

Open Source in Quant Finance

A brief and biased overview

Yves Hilpisch

For Python Quants Conference, New York, 01. May 2015



Feel free to take pictures and to tweet.

@dyjh @dataparkio

**#Python #QuantFinance #Finance #osqf
#PythonQuantsConf**

Mega Trends

Some mega trends that influence quant finance



Today's standard is "open source",
even for key technologies.



More and more data sets are
"open and free".



Complex analytics work flows are
coded in the browser.



Dynamic communities evolve
to professional networks.



Infrastructure is a standardized
commodity, billed by the hour.



Even individuals can trade real-
time and with high leverage.

I. The social aspects

Social Media

Relatively high interest in the topic

The screenshot shows a LinkedIn Pulse article page. The browser address bar displays the URL: <https://www.linkedin.com/pulse/open-source-quantitative-finance-neil-fowler>. The LinkedIn logo is in the top left, and navigation links like 'Was ist LinkedIn?', 'Werden Sie heute Mitglied', and 'Anmelden' are in the top right. The article is titled 'Open Source for Quantitative Finance' by Neil Fowler. Below the title, it shows the date '9. Mär 2015', view count '1.299', and engagement counts '15' likes and '1' comment. Social sharing icons for LinkedIn, Facebook, Google+, and Twitter are present. The article text discusses how open source software like Python, R, and Julia is revolutionizing quantitative financial workflows. On the left sidebar, there is a 'Pulse' section with a list of other articles, including 'How to Ask Great Questions to Get the Input You Need' by Jeff Haden, 'My Dream Job Has Become a Nightmare - Now What?' by Liz Ryan, '3 Things Smart Bosses Never Tell Employees' by Brian de Haaff, 'How Executives Should Communicate Online' by Bruce Kasanoff, 'Management vs Leadership. What's the difference?' by James Caan CBE, and '3 Lessons I Learned from Some of the Most Impressiv...' by Lily Herman.

Open Source for Quantitative Finance
Neil Fowler

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Lily Herman

Open Source for Quantitative Finance

9. Mär 2015 | 1.299 views | 15 likes | 1 comment

Open Source for Quantitative Finance

Open source software (like Python, R and Julia) is revolutionizing how quantitative financial workflows and applications are developed and deployed. Not only that times-to-insights and IT costs are significantly decreased, productivity of quants increases substantially as well. The right use of open source software therefore represents a measurable competitive advantage.

Online Communities

Gaining in popularity

The screenshot displays the Quantitative Finance Stack Exchange website. The browser window shows the URL `quant.stackexchange.com`. The site header includes navigation links for `sign up`, `log in`, `tour`, and `help`, along with a search bar. The main navigation bar features links for `Questions`, `Tags`, `Users`, `Badges`, `Unanswered`, and `Ask Question`.

The main content area is titled **Quantitative Finance beta**. It includes a description: "Quantitative Finance Stack Exchange is a question and answer site for finance professionals and academics. It's 100% free, no registration required." Below this is an orange button labeled **Take the 2-minute tour**.

A section titled **Here's how it works:** illustrates the site's functionality with three icons and descriptions:

- Anybody can ask a question**: Represented by a question mark icon.
- Anybody can answer**: Represented by an 'A' icon.
- The best answers are voted up and rise to the top**: Represented by an 'A' icon with up and down arrows.

The **Explore Our Questions** section shows filters for `active`, `1 featured`, `hot`, `week`, and `month`. Below these are tags for `options`, `option-pricing`, `volatility`, `equities`, `time-series`, `black-scholes`, `fixed-income`, `risk`, `interest-rates`, and `data`, with a link to `more tags`.

A featured question is displayed: **Machine learning to build top 3 price scenarios over n days**. It has `0 votes`, `0 answers`, and `14 views`. The question is tagged with `time-series`, `risk-management`, `forecasting`, `econometrics`, and `machine-learning`. It was asked 9 hours ago by user `mickG` and has 1 answer.

The **Site Stats** sidebar on the right provides the following data:

Site Stats
4,374 questions
6,732 answers
79% answered
8,600 users
4,158 visitors/day

more site stats on:

Meetup Groups

Popular topic for Meetup groups

The screenshot shows a web browser window with the URL www.meetup.com/Python-for-Quant-Finance-London/events/221077187/. The page features a sidebar on the left with a group logo (a blue circle with a bar chart and a snake-like shape), the text 'London, Großbritannien', 'Gegründet 17.04.2014', and a table of group statistics. The main content area displays the event title 'Open Source in Quantitative Finance', the date and time '02.04.2015 17:30:00 · 17:30', the location 'Thomson Reuters', and a description of the event. A 'Tools' dropdown menu is visible in the top right. The right sidebar lists attendees, including Yves Hilpisch, Delia Rusu, Philip Stavridis, and Rajeev Mavinkurve, each with a profile picture and a 'Schön dich zu sehen' button.

Open Source in Quantitative Finance

02.04.2015 17:30:00 · 17:30
Thomson Reuters

Dear Python Quants,

we are going **open**! For the first time, there will be a meetup which does not only focus on Python but on a variety of **Open Source technologies** useful for and used in Quantitative Finance. Expect a **series of shorter talks** on the following topics:

- **Dr. Malcolm Sherrington (Amis Consulting):** "Interoperability of Python, Julia & R" -- The Julia programming language is renowned for being very easy to work with and fast. In this talk Dr Malcolm Sherrington discusses a feature which is less well known, how easy it is to utilise modules from other languages, including C, Fortran, C++, Java, R and Python, from within Julia. To show that the cooperation is not all one-way, Malcolm will indicate how Python can use Julia to overcome "two-language" problems.

Python Quants 694
Gruppenreview 9
Vergangene Meetups 15
Unser Kalender

Yves Hilpisch
ORGANISATOR
EVENT-KOORDINATOR

Delia Rusu

Schön dich zu sehen

Philip Stavridis

Schön dich zu sehen

Rajeev Mavinkurve

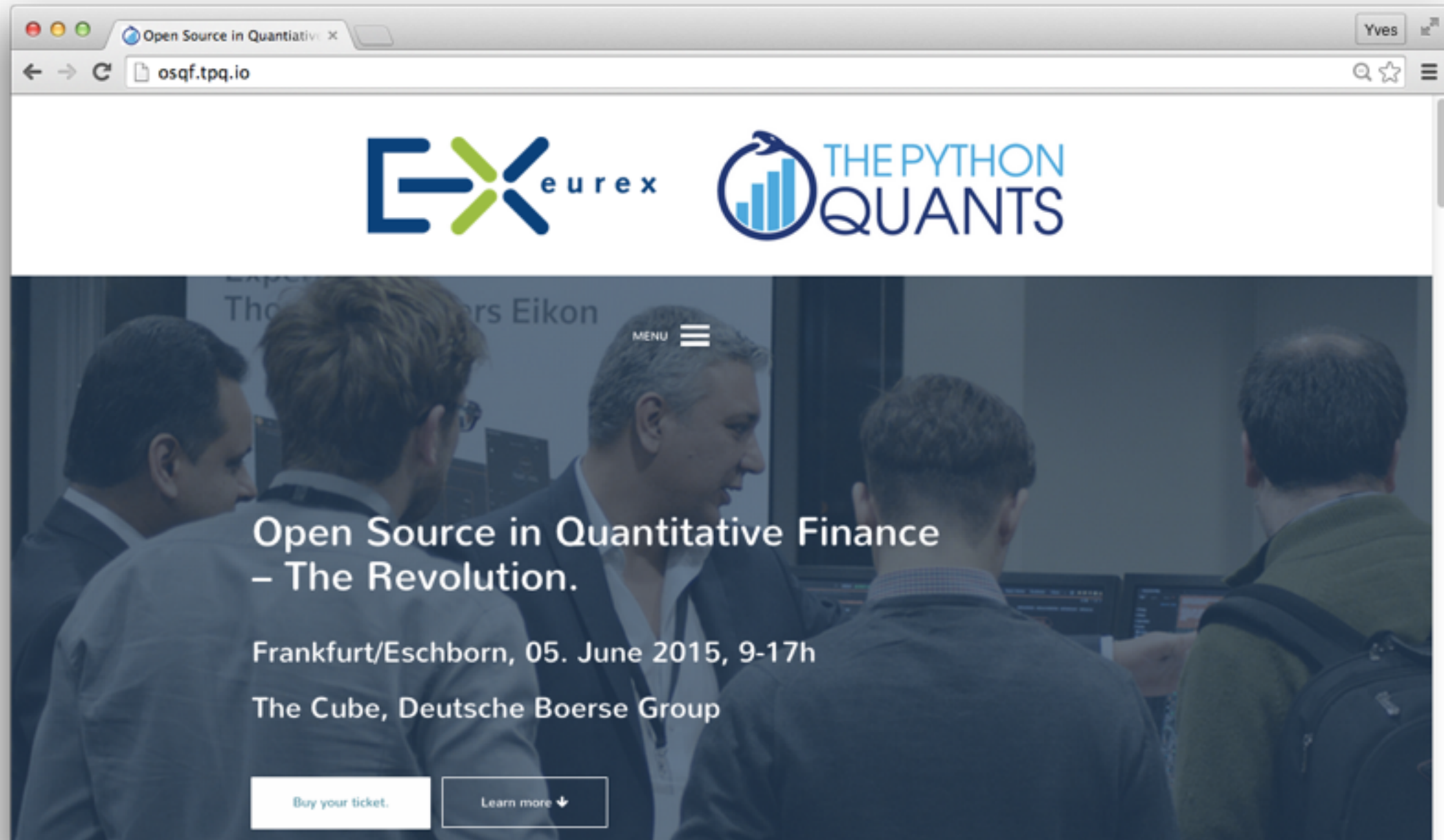
For Python Quants Conference

Third time today – and expanding



Open Source for Quant Finance Conference

First of its kind in Frankfurt, Germany

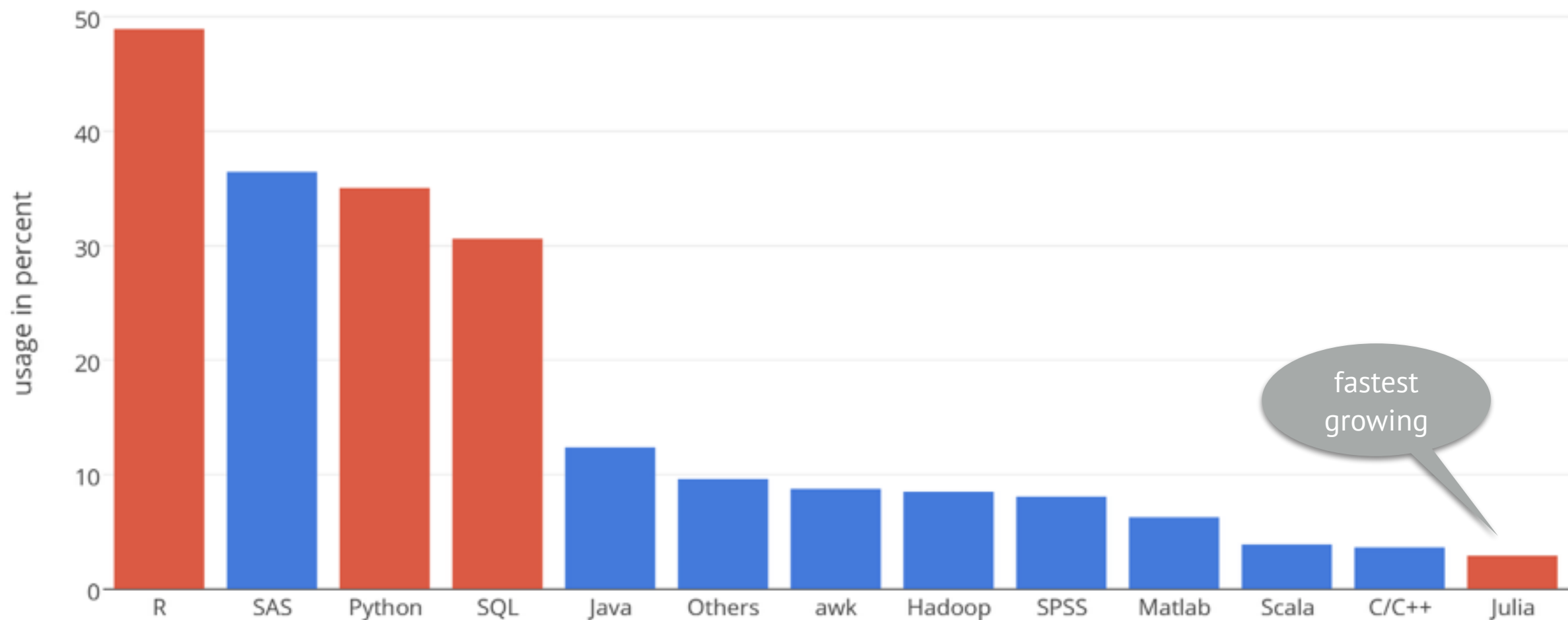


II. Some technological aspects

Open Source Data Science

OS languages dominate data science these days

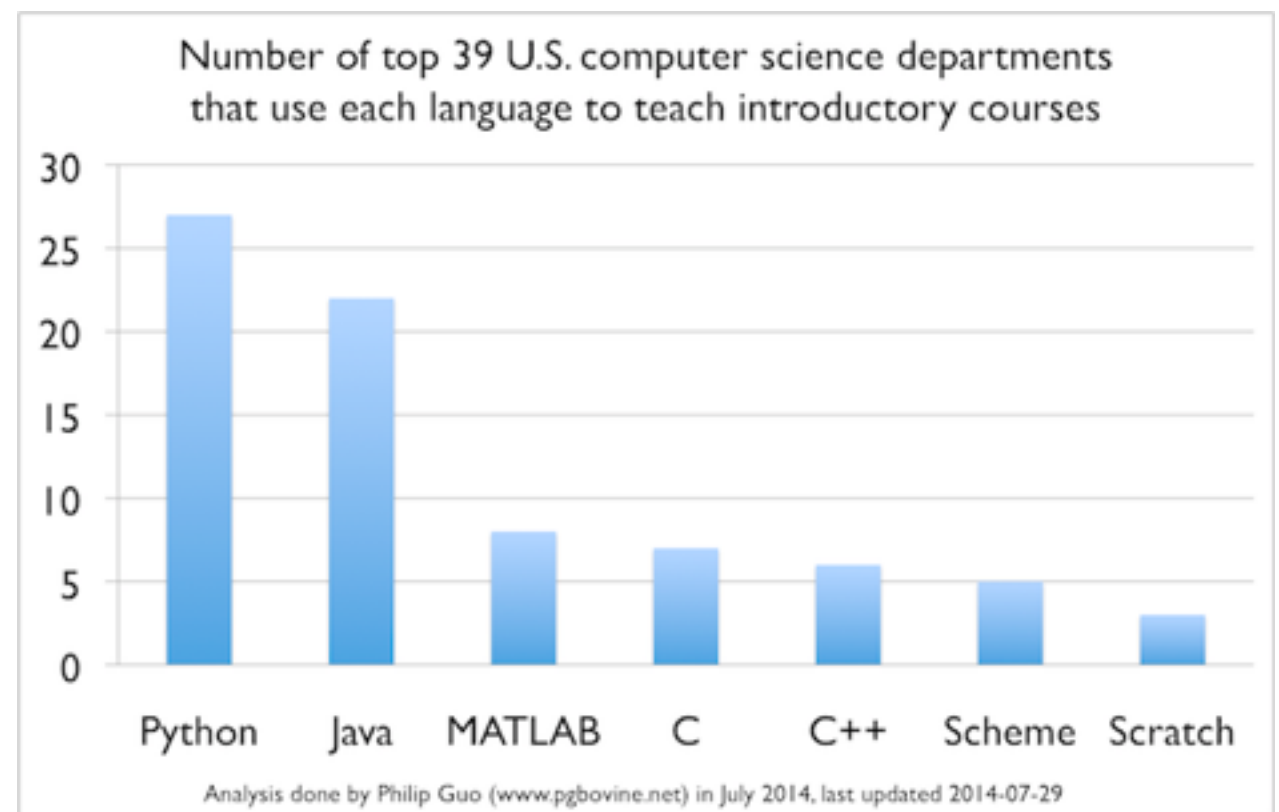
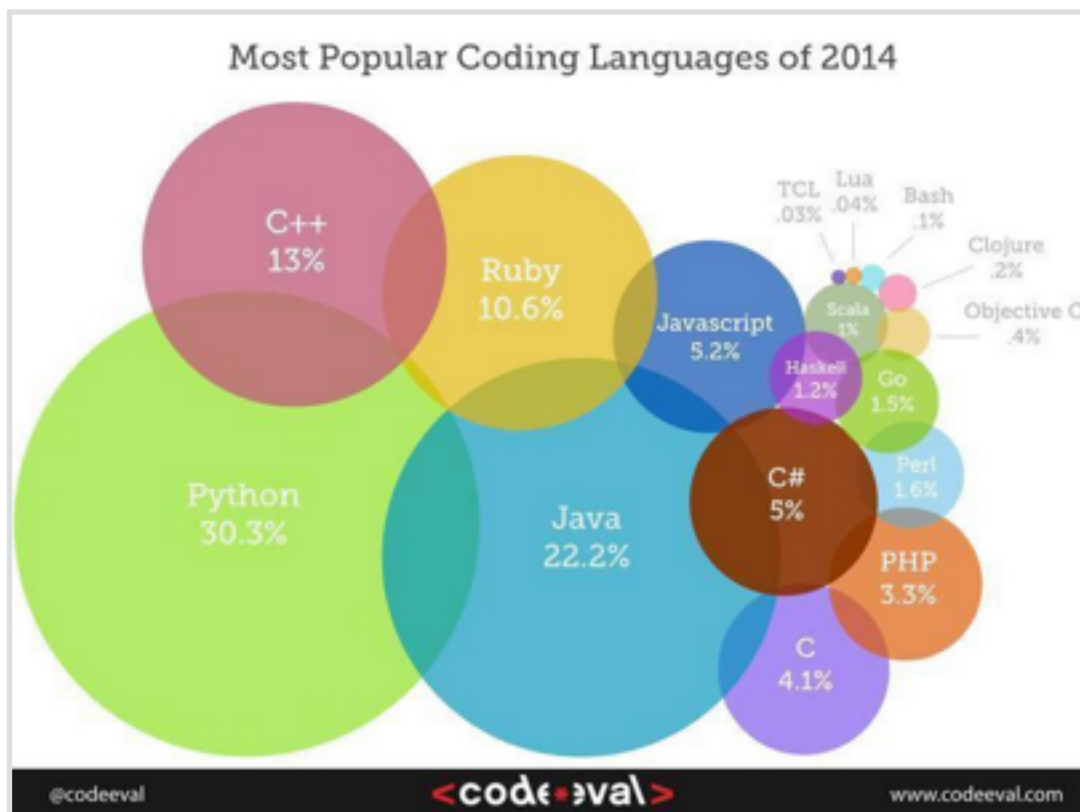
Data Science Languages



Poll data from August 2014. Source: <http://www.kdnuggets.com>

Python as Strategic Platform

Python plays an important role in the open source ecosystem



Financial Libraries in Python

Still not too many available as open source ...

The screenshot shows the DX Analytics website in a web browser. The browser's address bar displays 'dx-analytics.com'. The website has a dark blue sidebar on the left with the 'THE PYTHON QUANTS' logo and a 'Table Of Contents' section. The main content area is white and features the title 'DX Analytics' followed by a paragraph describing the library as a Python-based financial analytics tool. Below this is a section titled 'Basic Philosophy' which explains the library's approach to global valuation of derivatives. At the bottom of the main content area is a 3D surface plot representing a present value surface, with a color scale on the right ranging from 6 to 13. The sidebar includes links to 'Next topic' (Quickstart) and 'This Page' (Show Source), as well as a 'Quick search' bar.

DX Analytics — DX Analytics

dx-analytics.com

Yves

next | index

DX Analytics

DX Analytics is a Python-based financial analytics library (in its early stages) which allows the modeling of rather complex derivatives instruments and portfolios. Make sure to fully understand what you are using this library for and how to apply it. Please also read the license text and disclaimer.

You find the Github repository under <http://github.com/yhilpisch/dx>.

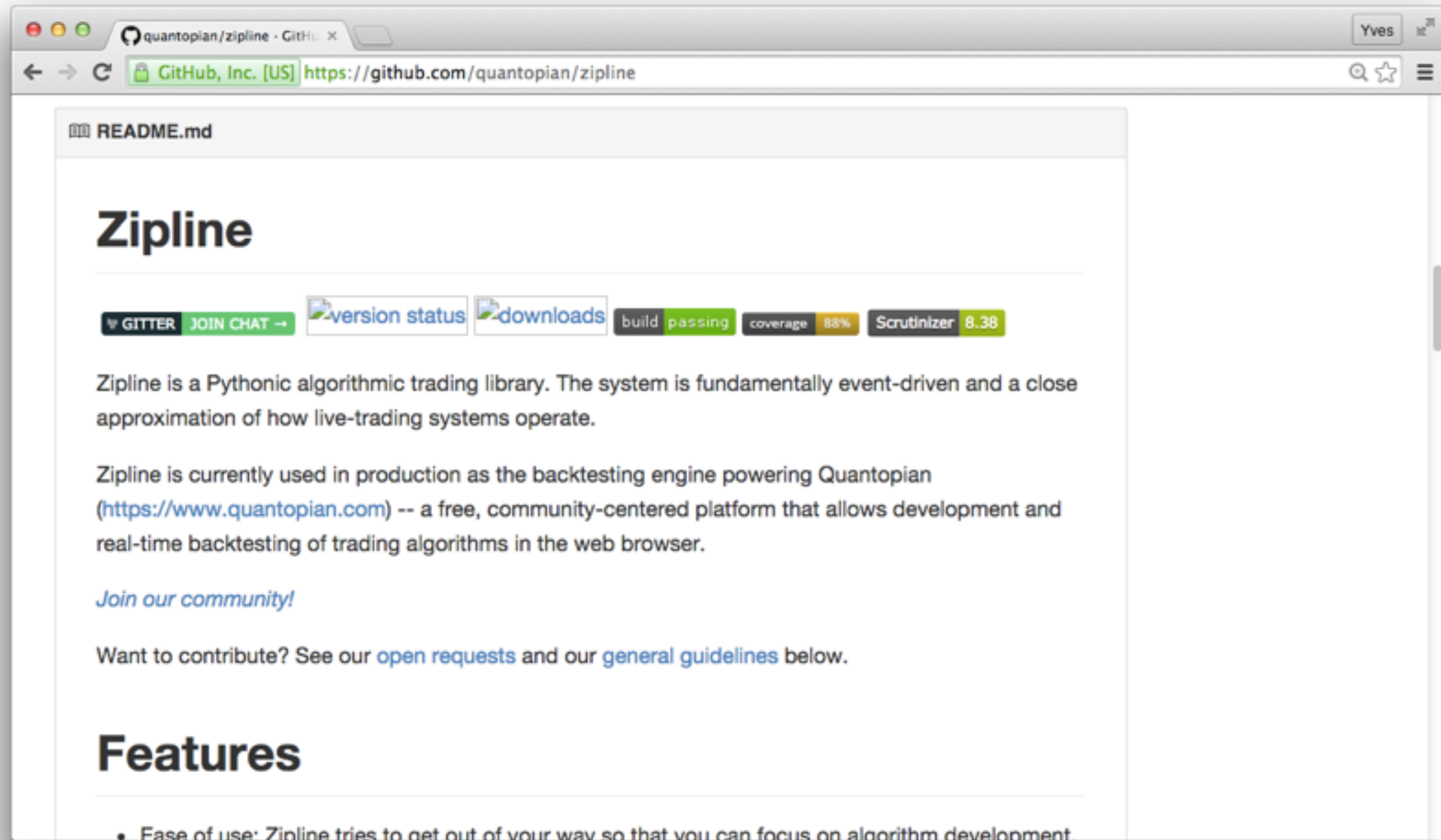
Basic Philosophy

DX Analytics is a Python-based financial analytics library that mainly implements what is sometimes called the global valuation of (complex portfolios of) derivatives instruments (cf. http://www.riskcare.com/files/7314/0360/6145/LowResRiskcare_Risk_0510_2.pdf). The major characteristic of this approach is the non-redundant modeling of all components needed for the valuation (e.g. risk factors) and the consistent simulation and valuation of all relevant portfolio components (e.g. correlated risk factors, multi-risk derivatives and portfolios themselves).

With DX Analytics you can, for instance, model and risk manage multi-risk derivatives instruments (e.g. American maximum call option) and generate 3-dimensional present value surfaces like this one:

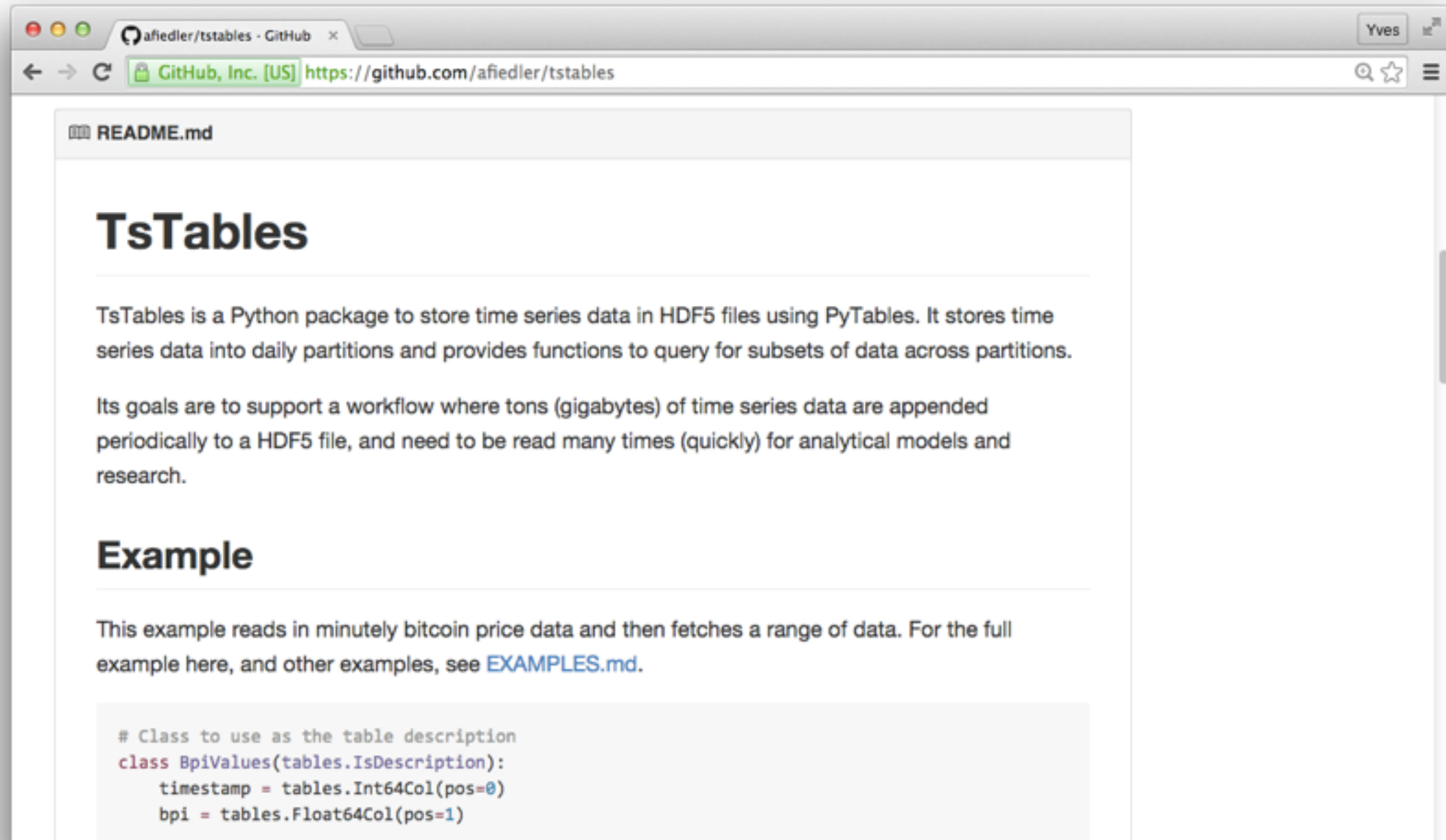
Financial Libraries in Python

... with notable exceptions of course



Financial Libraries in Python

There are also some specialized, but really helpful, ones



Python for Strategic Marketing

Using Python to communicate quantitative concepts



The screenshot shows a web browser window with the address bar displaying `eurexexchange.com/advanced-services/`. The page features a dark blue header with the Eurex logo and a search bar. The main content area is white and contains a 'Table Of Contents' sidebar on the left, a 'Eurex Advanced Services' section with a welcome message and a list of services, and a 'Python-based Tutorials' section with a description of Python and a list of tutorials. The footer is dark blue and contains links to 'Disclaimer', 'Privacy policy', 'Imprint', 'Rules and Regulations', and 'Sitemap'.

Table Of Contents

- > Eurex Advanced Services
- > Python-based Tutorials
- > Backtesting Applications
- > Quant Platform

Eurex Advanced Services

Welcome to the Eurex Advanced Services for the **VSTOXX and related derivatives** as well as for the **Variance Futures Contract**.

The Eurex Advanced Services provide you with a **comprehensive set of background information and tools**, among others:

- Python-based technical **tutorials**
- two **backtesting applications**
- executable IPython notebooks via the **Quant Platform**

Python-based Tutorials

Python (cf. <http://www.python.org>) is an open source programming language with a powerful scientific ecosystem of tools and libraries that becomes increasingly important in the financial industry and the financial and data analytics space in particular.

There are two **Python-based tutorials** available:

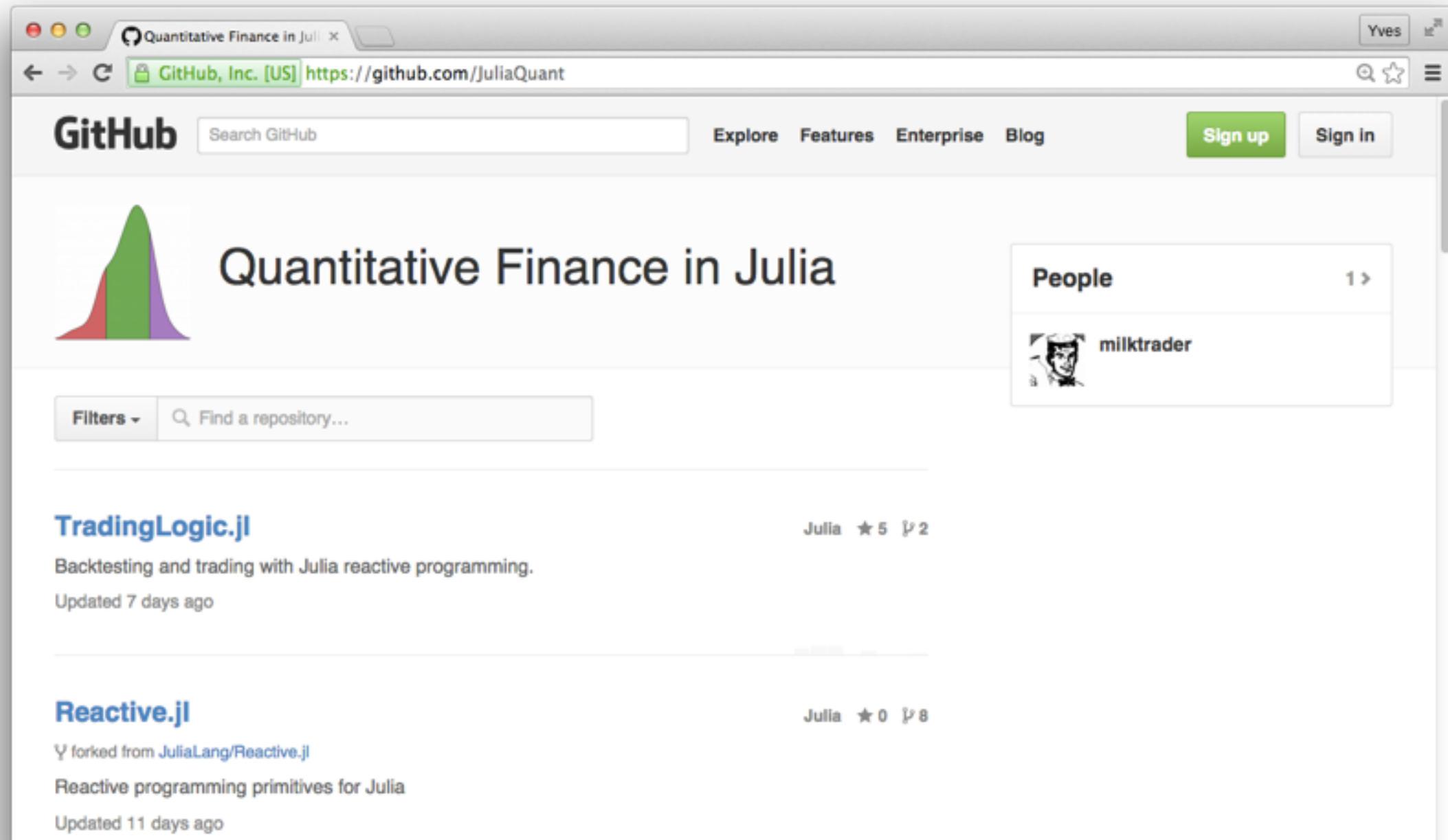
- **VSTOXX Advanced Services** under <http://www.eurexexchange.com/advanced-services/vstoxx/>
- **Variance Advanced Services** under <http://www.eurexexchange.com/advanced-services/variance/>

These tutorials provide theoretical and product-related background information, numerical examples and practical Python implementations.

Disclaimer | Privacy policy | Imprint | Rules and Regulations | Sitemap

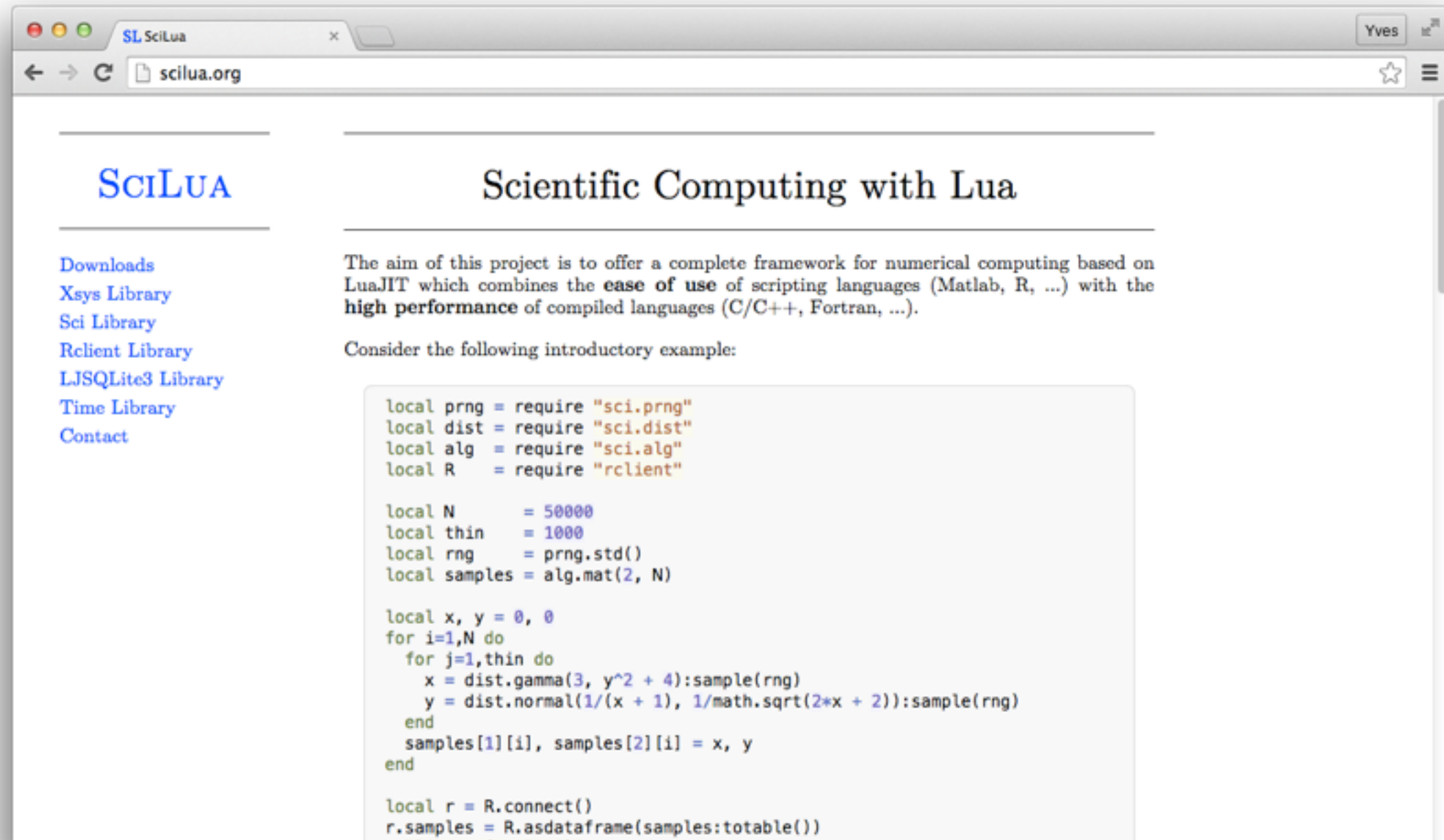
Financial Libraries in Other Languages

Quant Finance in Julia



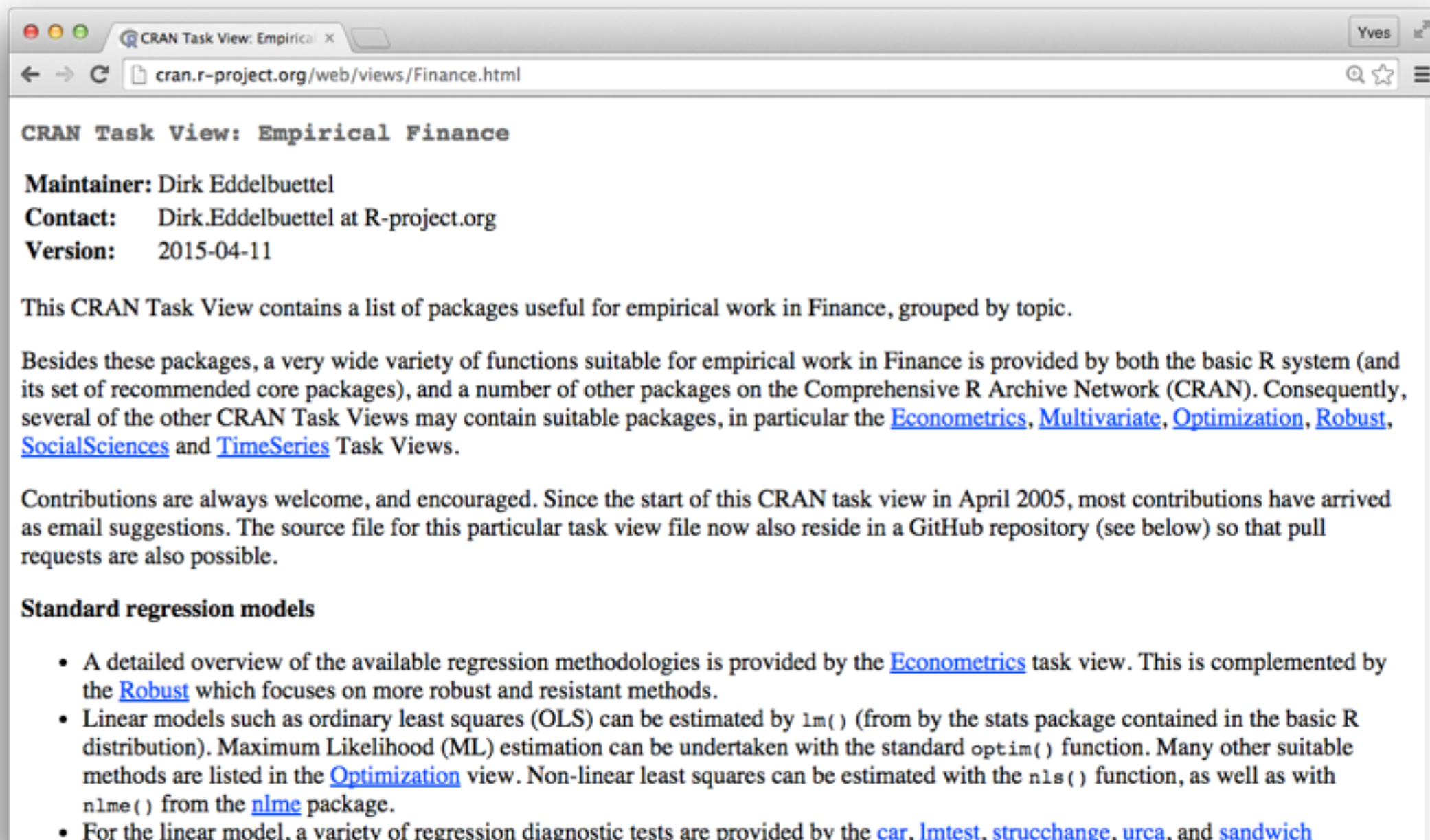
Financial Libraries in Other Languages

Scientific & financial computing in Lua



Financial Libraries in Other Languages

R has probably to offer the most



The image is a screenshot of a web browser window displaying the CRAN Task View for Empirical Finance. The browser's address bar shows the URL `cran.r-project.org/web/views/Finance.html`. The page title is "CRAN Task View: Empirical Finance". Below the title, the maintainer is listed as Dirk Eddelbuettel, with contact information `Dirk.Eddelbuettel at R-project.org` and a version date of 2015-04-11. The main text describes the task view's purpose and lists several CRAN Task Views that contain suitable packages: [Econometrics](#), [Multivariate](#), [Optimization](#), [Robust](#), [SocialSciences](#), and [TimeSeries](#). It also mentions that contributions are welcome and that the source file is in a GitHub repository. A section titled "Standard regression models" lists four bullet points: 1) A detailed overview of regression methodologies is provided by the [Econometrics](#) task view, complemented by the [Robust](#) view. 2) Linear models (OLS) can be estimated by `lm()` (from the `stats` package) or Maximum Likelihood (ML) estimation can be undertaken with the standard `optim()` function. Many other suitable methods are listed in the [Optimization](#) view. Non-linear least squares can be estimated with the `nls()` function, as well as with `nlme()` from the [nlme](#) package. 3) For the linear model, a variety of regression diagnostic tests are provided by the [car](#), [lmtest](#), [strucchange](#), [urca](#), and [sandwich](#) packages.

CRAN Task View: Empirical Finance

Maintainer: Dirk Eddelbuettel
Contact: Dirk.Eddelbuettel at R-project.org
Version: 2015-04-11

This CRAN Task View contains a list of packages useful for empirical work in Finance, grouped by topic.

Besides these packages, a very wide variety of functions suitable for empirical work in Finance is provided by both the basic R system (and its set of recommended core packages), and a number of other packages on the Comprehensive R Archive Network (CRAN). Consequently, several of the other CRAN Task Views may contain suitable packages, in particular the [Econometrics](#), [Multivariate](#), [Optimization](#), [Robust](#), [SocialSciences](#) and [TimeSeries](#) Task Views.

Contributions are always welcome, and encouraged. Since the start of this CRAN task view in April 2005, most contributions have arrived as email suggestions. The source file for this particular task view file now also reside in a GitHub repository (see below) so that pull requests are also possible.

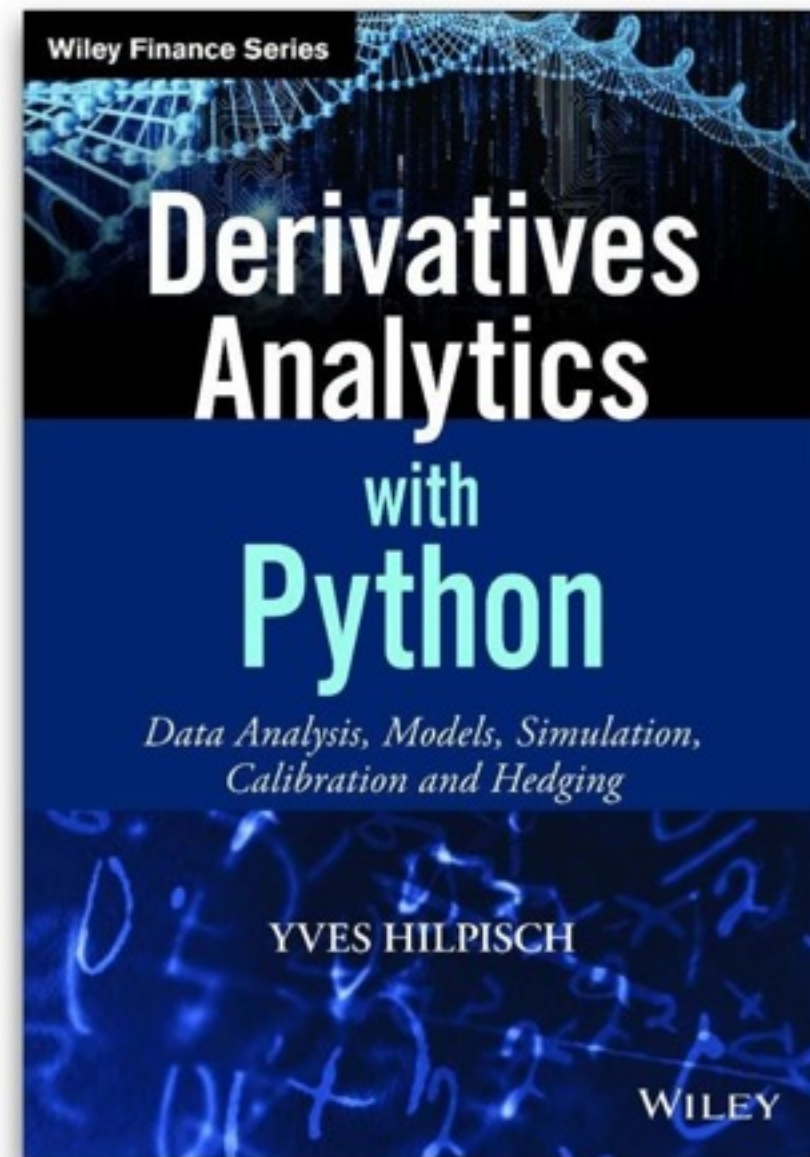
Standard regression models

- A detailed overview of the available regression methodologies is provided by the [Econometrics](#) task view. This is complemented by the [Robust](#) which focuses on more robust and resistant methods.
- Linear models such as ordinary least squares (OLS) can be estimated by `lm()` (from by the `stats` package contained in the basic R distribution). Maximum Likelihood (ML) estimation can be undertaken with the standard `optim()` function. Many other suitable methods are listed in the [Optimization](#) view. Non-linear least squares can be estimated with the `nls()` function, as well as with `nlme()` from the [nlme](#) package.
- For the linear model, a variety of regression diagnostic tests are provided by the [car](#), [lmtest](#), [strucchange](#), [urca](#), and [sandwich](#)

III. Educational Aspects

Books

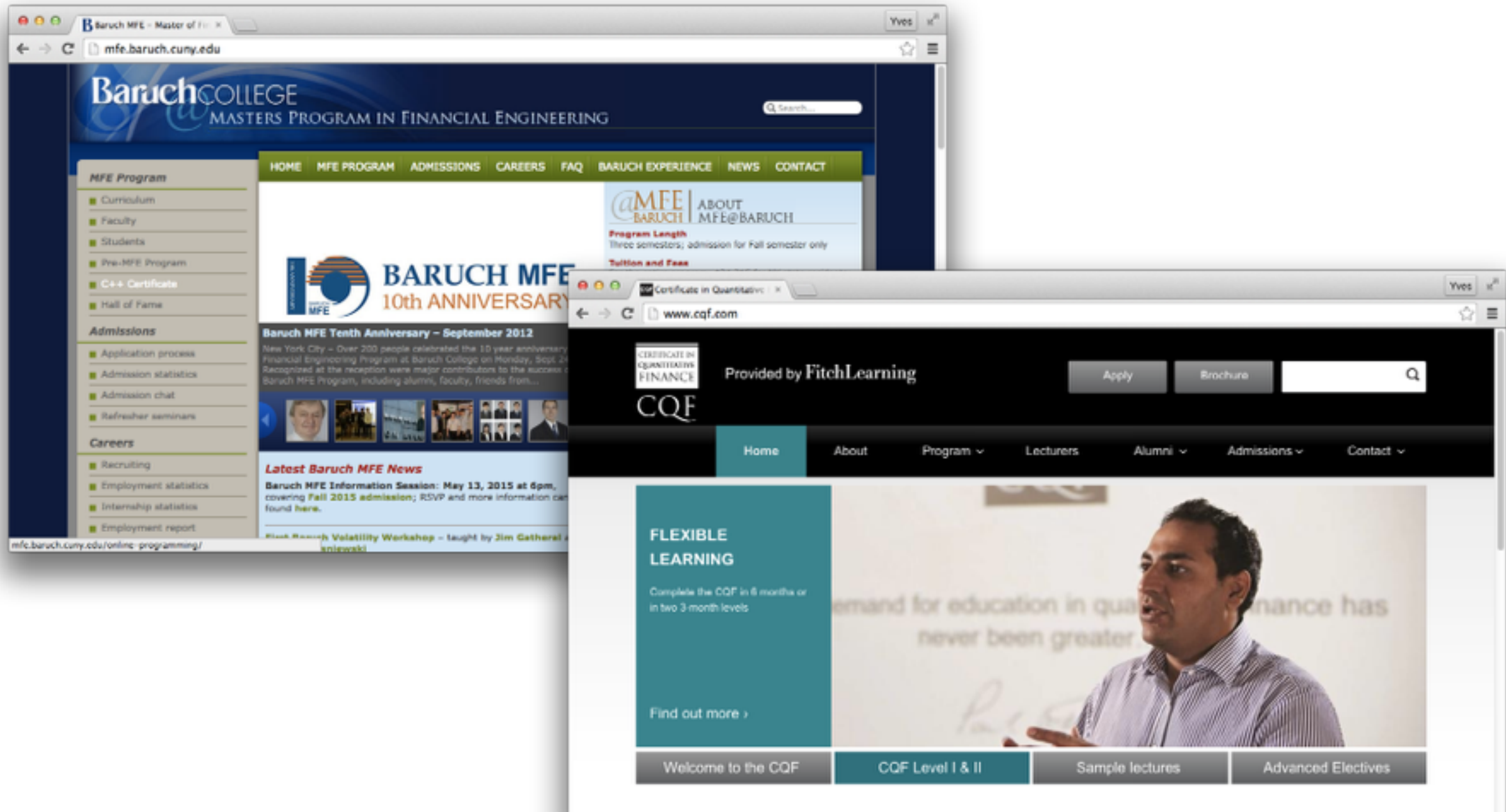
To make it easier to getting started



Third one in the making about “Listed Volatility and Variance Derivatives”.
Multiple others (e.g. about “Pandas for Finance”) now also available.

Education

Bringing formal education in this field to the next level



The Python Quants GmbH

Dr. Yves J. Hilpisch

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yves@tpq.io | [yves.hilpisch](#)

