

SST standard model captive

Manual for the shadow computation 2021 (SC 2021 captive)

1. June 2021

Contents

1	Aim	4
2	Model change	4
2.1.1	General	4
2.1.2	Currencies	4
2.1.3	Reserve risk.....	5
2.1.4	Premium risk.....	5
2.1.5	Expected insurance result	6
2.1.6	Individual events risk	6
2.1.7	Aggregation into insurance risk	7
3	Using the updated tools	7
3.1	List of updated tools for SC 2021 captive	7
3.2	Description of <i>SST-Captive-Template.xlsx</i>	8
3.2.1	Intro_SM_Captive	8
3.2.2	CA_update.....	8
3.2.3	CA_prescribed_parameters.....	9
3.2.4	CA_calculation_documentation	9
3.2.5	CA_reserves_and_premiums	9
3.2.6	CA_reserve_risk	10
3.2.7	CA_premium_risk	10
3.2.8	CA_expected_result	11
3.2.9	CA_IE3_risk.....	11
3.2.10	CA_discount_factors	11
3.2.11	CA_MVM	12
3.2.12	CA_insurance_cash_flows	12

3.2.13	CA_input_SST_Template.....	12
3.3	Features for the captive model of the <i>sstCalculation</i> tool	13
3.3.1	Computation of the premium risk	13
3.3.2	Aggregation into insurance risk	14
3.3.3	Results.....	14
4	Feedback to FINMA.....	14
5	Appendix: Changes related to the <i>sstCalculation</i> tool for the SC 2021 captive.....	16
5.1	Purpose	16
5.2	IT landscape.....	16
5.3	<i>SST-Template</i>	16
5.4	Pre-requirement	17
5.5	Updating the R package.....	17
5.6	Usage	19

1 Aim

In October 2020, FINMA announced a shadow computation in relation to the captive model in 2021 in the document *SST-Veröffentlichung / Publications du SST*.

This document specifies the shadow computation and uses company-specific inputs already prepared for the official SST 2021.

The new model specification tested in this shadow computation reflects the experience gained as well as changes in regulation since the first publication of the model in 2016, for the insurance risk of a re-insurance captive.

Please note that the requirements below are to be understood in the context of a shadow computation. Even if no conditional forms are used, everything is subject to FINMA's final decision for the SST 2022 taken in autumn 2021.

2 Model change

The changes refer to the current SST standard model captive for the SST 2021 as published at:

www.finma.ch > Supervision > Insurers > Cross-sectoral tools > Swiss Solvency Test (SST)

2.1.1 General

The design of the currently prescribed captive model for insurance risk was essentially frozen since 2016. The newly updated version is taking into account the development of StandRe and the requirements of FINMA Circ. 17/3 "SST".

Company-specific adjustments are subject to prior approval in the sense of mn 107-109 of that circular, if not permitted in the sense of mn 106. The latter have to be documented in the dedicated sheet *CA_calculation_documentation* of the *SST-Captive-Template*.

2.1.2 Currencies

The standard currencies of the captive model are CHF, EUR, USD, GBP and newly in addition JPY, as it is in StandRe.

For other currencies, the mapping to the standard currencies has to be consistent with the mapping used in the SST standard model market risk.

If the company needs to use its own currency, it has to apply for a company-specific adjustment in the sense of mn 107-109 FINMA Circ. 17/3 "SST".

2.1.3 Reserve risk

The naming convention "parameter segment" is used, as in StandRe (formerly "LOB").

The aggregation of the parameter segments is assumed to follow a lognormal distribution (formerly the lognormal distribution assumption was applied on each parameter segment).

In the special case where the coefficient of variation (CV) of each segment is the same and the correlation between each pair of distinct segments is equal to one, it can be shown mathematically that this provides the same reserve risk.

The correlation between parameter segments is set to 0.5 (formerly 1), to allow for diversification effects.

The standard CV is set to 15% for each parameter segment (formerly 10%). This stems from a study of ten benchmark companies using StandRe, and might still be quite progressive in particular instances.

Alternatively, a company can or might even have to use its own CVs, if by using the standard CV the capital requirement related to the risk situation is not sufficient. In that case, own CVs have to be derived and applied to each and every parameter segment. The particular parameter choice has to be justified. Own CVs can be based on gross instead of net data as simplification.

For claims that are reserved in the SST-balance sheet to the full contract limit without further deterioration possible no reserve risk needs to be allocated. In other words, the input value of the reserve risk component can be reduced by the share of the reserves meeting the conditions given above.

The reserves risk module in the captive model uses the value of the net reserves. It is not based on explicit ground-up simulations and/or the explicit modelling of reinsurance conditions. If the risk situation requires to model the reserve risk in an alternative way, the company has to apply for a company-specific adjustment in the sense of mn 107-109 FINMA Circ. 17/3 "SST".

2.1.4 Premium risk

The company can choose its modelling method by parameter segment. Accepted methods are the ground-up modelling or the conservative simplified approach of modelling by the maximal possible loss. This is unchanged compared to the SST 2021.

The premium risk model is a model for CY risk. If URR risk is substantial, the following rules can be applied (as in the SST 2021) within the CY risk model: expand artificially the frequency of a parameter segment, or duplicate the parameter segment into an URR segment.

Gross instead of net modelling (of outward retrocession) is possible if it is conservative. Gross modelling means that reinsurance conditions (EEL, AAL, etc.) are applied only to inward reinsurance contracts.

By ground-up modelling, the company can use its own transformation function from ground-up to captive claims, including conditions over several parameter segments.

If the expected frequency of attritional claims is high and might cause a long run-time for the simulation, the frequency-severity model can be replaced by an aggregated claims distribution using the following property:

The sum of N independent identically distributed Gamma distributed random variables is Gamma distributed. The mean and the standard deviation of the distribution of the aggregate claim can be deduced from the expected frequency f , the mean m and the standard deviation s of the single claims. They are given, respectively, by $f \cdot m$ and $\sqrt{f} \cdot s$.

In our case, it is possible to replace the frequency-severity model by an expected frequency of 1 and a severity using the above aggregate expectation and standard deviation. Note, however, that applying subsequently EEL and EED yields incorrect results for attritional claims. This simplification can be accepted if the impact on solvency is low. Not replacing the frequency-severity model remains possible.

It is not foreseen to split reserving risk and underwriting risk on an underwriting year basis as it is possible in StandRe. The modelling has to be performed on an accident year basis. If a company would nonetheless like to model on an underwriting year approach, this would be subject to a company-specific adaptation in the sense of mn 107-109 FINMA Circ. 17/3 "SST".

2.1.5 Expected insurance result

Recall that from the decomposition of the one-year risk (see Section 4.2 of the *Technical description of the SST standard model captives*), the expected insurance result reflects only the business which is not in the balance sheet at $t = 0$.

In case of gross instead of net (of outward retrocession) modelling of the reserve risk and/or premium risk, the expected insurance result has nonetheless to be computed on a net basis. This is necessary for consistency with the SST balance sheet.

2.1.6 Individual events risk

The captive company has to define one to three scenarios related to its own exposure and evaluate these by their occurrence probability and impact related to insurance risk. These scenarios will be aggregated WITHIN the insurance risk and are part of the captive model, under the name *individual events* (IE3; "3" is to differentiate them from the IE1 and IE2 scenarios used in StandRe).

The rationale behind that is that each captive is subject to specific risk stemming from the economic activities of the group owning the captive. Part of this risk is (to a large extent) not covered by data history and/or the standard modelling of reserve risk and premium risk of the captive model.

IE3 scenarios can be defined as a classical event (e.g. an industrial accident), but may also be understood in a broader sense, e.g. that a limit is reached (whatever is the underlying event) or that a court decision has an impact on the company balance sheet.

The overarching scenarios of the SST (as described in the *Technische Beschreibung Szenarien / Description technique scénarios*) remain outside the scope of the captive model. In particular, an IE3 scenario modelled within the insurance risk should not be aggregated again to the overall one-year risk.

2.1.7 Aggregation into insurance risk

Reserve risk and premium risk are assumed to be comonotone. This is unchanged compared to the SST 2021.

New the individual events, represented as IE3 scenarios, are aggregated into the insurance risk. The aggregation method is as follows.

In the particular case where it is assumed that IE3 scenarios are pairwise excluding (at most one scenario can occur in the year), the SST standard aggregation method for scenarios holds albeit at the insurance risk distribution level, see *Technische Beschreibung für das SST-Standardmodell Aggregation und Mindestbetrag / Description technique du modèle standard SST pour l'agrégation et le montant minimum*.

The captive model expands the method for scenario aggregation, allowing for any scenario combination (with 3 scenarios, they are $2^3 - 1$ combinations, without counting the possibility that no scenario occurs). It can be shown mathematically that defining pseudo-scenarios as distinct combinations of scenarios, the SST standard aggregation method for scenarios applied on these pseudo-scenarios is equivalent to the general method for scenario aggregation. In short, a convolution of the distribution without scenarios with that of scenarios is made, assuming independence between the scenarios (together) and the loss without IE3 risk.

This expansion of the aggregation method is especially useful if an IE3 scenario is set with relatively high probability, meaning that the underlying assumption of at most one scenario occurring within one year is likely to be violated.

3 Using the updated tools

3.1 List of updated tools for SC 2021 captive

The updated tools for the SC 2021 are:

- *SC_2021_SST-Captive-Template.xlsx*
- *SC_2021_SST-Template.xlsx*
- *sstCalculation_2.2.0.tar.gz*
- *app.R*

They can be downloaded from

- www.finma.ch > Supervision > Insurers > Cross-sectoral tools > Swiss Solvency Test (SST) > **Shadow computation 2021 captive**

and are explained below. If necessary please unzip the files in the zip-archive.

3.2 Description of *SST-Captive-Template.xlsx*

Changes related to the entire workbook

- This section replaces the section 10.1 *Description of the SST-Captives-Template* of the *Technical description of the SST standard model captives, 31 October 2020*.
- The design of the template incl. links has been amended. The names of the template and the sheets have been slightly changed.
- The sheet *CA_losses_history* has been removed. Figures on historical claims are no longer requested in the SST-Captive-Template. (Background: These figures were needed for monitoring the model that was introduced in 2015. In order to simplify the reporting requirements FINMA intends to stop the collection of this data. However, companies are expected to continue to monitor these figures internally and that they keep being available upon request.)

Purpose

The Excel workbook *SST-Captive-Template* is intended to collect all parameters and to support some computations related to the captive model. We explain the purpose and possible special feature of each worksheet below.

3.2.1 Intro_SM_Captive

Change

- Inputs of the *SST-Captive-Template* are in units of the SST currency, as in StandRe. However for backward compatibility (and for the shadow computation, if desired by the company), it is possible to set the input "unit" (cell E26) to "million", and the rest will follow automatically.

Purpose

This sheet states the purpose of the template and asks for a few company specific general inputs used throughout the template.

3.2.2 CA_update

Change

- The list of changes is now in a separate sheet.

Purpose

Contains the change log of the template.

3.2.3 CA_prescribed_parameters

Change

- JPY is prescribed as the fifth possible standard currency, as in StandRe.

Purpose

This sheet contains the FINMA prescribed parameters, such as yield curves and FX exchange rates. Parameters relating to 31 December are updated in January. In case JPY is used, please copy the yield curve from *SST-StandRe-Template* here.

3.2.4 CA_calculation_documentation

Change

- Formerly named *CA_model_used*. This sheet is essentially new. The explanations on own calculations can be omitted in the SST report if they are provided here.

Purpose

This sheet is intended to explain how the captive model was specifically applied by the company.

A selection of topics is listed (cf. columns "Field" and "Description/question"). Computations from different sheets are provided as information and helper for consistency checks (cf. column "Figure").

In places where explanations are needed for a third person familiar with the topic to understand the approach, please provide comments (mn 13 and 174 of FINMA Circ. 17/3 "SST"). In particular this relates to places where the model allows for company specific inputs or alternative approaches (mn 106 of FINMA Circ. 17/3 "SST").

Explanations can be provided directly in this sheet (at column "Comments/explanations"), or a precise reference to the SST report (e.g. page, section) can be given instead.

3.2.5 CA_reserves_and_premiums

Change

- No change of contents, but only some cosmetic changes of presentation.

Purpose

This is a reporting sheet to provide a standardised overview of the captive portfolio. It is based on a similar sheet already used in StandRe. The data must be entered by the company from column N onwards. The information in this sheet is not directly linked to the risk calculation.

3.2.6 CA_reserve_risk

Change

- Formerly named *CA_PY_insurance_risk*. The sheet has been updated to reflect the model changes. *LOBs* are renamed to *parameter segments*.

Purpose

This sheet reports the parameters of the reserve risk model. The reserve risk parameters have to be entered by the company per parameter segment.

Undiscounted reserves, column *alternative*: If a full limit loss has been reached for a segment, there is likely no more reserve risk: the reserve in the balance sheet is considered as deterministic. In that case, it is possible to write the value 0 instead of the effective reserve value.

Coefficient of variation, column *alternative*. If the company uses its own coefficients of variation, they have to be entered here.

3.2.7 CA_premium_risk

Change

- Sheet formerly named *CA_CY_insurance_risk*. *LOBs* are renamed to *parameter segments*. Part of the comments section has been moved to the sheet *CA_calculation_documentation*.
- The column *scope of risk* indicates if the parameter segment is an artificial duplication of a segment for modelling URR risk (scope of risk = *URR*), or if the frequency is artificially inflated to take into account the URR risk (scope of risk = *CY&URR*), else it has to be set to *CY*.

Purpose

This sheet reports the parameters of the premium risk model. The premium risk parameters have to be entered by parameter segment by the company.

For parameter segments with frequency of attritional claims greater than 10, the transformation of parameters for an aggregate loss model instead of a frequency-severity model is implemented in the sheet *CA_input_SST_Template*.

3.2.8 CA_expected_result

Change

- The difference between accident year and underwriting year was not clear in the sheet used for the SST 2021. Business already in the SST balance sheet at $t = 0$ should not be taken into account. The new version of the sheet aims to facilitate that.
- Coefficients of variation related to current year used in the calculation of the market value margin (MVM) are now entered in this sheet.

Purpose

In this sheet, the company needs to enter all the relevant information for the calculation of the expected insurance result. The expected insurance result of the new business, i.e. incepting between $t = 0$ and $t = 1$, is computed. An additional input for the calculation of the market value margin (MVM) is also entered in this sheet.

3.2.9 CA_IE3_risk

Change

- This is a new sheet.

Purpose

The company must propose one to three business-specific scenarios for insurance risks that have not been modelled (such as previously unobserved or emerging risks) or have been insufficiently modelled in the reserve risk or premium risk models. Occurrence probabilities and impacts are specific to the captive company, and have to be explained. More than one of these so-called individual event (IE3) scenarios can occur within one year (this should typically be the case if an occurrence probability is "high", e.g. 10%), and the aggregation is within insurance risk, i.e. with reserve risk and premium risk.

3.2.10 CA_discount_factors

Change

- Previously named *CA_payment_pattern_and_MVM*. The order has been changed: it begins with PY patterns followed by CY patterns, because this order is used everywhere.

Purpose

In this sheet, the payment patterns by parameter segment have to be entered. This sheet provides the information needed in other sheets using pattern information, and in particular computes the PY discount factor for reserve risk and the CY discount factor for premium risk.

3.2.11 CA_MVM

Change

- The MVM computation is now in a separate sheet. The new default coefficient of variation in the reserve risk model of 15% is used (previously 10%). Otherwise, the computation method has not changed.

Purpose

Computes the MVM. The necessary inputs are linked from other sheets. There is no additional input required by the company.

3.2.12 CA_insurance_cash_flows

Change

- There has been no changes of content, but only cosmetic changes of presentation and updates of links from other sheets.

Purpose

In this sheet, the cash flows stemming from the insurance business of the captive for the market risk model are calculated.

The company has to enter the positions of the SST balance sheet (to be found in the *SST-Template*) which are related to the insurance business. The breakdown into currency and into cash flows is linked from inputs of the other sheets used for the captive model. The company may provide alternatives to these default-calculated cash flows, with explanations.

3.2.13 CA_input_SST_Template

Change

- New there is an additional area for IE3 scenarios (within insurance risk).

Purpose

This sheet collects inputs from other sheets which are required by the *SST-Template* from the captive model and which have to be copied into the *SST-Template*.

Each section of this sheet corresponds to a specific sheet of the *SST-Template*. Further explanations can be found, in particular regarding the aggregation of reserve risk, premium risk and IE3 risk into insurance risk, and regarding the decomposition of insurance risk into PY CY shown in the FDS.

3.3 Features for the captive model of the *sstCalculation* tool

Change

The R-package *sstCalculation* provided for the SC 2021 captive allows for aggregating IE3 scenarios within insurance risk.

For the SC 2021, copy the range V39:X45 of the *sheet CA_input_SST_Template* of the *SST-Captive-Template* EXACTLY in the range AD18:AF24 of the *sheet Non Life* of the *SST-Template*.

All other features are unchanged from the official package for the SST 2021. In other words, except for scenario aggregation within insurance risk, the package used for the SST 2021 could be used (albeit not with the new SST-Template but with the official SST-Template published for the SST 2021).

Purpose

We describe here features for the captive model of the R-package *sstCalculation*. Other features are out of scope.

For the implementation of the application *SST-Dashboard* and of the R-package *sstCalculation*, as well as their use with the *SST-Template* as input and the *FDS* as output, see Appendix Section 0.

3.3.1 Computation of the premium risk

The *sstCalculation* tool computes, based on the distributions and parameters of the captive model and by simulation:

- the aggregation to an annual loss distribution by parameter segments, which is done with modelling of the following reinsurance structures by parameter segment for ground-up modelling, in this order:
 - EED-condition
 - EEL-condition
 - AAD-condition
 - AAL-condition
 - QS after application of the previous contract conditions as described above
- the aggregation of the net losses across the CY parameter segments independently.

To select this approach for the computation of the premium risk, set the selection to "captive" in the *Non Life* sheet of the *SST-template*. Please note that the computation within the tool might not be applicable; in particular, the following conditions apply:

- Reinsurance conditions across several LOBs cannot be calculated.
- The effect of reinstatement premiums is neglected (in case these are considerable, they should increase the net loss).
- The effect of sliding scale commissions and profit commissions have been neglected.
- The tool assumes that the reinsurance contracts are applied in the order given above.
- Applying both inward reinsurance conditions and outward retro conditions might not be possible.
- EEL and EED conditions cannot be applied meaningfully for aggregate modelling of parameter segments with expected frequency greater than 10, see also Section 3.2.7.

Companies can use the functionality of the tool to determine the premium risk if they have convinced themselves that none of the simplifications above or similar lead to a material underestimation of the risk.

3.3.2 Aggregation into insurance risk

With the *sstCalculation* tool there are two alternatives possible.

First, in case "captive" is selected in the *Non Life* sheet of the *SST-template*, the reserve risk, premium risk (simulated as above for ground-up parameter segments) and scenario risk are aggregated into insurance risk by the *sstCalculation* tool.

Second, in case "simulations" or "cumulative distribution function" is selected in the *Non Life* sheet of the *SST-template*, the scenarios within non-life are aggregated by the *sstCalculation* tool to the non-life risk distribution given as input in the *SST-template* by the company.

3.3.3 Results

The section "Insurance risk nonlife" of the *FDS* provides the expected shortfall 99% results (*Total 1-year insurance risk nonlife (centered)*; *Reserve risk*; *Centred new claims risk*). The impact of the scenario risk within the non-life risk can be deduced with the formula *Total 1-year insurance risk nonlife (centered)* minus *Reserve risk* minus *Centred new claims risk*.

4 Feedback to FINMA

The material for the shadow computation 2021 is published on the FINMA website see Section 3.1.

The purpose is to solicit the feedback of reinsurance captives using the captive model prior to publishing the new version at the end of October 2021 for use in the SST 2022.

Each of the reinsurance captives is contacted via a dedicated "EHP-Erhebung", and can use this platform for feedback. Participation in testing and providing feedback is voluntary.

- Deadline for written feedback is the 30 July 2021 (The submission should include the *SST-Captive-Template*, *SST-Template* and the *FDS*, and should be submitted via the EHP). Any partial feedback is also welcome.
- Contact address for questions is quantitative-risk-management@finma.ch. It is also possible to contact your contact person at FINMA.

5 Appendix: Changes related to the *sstCalculation* tool for the SC 2021 captive

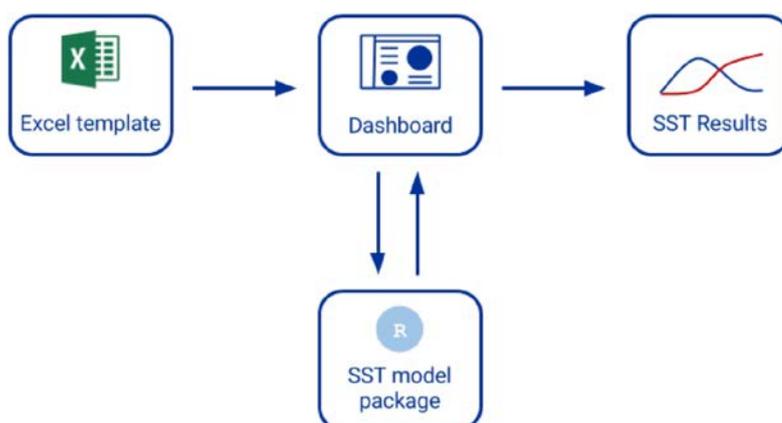
5.1 Purpose

This appendix explains the installation changes related to the *sstCalculation* tool for the SC 2021 captive. These changes are needed for the additional IE3 scenario aggregation WITHIN the insurance risk. The other features of the tool remain unchanged compared to the official SST 2021. In other words, the installation used for the official SST 2021 could be used for testing all features of the SC 2021 captive, but not the IE3 scenario aggregation (albeit not with the new SST-Template but with the official SST-Template published for the SST 2021).

Note: It is possible to install the official package (and any other package version) in the R-Tool.

5.2 IT landscape

The following illustration exhibits the IT landscape and workflow related to the *sstCalculation* tool:



5.3 SST-Template

This is the Excel template utilized for inputs in the illustration above.

1. Download *SC_2021_SST-Template.xlsx* (from www.finma.ch > Supervision > Insurers > Cross-sectoral tools > Swiss Solvency Test (SST) > **Shadow computation 2021 captive**)
2. Copy your inputs from the *SST-Template* you used for the official SST 2021 into *SC_2021_SST-Template.xlsx*
3. Replace the inputs from the sheet *CA_input_SST_Template* of *SC_2021_SST-Captive-template.xlsx* into the corresponding sheets of *SC_2021_SST-Template.xlsx*, and in particular fill out the IE3 scenarios in the sheet *Non Life* of that template.

Alternative:

- If you do not want to copy the inputs from the *SST-Template* you used for the official SST 2021 into *SC_2021_SST-Template.xlsx* (step 2. above), you have to modify *the SST-Template* you used for the official SST 2021 in this way:
 - Overwrite the sheet *Configuration* by that with the same name of the *SC_2021_SST-Captive-template.xlsx*.
 - You have nonetheless to do step 3. above.

In that situation the range AD18:AF24 of the sheet *Non Life* of the *SST-Template*, is not yet specifically formatted as an input area in the *SST-Template*, albeit the modified *Configuration* sheet allows for the use of inputs in that range for aggregating IE3 scenarios.

5.4 Pre-requirement

It is assumed that you have already installed the *sstDashboard* as described at Section 2 of the document *IT Notes* (available at www.finma.ch > Supervision > Insurers > Cross-sectoral tools > Swiss Solvency Test (SST) > **Tools**).

(Note: If you work instead from the R program as explained at Section 3 of the document *IT Note*, you can install and use *sstCalculation_2.2.0.tar.gz* mutatis mutandis and skip 5.5 below.)

5.5 Updating the R package

For the SC 2021 captive, you have to update the underlying R package as follows. (It is not required to be an R-user or to have R installed to do this update.)

Step 1

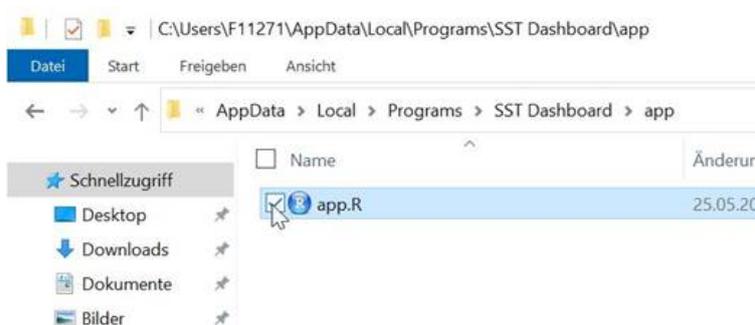
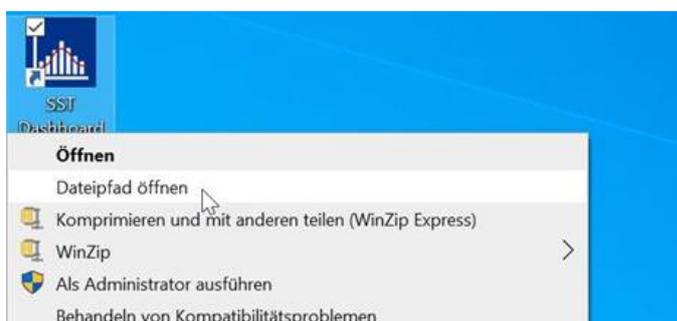
Download the file *app.R* and the R package *sstCalculation_2.2.0.tar.gz* (If necessary please unzip the files in the zip-archive)

from www.finma.ch > Supervision > Insurers > Cross-sectoral tools > Swiss Solvency Test (SST) > **Shadow computation 2021 captive**

Step 2

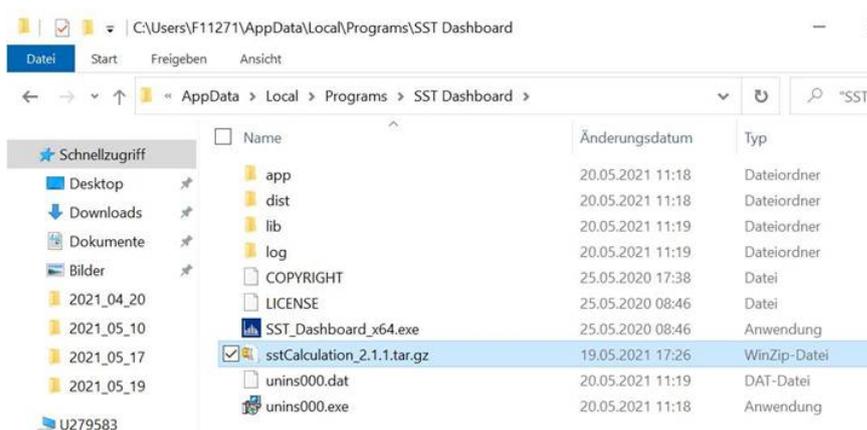
Replace the *app.R* file with that of step 1 in the folder `.\SST Dashboard\app\`

You can find where this folder is on your computer as follows:



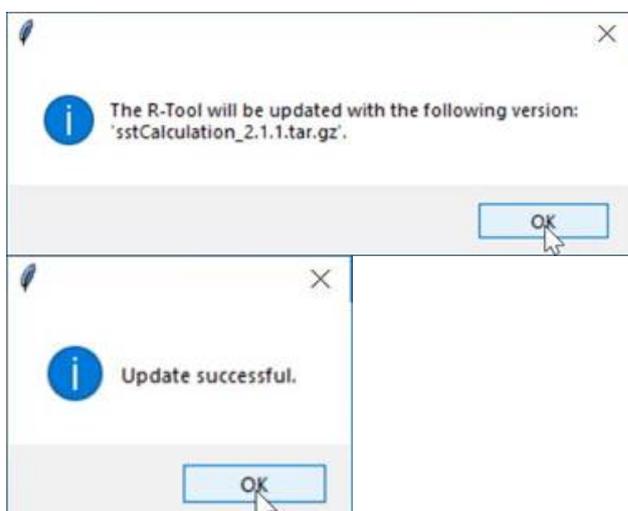
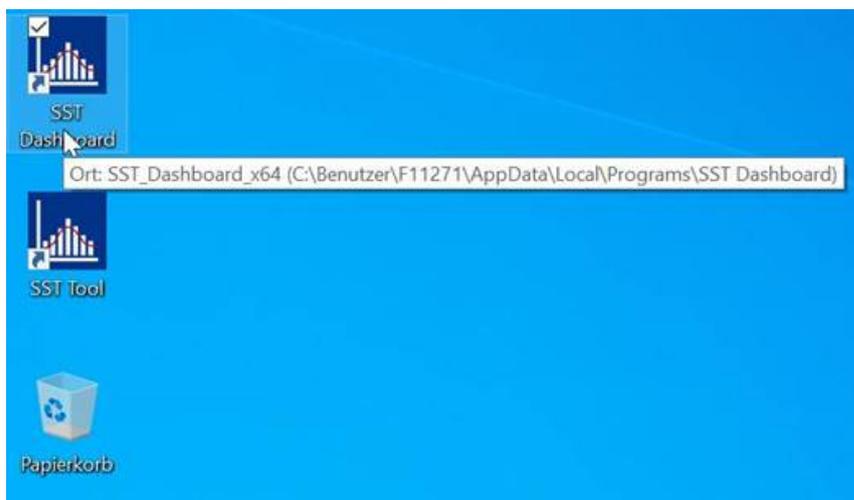
Step 3

Save the R package *sstCalculation_2.2.0.tar.gz* in the folder `.\SST Dashboard` (this is the parent folder of step 2).



Step 4

Open the SST Dashboard and click twice on OK



Now the new underlying functionality for aggregating IE3 scenarios within insurance risk is implemented.

Step 5

Re-open the SST Dashboard. See usage below.

5.6 Usage

Open the SST Dashboard and use it as usual (see Section 4 of *IT Notes*). Mind to use the *SST-Template* as described in Section 5.3.