Stock/ETF Portfolio Rebalancer

File   Edit   Colors   Options   Help

1. Select Currency   US Dollar
2. Find Workbooks   Book1
3. Select Worksheet   Sheet1   Ticker Column A   First Row 2
Cash Available: 960,815.10   Target Weight Column B   Read Data
Total Invested: 26,587.10   Trades: Required: 7 Left: 200
Additional Amount 0   Recalc   Trade   Net Cash Outflow: 8,045.46

Numerics   Chart

Include	Ticker/Name	Position	Last Value	Raw Weight	Target Weight	New Position	New Value	New Weight	Net Trade	Cash Required	Transaction Cost	Spread Impact	Total Impact
☑	AXP	30	2,729.10	0.10265	0.2000	58	5,276.26	0.19845	28.00	2,547.16	9.95	0.00%	0.39%
☑	BA	0	0.00	0.00000	0.1000	19	2,668.74	0.10038	19.00	2,668.74	9.95	0.00%	0.37%
☑	CAT	0	0.00	0.00000	0.0500	15	1,371.60	0.05159	15.00	1,371.60	9.95	0.00%	0.73%
☑	CSCO	0	0.00	0.00000	0.0000	0	0.00	0.00000	0.00	0.00	0.00	0%	0%
☑	CVX	200	23,858.00	0.89735	0.0000	0	0.00	0.00000	-200.00	-19,930.71	19.90	0.00%	0.08%
☑	DD	0	0.00	0.00000	-0.1000	-42	-2,688.84	-0.10113	-42.00	1,344.42	9.95	0.00%	0.37%
☑	DIS	0	0.00	0.00000	0.7500	270	19,974.60	0.75129	270.00	19,974.60	9.95	0.00%	0.05%

FTS Real Time Client: Equity Portfolio Rebalancer

Many portfolio management exercises require rebalancing. Examples include

- Portfolio diversification and asset allocation
- Indexation
- Trading strategies that move in and out of different stocks based on a trading rule

When you are rebalancing a portfolio it is important to understand the costs involved. These costs come in different forms:

- Pure transaction costs, e.g. a fixed amount or a variable amount per trade
- "Spread" costs, which are the effect on the value of the position due to the bid ask spread
    - Unlike transaction costs, the impact of the spread is not realized unless you reverse the position.
    - However, the spread affects the current market value of your portfolio.

Besides transactions costs, trading can require additional money, not just for buying and selling and transactions costs, but also for example when you short sell.

In this document, we first explain the *costs* of rebalancing your portfolio from its current position to a new one, and show you how to calculate the *cash required* to finance the trades. Then we introduce you to the **Equity Portfolio Rebalancer** (**EPR**) of the FTS Real Time Client. The EPR calculates the costs and cash flows that will be involved in rebalancing your portfolio. It also lets you automatically execute the trades necessary for the rebalancing. This makes it easy for you see at a glance, both visually and numerically, what the trades will cost, and greatly simplifies trade execution.

Background

Let w_i denote the target weight of the i'th stock.

We require that $\sum w_i = 1$. This means that you cannot have only short positions. If the sum of weights is positive but not equal to 1, the **EPR** adjusts all the weights so they sum to 1.

Let c_i be the current weight of the i'th stock in your portfolio.

If $w_i \neq c_i$ then a trade is required. But trading is costly (due to transactions costs as well as the bid ask spread), so you may not want to trade if w_i is close to c_i. And determining the cash required for the trade can be complicated.

Since prices change in real time, we "freeze" the calculation of the c_i at a point in time. This allows you to actually do the calculations and implement the trades. It is too much of a moving target if the c_i change all the time and if the number of shares to be traded change all the time. In the **EPR**, you can recalculate everything by clicking a button at any time.

- Even then, you will typically not be able to get exactly to your target weights because you can only buy or sell an integer number of shares.

How do we calculate the number of shares to trade? The textbook answer is the following:

- Suppose the total amount you want to invest is T. Then, $n_i = w_i * T / p_i$ where p_i is the price of the i'th stock and n_i denotes the number of shares.
    - Since the number of shares has to be an integer, we round this to the nearest integer; this may be zero if the weight is small and the stock price is large.
    - This also affects T as you will see in the example below.
    - It also means that you may not be able to get exactly to the w_i as you will see below.

But what is the total amount T? It is specified it in two parts:

First, we multiply your current holding of a stock by its price, and sum these values. We call this the "Invested Value." If this number is negative, you must add more money to rebalance. Second, we add (or subtract if it is a negative value) any "Additional Amount" you want to invest. The Additional Amount can be negative as long as the total amount is positive.

So now we know the number of shares of each stock. We then do the minimum trade to get from the current position to the new position and tell you how much cash will be needed. This is different from the total amount T: it includes transaction costs, the effect of the bid-ask spread, and also the cash requirements of short selling if any weight is negative. This cost of implementing the trade is shown to you. It helps you decide whether you want to actually execute the trades. For example, if you have many small adjustments, you may decide to only trade the stocks requiring large changes. Since you are shown the number of stocks to trade, you can even trade these manually.

Example 1: small T

Suppose there are 3 stocks, with

	Current Position	Price	Current Weight	Target Weight	New Position	Actual New Weight
Stock 1	10	20	1.4285	.2	1	0.154
Stock 2	-2	30	-0.4285	.2	1	0.230
Stock 3	0	40	0	.6	2	0.615

Suppose you don't want to invest any additional amount so $T = 10*20 - 2*30 = 200 - 60 = 140$.

So $w_1 = 200/140 = 1.4285$ and $w_2 = -0.4285$

The new position is calculated as follows.

- For stock 1, $n_1 = 0.2*140/20 = 1.4$ which is not "near" either 1 or 2; we rounded it down to 1.
- For stock 2, $n_2 = 0.2*140/30 = 0.9333$ which is "close" to 1.
- For stock 3, $n_3 = 0.6*140/40 = 2.1$ which is "near" 2.

If you do this, the actual amount invested is 130, not 140, and the actual weights are not equal to the target weights, buts they are as close as you can get.

- If you decided to hold 2 shares of stock 1, your total investment would be 150 and the weights would be 0.266, 0.2, and 0.533 respectively.

Example 2: Large T

Suppose you decide to invest an extra 100,000, so $T = 140+100,000 = 100,140$. We now get:

	Current Position	Price	Current Weight	Target Weight	New Position	Actual New Weight
Stock 1	10	20	1.4285	.2	1001	0.1999
Stock 2	-2	30	-0.4285	.2	668	0.200
Stock 3	0	40	0	.6	1502	0.5999

The new positions are:

- For stock 1, $n_1 = 0.2*100140/20 = 1001.4$, so 1001
- For stock 2, $n_2 = 0.2*100140/30 = 667.6$, so 668
- For stock 3, $n_3 = 0.6*100140/40 = 1502.1$, so 1502

The actual amount invested is 100140, and the weights are very close to the target weights. So investing a large amount reduces the error associated with integer quantities.

Example 3: The cost of trading

Let's continue with the data in example 2 and see what happens if when you execute the trade.

- Stock 1: we have to buy 1001-10 = 991 shares. This will cost 991*20=19,820. There will also be a transaction cost. This cost is $9.95 for the FTS US equities cases; for other countries, the costs are about the same value in the local currency. We will use 9.95 in this example.
- Stock 2: we have to go from a short position to a long position. This means that we first have cover the short position (buy two stocks) and this releases the deposits associated with our short sale.
    - Specifically: suppose the short sale margin is 50%. This means that when you short sell, the value of the sale is held and an additional 50% of the value must be deposited. If prices rise and the deposit amount falls too far below 50% of the current value, then you have to deposit more money. If prices fall enough, you get some of the deposit back.
    - If you short sold at 25, then 25*2 = 50 is held, and you would have had to put up an additional 25 as a deposit. When the price changed to 30, the deposit would have changed as well, to 30, and you would have put up an additional 5 to keep your deposit at 50% of the value. Let's suppose this is what happened.
    - Now, you buy 2 shares at 30, these cost you 60. You get back 50+30=80, so a net *addition of 20*. You also have to pay the transaction cost for covering the short position.
    - Finally, we have to buy 668 shares at 30 each, again with the transaction cost.
    - If the transaction cost is 9.95, the cash required would be:
        - (+20 – 9.95) – (668*30 – 9.95)
- Stock 3 is simple: you just buy 1502 stocks at 40, these cost you 60080 and you pay the transaction cost.

Summary of cash:

- Stock 1: -19820-9.95 to buy the stocks
- Stock 2: (+20 – 9.95) – 668*30 – 9.95 to cover the short and then buy the stocks
- Stock 3: -60080-9.95 to buy the stocks
- Total cash outflow: 99959.8
    - Another way to see this is
        - The 3 purchases cost 99940 = 991*20+668*30+1501*40
        - The three transaction costs for these trades were 9.95*3 = 29.85
        - The total so far is 99969.85
        - We got back 20 from covering the short sale but paid another 9.95, a net of 10.05
        - Subtract 10.05 from 99969.85 to get 99959.8

A note on margin trades

The EPR currently does not let you buy on margin. If you already have a margin position and want to decrease that position, it will sell that position (and calculate the associated cash flows). But to increase

that position, you will have to make cash purchases. This is not too limiting: you can always increase the margin position in the normal way and then re-run the equity portfolio balancer for the remainder of the trades.

The Equity Portfolio Rebalancer (EPR)

The EPR is currently only available in the Windows version of the FTS Real Time Client. To use it, you will need an Excel workbook with tickers in one column and target portfolio weights in another column, such as the one shown below.

- It does not have to include all the stocks in the trading case
- The target weights have to sum to 1 only within the set of tickers you use
  - It works by currency, i.e. you can rebalance equities that are traded in a specific currency, and those weights have to sum to 1. This is useful for cases such as the Global Equities case.
- Invalid tickers are ignored
- Equities that cannot be traded and indexes are ignored
- Securities that are not stocks or ETF's are ignored
- You can copy tickers easily from the ticker window and paste them into Excel to get started
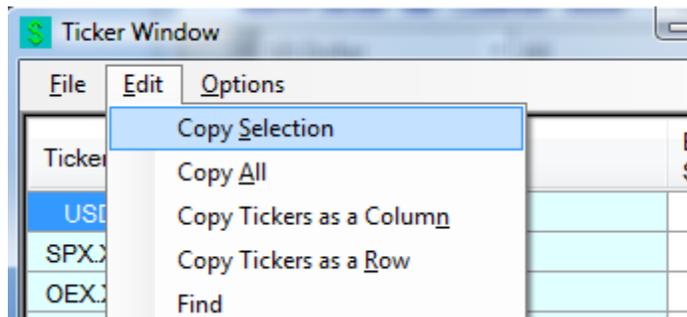
  - Just delete the tickers that are indexes, not a stock or ETF, or any ticker you don't want to rebalance

A sample Excel workbook then looks like this, and you should use the headers for the columns as shown:

The **EPR** is accessed from near the top of the main screen after you log in:
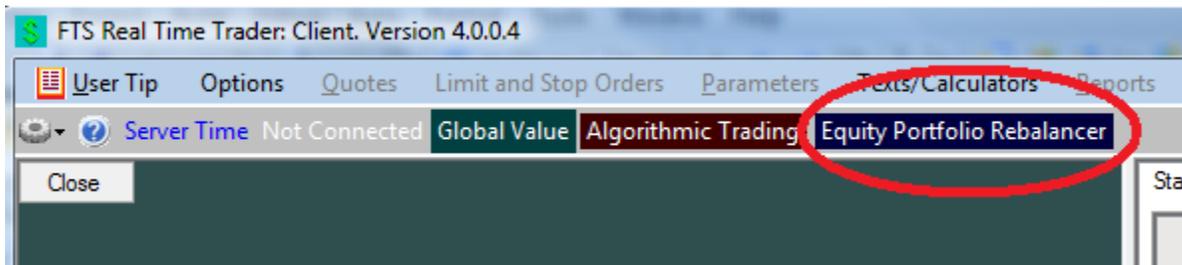
Click it to bring up:
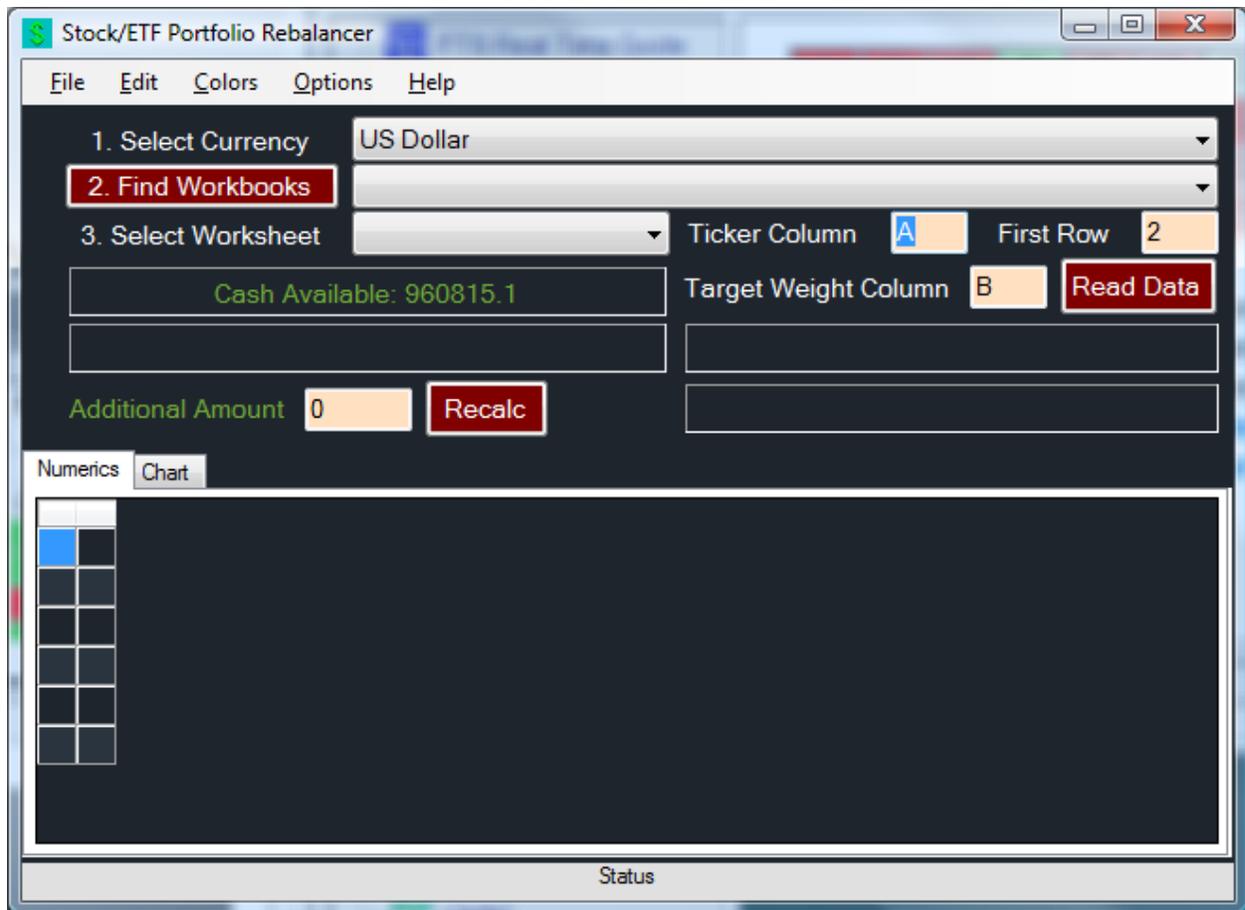
Now, it's fairly simple.

1. First, if there is more than one currency in your case, select the currency.
2. Second, click the red Find Workbooks button. This will find all open Excel workbooks; select the workbook containing your weights.
3. Now, select the worksheet within the workbook. Note that this lets you have multiple sets of tickers and weights in different workbooks, and you can easily switch between them.
4. Click the Read Data button.

You will now see something like the following:

You can see the cash available to invest and the value of the current investment in the equities represented by your tickers. The "Additional Amount" is initially set to zero, but you can add or subtract money, as long as the Total Invested plus/minus the additional amount is positive. The next two boxes tell you how many trades are required and how much cash is required to carry out all the transactions (including the cost of buying and selling and all transaction costs.

- Some transactions may require multiple trades. For example, if you change from a short position to a long position, two trades will be involved: covering the short position and then establishing the long position. You will also pay transactions costs separately on each transaction.
- Tickers not in your spreadsheet are not included in any of the calculations

The red "Recalc" button lets you recalculate everything at current market prices; the calculations are not updated in real time otherwise the required trades and cash and so on would change pretty much continuously during the trading day. The green "Trade" button lets you submit all the trades.

You are shown the trades required and the trades you have left for the day. The number of trades is limited so you have to think about what you want to trade; it can be increased or decreased by request from your instructor.

What is shown as Net Cash Outflow is the bottom line: it is the amount by which your cash available will change (except for small differences due to price changes and margin transactions, as explained below). If you will get cash back, this will say "New Cash Inflow" and be indicated in green.

Now, focus on the columns.

Include: The first allows you to include and exclude tickers from your set of tickers. This is useful because trading is costly, and if the current position in a stock or ETF is not very different from your desired position, you may decide to not carry out the transaction by un-checking that ticker.

Ticker: The second is the ticker (or name; you can enter either in the spreadsheet).

Position: The third is your current position, i.e. the number of shares you have. A negative number is shown for short positions.

Raw Weight: The fourth is the current "raw" weight of your position in that security, calculated as last price times position as a fraction of the Total Amount = Total Invested + Additional Amount.

Target Weight: The target weight is simply read in from the spreadsheet. But if you un-check a row, the target weight gets set equal to the current weight so no new trade will take place.

New Position: This column shows the *integer* quantity implied by the target weight and the Total Amount. Since there will be small differences due to not being able to buy fractions of a stock, the "**New Weight**" columns shows you the actual resulting weight. For a large Total Amount, these should be very close to the target weights.

The **Net Trade** column tells you the total number of shares to be traded.

The next column tells you the **Cash Required**. This does not include transaction costs (those are shown in the next column). These are calculated along the lines of the example above.

Important Caveat: this number is *approximate* for two reasons:

- The actual cash required depends on the prices at the server, which change in real time. It should be very close to what will be paid unless there is a huge market swing between the time you calculate this and the time you click the "Trade" button. You click the "Recalc" button to recalculate the cash required at current prices.
- Trading can lead margin and short sale accounts to be adjusted, resulting in a margin call or a return of excess margin deposits. This effect does not include in the number depicted. It should be small, again unless there has been a large change in prices between now and the last time the margins were checked.

The **Transaction Cost** column is shown next. For US equity cases, FTS typically has a fixed fee of $9.95 per trade. This can vary by currency.

Spread Impact: Suppose the bid price is B and the ask price is A. If you buy 10 shares, you will pay the ask price. If you wanted to sell them right away, you would get the bid price. The spread impact shows you the amount you would lose if you did this as a percentage of the value of the trade. In effect, this equals the spread (A-B) divided by the last traded price, and is a measure of liquidity. If this is high, it means that the bid-ask spread is wide, and you may not be trading at a very good price.

Total Impact: This is the spread impact plus the transaction cost divided by the value of the trade. It is another indicator of the "cost" of a trade, but we again repeat that the spread "cost" is not actually realized until you reverse the transaction.