

Implementing Overnight Strategy in the Korean Financial Environment

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1. Abstract

This Report illustrates how the overnight trading strategy can be implemented in the Korean financial environment. Target assets are KOSDAQ and Bio-Sector ETFs which will maximize profits and minimize transaction costs. Back testing results suggest that the overnight strategy will give yearly returns of 22.5% for KODEX 코스닥 150 ETF and 30.5% for TIGER 헬스케어 ETF.

The actual automated trading program is implemented using Python, AWS, CreonPlus API. The constructed system runs without a dedicated physical device and requires minimal human interference. The system has stabilized since May, 2019 and has been running without errors over a month until July, 2019.

2. Strategy Overview

The strategy is based on a research paper shown below.

<Overnight returns and firm-specific investor sentiment> - Aboody et al. 2015

http://scholar.google.co.kr/scholar_url?url=https://qiniu-images.datayes.com/SSRN-id2554010.pdf&hl=en&sa=X&scisig=AAGBfm0PGyM_E8A5FUy38Eq8QOoqdew0-g&nossl=1&oi=scholar

The paper states that overnight returns persist over assets that are largely controlled by sentiment-influenced investors. Based on this idea, I have researched the stability and persistence of overnight returns on the Korean stock market. I have observed that overnight returns are stronger in KOSDAQ and Bio-Sector ETFs. This could be due to that [investors participating in KOSDAQ are dominated by individuals](#), and that Bio-Sector companies are usually hard-to-value firms whose prices are dependent on investor sentiments.

The trading strategy will involve buying KOSDAQ ETF shares at the close price and selling them

back at the next day's opening price. Bio-Sector ETFs show higher returns, but they lack the liquidity to maintain the price influence of this strategy.

3. Back Testing Results

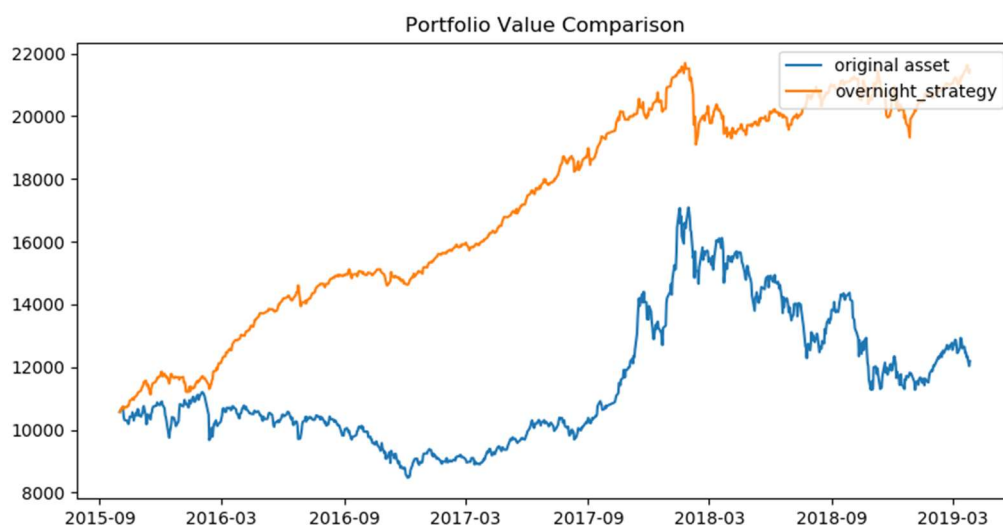
Graphs for whole lifecycle of ETF, 2015~ (after paper publication), yearly/monthly returns

(1) KODEX 코스닥 150 ETF

max value of portfolio: 2.0529324567235894

cumulated returns: 2.031859259474792

yearly returns: 1.2256034594055998

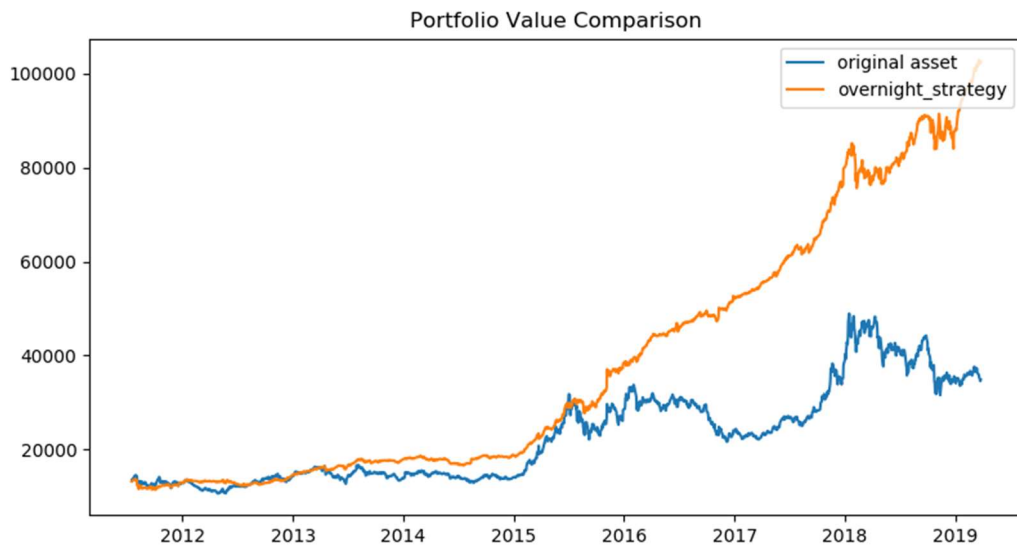


(2) TIGER 헬스케어 ETF

max value of portfolio: 7.790180708299001

cumulated returns: 7.7572240117786615

yearly returns: 1.3051161067180772

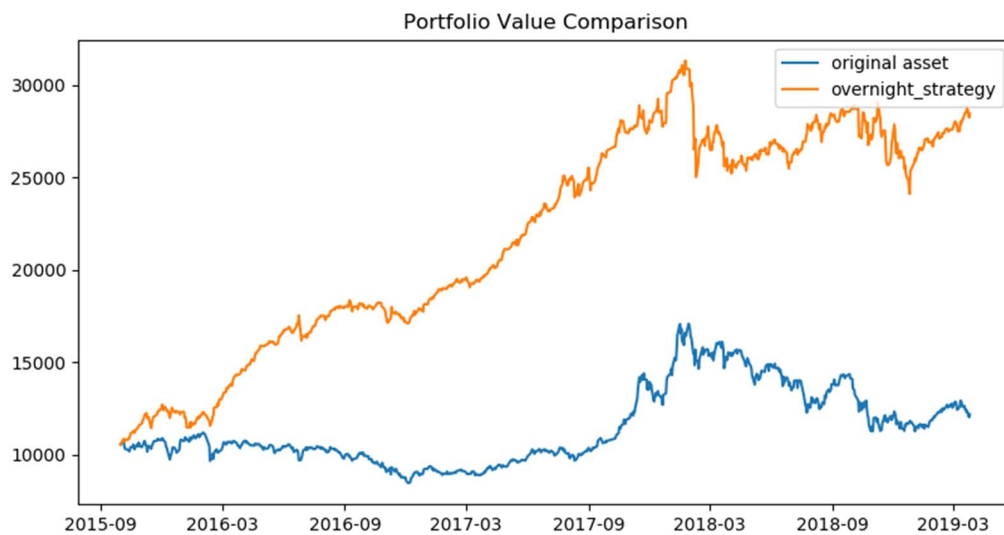


(3) KODEX 코스닥 150 ETF (Kelly Ratio = 1.7094)

max value of portfolio: 2.9634187106384076

cumulated returns: 2.6926381866847002

yearly returns: 1.3287382650142385

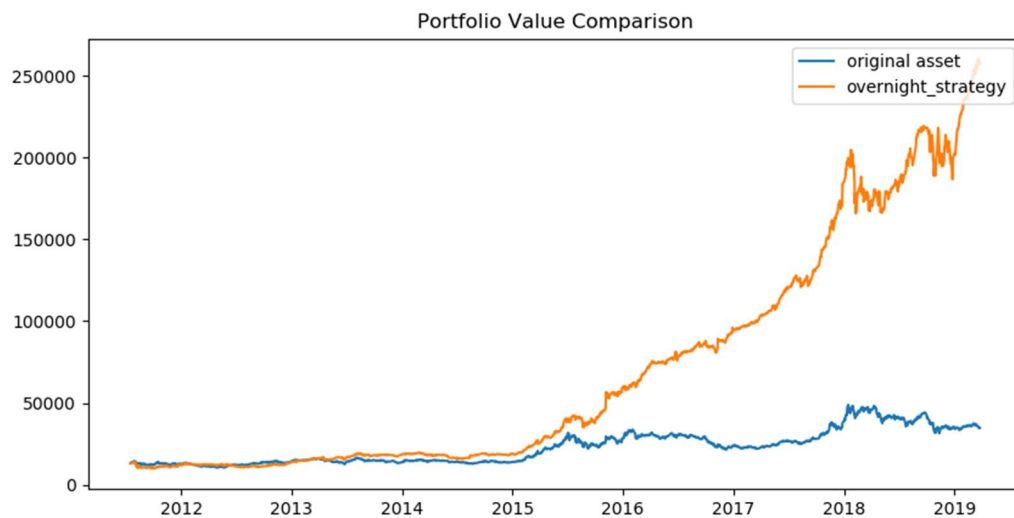


(4) TIGER 헬스케어 ETF (Kelly Ratio = 1.7094)

max value of portfolio: 19.698998416313174

cumulated returns: 19.537947840616045

yearly returns: 1.471620653679039



4. Transaction Costs

Securities transaction tax: $0.3\% \times 252 \text{ days} = 75.6\% / \text{yr}$

⇒ Not applicable to ETFs

Commission for Financial Institutions

⇒ $0.015\% / \text{day}$

⇒ Mitigated to $(0.0046077\% \times 2) / \text{day}$ by using commission-free promotions

⇒ $0.0046077\% \times 2 \text{ (tx per day)} \times 252 \text{ (trading days)} = 2.32\%$

(Residual is 유관기관비용 paid to KRX, etc...)

Conclusion: Total transaction costs can be mitigated at **2.32%** per year if enough liquidity is guaranteed so that the strategy does not influence the ETF prices to an influential degree.

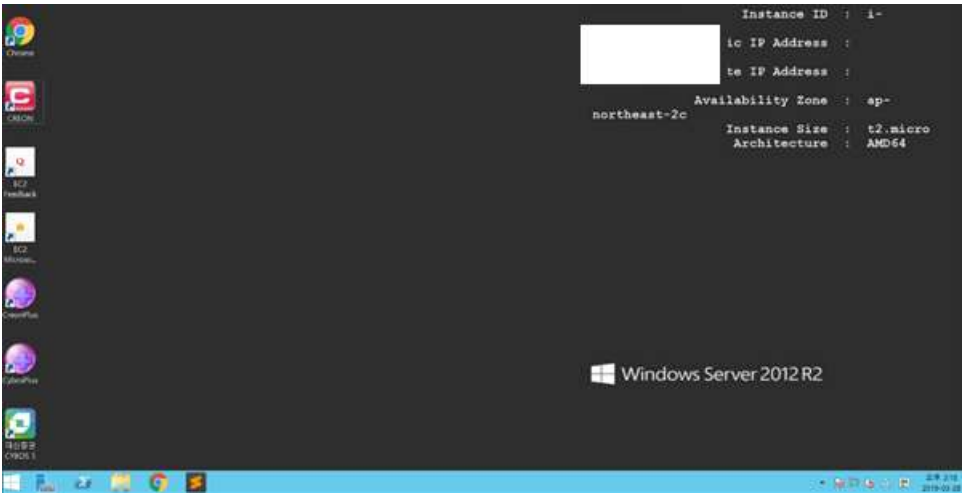
5. Implementation / Coding

(1) Host Device

An AWS EC2 Windows Server instance is used as the hosting device. A Windows device is

essential for running Korean HTS(Home Trading System) programs and the API they provide. However, AWS only offers server-purposed virtual machines such as Windows Server 2012 R2. Therefore, I have created the instance based on Windows Server 2012 R2 and configured the compatibility of the exe files to Windows 7 to run the HTS program without errors.

Once created, the instance will operate indefinitely unless the cloud service provider Amazon has issues. By using the AWS free tier instance with only the essential computing resources, we can use this device without any additional costs and maintenance.



Top Free Tier Services by Usage		
View all		
Service	Free Tier usage limit	Month-to-date usage
Amazon Elastic Compute Cloud	30 GB of Amazon Elastic Block Storage in any combination of General Purpose (SSD) or Magnetic	100.00% (30.00/30 GB-Mo)
Amazon Elastic Compute Cloud	750 hours of Amazon EC2 Microsoft Windows Server† t2.micro instance usage	71.60% (537.00/750 Hrs)

(2) Buy / Sell Operations

Buy / Sell orders are performed using the API service provided by the HTS of Daishin securities, named CreonPlus. CreonPlus provides modules for sending requests to the company's server via programs written using general-purpose programming languages which support win32api.

In this case, we will be using Python.

I have written modules for,

- Checking if the stock market is open
- Automatically launching and updating CreonPlus
- Automatically signing into CreonPlus
- Checking the account balance
- Calculating the amount to trade
- Placing orders

All the modules have been assembled to be a program that will execute the sequence of tasks in one execution. This program will be registered on the Windows Task Scheduler to be performed every day on the opening / closing time of the Korean Stock Exchange.

(3) Log Writer

CreonPlus is used to collect the trade execution data, and the following daily portfolio value. The daily log data is written into a local csv(comma separated value) file for forward-testing and portfolio evaluation purposes. Further functionalities can be added such as sending a weekly report to a specified email address.

Please contact the author for more details on the code.

6. Limitations & Possible Improvements

(1) Kelly Ratio / Leverage

The distribution on the returns suggest a Kelly ratio(leverage) of 17.58 for KODEX KOSDAQ 150 ETF and 13.36 for TIGER 헬스케어. This means that we have to use significant leverage for both cases even using the half-Kelly ratio. Methods to achieve this level of leverage is unavailable or too expensive for individual investors.

However, one can use contracts such as 신용거래 if he/she has the confidence to achieve stable returns. 대신증권 offers credit loans with margin requirement of 45% on a yearly interest of 4.9% if the holding period of the asset is below 7 days. One will be able to achieve a leverage level of 1.7 with this method.

$$\text{Leverage Level} = 1 / 0.45 = 2.2222$$

(2) Idle cash due to ordering on market price

The strategy places **market price orders** on the 동시호가 right before the market closes. This order will automatically set the acquiring price of the asset on the closing price. However, as the closing price is not yet determined when the order is placed, the maximum amount of orders that one can place is calculated based on the maximum price limit of the given stock, being 130% of the opening price. This will limit the amount of cash that is used to buy the asset, which is roughly around 77% of the portfolio cash.

Combined with the leverage of 신용매매 shown above, the maximum leverage that one can achieve will be around 1.7.

$$\text{Leverage Level} = (1 / 0.45) * (1 / 1.3) = 1.7094$$

There are ways to acquire the asset on closing price after the market close, using 장전 or 장후시간외주문 which executes trades based only on the closing price. However, liquidity on these trade methods are limited and may cause a bias on the number of assets on holds each night. For example, it will be much easier to acquire the asset on 장전시간외 if the opening price is speculated to fall. Therefore, using these methods is not recommended.

(3) Lack of liquidity for some ETFs

Most of the ETFs traded on the KRX do not have enough liquidity to minimize the slippage of trading large volumes on every opening and closing time. Therefore, participants rely on designated LP(Liquidity Providers) that offer bid/ask offers based on the iNAV of the portfolio. However, the spread on the offers might range up to 1%, which is significant enough to consume the daily overnight return.

This is why we choose KODEX 코스닥 150 which shows biggest trade volume among KOSDAQ ETFs, and TIGER 헬스케어 which shows biggest trade volume among bio-healthcare ETFs.

(4) Intraday Fund Usage

This strategy only holds assets during overnight. Therefore, the cash equivalent to the portfolio value is idle during when the market is open. If there are any good intraday strategies to utilize this idle cash, that strategy can be mixed with this strategy to achieve better returns on the whole portfolio performance.