Measuring background and systemic risk in finance

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Abstract

(200 or fewer words.) This article refines, builds on, and extends SRISK methodology recently proposed in the literature. The refinement is to define SRISK in terms of a put on the Basel shortfall. This is built on by defining the background and systemic stress of a firm as unconditional and departure from unconditional expectation of the put, the latter when a hypothetical systemic stress is applied. Systemic stress is defined in terms of a random variable and can take on variety of forms including alternative scenarios in usual stress testing as well stress driven by the interaction of variables. Stressor random variables are chosen by the practitioner. Stressed expectations are linear, a sector systemic stress is naturally defined as linear in the firm specific systemic stress. Application is made to Australian financial data.

Keywords: 3 to 6 keywords, that do not appear in the title

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1 Month to month monitoring of financial stress

Table 1 contains real time stress calculations on the first trading day of January 2009 and November 2014. As before there is no look ahead bias – all calculations on each of the two dates only use data available on the first day of the applicable month. The initial eight rows in Table 1 lists the eight banks used in this study.

Table 1: One month ahead stress calculations for Australian banks†

	January 2009					November 2014				
bank	B-log lev	debt prop	stress back	stress syst	B-def prob	B-log lev	debt prop	stress back	stress syst	B-def prob
	ℓ_{it}	π_{it}	μ^*_{it}	s^*_{it}	q_{it}	ℓ_{it}	π_{it}	μ^*_{it}	s^*_{it}	q_{it}
cba	18.57	24.30	22.99	29.60	91.43	-70.34	22.70	0.00	0.00	0.00
anz	15.93	18.37	14.87	18.89	92.82	-38.64	22.10	0.00	0.00	0.00
nab	31.97	25.50	39.98	19.41	99.97	-12.45	25.61	50.52	67.13	1.23
wbc	-1.55	22.84	5.86	23.94	40.42	-53.84	22.03	0.00	0.00	0.00
mqg	41.22	5.75	11.02	5.46	99.92	-46.10	4.33	0.17	0.12	0.03
boq	63.30	1.32	3.55	0.99	99.95	-17.05	1.33	0.80	1.34	0.33
ben	18.91	1.81	1.72	1.71	90.53	-7.63	1.84	25.43	30.71	8.47
aba	-8.12	0.10	0.00	0.00	9.97	9.22	0.07	23.07	0.71	89.63
$\mathcal{E}_d$	18.78		17.17	8.63	82.72	-41.91		0.03	0.12	0.54
Σ	17.81	†2.42	15.28	10.18	96.72	-44.22	†3.27	0.00	0.00	0.00

†All numbers multiplied by 100 except total debt (in $bln).

January 2009 was a time of great stress for all eight banks. The first and second columns in the two halves of the table body contain the Basel log–leverage ℓ_{it} and debt $\pi_{it} \equiv d_{it}/d_t$ (as a proportion of total debt) for each of the banks. Six of the eight banks were in Basel default with positive capital shortfalls as indicated in by the ℓ_{it} column: the two banks not in Basel default were wbc and aba. Background and systemic stress

$$\mu^*_{it} \equiv \frac{\pi_{it}\mu_{it}}{\mathcal{E}_d(\mu_{it})}\,, \qquad s^*_{it} \equiv \frac{\pi_{it}s_{it}}{\mathcal{E}_d(\mu_{it})}\,,$$

for the eight banks as well as the probability of a Basel default in one month q_{it} and the proportion π_{it} of total debt are displayed in the next 3 columns. The background

stress column indicates most of the background stress arises from nab – almost 40% of the total. The next most background stressed bank is cba with wbc also a substantial contributor. The mqg bank contributes almost double to background stress compared to the proportion of total debt it carries. The other three small banks contribute relatively little to background stress with boq almost 3 times expected on the basis of its debt. Systemic stress is highest for the cba, higher than expected on the basis of its debt load and hence cba was most susceptible to stress from additional general market equity devaluation. All other banks appear have systemic stress comparable to their size in terms of debt load with only nab being less systemically important. This should be compared to nab's high background stress.

Continuing with January 2009, the final two rows indicate the total amount of stress in the system and it's diversifiability. The second last row labelled $\mathcal{E}_d$ displays, in order, $\mathcal{E}_d(\ell_{it})$, blank, $\overline{\mu}_t \equiv \mathcal{E}_d(\mu_{it})$, $\overline{s}_t \equiv \mathcal{E}_d(s_{it})$ and $\mathcal{E}_d(q_{it})$. The final row labelled Σ displays the aggregate stress quantities,treating all eight banks as one entity, ℓ_t, total debt d_t in billions of dollars, μ_t, s_t, and q_t. On an aggregate basis background stress is about twice systemic stress. Thus there is more danger of increasing capital shortfall due to market volatility as opposed to further stress from further substantial general market devaluation. The final row indicates stresses are not diversifiable: The marginally smaller "diversified" background stress is offset by an increase in systemic stress. Also the diversified probability of Basel default is higher than the debt weighted average.

Stress readings alter dramatically when moving to November 2014 – there is virtually no stress in any bank and the small amount of stress in the system is diversifiable. Most of the background stress is carried by nab with lesser contributions by ben and aba. All the stress in the minor bank aba is background stress as only nab and nab have substantial systemic stress contributions. Again, however, it must be emphasised that there is minimal systemic stress in the system. Only aba has substantial Basel default probability, but this bank is a very minor player in the Australian banking scene. Notice total debt in the banking sector jumps about 35% between January 2009 and November 2014.

Figure 1: Consistency comparison in fitting surrogate model in the tidal power example.

Table 2: D-optimality values for design X under five different scenarios.

one	two	three	four	five
1.23	3.45	5.00	1.21	3.41
1.23	3.45	5.00	1.21	3.42
1.23	3.45	5.00	1.21	3.43

2 Further guidelines

- Note that figures and tables (such as Figure 1 and Table 2) should appear in the paper, not at the end or in separate files.
- In the latex source, near the top of the file the command `\newcommand{\blind}{1}` can be used to hide the authors and acknowledgements, producing the required blinded version.
- Remember that in the blind version, you should not identify authors indirectly in the text. That is, don't say "In Smith et. al. (2009) we showed that ...". Instead, say "Smith et. al. (2009) showed that ...".
- These points are only intended to remind you of some requirements. Please refer to the instructions for authors at `http://amstat.tandfonline.com/action/authorSubmission?journalCode=ubes20&page=instructions#`
- For more about ASA style, please see `http://journals.taylorandfrancis.com/amstat/asa-style-guide/`
- If you have supplementary material (e.g., software, data, technical proofs), identify them in the section below. In early stages of the submission process, you may be unsure what to include as supplementary material. Don't worry—this is something that can be worked out at later stages.

3 Methods

Don't take any of these section titles seriously. They're just for illustration.

4 Verifications

This section will be just long enough to illustrate what a full page of text looks like, for margins and spacing.

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5 Conclusion

SUPPLEMENTARY MATERIAL

Title: Brief description. (file type)

R-package for MYNEW routine: R-package MYNEW containing code to perform the diagnostic methods described in the article. The package also contains all datasets used as examples in the article. (GNU zipped tar file)

HIV data set: Data set used in the illustration of MYNEW method in Section 3.2. (.txt file)

6 BibTeX

We hope you've chosen to use BibTeX! If you have, please feel free to use the package natbib with any bibliography style you're comfortable with. The .bst file Chicago was used here, and agsm.bst has been included here for your convenience.