

Currency Trading, NeuroShell, eSignal, and Interactive Brokers

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I. The Currency Dealer or Broker

Unlike in equities trading where there is a centralized exchange, currency trading is decentralized, and effectively, your dealer or broker is your exchange. Understanding this is crucial to your currency trading, your data source, and your modeling in NeuroShell. There are two ways of classifying currency dealers or brokers as relevant to modeling and automated trading:

A. Liquidity Providers

There are two types of brokers based on their liquidity providers:

- 1) The more common *market maker-type broker* is its own liquidity provider. This means that the broker himself will transact your position, that is, the dealer will directly take the position against yours. If you are buying, he will sell, and if you are selling, he will buy from you. He then re-transacts the positions out to his affiliated banks (at an additional profit). For this type of dealer, you will pay only the spread.
- 2) The less common *ECN-type broker* simply posts the bid/ask spread, and your order is seen and transacted directly by his affiliated banks who are his real liquidity providers (In fact, you can demand from an ECN-type broker his list of liquidity providers). He does not take positions against you. For this type of dealer, you pay the both spread (which goes to the bank) and the commission (which goes to the dealer). An ECN-type dealer usually requires a higher margin deposit than a market-maker type mainly because you are dealing directly with large, reputable banks.

Interactive Brokers is an ECN-type broker.

B. Exclusivity

There are two types of brokers based on their exclusivity in trading currencies:

- 1) The more common *exclusive type* allows only trading of currencies, and occasionally, precious metals such as gold. Their software client interfaces are usually easier to use since you are dealing with them directly. They usually offer many more currency pairs to trade. In order to automate trading, they have their proprietary APIs that are either free or rented out for a fee (which can then be recouped by exceeding monthly transaction limits).

- 2) The less-common *comprehensive type* allows trading of many financial instruments other than currencies. Although their software client interfaces are easy for equities, most of their currency trading programs are retrofitted from equities. They will have a name for their own exchange (remember that this exchange is seen only by them and not by other brokers) and will tend to trade less currencies. Their APIs are usually free since they are commission-based.

Interactive Brokers is a comprehensive-type broker. The name of its currency-trading exchange is IDEALPRO and the name of its software client interface is TWS.

II. Currency Trading

Trading currencies is like exchanging money for foreign travel. For example, a Japanese from Tokyo will exchange his Yen for some Euro before heading out to tour Paris. Therefore, unlike equities, currencies are traded in pairs with one long position (buying Euro) and one short position (selling Yen) at the same time. The tourist may do this in a foreign exchange booth (market maker-type dealer) or in a bank (ECN-type dealer).

A. Data Issues

1. *Indicative Data*: Since currency trading is decentralized, the data you get from eSignal will be indicative data, meaning, these are data or averages of data from as many banks that provide them with data. You must be mindful of this when modeling using NeuroShell, since very short timeframes are very sensitive to actual data. There are some brokers that will provide data in real-time, sometimes for free, sometimes for a fee.

2. *Level II*: Being decentralized, currency data as provided by eSignal has no volume, and the volume appearing in the data stream is actually the number of transactions for that time bar (not the size of the transactions) from eSignal data feeders. Note that ECN-type brokers usually provide a Level-II type screen where you can see the actual volume of transactions. The only way to access this broker-specific volume for use in NeuroShell is to use their API, if they allow access to these data.

3. *24-Hour Data*: Currency trading is a 24-by-6 activity, starting in Sydney, then proceeding to Tokyo, London, and US. Each will have a currency market open that is different from the equities market open. So, when does a day begin? The answer, for most brokers, is the time the banks reset their servers, usually at 5PM EST. This time is usually posted on the brokers website. eSignals day always begins at 14:00 PST or 15:00 PDT, and opens the week at 9AM PT on Sundays. NeuroShell already takes this into account for the eSignal data stream.

B. Modeling Issues

1. Home Currency: In the Japanese tourist example above, it is clear that his home currency is the Yen. In currency trading, the monetary denomination of the account that you are trading is called the home currency or account currency. There are brokers who will allow you to create several sub-accounts with different currency denominations.

Interactive Brokers uses the non-conventional term Underlying to signify your home currency or your account currency.

2. Lots: In currency trading, a standard lot is 100K and a mini-lot is 10K. These are almost pass now, and with automation, variable lots are now the norm. Although some market maker-type dealers will allow you to trade a few dollars at the time, ECN-types will usually require a minimum, after which you can do variable lot sizing.

Interactive Brokers requires a different minimum trade size per currency pair offered for trading. You should check the minimum trade size before trading any currencies in IB. If you submit orders below this minimum size, you will usually, but not always, get an Order Size pop-up error message back from Interactive Brokers after the order is placed. Variable lot sizing can then be used beyond the minimum.

3. Currency Pairs: Currencies not paired with the USD are nicknamed crosses. The Japanese tourist example deals with the EUR/JPY cross pair, a direct conversion of Yen to Euro without any intervening conversion of either currency into USD rates, i.e., EUR/USD and USD/JPY. This is called a true cross. When a dealer does not offer a currency pair of choice, one can create what is called a synthetic cross pair, where conversion to USD rates are used. In the example above, if EURJPY were not offered by the broker, a simultaneous transaction of EUR/USD and USD/JPY can be done. This effectively doubles the spread as well, in addition to commissions, if any.

Interactive Brokers treats crosses as synthetic pairs by splitting them up into their major (USD paired) components. When you place an order of EUR/JPY in IB, for example, IB will automatically split it into two orders, one for EUR/USD and the other for USD/JPY. This has critical consequences in creating NeuroShell models, especially those that are based solely on true EUR/JPY cross data. Spreads are doubled, in addition to the commission, so these increased fees have to be factored into the model as well.

4. Client Software Interface: Even before attempting to connect any dealer interface with NeuroShell, practice with the dealers client software interface is essential. For example, some clients will allow you to do a one-click simultaneous selling of Yen and buying of Euro in a USD home account. Others, like Interactive Brokers, are more involved. The following examples from Interactive Brokers website should help you understand trading FOREX with Interactive Brokers:

a. Example 1

If you want to buy/sell a specific amount of GBP, first enter the symbol GBP as the transaction currency. Then choose USD as the settlement currency from the drop down menu. You will then receive the quote USD.GBP, e.g., Bid: 1.5300 Ask: 1.5310. This means that $\text{GBP } 1 = \text{US\$}1.53\text{XX}$.

If you want to buy GBP 10,000, click on the Ask and enter 10,000 as the quantity of GBP that you wish to buy. You will pay \$1.5300 for each GBP. Thus, you will pay \$15,300.

If you want to sell GBP 10,000, click on the Bid and enter 10,000 as the quantity of GBP that you wish to sell. You will receive \$1.5300 for each GBP. Thus, you will receive \$15,300.

b. Example 2

If you want to buy/sell a specific amount of USD, first enter the symbol USD as the transaction currency. Then choose GBP as the settlement currency from the drop down menu. You will then receive the quote GBP.USD, e.g., Bid: 0.6530 Ask: 0.6536. This means that $\text{USD } 1 = \text{GBP } 0.653\text{XX}$

If you want to buy USD 10,000, click on the Ask and enter 10,000 as the quantity of USD that you wish to buy. You will pay GBP 0.6536 for each USD. Thus, you will pay GBP 6,536.

If you want to sell USD 10,000, click on the Bid and enter 10,000 as the quantity of USD that you wish to sell. You will receive GBP 0.6530 for each USD. Thus, you will receive GBP 6,530.

Closing the EUR/JPY the previous example above and reconvertting everything to a USD home account may come as a single button called Close Position. Others, like Interactive Brokers, will be more involved. In IB, if you bought EUR and sold JPY and would now like to close the trade (in a USD account), you will have to re-sell the EURUSD and repurchase the USDJPY at the correct amounts. Since rates are always moving, there will be some unconverted bits and pieces of Euro and Yen which need to be reconverted to USD via another manual mechanism.

5. Using NeuroShell

a. Addressing Variable Denomination of Home Accounts:

1) The Pip-Based Model: Given that NeuroShell can be used to model many account currency denominations, the key to simplifying NeuroShell model-making in currency trading is to treat \$1 as 1 pip. This way, all models are pip-based rather than currency denomination-based.

This is easily done by setting 2 boxes in the Other Costs in the Cost tab. Margin \$ per unit is set to \$1.00 and Point values for futures, forex, etc. should reflect the conversion of the price of a currency pair to one pip. Since a pip is the smallest tradable increment that a currency pair can move, all pairs with 4 significant digits (those pairs that are not crossed with JPY) should have a point value of 10000, and all pairs paired with 2 significant digits (those pairs that are crossed with JPY) should have a point value of 100. This way, in all profit columns of the model, the \$1 is actually 1 pip and not 1 USD. EUR/JPY, for example, will have a point value of 100, meaning, all changes in EUR/JPY price have to be multiplied by 100. If the price were 155.45 and moved to 155.50, then the change is 5 pips, already reflected in the model as such, and not as .05 Yen. Do not forget to factor in the spread and any commissions, which are also expressed in pips or percentage of a pip.

Using this technique, models become quickly adaptable to other home or sub-account currencies, since many currency traders use more than one broker and more than one home currency. It also makes sense when you try to optimize across all chart pages in NeuroShell, because all the profits and losses are expressed in the same unit: pips.

2) The Currency Denomination-Based Model: Should you decide not to use the easier pip-based model for whatever reason, remember that NeuroShell Trader was originally designed to trade U.S. stocks and U.S. futures, long before FOREX trading became easily accessible and popular. As a result, NeuroShell Trader assumes a settlement currency of USD (\$). As described below, this can cause some confusion when trading a FOREX currency pair in which the settlement currency (home currency) is not USD.

Trading Strategies in NeuroShell Trader provide you with the following options:

Buy a fixed number of units -> ___ Units

Buy a fixed amount of units -> ___ Dollars

Buy as many units as possible with current account balance -> ___ Dollars

For buying a fixed number of units, the number of units equates to the transaction currency. As described above, if you are trading USD.EUR, an order size of 50,000 units is an order for 50,000 Euro. Likewise, if you are trading EUR.USD, an order size of 50,000 units is an order for \$50,000.

However, because NeuroShell Trader assumes a settlement currency of USD, the latter two options will only make sense if you trade FOREX symbols of the form USD.XXX. For instance, trading a \$50,000 amount of the currency

pair USD.GBP, which is currently quoted at 1.5310, would result in trading 32,658 units (i.e., GBP).

If you trade a currency like JPY.EUR, then the fixed amount is actually in Yen instead of Dollars as it is labeled, and the account balance is actually in Yen and not Dollars as it is labeled. Likewise, a currency pair of EUR.JPY would mean that the fixed amount is actually in Euro instead of Dollars, and the account balance is actually in Euro and not Dollars. For instance, trading a 50,000 amount of the currency pair EUR.JPY, which is currently quoted at 0.006440, would result in trading 7,763,975 units (i.e., Yen).

Because NeuroShell Trader assumes a settlement currency of \$, all of the statistics like profit and drawdown are labeled as \$XXX,XXX.xx. However, as above, if you are trading a currency pair like JPY.EUR, the statistics will actually be in Yen, even though NeuroShell Trader labels them as \$. Likewise a currency pair of EUR.JPY would result in statistics that are actually Euro, even though they are labeled as \$.

Although all of the above may be simple to understand when analyzing one currency pair, keep in mind that NeuroShell Trader allows trading strategies to be applied across multiple chart pages (for example EUR.USD, JPY.GBP). The result is that using fixed amount and account balance trading may not result in balanced trading amounts as each chart page is in the settlement currency (in the EUR.USD, JPY.GBP example, trading an amount of 50,000 would not be balanced because obviously 50,000 Euro is a lot different size than 50,000 Yen). Likewise, comparison of statistics across chart pages will not make much sense as each is in a different transaction currency (in the EUR.USD, JPY.GBP example one chart page is showing profit in Euro and the other is showing profit in Yen).

And this is why a pip-based model makes more sense. Besides, profits in currency trading are really expressed in pips.

- b. Addressing Variable Lot Sizing: You can take advantage of variable lot sizing manually at trading run-time. Most brokers are moving away from fixed lots, and the key to simplifying lot sizing is to base the calculations on the number of units of currency to be traded and not the actual leveraged monetary value of the trade. Remember that a currency pair is composed of the BASE currency/QUOTE currency, and the account from which you are trading is your HOME currency. The formula to calculate the number of units available for you to trade is:

Margin Available * (margin ratio) / ((BASE}/HOME Currency} Exchange Rate)

For example, if the HOME Currency is USD, and the currency pair you wish to trade is GBP/CHF, and if you had \$100 in the account with a margin ratio (leverage) of 20:1, then lookup the current BASE/HOME Currency Exchange Rate for GBP/USD (say 1.584). Units = $(100*20)/1.584 = 1262$ units available to trade. You can trade all of these, or less.

C. Currency Trading Automation

1. During model-making, you should set NeuroShells lot size to 1. This has to be changed at trading run-time, however. When using the automated bridge from NeuroShell, Interactive Brokers picks up lot size from NeuroShell as the number of units to be traded, so you have to set this according to your money management plan using the unit computations given above. Since this is not yet automated, and currency exchange rates are continuously changing, you will have to do this manually. After setting the lot size, NeuroShell will want to reoptimize. Cancel the optimization to preserve the signals of a pip-based model. When trading automatically, make sure that you are still trading your desired number of units by monitoring the BASE/HOME rates. If not, adjust accordingly.
2. A standard interface to bridge currency brokers and other software such as NeuroShell is still at its nascent stage. Even if completed, it will take a while to migrate the currently offered proprietary APIs of currency brokers to the standardized format. For now, the only recourse for full automation is to use the API provided by your broker, if they have one.
3. If you are using the IB bridge from NeuroShell, you may never see a EUR/JPY order, even if everything is correctly mapped from eSignal, and everything is working correctly. This is because IB splits the order, as discussed earlier. In TWS all you may see are two separate orders, one for EUR/USD, and the other for EUR/JPY. NeuroShell, however, records the order correctly.