1	184	Rome	Italy
5	DoubleD Bank	539570UZTXA1KYOIUX23	Avenue Anatole	5	75007	Paris	France
6	Prague International	66B3D5D48D067B68E2D7	Musterstrasse	1	10000	Praque	Czech Republic
7	Madrid Bank	A930D85DD51B7D91C46B	Calle de Toledo	37	28005	Madrid	Spain
8	BDouble Bank	F35CA9E73733F606FE8C	Musterstrasse	1	20095	Hamburg	Germany

Financial Risk Demonstrator: Screenshots

~/Documents/idp/Lehre.local/2018FS/BA/System/CD/Shiny-App - Shiny
http://127.0.0.1:6044 Open in Browser Publish

BA_FS2018

Date input: 2018-06-14

Update all data | Update Stresstest

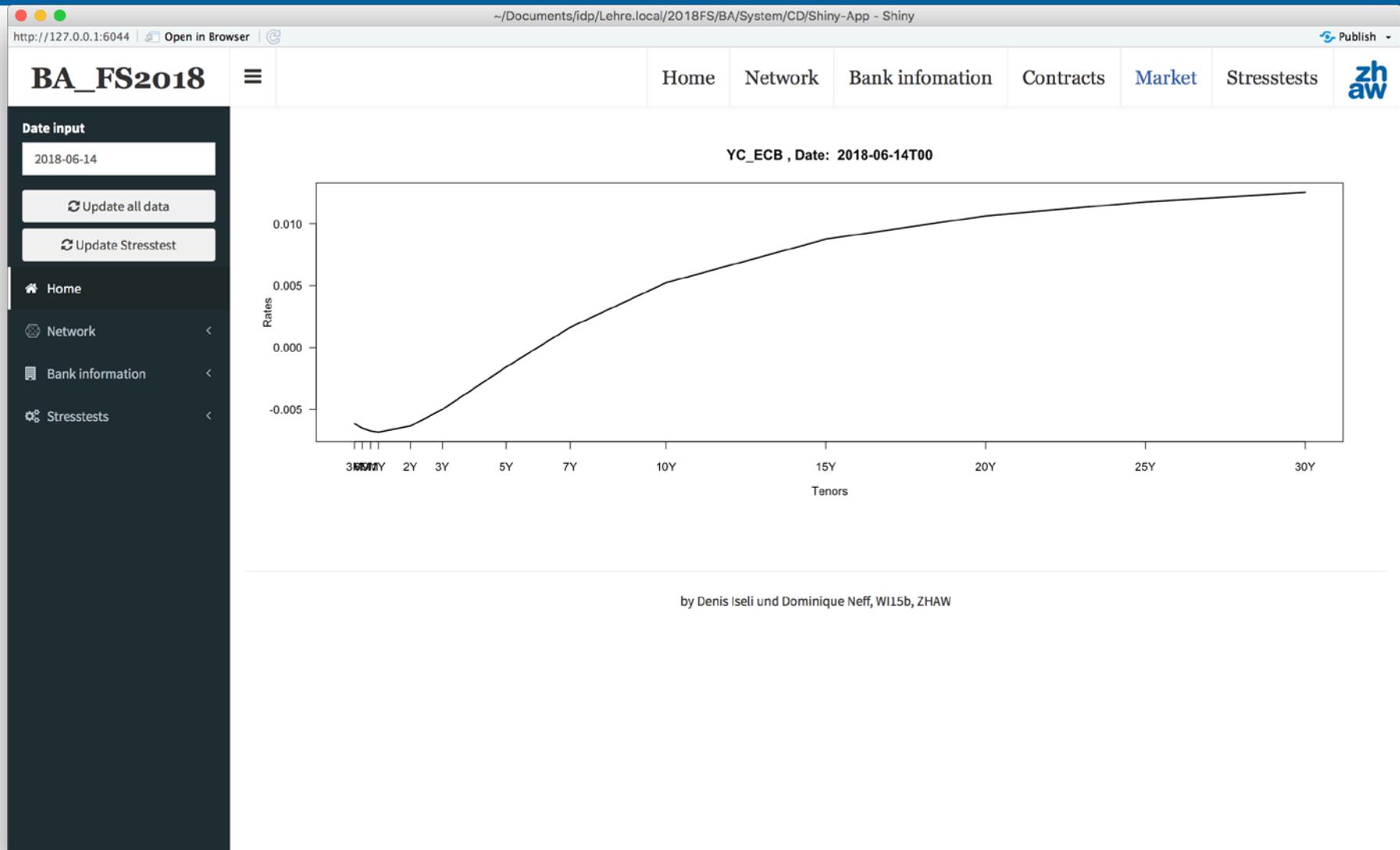
Home | Network | Bank infomation | Contracts | Market | Stresstests | zhaw

Show 10 entries | Search:

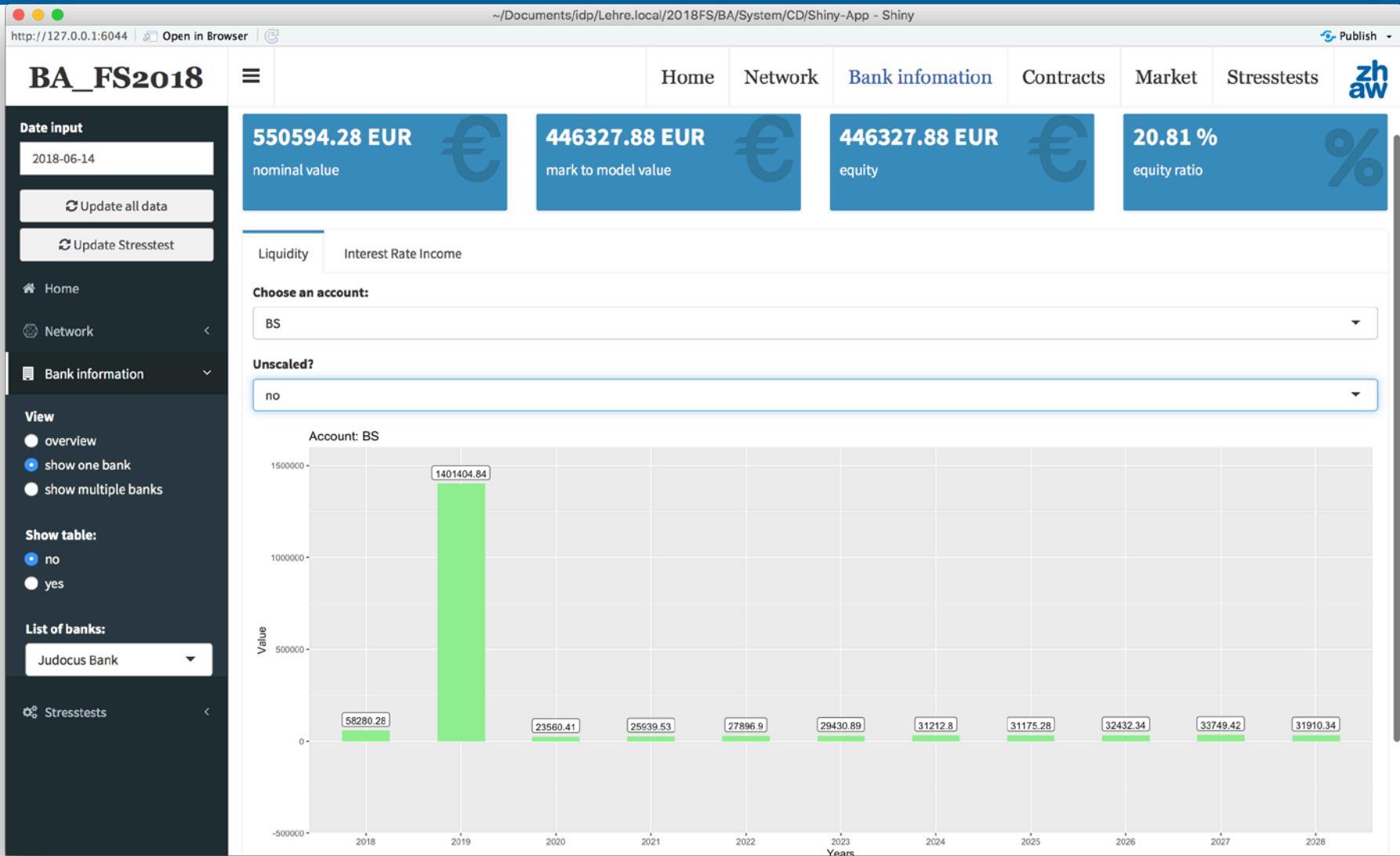
.id	ContractRole	Comment	SubAccount	NotionalPrincipal	ContractType	NominalInterestRate	PremiumDisc
1	RPL	Sparkonto	SavingAccount	550000	PAM	0.005	
2	RPL	Sparkonto	SavingAccount	350000	PAM	0.002	
3	RPL	Sparkonto	SavingAccount	550000	PAM	0.005	
4	RPL	Sparkonto	SavingAccount	450000	PAM	0.004	
5	RPA	Anleihe	Loan.A	200000	PAM	0.02	
6	RPA	Hypothek ohne Amortisation	Mortgage	600000	PAM	0.02	
7	RPA	Hypothek mit Amortisation	Mortgage	400000	ANN	0.027	
8	RPA	Hypothek mit Linearer Amortisation	Mortgage	100000	LAM	0.025	
9	RPA	Anleihe	Loan.L	603000	PAM	0.02	
10	RPL	Anleihe	Loan.L	300000	PAM	0.02	

Showing 1 to 10 of 105 entries | Previous | 1 | 2 | 3 | 4 | 5 | ... | 11 | Next

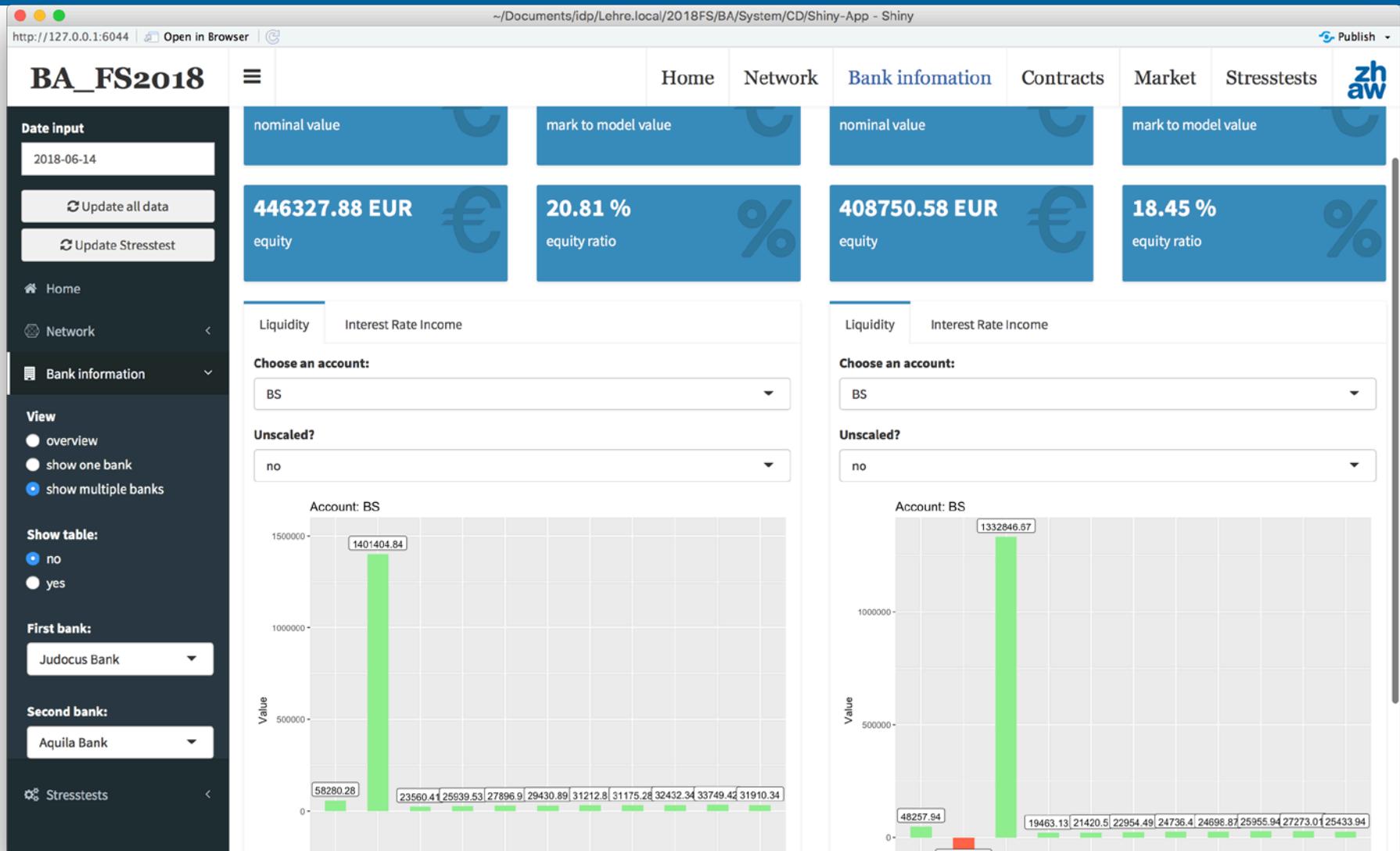
Financial Risk Demonstrator: Screenshots



Financial Risk Demonstrator: Screenshots



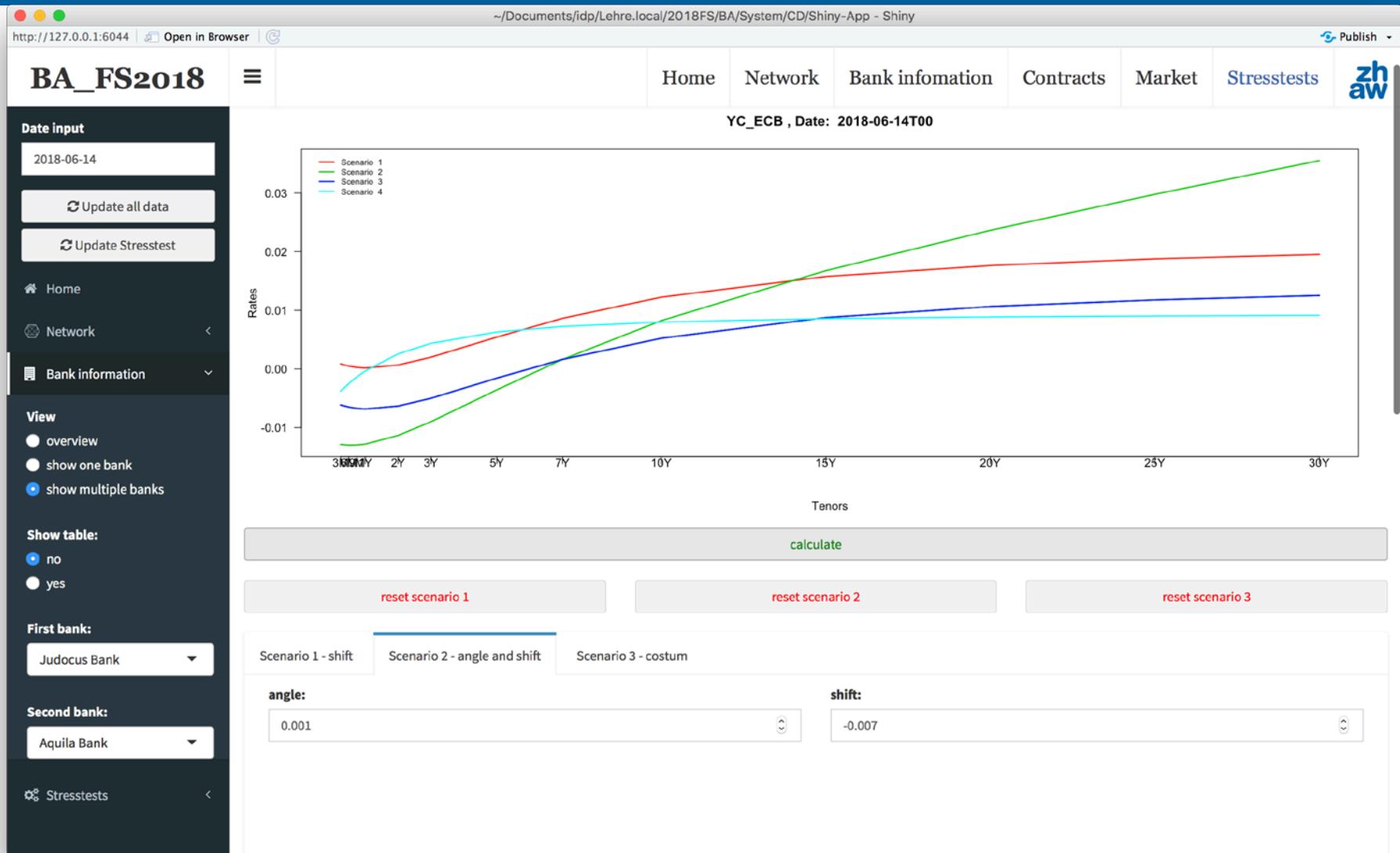
Financial Risk Demonstrator: Screenshots



Financial Risk Demonstrator: Screenshots



Financial Risk Demonstrator: Screenshots



Financial Risk Demonstrator: Screenshots

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BA_FS2018

Date input: 2018-06-14 | Update all data | Update Stresstest

Home | Network | Bank information | Contracts | Market | Stresstests | zhaw

Judocus Bank
LEI: 213800QILIUD4ROSU003

Nominal value	Mark to Model value	Equity	Equity ratio
normal: 550594.28 EUR	normal: 446327.88 EUR	normal: 446327.88 EUR	normal: 20.81 %
shocked: 550594.28 EUR	shocked: 187426.58 EUR	shocked: 187520.76 EUR	shocked: 8.62 %
difference: 0 EUR	difference: -258901.3 EUR	difference: -258807.12 EUR	difference: -12.19 %

Val mark Income nom | Val mark shocked Income nom shocked

Show 10 entries | Search: markToModel

	markToModel
BS	446327.88
BS.Assets	2144788.41
BS.Assets.Credit.A	53010.31
BS.Assets.Loan.A	1149825.51
BS.Assets.Mortgage	941952.59
BS.Liabilities	-1698401.95
BS.Liabilities.Credit.L	-413631.43
BS.Liabilities.Income.L	-214000.00

Val mark Income nom | Val mark shocked Income nom shocked

Show 10 entries | Search: markToModel

	markToModel
BS	187426.58
BS.Assets	2176184.9
BS.Assets.Credit.A	53470.36
BS.Assets.Loan.A	1158130.31
BS.Assets.Mortgage	964584.23
BS.Liabilities	-1988664.14
BS.Liabilities.Credit.L	-416639.59
BS.Liabilities.Income.L	-216557.00

Show: plot, scenario settings, normal vs shocked, table

List of banks: Judocus Bank

Scenarios: scenario 1, scenario 2, scenario 3, scenario 4

Financial Risk Demonstrator: Screenshots

The screenshot shows a Shiny application interface titled "BA_FS2018". The left sidebar contains "Date input" (2018-06-14), "Update all data", "Update Stresstest", and navigation links for Home, Network, Bank information, and Stresstests. Under "Stresstests", checkboxes are checked for "plot", "scenario settings", "normal vs shocked", and "table". A dropdown menu for "List of banks" shows "Judocus Bank". Under "Scenarios", "scenario 2" is selected. The main area displays two tables of financial data for BS accounts across years 2018-2022. The first table, under "Val mark", shows values like 27813.5, 31515.25, etc. The second table, under "Income nom", shows values like 23928.21, 27315.25, etc. Both tables include columns for 2018, 2019, 2020, 2021, and 2022.

	2018	2019	2020	2021	2022
BS	27813.5	31515.25	2236.45	4169.33	5668.26
BS.Assets	39811.94	38455.25	10236.45	12169.33	13668.26
BS.Assets.Credit.A	1633.33	1600	0	0	0
BS.Assets.Loan.A	22060	22060	0	0	0
BS.Assets.Mortgage	10058.61	8735.25	10236.45	12169.33	13668.26
BS.Liabilities	-11940	-6940	-8000	-8000	-8000
BS.Liabilities.Credit.L	-10000	-5000	0	0	0
BS.Liabilities.Loan.L	6060	6060	0	0	0
BS.Liabilities.SavingAccount	-8000	-8000	-8000	-8000	-8000
BS.Offbalance	-58.44	0	0	0	0
BS.Offbalance.Swap.PFL	17.17	0	0	0	0
BS.Offbalance.Swap.RFL	-75.62	0	0	0	0

	2018	2019	2020	2021	2022
BS	23928.21	27315.25	-1963.55	-30.67	1468.26
BS.Assets	35961.94	34255.25	6036.45	7969.33	9468.26
BS.Assets.Credit.A	1633.33	1600	0	0	0
BS.Assets.Loan.A	22060	22060	0	0	0
BS.Assets.Mortgage	6208.61	4535.25	6036.45	7969.33	9468.26
BS.Liabilities	-11940	-6940	-8000	-8000	-8000
BS.Liabilities.Credit.L	-10000	-5000	0	0	0
BS.Liabilities.Loan.L	6060	6060	0	0	0
BS.Liabilities.SavingAccount	-8000	-8000	-8000	-8000	-8000
BS.Offbalance	-93.73	0	0	0	0
BS.Offbalance.Swap.PFL	-18.11	0	0	0	0
BS.Offbalance.Swap.RFL	-75.62	0	0	0	0

Financial Risk Demonstrator: Screenshots

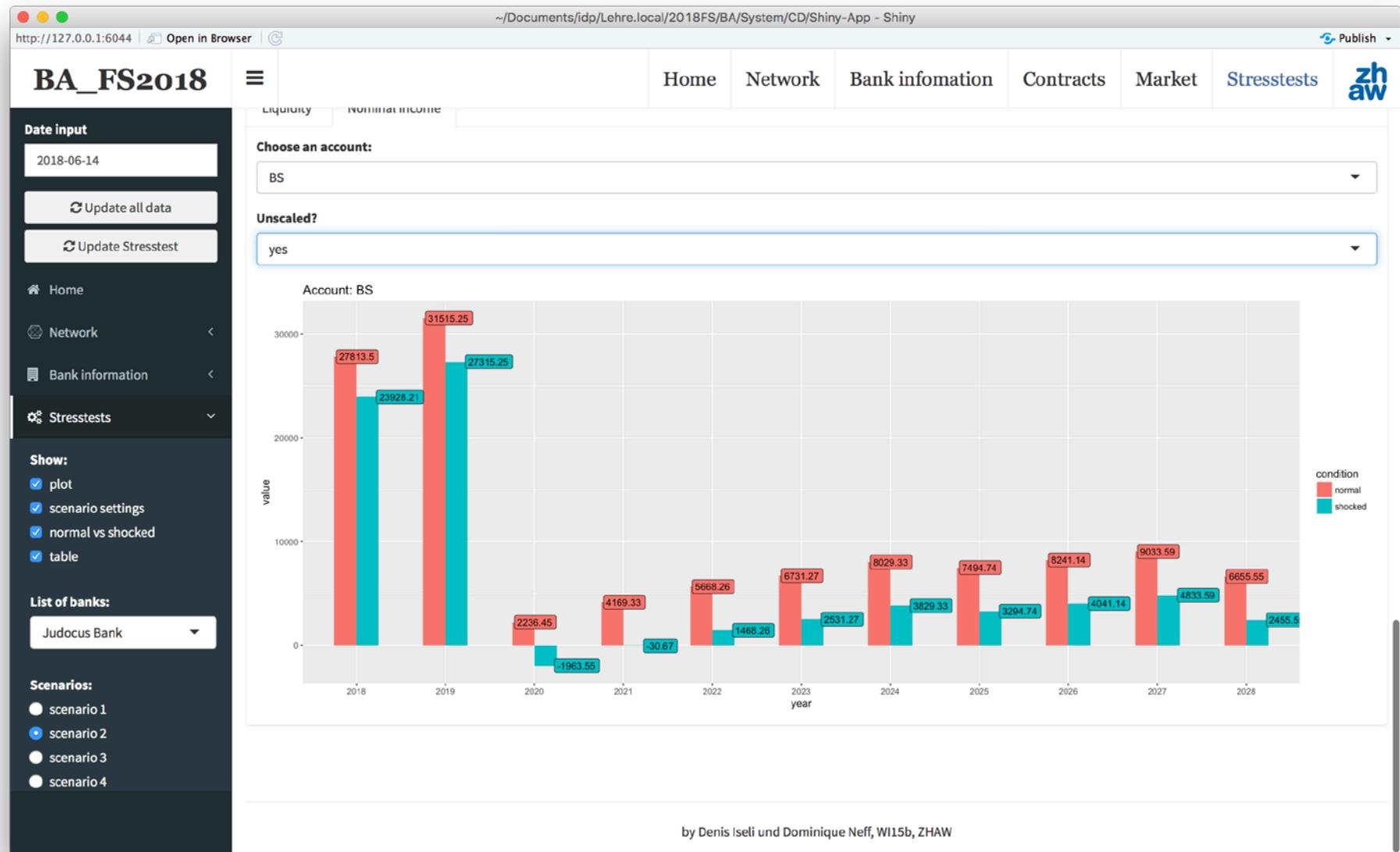
The screenshot shows a Shiny application window titled "BA_FS2018". The left sidebar contains navigation links for Home, Network, Bank information, Stresstests (selected), and a dropdown for List of banks (Judocus Bank). Under "Stresstests", there are checkboxes for plot, scenario settings, normal vs shocked, and table, all of which are checked. A "Scenarios" section lists four scenarios: scenario 1 (radio button), scenario 2 (selected), scenario 3, and scenario 4.

The main content area has tabs for Home, Network, Bank information, Contracts, Market, and Stresstests. The "Stresstests" tab is active, displaying two tables side-by-side. Both tables have columns for account names and values. The first table is for "Val mark" and the second for "Income nom". Each table includes a search bar, a "markToModel" dropdown, and pagination controls (Showing 1 to 12 of 12 entries, Previous, Next).

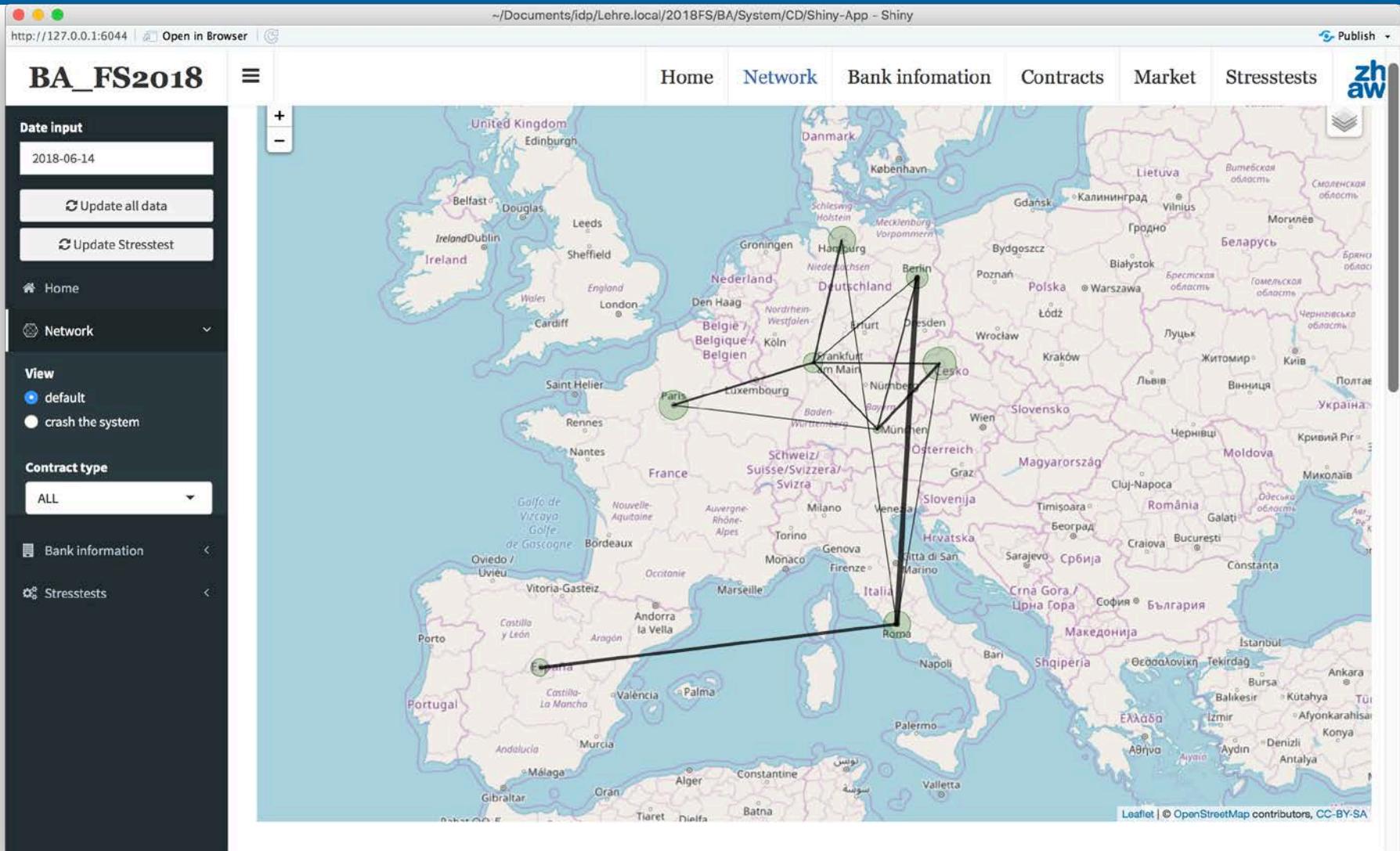
Account	Val mark	Income nom
BS	446327.88	
BS.Assets	2144788.41	
BS.Assets.Credit.A	53010.31	
BS.Assets.Loan.A	1149825.51	
BS.Assets.Mortgage	941952.59	
BS.Liabilities	-1698401.95	
BS.Liabilities.Credit.L	-413631.43	
BS.Liabilities.Loan.L	314088.89	
BS.Liabilities.SavingAccount	-1598859.42	
BS.Offbalance	-58.58	
BS.Offbalance.Swap.PFL	17.21	
BS.Offbalance.Swap.RFL	-75.79	

Account	Val mark shocked	Income nom shocked
BS	187426.58	
BS.Assets	2176184.9	
BS.Assets.Credit.A	53470.36	
BS.Assets.Loan.A	1158130.31	
BS.Assets.Mortgage	964584.23	
BS.Liabilities	-1988664.14	
BS.Liabilities.Credit.L	-416639.59	
BS.Liabilities.Loan.L	316357.22	
BS.Liabilities.SavingAccount	-1888381.78	
BS.Offbalance	-94.17	
BS.Offbalance.Swap.PFL	-18.2	
BS.Offbalance.Swap.RFL	-75.97	

Financial Risk Demonstrator: Screenshots



Financial Risk Demonstrator: Screenshots



Financial Risk Demonstrator: Screenshots

~/Documents/idp/Lehre.local/2018FS/BA/System/CD/Shiny-App - Shiny
http://127.0.0.1:6044 Open in Browser Publish

BA_FS2018

Date input: 2018-06-14
Update all data
Update Stresstest

Home Network Bank infomation Contracts Market Stresstests zhaw

BDouble Bank
LegalEntityID: F35CA9E73733F606FE8C
Adress: Musterstrasse 1
20095 Hamburg
Germany
Value: 326276.07

The screenshot shows a web-based application interface for financial risk analysis. On the left, there's a sidebar with 'Date input' set to '2018-06-14', and buttons for 'Update all data' and 'Update Stresstest'. Below that are sections for 'View' (set to 'default') and 'Contract type' (set to 'ALL'). Further down are links for 'Bank information' and 'Stresstests'. The main area features a map of Europe with several green circular nodes representing data points. A callout box highlights one node labeled 'BDouble Bank' with address 'Musterstrasse 1, 20095 Hamburg, Germany' and value '326276.07'. A network of black lines connects the nodes, showing relationships between cities like Paris, Berlin, Frankfurt, and Munich. The map also includes labels for countries and major cities across Europe.

Financial Risk Demonstrator: Screenshots

~ /Documents/idp/Lehre.local/2018FS/BA/System/CD/Shiny-App - Shiny
http://127.0.0.1:6044 Open in Browser Publish

BA_FS2018

Date input: 2018-06-14

Home Network Bank information Contracts Market Stresstests zhaw

View: default (radio button selected), crash the system (radio button)

Contract type: ALL

Bank information

Stresstests

Comment	NotionalPrincipal	ContractType	MaturityDate	ContractID
17 Anleihe	603000	PAM	2019-07-01T00	81b8f869f7f0
20 Mittelfristiger Kredit	200000	PAM	2019-07-01T00	1c076c46dabc

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Financial Risk Demonstrator: Screenshots

~/Documents/idp/Lehre.local/2018FS/BA/System/CD/Shiny-App - Shiny
http://127.0.0.1:6044 | Open in Browser | Publish

BA_FS2018

Date input: 2018-06-14

Update all data | Update Stresstest

Home | Network | Bank infomation | Contracts | Market | Stresstests

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Beta.Index Durchmesser AVG.Pfadlaenge

Network	1.5	4	1.84210526315789
Showing 1 to 1 of 1 entries			
Previous	1	Next	

Degree.In Degree.Out Closeness Hub.Score Autoritie.Score

Aquila Bank	0.2857	0.1429	1	0.2863	0.0842
Banca Roma	0.1429	0.4286	0.7	0.1688	0
Judocus Bank	0.5714	0.4286	1.4	0.4461	0.6925
DoubleD Bank	0.1429	0.2857	1.1667	0.551	0.1845
BDouble Bank	0.2857	0.1429	0.875	0.2863	0.2543
Hometown Bank	0.4286	0.1429	0.7778	0.0348	0.6402
Madrid Bank	0	0.1429	0.4118	0	0
Prague International	0.1429	0.2857	0.875	0.551	0.0698

Showing 1 to 8 of 8 entries

Previous 1 Next

Hubs Authorities

Financial Risk Demonstrator: Screenshots

~ /Documents/idp/Lehre.local/2018FS/BA/System/CD/Shiny-App - Shiny
http://127.0.0.1:6044 | Open in Browser | C | Publish

BA_FS2018

	Home	Network	Bank infomation	Contracts	Market	Stresstests	zhaw
DoubleD Bank	0.1429	0.2857	1.1667	0.551		0.1845	
BDouble Bank	0.2857	0.1429	0.875	0.2863		0.2543	
Hometown Bank	0.4286	0.1429	0.7778	0.0348		0.6402	
Madrid Bank	0	0.1429	0.4118	0		0	
Prague International	0.1429	0.2857	0.875	0.551		0.0698	

Date input: 2018-06-14 | |

View: default | crash the system

Contract type: ALL

Network

Showing 1 to 8 of 8 entries | Previous | 1 | Next

Hubs

```

graph TD
    DoubleD[DoubleD Bank] --> Aquila[Aquila Bank]
    DoubleD --> Judocus[Judocus Bank]
    DoubleD --> BDoubl[BDouble Bank]
    DoubleD --> Hometown[Hometown Bank]
    DoubleD --> Prague[Prague International]
    Aquila --> Judocus
    Aquila --> BDoubl
    Aquila --> Hometown
    Aquila --> Madrid[Madrid Bank]
    Judocus --> BDoubl
    Judocus --> Hometown
    Judocus --> Prague
    BDoubl --> Hometown
    BDoubl --> Prague
    Hometown --> Prague
  
```

Authorities

```

graph TD
    Madrid[Madrid Bank] --> BancaRoma[Banca Roma]
    BancaRoma --> Aquila
    BancaRoma --> Judocus
    BancaRoma --> Hometown
    Aquila --> Judocus
    Aquila --> Hometown
    Aquila --> Prague
    Judocus --> DoubleD
    Judocus --> BDoubl
    Judocus --> Hometown
    Judocus --> Prague
    BDoubl --> DoubleD
    BDoubl --> Hometown
    BDoubl --> Prague
    Hometown --> Prague
  
```

by Denis Iseli und Dominique Neff, WI15b, ZHAW

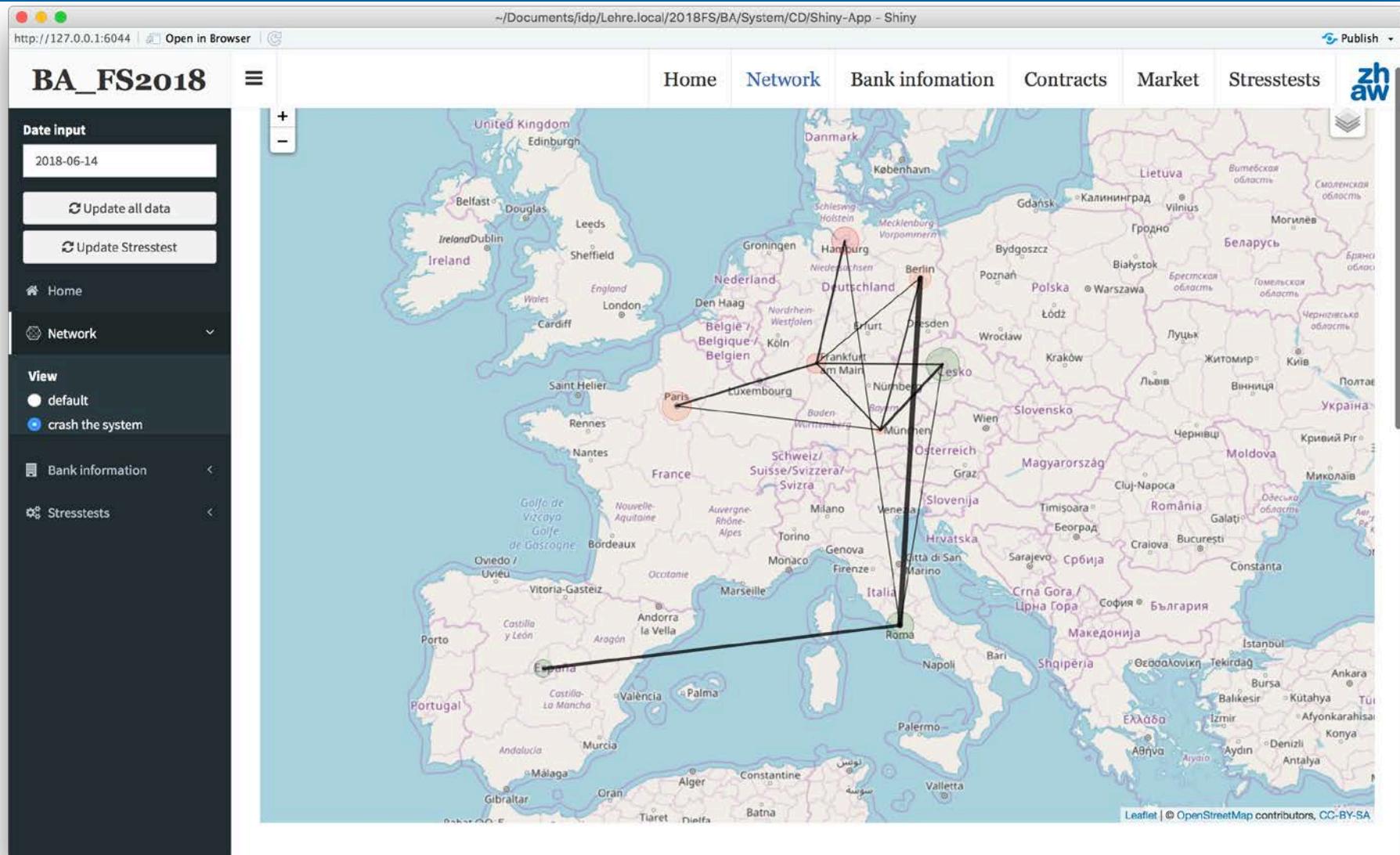
Financial Risk Demonstrator: Screenshots

The screenshot shows a web-based application interface for financial risk analysis. On the left, a sidebar menu includes 'Date input' (set to 2018-06-14), 'Update all data', 'Update Stresstest', 'Home', 'Network' (selected), 'View' (with 'crash the system' selected), 'Bank information', and 'Stresstests'. The main area features a map of Europe with several cities highlighted by red boxes. A tooltip for 'BDouble Bank' is displayed, containing the following information:

BDouble Bank
LegalEntityID: F35CA9E73733F606FE8C
Adress: Musterstrasse 1
20095 Hamburg
Germany
Value: 326276.07

A red button labeled 'Crash' is visible at the bottom of the tooltip. The map also shows labels for various countries and cities, such as Scotland, United Kingdom, Ireland, France, Germany, Italy, and Russia.

Financial Risk Demonstrator: Screenshots



Financial Risk Demonstrator: Screenshots

The screenshot displays a Shiny application interface titled "BA_FS2018". The left sidebar contains "Date input" (2018-06-14), "Update all data", "Update Stresstest", "Home", "Network" (selected), "View" (radio buttons for "default" and "crash the system"), "Bank information", and "Stresstests". The main content area shows two tables. The top table has columns: LegalEntityID, BankName, total.asset, equity, equity.ratio, Default, and Default.round. The bottom table has columns: LEI, Bankname, Asset.loss, defaults, and bank.default. Both tables show data for eight banks: Banca Roma, Prague International, Madrid Bank, BDouble Bank, Judocus Bank, Hometown Bank, DoubleD Bank, and Aquila Bank.

LegalEntityID	BankName	total.asset	equity	equity.ratio	Default	Default.round
1 4FDA8DF739BE97A109EA	Banca Roma	2443401.47	284206.49	0.1163	no	-
2 66B3D5D48D067B68E2D7	Prague International	2013397.98	325347.64	0.1616	no	-
3 A930D85DD51B7D91C46B	Madrid Bank	1173582.03	369044.52	0.3145	no	-
4 F35CA9E73733F606FE8C	BDouble Bank	0	0	-1	yes	0
5 213800QILIUD4ROSUO03	Judocus Bank	0	0	-1	yes	1
6 529900HNOAA1KXQJUQ27	Hometown Bank	0	0	-1	yes	2
7 539570UZTXA1KYOIUX23	DoubleD Bank	0	0	-1	yes	2
8 391200BODWBDLTH1TS43	Aquila Bank	0	0	-1	yes	3

Showing 1 to 8 of 8 entries

LEI	Bankname	Asset.loss	defaults	bank.default
7 A930D85DD51B7D91C46B	Madrid Bank	13831379.24	6	Banca Roma, Aquila Bank, Prague International, Judocus Bank, Hometown Bank, DoubleD Bank
4 4FDA8DF739BE97A109EA	Banca Roma	11387977.78	5	Aquila Bank, Prague International, Judocus Bank, Hometown Bank, DoubleD Bank
6 66B3D5D48D067B68E2D7	Prague International	9167764.07	4	Judocus Bank, Hometown Bank, Aquila Bank, DoubleD Bank
8 F35CA9E73733F606FE8C	BDouble Bank	8960948.37	4	Judocus Bank, Hometown Bank, DoubleD Bank, Aquila Bank
5 539570UZTXA1KYOIUX23	DoubleD Bank	7154366.09	3	Judocus Bank, Hometown Bank, Aquila Bank
1 213800QILIUD4ROSUO03	Judocus Bank	6397907.67	3	Hometown Bank, DoubleD Bank, Aquila Bank
3 529900HNOAA1KXQJUQ27	Hometown Bank	2422173.03	1	Aquila Bank
2 391200BODWBDLTH1TS43	Aquila Bank	207319.41	0	

Show 10 entries Search:

Summary – Conclusion

- An R interface to the ACTUS library has been created that makes it possible to use ACTUS contracts in R.
- This provides a convenient means to become acquainted and experiment with the ACTUS library.
- This tool is also used in our Bachelor studies.
- A visual demonstrator has been build by two students during their Bachelor's thesis.
- This demonstrator models a system of eight simple banks and allows to carry out stress tests and simple systemic analysis.
- The demonstrator will be extended and its performance enhanced in a project for and with ECB that is about to start.
- The ACTUS website: <http://actusfrf.org>