



The challenges of designing and running algorithmic trading systems

Robert Carver

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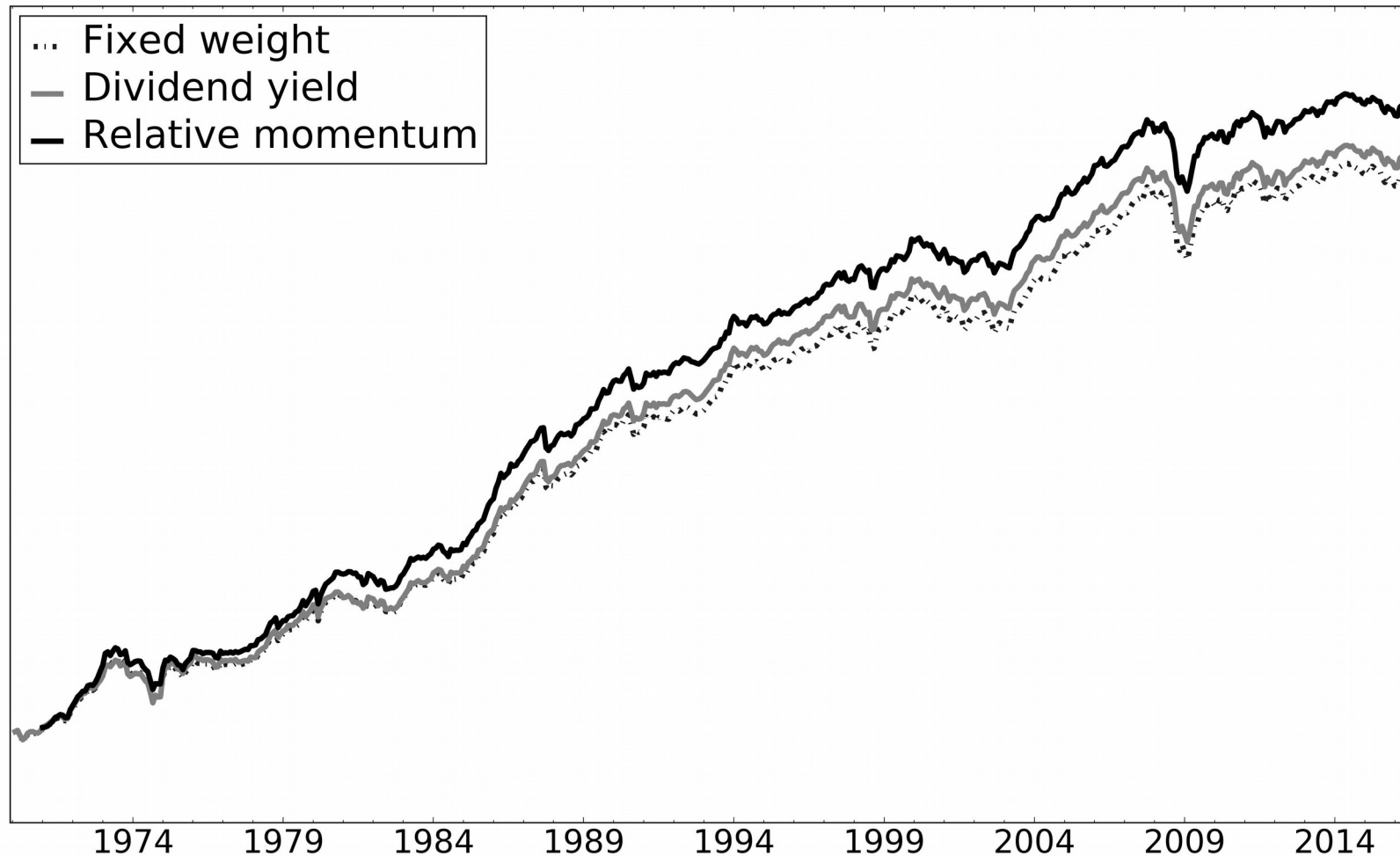
Robert Carver

- BA and Msc Economics
- 2002-2004 Exotic Derivatives trader, Barclays Capital
- 2004-2006 Research Manager, CEPR
- 2006-2010 Head of fundamental strategies, AHL
- 2010-2013 Head of fixed income, AHL
- 2013 - Independent trader & author
- 2018 - Visiting lecturer, QMUL

- What makes a good system
- Technology
- Backtesting and fitting
- Execution
- Operational and risk management
- Sticking to the system

- **What makes a good system**
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What makes a good system



What makes a good trading system?

- Objective
- Simple
- Intuitive
- Explainable
- Profitable (in the past)
- Ideas first, versus data first

- *What makes a good system*
- **Technology**
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Data



Data

- Quantified
- Tradeable prices
- Length and frequency of history
- Cost and access
- Storage

Backtesting software

The screenshot displays the PyCharm IDE interface for a project named 'pysystemtrade'. The top menu bar includes File, Edit, View, Navigate, Code, Refactor, Run, Tools, VCS, Window, Salesforce, and Help. The breadcrumb navigation shows the path: pysystemtrade > docs > FAQ.md. The left sidebar shows the project structure with folders 'sysbrokers' and 'syscore', and various Python files. The main editor window shows the 'rawdata.py' file with the following code:

```
180 2015-12-10 0.055281
181 2015-12-11 0.059789
182 """
183 denom_price = self.daily_denominator_price(instrument_code)
184 return_vol = self.daily_returns_volatility(instrument_code)
185 (denom_price, return_vol) = denom_price.align(return_vol, join="right")
186 perc_vol = 100.0 * \
187     (return_vol / denom_price.shift(1))
188
189 return perc_vol
190
191 @diagnostic()
192 def norm_returns(self, instrument_code):
193     """
194     Get returns normalised by recent vol
195
196     Useful statistic, also used for some trading rules
197
198     This is an optional subsystem; forecasts can go straight to system.data
199     :param instrument_code: Instrument to get prices for
200     :type trading_rules: str
201     """
```

The bottom panel shows the Python Console with the following output:

```
/usr/bin/python3.5 /home/rob/pycharm/pycharm-community-2016.3.2/helpers/pydev/pydevconsole.py 34798 35664
Python 3.5.2 (default, Nov 17 2016, 17:05:23)
Type 'copyright', 'credits' or 'license' for more information
IPython 6.4.0 -- An enhanced Interactive Python. Type '?' for help.
PyDev console: using IPython 6.4.0

import sys; print('Python %s on %s' % (sys.version, sys.platform))
sys.path.extend(['/home/rob/workspace3/pysystemtrade'])

Python 3.5.2 (default, Nov 17 2016, 17:05:23)
[GCC 5.4.0 20160609] on linux

In[2]:
```

A notification bubble in the bottom right corner states: "Platform and Plugin Updates: PyCharm Community Edition is ready to update." The status bar at the bottom indicates: "Unregistered VCS root detected: The directory /home/rob/workspace3/pysystemtrade/build/lib is under Git, but is not registered in the Settings. // Add root Configure Ignore 12:1 LF+ UTF-8+ Git: master + 1".

Backtesting software

- Broker supplied
- Off the shelf
- Custom built (via open source)
- Align research and live platform

- *What makes a good system*
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Backtesting and fitting

- Use historic data
- Types of (over) fitting
- Limit model complexity
- Use robust methods
- Leverage
- Costs

- *What makes a good system*
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Execution: Manual or automated?



Execution: manual or automated

- Manual

- Reduces operational complexity
- Less liquid markets
- Voice broked or point&click trading
- Large volumes

- Automated

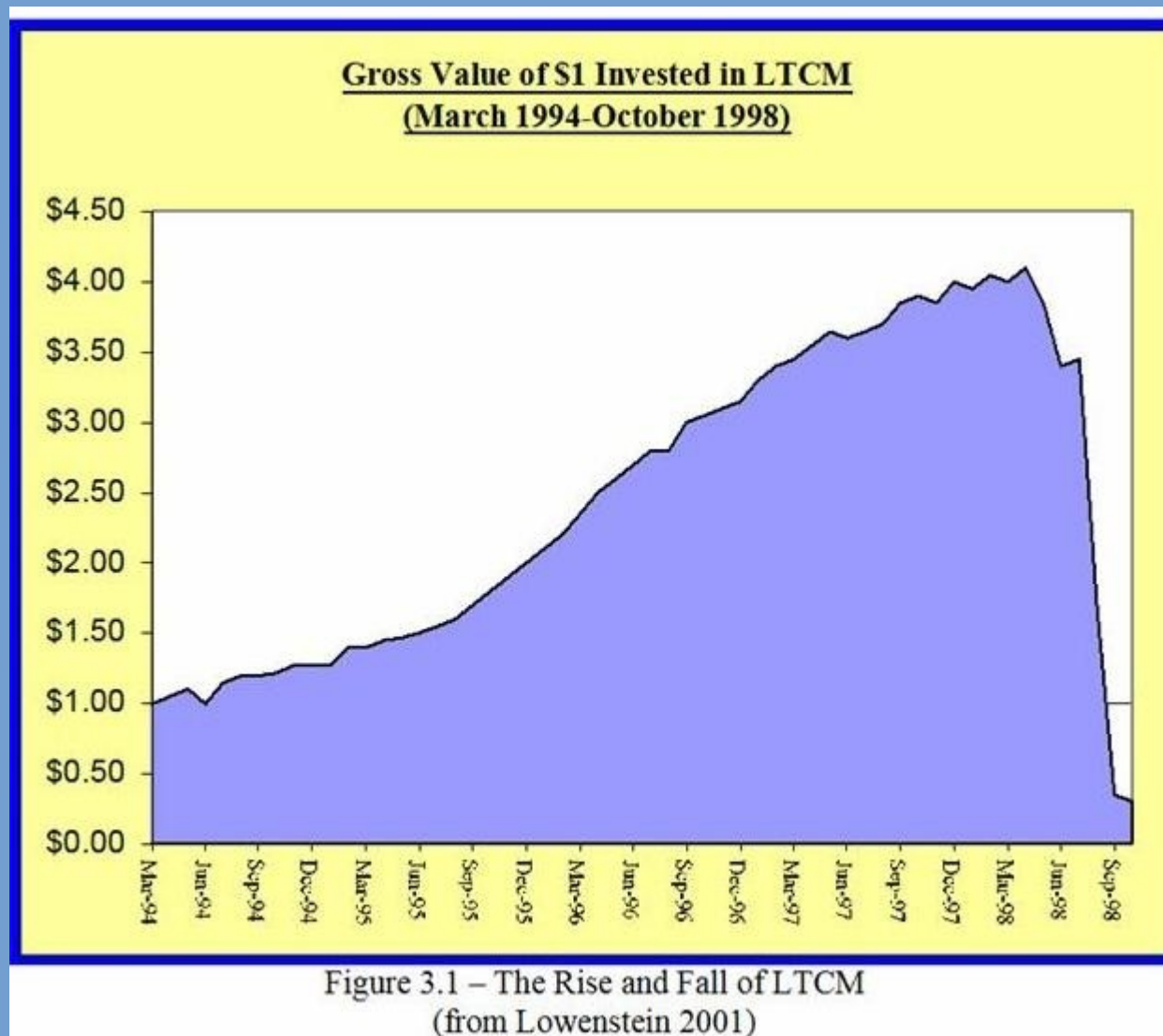
- Substantial operational complexity
- Liquid markets, smaller orders
- Need to have trading API

- Both

- Manual traders can use off the shelf algos
- Monitor execution costs for matched orders

- *What makes a good system*
- *Technology*
- *Backtesting and fitting*
- *Execution*
- **Operational and risk management**
- Sticking to the system

Operational and risk management



Operational and risk management



Market risk management

- “Known unknowns” - risk captured by risk model
- “Unknown unknowns” - risk outside of risk model
- Simple or complex risk model

Operational risk management

- More important if execution is fully automated
- Logging, diagnostics and monitoring
- Backups and failover
- On site, managed remote or cloud
- Software checks and balances
- Test, paper and minimal capital trading

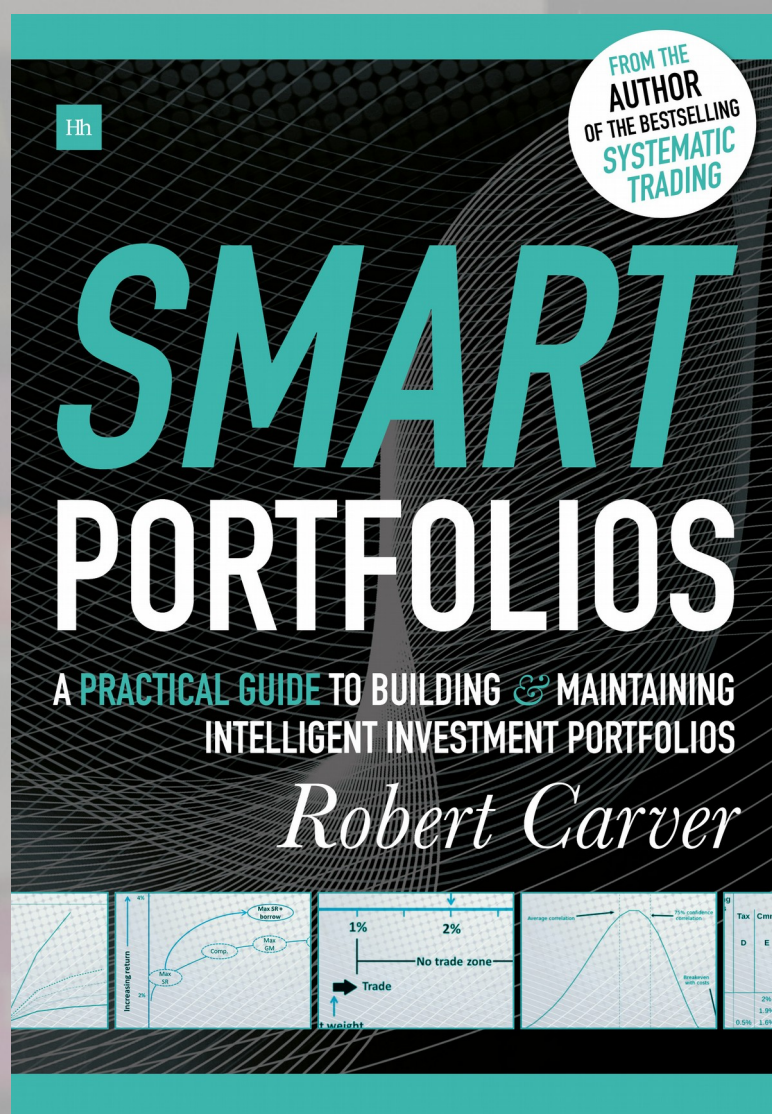
- *What makes a good system*
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- **Sticking to the system**

Odysseus en de sirenen, Theodoor van Thulden, rijksmuseum.nl/



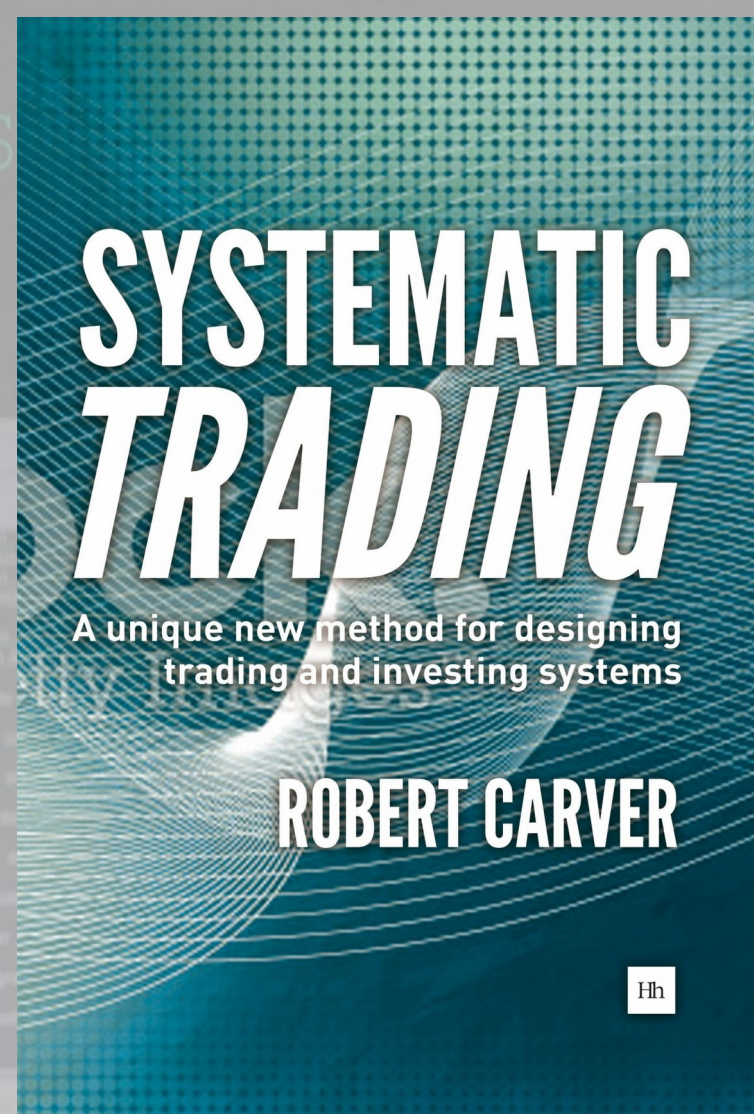
Sticking to the system

- *Objective*
- **Simple**
- **Intuitive**
- **Explainable**
- *Profitable (in the past)*
- *Ideas first, versus data first*



My website:
systematicmoney.org

My blog:
qoppac.blogspot.com



Some python:
github.com/robcarver17/

Twittering:
[@investingidiocy](https://twitter.com/investingidiocy)