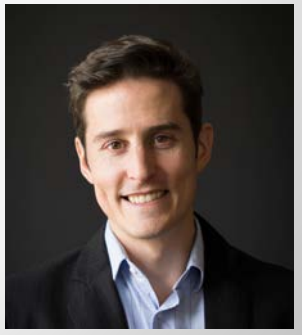
python

QUANTCONNECT

Risk Control with Trailing Stops and Options

Systematic Evaluation of Popular Risk Control Techniques

Jared Broad
Founder & CEO



www.quantconnect.com

Outline

- Introduction to QuantConnect
- Algorithm Development Process
- Creating Our Investigation Thesis
- Developing a Control
- Testing and Researching
- Experiment 1: Adding Trailing Stop
- Experiment 2: Adding Option Hedge
- Experiment 3: Covered Calls
- Summary

What is QuantConnect?

We empower investors with powerful investment tools and connect the brightest minds from around the world with capital they need.

What is QuantConnect?

QuantConnect is a community of 44,000 Engineers, Data Scientists, Programmers

From 6,100 Cities and 173 Countries

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```
class ChewHistory(QCAlgorithm):
    def Initialize(self):
    '''Initialise the data and resolution required, as well as the cash and start-end dates
    for your algorithm. All algorithms must initialized.'''
    self.SetStartDate(2011, 01, 02)    #Set Start Date
    self.SetEndDate(2016, 12, 23)      #Set End Date
    self.SetCash(100000)               #Set Strategy Cash
    self.symbols = ["SPY"]
    for s in self.symbols:
        self.AddEquity(s,Resolution.Minute)
     self.window=128
    self.SetWarmup(self.window)
    self.calc_len=self.window
    for i in range(16):
        self.Schedule.On(self.DateRules.EveryDay("SPY"), self.TimeRules.AfterMarketOpen("SPY",140+i*15), Acti
    def runAndTrade(self):
        # wait for warmu
        if self.IsWarmingUp: return

        for s in self.symbols:
            history = self.History(s
            data=[]
            index=[]
            for slice in history:
                data.append([np.float(slice.Open),np.float(slice.High),np.float(slice.Low),np.float(slice.C
                index.append(slice.Time.date()) df=pd.DataFrame(data,columns=['o','h','l','p','v'],index=pd
            if len(df)==self.calc_len:
                self.Debug("Acquired "+str(len(df))+" rows of history")
                r=df['p'].diff().fillna(0).values
                a=np.diff(r)
                m1=(r[-15:].mean()-r.mean()/r.std())
                m2=(a[-15:].mean())/a.std()
                #self.Debug("Finished calculations")
                signal=np.sign(m1)+np.sign(m2)
                self.SetHoldings(s,signal/self.Securities.Count)
```

Building Thousands of Algorithms Every Day

How do we do it?

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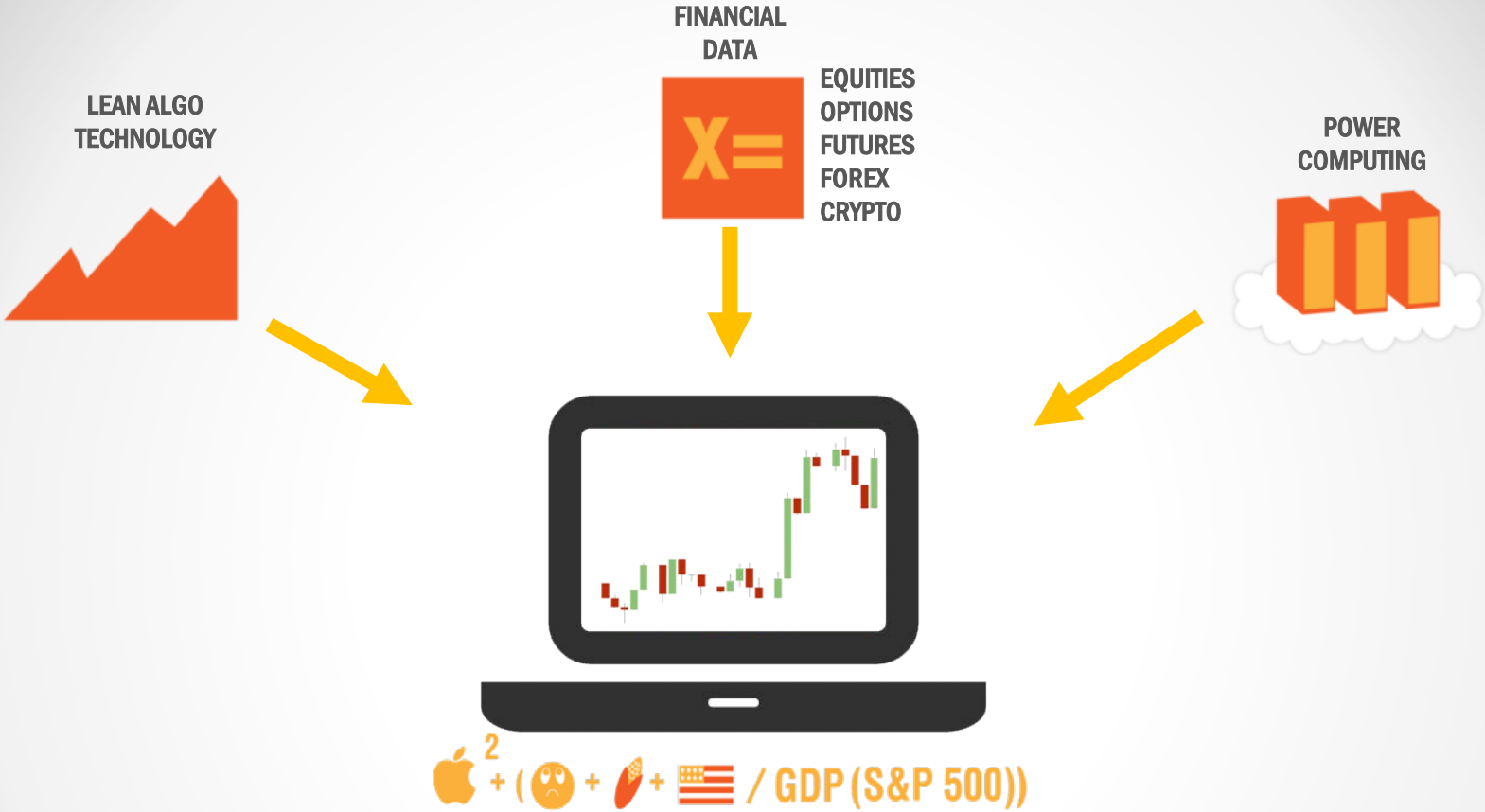

We've built a web algorithm lab where thousands of

people test their ideas on financial data we provide; for free.

Development Process

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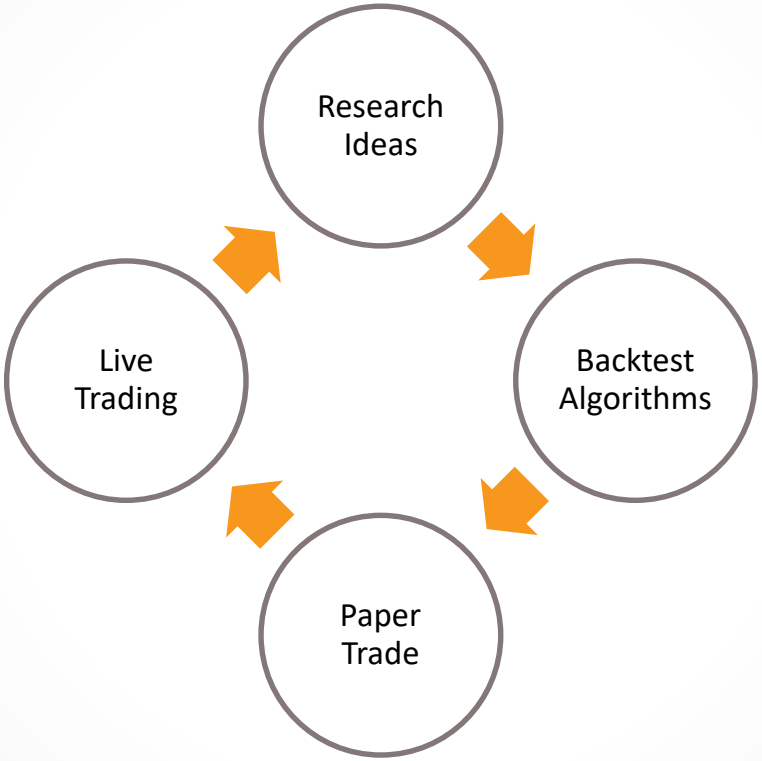
Research

Quickly test ideas in a command line environment.



Live Trade

Deploy the strategy live in a real money account.

Backtest

Codify and run full simulation in the Algorithm Lab.

Paper Trade

Run idea on live market data.

Creating Our Investment Hypothesis

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First we define our null hypothesis,

something we setout to disprove:

The market is completely efficient and attempts

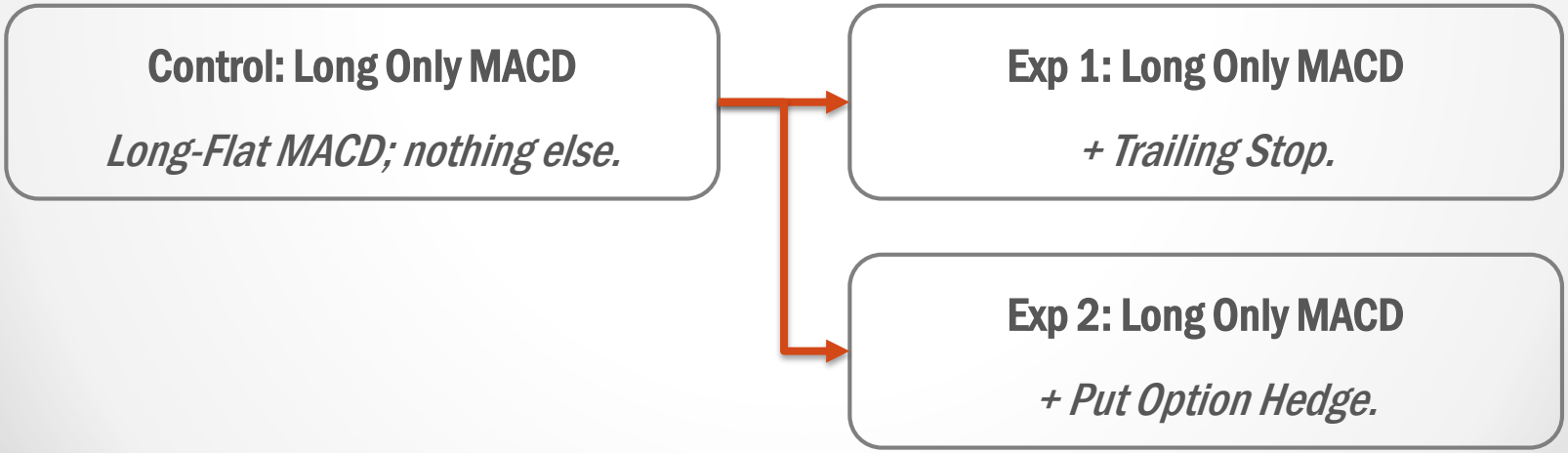
at risk control are futile.

We are testing this theory by evaluating popular risk control methods;

(e.g. **Trailing Stops** and **Option Hedging**), and comparing the performance.

Setting the Benchmark, Control

- Define a baseline performance for judging algorithm studies.
- Baseline should ideally be as close as possible to study. This reduces other variables and makes it easier to identify potential causes.



Exploratory Research

Control Implementation

Trailing Stop Hypothesis

Experiment 1: Adding Trailing Stop

Option Hedge Hypothesis

Experiment 2: Buying Put Hedge

Covered Call, Selling Options Hypothesis

Experiment 3: Selling Covered Call

Not strictly "risk control"

Key Statistics

Key statistics from testing our experimental strategy against a downward/sideways trending asset; IBM.

IBM Experiment	Sharpe Ratio	Drawdown	Alpha
Control Study	0.19	9%	0.11
Trailing Stop	0.19	9%	0.11
Option Hedging	0.19	9%	0.11
Covered Calls	0.19	9%	0.11

Key statistics summary from re-testing the control and experimental strategies against a trending asset; the SPY ETF.

SPY Experiment	Sharpe Ratio	Drawdown	Alpha
Control Study	0.19	9%	0.11
Trailing Stop	0.19	9%	0.11
Option Hedging	0.19	9%	0.11
Covered Calls	0.19	9%	0.11

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Thank you.

Appendix

Our Research Environment

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Research Environment - QuantConnect Corporation [US] https://www.quantconnect.com/research/notebook/106/MyResearch.ipynb

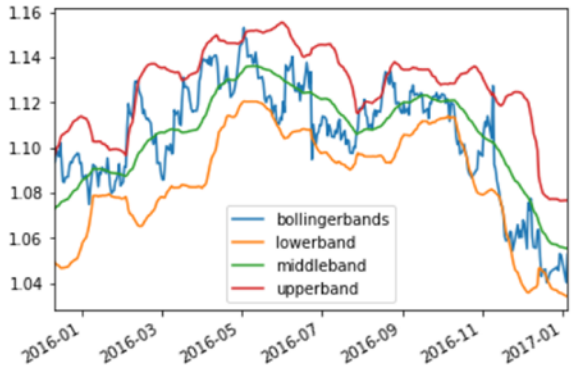
QUANTCONNECT Research BETA | Pricing | Data | Community | Algorithm Lab | Research | Documentation | Jared Broad

File Edit View Insert Cell Kernel Help | Not Trusted | Python 2

Code

In [14]:
```
# For EURUSD
bbdf = qb.Indicator(bb, "EURUSD", 360, Resolution.Daily)
bbdf = bbdf.drop('standarddeviation', 1)
bbdf.plot()
```

Out[14]: <matplotlib.axes._subplots.AxesSubplot at 0x7efce87ea250>



In [ ]:
```
# Example with ADX, it is a bar indicator
adx = AverageDirectionalIndex("adx", 14)
adxdf = qb.Indicator(adx, "SPY", 360, Resolution.Daily)
adxdf.plot()
```

Out[15]: <matplotlib.axes._subplots.AxesSubplot at 0x7efce8439650>

Coding the Idea, The Algorithm Lab

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Basic Template (C#) - Qu

QuantConnect Corporation [US] https://www.quantconnect.com/terminal/#open/675431

QUANTCONNECT Terminal | Pricing | Mode BACKTEST | Data | Community | Algorithm Lab | Research | Documentation | Jared Broad

University | My Projects | Co-Pilot | Data Manager | Live Projects | Support

Basic Template (C#)

Delete | Close Project

Files

Main.cs

+ Add New File

Libraries

+ Add New Library

General

Share

Clone this Project

Project Language: C#

Lean Engine: Master (563d2df4b5)

Algorithm Parameters

+ Add New Parameter

Live Logs

Backtest Logs

2017-09-04 15:34:40	22274c8e08da0a8948718d0988d61c8d
2017-09-01 21:36:41	f6153598a08d5629363e447c7d541ac1
2017-09-01 21:35:47	9a0b6018c2c575f06fb9e833066Sae5a
2017-09-01 21:35:37	1614aa7a6b090d32cf2e2964fa1c2888
2017-09-01 21:25:38	80dae2fa881f3a8832c8b44b62d5e283
2017-09-01 21:25:03	90f87282d971337c2959ccc0ae034464
2017-09-01 21:20:02	598b97bf770141340eb0abf72e6c8965
2017-09-01	751869fc1d2057e7d6da8562b0c53008

Main.cs | Build | Backtest | Go Live | Results

```
33      private List<String> _universeSymbols = new List<String>();
34
35      public override void Initialize() {
36          // this sets the resolution for data subscriptions added by our universe
37          UniverseSettings.Resolution = Resolution.Second;
38          UniverseSettings.FillForward = true;
39
40          // set our start and end for backtest mode
41          SetBrokerageModel(BrokerageName.InteractiveBrokersBrokerage);
42          SetStartDate(2017, 08, 18);
43          SetEndDate(2017, 08, 24);
44
45          var spyEquity = AddEquity("SPY", Resolution.Second, Market.USA, true, 0, true);
46          // Schedule events
47          Schedule.On(DateRules.EveryDay("SPY"), TimeRules.AfterMarketOpen("SPY", 5), () => {
48              OpenPositions();
49          });
50          Schedule.On(DateRules.EveryDay("SPY"), TimeRules.AfterMarketOpen("SPY", 15), () => {
51              ClosePositions();
52          });
53          Schedule.On(DateRules.EveryDay("SPY"), TimeRules.BeforeMarketClose("SPY", 1), () => {
54              canPoll = false;
55              List<OrderTicket> stopTickets = Transactions.GetOrderTickets(x => x.OrderType == Orders.OrderType.StopMarket).ToList();
56              foreach (OrderTicket stopTicket in stopTickets ?? Enumerable.Empty<OrderTicket>())
57              {
58                  Debug(String.Format("Cancelling stop order for {0}", stopTicket.Symbol));
59                  stopTicket.Cancel();
60              }
61              Debug("Finished Cancelling stop orders for the day");
62
63              De
64          }); Debug                                   Void
65                  DebugMessages
66          // (    DEMA                                 l trigger each day at midnight
67          Addt     define                  local        ution.Daily, dateTime =>
68          {        Debug                   local
69                   decimal                 local        ");
70                   Decimal                 local        .dropbox.com/s/7qqb9zxz7q2n5ib/live_stocks.csv?dl=1";
71                   default                 keyword      /www.dropbox.com/s/fx7n5abh04aqcbs/backtest_stocks.csv?dl=1";
72                                                        estUrl;
73                   using (var client = new WebClient())
74                   {
75                       // handle live mode file format
76                       if (LiveMode)
77                       {
78                           // fetch the file from dropbox
79                           String file = client.DownloadString(url);
80                           // if we have a file for today, break apart by commas and return symbols
81                           if (file.Length > 0)
82                           {
83                               file = file.Replace("\r\n", "");
84                               _universeSymbols = file.ToCsv();
85                               _universeSymbols.ForEach(Debug);
86                               return _universeSymbols;
87                           }
88                           // no symbol today, leave universe unchanged
```

Console | Unsaved. | C#

Going Live, Deploying to Live Trading

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Live: Clone of FX Combi

QuantConnect Corporation [US] | https://www.quantconnect.com/terminal/#openLive/615470

QUANTCONNECT Terminal | Upgrade | Mode LIVE | Data | Community | Algorithm Lab | Research | Documentation | Bernard Blazquez

Dashboard | Logs | Orders | Code | Live Projects

Unrealized	Fees	Net Profit	Return	Equity	Holdings	Volume
$2.21	-$0.00	$0.00	2.81 %	$132.08	$132.10	$259.79

Range | Stop | Liquidate

Zoom 10m 1h 1d 1w All

Jul 26, 2017
Equity: $131.4445

Equity

Market	Status	Time
Equity	Open	18:24:02 EDT
Forex	Open	18:24:02 EDT

Select Chart
Strategy Equity
Benchmark
Select Stockplot

Status
Running

Server Statistics
CPU : 79.1%
RAM : 320 Mb / 512 Mb
Host : QC-COLO-1-6f0ca110
Up Time : 57d 01:35:09

Portfolio Holdings — Show All Portfolio

Symbol	Average Price	Quantity	Market Price	Market Value	Unrealized
GBPUSD	$1.29897	100	$1.32102	$132.102	$2.20

Orders — Open Orders Only

Id	DateTime	Symbol	Fill Price	Quantity	Type	Operation	Status
4	2017-09-01 09:31:05	USDCAD	$CAD	-136	Market	Short	Invalid
3	2017-09-01 09:31:05	GBPUSD	$1.29897USD	100	Market	Long	Submitted
2	2017-08-01 09:31:05	USDCAD	$CAD	-132	Market	Short	Invalid

Console | C#