Quantitative Tactics
Fixed Income Lab (QTFIL)

White Paper, June, 2009

Quantitative Tactics
Harlan Seymour, Principal
harlan@quantactics.com
+1.650.340.9200

BACKGROUND

We develop software to pinpoint **capital structure arbitrage** opportunities in the **fixed income** markets. The **Quantitative Tactics Fixed Income Lab (QTFIL)** maintains a database of over 10,000 actively traded **preferred stocks** and **corporate bonds**, analyzing them in real-time. It supports queries to rank the relative values of these instruments based on their analytics, with in-depth analysis of each instrument for further examination.

QTFIL tracks fixed income portfolios held in brokerage accounts, providing insight into current yields (by credit rating or by sector), past returns, ranking those instruments held by their relative values, allowing portfolios to be optimized over time for increased returns. The effect of yield curve changes on portfolio value can be simulated to get a view of the resultant risks (or rewards).

To calculate Equivalent Yield (EY) for a given instrument, with a given credit rating, QTFIL calculates its own yield indexes for both corporate bonds and preferred stocks.

QTFIL, developed in **C#**, runs as a **Windows service** with an **ASP.NET** web interface, and a **SQL Server** back-end. The software is in active use, but only privately. Potential business opportunities for QTFIL are under investigation, such as:\

- Integrated into an online brokerage website to give customers a new tool with which to analyze fixed income instruments (**Charles Schwab** has an initiative to increase its customers trading of corporate bonds).
- Used as a trading tool by hedge funds (or by other entities). According to the **WSJ** (Aug 30, 2007) hedge funds account for almost 30% of all bond trading.
- Used as the basis for a finance portal / paid subscription service, focusing on fixed income.

DATA SOURCES

QTFIL maintains a database of more than 10,000 preferred stocks and corporate bonds, pruning out inactive and retired instruments, and adding newly issued ones. It also monitors the health of the parent (issuing) companies in terms of their ability to pay a dividend stream.

QTFIL retrieves data from many sources each day after market close, merging the updates into the database. While the market is open it updates information about the active instruments in its database every 3 minutes, and in real-time whenever these instruments are examined by the web interface.

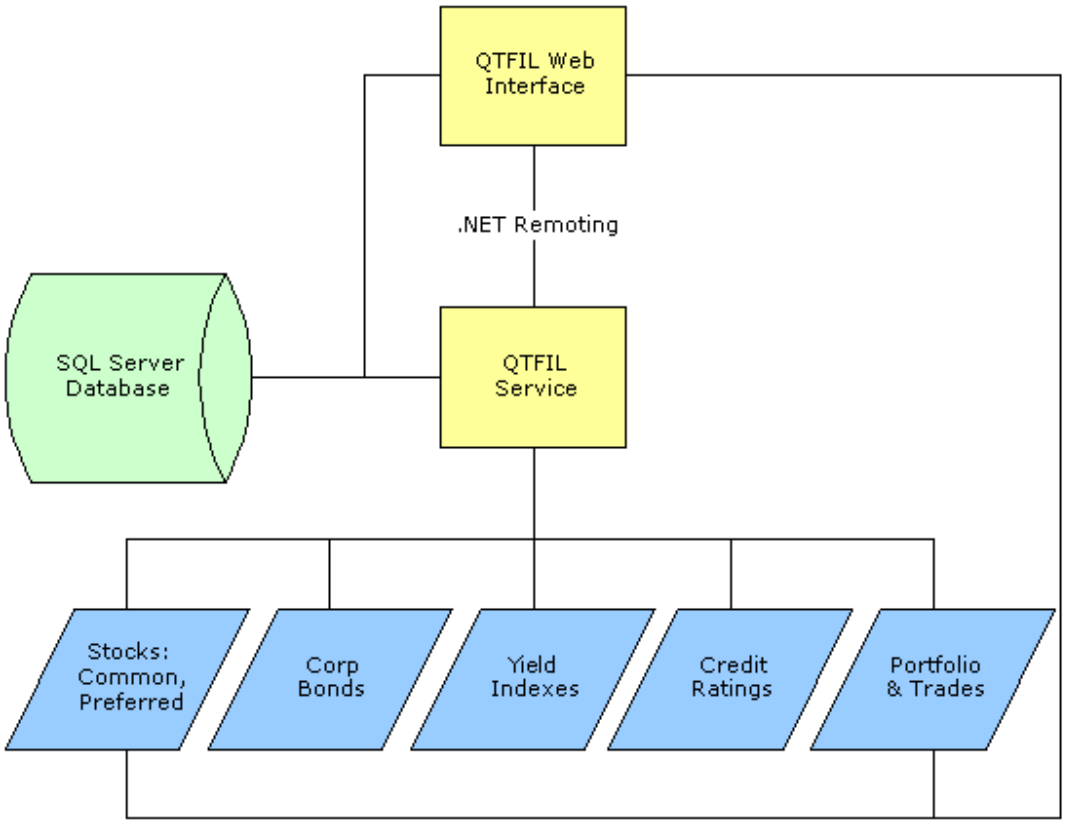


Figure 1: Overview of data sources and how they are used

Here is an overview of the data sources (as in the Figure 1, above):

SOURCE	DATA
Stocks: Common, Preferred	Quotes and historical data (both live and archived) provided by 3 data sources, for fail-over. Dividend history provided by 2 data sources. Profile information (sector, parent, etc.) from various sources.
Corporate Bonds	Daily bond quotes pulled from NASD. Live data source in development. Profile information (sector, parent, etc.) from various sources.

Yield Indexes	Treasury yields pulled from ustreas.gov (for comparison and risk-free yield). LIBOR rates retrieved for use with LIBOR-based variable rate instruments. Corporate bond indexes are pulled from Merrill Lynch.
Credit Ratings	Credit ratings of preferred stocks and corporate bonds averaged over 2 data sources.
Portfolio & Trades	Query portfolio (current and historical) and trade records from Interactive Brokers. Ability to import statements from various brokers.

INDEXES

Reliable indexes for Treasury yields and LIBOR rates, per maturity, are available from reliable sources like ustreas.gov. But, corporate bond yield indexes (per credit rating, or per maturity) from various sources (WSJ, etc.) were found to be non-comprehensive, and, in fact, in the case of corporate bonds, possibly inaccurate. Preferred stock yield indexes were found to be non-existent. Fixed income instrument yields are highly correlated with their credit ratings, so accurate yield indexes for comparing against are paramount.

Treasury Bills

Duration	Yield	1 Mo
3Mo	4.63 %	-0.39 %
1Yr	4.55 %	-0.45 %
5Yr	4.39 %	-0.47 %
10Yr	4.60 %	-0.37 %
20Yr	4.92 %	-0.23 %

As Of: 8/27/2007

LIBOR

Duration	Yield	1 Mo
1Mo	5.50 %	0.18 %
3Mo	5.49 %	0.13 %
6Mo	5.33 %	-0.07 %
1Yr	5.07 %	-0.36 %

As Of: 8/22/2007

Corporate Bonds

Rating	Yield	1 Day	1 Mo
Overall	6.13 %	0.01 %	0.04 %
AAA	5.53 %	0.11 %	-0.05 %
AA	5.77 %	0.02 %	-0.23 %
A	6.10 %	0.04 %	0.03 %
BBB	6.46 %	0.00 %	0.24 %

Preferreds

Rating	Yield	1 Day	1 Wk	1 Mo
Overall	7.02 %	-0.01 %	-0.23 %	0.00 %
AAA	6.09 %	0.00 %	-0.12 %	-0.18 %
AA	6.61 %	0.04 %	-0.19 %	-0.12 %
A	6.96 %	-0.02 %	-0.23 %	-0.02 %
BBB	7.52 %	-0.03 %	-0.27 %	0.17 %

Preferreds (15%)

Rating	Yield	1 Day	1 Wk	1 Mo
Overall	6.88 %	-0.01 %	-0.15 %	0.21 %
AAA	6.25 %	-0.03 %	-0.14 %	-0.06 %
AA	6.41 %	0.01 %	-0.10 %	0.03 %
A	6.61 %	0.01 %	-0.16 %	0.00 %
BBB	7.34 %	0.03 %	-0.11 %	0.44 %

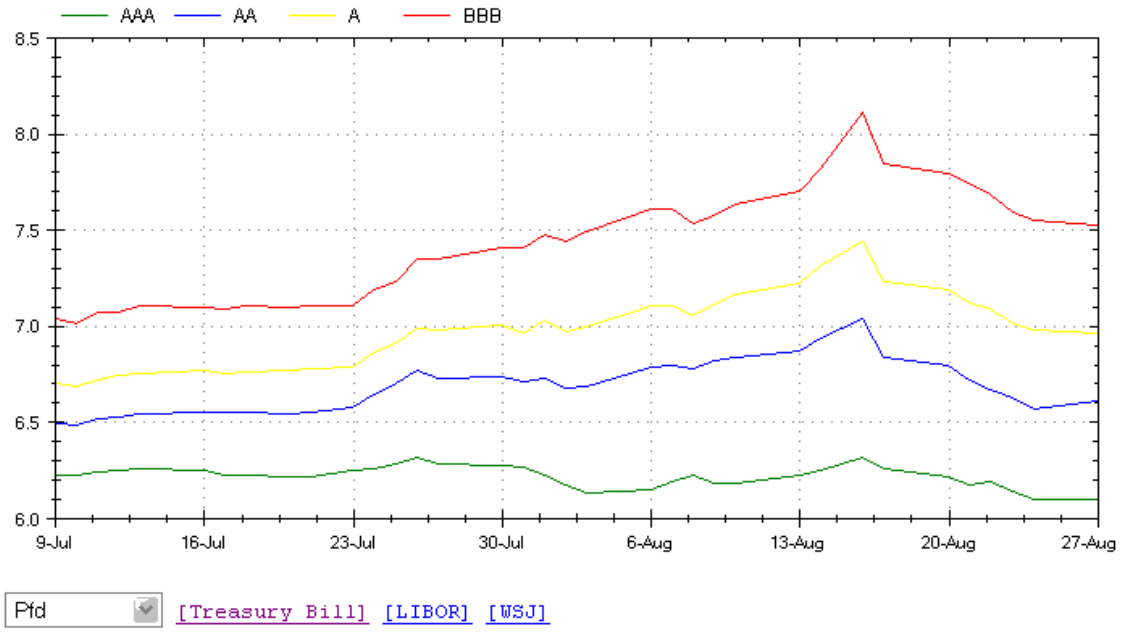


Figure 2: Yield indexes presented via the web interface

QTFIL calculates preferred stock and corporate bond indexes on a daily basis by taking sub-sections of its up-to-date database of more than 10,000 active instruments. These indexes are then interpolated (by fine-grained rating and term) to calculate Equivalent Yield (EY) for each instrument.

The instruments supported are categorized into these 3 types:

TYPE	DESCRIPTION
Preferred Stocks	Preferred stocks, excluding those that are tax advantaged.
Tax-Advantaged	Preferred stocks with qualified dividends taxed at the reduced

Preferred Stocks	federal rate of 15%.
Corporate Bonds	Fixed rate, “vanilla”, corporate bonds.

Tax-advantaged preferred stocks tend to trade at a significant premium and so earn a separate category. Note that their tax-advantaged status will expire at the end of 2010 if not further extended by Congress.

The credit ratings are categorized as follows:

RATING
AA
A
BBB
BB
B
Overall (Investment Grade: BBB- or higher)

Note: AAA instruments are no longer tracked in an index since there are too few of them, and BB and B indexes are now being tracked. Yields for sub-ratings (+ or -) are available via interpolation.

Corporate bonds are categorized ad-hoc into the following maturity ranges:

TERM	**RANGE**
Short	0-3 years maturity
Medium	3-9 years maturity
Long	9+ years maturity
Overall	All maturities

ANALYTICS

Prospecting the database for undervalued instruments consists of classification combined with powerful analytics. Some of the analytics used by QTFIL are standard for the fixed income arena, with a few custom analytics developed in an attempt to better dig out best values.

Instruments are categorized by parent (issuer) in the database since it is assumed that instruments from the same issuer should have the same risk of default (with potential post-default recovery varying somewhat based on the seniority of the debt). The “Parent Rating” metric is calculated based on common stock performance of the issuer:

Rating (0-10)	Calculated for each preferred stock and/or corporate bond issuer. Custom measure of ability of issuer to sustain dividends based on 5 metrics of the issuer’s common stock: Price Trend, Big Price Drop Avoidance, Dividend Regularity, Present/Future PE, Market Cap.

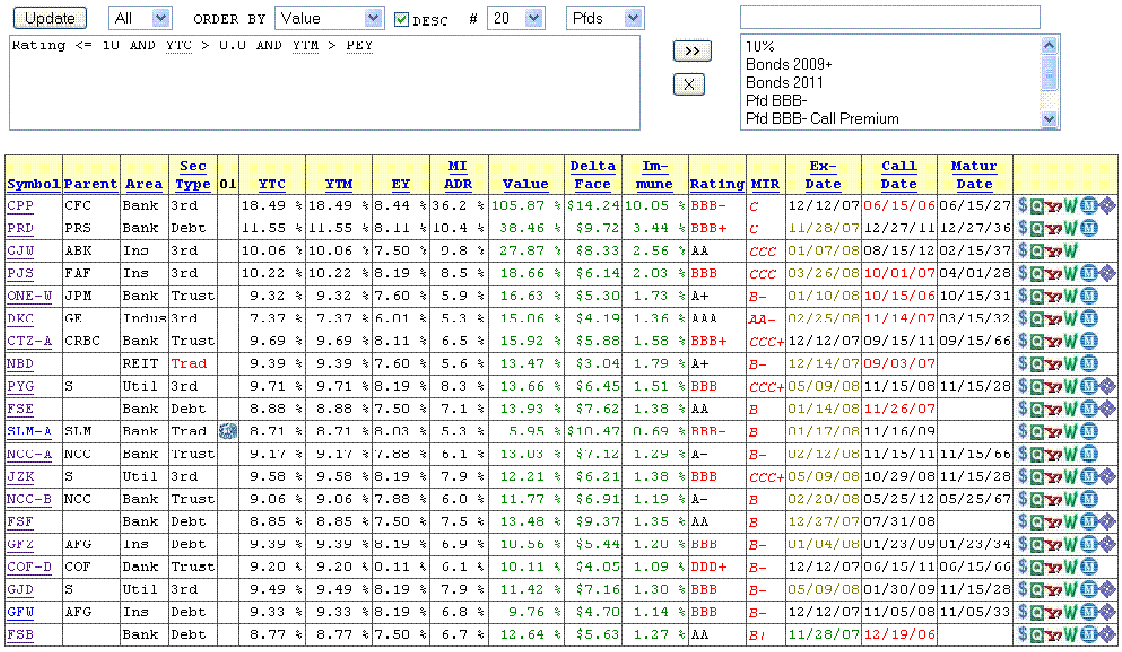
The database record of each instrument contains many fields to define and classify it, which in the interest of brevity are not listed, below. Here are the calculated analytics:

Delta Face	Delta of dirty price from face value. Used for preferred stocks where dirty price must be calculated (= Market Price + Retained Dividend).
EY	Equivalent yield. Average yield of basket of similar instruments, categorized by: type (Preferred, Preferred Taxed at 15%, Corp Bond) and rating (AAA, AA+, AA, AA-, etc.)
Immunity	YTM - EY. If positive, then market price should hold reasonably steady (be "immune" to dropping) until it dips below 0.00%.
Rating	Credit rating of instrument, displayed in Standard & Poor's format, averaged over ratings from multiple credit agencies.
MIR	Market-implied (credit) rating: calculated by matching an instrument's end-of-day YTC and YTM against the indexes ratings vs. yields graph.
Value	Custom measure of percent undervalued versus similar instruments (by type and rating). Best used for selecting most undervalued among a grouping (by parent, by rating, by type, etc.).
YTC	Yield-to-call. Note that if YTM > YTC, then YTM is used.
YTC2	Yield-to-2nd-call. Yield if call is delayed one dividend period past next call date. Note that if YTM > YTC2, then YTM is used.
YTM	Yield-to-maturity.
MIADR	Market implied annual default rate: break-even point vs. returns via risk-free rate (vs. T-Bill) if bankruptcy were to occur each year with probability MIADR (note that recovery rate per instrument type is estimated using historical data). MIADR is default risk as judged by the market.

Duration and Convexity for both call and maturity scenarios are also calculated, and used internally, but are not available in the web interface.

SCREENING

Screening is the querying of the database of fixed income instruments via the web interface to pull out an ordered subset (e.g. of most under-valued instruments via the "Value" analytic). Queries can be named and saved for re-use. The ordered subset is presented in tabular form:



Symbol	Parent	Area	Sec Type	01	YTC	YTM	FY	MI ADR	Value	Delta Face	Im-mune	Rating	MIR	Ex-Date	Call Date	Matur Date	
CPP	CFC	Bank	3rd		18.49 %	18.49 %	8.44 %	36.2 %	105.87 %	$14.24	10.05 %	BBB-	C	12/12/07	06/15/06	06/15/27	
PRD	PRS	Bank	Debt		11.55 %	11.55 %	8.11 %	10.4 %	38.46 %	$9.72	3.44 %	BBB+	C	11/28/07	12/27/11	12/27/36	
GJW	ABK	Ins	3rd		10.06 %	10.06 %	7.50 %	9.8 %	27.87 %	$8.33	2.56 %	AA	CCC	01/07/08	08/15/12	02/15/37	
PJS	FAF	Ins	3rd		10.22 %	10.22 %	8.19 %	8.5 %	18.66 %	$6.14	2.03 %	BBB	CCC	03/26/08	10/01/07	04/01/28	
ONE-W	JPM	Bank	Trust		9.32 %	9.32 %	7.60 %	5.9 %	16.63 %	$5.30	1.73 %	A+	B-	01/10/08	10/15/06	10/15/31	
DKC	GE	Indus	3rd		7.37 %	7.37 %	6.01 %	5.3 %	15.06 %	$4.19	1.36 %	AAA	AA-	02/25/08	11/14/07	03/15/32	
CTZ-A	CREC	Bank	Trust		9.69 %	9.69 %	8.11 %	6.5 %	15.92 %	$5.88	1.58 %	BBB+	CCC+	12/12/07	09/15/11	09/15/66	
NBD		REIT	Trad		9.39 %	9.39 %	7.60 %	5.6 %	13.47 %	$3.04	1.79 %	A+	B-	12/14/07	09/03/07		
PYG	S	Util	3rd		9.71 %	9.71 %	8.19 %	8.3 %	13.66 %	$6.45	1.51 %	BBB	CCC+	05/09/08	11/15/08	11/15/28	
FSE		Bank	Debt		8.88 %	8.88 %	7.50 %	7.1 %	13.93 %	$7.62	1.38 %	AA	B	01/14/08	11/26/07		
SLM-A	SLM	Bank	Trad		8.71 %	8.71 %	8.03 %	5.3 %	5.95 %	$10.47	0.69 %	BBB-	B	01/17/08	11/16/09		
NCC-A	NCC	Bank	Trust		9.17 %	9.17 %	7.88 %	6.1 %	13.03 %	$7.12	1.29 %	A-	B-	02/12/08	11/15/11	11/15/66	
JZK	S	Util	3rd		9.58 %	9.58 %	8.19 %	7.9 %	12.21 %	$6.21	1.38 %	BBB	CCC+	05/09/08	10/29/08	11/15/28	
NCC-B	NCC	Bank	Trust		9.06 %	9.06 %	7.88 %	6.0 %	11.77 %	$6.91	1.19 %	A-	B	02/20/08	05/25/12	05/25/67	
FSF		Bank	Debt		8.85 %	8.85 %	7.50 %	7.5 %	13.48 %	$9.37	1.35 %	AA	B	12/27/07	07/31/08		
GPZ	AFG	Ins	Debt		9.39 %	9.39 %	8.19 %	6.9 %	10.56 %	$5.44	1.20 %	BBB	B-	01/04/08	01/23/09	01/23/34	
COF-D	COF	Bank	Trust		9.20 %	9.20 %	8.11 %	6.1 %	10.11 %	$4.05	1.09 %	DDD+	B-	12/12/07	06/15/11	06/15/66	
GJD	S	Util	3rd		9.49 %	9.49 %	8.19 %	7.9 %	11.42 %	$7.16	1.30 %	BBB	B-	05/09/08	01/30/09	11/15/28	
GFW	AFG	Ins	Debt		9.33 %	9.33 %	8.19 %	6.8 %	9.76 %	$4.70	1.14 %	BBB	B-	12/12/07	11/05/08	11/05/33	
FSB		Bank	Debt		8.77 %	8.77 %	7.50 %	6.7 %	12.64 %	$5.63	1.37 %	AA	B!	11/28/07	12/19/06		

Figure 3: Screening via the web interface
(Please zoom image for a more detailed view)

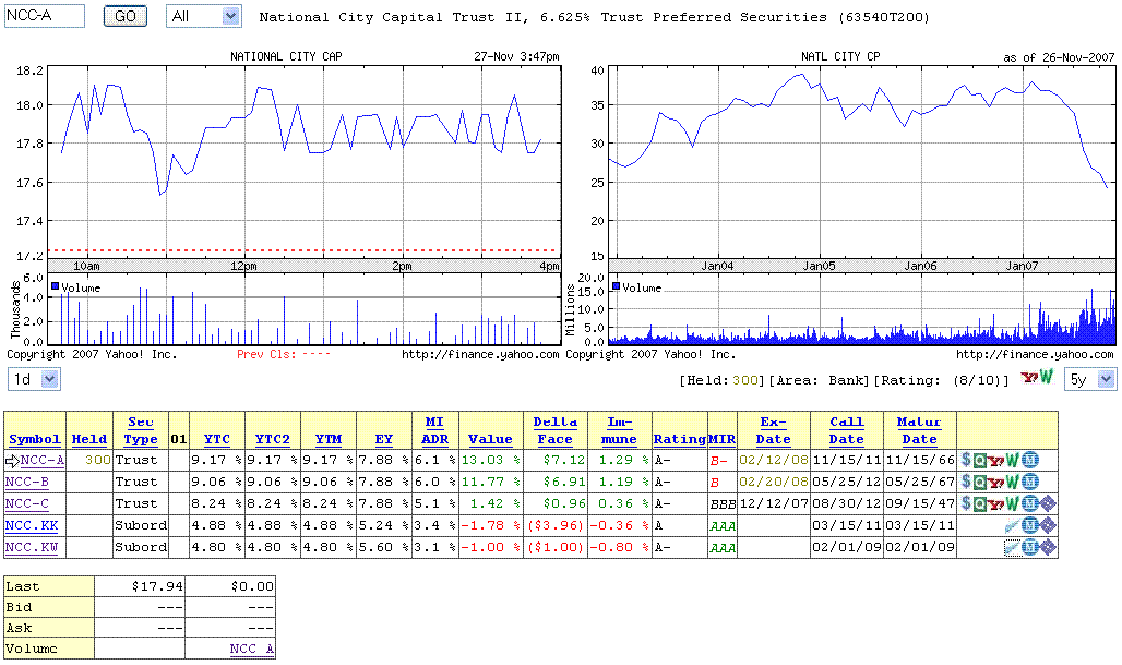
Many cell values are color-coded and provide hotlinks to further information. It is left to the User's Manual (to be developed) to define the meaning of each and every color and hotlink jump-to-location.

The ordered subsets can be sub-ordered in the web interface by clicking on the column headers. For example, you could sort the Value subset by YTC. The symbol field is clicked to further investigate a particular instrument – this brings up the Dashboard.

DASHBOARD

The dashboard is an overview of the selected instrument, with the following elements:

- Chart of the instrument (top-left)
- Chart of the issuer (top-right)
- Shares from issuer held and its "Rating" (middle-right)
- Table of instruments from the issuer of the selected instrument (middle)
- Real-time quote (at bottom) updated every 5 seconds (lower-left)



Symbol	Held	Sec Type	01	YTC	YTC2	YTM	EY	MI ADR	Value	Delta Face	Im-mune	Rating	MIR	Ex-Date	Call Date	Matur Date
NCC-A	300	Trust		9.17 %	9.17 %	9.17 %	7.88 %	6.1 %	13.03 %	$7.12	1.29 %	A-	B-	02/12/08	11/15/11	11/15/66
NCC-B		Trust		9.06 %	9.06 %	9.06 %	7.88 %	6.0 %	11.77 %	$6.91	1.19 %	A-	B	02/20/08	05/25/12	05/25/67
NCC-C		Trust		8.24 %	8.24 %	8.24 %	7.88 %	5.1 %	1.42 %	$0.96	0.36 %	A-	BBB	12/12/07	08/30/12	09/15/47
NCC.KK		Subord		4.88 %	4.88 %	4.88 %	5.24 %	3.4 %	-1.78 %	($3.96)	-0.36 %	A	AAA		03/15/11	03/15/11
NCC.KW		Subord		4.80 %	4.80 %	4.80 %	5.60 %	3.1 %	-1.00 %	($1.00)	-0.80 %	A-	AAA		02/01/09	02/01/09

Last	$17.94	$0.00
Bid	---	---
Ask	---	---
Volume		NCC A

Figure 4: Dashboard via the web interface of instruments from the same issuer
(Please zoom image for a more detailed view)

There is some programmability with combo boxes to change the date-range of the charts, and to just view preferred stocks or corporate bonds or both. The icons in the far-right field of the table are hyperlinked:

Auto-Trade	$	Jumps to QTFIL's auto-trade page
Quantum Online	Q	Contains detailed information on preferred stocks
Yahoo! Finance	Y!	Finance portal for stocks
MarketWatch	W	Finance portal for stocks
Moody's	M	Moody's opinion on the instrument
NASD Bond Info		Contains detailed information on corporate bonds

The selected instrument in Figure 4 is National City Capital (NCC) Preferred-A (NCC-A). All preferred stocks and corporate bonds issued by NCC, along with their analytics, are presented in the table. Based on the "Value" score the preferred stocks are more attractive than the corporate bonds, with NCC-A and NCC-B more-or-less equally valued, and NCC-C less so.

Ex-dividend dates (for preferred stocks only) and next call dates are presented since these must be given careful consideration before trading an instrument. In this release QTFIL only supports the pinpointing and analysis of relatively undervalued instruments – trade orders must be manually submitted to your broker, i.e. QTFIL is not an ATS (automated trading software) or manually scheduled for auto-trading.

PORTFOLIO SIMULATION

QTFIL calculates overall portfolio yield, and the yields of portfolio tranches by credit rating and by sector. It also calculates the distribution of the portfolio by credit rating and sector, making it easy to re-distribute the portfolio as desired by credit rating and/or sector.

A fixed income portfolio's value is very sensitive to changes in the yield curve, with a large increase in the yield curve causing a dramatic percent change decrease in an (un-hedged) portfolio's value. QTFIL allows yield curve delta, varying by grade, to be input and corresponding percent change in portfolio value to be calculated for simulation purposes.

All Account: All

Yields by Rating

	Held %	Yield %
All	100.00 %	8.38 %
AAA	0.00 %	0.00 %
AA	24.31 %	7.85 %
A	40.10 %	8.01 %
BBB	27.64 %	8.87 %
Junk	7.95 %	10.09 %

Yields by Sector

	Held %	Yield %
Bank	61.48 %	8.13 %
Indus	2.13 %	9.36 %
Ins	22.51 %	8.49 %
Media	4.52 %	9.51 %
REIT	6.35 %	9.02 %
Util	3.00 %	8.73 %
UNK	0.00 %	0.00 %

Percent Changes

	Yield Δ%	Percent Δ%	Duration
All		2.68 %	12.60
AAA	0.00	0.00 %	0.00
AA	-0.10	1.33 %	13.31
A	-0.20	2.68 %	13.40
BBB	-0.30	3.42 %	11.40
Junk	-0.40	4.25 %	10.62

Update

Figure 5: Portfolio yields and percent changes in portfolio value induced by yield curve changes via the web interface

Duration of a fixed income instrument with an embedded call option is non-trivial to calculate. If the callable instrument is trading well over face (or, better, the "dirty" value), then the call date can be used as the maturity date, and the duration is shorter-term. A callable instrument trading well under face makes the call option mostly irrelevant making the duration calculation is straightforward.

If the change in the yield curve causes the instrument's price cross the threshold between being above or below face, then the duration is a weighted average of the call duration and maturity duration. QTFIL takes this into account when calculating overall and by-grade portfolio duration (see *Figure 5*).

PORTFOLIO ANALYSIS

QTFIL keeps track of transactions and portfolio contents. Brokerage statements are imported periodically, via the web interface, into the database. If a broker provides an API to monitor transactions and portfolio contents (as does Interactive Brokers) then the API can be used to automatically stay up-to-date.

The portfolio can be screened to find overvalued instruments to sell and undervalued instruments to buy (see *Screening*). Past performance can be analyzed for custom date ranges via the web interface:

Symbol	#	Start Date	Start Price	End Date	End Price	Days	Divs	Delta	Profit	Profit %	Annual %
ABW-A	200	03/22/07	$25.12		$25.15	10		($0.03)	$0.02	0.10 %	3.63 %
CFC-A	300	03/26/07	$24.41		$24.26	6	$0.4219	$0.23	$0.27	1.09 %	66.51 %
CFC-B	200	03/14/07	$24.12	03/19/07	$24.48	6		$0.34	$0.35	1.45 %	88.27 %
CHZ-A	200	03/26/07	$25.60		$25.11	6	$0.5000	($0.04)	$0.00	0.02 %	1.19 %
CIL	200	03/20/07	$25.62		$25.78	12		$0.09	$0.16	0.60 %	18.40 %
CTZ-A	200	03/22/07	$25.70		$25.80	10		$0.04	$0.10	0.37 %	13.49 %
GPE-W	300	03/23/07	$25.48		$25.11	9	$0.4453	$0.02	$0.07	0.28 %	11.19 %
KCV	300	03/26/07	$24.97		$24.99	6		($0.02)	$0.01	0.06 %	3.65 %
KOS	300	03/26/07	$25.11		$25.15	6		$0.01	$0.03	0.14 %	8.48 %
KTP	200	03/20/07	$25.84		$25.85	12		($0.06)	$0.01	0.02 %	0.59 %
KVZ	200	03/13/07	$25.15		$25.25	19		$0.00	$0.10	0.38 %	7.26 %
MJT	300	03/29/07	$25.02		$25.00	3		($0.04)	($0.02)	-0.10 %	-12.16 %
ONB-B	300	03/26/07	$25.33		$25.36	6		($0.01)	$0.03	0.10 %	6.00 %
PRD	200	03/13/07	$24.77	03/29/07	$24.96	17	$0.4375	$0.54	$0.62	2.49 %	53.52 %
PYS	200	03/13/07	$22.78	03/19/07	$23.31	7		$0.50	$0.52	2.28 %	119.03 %
RE-A	500	03/22/07	$25.42		$25.54	10		$0.06	$0.11	0.45 %	16.51 %
TDA	200	03/26/07	$25.23		$24.97	6	$0.4750	$0.17	$0.21	0.83 %	50.63 %
WPD	300	03/26/07	$25.32	03/30/07	$24.95	5	$0.4344	$0.04	$0.05	0.21 %	15.68 %
WSF	100	03/08/07	$25.12	03/12/07	$25.14	5		$0.00	$0.00	0.00 %	0.00 %
XKY	100	03/14/07	$25.11		$25.20	18	$0.1936	$0.19	$0.27	1.09 %	22.10 %
(total)	0					24				1.42 %	21.54 %

Update At End: All

From: 3 / 1 / 2007 To: 3 / 31 / 2007

Figure 6: Portfolio performance analysis via the web interface

Performance measuring takes into account dividends received and retained dividends (for preferred stocks) at the starting and ending dates specified. Consumer financial software programs like Quicken® commonly do not take dividends (distributed and/or retained) into account when evaluating portfolio performance.

Here are 4 per-instrument portfolio metrics calculated:

Delta	= (End Price + Retained at End) – (Start Price + Retained at Start) – Commission(s). For preferred stocks only, retained dividend at start and end are non-zero in the formula.
Profit	= (End Price + Dividend) – Start Price – Commission(s). The Dividend is composed of both the distributed dividend(s) and change in retained dividend (for preferred stocks).
Profit %	Profit % over time period.
Delta	Profit % over time period on an annualized basis.

“Delta” measures whether the instrument has appreciated in price, ignoring dividends (distributed and/or retained). If strongly positive, then the instrument’s value has appreciated, and may be a sell-side candidate.

MAINTENANCE

QTFIL can query Interactive Broker's Trader Workstation on a daily basis to keep track of transactions, but occasionally actual ActivityFlex statements should be loaded in. Also, the loading of statements (to obtain positions only) exported from Schwab or Fidelity positions page is supported.

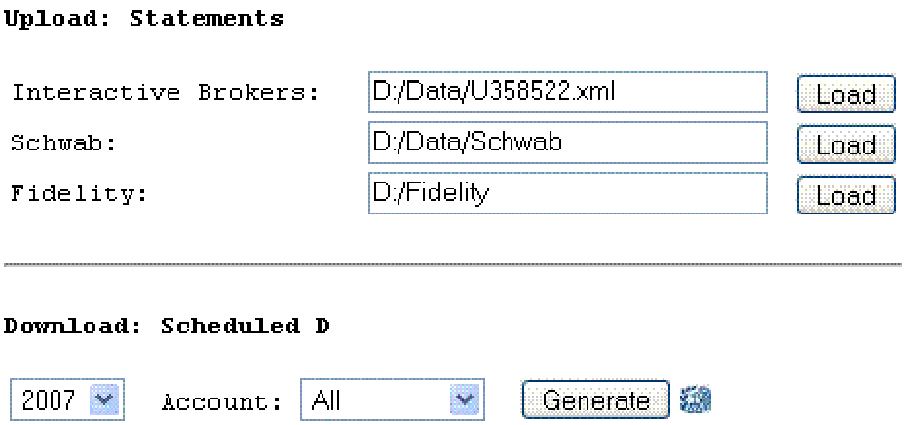


Figure 8: Maintenance via web interface

For Interactive Brokers accounts all Schedule D activity is tracked so that it can be automatically generated for a given tax year or account.

Beneath the hood (i.e., not yet available to the web interface) more things are tracked:

- Called securities (how and when the were called)
- All levels of logging (Alert, Fatal, Error, Warning, Success, Info, Debug)

DEVELOPMENT NOTES

Since it may be of interest to merge or integrate all or parts of QTFIL into another software product, or for QTFIL itself to be integrated into as the base product, an overview of the software is provided here. This section is of interest to software developers.

ENVIRONMENT

QTFIL is developed using Microsoft C# and .NET 2.0. The database is Microsoft SQL Server 2005. A simple web interface is developed using ASP.NET 2005.

All analytics and data source management are implemented within a logical set of .NET assemblies, so that they can be shared between the service, ASP.NET web interface, command line utility, etc. Assemblies implemented:

Name	Uses	Description
Utils		Miscellaneous utilities (logger, reporting, settings, etc.) along with interfaces for data source and portfolio management.
OT	Utils	Data API interfacing to opentick's opfeed API
IB	Utils	Data, trading and portfolio API interfacing to Interactive Broker's TWSAPI.
Yahoo	Utils	Data API interfacing to Yahoo's market data
QT	Utils, OT, IB, Yahoo	Core logic with more data feeds, analytics, portfolio management, database interface, etc.
Render	Utils	Generic web rendering functionality.

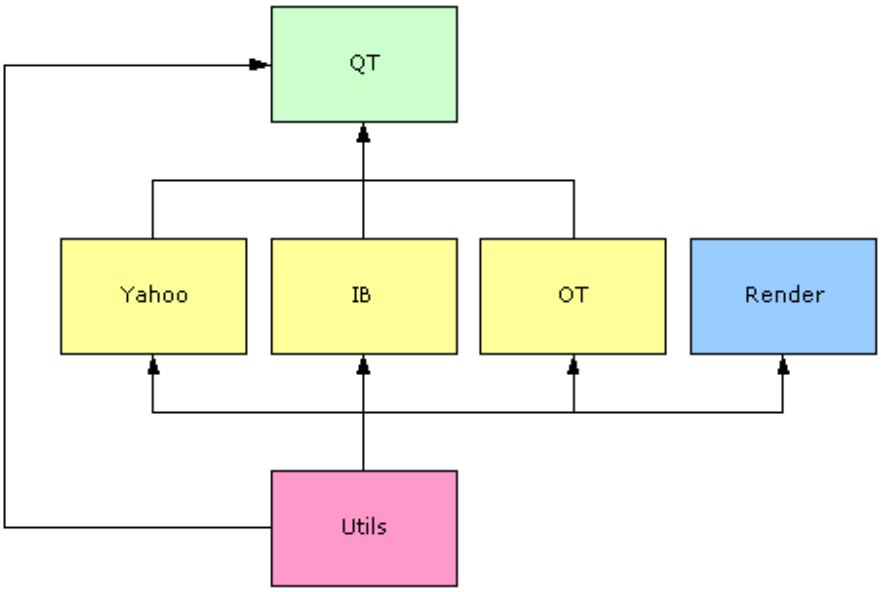


Figure 6: Overview of QTFIL .NET assemblies and their dependencies.

Non-graphics 3rd party components used:

NINI 1.1	Used to store manage settings in an .INI file
IBJWrapper 9.2	J#.NET wrapper for socket-based interface to Interactive Broker's TWSAPI 9.2.
otfeed_net	opentick's .NET API (NOTE: OpenTick has been closed)
Webcab Bonds v2.0	Used to calculate YTM, Duration, Convexity, etc.
Webcab Probability and Statistics 3.6	Used for regressions, etc.

Graphics 3rd party components used:

Anthem.NET 1.5	AJAX for dynamic update of some web pages
ZedGraph 5.1	For generating yields graphs, etc.

Some unit tests that are run with NUnit 2.0 have been developed to automatically unit test some analytics.

QTFIL Service

The QTFIL service schedules database maintenance activities at intervals specified by a database table. As currently configured, while markets are open, it updates prices and analytics (YTM, etc.) every 5 minutes.

Once per day, after market close, it downloads data from a variety of sources, updates analytics and calculates yields indexes (based on the day's final analytics). It also uses the portfolio API to download the day's transactions and reconciles the portfolio.

Parent ratings (which require regression of historical data) and credit ratings are updated on a weekly basis. Any activity that the service can be scheduled to run can also be manually invoked using a command-line utility.

QTFIL Web Interface

The main job of the web interface is to query the database and display results in a rich manner (like creating a graph of daily indexes).

Date ranges can be specified when examining portfolio performance, and in this case the web interface must not just display, but also massage data to calculate individual and overall performance.

The web interface recalculates up-to-the-moment analytics for displayed data using AJAX callbacks. Only drilled-down instruments have their analytics recalculated in real-time. Normally, the service updates all instruments every 15 minutes.

The web interface is intentionally primitive at this point since the emphasis has been on the QTFIL engine development. Raw SQL queries to the database via a SQL query tool can also be made to display results and manage the database. Since the engine is componentized it would be straightforward to develop a Windows forms based interface.