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COMPACT EDITORIAL JANUARY 2011

We have a wide variety of articles in this edition of CompAct. There are several articles that will introduce you to tools to use the Web effectively. The Technology Section has put together a "quick guide" to get you started with Linked-In, a social networking tool geared for individuals in the business world. ...

[full article]

LETTER FROM THE CHAIR

by Jeff Pomerantz

I am pleased to introduce myself as the new chairman of the Technology Section Council. Last year, I served as the vice chair in preparation for this year. I feel as though we have a great group on the Council and am excited to do some new and exciting things this year. ...

[full article]

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Have you ever received an e-mail with the subject line "Plagiarism"? Do you and your company take steps to mitigate the risk of theft or loss of intellectual property? ...

[full article]

REDUCING THE RISK IN EXCEL RISK MODELING

by Rickard Warnelid

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Fiction Contest

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SOA Staff
Meg Weber, Staff Partner

Sue Martz,
Section Specialist

Sam Phillips, Staff Editor

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[full article]

A LOOK AT TWO SOA TECHNOLOGY SECTION SESSIONS AT THE 2010 ANNUAL MEETING
by Mary Pat Campbell

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[full article]

FIVE EASY STEPS TO GET STARTED ON LINKEDIN
by J. Eddie Smith, IV, and other members of the Technology Section LinkedIn group

By J. Eddie Smith and other members of the Technology Section LinkedIn group In a recent press release, LinkedIn reports that it now has more than 85 million members and adds a new member approximately every second. You can use this guide to set up a free LinkedIn account in five easy steps. ...
[full article]

NONLINEAR INTERPOLATION WITH EXCEL TO CONSTRUCT U.S. TREASURY BOND YIELD CURVE
by Andrew Chan

Excel offers many powerful mathematical and statistical functions that allow us to solve numerous business problems. ...
[full article]

R CORNER – CREATING HISTORICAL PORTFOLIOS
by Steve Craighead

Over the years, I have built a large number of econometric models, but the most painful part of the modeling process was to collect separate economic series and merge them together by date. ...
[full article]

RECOMMENDED APPLICATION: INSTAPAPER
by Eddie Smith

Lack of information is not a 21st-century problem. Figuring out how to digest it all very much is. ...

[full article]

NUMBER PUZZLE

by Marc Whinston

A challenging, fun puzzle for the readers of CompAct. Answers are due to Marc Whinston, at mwhinston@tiaa-cref.org, by February 18th. [download]

OCTOBER NUMBER PUZZLE SOLUTIONS

by Marc Whinston

The solvers of last issue's puzzle are: Ken Klinger (Aegon USA); Lee Michelson (Office of the Insurance Commissioner, Washington); and Adam Ockman (Prudential). [download]

ARTICLES NEEDED

by CompAct Newsletter

Your help and participation are needed: Articles, book reviews and other information on technology useful to actuaries are needed!
[full article]

SOA NEWS TODAY HAS A NEW LOOK! IMPROVED NAVIGATION!

by SOA News Today

We've redesigned SOA News Today. We've changed the masthead, organized material for an easy read and improved overall navigation
[Take a look!]

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COMPACT EDITORIAL JANUARY 2011

by Howard Callif & J. Eddie Smith, IV, FSA, MAAA

We have a wide variety of articles in this edition of *CompAct*. There are several articles that will introduce you to tools to use the Web effectively. The Technology Section has put together a "quick guide" to get you started with Linked-In, a social networking tool geared for individuals in the business world. We want you to join Linked-In to give you access to actuarial discussion groups, and encourage you to participate in information exchange on topics that are relevant to you. These forums are very new, and only have value if people participate. Please give this a try!

In addition, Howard Callif wrote an article on ethics, which we hope will generate some discussion, or at least raise awareness on issues that are many times not considered when working on projects. Eddie Smith has written an article about "Instapaper," a utility to save articles on the Web for viewing later. There are other utilities like this, but we think it is important to highlight applications and utilities that we have real experience with, and find very useful. We encourage you to write us about utilities you use and would recommend Beyond Compare and Ultra-Edit/Ultra-Compare for example.

We have an article summarizing the Technology Section Annual Meeting sessions. The meeting was also covered "real time" on Twitter, so those not attending could get a summary of what was being covered.

The Technology Section is always looking for ways to help its

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members understand and use technology. We are working on a set
of articles to define and explain common terms. Look for the first of
this series titled "Speaking Data" in future editions. Please contact us
with any comments, and submit articles on how you are using
technology!

Howard Callif at howard.callif@gmail.com
Eddie Smith, IV j.eddie.smith.IV@gmail.com

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LETTER FROM THE CHAIR

by Jeff Pomerantz

I am pleased to introduce myself as the new chairman of the Technology Section Council. Last year, I served as the vice chair in preparation for this year. I feel as though we have a great group on the Council and am excited to do some new and exciting things this year. I would like to thank the outgoing council members for their three years of service—**Tim Pauza**, **Holly Loberg**, and **Carl Desrochers**. Thank you very much for your contributions and support!!

Now, I would like to take this opportunity to introduce you to our 2011 council and some of the projects they will be working on this year.

Tim Deitz is from Milliman and is the outgoing Section Chair, and I want to thank him for the guidance he has given me in the past year in preparation for my role as Chair. Tim set a good example in facilitating the work the Council has done the past year. Tim will serve his third and final year on the council as the Web coordinator. If you have any ideas for the Technology Section or SOA sites, please let Tim or me know.

Frank Reynolds is a third—year council member and is from the University of Waterloo. Last year, Frank served as the spring meetings

coordinator and will continue with that role again this year. Also, with his background in education, Frank will again serve as our education liaison.

Mary Pat Campbell is a second—year council member from Scor Re, headquartered in France. You may recognize her name from her frequent CompAct article contributions. Mary Pat will again serve as our webinar coordinator. We are in the process of planning some webinars for the upcoming year, but are constantly looking for ideas. If you have any good webinar ideas, please feel free to contact Mary Pat or me.

Dave Kester is another second —year council member, from SALT Solutions Inc., in Des Moines, Iowa. Dave will continue to build on the momentum he has created regarding our involvement in local actuarial clubs as the actuarial club program coordinator. We see this as a great opportunity to get involved with and share ideas with actuaries in a smaller group setting. If you know of any actuarial clubs that would be interested in hosting a speaker, please let Dave know.

Lisa Lefkowitz is a second-year council member and works at PolySystems in Chicago, Ill. Lisa will serve as the other meetings coordinator. Additionally, Lisa will head up the Speculative Fiction Contest.

Eddie Smith is a first—year council member from RBC Insurance in Greenville, South Carolina. Although Eddie is only now officially a council member, Eddie has been actively participating in Technology Section calls since 2009. Eddie will serve as the vice chair for the coming year.

Chris Olechowski is a first—year council member from ARC and is working out of Chicago. Chris will serve as the annual meeting coordinator for the coming year.

Steve Finn is a first—year council member from Ameriprise Financial in Minneapolis, Minn. Steve's financial reporting background will come in handy as he serves as the secretary/treasurer in the coming year.

There are a couple of others that need special recognition for service to the council. **Howard Callif** is entering his fourth year as editor of the newsletter, but the role as editor is typically a two—year commitment! Eddie Smith will enter his second year as co-editor of CompAct. **Jim Toole**, of MBA Actuaries Inc. in Winston-Salem, N.C., served this past year as the council's board partner and I want to thank him for that service. Our new board partner this year is **Jennifer Gillespie**, of Blue Cross/Blue Shield of MN. I look forward to working with Jennifer in this role. I'm looking forward to the upcoming year and want to encourage all of the Technology Section members to feel free to contact me with any ideas how we, as a council, can better serve you, our members. If you have an idea, we would definitely love to hear about it!!

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A QUESTION OF ETHICS

by Howard Callif

Have you ever received an e-mail with the subject line "Plagiarism"?
Do you and your company take steps to mitigate the risk of theft or
loss of intellectual property? Do you have controls in place to keep
employees from stealing or using proprietary information from other
companies? I began to ponder these questions when I received the
following e-mail:

From: Brad Smith/DALL/MILLIMAN
To: Milliman All Consultants
Date: 10/13/2010 03:06 PM
Subject: Plagiarism

In recent years, with the accessibility of so much more content on
the Internet, plagiarism has become a significant problem in our
society. A recent article from the New York Times frames the issue.

What constitutes plagiarism? It only takes a few sentences of
someone else's words. Oftentimes people don't even realize they are
plagiarizing—maybe they paste a paragraph that's not theirs as a
placeholder, or they duplicate a sentence with the intention of
changing it later, and forget. In some cases people may seek help
from others who can introduce plagiarism unbeknownst to the author.
Plagiarism is often the result of sloppy editorial practices or cutting
corners more than outright malice. But regardless of the intention, it
is still illegal, unprofessional and cannot be tolerated.

QUICK LINKS

Milliman's acknowledged expertise in a wide range of high profile subject matter is a source of justifiable pride for all of us. It also means that our firm is constantly under scrutiny, as our words are parsed and referenced; in government, the private sector and by the public media. I am writing to remind you that every word produced by Milliman consultants—whether it is work product or an item for external publication—must be 100 percent original or attributable to the original author/reputable source.

Plagiarism represents a substantial reputation risk for Milliman. Consequently, I have asked our editorial team to assist in identifying potential instances of plagiarism. We have software in house that detects plagiarism. We have and will continue to make use of this capability as part of our larger risk management efforts. However, nothing will replace vigilance on the part of our consultant authors. Please err on the side of caution.

Brad

I was struck by several things, but most importantly, I was impressed with the concrete actions that have been taken by Milliman (the company I work for) to enforce an ethical standard. It is a basic requirement to attend an ethics seminar for fellowship in the SOA, but how many companies go beyond the classroom or a "theoretical-based" environment for ethical issues? How many implement procedural steps or processes to enforce ethical guidelines? There is a line to be drawn regarding using the Internet as a resource and reference guide, and how hard to protect against using proprietary or copyrighted materials.

Spreadsheets and software are key tools for actuaries, and these become significant sources of intellectual property for the companies paying for their development. There have been several articles in CompAct on how to ensure that these are error-free, but we should also pay attention to how to protect them from theft or unauthorized access.

In addition, is it possible that these are being developed using some other companies' intellectual property? For example, did the actuary just hired in the product development area bring along some spreadsheets "from a prior life"? Do your developers use the Internet to solve programming problems? If so, is there anything preventing them from copying potentially proprietary code?

There are lots of tools available. Developing a "code of conduct" is a

start; it gives people the authority to act ethically. Documenting development projects from start to finish helps establish a "paper trail" which proves ownership, and also enables peer review. There are numerous software products that can help with these issues. Do you use any of them?

I know that I am asking a lot of questions, and not providing many answers. Please provide any insights and solutions you may have, and we will be sure to publish the results.

Howard Callif at howard.callif@gmail.com

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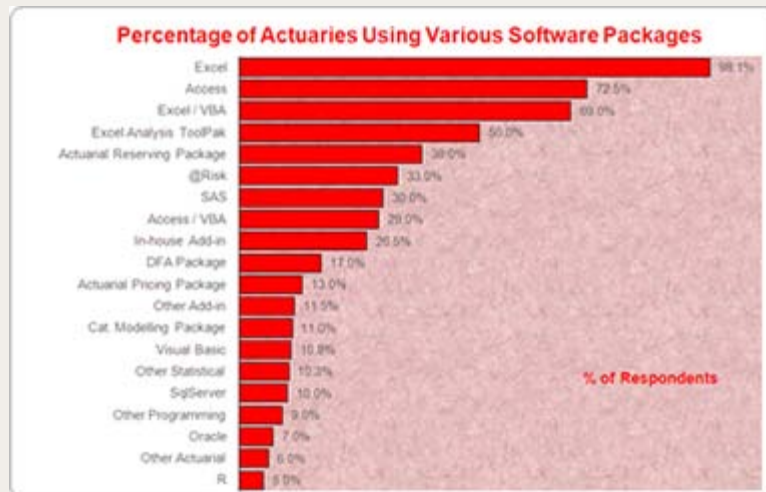
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REDUCING THE RISK IN EXCEL RISK MODELING

by Rickard Warnelid

In a world demanding more and more quantitative analysis, never has the actuary placed so much reliance on spreadsheets. Indeed, *Pryor et al.* [1] showed Excel as the software of choice for day-to-day analysis:

Percentage of Actuaries Using Various Software Packages

Software Package	% of Respondents
Excel	99.1%
Access	72.5%
Excel / VBA	69.0%
Excel Analysis ToolPak	50.0%
Actuarial Reserving Package	38.0%
@Risk	33.0%
SAS	30.0%
Access / VBA	29.0%
In-house Add-in	26.5%
DFA Package	17.0%
Actuarial Pricing Package	13.0%
Other Add-in	11.5%
Cat. Modeling Package	11.0%
Visual Basic	10.8%
Other Statistical	10.2%
SqlServer	10.0%
Other Programming	9.0%
Oracle	7.0%
Other Actuarial	6.0%
R	5.0%

Enlarge

As a group, actuaries are no different than other finance professionals in their use of Excel. Most are self-taught and only realize there is a better way to model once burned. Various studies have shown that Excel models **will** contain errors:

- 100 percent of models contain errors of some kind; *Ernst & Young.* [2]

QUICK LINKS

90 percent of all Excel spreadsheets with more than 150 rows of Excel formulae contain material errors; *KPMG*. [*3*]

- MBA students with over 250 hours of spreadsheet development experience had a 24 percent chance of introducing spreadsheet errors into the first worksheet they built; *R. Panko*. [*4*]

Actuaries have a reputation for being fastidious and meticulous, and they are conversant in many of Excel's flaws: the RAND() function does not generate truly random numbers; the Analysis ToolPak does not use the best available algorithms and uses non-standard definitions; missing data is handled incorrectly and various functions do not calculate correctly in the tail of various distributions.

But are actuaries conversant in their own modelling flaws? Do they consider how they may reduce the risk in the models they build in Excel?

I have spent more than 20 years working with and auditing the spreadsheets of many professionals. Based on our work with Corality auditing hundreds of third party models, I suggest the following Top 10 tips to reduce the likelihood of errors.
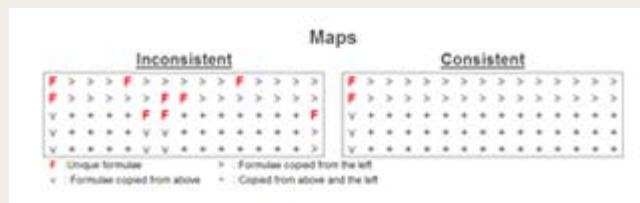
1. **Be transparent**
   Most end users see the outputs and/or conclusions as an appendix in a written document or as a slide in a presentation. By stepping out key calculations and making the assumptions explicit, many simple errors can be spotted immediately.

Massively long formula broken down to "bite-sized" formulae.
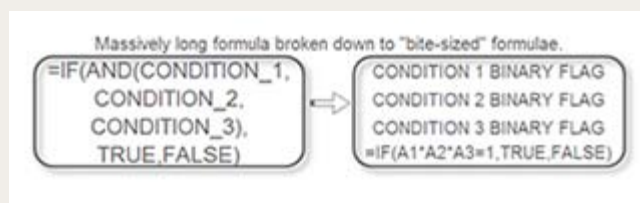
2. **Fewer formulae**
   Various studies seem to suggest that error rates in spreadsheets remain consistent regardless of the experience of the author. It's a naïve thought, but if error rates remain constant, shouldn't fewer calculations reduce the number of absolute errors in a spreadsheet, and in turn, make it quicker to check? Of course there is a balance between the number of formulae used and the related complexity. Further, the point here is not to prepare fewer, but very long formulae. Instead, consider using high-level models to verify more detailed models.

Maps
Inconsistent — Consistent

F Unique formulae — Formulae copied from the left
v Formulae copied from above — Copied from above and the left

🔍 **Enlarge**

3. **Be consistent in Excel calculation blocks**
Try to code only one unique formula per row or block of calculations. Errors in logic often jump out when spreadsheets are modelled this way. Consistency can be far-reaching: consider keeping worksheets similar in design, layout and format wherever possible. It also makes it easier for the end user to understand the spreadsheet as well as being quicker to review.

4. **Be flexible to allow for all assumptions to change**
Assume every assumption may change. Avoid including hard coded numbers in any formula, where possible. Of course, like with all good rules there are exceptions: e.g., X > 0 is always a test for a positive number and percentages must add up to 100 percent.

5. **Keep it simple stupid**
Endeavour to keep your formulae short and use commonly used functions. If a formula must be longer, try and split it up over several lines. If this seems like a difficult exercise, it can be a flag that the modeller has not thought through the underlying logic sufficiently.

6. **Use checks to verify calculations in Excel**
We all make "simplifying assumptions" or can spot where X calculated in one part of a spreadsheet should equal Y calculated somewhere else. As you build the model, ensure that checks are included to confirm that totals agree, assumptions remain valid, etc.

7. **Control relative and absolute references in Excel with '$'**
As you write formulae, check that absolute references remain absolute and that relative references remain relative. Inserting the $ symbol (or using the F4 key in edit mode), is a good practice for keeping columns and rows anchored as necessary. This helps ensure that formulae can be copied to other sections of the spreadsheet free of error and with consummate ease.

8. **Use formats and styles**
Rather than divide numbers by 1,000,000 or other common

divisors, it is less risky if numbers are suitably formatted using Excel's custom number formatting (CTRL + 1). Furthermore, if all cells are given a suitable style (ALT + O + S) as coded, it can make it much easier to protect or alter the appearance of cells as required.

For more information on custom formatting:

http://www.corality.com/training/tutorials/custom-formats-excel/

http://www.navigatorpf.com/tutorials/custom-number-formats-excel/

9. **Have models peer reviewed**

   How many times have we handed a model over to a line manager who points out a *#DIV/0!* or *#REF!* error immediately upon receipt? Whilst checks for these prima facie errors can be automated using the keyboard shortcut *CTRL + F* and searching for '#', it makes sense to arrange for a colleague to quickly review our models. It is beneficial to remember that we will seldom spot flaws in our own logic.
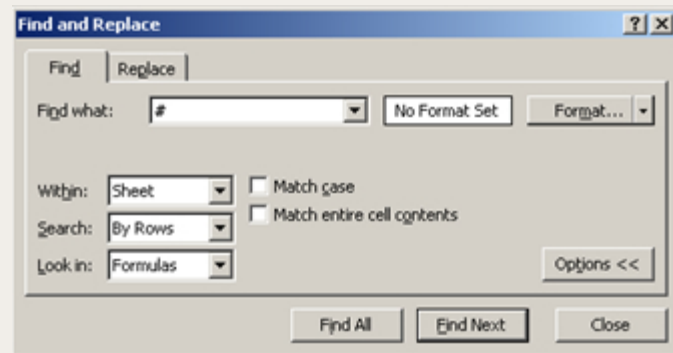
10. **Assess your team's capabilities and introduce modelling standards**

    Among finance professionals, actuaries tend to maintain some of the most complex spreadsheet models. Based on this fact alone, many organizations regard actuaries as Excel experts. While this is often true for experienced actuaries, the more junior team members may not have all the necessary skills to prepare robust, transparent and flexible Excel models. A good first step to understanding your limitations is to speak to an expert in the field who can help evaluate your internal capabilities and assess the risks you are taking. The most efficient way of getting this started is to speak to a professional services provider such as Ernst & Young, KPMG or Corality. These professionals are experienced in formally auditing such models by making use of software and expertise not readily possessed by others. Very often the risks can be significantly reduced through a quickly

implemented best-practice modelling framework.

Rickard Warnelid is the Managing Director of analytical consultancy firm Corality, and can be reached at

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Web: Corality.com

References

1. Actuaries excel: but what about their software? Louise Pryor, Richard Evans, Brian Foley, Michael Garner, Neil Hilary, Justin Skinner, Mark Shapland, Kathryn Staff, James Tanser {Palisade, 2008].

2. Excel Modelling Survey, L. Bastick [Ernst & Young, 2006].

3. KPMG marketing literature [2008].

4. What We Know About Spreadsheet Errors, R. Panko [University of Hawaii, 1998 - 2005].

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A LOOK AT TWO SOA TECHNOLOGY SECTION SESSIONS AT THE 2010 ANNUAL MEETING

by Mary Pat Campbell

Joint Technology and Entrepreneurial Actuaries sections' reception attendees discuss football, baseball, retirement issues and interest rate scenario generators

Attendees at the joint Technology and Entrepreneurial Actuaries sections reception on the Sunday evening preceding the meeting not only got in some great networking and discussions on hot topics, they enjoyed football and baseball playoffs as well. Co-sponsored with the Actuarial Society of Greater New York, the reception featured a large screen TV showing football, and then baseball, playoffs (Phillies beat the Giants 6-1). But while the playoffs piqued attendees' interest, most spent the time engrossed in deep conversation on a variety of key issues, while enjoying a delicious dessert spread (including some darn good ice cream bars!)

Actuaries share war stories in the ongoing battle with IT departments [hey guys, can't we all get along?]

In the session, "The Actuarial Technology Perfect Storm," Steven Leigh of Gartner, and Eddie Smith and Tim Pauza from the SOA Technology Section Council, had a presentation regarding actuarial attitudes toward IT departments, a survey that has been conducted by Gartner for the SOA for three years running.

Not only were the survey results presented and compared to prior year results, but also look to what is coming ahead as well as recommendations for both actuaries and IT departments (only if a few IT professionals were at the SOA meeting ...)

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The "perfect storm" mentioned in the session's title referred to the challenges that are coming due to new demands (such as more complicated work due to regulatory changes, such as Solvency II and C3 Phase 3), new technologies (and how often end users will have personal tech that is much more effective than that provided by their IT departments, so that people end up routing around the formal systems), and a lack of a proven model in how IT and actuarial departments work together.

Or don't work together. During the presentation, many audience members commented on their own experiences and the history of their relationship with tech and IT. There were a few happy stories mixed in with common plaints. The presenters offered some recommendations and action items for audience members to take away. Perhaps next year, some audience members may have happier stories to tell as a result.

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FIVE EASY STEPS TO GET STARTED ON LINKEDIN

This "how-to guide" was the collaborative effort of J. Eddie Smith, IV, and other members of the Technology Section LinkedIn group.

In a recent press release, LinkedIn reports that it now has more than 85 million members and adds a new member approximately every second. You can use this guide to set up a free LinkedIn account in five easy steps. Creating an account takes less than a minute of your time, and will give you access to discussion groups and other resources.

Step 1 - Sign up
Go to Linkedin.com On the right side of the home page, you'll see a blue "Join LinkedIn Today" banner. Enter your name and e-mail address and click the green "Join Now" button.

Next, you'll be asked to enter just a few simple employment details (things like employer, job title, and industry). You can enter your complete employment history (which helps find and link to contacts), but that is not required.

Step 2 - Connect
Once in, LinkedIn will suggest connections in three ways. All of these steps are optional and can be easily skipped:

- Using your contacts in Gmail, Yahoo, etc. Be careful to follow the directions with this option, since it is easy to mistakenly send invites to all of your contacts.

- Using your employer and job title, LinkedIn will suggest connecting with colleagues that are already on LinkedIn.

- You can easily search LinkedIn for people by name using the ever-present search field at the top of all LinkedIn pages.

Step 3 - Join a group
You can browse groups using the "Groups" menu at the top of every LinkedIn page. If you know all or part of the name of a group you'd like to join, the fastest way to join is by searching for the group. The search field at the top of every LinkedIn page will search not only people but LinkedIn groups as well.

For example, start typing "Society of Actuaries ..." and you'll see a drop list populate with matches. A good choice for your first group is the "Society of Actuaries Technology Section" group.

Simply choose the group you're interested in, and click the "Join Group" on the group home page. The group owner will notify you when your access has been granted.

Step 4 - Enhance your profile
You can see and edit your LinkedIn profile at any time by clicking on the Profile menu at the top of any LinkedIn page. Your profile is like a digital resume. You can put as much or as little on it as you like.

Step 5 - Participate (optional)
There are several key ways you can interact with others on LinkedIn:

- Posting "status updates" and questions on your profile.

- Asking and responding to questions within your groups.

- Messaging other LinkedIn members (like e-mail).

A Note about Privacy
Linkedin is secure and respects privacy. Their privacy policy can be found at http://www.linkedin.com/static?key=privacy_policy. Your information is shared within the group and of course anything you post can be reproduced, therefore we recommend that you treat your posts as you would treat open e-mails.

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NONLINEAR INTERPOLATION WITH EXCEL TO CONSTRUCT U.S. TREASURY BOND YIELD CURVE
by Andrew Chan

Excel offers many powerful mathematical and statistical functions that allow us to solve numerous business problems. One of the typical challenges is that we don't have all the information we need! Using U.S. Treasury bonds as an example; it only has yield rate for certain maturities, e.g., one year, two years, three years, five years. If we want yield rate for a four-years maturity bond, then we may have to find a mathematician/statistician to interpolate the value for us. Fortunately, we can be the mathematician/statistician if we have Microsoft Excel. Excel has a few tools that we can use to interpolate values; and we are going to demonstrate a few of them in this article.

Trendline
I went to the U.S. Treasury website and copied the following yield rates to my Excel Worksheet.

US Treasury bonds

Year	Yield %
1	0.28%
2	0.56%
3	0.85%
5	1.64%
7	2.35%
10	2.99%
20	3.82%
30	4.06%

Once we have the data, we can create a trendline. The first step is to create a chart (graph) based on the yield rate.
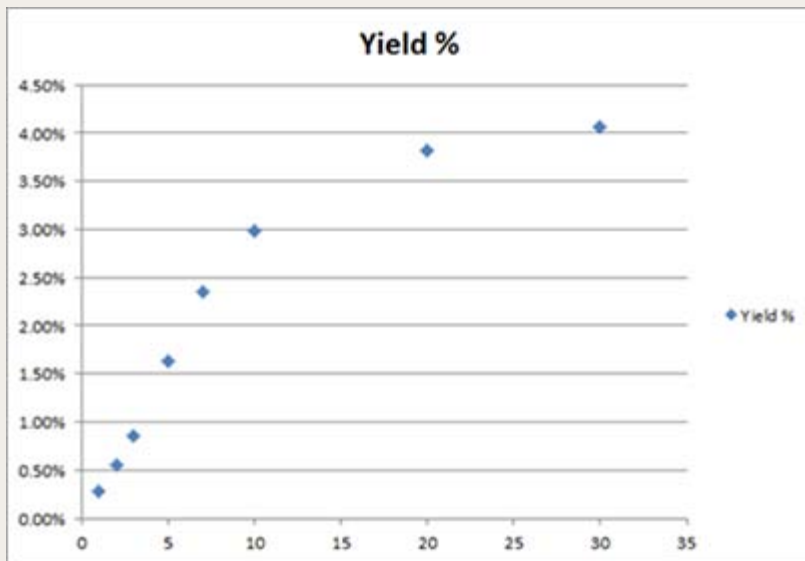
It is very simple to add a Trendline: just right-click the data series in the chart. From the pop-up menu, select **Add Trendline**.
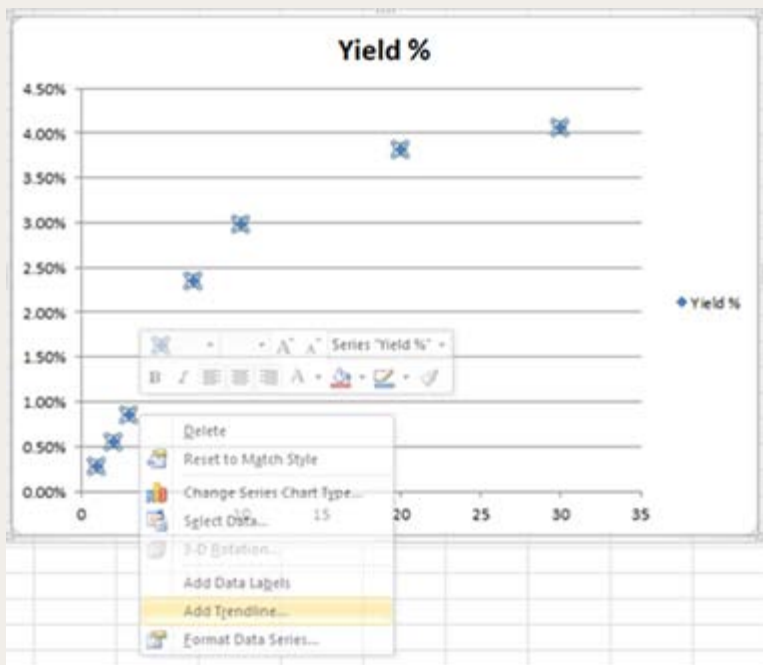
The **Format Trendline** dialogue will be displayed (see below). For this example, we will choose Polynomial with Order 3 as the trend type and we also select to **Display Equation** on chart and **Display R-squared value on chart**.
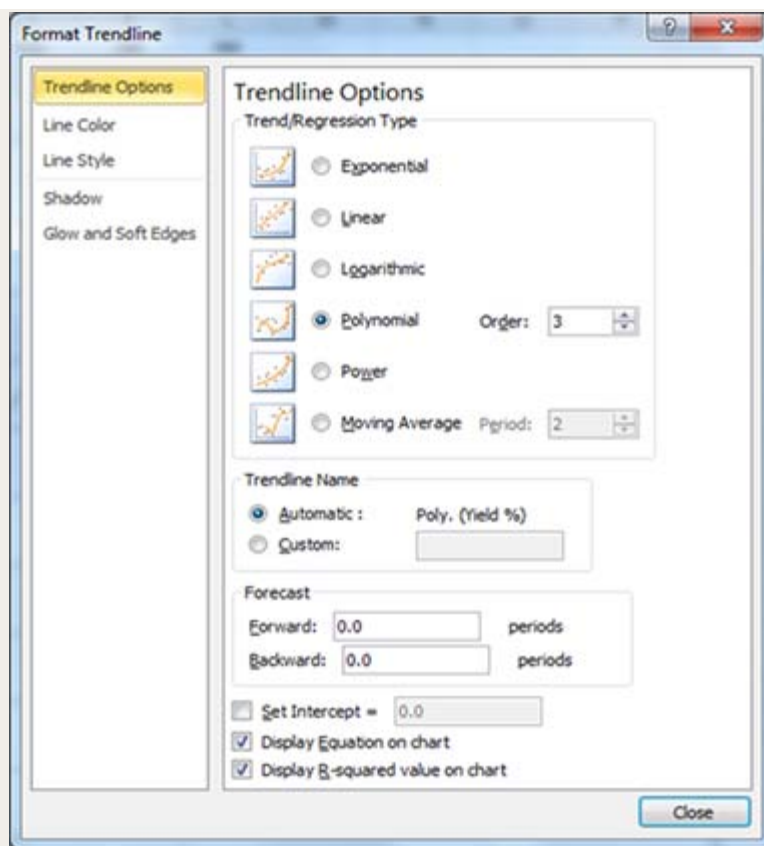
After we click the Close button, we would see a trendline is added to the chart with the equation and R^2.
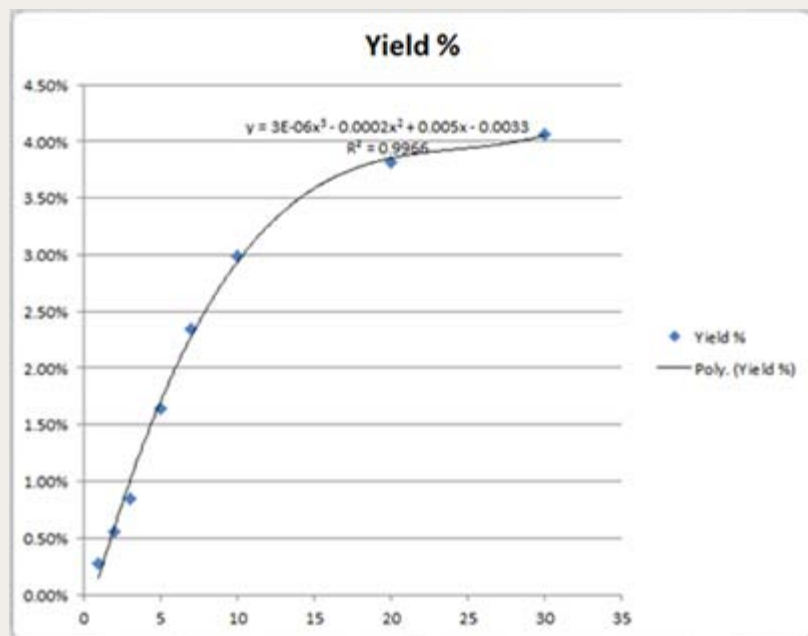
Worksheet Functions

Excel provides many functions to project values:

- **FORECAST**

- **TREND**

- **GROWTH**

- **LINEST**

- **LOGEST**

We are going to use **LINEST** in this demonstration, which generates statistics for a "least squares" linear regression (for complete documentation on the function parameters, see Microsoft's website http://office.microsoft.com/en-us/excel-help/linest-HP005209155.aspx?CTT=1). Since the yield curve is a third order polynomial function, we have four variables.

Yield = a1 * Years3 + a2 * Years2 + a3 * Years + a4

Enter the following formula in our Excel worksheet to identify the coefficients a1 through a4 in the formula above:

=INDEX(LINEST(Yield, Years^{1,2,3}),1,1)
=INDEX(LINEST(Yield, Years^{1,2,3}),1,2)
=INDEX(LINEST(Yield, Years^{1,2,3}),1,3)
=INDEX(LINEST(Yield, Years^{1,2,3}),1,4)

Yield and **Years** are the defined range names containing the Y and X points. We can see the coefficients a1, a2, a3 a4 and even R2 are very close to the results from **Trendline**.

a1	2.70683E-06
a2	-0.000198231
a3	0.004970323
a4	-0.003253473
R2	0.996593232

The formula for R2 is: **=INDEX(LINEST(Yield, Years^{1,2,3},TRUE,TRUE),3,1)** Note the additional parameters in the **LINEST** function—the last one (TRUE) tells the function to return additional regression statistics.

Now we have all coefficients, we can interpolate the yield rates that we need.

| Years	US Treasury Bond Yield Rate	Projected Yield Rae
1	0.28%	0.15%
2	0.56%	0.59%
3	0.85%	0.99%
4		1.36%
5	1.64%	1.70%
6		2.00%
7	2.35%	2.28%
8		2.52%
9		2.74%
10	2.99%	2.93%
11		3.10%
12		3.25%
13		3.38%
14		3.49%
15		3.58%
16		3.66%
17		3.73%
18		3.78%
19		3.82%
20	3.82%	3.85%
21		3.88%
21		3.88%
23		3.91%
24		3.93%
25		3.94%
26		3.95%
27		3.97%
28		3.99%
29		4.02%
30	4.06%	4.05%

Solver

If we want to use some custom functions, e.g., the Nelson-Siegel function to interpolate the yield value, "Solver" is a good tool for the job. The Nelson—Siegel function is a modified Exponential function:

*Yield = A1 + (A2+A3) * (Beta / Years) * (1-e-Years/Beta) - A3 * e-Years/Beta*

	A	B	C	D	E
1		Years	Yield %	Nelson-Siegel Projected Values	Squared Residual
2		1	0.28%	9.48%	0.008467328
3		2	0.56%	8.65%	0.006539386
4		3	0.85%	7.92%	0.004996286
5		5	1.64%	6.95%	0.002822621
6		7	2.35%	6.42%	0.001658696
7		10	2.99%	6.00%	0.000905846
8		20	3.82%	5.50%	0.00028224
9		30	4.06%	5.33%	0.000162138
10					0.025834541
11					
12				Alpha1	0.05
13				Alpah2	0.05
14				Alpha3	0.05
15				Beta	1

Column D shows the projected values that are based on Nelson-Siegel function (using arbitrary initial parameters) and Column E is the Squared Residual value between the projected and actual values. We can use "Solver" to minimize the sum of all Squared Residual values (cell E10) by adjusting the function parameters (cells E12 through E15).

"Solver" is accessed from the "Data" ribbon bar in the "analysis" section at the far right. Solver setup is quite straight forward: we specify the **Objective** (and whether to solve for Minimum, Maximum, or a specific value), and **Variable Cells** (the parameters that will be changed). Also choose the option shown below for **Select a Solving Method**. [*Editor's Note: Excel 2007 "out of the box" does not have this option in the dialog. See the "Addendum: Advanced Solve Functionality Setup in Excel 2007*]. When everything is ready, we click the **Solve** button.
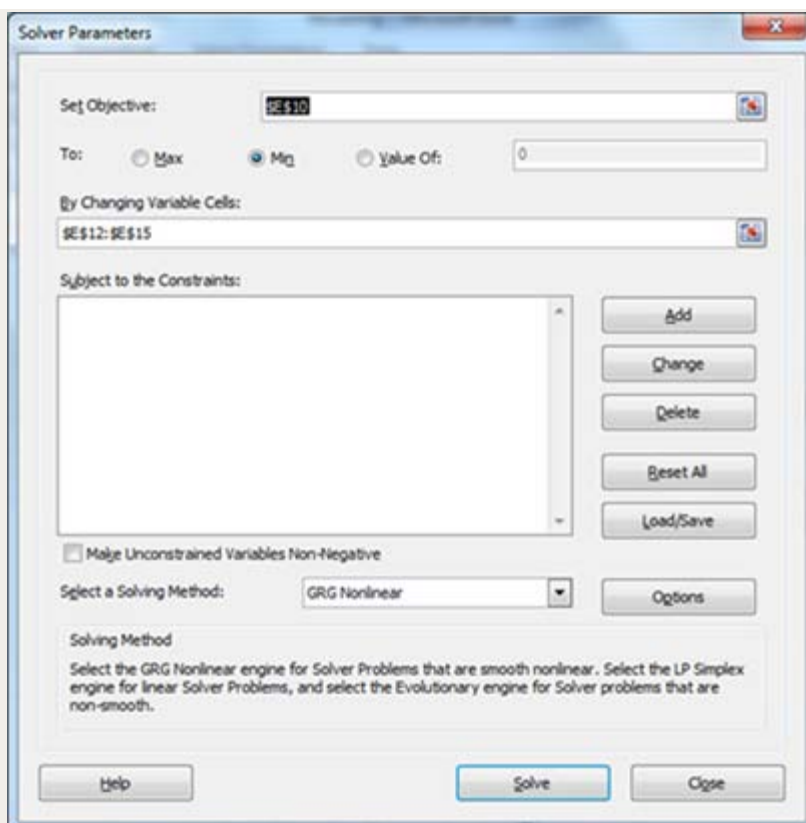
The variable cells have been changed to their optimal values.

	A	B	C	D Nelson-Siegel Projected Values	E Squared Residual
1		Years	Yield %		
2		1	0.28%	0.30%	3.3678E-08
3		2	0.56%	0.50%	3.34644E-07
4		3	0.85%	0.88%	1.0457E-07
5		5	1.64%	1.69%	2.34899E-07
6		7	2.35%	2.33%	5.48605E-08
7		10	2.99%	2.96%	1.017E-07
8		20	3.82%	3.80%	2.88858E-08
9		30	4.06%	4.09%	9.58936E-08
10					9.8913E-07
11					
12				Alpha1	0.046669726
13				Alpah2	-0.040938811
14				Alpha3	-0.063510791
15				Beta	1.654403566

Again, we can now use the coefficients to interpolate the yield rate.

The R2 is 0.9993 vs. 0.9966 from **LINEST**.

Years	US Treasury Bond Yield Rate	Nelson-Siegel Projected Values
1	0.28%	0.30%
2	0.56%	0.50%
3	0.85%	0.88%
4		1.30%
5	1.64%	1.69%
6		2.03%
7	2.35%	2.33%
8		2.57%
9		2.78%
10	2.99%	2.96%
11		3.11%
12		3.23%
13		3.34%
14		3.43%
15		3.52%
16		3.59%
17		3.65%
18		3.71%
19		3.76%
20	3.82%	3.80%
21		3.84%
21		3.84%
23		3.92%
24		3.95%
25		3.98%
26		4.00%
27		4.03%
28		4.05%
29		4.07%
30	4.06%	4.09%

Others

There are other Excel tools that we can use to project/interpolate values, such as Analysis ToolPak or Microsoft Solver Foundation. I will discuss these in future articles.
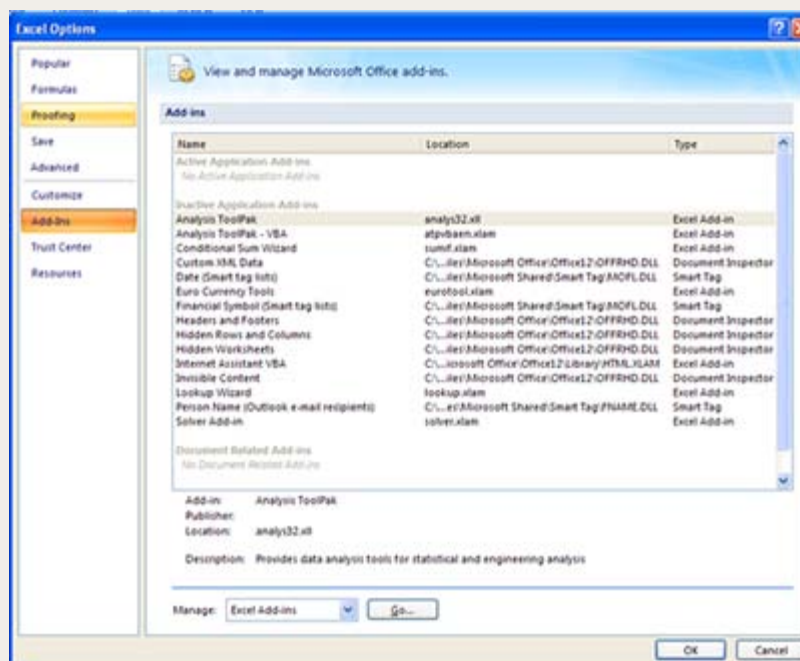
Addendum: Advanced Solve Functionality Setup in Excel 2007

Advanced solve functionality is available in Excel, it just needs to be enabled through an Add-In. It is very easy to enable it in Excel 2007:

Click Excel Options
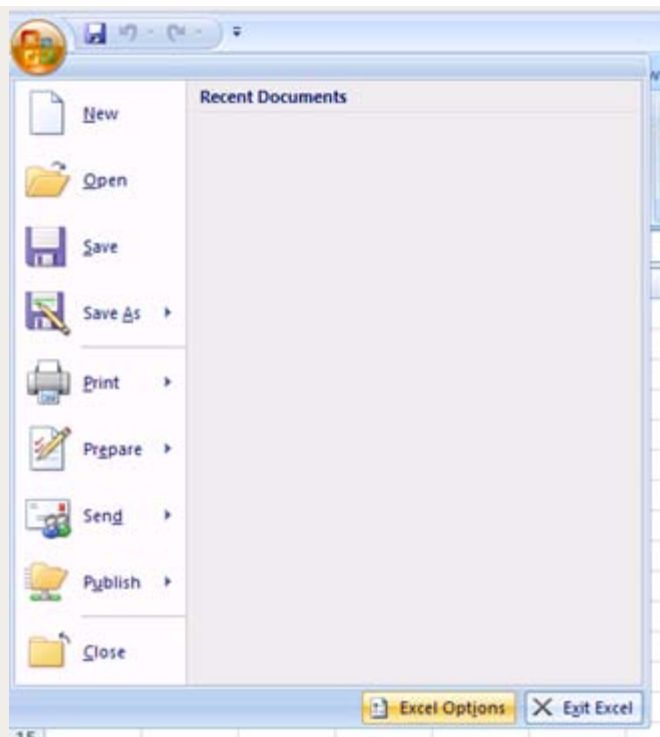
Select Add-ins and click Go button

Select Solver Add-in and click OK button.

You can start using Solver!

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R CORNER - CREATING HISTORICAL PORTFOLIOS

by Steve Craighead

Over the years, I have built a large number of econometric models, but the most painful part of the modeling process was to collect separate economic series and merge them together by date. I suffered the same fate when I created asset portfolios. Too much of my life was wasted in entering "N/A" on the assets at different dates in the consolidated portfolio.

The "tseries"[1] package in R has two very powerful commands. These are "get.hist.quote" and "merge." The first one allows you to download assets from both quote.yahoo.com and oanda.com, using asset ticker symbols. Also, the starting date and the ending date for the date extraction must be specified. The quotes pulled can be specified as "Open," "High," "Low," "Close," "AdjClose," and "Volume." Extraction of data on a daily, weekly or monthly basis is allowed. The only draw back is that "get.hist.quote" only extracts one set of quotes at a time. To overcome this weakness, the "merge" command comes to the rescue. Say that you have a portfolio of one asset (call this "Portf") and you use "get.hist.quote" to obtain another asset (call this "asset"). By using the command "Portf-merge(Portf,asset)," the resultant portfolio Portf has merged the two assets. All dates are consistent and any missing data automatically has the "N/A" inserted. By setting up a loop over a list of ticker symbols combined with "get.hist.quote" and "merge," all the asset data are consolidated and the N/As are in the right place!

To aid you in this, I have constructed a function that takes a ticker list, a start and a finish date and a numerical code (1, 2, or 3) to

specify the extraction as daily, weekly or monthly. It is limited in that it pulls from quote.yahoo.com and only closing quotes are returned. This function is called "buildportfolio" and is available at portfolio. The function is well documented with the first portion of the function implementing a loop through the ticker symbols, extracting and merging the closing prices into a portfolio. The results of this are returned as "PricePortfolio." The second half of the function will remove all N/As and create the price returns {(PRICE2-PRICE1)/PRICE1} through time. The return data is called PRPortfolio.

For example, define the ticker to pull the DJIA, S&P500, FTSE, DAX, Nikkei 225 and the Hang Seng indices with this command:

(ticker<-c("^DJI","^GSPC","^FTSE","^GDAXI","^N225","^HSI"))

Note that the ticker symbols correspond to the ones used in finance.yahoo.com.

---

[1] Adrian Trapletti and Kurt Hornik (2009). tseries: Time Series Analysis and Computational Finance. R package version 0.10-22.

To set the time horizon for the data extraction use the "YYYY-MM-DD" format for the dates:

(startdate <- "1990-12-03")
(enddate <- "2010-08-02")

Use 1 for daily rates, 2 for weekly rates and 3 for monthly rates. Set the extraction frequency as daily:

(freq<-1)

Now store the results in the test object by this command:

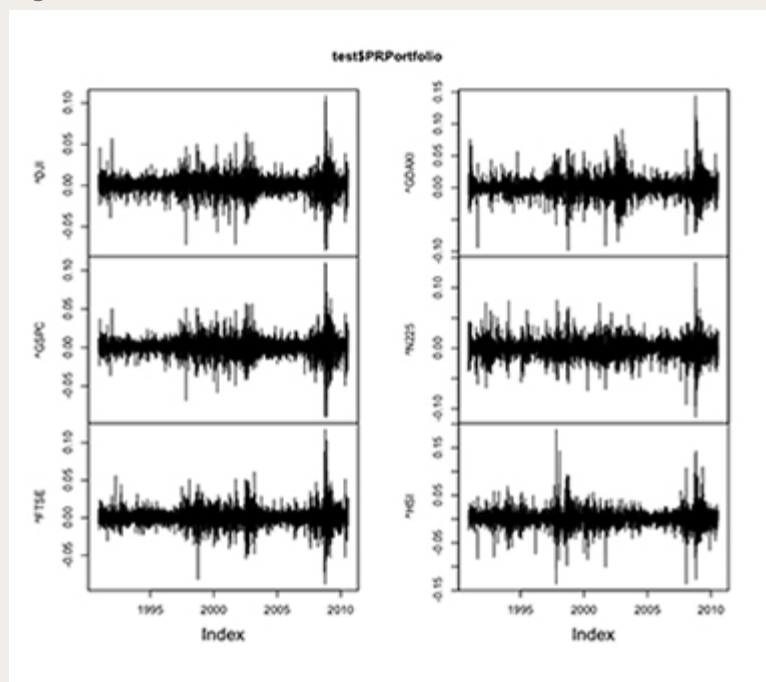test<-buildportfolio(ticker,startdate,enddate,freq)

You access the closing index values by referring to test$PricePortfolio. The price returns are in test$PRPortfolio.

To plot each of the closing values through time use this command:

plot(test$PricePortfolio)

Figure 2: Price Returns

🔍 Enlarge

Over the next several articles, I will examine two separate applications that can use the "buildportfolio" function. The first application is the generation of extreme scenarios by implementing Dependent Multidimensional Fractional Brownian Motion (DMFBM). These extreme scenarios correspond to what Taleb calls "Mandelbrotian Grey Swans." When prices are modeled with DMFBM the various asset prices are dependent upon one another, produce long memory models and have heavier tails than lognormal. These traits correspond to Mandelbrot's[2] and Taleb's view of fractal and power scaling traits observed in market prices.

The final application will be using packages that have implemented portfolio theory. Our goal in that article is to look at various types of efficient frontiers.

---

[2] Benoit Mandelbrot (1997), "Fractals and Scaling in Finance, Discontinuity, Concentration, Risk," Springer-Verlag, New York, NY.

[3] Nassim Taleb (2010), "The Black Swan, the Impact of the Highly Improbable, 2nd Edition," Random House Trade Paperbacks, New York, NY.

So hold on to your hats, the next article will really go to the extremes!

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RECOMMENDED APPLICATION: INSTAPAPER

by J. Eddie Smith, IV

Lack of information is not a 21st-century problem. Figuring out how to digest it all very much is. Throughout our day, we get pelted with a steady rain of links from newsletters like this one, e-mails, news sites, social networks, and a number of other 24/7 e-torrents.

Reading and staying informed is critical to the success of a 21st-century actuary, but if you're like me, you rarely have time to read Web articles when you encounter them. Traditional browser bookmarking helps a little, but that can quickly turn into a mess.

Fortunately, there's a tool that lets you easily store articles for later reading and allows you to archive them when you're done. It's called Instapaper, a free Web-based service that corrals any Web page you send to it. Instapaper has other benefits as well:

- It removes ads and other distractions from pages making them easier to read.

- You can access it on any computer with an Internet connection by going to Instapaper.com.

- There are excellent Instapaper mobile apps for the iPhone and iPad (free and paid) for reading on the go. Note: the free version has a limit of 10 articles, and is ad-supported. The paid version ($4.99) removes these restrictions, and has additional functionality).

Getting articles into Instapaper is easy, too. You can find a full list of

tools at the **Instapaper Extras page** with instructions on how to use each. Here are a few:

- The Instapaper browser bookmarklet instantly saves the current page when pressed.

- You can e-mail links to a unique e-mail address associated with your Instapaper account.

- Many iPhone apps now offer a "send to Instapaper" option.

If you often find yourself losing track of Web-based articles because you don't have time to read them right away, I highly recommend giving Instapaper a try.

If you're using mobile apps in your actuarial workflow, please contact me at j.eddie.smith.iv@gmail.com. I'm currently working with other Technology Section council members and the SOA to identify apps that would be useful to actuaries on the job. Thanks!

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