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Optimalizace portfolia na burze cenných papírů v Hongkongu
Portfolio Optimization at Hong Kong Stock Exchange

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1. Introduction

Portfolio optimization is the process of selecting the best portfolio (asset allocation) from all portfolios to be considered. The main idea behind portfolio optimization is that investors want to maximize returns and minimize risks.

The aim of the thesis is to compare the out-of-sample performances of chosen portfolio optimization strategies in terms of return and risk, thereby selecting the investment strategy or model that find the best portfolio in a given situation. The strategies chosen are the naive strategy, the Markowitz model, and Conditional Value at Risk, with the Hang Seng Index, a representative of the Hong Kong Stock Exchange, as the benchmark. We used the adjusted stock prices of the 30 stocks in the Hang Seng Index as the data for selection. The criteria for stock selection are market capitalization size and data availability. Data are weekly for the period 1st January 2012 to 31st December 2012. Currency units are in Hong Kong dollars.

This thesis is structured into 5 chapters. In Chapter 1, we address the purpose of the entire thesis and briefly introduce the framework of the whole.

In Chapter 2 we focus on describing the history, characteristics, and performance of the stock exchanges. It also includes a brief introduction to the Hong Kong Stock Exchange.

In Chapter 3 we describe the theory of the strategies that we apply in the practical part. This includes the historical data approach, the naive strategy, the Markowitz model, and Conditional Value at Risk. Portfolio backtesting and portfolio performance measures are also described. The performance metrics we have chosen are Sharpe ratio and maximum drawdown.

In Chapter 4, we divide the analysis into in-sample and out-of-sample periods. We apply the strategies in each of these two periods and backtest the strategies in the out-of-sample period. Finally, we compare the strategies in the out-of-sample period by performance metrics and select the optimal portfolio strategy. Chapter 5 is a concluding description of the full thesis.

2. Characterization of Stock Exchanges

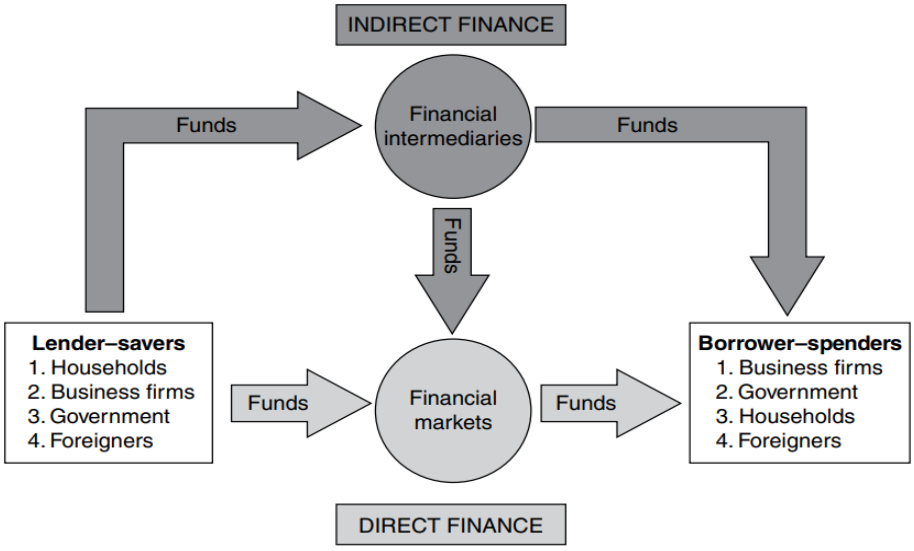
The establishment of a stock exchange provides a venue for the trading of securities and, thanks to this venue, a centralized place for the buying and selling of securities, thus enabling the parties to transfer and cash in securities in order to ensure a continuous flow of securities and the formation and publication of prices. Because trading on a stock exchange is constitutional and disclosed, the prices of bilateral bids are reasonable in theory, so that transactions in securities completed on the exchange also affect the prices of various types of securities. In chapter 2, therefore, we describe the history of the stock exchange, its main performance and its regulatory system.

2.1 Financial System and Financial market

A key priority decision condition for economic development is to have a well-functioning financial system and to channel funds to their most productive use. The financial system includes all financial intermediaries and financial markets and their relationship with the financial flows of households, governments, commercial companies and foreigners, as well as the financial infrastructure. The financial infrastructure is the set of institutions that enable financial intermediaries and financial markets to function effectively and includes elements such as payment systems, credit information bureaus, and collateral registries. In this chapter, most of the descriptions are based on information from Haan (2012).

The following is a brief description of how the financial system works. The main task of the financial system is to channel funds from participants with surpluses to those with shortfalls. Figure 2.1 provides a schematic diagram explaining the functioning of the financial system.

Figure 2.1 Working of the financial system



Source: Mishkin (2006, p.26)

Those on the left of figure 2.1 represent participants that have saved and are lending funds, while those on the right of figure 2.1 represent participants that have to borrow money to finance expenditure. Direct financing occurs when the participant in need of funds borrows from another participant through the financial markets. Financial markets are markets in which participants issue and trade securities. In turn, indirect financing occurs when financial intermediaries obtain funds from savers and use these savings to lend to the sector that needs financing. In most countries, indirect financing is the main way of transferring funds from lenders to borrowers.

The financial system helps to overcome information asymmetries between borrowers and lenders. Information asymmetries can occur both before and after a financial contract is concluded. Information asymmetry before a financial contract is concluded occurs because borrowers generally know more about their investments than lenders. The borrower who is most eager to participate in the transaction is therefore most likely to have an adverse outcome for the lender (adverse selection). Individual savers do not have the time, capacity or means to collect and process large amounts of information about borrowers, but financial intermediaries can reduce the cost of acquiring and processing information and thus improve resource allocation.

Information asymmetries emerge after a financial contract is concluded because the actual behavior can be observed by borrowers rather than investors.

In addition, the financial system reduces the time and money spent on conducting financial transactions. Financial intermediaries can reduce transaction costs because they have developed expertise and can take advantage of economies of scale and scope. By reducing information and transaction costs, the financial system reduces the cost of moving money between borrowers and lenders, freeing up resources for other uses, such as investment and innovation.

And a sound financial system also includes financial markets. The following is a brief introduction to the financial markets. Financial markets are broadly defined as any market in which securities are traded, including stock markets, bond markets, foreign exchange markets and derivatives markets. The financial market is a market where financial assets are the object of transactions, where the supply and demand sides of financial assets are the subjects of transactions. The so-called money financing refers to the process of economic operation, the supply and demand of funds to use a variety of financial instruments to adjust the surplus of funds, is the general term for all financial transactions.

Financial markets can be thought of as a set of arrangements that allow transactions to take place between their participants. Financial markets perform the following functions depending on the stage of the transaction (Bailey, 2005, p.131):

"Price discovery: Markets facilitate the dissemination of information. This enables participants who want to buy and sell to find out the price at which they can agree on a deal (pre-trade stage).

Trading mechanism: The market provides a mechanism to facilitate agreement. There must be a way for those who want to sell to communicate with those who want to buy (the trading phase).

Clearing and settlement arrangements: Agreements are executed. The market must ensure compliance with the terms of each agreement (post-trade phase).

Price discovery: the market facilitates the dissemination of information. This enables participants who want to buy or sell to find out the prices at which trades can be agreed upon (pre-trading phase).”

Participants in financial markets can be divided into different groups of participants based on their motivation for trading. First, public investors, who are motivated by the returns from holding securities. Public investors include private investors and institutional investors, such as pension funds and mutual funds. Second, brokers, or agents of public investors, are motivated by the services they provide to public investors and the remuneration they receive for doing so. Third, dealers, who trade on their own account but whose primary motivation is to make a profit from trading rather than from holding securities. Usually, traders are rewarded from the difference in price of the securities they buy and sell over a short period of time.

In practice, these three groups are not mutually exclusive. Some public investors may occasionally act on behalf of others; brokers may act as dealers and hold securities themselves, and dealers often hold more securities than are necessary to facilitate their trading activities. The role of these three groups varies depending on the trading mechanism used in the financial markets. Another important group of firms are the credit rating agencies (CRAs) that assess the credit risk of borrowers.

2.2 History of Stock Exchanges

The stock exchange began when European moneylenders began to fill the void left by the banks. They traded debts among themselves, mainly high-interest loans in exchange for securities. In the 1300s, the Venetians began trading in securities issued by other governments. They scribbled information about sales issues on stone tablets and carry them with them when they meet with their clients. In the late 1400s, Antwerp in Belgium became a center of international trade and for those who needed to borrow money, wealthy merchants would lend it at high interest rates. These merchants would then sell bonds backed by these loans and pay interest to others who

bought them.

But all these early stock markets had no real stocks. Although the infrastructure and institutions resembled today's stock markets, no one was actually trading stocks in companies. Instead, the markets dealt with government, corporate and personal debt. The systems and organizations were similar, although the actual property trade was different.

In 1602, the Dutch East India Company officially became the world's first listed company when it issued company stocks on the Amsterdam Stock Exchange. In order to raise funds, the company decided to sell stocks and pay a stock dividend to investors, each of whom was entitled to a fixed percentage of the East India Company's profits.

London's first stock exchange was officially established in 1773, 19 years before the New York Stock Exchange. But the London Stock Exchange had extremely limited development because of the laws restricting stocks, whereas the New York Stock Exchange had been dealing in stocks, for better or worse, since its inception. Headquartered on Wall Street, the New York Stock Exchange is the heart of all commerce and trade into and out of the United States, and the domestic basis for most banks and large corporations. Its unique exchange location has allowed the NYSE to quickly dominate the exchange. By setting listing requirements and charging fees, the New York Stock Exchange became a very wealthy institution. Over the next two centuries, its international reputation rose with the booming American economy and it soon became the world's most important stock exchange.

Today, almost every country in the world has its own stock market. In developed countries, the main stock markets usually emerged in the 19th and 20th centuries. From Switzerland to China, all the world's major economic powers have highly developed stock markets which are still active today.

In our thesis, we mainly consider the Hong Kong Stock Exchange. And the following information is received from the Hong Kong Stock Exchange.

In March 2000, the Hong Kong exchanges and clearing Limited was established with the principal business of owning and operating the only stock exchange and futures exchange in Hong Kong, and its associated clearing house. HKEX is the sole operator of the Hong Kong stock market and no individual or organization is permitted to hold more than 5% of the stocks of HKEX without the consent of the Financial Secretary. In September 2006, HKEX became a constituent stock of the Hang Seng Index.

At the end of May 2020, there were 2,482 companies listed on the HKEX, 2,105 on the Main Board and 377 growth companies. At the end of 2019, the total market capitalization of listed companies reached a record HK$38.2 trillion. The primary role of capital markets is financing, particularly initial public offering (IPO). 2018 saw 218 IPO, raising HK$288 billion. For the first time since 2011, HKEX IPO raised more money than refinancing. HK$288 billion (US$36.56 billion), the total amount raised by IPO, ranked first among the world's major capital markets.

2.3 Main Performance of Stock Exchanges

Since the late 1980s, financial exchanges for the global trading of securities and derivatives have taken on a major new role in international finance. This role differs from other matters that have arisen since the Second World War. In terms of numbers, exchanges have grown to previously unimaginable proportions and are now at the center of the world's economy. Capital markets have taken on a more important role in the world's economy, and exchanges have played a key role in this transformation. This section mainly describe the functions and features of the stock exchange.

2.3.1 Functions of Stock Exchanges

Firstly, one of the main functions of a stock exchange is to provide a fast and continuous venue for buying and selling securities. Investors are able to invest in quality securities and, subject to any risks, it enables people to switch from one type

of security to another. A stock exchange therefore provides a continuous channel for securities.

As well, the most important function of the stock exchange is that it acts as a reliable barometer of the state of the country's economy. Every major change in the country and the economy is reflected in the price of stocks. Because of the complete scale of the economy, the stock market is where people can invest their savings in the country's development. Investors want to maximize their personal profits, but in general, investors' decisions about where they invest their money usually go to the companies with the greatest growth potential and avoid investing in underperforming or unhealthy companies. In other words, the stock market effectively allocates money to the companies it does best, thereby strengthening the economy as a whole. And while rising stock prices herald a boom cycle in the economy, falling stock prices herald a downturn cycle in the economy.

Meanwhile, a politically and economically powerful government will see an upward trend in the stock market. Whereas an unstable government, which borrows heavily from other countries, will trend down in the stock market. Therefore, every government will adopt a policy of keeping the stock exchange alive. And the stock exchange is also a barometer of the business situation in that country. Booms and busts are reflected by the price indices of the various securities maintained on the stock exchange. By analyzing the ups and downs of market quotations, it is possible to determine the causes of changes in the business environment.

On the one hand, the stock exchange formulates listing rules, trading rules, membership management rules and other relevant rules in accordance with the securities laws and administrative regulations and submits them to the security’s regulatory authority for approval. Then, the stock exchange has the right to suspend, resume or terminate the listing of stocks and bonds in accordance with the laws and administrative regulations and the regulations of the security’s regulatory authorities.

When the normal conduct of securities trading is affected by sudden events, the

stock exchange may take measures of technical suspension; due to sudden events of force majeure or to maintain the normal order of securities trading, the stock exchange may decide to temporarily suspend the market. When the stock exchange adopts a technical suspension or decides to temporarily suspend the market, it must promptly report to the security's regulatory authority. On the stock exchange, listed companies must always comply with the rules and regulations that have been clearly defined. Only listed securities are traded on the stock market and the stock exchange may only include a company's name in the trading list after verifying the soundness of the company. Listed companies must also comply with strict rules and regulations. This ensures the security of trading through the stock exchange.

On the other hand, the Stock Exchange exercises real-time monitoring of securities transactions and makes reports on unusual transactions as required by the security's regulatory authorities. Trading on the stock exchange is conducted publicly in accordance with clearly defined rules and regulations and by-laws. The Stock Exchange shall monitor the disclosure of information by listed companies and relevant information disclosure obligations and urge them to disclose information in a timely and accurate manner in accordance with the law. The Stock Exchange may, as necessary, restrict trading in securities accounts where there are significant unusual trading conditions. This factor ensures safety and fair trading for ordinary investors. And because only genuine companies are listed, the activities of the stock exchange are controlled, and investors' funds are greatly protected.

In addition to this, another critical function of the stock exchange is to help and enable the creation of new businesses. For a business to function, it needs financing and capital. This is done by the stock exchanges. They are the fundamental platform for new businesses to raise capital to meet their financial needs. Stock exchanges help to establish new businesses. At the same time, stock exchanges play an effective role in the country's capital formation. Companies can raise capital by issuing more stocks through bonus stocks. But when a company wants to diversify, they can issue stocks and raise more capital. As a result, they are able to generate more capital and thus

contribute to the country's economic growth.

2.3.2 Features of Stock Exchanges

There are four main characteristics of the stock exchange：

- Organized market

The stock exchange is an organized market. A stock exchange is a non-profit social corporate frame formed voluntarily by a number of members. Each stock exchange has a management board, which has all the powers related to the management and control of the exchange. All transactions carried out on the stock exchange are conducted under the direction of the management board and in accordance with the prescribed procedures.

- Regulation of securities trading

A stock exchange does not trade any securities on its own behalf. It only provides its members and brokers engaged in securities trading with the infrastructure and facilities required for securities trading. It regulates trading activities to ensure that its members and brokers dealing in securities enjoy free and fair trading infrastructure and facilities for dealing in securities. It regulates trading activities to ensure free and fair trade.

- Only listed securities are allowed to be traded

The stock exchange facilitates the trading of stocks. In fact, the stock exchange has an official list of securities that can be traded on its floor. Securities that do not appear on the official list of the stock exchange are called unlisted securities. Such unlisted securities cannot be traded on the stock exchange.

- Working according to the rules

Trading in securities on the stock exchange is governed by the rules and regulations of the stock exchange. No deviation from the rules and guidelines will be permitted under any circumstances.

3. Description of Portfolio Optimization Methodology

In this chapter, we describe in detail basic information about stock portfolios, such as portfolio returns, the mean and variance of returns, and the skewness and kurtosis of returns. In addition to this, we describe several asset portfolios allocation strategies, such as the native portfolio strategy, the Markowitz model, and Conditional Value at Risk for portfolio optimization for efficient risk management. We then present two performance ratios that can help us to evaluate the performance of these portfolio strategies.

3.1 Basic Description of Stock Portfolio

In this sub-section, we briefly introduce the elemental input data about the portfolio, which is the basis for the model calculations, as well as introduce the characteristics of the data about the portfolio.

3.1.1 Historical Data Estimation

In general, the returns on assets can be divided into discrete returns and continuous compound returns. In this thesis, discrete returns are applied. In the discrete case, the return $R_{i,t}$ is calculated as the relative change in asset price $P_{i,t}$, with $P_{i,t}$ denoting the stock price of asset i at time t and $P_{i,t-1}$ denoting the previous price of asset i at time $t-1$. The formula is as follows:

$$R_{i,t} = \frac{P_{i,t}-P_{i,t-1}}{P_{i,t-1}}. \tag{3.1}$$

After calculating the return of assets, we should consider the return of stock portfolio. The formula is as follows:

$$R_{p,t} = \sum_{t=1}^{N} w_i \cdot R_{i,t}. \tag{3.2}$$

According to formula (3.2), the return of the portfolio $R_{p,t}$ is given as the sum of the products of specified return of stock $R_{i,t}$ and the weight of each stock w_i in the portfolio.

Having calculated the portfolio returns, investors can apply the average of the historical asset return data to show the expected return for each stock. The formula for calculating expected return is shown below:

$$E(R_i) = \frac{1}{N} \cdot \sum_{t=1}^{N} R_{i,t} \,. \tag{3.3}$$

The expected return in a portfolio is briefly described above, followed by a discussion of the risk in a portfolio. The level of risk in a portfolio is usually measured using the standard deviation, which is the square root of the variance. Risk is closely related to the potential gain or loss to the investor. This is because a portfolio with a low standard deviation means that portfolio returns are less volatile and more stable and is a very useful financial indicator when comparing different portfolios. Rational investors want to maximize returns but also minimize risk. The formula for standard deviation is shown below:

$$\sigma_i = \sqrt{\frac{1}{N} \cdot \sum_{t=1}^{N} \left[R_{i,t} - E(R_i)\right]^2} = \sqrt{\sigma_i^2}. \tag{3.4}$$

Then, the covariance measures the directional relationship between the returns of two assets. When two stocks tend to move together, they are considered to have a positive covariance; when they move in opposite directions, the covariance is negative. The formula for covariance is shown below：

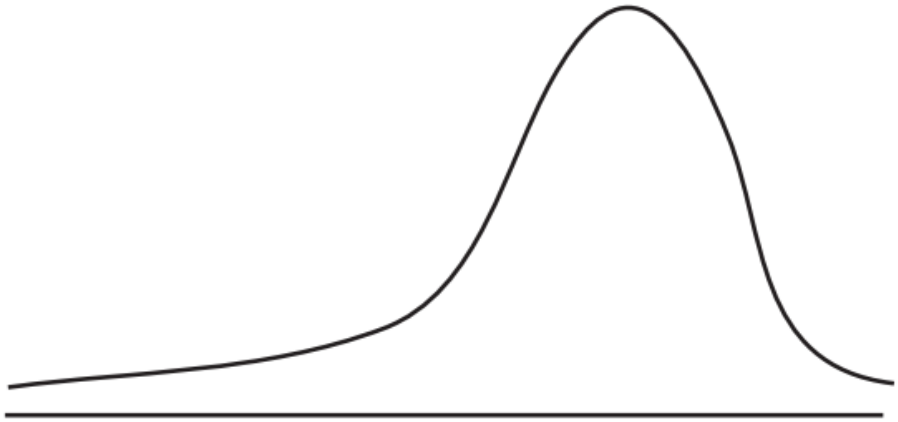
$$cov(R_i, R_j) = \frac{1}{N} \cdot \sum_{t=1}^{N} [\, R_{i,t} - E(R_i)] \cdot [R_{j,t} - E(R_i)]. \tag{3.5}$$

The covariance is shown in formula (3.5), which measures the relationship between asset i and asset j. It measures how much asset j can be changed on return, due to the return's change on asset i, and vice versa.

3.1.2 Skewness and Kurtosis of Return

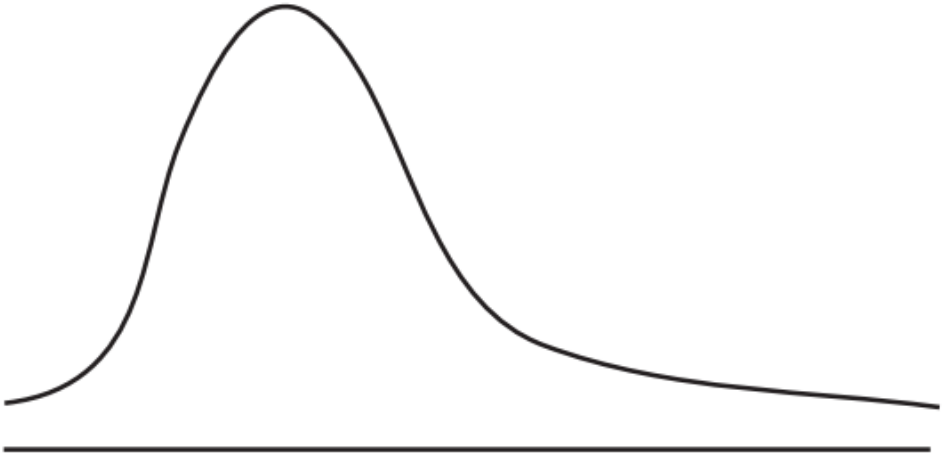
Skewness is often considered a simple measure of the symmetry in the distribution of returns. A stock is negatively skewed if its return distribution is right-skewed. Conversely, if a stock has a left-skewed return distribution, it is positively skewed.

Figure 3.1 Distribution Skewed to the Left



Source: Rachev at al. (2005, p.49)

Figure 3.2 Distribution Skewed to the Right



Source: Rachev at al. (2005, p.49)

The formula for skewness is as follows:

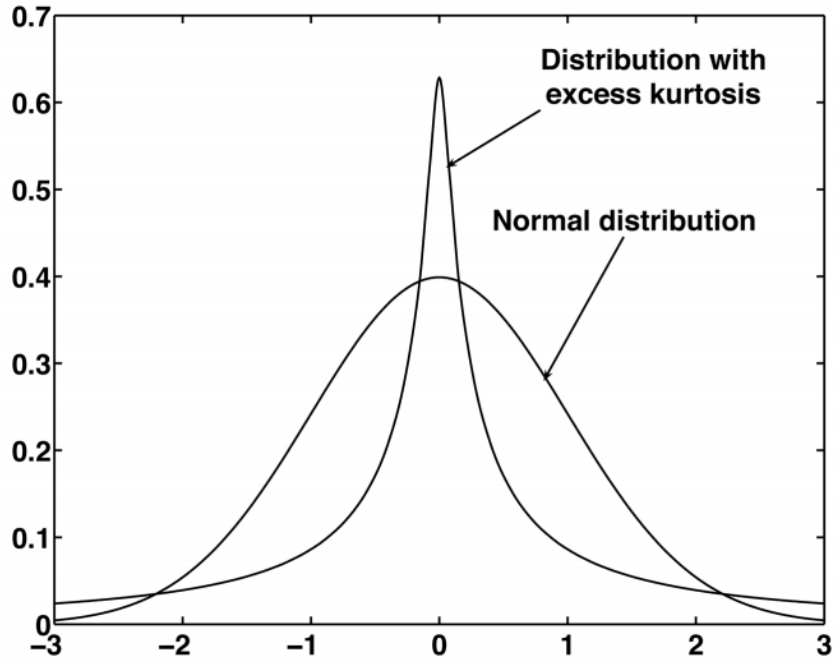
$$S = \frac{E(X-EX)^3}{VX^{\frac{3}{2}}}. \tag{3.6}$$

According to formula (3.6), the S represents skewness, VX expresses the variance, and mean is denoted by EX.

A large kurtosis is associated with a high level of investment risk as it indicates the increased probability of very high and very low returns. On the other hand, a small

kurtosis indicates a medium level of risk, as the probability of extreme returns is relatively low. *"Additional information about a probability distribution function is provided by measuring the concentration (mass) of potential outcomes in its tails. The tails of a probability distribution function contain the extreme values. In financial applications, it is these tails that provide information about the potential for a financial fiasco or financial ruin. As we will see, the fatness of the tails of the distribution is related to the peakedness of the distribution around its mean or center. The joint measure of peakedness and tail fatness is called kurtosis."* (Rachev at al, 2005, p.48)

Figure 3.3 Difference Between a Standard Normal Distribution and a Distribution with High Excess Kurtosis



Source: Rachev at al. (2005, p.55)

When a distribution has a peak below the normal distribution, this means that most of the data points are very close to the mean. It will have a kurtosis of less than 3, or equivalently, a negative super kurtosis. A kurtosis greater than 3, which has a long, thin tail, means that outliers are more likely. Positive kurtosis means that the distribution has peaked and has a thick tail. Extreme positive kurtosis means that more of the numbers in the distribution are in the tails of the distribution rather than close to

the mean. The formula for kurtosis is as follows:

$$K = \frac{E(X-EX)^4}{VX^2}. \quad (3.7)$$

According to formula (3.7), the K represents kurtosis, VX expresses the variance, and mean is denoted by EX.

3.2 Naive Strategy

A naive strategy is an investment approach that assumes that an investor can reduce overall portfolio risk by investing in many different assets without using a mathematical model to calculate the exact weights. For example, an investor could allocate funds equally between all investment options, regardless of what those options are. Compared to other models, it is simple and easy to implement. Such a simple strategy can be applied as a benchmark for a portfolio strategy. Another benchmark could be stock index. The formula for calculating the weights of the naive strategy is shown below:

$$w_i = \frac{1}{N}. \quad (3.8)$$

where the w_i represents the weights of each stock, and the N is defined as number of assets.

3.3 Markowitz Model – Efficient Set Construction

Firstly, the modern portfolio theory (MPT) was first introduced by Harry Markowitz in 1952. Overall, the risk components of MPT can be quantified using various mathematical formulas and mitigated by the concept of diversification, which entails the careful selection of a weighted collection of investment assets that together exhibit lower risk characteristics than any single asset or asset class. Diversification is a core concept of MPT and is based on the maxim "never put all your eggs in one basket."

And the Markowitz model is based on the following assumptions. *"Individuals*

construct their portfolios in order to maximise the expected utility of their terminal wealth. Their utility function is an increasing function of their wealth and they are risk averse. They make their choice based only on the first two moments of the random distribution of their wealth: the expectation and the variance. Since the final wealth is determined by the return on the investment, it is therefore equivalent to basing it on the expected portfolio return and the variance of the portfolio return. The expected utility of an individual's terminal wealth is therefore a function of the mean and the variance of the portfolio return. Portfolios that result from maximising the investor's utility are, by definition, efficient portfolios." (Amenc, 2003, p.80)

Based on the above assumptions, the Markowitz model is described as a mean-variance approach as it considers only these two parameters, namely average return and return variance. The expected return of the portfolio is measured by the mean return. The risk corresponding to the uncertainty of obtaining the return is measured by the variance.

In addition to this, Markowitz introduces a new concept of considering the portfolio as a whole, which significantly changes the approach to investment methods. Within the framework of this approach, the role of financial analysts remains essential, as they provide an assessment of the data applied by the model. Markowitz theory does not talk about efficient markets, but about efficient portfolios. An efficient portfolio is defined as the portfolio with the least risk for a given return, or in other words, the portfolio with the highest return for a given level of risk. The complete set of these portfolios forms the efficient frontier, which constitutes the concave envelope of all portfolios that can be produced.

Summarizing the conditions, the steps, and constraints for conducting a valid boundary are found in Zmeškal et al (2004, p. 91)：

1)" find the portfolio with minimum standard deviation.

2) find the portfolio with the maximal return.

3) find the return and standard deviation of portfolios in equidistant points."

Based on the above steps and constraints for finding the efficient frontier, the first

step is to calculate the expected return and standard deviation of each asset based on formula (3.1) and (3.3). The search is then conducted at the efficient frontier, with the first step being to find the portfolio with the least risk and the second step being to find the portfolio with the greatest expected return. The final step consists of selecting portfolios for the interior points of the efficient set. A portfolio is defined by a set of weights, the sum of which is equal to 1.

Figure 3.4 Find the portfolio with minimum standard deviation

Objective function:	$\sigma_P \rightarrow min.$
Constraints	$\sum_i x_i = 1.$
	$x_i \geq 0, for\ i = 1, 2, \ldots . N$
Where	$\sigma_P = \sqrt{\sum_i \sum_j x_i \cdot \sigma_{ij} \cdot x_j}$.

Source: Zmeškal et al. (2004, p. 91)

The objective function requires the data tool solver to find an efficient portfolio of assets with a minimum standard deviation subject to a constraint. The constraints include a requirement that the sum of relative stocks (percentages) x_i equals 1. In addition, the model does not allow short selling.

Figure 3.5 Find the portfolio with maximum expected return

Objective function:	$E(R_P) \rightarrow max$
Constraints	$\sum_i x_i = 1.$
	$x_i \geq 0, for\ i = 1, 2, \ldots . N$
Where	$E(R_P) = \sum_i x_i \cdot E(R_i).$

Source: Zmeškal et al. (2004, p. 91)

Unlike the above steps, the objective function needs to be set to maximize the expected return. The other constraints are the same.

Figure 3.6 Find the expected return and standard deviation of equidistant points

Objective function:

$$\sigma_P \rightarrow min$$

Constraints

$$\sum_i x_i = 1$$

$$x_i \geq 0, for\ i = 1, 2, \ldots . N$$

Where $\sigma_P = \sqrt{\sum_i \sum_j x_i \cdot \sigma_{ij} \cdot x_j}$

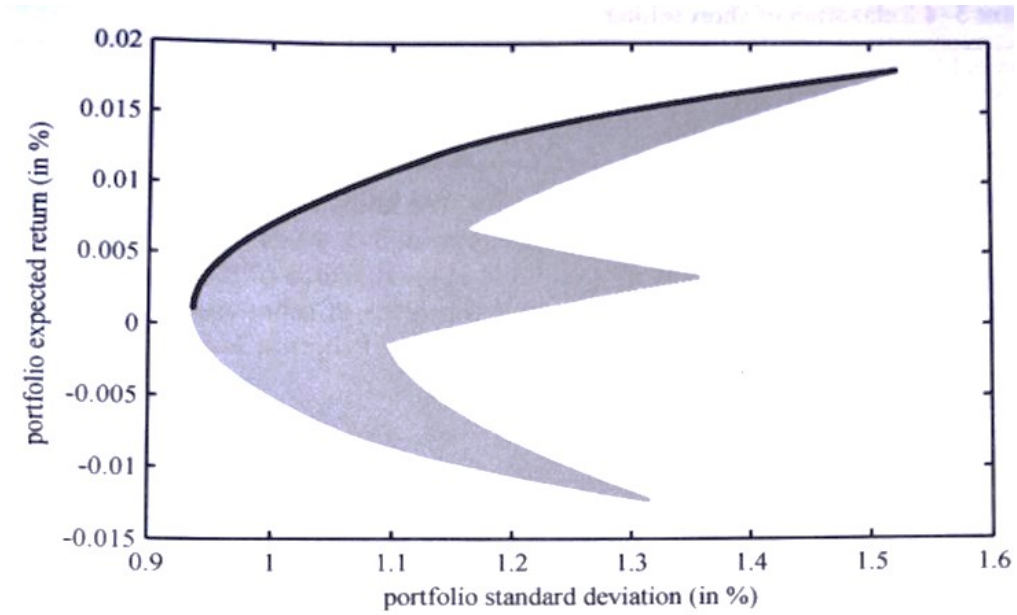
$$Equidistant\ interval = \frac{E(R_{P,max}) - E(R_{P,min})}{100}$$

$$E\left(R_{P_j}\right) = E\left(R_{P_{j-1}}\right) + equidistant\ interval.$$

Source: Zmeškal et al. (2004, p. 91)

In order to find the point between the minimum variance and the maximum expected return, the equidistant interval applies to be calculated and added to the constraints. The resulting portfolio points are then joined into a smooth curve to form the effective frontier. Figure 3.7 shows the efficient frontier of the Markowitz model.

Figure 3.7 Efficient frontier of Markowitz model



Source: Kresta (2015, p.51)

3.4 Conditional Value at Risk

The goal of portfolio theory is to find a balance between maximizing return and minimizing risk. To do this, we must measure risk. In the Markowitz model, variance is used as the risk measure, but in some cases, this can lead to erroneous conclusions. Several other measures of risk have therefore been introduced, of which value at risk (VaR) is the one that has been most widely used in recent years. However, the more volatile an investment is, the greater the likelihood that VaR does not fully reflect risk, as it is indifferent to anything beyond its threshold. Instead, they have a Conditional Value at Risk (CVaR) rather than just VaR, which tends to lead to a more conservative approach to risk exposures. CVaR is an extended measure of risk for value at risk and is used to quantify the average loss over a specified period of time for unlikely scenarios that exceed the confidence level.

A new approach to optimizing or hedging a portfolio of financial instruments to reduce risk is proposed and tested on an application. It focuses on minimizing the Conditional Value at Risk (CVaR) rather than minimizing the value at risk (VaR), but a portfolio with a low CVaR will also necessarily have a low VaR. *"From a portfolio optimization perspective, an intrinsic limitation of VaR is that VaR portfolio optimization is a nonconvex, nonsmooth problem with multiple local minima that can result in portfolio composition discontinuities. Furthermore, it requires complex calculation techniques such as integer programming. In contrast, portfolio optimization with CVaR turns out to be a smooth, convex problem with a unique solution."* (Rachev at al, 2005, p.203)

To calculate the CVaR it is necessary to obtain the VaR at confidence level α. The corresponding formula is shown below：

$$VaR_{X,\alpha} = -\inf\{x \in R: F_X(X) \geq \alpha\}, \tag{3.9}$$

where FX is the cumulative distribution function and X is the random variable profit, which can be calculated at time t as the wealth at time t–1 multiplied by the random portfolio return at time t. And the α is the level of probability of selection, i.e., the probability that the observed loss can exceed the VaR of the estimated loss.

The most common α probability is usually 5%. Therefore, the formula for CVaR is shown below：

$$F_{\alpha}(X,V) = \frac{1}{\alpha} \cdot \sum_{i=1}^{N} P_i \cdot [\max(V - \sum_{i=1}^{N} x_j \cdot r_{ij}, 0)] - V, \quad (3.10)$$

where F_{α} denotes CVaR at a confidence level of α, P_i denotes probability, V denotes VaR, x_j denotes the weight of each asset, and r_{ij} denotes return of assets under scenario.

Figure 3.8 Find the portfolio with minimum CVaR

Objective function:

$$CVaR \rightarrow min.$$

Constraints

$$\sum_j x_j = 1.$$

$$x_j \geq 0, for\ j = 1, 2, \ldots . N.$$

Source: URYASEV (2000, p.278)

The objective function requires the data tool solver to find an efficient portfolio of assets with a minimum CVaR subject to constraints. The constraints include that the weights of all stocks add up to 1 and that the weights of all stocks cannot be less than 0.

3.5 Backtesting of Portfolio Optimization

Backtesting is a framework that, in the financial sector, examines the viability of a trading strategy by testing its performance against historical data. In other words, it uses past data to see how well a strategy has performed so that traders can adapt and adjust successful strategies. If the backtest shows good results, the trader or investor may go on to apply the strategy to a real-world environment. If the strategy performs poorly on historical data, the trader or investor will discard or re-evaluate the hypothesis. The two main components to look at during testing are overall profitability and the level of risk taken. Common types of trading backtesting include

in-sample and out-of-sample testing, walk-forward analysis or walk-forward optimization, instrument-level analysis and portfolio-level assessment. In this thesis, we apply in-sample and out-of-sample testing as the backtesting types.

In the backtesting process, we set *T* as the observation period. The variable *m* represents the decision size of past data and the variable *t* is the date when the backtest starts. We know the historical price of the asset at time *T*. To assess the effectiveness of the different strategies, we apply the price data for the same asset. During periods (*t*-*m*) and (*t*-1) to obtain a portfolio weighting. This is then simulated to reinvest the portfolio at time *t* with the obtained weights during period from *t* to *T*. That is, in the in-sample and out-of-sample tests, the out-of-sample weights are obtained from the in-sample period. We calculate the ex-post portfolio returns as follows:

$$R_{p,t} = R_{i,t} \cdot w_{i,t}, \tag{3.11}$$

where $R_{p,t}$ represents the return of the ex-post portfolio, $R_{i,t}$ denotes the return of the *i*th asset on the out-of-sample data, and $w_{i,t}$ denotes the weigh of the out of the *i*th asset.

Finally, it is necessary to compare the in-sample with the out-of-sample returns obtained and the final wealth. The formula for calculating wealth is shown below:

$$W_{t+1} = W_t \cdot (1 + R_{p,t}) \tag{3.12}$$

3.6 Portfolio Performance Measures

Portfolio performance measures are a key element of investment decisions and refer to the assessment of the performance of an investor's portfolio. At the heart of performance assessment is the notion that investors prefer higher returns and lower risk. In this sub-section, the two main indicators that will be presented are Sharpe ratio and maximum drawdown.

3.6.1 Sharpe Ratio

The Sharpe ratio is a measure of the risk-adjusted return of a financial portfolio

and is used to help investors understand the return on investment compared to risk. The higher the ratio, the higher the risk compensation provided by the investment. Investors will therefore prefer investments with a high Sharpe ratio or investments that increase the Sharpe ratio of the portfolio as a whole through diversification. The formula for the Sharpe ratio is shown below:

$$Sharpe\ ratio = \frac{E(R_p) - R_f}{\sigma_p}. \tag{3.13}$$

From the formula (3.13), $E(R_p)$ represents the expected return of the portfolio, or the mean historical return, R_f represents the return of risk-free asset, and is applied as a benchmark, or the return that can be obtained with little or no risk. Sharpe ratios are often applied here for treasury bonds because they are less likely to default. And σ_p represents the standard deviation of the portfolio's return. Subtracting the risk-free rate from the average return allows investors to better isolate the profits associated with risky activities. The risk-free rate of return is the return on a zero-risk investment, which means that this is the return that investors can expect without taking risk.

3.6.2 Maximum Drawdown

There is one thing that investors usually focus on when assessing the historical returns of an investment. It makes sense that investors are most concerned with past returns. In financial technical analysis, drawdown is a measure applied to gauge the financial risk of an investment, usually as percentage, and is the decline in the value of an individual investment or portfolio from a relative peak to a relative trough. Measuring this drawdown allows investors to understand the volatility of investment returns. It is an important risk factor for investors to consider and has become increasingly important in recent years in asset management.

The two elements of a drawdown are the monetary amount of the drawdown and the time it takes for the investment to recover from the retracement. More conservative investors look for investments with lower drawdown and will usually

forego changes for greater investment returns. For these investors, not losing money is more important than getting a good return. Conservative investors typically avoid more volatile investments. The formula relating to drawdown is shown below:

$$DD_t = 1 - \frac{W(t)}{\max\limits_{\tau \in (0,t)} W(\tau)}, \tag{3.14}$$

where $W(t)$ represents the wealth at time *t*.

Maximum Drawdown (MDD) measures the maximum fall in the value of an investment and is given by the difference between the lowest trough and the highest peak before the trough. MDD is usually applied to measure the risk associated with a particular asset or a portfolio consisting of a basket of assets.

Investors and financial analysts consider it when constructing portfolios because maximum drawdown is suggestive of future risk. They calculate future expected stock returns based on historical returns. A low MDD value indicates a slight fluctuation in the value of an investment and therefore a lower level of risk, and vice versa. When comparing the two investment options, an investor who wants the assurance of a stable return is likely to choose the option with the lower MDD value. On the other hand, another investor who is willing to take a higher risk in return for a higher return will choose the asset with a higher MDD. The formula relating to maximum drawdown is shown below:

$$MDD_{(0,T)} = \max_{\tau \in (0,T)} \left(1 - \frac{W(\tau)}{\max\limits_{t \in (0,\tau)} W(t)}\right). \tag{3.15}$$

4. Application of Selected Portfolio Optimization Models

This chapter is the practical part. We apply the theoretical knowledge presented in Chapter 3 to actual stock data and solve portfolio optimization problems. We apply two benchmark methods and the Markowitz model and Min-CVaR to solve the portfolio optimization problem and calculate the out-of-sample returns and final wealth of the portfolio, then compare the performance of the chosen strategies to find the best portfolio optimization strategy. We optimize our portfolios using Solver in Microsoft Excel.

This chapter can be divided into four parts, in the first part we present the data characteristics, in the second part we analyse the performance of the four different methods or models applied for the in-sample period, and in the third part we analyse the performance of the four different methods or models for the out-of-sample period. Finally, we compare the performance of the selected strategies and select the best strategy.

4.1 Data description

In this thesis, we have selected stocks based not only on the fact that they are listed on the Hong Kong Stock Exchange, but also that they are constituent stocks of the Hang Seng Index. The Hang Seng Index is the most important index of the Hong Kong Stock Exchange and can be regarded as representative of the Hong Kong Stock Exchange.

In this regard, we have selected the top 30 stocks that are constituents of the Hang Seng Index by market capitalization that fit into the time period of the data. The data set we created for the time period is for a 10-year period from 1st January 2012 to 26th December 2021. The data is presented as weekly data of stock-adjusted closing prices, so there are approximately 522 weeks of stock price data. We assume each week we rebalance the portfolio composition without transaction costs. The

sample period for the equity portfolio is divided into an in-sample period (1st January 2012 – 25th December 2016) and an out-of-sample period (1st January 2017 – 26th December 2021). Stock prices are shown in Hong Kong dollars (HKD). The name and abbreviation of each selected stock are shown in table 4.1.

Table 4.1 List of company's names and abbreviations

Name	Abbreviation
Tencent Holdings Limited	TCEHY
China Construction Bank Corporation	CCB
China Mobile Communications Group Co, Ltd	CMCC
HSBC Holdings plc	HSBC
AIA Group Limited	AIA
Hong Kong Exchanges and Clearing Limited	HKEX
Ping An Insurance Company of China, Ltd	PNGAY
Industrial and Commercial Bank of China Limited	ICBC
BOC Hong Kong Holdings Limited	BHKLY
Hang Seng Bank Limited	HSNGY
China Overseas Land & Investment LTD	COLI
China Merchants Bank Co, Ltd	CMB
Sun Hung Kai Properties Ltd	SUHJY
China Resources Land Ltd	CRL
Bank of China Limited	BOC
CHINA Longfor CO, Ltd	CLC
BYD Company Limited	BYD
MTR Corporation Limited	MTR
ANTA Sports Products Ltd	ANTA
CITIC Limited	CITIC
CHEUNG KONG Hutchison Holdings Limited	CKHUY
Techtronic Industries Co. Ltd	TTI
Galaxy Entertainment Group Limited	GEG
CLP Group	CLP
The Hong Kong and China Gas Company Limited	HOKCY
Li-Ning Company Limited	LN
Inner Mogolia Mengniu Dairy Industry Limited	MN
Henderson Land Development Company Limited	HLDCY
Shenzhou International Group Holdings Limited	SIG
Country Garden Holdings Limited	CG

Source: https://finance.yahoo.com/

We have 522 weeks of stock price data from 1st January 2012 to 26th December 2021. We can then use formula (3.1) to obtain the 521 weekly returns for the 30 stocks and calculate the average return for each stock, which is a measure of the stock's expected return. Another necessary metric is the standard deviation, calculated by formula (3.3).

Table 4.2 Expected returns and standard deviations (weekly)

	Whole period		In-sample		Out-of-sample	
	Expected return	σ	Expected return	σ	Expected return	σ
TCEHY	0.601%	3.941%	0.777%	3.802%	0.415%	4.080%
CCB	0.158%	3.325%	0.194%	3.366%	0.131%	3.293%
CMCC	0.034%	2.935%	0.135%	2.734%	-0.074%	3.128%
HSBC	0.096%	3.106%	0.161%	2.847%	0.021%	3.353%
AIA	0.304%	3.218%	0.296%	2.965%	0.304%	3.462%
HKEX	0.370%	3.737%	0.279%	3.851%	0.458%	3.632%
PNGAY	0.278%	4.090%	0.292%	4.303%	0.257%	3.880%
ICBC	0.151%	3.444%	0.160%	3.470%	0.136%	3.430%
BHKLY	0.193%	3.037%	0.288%	2.882%	0.091%	3.191%
HSNGY	0.195%	2.532%	0.276%	2.141%	0.104%	2.872%
COLI	0.242%	4.459%	0.343%	4.555%	0.126%	4.369%
CMB	0.429%	4.379%	0.236%	4.300%	0.615%	4.463%
SUHJY	0.113%	3.115%	0.109%	3.072%	0.097%	3.151%
CRL	0.368%	4.904%	0.308%	4.996%	0.415%	4.824%
BOC	0.164%	3.158%	0.244%	3.455%	0.074%	2.838%
CLC	0.478%	4.909%	0.236%	4.428%	0.707%	5.351%
BYD	0.764%	6.859%	0.574%	6.866%	0.940%	6.870%
MTR	0.197%	2.168%	0.248%	2.116%	0.140%	2.223%
ANTA	0.694%	5.553%	0.601%	5.761%	0.786%	5.358%
CITIC	0.038%	3.762%	0.062%	4.046%	0.007%	3.469%
CKHUY	0.084%	3.074%	0.261%	3.087%	-0.101%	3.059%
TTI	0.687%	4.263%	0.575%	3.816%	0.800%	4.679%
GEG	0.359%	5.167%	0.498%	5.263%	0.218%	5.085%
CLP	0.129%	1.865%	0.117%	1.733%	0.129%	1.987%
HOKCY	0.151%	2.102%	0.134%	2.093%	0.165%	2.120%
LN	0.720%	6.443%	0.150%	6.782%	1.278%	6.054%
MN	0.390%	4.200%	0.258%	4.075%	0.533%	4.329%
HLDCY	0.222%	3.273%	0.271%	3.354%	0.168%	3.202%
SIG	0.643%	4.370%	0.710%	3.968%	0.584%	4.751%
CG	0.444%	5.521%	0.423%	5.319%	0.480%	5.731%

Source: own elaboration

The results of the mean and standard deviation of returns were calculated as shown in table 4.2. The stock with the highest expected return for the entire period was BYD at 0.764%. The stock with the lowest standard deviation was CLP at 1.865%. The stock with the highest expected return over the in-sample period is TCEHY at 0.777%. The stock with the lowest standard deviation is still CLP at 1.733%. Out of sample, the stock with the highest expected return of 0.940% and the highest standard deviation of 6.870% is BYD and the stock with the lowest standard deviation is CLP. It is worth noting that the standard deviation of the CLP is the smallest at all periods.

Another necessary input data is the covariance matrix. formula (3.5) in Chapter 3 provides information on how to calculate the covariance.

Table 4.3 Covariance matrix (whole period)

	TCEHY	CCB	CMCC	HSBC	AIA	HKEX	…	HOKCY	LN	MN	HLDCY	SIG	CG
TCEHY	0.0017	0.0007	0.0004	0.0005	0.0007	0.0009	…	0.0001	0.0008	0.0006	0.0005	0.0007	0.0012
CCB	0.0007	0.0011	0.0004	0.0005	0.0006	0.0006	…	0.0002	0.0006	0.0004	0.0005	0.0006	0.0009
CMCC	0.0004	0.0004	0.0010	0.0002	0.0004	0.0003	…	0.0001	0.0001	0.0001	0.0003	0.0004	0.0003
HSBC	0.0005	0.0005	0.0002	0.0011	0.0005	0.0004	…	0.0002	0.0004	0.0003	0.0004	0.0005	0.0006
AIA	0.0007	0.0006	0.0004	0.0005	0.0012	0.0007	…	0.0003	0.0008	0.0006	0.0006	0.0008	0.0009
HKEX	0.0009	0.0006	0.0003	0.0004	0.0007	0.0013	…	0.0002	0.0009	0.0007	0.0004	0.0008	0.0009
…	…	…	…	…	…	…	…	…	…	…	…	…	…
HOKCY	0.0001	0.0002	0.0001	0.0002	0.0003	0.0002	…	0.0004	0.0001	0.0002	0.0004	0.0003	0.0003
LN	0.0008	0.0006	0.0001	0.0004	0.0008	0.0009	…	0.0001	0.0037	0.0006	0.0006	0.0013	0.0011
MN	0.0006	0.0004	0.0001	0.0003	0.0006	0.0007	…	0.0002	0.0006	0.0019	0.0004	0.0008	0.0007
HLDCY	0.0005	0.0005	0.0003	0.0004	0.0006	0.0004	…	0.0004	0.0006	0.0004	0.0010	0.0005	0.0008
SIG	0.0007	0.0006	0.0004	0.0005	0.0008	0.0008	…	0.0003	0.0013	0.0008	0.0005	0.0022	0.0011
CG	0.0012	0.0009	0.0003	0.0006	0.0009	0.0009	…	0.0003	0.0011	0.0007	0.0008	0.0011	0.0033

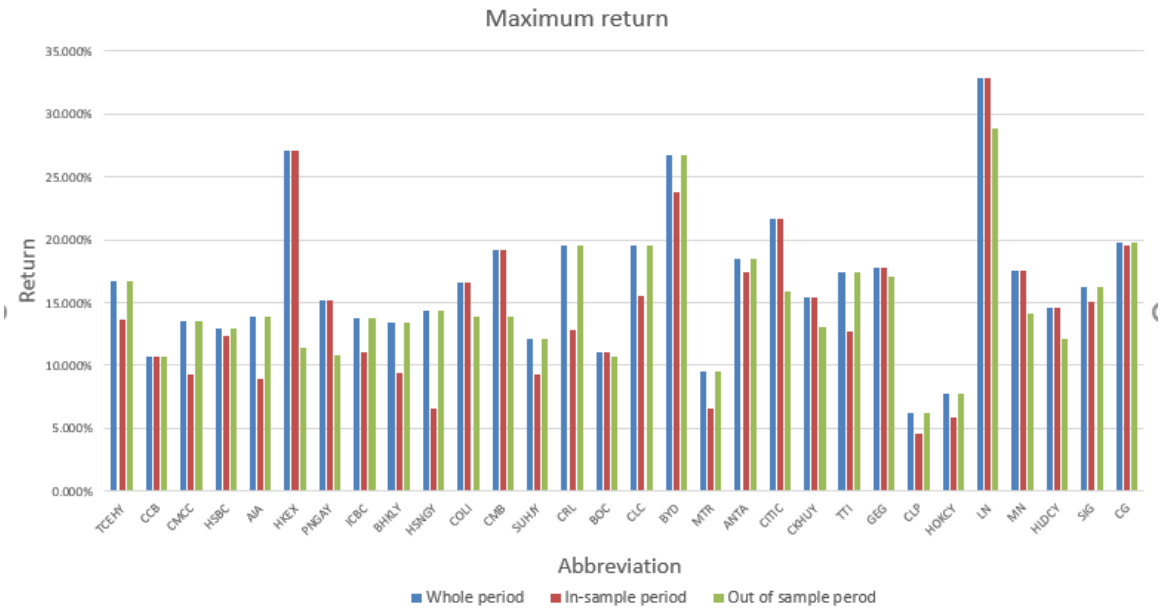
Source: own elaboration

Table 4.3 shows the covariances for the whole period and the covariances for the in-sample and out-of-sample periods can be detailed in Appendix 2. For the example of table 4.3, the results of the covariance matrix are all positive, representing the fact that any two variables between any two of the 30 constituent stocks tend to be higher or lower at the same time. The larger the covariance, the greater the degree to which any two stocks change in the same direction, and the smaller the covariance, the

smaller the degree to which any two stocks change in the same direction. However, if the covariance is negative, it means that the two stocks are moving in opposite directions and if the return on one stock becomes higher, the return on the other stock tends to be lower.

Next, we perform further analysis of the underlying data. Figures 4.1 and 4.2 show the maximum and minimum returns for each of the 30 stocks.

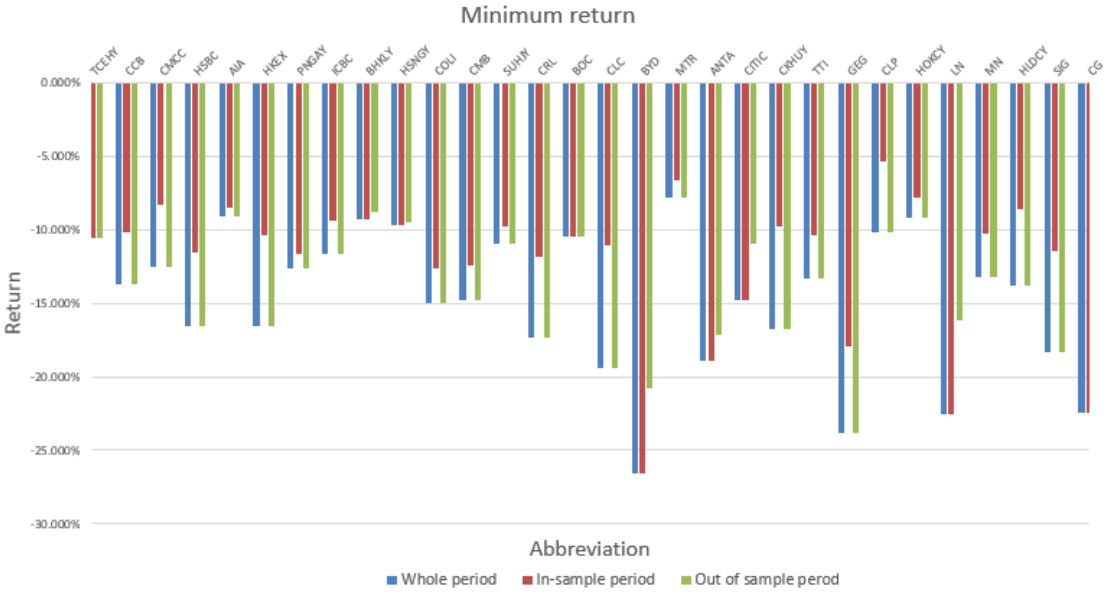
Figure 4.1 The maximum return of chosen stocks



Source: own elaboration

According to figure 4.1, LN not only had the highest maximum return over the full period, but also the highest maximum return in-sample versus out-of-sample, peaking at 32.853% on 15 March 2015. Li Ning Limited is one of the leading sports brand companies in China, operating under the Li Ning brand of professional and casual sports footwear, apparel, equipment, and accessories products. In early 2015, in the face of several consecutive years of losses, founder Li Ning returned to the company, adjusting channels, repositioning the brand and a series of reforms, the company transformed from a traditional equipment provider to an "Internet and sports life service provider".

Figure 4.2 The minimum return of chosen stocks



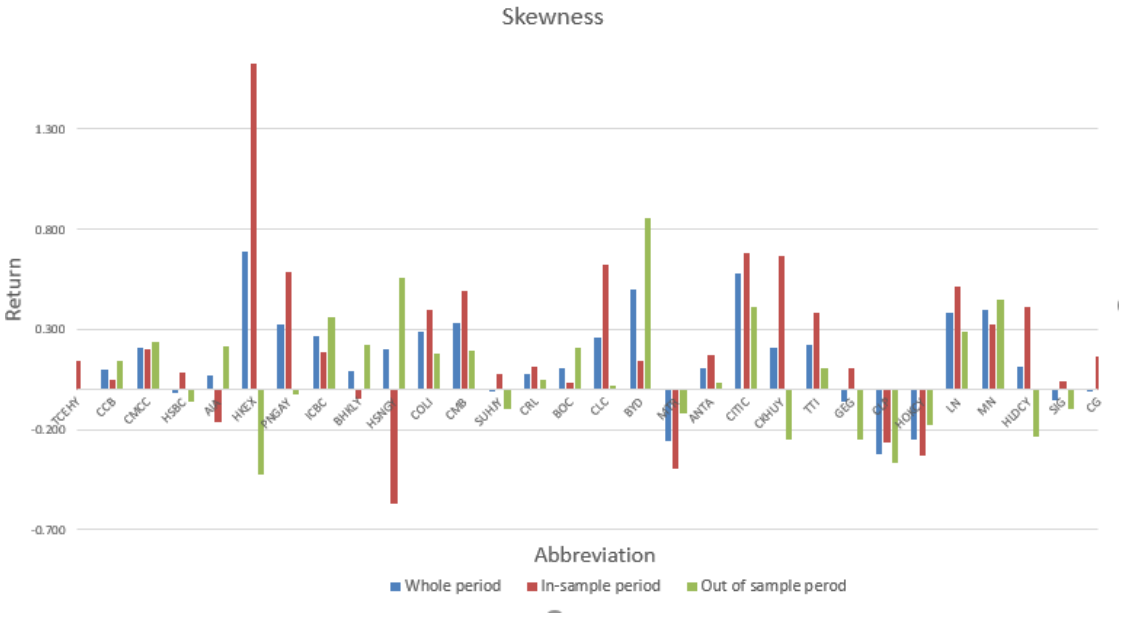
Source: own elaboration

As can be seen from the figure, BYD experienced the smallest return of the entire period of 30 stocks at -26.573% as of December 14, 2014. It is worth noting that BYD had the highest expected return and standard deviation for the entire period. This shows that BYD has the highest degree of volatility among the 30 stocks and further supports the principle that the higher the risk the greater the reward.

BYD is a new technology private company with three major industry groups: IT, automotive, and new energy. The sharp fall in the stock price at the end of 2014 was linked to the company suffering a foreign exchange loss in Russia, a sharp contraction in orders for electric buses, the collapse of its financing position, and the triggering of stop-losses in fund's long position, as well as Warren Buffett's proposed major reduction in his holdings.

The characteristics of skewness and kurtosis have been described in the previous chapter and are shown in figures 4.3 and 4.4 for the selected data.

Figure 4.3 The skewness of chosen stocks' returns

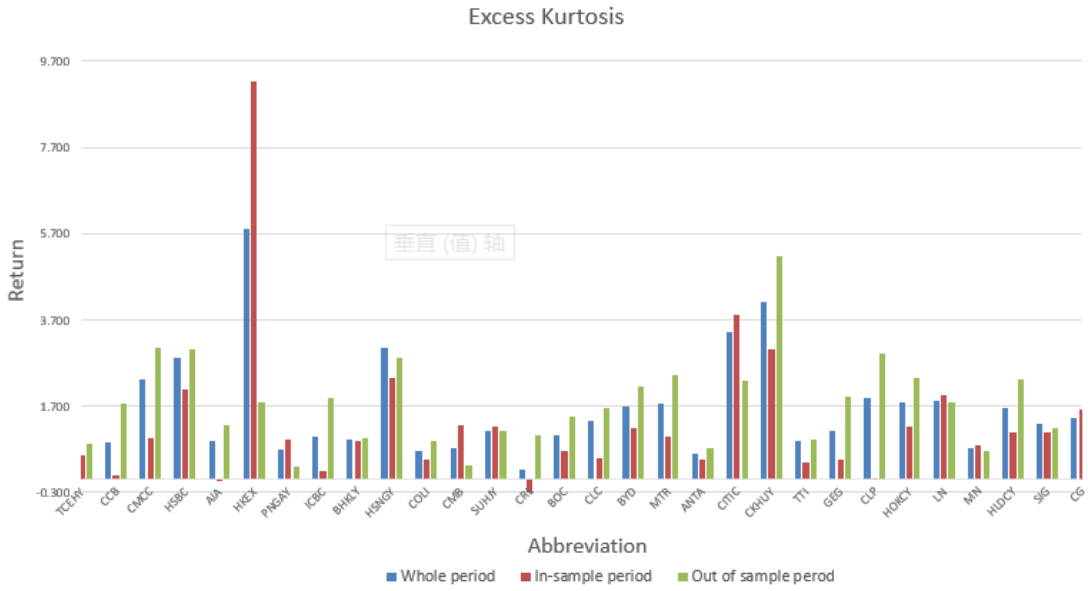


Source: own elaboration

If the skewness value is positive, the distribution is skewed to the right, while if the skewness value is negative, the distribution is skewed to the left. The presence of a large absolute value of skewness indicates the presence of extreme values for that sample data.

As observed in figure 4.3, the skewness of HKEX, BYD and CMC are all large. positive skewness for both BYD and CMC indicate that the distributions are right skewed, and large absolute values in the BYD out-of-sample period versus the CMC in-sample period indicate the presence of extreme values. In contrast, the absolute value of the HKEX skewness is maximum during the in-sample period and the skewness is positive for both the full period and the in-sample period, indicating a distribution that is skewed to the right, which suggests the presence of some extreme values affecting the sample data. with higher future returns due to higher volatility. In contrast, the HKEX skewness is negative and large in absolute value in the out-of-sample period, indicating that the distribution is skewed to the left and that extreme values exist for this sample data. In contrast, HSNGY has a negative skewness in the in-sample period and is the maximum of the negative skewness, indicating that the distribution is skewed to the left and that extreme values exist for this sample data.

Figure 4.4 The kurtosis of chosen stocks' returns



Source: own elaboration

The kurtosis of the normal distribution is 3. Figure 4.4 shows the excess kurtosis, in other words, the excess kurtosis over the kurtosis of the normal distribution. It is easy to observe that most of the selected stocks have kurtosis values above 3, with only the CRL in the in-sample period having a kurtosis less than 3 but very close to 3. This indicates that the distribution of the selected stocks is steeper than the normal distribution, which also implies that there are thick tails, meaning that outliers are more likely. More importantly, in discussing the skewness above, HKEX, CMC and KCKHUY have shown that there are some extreme values in these sample cycles. In contrast, the kurtosis of HKEX reaches extreme positive kurtosis during the in-sample period, implying that more of the numbers in the distribution lie in the tails of the distribution. Combining this with figure 4.3 and figure 4.4 shows that skewness and kurtosis are closely related.

4.2 Portfolio Optimization in In-Sample Period

In this subsection, we apply the chosen model to optimise the portfolio for the in-sample period data. There are two benchmark methods - the Hang Seng Index and the Naive strategy and the Markowitz model and Min-CVaR.

4.2.1 Hang Seng Index

The Hang Seng Index (HSI) is Hong Kong's benchmark stock index and is the most influential stock price index reflecting the price movements of the Hong Kong stock market and is a market capitalization-weighted index of the 50 largest companies traded on the Hong Kong Stock Exchange, which account for approximately 65% of the total market capitalization of the Hong Kong Stock Exchange. The index is divided into four industry sectors: financials, industrials, real estate investment trusts, and utilities.

The Hang Seng Index is one of the largest indices in Asia and is also known as the "Dow Jones of Asia". It is the primary indicator of the price and overall market performance of the Hong Kong stock market. Since its launch in 1969, the Hang Seng Index has reflected the performance of the largest and most liquid companies in the Hong Kong stock market. The Hang Seng Index is a widely quoted barometer of the Chinese and Hong Kong economies. As Hong Kong is a special administrative region of China, the economies of the two places are closely linked and many mainland Chinese companies are listed on the Hong Kong Stock Exchange, so mainland Chinese economic factors effectively influence the movement of the Hang Seng Index.

Therefore, the analysis of the Hang Seng Index as a benchmark is also a reflection of the Hong Kong Stock Exchange and the Hong Kong and China stock markets. Based on formulas (3.1), (3.11), and (3.12) we can obtain the return and wealth path of the HSI for the period in the in-sample in table 4.4. Where HSI is a stock so the weight is 1 and the initial wealth value is 1 HKD.

As can be seen from table 4.4, the wealth on 8th January 2012, the second week, had a value of 1.019704 HKD and increased to 1.183267 HKD at the end of the in-sample period, which also implies a positive return. During this period, the minimum wealth was 0.985291 HKD and the maximum wealth was 1.513091 HKD.

Table 4.4 In-sample period portfolio returns and wealth of HSI (in HKD)

Data	Return	Wealth	Data	Return	Wealth
2012/1/01		1	2014/12/21	1.007%	1.255809
2012/1/08	3.288%	1.019704	2014/12/28	1.593%	1.275815
2012/1/15	4.717%	1.012743	2015/1/04	0.837%	1.286499
2012/1/22	1.946%	1.018812	2015/1/11	0.767%	1.296372
……	……	……	……	……	……
2012/12/23	0.712%	1.219089	2015/12/20	1.758%	1.190666
2012/12/30	2.932%	1.254828	2015/12/27	-1.011%	1.178633
2013/1/06	-0.287%	1.251223	2016/1/03	-6.665%	1.100072
2013/1/13	1.452%	1.269386	2016/1/10	-4.561%	1.049895
……	……	……	……	……	……
2013/12/22	1.890%	1.250103	2016/11/27	-0.698%	1.213615
2013/12/29	-1.833%	1.227193	2016/12/04	0.869%	1.224165
2014/1/05	0.127%	1.228751	2016/12/11	-3.252%	1.184353
2014/1/12	1.257%	1.244193	2016/12/18	-2.025%	1.160366
……	……	……	2016/12/25	1.974%	1.183267

Source: own elaboration

Figure 4.5 The trend of in-sample period wealth of HSI

Source: own elaboration

The trend of the wealth path of the Hang Seng Index in the in-sample period can be observed more visually in figure 4.5. From 1 January 2012 to 1 July 2015, the overall wealth shows a volatile upward trend and reaches a maximum value of 1.513091 HKD during the in-sample period, while from then on it shows an overall downward trend to a minimum value of 0.985291 HKD and then an upward trend again.

The next step is to calculate the Sharpe ratio of the Hang Seng Index in in-sample period based on formula (3.13). According to World Government Bonds[1], the10-year Hong Kong government bond return rate is 2.536%, the initial wealth is 1 HKD, and data units in weeks, so the weekly return of this government bond should be:

$$Weekly\ risk\ free\ rate = 1 \cdot (1 + 0.02536)^{\frac{1}{52}} - 1 = 0.00048. \qquad (4.1)$$

Once the weekly risk-free rate is known, the weekly Sharpe ratio can be further calculated. However, in order to make the Sharpe ratio more comparable, the weekly Sharpe ratio needs to be changed to an annual Sharpe ratio. Therefore, multiplying the average weekly return, the weekly risk-free rate, and the weekly return variance by 52, with the standard deviation being the square root of the variance, we can obtain the annual Sharpe ratio. The new calculation yields an annual average return of 4.726%, an annual risk-free rate of 2.505% and an annual standard deviation of 16.508%. The annual Sharpe ratio is calculated as shown in formula (4.2):

$$Sharpe\ ratio = \frac{(0.04726 - 0.02505)}{0.16508} = 0.134557. \qquad (4.2)$$

It is worth noting that all subsequent calculations of Sharpe ratios are based on formulas (4.1) and (4.2). The maximum drawdown is calculated based on formula (3.15).

Table 4.5 Results of Hang Seng Index in the in-sample period

Final wealth	1.183267 HKD
Annual portfolio return	4.726%
Annual standard deviation	16.508%
Maximum drawdown	34.882%
Sharpe ratio	0.134557

Source: own elaboration

[1] http://www.worldgovernmentbonds.com/bond-historical-data/hong-kong/10-years/

The results relating to the calculation of the Hang Seng Index in the in-sample period are summarized in table 4.5.

4.2.2 Naive strategy

The naive strategy also provides a benchmark. As described in the previous chapter for the naive strategy, investors can allocate their money equally between all investment options, regardless of what those options are. In other words, the stocks in the portfolio are all weighted equally. We have selected a total of 30 stocks, so according to formula (3.8) each stock has a weight of $\frac{1}{30}$. In table 4.6 are the weekly portfolio returns and wealth under the naive strategy in the in-sample period.

Table 4.6 In-sample period portfolio returns and wealth under naive strategy (in HKD)

Data	Return	Wealth	Data	Return	Wealth
2012/1/01		1	2014/12/21	1.596%	1.737740
2012/1/08	5.792%	1.057919	2014/12/28	4.114%	1.809239
2012/1/15	5.229%	1.113232	2015/1/04	-0.470%	1.800730
2012/1/22	2.559%	1.141717	2015/1/11	0.017%	1.801045
……	……	……	……	……	……
2012/12/23	1.633%	1.372092	2015/12/20	1.955%	1.959134
2012/12/30	4.507%	1.433936	2015/12/27	-0.066%	1.957834
2013/1/06	0.349%	1.438947	2016/1/03	-6.481%	1.830948
2013/1/13	2.599%	1.476347	2016/1/10	-4.983%	1.739710
……	……	……	……	……	……
2013/12/22	1.363%	1.620634	2016/11/27	-0.300%	2.148472
2013/12/29	-0.793%	1.607779	2016/12/04	0.218%	2.153161
2014/1/05	0.503%	1.615865	2016/12/11	-3.372%	2.080545
2014/1/12	-0.061%	1.614887	2016/12/18	-2.235%	2.034037
……	……	……	2016/12/25	1.799%	2.070634

Source: own elaboration

From table 4.6 it can be observed that the wealth value for the second week was 1.057919 HKD and increased to 2.070634 HKD at the end of the period in the in-sample period, which also means that the portfolio ended up with a positive return. The lowest wealth value during the in-sample period was 1.057919 HKD in the second week and the highest wealth value was 2.270680 HKD.

Figure 4.6 The trend of in-sample period wealth under naive strategy

Source: own elaboration

All wealth results for each week here are based entirely on the initial investment wealth, i.e., 1HKD. From figure 4.6 shows the overall trend in portfolio wealth in the in-sample period. Over the five years of the in-sample period, the wealth path shows a rapid growth trend. However, it is worth noting that, as presented in figure 4.5, wealth falls sharply from 1st July 2015 until 1st January 2016 when it starts to rise again. This is largely due to an unprecedented wild spike since November 2014, which took the Chinese stock market to staggering heights back in June 2015. The Hong Kong stock market was also influenced by the mainland Chinese stock market at the same time and soared wildly. So, the reason for the sharp fall afterwards was the abnormal rise in the previous period, which was not fundamentally consistent in nature and it was only a matter of time before it fell back to its normal price level.

Similarly in the analysis of the Hang Seng Index, we similarly need to then calculate the annual average return of the portfolio, with the standard deviation of the annual return. The annual average return is 15.978% and the annual standard deviation of return is 16.761%. The Sharpe ratio and maximum retracement are calculated in the same way as in the previous subsection. The results of the calculation for the naive strategy are shown in table 4.7.

Table 4.7 Results of Naive strategy in the in-sample period

Final wealth	2.070634 HKD
Annual portfolio return	15.978%
Annual standard deviation	16.761%
Maximum drawdown	27.690%
Sharpe ratio	0.803797

Source: own elaboration

4.2.3 Markowitz model

The Markowitz model is described as a mean-variance approach because it considers only these two parameters, namely the average return and the variance of returns. The expected return of a portfolio is measured by the average return. The risk corresponding to the uncertainty of obtaining the return is measured by the variance. In this section, we apply the Markowitz model over the in-sample period to construct the efficient frontier and find the weights of each stock in these portfolios.

Table 4.5 shows the results of the Markowitz model we used to obtain the weights of the stocks in these portfolios over the in-sample period. The first step is to find the efficient portfolio A with minimum risk i.e., with minimum standard deviation, and the second step is to find the efficient portfolio B with maximum expected return i.e., with maximum return. The final step is to find the portfolios C-H that are chosen for the interior points of the efficient set.

Table 4.8 The weights of stocks in Markowitz model in the in-sample period

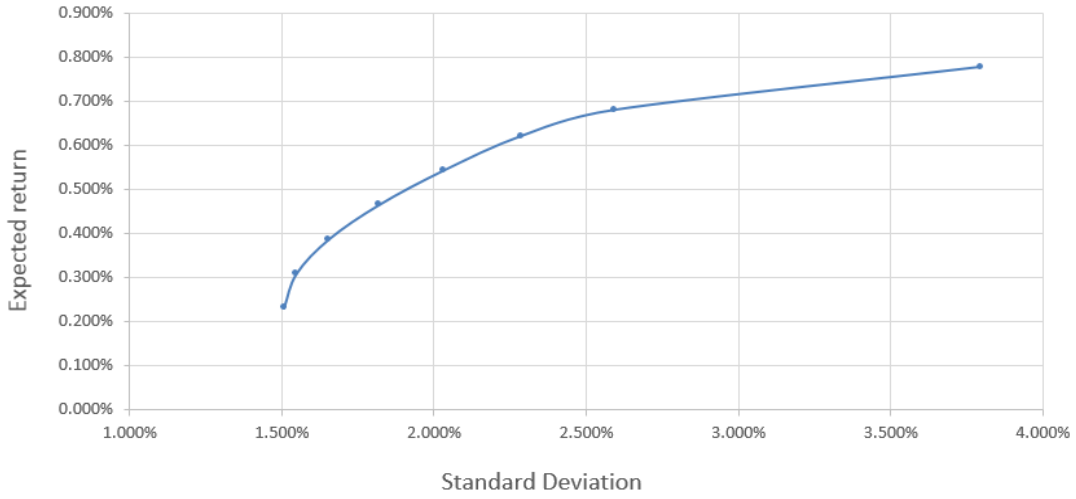
Stocks	A	C	D	E	F	G	H	B
TCEHY	0.00%	3.76%	9.38%	15.20%	20.92%	28.79%	39.41%	100.00%
CCB	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
CMCC	1.24%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
HSBC	8.19%	4.15%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
AIA	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
HKEX	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
PNGAY	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
ICBC	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
BHKLY	0.00%	0.13%	0.53%	0.00%	0.00%	0.00%	0.00%	0.00%
HSNGY	12.36%	17.31%	19.99%	20.01%	19.78%	13.95%	0.00%	0.00%
COLI	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
CMB	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
SUHJY	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
CRL	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
BOC	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
CLC	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
BYD	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
MTR	13.53%	14.63%	13.76%	12.58%	11.40%	2.52%	0.00%	0.00%
ANTA	1.79%	3.61%	4.93%	6.19%	7.42%	8.62%	8.92%	0.00%
CITIC	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
CKHUY	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
TTI	4.89%	7.82%	10.46%	13.43%	16.38%	19.65%	20.35%	0.00%
GEG	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
CLP	45.64%	37.05%	26.47%	14.38%	2.05%	0.00%	0.00%	0.00%
HOKCY	4.76%	0.51%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
LN	0.76%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
MN	0.00%	0.11%	0.06%	0.00%	0.00%	0.00%	0.00%	0.00%
HLDCY	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
SIG	6.84%	10.93%	14.42%	18.22%	22.04%	26.47%	31.31%	0.00%
CG	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Sum	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

Source: own elaboration

We can clearly see the weighting of each stock in the different portfolios. And then we need to apply the same weights to the out-of-sample period for further analysis. In the case of portfolio B, for example, it invests all its funds in TECHY, because we set portfolio B to have the maximum return and TECHY to have the highest return, but at the same time, this is also very risky, as can be seen from the fact that portfolio B has the maximum standard deviation.

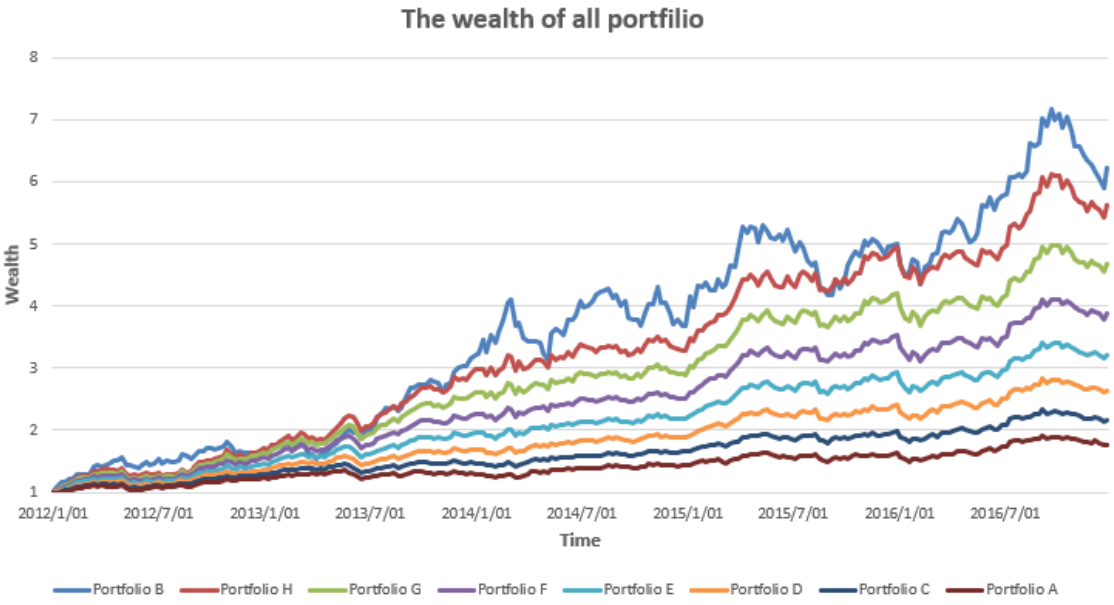
Figure 4.7 shows the effective frontier for the Markowitz model in the in-sample period. And figure 4.8 shows the trend in the wealth path of portfolios A to H over the in-sample period.

Figure 4.7 Efficient frontier in the in-sample period (weekly)



Source: own elaboration

Figure 4.8 The wealth of all portfolios under Markowitz model in the in-sample period



Source: own elaboration

Through the figure 4.8, it can be observed that the overall trend in wealth for the entire portfolio is upwards over the in-sample period. At the beginning of the in-sample period，the wealth of all portfolios increases upwards but with a small difference, while as time goes on, the difference in wealth of each portfolio increases at the end of the in-sample period. While Portfolio A has the smallest wealth, Portfolio

B has the largest wealth. This is also because we have set Portfolio A to have the lowest risk and therefore the lowest return. Portfolio B is set to have the maximum return and the corresponding maximum risk.

As well, to make the results more comparable, the weekly units need to be changed to annual units, as shown in table 4.9.

Table 4.9 The performances of each portfolio under Markowitz model in the in-sample period

Portfolio	Final wealth	Annual portfolio return	Annual standard deviation	Maximum drawdown	Sharpe ratio
Portfolio A	1.769269	12.015%	10.889%	9.857%	0.873407
Portfolio C	2.162485	16.072%	11.187%	9.891%	1.212787
Portfolio D	2.635317	20.130%	11.958%	9.868%	1.473916
Portfolio E	3.201436	24.187%	13.153%	10.512%	1.648405
Portfolio F	3.876477	28.244%	14.688%	12.012%	1.752351
Portfolio G	4.676534	32.301%	16.526%	12.478%	1.803000
Portfolio H	5.613528	36.359%	18.729%	12.159%	1.807572
Portfolio B	6.226981	40.416%	27.415%	24.060%	1.382858

Source: own elaboration

From table 4.9 it can be obtained that there are eight portfolios with different final wealth, annual standard deviation, annual portfolio return, maximum drawdown, and Sharpe ratio. The final wealth increases as the annual portfolio return increases, while the increase in final wealth and annual portfolio return also leads to an increase in risk i.e., an increase in the annual standard deviation of returns. The maximum drawdown is in Portfolio B, where losses are higher when facing the worst-case scenario. The highest Sharpe ratio, on the other hand, is in portfolio H, indicating that the investment provides the highest compensation for unit of risk in these portfolios. If we were to select portfolios based solely on Sharpe ratios, Portfolio H would be a good choice.

4.2.4 Min-CVaR

CVaR is an extended value-at-risk measure used to quantify the average loss over a specified period of time for unlikely scenarios that exceed the confidence level. It is worth noting that it focuses on minimizing the Conditional Value at Risk (CVaR) rather than minimizing the value at risk (VaR), but a portfolio with a low CVaR necessarily also have a low VaR. Therefore, we first need to find the VaR.

We assume a confidence level α of 5% and a number of scenarios in the in-sample period of 260.The position with regard to the calculation of VaR is given in formula (4.3),

$$Position\ of\ VaR = 5\% \cdot 260 = 13. \tag{4.3}$$

According to from (3.10), after setting the return of assets under scenario i.e., r_{ij}, and from formula (4.3) we thus know that the position of VaR is 13th in the descending order of the portfolio's one-week losses. In Slover, we need to set the CVaR to the minimum, calculated by changing the weights of the 30 stocks. Where the weights of these stocks need to add up to one and no short selling is allowed. Another restriction is that the target return needs to be gainful. The solution method we have chosen in Slover is "Evolutionary". After the calculation, the resultant operation regarding CVaR is obtained in table 4.10.

Table 4.10 The weight of each stock under CVaR

Stocks	Weights	Stocks	Weights	Stocks	Weights
TCEHY	0.00%	COLI	0.00%	CKHUY	0.00%
CCB	0.00%	CMB	0.00%	TTI	13.57%
CMCC	17.35%	SUHJY	0.00%	GEG	0.00%
HSBC	1.34%	CRL	0.00%	CLP	46.70%
AIA	1.19%	BOC	0.00%	HOKCY	2.69%
HKEX	0.00%	CLC	0.00%	LN	0.00%
PNGAY	0.00%	BYD	0.00%	MN	0.25%
ICBC	0.00%	MTR	2.18%	HLDCY	0.00%
BHKLY	4.29%	ANTA	0.00%	SIG	10.42%
HSNGY	0.02%	CITIC	0.00%	CG	0.00%

Source: own elaboration

Under CVaR, the stocks with nonzero weights are the 11 stocks: CMCC, HSBC, AIA ,BHKLY, HSNGY, MTR, TTI, CLP, HOKCY, MN and SIG. The largest weight is 46.7% for CLP and the smallest weight is 0.02% for HSNGY. In table 4.11 are the weekly portfolio returns and wealth under the CVaR in the in-sample period.

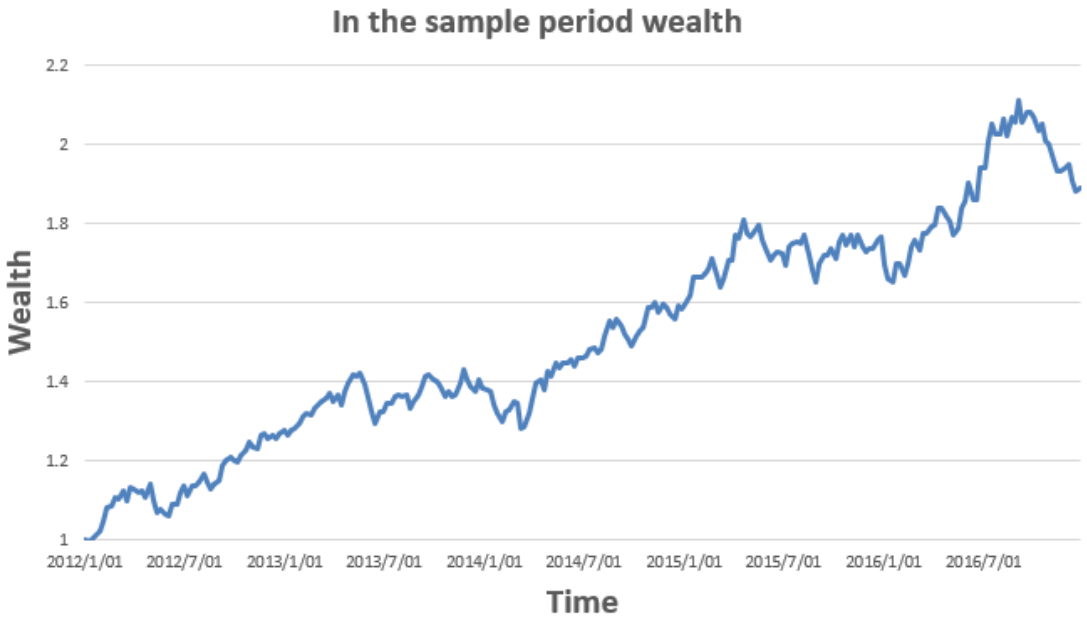
Table 4.11 In-sample period portfolio returns and wealth under CVaR (in HKD)

Data	Return	Wealth	Data	Return	Wealth
2012/1/01		1	2014/12/21	2.084%	1.590985
2012/1/08	-0.413%	0.995870	2014/12/28	-0.398%	1.584654
2012/1/15	0.558%	1.001431	2015/1/04	0.917%	1.599191
2012/1/22	1.186%	1.013311	2015/1/11	1.274%	1.619570
……	……	……	……	……	……
2012/12/23	0.718%	1.267683	2015/12/20	1.169%	1.758938
2012/12/30	0.649%	1.275917	2015/12/27	0.565%	1.768869
2013/1/06	-0.978%	1.263443	2016/1/03	-4.246%	1.693771
2013/1/13	0.992%	1.275974	2016/1/10	-1.870%	1.662094
……	……	……	……	……	……
2013/12/22	1.995%	1.404308	2016/11/27	0.488%	1.943691
2013/12/29	-1.360%	1.385213	2016/12/04	0.407%	1.951602
2014/1/05	-0.260%	1.381605	2016/12/11	-2.222%	1.908238
2014/1/12	-0.458%	1.375273	2016/12/18	-1.438%	1.880791
……	……	……	2016/12/25	0.468%	1.889591

Source: own elaboration

As can be seen from table 4.11, the initial wealth is 1 HKD and the final wealth is 1.889591 HKD, indicating a mostly positive return on the portfolio. Over the in-sample period, the minimum wealth was 0.995870 HKD in the second week and the maximum wealth was 2.111349 HKD.

Figure 4.9 The trend of in-sample period wealth under CVaR



Source: own elaboration

Figure 4.9 clearly shows the trend in wealth paths obtained by CVaR during the in-sample period. The trend in wealth is an overall upward increase over the entire in-sample period. After calculating the return of the portfolio, the results of the portfolio were obtained as shown in table 4.12.

Table 4.12 Results of CVaR in the in-sample period

Final wealth	1.889591 HKD
Annual portfolio return	13.416%
Annual standard deviation	11.633%
Maximum drawdown	10.92%
Sharpe ratio	0.937926

Source: own elaboration

4.3 Portfolios' Performance in Out-of-Sample Period

In the previous section, applying different models to the in-sample period, we obtained different weights and characteristics for each portfolio. We now evaluate each portfolio for the out-of-sample period. The out-of-sample period is from 1st

January 2017 to 26th December 2021. However, we have applied the same weights to each method as we found in the in-sample period so that we can better compare the performances of the model.

4.3.1 Hang Seng Index

In the previous subsection, we have obtained the relevant results for the Hang Seng Index in the in-sample period. The returns and wealth of the Hang Seng Index in the out-of-sample period are shown in table 4.13.

Table 4.13 Out-of-sample period portfolio returns and wealth of HSI (in HKD)

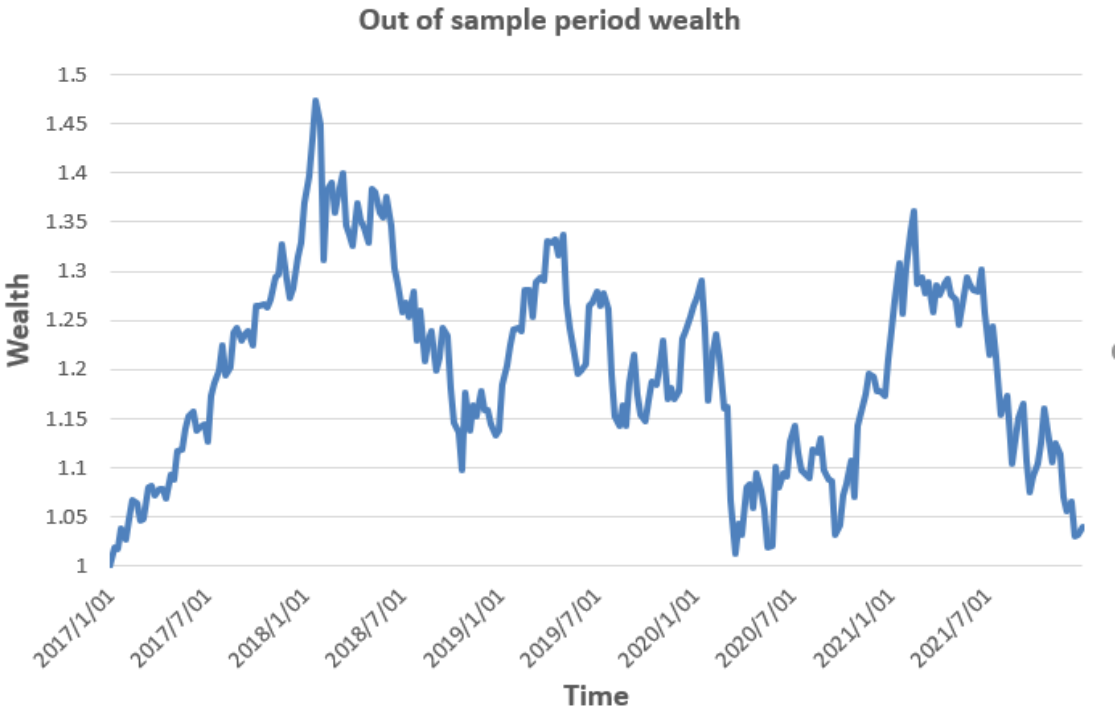
Data	Return	Wealth	Data	Return	Wealth
2017/1/01		1	2019/12/22	1.270%	1.254295
2017/1/08	1.930%	1.019303	2019/12/29	0.801%	1.264342
2017/1/15	-0.224%	1.017016	2020/1/05	0.656%	1.272639
2017/1/22	2.075%	1.038118	2020/1/12	1.460%	1.291224
……	……	……	……	……	……
2017/12/24	1.153%	1.329562	2020/12/20	-0.423%	1.172579
2017/12/31	2.993%	1.369356	2020/12/27	3.201%	1.210111
2018/1/07	1.940%	1.395926	2021/1/03	2.376%	1.238866
2018/1/14	2.682%	1.433359	2021/1/10	2.495%	1.269779
……	……	……	……	……	……
2018/12/23	-0.968%	1.133368	2021/11/28	-1.303%	1.056156
2018/12/30	0.478%	1.138782	2021/12/05	0.964%	1.066334
2019/1/06	4.063%	1.185053	2021/12/12	-3.347%	1.030646
2019/1/13	1.588%	1.203875	2021/12/19	0.134%	1.032029
……	……	……	2021/12/26	0.749%	1.039757

Source: own elaboration

As can be seen from table 4.13, the wealth value for the second week of 8 January 2017 was 1.019303 HKD, increasing to 1.039757 HKD at the end of the

period within the out-of-sample, a very small increase. The lowest wealth during the period was 1.013423 HKD and the highest wealth was 1.473319 HKD.

Figure 4.10 The trend of out-of-sample period wealth of HSI



Source: own elaboration

Figure 4.10 shows the wealth path of the overall trend over the out-of-sample period. The degree of volatility is much higher in the out-of-sample period than in the in-sample period. The ups and downs of the Hang Seng Index throughout the out-of-sample period are significant. This illustrates the volatility of the Hong Kong stock market during this period. See table 4.14 for the results of the Hang Seng Index for the out-of-sample period.

Table 4.14 Results of HSI in the out-of-sample period

Final wealth	1.039757 HKD
Annual portfolio return	2.405%
Annual standard deviation	18.007%
Maximum drawdown	31.215%
Sharpe ratio	-0.005545

Source: own elaboration

4.3.2 Naive strategy

In the naive strategy, investors can allocate their capital equally between all investment options and the stocks in the portfolio are equal regardless of what those options are. We have chosen a total of 30 stocks, so each stock is weighted $\frac{1}{30}$ according to formula (3.8). Table 4.15 shows the weekly portfolio returns and wealth for the out-of-sample period under the naive strategy.

Table 4.15 Out-of-sample period portfolio returns and wealth under naive strategy

Data	Return	Wealth	Data	Return	Wealth
2017/1/01		1	2019/12/22	0.872%	1.806660
2017/1/08	1.998%	1.019980	2019/12/29	0.541%	1.816434
2017/1/15	0.071%	1.020704	2020/1/05	0.900%	1.832778
2017/1/22	1.750%	1.038564	2020/1/12	2.667%	1.881653
……	……	……	……	……	……
2017/12/24	1.859%	1.497964	2020/12/20	0.439%	1.980570
2017/12/31	3.022%	1.543239	2020/12/27	2.733%	2.034708
2018/1/07	2.652%	1.584172	2021/1/03	3.014%	2.096026
2018/1/14	2.178%	1.618677	2021/1/10	1.145%	2.120034
……	……	……	……	……	……
2018/12/23	-0.566%	1.460339	2021/11/28	-0.047%	2.207634
2018/12/30	0.113%	1.461990	2021/12/05	1.738%	2.246008
2019/1/06	3.800%	1.517543	2021/12/12	-3.041%	2.177718
2019/1/13	1.051%	1.533494	2021/12/19	0.448%	2.187473
……	……	……	2021/12/26	0.160%	2.190979

Source: own elaboration

Our initial investment wealth was 1 HKD and at the end of the out-of-sample period the wealth was already over 2 HKD. The minimum wealth during the out-of-sample period under naive strategy was 1.019980 HKD and the maximum wealth was 2.377443 HKD.

Figure 4.11 The trend of out-of-sample period wealth under naive strategy

Source: own elaboration

From figure 4.11 it can be observed that the overall trend is increasing upwards throughout the out-of-sample period. From a steady increase at the beginning of the out-of-sample period, to an overall flattening out in the middle of the out-of-sample period to a rapid increase again at the end of the out-of-sample period. Finally, table 4.16 summarizes the results of the naive strategy during the out-of-sample period.

Table 4.16 Results of Naive strategy in the out-of-sample period

Final wealth	2.190979 HKD
Annual portfolio return	17.339%
Annual standard deviation	18.056%
Maximum drawdown	21.194%
Sharpe ratio	0.821519

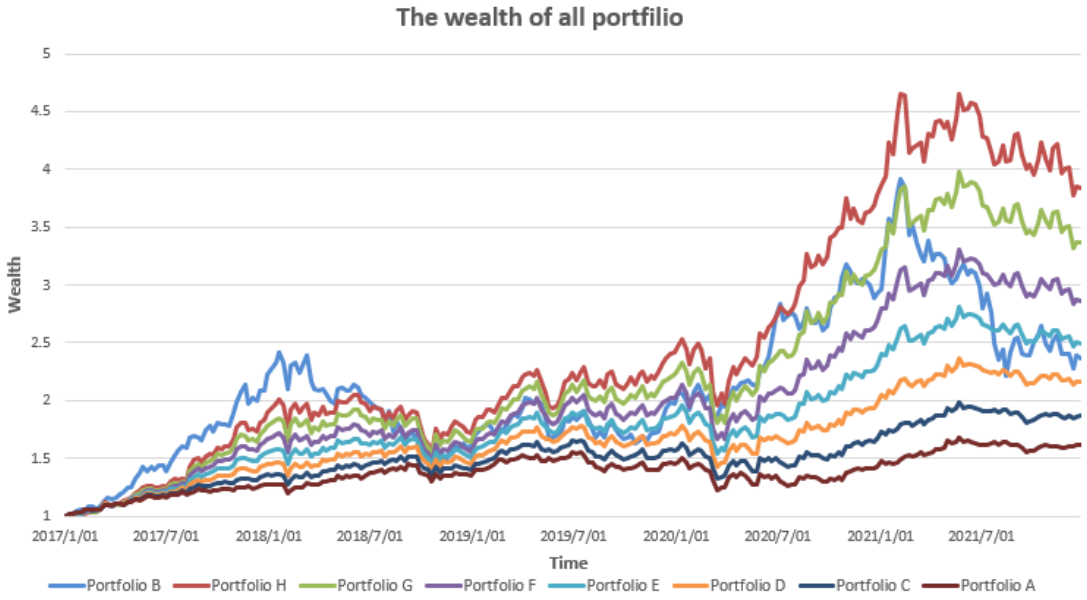
Source: own elaboration

4.3.3 Markowitz model

In this section, the Markowitz model is applied to the out-of-sample period. We have obtained in table 4.8 the weights of the stocks in the different portfolios of the Markowitz model in the in-sample period. We apply the same weights in the out-of-

sample period. We can then calculate the weekly returns and wealth paths for these portfolios in the out-of-sample period. To get a more visual view of the wealth trends of the different portfolios, the wealth paths of portfolios A to H will be compared in graphical form.

Figure 4.12 The wealth of all portfolios under Markowitz model in the out-of-sample period



Source: own elaboration

The overall trend for portfolios A to H over the out-of-sample period is found to be increasing upwards from figure 4.12. The path of wealth for portfolios A to H is still consistent over the out-of-sample period, with a small gap at the beginning of the out-of-sample period, but the gap between the different portfolios increases as time grows. Within Portfolio A to Portfolio H, Portfolio A has the smallest wealth and Portfolio H has the largest wealth. This is also related to the setting of the different portfolios. Portfolio A does not fluctuate greatly throughout the out-of-sample period and grows gently until the end of the out-of-sample period, while Portfolio H fluctuates greatly throughout and grows rapidly at the end of the out-of-sample period.

Of note is Portfolio B. During the in-sample period originally Portfolio B was set to have the largest return of these portfolios. According to the weighting information

all funds are invested in TCEHY alone, but when this weighting is applied to the out-of-sample period, Portfolio B's wealth results are well ahead at the beginning of the out-of-sample period but not the highest of these portfolios at the end of the out-of-sample period.

In addition to analyzing the wealth of the different portfolios, we also need to analyse the performance results under the Markowitz model in the out-of-sample period.

Table 4.17 The performances of each portfolio under Markowitz model in the out-of-sample period

Portfolio	Final wealth	Annual portfolio return	Annual standard deviation	Maximum drawdown	Sharpe ratio
Portfolio A	1.622227	10.519%	12.941%	20.638%	0.619288
Portfolio C	1.866892	13.482%	14.045%	20.307%	0.781608
Portfolio D	2.165476	16.677%	15.541%	19.975%	0.911951
Portfolio E	2.498721	19.894%	17.633%	20.981%	0.986140
Portfolio F	2.863056	23.098%	20.143%	22.049%	1.022335
Portfolio G	3.362897	26.890%	22.766%	22.720%	1.071098
Portfolio H	3.838351	30.131%	25.204%	25.246%	1.096097
Portfolio B	2.371331	21.603%	29.424%	44.703%	0.649050

Source: own elaboration

Portfolio H has the highest final wealth in the out-of-sample period and has the largest Sharpe ratio. Portfolio H is the best choice if we look at the Sharpe ratio alone. The final wealth, annual portfolio returns and annual standard deviation of Portfolio A to Portfolio H all increase progressively. Portfolio B, however, has the largest annual standard deviation but is not the portfolio with the largest annual return and final wealth of all portfolios. Portfolio B has the second lowest Sharpe ratio of all portfolios and the highest maximum drawdown of all portfolios at 44.703%. The smallest maximum drawdown was 19.975% in Portfolio D. This shows that concentrating all investments in one basket is not an optimal choice.

4.3.4 Min-CVaR

In this section, Conditional Value at Risk is applied to the out-of-sample period. We apply in Conditional Value at Risk, as in the previous subsection for the out-of-sample period in the Markowitz model, the same weights to the stocks obtained through Conditional Value at Risk in the out-of-sample period, see table 4.10. We can then use the weights to calculate the weekly returns and wealth path of the portfolio in Conditional Value at Risk in the out-of-sample period.

Table 4.18 Out-of-sample period portfolio returns and wealth under CVaR

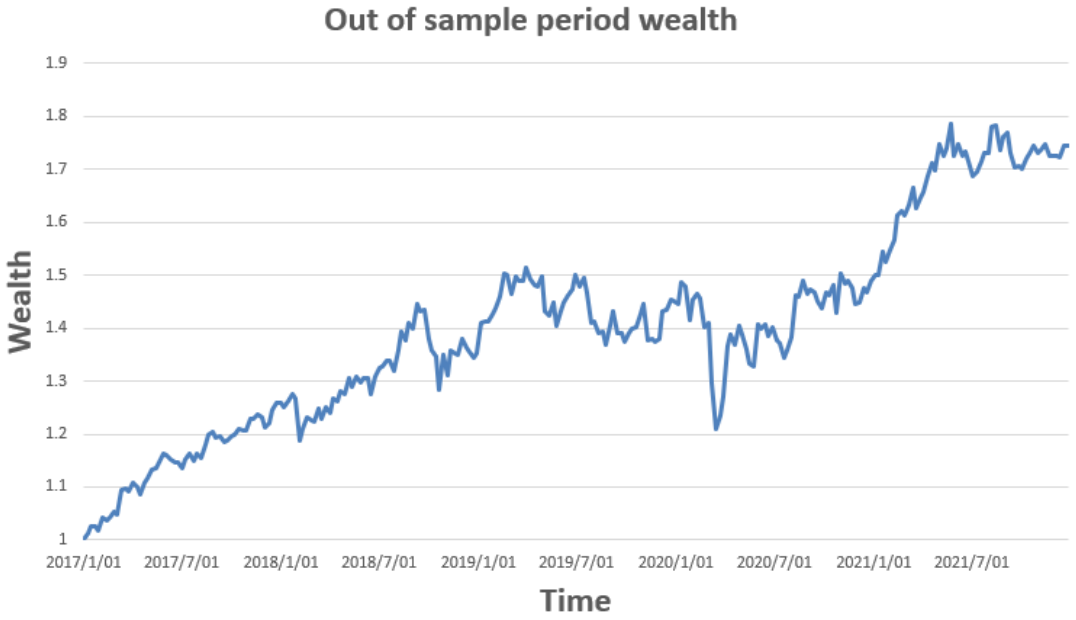
Data	Return	Wealth	Data	Return	Wealth
2017/1/01		1	2019/12/22	1.300%	1.453343
2017/1/08	1.248%	1.012480	2019/12/29	-0.217%	1.450185
2017/1/15	1.285%	1.025495	2020/1/05	-0.370%	1.444819
2017/1/22	0.073%	1.026242	2020/1/12	2.989%	1.488011
……	……	……	……	……	……
2017/12/24	1.153%	1.260042	2020/12/20	-0.642%	1.467160
2017/12/31	-0.185%	1.257717	2020/12/27	1.474%	1.488780
2018/1/07	-0.440%	1.252187	2021/1/03	0.851%	1.501456
2018/1/14	0.822%	1.262482	2021/1/10	0.022%	1.501788
……	……	……	……	……	……
2018/12/23	-0.801%	1.343053	2021/11/28	-0.072%	1.725430
2018/12/30	0.687%	1.352278	2021/12/05	0.045%	1.726212
2019/1/06	4.223%	1.409388	2021/12/12	-0.177%	1.723156
2019/1/13	0.270%	1.413194	2021/12/19	1.213%	1.744062
……	……	……	2021/12/26	0.096%	1.745738

Source: own elaboration

As can be seen from table 4.18, with an initial investment of 1 HKD, the final wealth grew to 1.745738 HKD, indicating an overall positive return for this portfolio. Over the entire out-of-sample period, the minimum wealth was 1.012480 HKD on 8th January 2017, the second week. The maximum wealth was 1.786005 HKD on 23th

May 2021. The figure further reveals the trend of the entire wealth path for the Conditional Value at Risk over the out-of-sample period.

Figure 4.13 The trend of out-of-sample period wealth under CVaR



Source: own elaboration

As can be seen through figure 4.13, the trend in the wealth path under CVaR for the entire out-of-sample period is upward. At the beginning of the out-of-sample period, wealth shows signs of rapid growth. At the middle of the out-of-sample period, wealth stays at a level, even dropping sharply in one period but returning immediately to the original mid-term level. At the end of the out-of-sample period, wealth rises rapidly again.

Finally, table 4.19 summarizes the results of the CVaR in the out-of-sample period.

Table 4.19 Results of CVaR in the out-of-sample period

Final wealth	1.745738 HKD
Annual portfolio return	12.150%
Annual standard deviation	14.107%
Maximum drawdown	20.198%
Sharpe ratio	0.683651

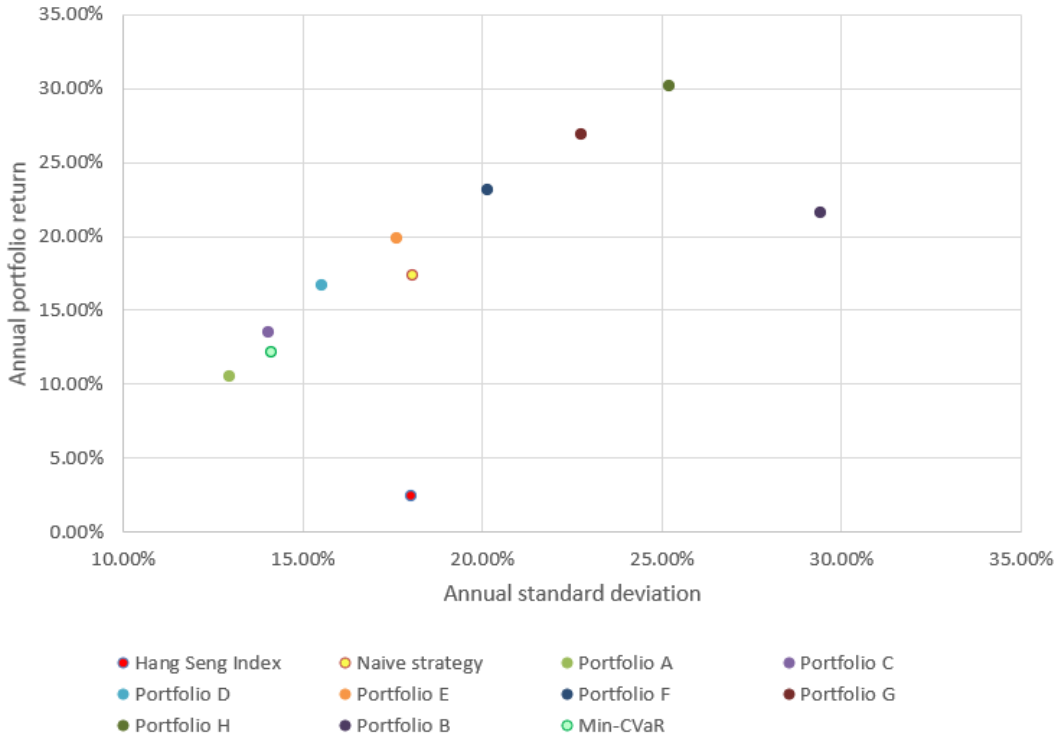
Source: own elaboration

4.4 Comparison of different strategies

In the previous section, we divided the entire sample period into an in-sample period (01/01/2012-25/12/2016) and an out-of-sample period (01/01/2017-26/12/2021)). Portfolio returns, standard deviations, wealth, Sharpe ratios and maximum drawdowns are calculated separately for different efficient portfolios based on different models for different periods. For comparison purposes, portfolio returns, standard deviations, and Sharpe ratios for all selected models are calculated on an annual basis. In this section, we compare the portfolio optimization strategies we applied based on out-of-sample periods. We compare the final wealth and performance metrics to find the best strategy.

The Hong Kong Stock Exchange is represented by the Hang Seng Index, so we use the Hang Seng Index as the benchmark for comparison. We first compare the annual portfolio returns and annual standard deviations of the different models over the out-of-sample period.

Figure 4.14 Compare the portfolio returns and standard deviations of different models in out-of-sample



Source: own elaboration

The Hang Seng Index, as the market benchmark, has the lowest annual return of all the models selected for the out-of-sample period. This indicates that in terms of portfolio returns, all the models selected outperformed the results of relying alone on a single index data, the Hang Seng Index. And not only do Portfolios A to E in the Markowitz model, the Naive Strategy and CVaR deliver significantly higher returns than the Hang Seng Index, but they are also less risky than the Hang Seng Index.

Portfolios A to H are the results of the Markowitz model for the out-of-sample period. The figure 4.14 clearly shows that Portfolio A to H is a smooth efficient frontier curve, with Portfolio A having the smallest return and the smallest risk of all portfolios. Portfolio A has the smallest return and the least risk of all portfolios, while Portfolio H has the largest return. It is worth noting that Portfolio B was originally set to have the highest return and risk, but in fact, Portfolio B has a lower return than Portfolios F, G and H, but still has the highest risk of all portfolios.

In terms of the Naive Strategy, it performs very closely to Portfolio E in the Markowitz model, but does not have as high a return as Portfolio E and is slightly riskier than Portfolio E.

For Min-CVaR, it is also very close to portfolio C in the Markowitz model, but also not as high portfolio return as portfolio C and slightly riskier than portfolio C.

So, in terms annual returns and annual standard deviations, the Markowitz model is the best choice.

Table 4.20 Comparison of final wealth in the out-of-sample period (in HKD)

Strategy		Final wealth	Rank
Hang Seng Index		1.039757	11
Naive strategy		2.190979	6
Min-CVaR		1.745738	9
Markowitz model	Portfolio A	1.622227	10
	Portfolio C	1.866892	8
	Portfolio D	2.165476	7
	Portfolio E	2.498721	4
	Portfolio F	2.863056	3
	Portfolio G	3.362897	2
	Portfolio H	3.838351	1
	Portfolio B	2.371331	5

Source: own elaboration

Final wealth is an important indicator for choosing the optimal investment strategy. Table 4.20 shows the final wealth of different portfolios in the Hang Seng Index, the Naive Strategy, the Conditional Value at Risk, and the Markowitz Model. The initial investment for all models is 1 HKD. A larger final wealth indicates a larger return from converting the initial investment. We have ranked the final wealth in descending order. It can be seen that the Hang Seng Index, the market benchmark, has the lowest final wealth at 1.039757 HKD, indicating that all other strategies outperform the market benchmark. While portfolio H in the Markowitz model has the highest final wealth within all strategies at 3.838351 HKD. Other than that, all other portfolios in the Markowitz model ranked higher in terms of final wealth. Averaging the final wealth of the eight portfolios in the Markowitz model gives an average wealth of 2.573619 HKD, which is still higher than the other strategies. So, in terms of final wealth, the Markowitz model is the best choice.

Table 4.21 Comparison of annual Sharpe ratio in the out-of-sample period

Strategy		Sharpe ratio	Rank
Hang Seng Index		-0.005545	11
Naive strategy		0.821519	6
Mean-CVaR		0.683651	8
Markowitz model	Portfolio A	0.619288	10
	Portfolio C	0.781608	7
	Portfolio D	0.911951	5
	Portfolio E	0.986140	4
	Portfolio F	1.022335	3
	Portfolio G	1.071098	2
	Portfolio H	1.096097	1
	Portfolio B	0.649050	9

Source: own elaboration

The Sharpe Ratio is a composite indicator that takes into account both return and risk and is able to exclude the adverse effects of risk factors on the assessment of performance in the long term. Generally, a higher Sharpe ratio indicates good investment performance, taking risk into account. The higher the Sharpe ratio, the better it is for investors. A higher Sharpe ratio indicates a higher risk-reward per unit

of risk for the fund. If the Sharpe ratio is positive, it indicates that the average net value growth rate of the fund exceeded the risk-free rate during the measurement period, indicating that investing in the fund is better than bank deposits when the bank deposit rate is used as the risk-free rate for the same period. Conversely, while a negative Sharpe Ratio indicates that investing in bank deposits is better than the fund.

We rank the Sharpe ratios derived from all strategies. Using table 4.21, we can see that the Sharpe ratio of the Hang Seng Index, which is the benchmark, is the lowest, or even negative, out of all the strategies. This also shows that all other strategies outperform this market benchmark.

And looking at the Markowitz model, portfolios D to H are ranked in the top five of all the strategies selected. Of these, portfolio H has the highest Sharpe ratio of all strategies and a ratio above 1, indicating that for every 1% increase in risk, there is a 1% excess return. We averaged the Sharpe ratios of all portfolios in the Markowitz model to obtain an average Sharpe ratio of 0.892196, which is also higher than the Sharpe ratio of the Naive strategy, which has the highest Sharpe ratio of the remaining strategies excluding the Markowitz model.

This indicates that the Markowitz strategy is the optimal choice as far as the Sharpe ratio is concerned, where portfolio H is the optimal portfolio.

Table 4.22 Comparison of maximum drawdown in the out-of-sample period

Strategy		Maximum drawdown	Rank
Hang Seng Index		31.215%	10
Naive strategy		21.194%	6
Mean-CVaR		20.198%	2
Markowitz model	Portfolio A	20.638%	4
	Portfolio C	20.307%	3
	Portfolio D	19.975%	1
	Portfolio E	20.981%	5
	Portfolio F	22.049%	7
	Portfolio G	22.720%	8
	Portfolio H	25.246%	9
	Portfolio B	44.703%	11

Source: own elaboration

Investors usually aim to achieve the highest possible return with the lowest possible risk. They want to avoid or limit losses. And maximum drawdown provides an indication of the sensitivity to loss of an investment. The smaller the maximum drawdown, the better, as it is proportional to risk, i.e., the greater the maximum drawdown, the greater the risk. A small maximum drawdown means a good holding experience.

Table 4.22 shows the maximum drawdowns of all the selected strategies. The benchmark Hang Seng Index has the second highest maximum drawdown among all selected strategies, indicating that all other strategies except Portfolio B in the Markowitz model outperform the Hang Seng Index in terms of maximum drawdown.

It is worth mentioning Portfolio B of the Markowitz model, which has the highest maximum drawdown of all the selected strategies. This is mainly due to the more aggressive investment style set. This is because in Portfolio B, all funds are put into TCEHY. This also illustrates the need for diversification rather than homogenization of superior investments. In addition to this, the smallest maximum drawdown is in portfolio D in the Markowitz model. We averaged the maximum drawdown of the eight portfolios in the Markowitz model and obtained a result of 24.58%. This result is higher than the second ranked Min-CVaR. This means that in terms of maximum drawdown, Min-CVaR is the best choice.

After analyzing the annual returns, annual standard deviations, final wealth, Sharpe ratio and maximum drawdowns of the Hang Seng Index, Naive Strategy, Markowitz Model and Conditional Value at Risk for the out-of-sample period respectively. We have to combine all the obtained results into one analysis to obtain the optimal portfolio optimization strategy. The detailed results are shown in table 4.23.

Table 4.23 Selected results of each Strategy in the out-of-sample period

Strategy		Annual portfolio return	Annual standard deviation	Final wealth	Sharpe ratio	Maximum drawdown
Hang Seng Index		2.41%	18.01%	1.040	-0.006	31.22%
Naive strategy		17.34%	18.06%	2.191	0.822	21.19%
Min-CVaR		12.15%	14.11%	1.746	0.684	20.20%
Markowitz model	Portfolio A	10.52%	12.94%	1.622	0.619	20.64%
	Portfolio C	13.48%	14.05%	1.867	0.782	20.31%
	Portfolio D	16.68%	15.54%	2.165	0.912	19.98%
	Portfolio E	19.89%	17.63%	2.499	0.986	20.98%
	Portfolio F	23.10%	20.14%	2.863	1.022	22.05%
	Portfolio G	26.89%	22.77%	3.363	1.071	22.72%
	Portfolio H	30.13%	25.20%	3.838	1.096	25.25%
	Portfolio B	21.60%	29.42%	2.371	0.649	44.70%

Source: own elaboration

In the table above, we have used color to compare the results of the different strategies more visually. The results in each column are ranked from best to worst and are represented by color, in the order green-yellow-red. This means that under each column, the green cells represent the best results and the red cells represent the worst results.

It can be observed that the green part of each column is mostly in the Markowitz model. Except that Portfolio B in the Markowitz model has the largest standard deviation and the largest maximum drawdown, both of which indicate that Portfolio B is extremely risky. The Markowitz model is the optimal portfolio optimization strategy, with Portfolio H being the best performer, having not only the highest annual return, the highest final wealth, but also the highest Sharpe ratio. And the risk is also in an acceptable range when compared to other portfolios and strategies. However, it is worth mentioning that when applying the Markowitz model, it is best not to put all

your funds into one basket in the pursuit of maximum returns, Portfolio B being an example.

5. Conclusion

Finding the right asset allocation is crucial, as it determines a large part of the overall return of a portfolio. In this thesis, we seek optimal portfolios with lower risk and higher returns. We apply three models used to generate different portfolios, which are the naive strategy, the Markowitz model, and the Conditional Value at Risk. Finally, we need to evaluate the performance of each portfolio under the different models in the out-of-sample period in order to select the optimal portfolio strategy for investment.

In applying the naive strategy, we generate a portfolio where each stock in the portfolio has the same weighting. The performance of the naive strategy is moderate in terms of portfolio return, standard deviation, final wealth, Sharpe ratio and maximum drawdown.

For Conditional Value at Risk, we generate a portfolio and find the corresponding weights for each stock in that portfolio by minimizing the CVaR and applying it to the out-of-sample period. In Conditional Value at Risk, both the standard deviation and the maximum drawdown are relatively well. It is worth mentioning that the results of the Min-CVaR and the results of Portfolio A in the Markowitz model need to be compared. Both of them are about finding the best portfolio by setting a minimized risk. Firstly, the results of these two portfolios are very similar, but Min-CVaR slightly outperforms Portfolio A in terms of annual portfolio return, final wealth, Sharpe ratio and maximum drawdown. Therefore, Min-CVaR is the best choice for choosing the optimal strategy in terms of minimizing risk.

In applying the Markowitz model, we set up a total of eight different portfolios. Each portfolio has a different weighting. Portfolios A to H outperformed in terms of return, final wealth, and Sharpe ratio. Although Portfolio B has the largest standard deviation and the largest maximum drawdown, we averaged the performance of all the portfolio values and obtained the best results compared to the other strategies, except for the maximum drawdown which is slightly worse than the Conditional Value at Risk.

From the results of this thesis, it appears that the Markowitz model portfolios are optimal for investors, regardless of which aspect of performance we consider. However, it is worth noting that it is important not to put all funds into one basket.

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List of Abbreviations

$E(R_p)$	The expected return of portfolio
Q	Covariance matrix
σ_p^2	Variance of the portfolio
S_k	Skewness
W_t	The wealth of initial investment
R_f	The risk-free rate
DD_t	Drawdown
$MDD_{0,T}$	Maximum drawdown
AIA	AIA Group Limited
ANTA	ANTA Sports Products Ltd
BHKLY	BOC Hong Kong Holdings Limited
BOC	Bank of China Limited
BYD	BYD Company Limited
CCB	China Construction Bank Corporation
CG	Country Garden Holdings Limited
CITIC	CITIC Limited
CKHUY	CHEUNG KONG Hutchison Holdings Limited
CLC	CHINA Longfor CO, Ltd
CLP	CLP Group
CMB	China Merchants Bank Co, Ltd
CMCC	China Mobile Communications Group Co, Ltd
CVaR	Conditional Value at Risk
COLI	China Overseas Land & Investment LTD
CRL	China Resources Land Ltd

GEG	Galaxy Entertainment Group Limited
HKD	Hong Kong Dollar
HKEX	Hong Kong Exchanges and Clearing Limited
HLDCY	Henderson Land Development Company Limited
HOKCY	The Hong Kong and China Gas Company Limited
HSBC	HSBC Holdings plc
HIS	Hang Seng Index
HSNGY	Hang Seng Bank Limited
ICBC	Industrial and Commercial Bank of China Limited
IPO	Initial Public Offerings
LN	Li-Ning Company Limited
MN	Inner Mogolia Mengniu Dairy Industry Limited
MPT	Modern Portfolio Theory
MTR	MTR Corporation Limited
PNGAY	Ping An Insurance Company of China, Ltd
SIG	Shenzhou International Group Holdings Limited
SUHJY	Sun Hung Kai Properties Ltd
TCEHY	Tencent Holdings Limited
TTI	Techtronic Industries Co. Ltd
VaR	Value at Risk

List of Annexes

Annex 1: : Weekly historical adjusted closing prices of stocks for the period 1st January 2012 to 31st December 2021(example).

Annex 2: Covariance matrix of Markowitz model (in-sample period).

Annex 3: The weights and return of assets under scenario of CVaR.

Annexes

Annex 1: : Weekly historical adjusted closing prices of 30 stocks for the period 1 January 2012 to 31 December 2021(example) (in HKD)

Date	TCEHY	CCB	CMCC	HSBC	AIA	…	LN	MN	HLDCY	SIG	CG
2012/1/01	30.08	3.17	48.93	36.53	21.13	…	5.83	9.15	13.82	8.72	1.51
2012/1/08	33.12	3.35	49.28	36.87	20.91	…	6.42	9.06	14.47	8.77	1.81
2012/1/15	35.38	3.55	49.64	39.63	22.61	…	6.51	9.73	15.18	8.96	1.92
2012/1/22	35.30	3.63	51.13	40.31	23.09	…	7.29	9.69	15.48	9.40	1.99
2012/1/29	36.19	3.73	51.13	41.08	22.87	…	7.22	10.24	15.56	10.32	1.83
2012/2/05	36.21	3.63	50.96	42.49	22.96	…	8.52	10.15	15.18	10.69	1.97
2012/2/12	38.55	3.77	52.91	43.29	23.31	…	8.09	10.22	17.40	11.10	1.89
2012/2/19	38.92	3.79	52.71	43.26	24.76	…	8.20	9.87	17.16	11.67	1.97
2012/2/26	38.94	3.83	52.87	43.23	25.54	…	8.47	9.83	17.04	11.61	1.83
2012/3/04	38.70	3.67	54.49	41.97	23.92	…	8.46	9.80	16.25	11.53	1.82
2012/3/11	42.25	3.66	54.20	43.01	24.84	…	8.71	10.20	16.68	12.35	1.75
2012/3/18	43.22	3.49	53.84	43.11	24.32	…	7.90	9.62	15.81	12.02	1.65
2012/3/25	42.17	3.50	55.30	42.64	24.89	…	7.38	10.54	15.31	12.70	1.63
2012/4/01	43.38	3.50	54.14	37.71	24.62	…	7.09	10.66	15.70	12.77	1.80
2012/4/08	44.04	3.62	54.85	42.36	23.88	…	6.97	10.94	16.16	12.93	1.87
2012/4/15	45.56	3.55	56.59	43.30	24.49	…	6.95	10.64	16.07	11.92	1.80
2012/4/22	45.56	3.45	54.26	43.33	23.62	…	6.48	11.12	15.63	12.11	1.80
2012/4/29	47.23	3.46	57.50	44.14	24.67	…	6.22	11.05	15.59	12.24	1.74
2012/5/06	43.53	3.26	56.24	42.67	23.18	…	5.99	10.73	14.25	12.01	1.48
2012/5/13	43.61	3.02	53.78	39.77	22.80	…	5.89	10.13	13.70	11.80	1.45
2012/5/20	42.39	3.00	51.48	39.52	21.78	…	5.36	9.80	13.73	12.06	1.52
2012/5/27	41.80	3.16	51.50	38.35	22.27	…	5.46	9.83	14.04	11.68	1.58
2012/6/03	43.09	3.08	51.40	39.71	22.53	…	4.83	9.57	14.25	12.35	1.67
2012/6/10	44.97	3.08	52.89	42.10	22.93	…	4.41	9.18	14.66	12.67	1.81
2012/6/17	43.52	3.18	53.68	42.51	22.80	…	4.24	9.69	14.75	12.02	1.61
2012/6/24	44.15	3.23	56.03	43.20	23.37	…	3.88	9.52	15.50	11.84	1.66
2012/7/01	46.02	3.14	56.62	43.14	24.56	…	4.35	10.11	16.52	11.95	1.83
2012/7/08	43.68	2.92	56.49	41.94	23.99	…	3.94	10.62	16.08	12.05	1.68
2012/7/15	45.32	3.02	58.34	42.16	24.60	…	3.50	10.20	16.61	11.87	1.67
2012/7/22	44.73	3.01	58.77	40.43	23.59	…	3.49	10.60	15.84	12.02	1.63
2012/7/29	45.01	3.21	58.17	41.34	23.59	…	3.53	10.53	16.57	11.70	1.62
2012/8/05	45.48	3.25	59.96	43.11	23.59	…	4.17	10.60	17.06	11.75	1.62
2012/8/12	48.48	3.29	55.30	43.55	24.10	…	3.93	10.67	17.30	11.73	1.50
2012/8/19	47.86	3.21	54.90	43.48	23.70	…	3.81	10.71	17.82	10.39	1.54
2012/8/26	46.30	3.11	54.74	42.72	23.61	…	3.32	10.92	17.33	11.29	1.49
2012/9/02	47.51	3.16	54.41	43.86	24.90	…	3.46	11.23	18.08	11.84	1.54
2012/9/09	49.93	3.15	56.11	46.28	25.78	…	3.66	10.85	19.81	11.93	1.60
2012/9/16	49.62	3.23	57.73	47.18	25.21	…	3.63	10.85	19.70	11.75	1.63
2012/9/23	51.61	3.28	57.96	46.44	25.60	…	3.69	10.85	20.41	11.75	1.66
2012/9/30	51.57	3.34	57.93	47.33	26.53	…	4.14	10.81	20.65	11.82	1.63
2012/10/07	50.55	3.51	56.89	47.24	25.91	…	4.31	10.55	19.99	12.25	1.62
2012/10/14	51.14	3.54	57.02	48.74	26.49	…	4.02	10.81	20.43	12.51	1.74
2012/10/21	52.12	3.50	57.83	48.32	27.38	…	3.63	10.95	20.81	13.08	1.68
2012/10/28	54.34	3.62	59.21	50.08	28.17	…	3.93	10.92	19.95	13.92	1.86
2012/11/04	52.16	3.50	58.10	47.80	26.76	…	3.80	10.50	19.29	13.46	1.84
2012/11/11	48.48	3.47	57.22	47.51	26.67	…	3.80	10.29	19.38	13.16	1.86
2012/11/18	50.09	3.62	59.31	49.60	26.89	…	3.61	10.11	20.03	13.23	1.93
2012/11/25	49.46	3.62	59.75	50.60	26.71	…	3.66	10.15	20.19	13.18	2.03
2012/12/02	49.03	3.70	59.45	50.92	26.58	…	3.79	9.47	20.34	13.43	2.02
2012/12/09	49.15	3.83	59.95	51.88	28.04	…	4.37	9.54	20.48	14.81	1.99
2012/12/16	48.41	3.75	60.80	52.07	26.84	…	4.63	10.08	20.54	15.36	2.04
2012/12/23	48.84	3.81	60.86	52.62	26.84	…	4.69	10.36	20.28	15.85	2.19
2012/12/30	50.63	3.97	61.13	52.69	27.38	…	5.21	10.25	20.39	15.87	2.40
2013/1/06	49.85	3.94	60.59	53.87	26.53	…	5.39	11.11	21.20	14.93	2.24
2013/1/13	52.82	4.04	59.11	54.81	26.31	…	6.11	11.11	21.71	14.75	2.23

2013/1/20	52.19	4.07	56.65	55.58	27.33	…	4.73	10.78	21.40	16.26	2.15
2013/1/27	52.47	4.08	57.32	56.54	27.20	…	4.74	10.88	20.26	17.26	2.25
2013/2/03	52.86	3.92	57.63	55.48	28.04	…	4.18	10.48	19.95	18.38	2.20
2013/2/10	53.60	4.00	57.83	56.25	27.51	…	4.28	10.50	19.77	19.13	2.19
2013/2/17	51.65	3.84	57.83	54.58	28.31	…	4.08	10.36	19.53	18.38	2.10
2013/2/24	52.47	3.87	57.02	54.81	29.77	…	4.29	10.18	19.48	19.57	2.17
2013/3/03	55.55	3.93	56.78	54.58	29.95	…	4.45	10.64	19.22	19.48	2.14
2013/3/10	53.56	3.82	55.67	55.32	30.57	…	4.05	10.13	17.74	19.00	1.91
2013/3/17	47.94	3.76	54.96	53.39	29.81	…	4.06	9.96	18.01	19.26	2.23
2013/3/24	48.21	3.87	55.44	53.57	30.12	…	4.08	10.43	19.42	19.30	2.13
2013/3/31	46.33	3.70	55.30	53.15	29.19	…	3.82	10.08	19.40	19.22	2.08
2013/4/07	48.84	3.78	55.94	53.60	29.41	…	3.73	10.67	20.13	19.00	2.20
2013/4/14	49.42	3.81	55.40	52.98	29.50	…	3.78	10.29	20.50	18.42	2.35
2013/4/21	50.59	3.89	56.72	54.49	30.34	…	3.49	10.13	20.56	19.17	2.33
2013/4/28	52.94	3.94	57.19	55.69	30.30	…	3.54	10.50	20.50	20.06	2.42
2013/5/05	54.07	4.05	58.13	57.52	31.89	…	3.69	11.27	21.07	21.16	2.54
2013/5/12	57.08	3.93	57.80	58.01	31.10	…	3.75	11.46	20.46	21.47	2.31
2013/5/19	58.48	3.84	55.91	56.28	31.18	…	4.04	12.37	20.81	22.40	2.52
2013/5/26	60.33	3.84	55.60	56.74	30.83	…	4.72	12.65	20.01	23.37	2.53
2013/6/02	58.76	3.72	53.04	55.48	29.17	…	4.46	12.96	18.65	23.41	2.45
2013/6/09	58.96	3.34	52.06	54.79	29.49	…	4.09	12.56	18.35	21.81	2.21
2013/6/16	56.02	3.31	52.92	53.15	29.00	…	3.94	12.94	18.23	19.41	2.12
2013/6/23	59.63	3.50	55.60	53.54	29.31	…	3.46	13.06	18.88	19.85	2.30
2013/6/30	60.45	3.42	55.36	54.86	29.67	…	3.51	13.36	19.33	19.67	2.27
2013/7/07	60.72	3.47	55.98	55.81	30.87	…	3.70	13.46	20.00	18.43	2.34
2013/7/14	65.43	3.50	56.08	57.13	30.83	…	3.88	14.51	19.92	19.90	2.33
2013/7/21	68.09	3.69	57.28	58.05	31.98	…	3.91	14.70	20.19	20.87	2.47
2013/7/28	70.60	3.70	57.07	58.52	33.14	…	4.46	15.27	20.05	19.32	2.60
2013/8/04	70.05	3.60	56.66	55.85	31.85	…	4.67	15.22	19.56	20.47	2.61
2013/8/11	71.86	3.80	57.45	56.77	32.47	…	5.13	14.91	19.84	21.81	2.86
2013/8/18	69.74	3.70	57.07	55.16	30.90	…	4.96	14.56	19.33	20.96	2.73
2013/8/25	71.27	3.63	57.21	54.53	30.50	…	5.21	15.43	18.56	22.43	2.75
2013/9/01	75.86	3.80	59.03	57.43	31.40	…	5.15	15.27	19.25	22.30	2.83
2013/9/08	80.52	3.86	61.09	57.16	31.49	…	5.07	15.79	19.05	22.03	2.79
2013/9/15	80.40	3.96	61.34	58.49	33.23	…	4.93	15.97	20.39	21.94	2.86
2013/9/22	81.89	3.87	61.48	56.76	33.32	…	5.35	16.68	20.02	23.23	2.82
2013/9/29	82.17	3.87	58.58	56.10	33.23	…	5.41	17.15	19.61	24.12	2.87
2013/10/06	82.13	3.86	59.35	56.20	34.04	…	6.22	16.70	19.30	24.26	3.14
2013/10/13	84.25	3.86	59.00	56.43	35.87	…	6.47	17.08	18.91	24.08	3.14
2013/10/20	83.54	3.64	55.86	56.50	34.71	…	6.18	16.75	18.81	23.77	2.84
2013/10/27	82.83	3.86	56.49	57.32	35.61	…	6.63	15.86	19.07	23.32	3.03
2013/11/03	78.68	3.77	56.14	57.32	34.13	…	5.88	14.70	18.56	23.63	3.01
2013/11/10	82.25	3.81	56.49	57.45	34.58	…	5.91	15.76	18.66	23.63	3.06
2013/11/17	83.23	4.00	56.11	58.12	34.93	…	5.97	16.30	18.81	24.21	2.88
2013/11/24	87.89	4.01	58.24	58.12	35.20	…	6.10	16.68	18.62	26.08	2.88
2013/12/01	90.17	4.00	59.04	56.51	34.35	…	6.47	16.91	18.13	25.06	2.83
2013/12/08	91.38	3.84	56.70	55.44	33.59	…	6.11	16.40	17.97	25.37	2.67
2013/12/15	90.87	3.72	55.72	55.03	33.86	…	5.81	16.75	17.94	24.66	2.77
2013/12/22	94.71	3.77	56.49	56.31	34.31	…	5.43	17.06	18.19	25.46	2.71
2013/12/29	96.83	3.63	54.82	55.67	34.44	…	5.85	16.91	18.09	26.30	2.64
2014/1/05	97.50	3.54	54.26	57.32	33.68	…	6.34	17.01	18.33	25.01	2.69
2014/1/12	103.69	3.50	54.29	57.62	34.71	…	5.99	17.55	18.46	23.37	2.53
2014/1/19	98.20	3.45	53.11	56.64	33.14	…	5.63	17.20	17.99	23.95	2.45
2014/1/26	106.53	3.44	51.64	54.33	32.02	…	5.55	16.82	17.16	23.81	2.41
2014/2/02	102.81	3.36	50.98	53.22	31.93	…	5.56	17.31	17.37	22.97	2.42
2014/2/09	107.51	3.44	51.51	55.10	32.78	…	5.47	18.09	17.43	23.72	2.54
2014/2/16	113.78	3.39	51.57	56.61	33.41	…	5.45	18.42	17.74	23.28	2.39
2014/2/23	122.02	3.40	51.44	55.20	33.99	…	5.33	18.73	17.86	24.12	2.28
2014/3/02	123.59	3.34	51.19	54.56	33.41	…	5.77	19.20	17.90	22.34	2.35
2014/3/09	110.55	3.21	48.47	52.15	32.02	…	5.13	17.97	17.02	21.81	1.82
2014/3/16	112.22	3.19	44.98	52.34	31.44	…	5.32	17.55	17.29	22.88	1.84
2014/3/23	104.87	3.42	48.75	53.70	33.10	…	4.55	18.49	18.07	21.85	1.82
2014/3/30	102.91	3.45	49.59	54.11	34.26	…	4.38	19.06	19.14	22.34	2.01

2014/4/06	102.91	3.49	52.03	55.24	35.52	…	4.41	19.85	19.26	22.88	2.05
2014/4/13	103.00	3.48	50.18	54.86	34.98	…	4.44	19.27	19.05	24.35	1.94
2014/4/20	102.61	3.39	48.16	53.84	33.90	…	4.76	19.38	18.52	24.84	1.79
2014/4/27	97.10	3.40	50.98	54.08	34.26	…	4.80	19.24	19.36	24.92	1.76
2014/5/04	93.85	3.38	51.96	53.26	33.59	…	4.58	18.30	18.70	24.39	1.63
2014/5/11	106.63	3.52	53.32	55.62	34.26	…	4.85	18.02	20.00	24.88	1.78
2014/5/18	109.12	3.59	53.88	55.10	34.43	…	4.70	18.40	20.31	23.41	1.81
2014/5/25	107.36	3.63	52.90	56.42	35.06	…	4.88	17.90	20.74	24.08	1.99
2014/6/01	106.28	3.63	53.82	56.01	34.88	…	4.88	17.62	21.19	24.17	2.00
2014/6/08	114.04	3.75	53.99	56.14	35.47	…	5.31	16.70	20.96	23.89	1.97
2014/6/15	113.74	3.73	54.03	55.77	35.38	…	5.17	16.67	21.35	23.18	1.83
2014/6/22	116.30	3.72	53.85	54.56	35.56	…	5.50	17.22	21.07	23.94	1.83
2014/6/29	122.88	3.60	54.21	55.49	35.74	…	5.43	16.65	21.51	23.89	2.12
2014/7/06	119.44	3.79	54.56	54.25	35.47	…	4.88	16.96	20.73	24.34	2.03
2014/7/13	120.72	3.81	58.13	54.76	35.69	…	4.40	17.98	21.33	23.72	2.02
2014/7/20	122.68	3.97	59.87	56.39	37.36	…	4.07	17.86	21.35	22.64	2.28
2014/7/27	125.92	4.04	60.76	57.11	37.95	…	4.19	18.05	22.22	21.12	2.40
2014/8/03	127.49	3.94	60.90	56.56	37.36	…	4.45	17.81	21.69	20.76	2.25
2014/8/10	127.98	4.03	66.53	57.90	38.76	…	4.21	18.28	22.82	21.20	2.30
2014/8/17	128.38	4.02	67.67	57.42	39.27	…	3.95	17.88	23.23	21.03	2.23
2014/8/24	124.25	3.93	68.67	58.27	38.32	…	3.86	17.03	23.53	21.65	2.09
2014/8/31	126.02	4.06	71.38	58.24	39.23	…	4.16	17.55	25.13	21.83	2.07
2014/9/07	120.72	3.94	71.82	57.54	38.73	…	3.96	17.26	25.56	21.47	1.99
2014/9/14	122.97	3.90	69.72	58.66	38.73	…	3.96	16.63	25.40	21.38	1.95
2014/9/21	114.43	3.84	67.05	57.23	37.32	…	3.71	15.77	24.11	22.01	1.87
2014/9/28	113.94	3.73	67.16	54.79	37.32	…	3.72	15.13	23.28	22.24	1.90
2014/10/05	113.64	3.75	66.80	54.62	37.32	…	3.64	15.70	23.18	22.82	1.84
2014/10/12	110.70	3.76	66.51	54.27	37.23	…	3.63	15.35	23.83	23.63	1.76
2014/10/19	117.38	3.81	65.10	54.30	38.00	…	3.65	15.16	24.11	24.43	1.85
2014/10/26	121.40	3.94	69.80	55.48	39.18	…	3.67	16.22	24.13	23.98	1.88
2014/11/02	120.91	3.85	69.80	54.84	38.91	…	3.59	14.90	23.12	23.94	1.87
2014/11/09	129.56	3.94	69.91	54.77	40.72	…	3.66	14.49	23.97	23.40	1.83
2014/11/16	121.99	3.82	68.60	53.82	39.81	…	3.60	14.78	23.60	23.13	1.77
2014/11/23	121.80	4.01	69.11	54.21	40.58	…	3.50	14.90	23.97	23.13	2.00
2014/11/30	116.79	4.21	68.75	54.21	40.40	…	3.44	14.33	24.11	23.40	1.93
2014/12/07	111.68	4.09	65.57	52.87	39.13	…	2.97	14.33	23.83	22.82	1.87
2014/12/14	113.64	4.18	65.28	51.64	38.50	…	2.85	13.69	23.88	22.64	1.84
2014/12/21	110.70	4.21	66.14	52.24	38.95	…	3.04	14.83	24.43	22.82	1.84
2014/12/28	110.79	4.43	66.11	52.07	39.81	…	3.45	15.18	25.31	22.73	2.03
2015/1/04	124.94	4.40	68.75	50.02	38.91	…	3.13	15.77	24.54	23.81	2.00
2015/1/11	119.73	4.35	70.77	49.39	40.45	…	2.99	16.36	24.91	24.12	1.92
2015/1/18	130.34	4.43	75.58	51.43	40.72	…	3.13	16.39	25.31	25.06	1.96
2015/1/25	129.65	4.25	74.14	50.97	40.99	…	3.35	16.74	25.54	25.28	1.92
2015/2/01	131.81	4.31	76.60	51.26	40.04	…	2.98	17.22	25.21	26.27	1.90
2015/2/08	127.89	4.37	77.54	50.48	40.27	…	3.04	17.36	25.03	27.62	1.88
2015/2/15	127.59	4.39	77.32	50.62	40.31	…	3.18	17.19	25.42	27.93	1.90
2015/2/22	133.48	4.40	76.23	49.11	41.35	…	3.02	16.58	24.43	27.53	1.91
2015/3/01	129.36	4.22	73.27	47.70	43.98	…	3.29	17.10	23.65	27.80	1.85
2015/3/08	131.22	4.32	72.26	46.77	42.26	…	3.41	16.98	23.69	28.24	1.82
2015/3/15	140.06	4.42	71.13	47.81	43.48	…	4.54	17.17	23.42	28.06	1.82
2015/3/22	139.38	4.31	72.29	48.46	44.25	…	4.27	18.24	24.84	32.14	1.90
2015/3/29	147.14	4.48	74.35	48.21	44.71	…	4.39	18.99	25.54	33.76	2.03
2015/4/05	158.92	4.84	80.00	49.79	48.69	…	4.65	20.53	27.66	34.65	2.17
2015/4/12	155.98	5.19	77.90	50.77	48.24	…	4.39	19.47	27.29	33.76	2.34
2015/4/19	158.73	5.19	83.25	53.10	46.97	…	4.33	20.32	27.24	33.80	2.35
2015/4/26	158.04	5.15	80.07	55.37	46.93	…	4.23	18.59	28.72	32.77	2.60
2015/5/03	151.26	5.04	78.26	55.08	46.43	…	3.89	19.49	28.62	32.05	2.56
2015/5/10	159.41	5.08	78.84	54.43	47.42	…	4.43	19.63	29.13	33.31	2.48
2015/5/17	156.33	5.27	76.52	54.08	47.10	…	4.75	20.18	29.61	34.34	2.37
2015/5/24	153.27	5.32	73.85	53.92	46.55	…	4.47	20.96	28.83	34.34	2.32
2015/5/31	152.29	5.32	73.99	53.15	46.28	…	3.93	20.37	28.09	31.56	2.31
2015/6/07	154.75	5.29	74.54	53.26	46.05	…	3.71	19.56	27.45	31.64	2.28
2015/6/14	151.80	5.14	72.97	52.72	46.83	…	3.48	19.92	27.22	31.64	2.21

2015/6/21	157.41	4.84	73.15	52.32	47.24	...	3.44	18.71	27.35	34.17	2.20
2015/6/28	152.68	5.06	73.26	50.57	46.51	...	3.39	17.70	27.02	32.77	2.17
2015/7/05	146.58	4.68	70.25	49.52	45.19	...	3.24	17.85	26.30	33.40	2.01
2015/7/12	151.21	4.70	71.50	51.12	46.28	...	3.33	18.25	27.50	34.40	2.09
2015/7/19	149.14	4.64	73.44	50.28	46.14	...	3.71	18.18	27.19	36.34	2.04
2015/7/26	142.45	4.55	74.39	50.68	46.05	...	3.77	16.75	26.25	36.89	1.98
2015/8/02	139.89	4.60	73.95	51.66	45.78	...	3.78	15.96	25.94	35.12	1.95
2015/8/09	141.17	4.47	72.89	49.44	43.59	...	4.20	15.98	24.76	36.48	1.91
2015/8/16	129.35	4.17	73.37	47.73	39.87	...	3.86	14.84	24.43	34.31	1.82
2015/8/23	128.66	3.86	67.29	44.97	39.41	...	3.60	13.71	24.76	34.80	1.83
2015/8/30	125.42	3.69	67.07	43.68	37.94	...	3.61	12.30	23.71	35.12	1.68
2015/9/06	125.42	3.89	67.10	44.46	38.81	...	3.82	12.71	25.38	35.57	1.79
2015/9/13	133.19	4.01	68.69	44.31	39.54	...	3.56	13.28	25.66	36.30	1.75
2015/9/20	128.96	3.76	70.36	43.21	37.16	...	3.22	13.04	24.42	35.80	1.87
2015/9/27	133.39	3.78	70.29	43.65	38.95	...	3.60	13.86	24.16	36.16	1.97
2015/10/04	139.69	4.06	68.28	46.07	40.87	...	3.65	14.33	24.84	32.86	2.04
2015/10/11	144.32	4.13	70.21	46.15	42.29	...	3.82	13.91	26.08	33.40	2.11
2015/10/18	146.88	4.20	69.58	44.93	42.79	...	3.69	14.54	26.46	34.44	2.11
2015/10/25	144.32	4.04	69.17	45.43	41.74	...	3.98	14.39	25.66	34.62	2.05
2015/11/01	152.09	4.04	69.54	45.35	43.76	...	4.09	13.13	25.35	36.48	2.10
2015/11/08	149.83	3.91	67.49	45.46	43.62	...	4.03	13.03	24.68	36.12	2.02
2015/11/15	152.68	4.01	68.39	46.88	43.85	...	4.21	12.88	25.51	36.25	2.09
2015/11/22	150.81	3.85	66.19	46.17	42.57	...	4.03	11.98	24.81	36.89	2.00
2015/11/29	148.65	3.83	67.31	45.80	44.35	...	4.09	12.38	24.84	36.75	2.15
2015/12/06	145.30	3.71	66.79	44.72	42.66	...	3.87	12.21	24.11	38.47	1.99
2015/12/13	148.94	3.80	65.67	45.80	42.70	...	3.83	12.21	24.68	38.20	2.13
2015/12/20	149.43	3.90	66.00	46.28	43.02	...	4.03	12.16	24.89	39.78	2.16
2015/12/27	150.12	3.81	65.22	46.10	42.66	...	4.13	12.08	24.55	40.33	2.20
2016/1/03	140.38	3.61	61.16	42.74	40.05	...	4.15	11.30	23.54	36.89	2.11
2016/1/10	134.87	3.40	59.97	41.78	38.86	...	3.65	10.36	21.58	34.94	2.04
2016/1/17	136.83	3.28	61.61	39.36	38.26	...	3.57	10.47	19.87	35.57	2.07
2016/1/24	142.64	3.40	63.88	40.59	39.22	...	3.53	10.26	21.71	37.66	2.06
2016/1/31	141.66	3.33	63.06	38.98	36.07	...	3.43	10.93	20.86	36.34	2.08
2016/2/07	131.22	3.10	61.27	35.82	34.10	...	3.35	10.68	20.08	35.12	2.02
2016/2/14	139.00	3.31	62.87	37.42	36.02	...	3.52	11.18	21.42	37.02	2.06
2016/2/21	140.48	3.29	62.95	36.90	37.21	...	3.34	10.89	21.68	37.25	2.00
2016/2/28	144.91	3.44	63.88	37.42	38.49	...	3.50	10.49	23.41	35.66	2.18
2016/3/06	145.79	3.45	63.73	38.70	39.36	...	3.62	10.47	23.28	35.89	2.33
2016/3/13	155.44	3.59	63.43	38.47	39.09	...	3.64	10.51	24.73	36.80	2.15
2016/3/20	156.33	3.49	62.09	37.54	38.31	...	3.57	10.44	23.88	37.47	2.08
2016/3/27	156.03	3.53	63.84	36.89	39.50	...	3.49	11.66	24.40	37.16	2.10
2016/4/03	157.51	3.50	64.36	35.39	39.59	...	3.51	11.68	24.60	36.75	2.15
2016/4/10	162.72	3.64	66.97	37.93	41.15	...	3.49	12.96	25.87	36.25	2.17
2016/4/17	160.26	3.63	68.05	40.12	42.84	...	3.35	12.96	25.61	36.39	2.19
2016/4/24	156.42	3.58	66.30	39.85	42.75	...	3.33	12.60	25.07	36.39	2.13
2016/5/01	151.50	3.42	63.99	37.20	40.69	...	3.30	11.75	23.85	36.25	2.15
2016/5/08	152.68	3.32	62.57	36.39	39.36	...	3.09	11.75	23.00	33.22	2.08
2016/5/15	156.03	3.27	62.91	37.46	39.96	...	3.18	11.70	23.18	33.81	2.07
2016/5/22	169.04	3.55	64.96	39.75	41.53	...	3.09	12.21	23.62	35.85	2.22
2016/5/29	168.64	3.66	65.67	39.72	42.73	...	3.10	12.98	25.07	34.49	2.19
2016/6/05	172.89	3.68	67.27	38.58	43.20	...	3.25	13.40	24.19	34.39	2.18
2016/6/12	166.77	3.63	64.13	37.29	41.30	...	3.15	12.66	23.60	34.62	2.20
2016/6/19	171.61	3.50	63.26	37.10	41.44	...	3.48	12.40	23.92	33.48	2.24
2016/6/26	173.88	3.88	66.96	37.02	42.92	...	3.74	13.04	25.32	34.21	2.32
2016/7/03	174.76	3.84	66.06	36.63	42.46	...	3.85	12.66	25.03	35.40	2.30
2016/7/10	182.47	4.10	70.40	38.78	44.49	...	3.99	13.06	25.84	38.18	2.29
2016/7/17	182.86	4.12	72.93	39.36	45.42	...	4.07	12.77	27.03	38.50	2.36
2016/7/24	184.14	3.94	72.25	39.52	44.49	...	3.99	12.54	26.86	37.36	2.25
2016/7/31	182.27	4.08	72.86	41.83	45.61	...	4.05	12.62	26.74	37.41	2.37
2016/8/07	185.43	4.31	74.78	42.69	45.70	...	4.65	13.04	26.83	39.78	2.41
2016/8/14	199.25	4.36	74.55	43.54	44.74	...	4.82	12.69	26.83	39.92	2.66
2016/8/21	197.87	4.37	72.70	44.33	45.02	...	5.11	14.92	26.89	45.95	2.62
2016/8/28	199.25	4.50	71.80	46.79	46.46	...	5.19	14.69	26.37	46.68	2.78

2016/9/04	211.10	4.62	75.19	47.42	47.71	…	5.39	14.77	27.56	48.64	2.99
2016/9/11	207.15	4.40	72.51	46.27	46.83	…	5.24	14.26	26.61	47.59	2.91
2016/9/18	215.44	4.50	73.93	46.04	48.18	…	5.24	14.03	27.52	49.78	3.13
2016/9/25	210.31	4.36	72.01	45.32	47.95	…	5.22	13.93	26.99	49.33	2.97
2016/10/02	213.47	4.49	74.01	46.75	50.18	…	5.38	14.40	27.08	48.50	2.91
2016/10/09	206.36	4.29	72.01	46.39	48.46	…	5.35	14.36	26.70	46.59	2.97
2016/10/16	211.49	4.34	70.59	46.63	49.06	…	5.72	14.55	26.67	47.18	2.95
2016/10/23	205.37	4.25	67.68	46.89	47.81	…	5.59	14.61	26.76	46.08	2.98
2016/10/30	197.47	4.25	66.98	46.17	44.46	…	5.42	14.20	26.85	45.54	3.03
2016/11/06	197.47	4.18	64.64	49.14	44.97	…	5.51	14.80	25.03	43.25	3.05
2016/11/13	192.93	4.15	64.91	49.10	43.58	…	5.50	14.59	24.59	43.98	3.06
2016/11/20	190.56	4.36	64.38	49.50	43.99	…	5.45	15.79	25.00	41.70	3.04
2016/11/27	188.59	4.40	64.68	49.14	42.13	…	5.50	14.82	24.82	43.75	3.22
2016/12/04	185.82	4.46	64.15	52.84	40.65	…	4.88	15.52	25.14	43.71	3.27
2016/12/11	181.58	4.21	62.34	51.39	41.30	…	4.55	14.51	24.15	44.48	3.13
2016/12/18	177.43	4.26	61.77	49.98	40.88	…	4.62	13.88	23.77	43.43	3.11
2016/12/25	187.30	4.53	63.07	50.02	40.69	…	4.79	14.46	24.21	44.80	3.16
2017/1/01	192.64	4.42	64.45	51.23	41.67	…	4.99	14.07	24.50	44.17	3.05
2017/1/08	197.18	4.45	65.49	51.43	43.16	…	4.63	14.59	25.58	44.39	3.14
2017/1/15	195.20	4.39	66.29	51.83	44.13	…	4.83	13.55	24.91	46.59	3.23
2017/1/22	201.82	4.40	67.41	53.64	44.92	…	4.87	14.11	25.26	43.89	3.24
2017/1/29	202.41	4.37	66.72	52.88	43.81	…	4.83	14.44	25.12	43.57	3.20
2017/2/05	200.04	4.48	67.25	53.88	43.95	…	5.26	15.07	25.64	44.85	3.83
2017/2/12	209.52	4.81	66.45	54.89	45.58	…	5.05	14.59	25.82	43.39	3.88
2017/2/19	208.53	4.86	66.37	51.07	45.34	…	5.04	14.65	26.52	42.98	4.16
2017/2/26	204.58	4.66	65.30	52.13	45.58	…	5.11	14.47	26.44	43.07	4.07
2017/3/05	209.72	4.59	64.76	51.92	46.78	…	5.06	14.63	26.64	44.94	4.67
2017/3/12	219.20	4.88	66.87	52.87	46.32	…	5.21	15.25	27.11	47.59	4.75
2017/3/19	222.36	4.84	66.33	51.92	46.60	…	4.72	14.77	28.34	46.68	5.19
2017/3/26	219.99	4.74	65.26	52.17	45.58	…	4.49	15.58	28.25	44.80	5.08
2017/4/02	224.33	4.72	65.60	52.13	46.18	…	4.58	14.77	28.75	46.04	5.38
2017/4/09	227.69	4.75	64.84	52.21	46.37	…	4.80	14.57	29.37	44.80	5.63
2017/4/16	233.41	4.69	64.34	51.34	46.27	…	4.79	14.46	28.75	46.77	5.60
2017/4/23	240.33	4.79	63.65	52.95	50.09	…	5.04	14.57	28.93	46.77	5.38
2017/4/30	240.72	4.67	64.68	54.80	50.78	…	5.02	13.86	28.40	47.32	5.25
2017/5/07	254.94	4.83	65.30	56.12	51.53	…	5.09	14.30	29.13	48.18	5.58
2017/5/14	265.01	4.79	65.80	55.22	50.88	…	5.10	14.86	28.96	48.41	5.96
2017/5/21	275.13	4.90	66.10	56.27	51.51	…	5.26	15.25	29.08	48.46	6.25
2017/5/28	267.21	5.00	65.60	57.02	52.08	…	5.24	15.33	30.19	49.51	6.94
2017/6/04	274.53	4.90	65.39	57.18	52.97	…	5.74	15.33	29.69	48.00	7.00
2017/6/11	269.78	4.84	65.50	56.98	52.60	…	6.00	14.90	29.42	47.81	6.51
2017/6/18	277.30	4.63	64.92	56.52	54.05	…	5.86	15.04	29.29	46.89	6.44
2017/6/25	276.31	4.83	64.49	60.56	53.68	…	5.84	14.90	28.73	47.17	6.68
2017/7/02	266.22	4.73	62.97	60.98	52.08	…	5.82	14.49	28.66	46.99	6.57
2017/7/09	281.85	5.11	64.03	62.64	54.66	…	6.06	14.65	29.45	49.19	6.78
2017/7/16	293.93	5.07	65.58	62.60	55.37	…	6.07	15.87	30.02	50.20	7.09
2017/7/23	301.65	5.16	64.96	63.73	55.98	…	6.12	15.06	29.85	48.46	7.81
2017/7/30	308.18	5.27	64.88	65.44	57.35	…	6.10	14.96	31.00	49.01	7.61
2017/8/06	307.39	5.06	68.27	62.93	55.37	…	5.77	15.19	30.84	48.04	7.10
2017/8/13	322.43	5.19	67.26	62.13	54.81	…	5.70	16.15	31.00	52.60	6.76
2017/8/20	325.00	5.56	68.27	63.14	56.46	…	5.85	16.63	31.66	57.19	7.31
2017/8/27	322.83	5.43	64.53	63.90	57.17	…	5.78	18.97	32.16	58.30	7.99
2017/9/03	318.47	5.37	66.47	62.68	55.57	…	5.97	18.97	34.86	55.08	8.82
2017/9/10	335.30	5.29	65.83	63.44	55.75	…	6.46	20.16	36.08	55.13	10.01
2017/9/17	342.62	5.28	64.13	64.15	56.60	…	6.97	20.01	36.21	56.62	10.03
2017/9/24	332.72	5.17	63.93	64.45	54.43	…	6.85	21.28	34.48	56.90	9.30
2017/10/01	348.36	5.49	63.77	65.12	56.32	…	7.27	21.42	35.34	59.41	9.88
2017/10/08	345.59	5.55	63.32	64.99	57.79	…	6.78	21.13	34.98	59.41	9.65
2017/10/15	345.98	5.53	64.05	65.05	56.89	…	6.71	21.03	34.98	60.71	9.34
2017/10/22	344.20	5.58	63.97	65.56	56.70	…	6.39	20.69	34.08	61.69	9.21
2017/10/29	364.19	5.46	63.69	64.29	56.94	…	6.93	20.74	35.24	62.29	9.10
2017/11/05	381.41	5.45	64.86	64.59	58.21	…	6.77	20.16	35.44	69.17	9.19
2017/11/12	399.23	5.43	63.12	63.99	62.27	…	6.31	19.96	34.64	70.34	9.71

2017/11/19	411.50	5.59	64.33	64.88	64.59	…	6.13	20.40	34.94	67.41	9.80
2017/11/26	381.02	5.43	63.64	66.24	59.72	…	5.90	19.46	33.68	67.87	9.64
2017/12/03	389.93	5.31	61.38	65.31	58.40	…	6.21	19.82	32.15	68.15	9.71
2017/12/10	384.98	5.50	62.03	66.80	58.54	…	6.08	20.94	33.21	66.15	9.76
2017/12/17	401.60	5.62	63.00	68.03	60.43	…	6.47	22.88	33.81	67.45	10.03
2017/12/24	401.80	5.74	64.01	67.99	62.98	…	6.23	22.64	34.31	69.17	11.15
2017/12/31	428.72	6.07	63.04	68.71	63.74	…	6.48	21.81	35.61	69.27	12.14
2018/1/07	437.63	6.21	62.80	71.18	63.55	…	6.77	23.76	34.98	72.52	13.70
2018/1/14	447.72	6.77	65.02	72.62	62.98	…	6.33	25.66	34.91	74.75	12.75
2018/1/21	466.33	7.22	66.47	72.88	62.94	…	6.20	25.27	36.78	75.08	12.65
2018/1/28	447.72	7.14	65.34	71.18	61.61	…	6.13	24.00	35.84	72.89	12.54
2018/2/04	403.19	6.16	60.25	67.86	56.04	…	5.68	22.98	32.78	65.59	9.82
2018/2/11	442.38	6.77	59.93	71.05	59.82	…	6.20	24.54	33.38	72.15	10.37
2018/2/18	448.71	6.73	60.37	67.73	60.15	…	6.50	25.37	33.74	74.33	11.26
2018/2/25	431.49	6.38	58.64	67.00	60.86	…	6.77	24.69	34.11	70.48	10.43
2018/3/04	442.38	6.54	58.31	66.48	62.37	…	7.49	25.56	34.21	71.92	11.15
2018/3/11	460.39	6.78	58.40	66.78	63.46	…	8.32	24.39	34.94	74.47	12.39
2018/3/18	415.66	6.45	57.18	64.79	62.42	…	8.02	23.13	34.44	70.57	11.63
2018/3/25	405.36	6.43	58.11	64.22	62.75	…	7.91	26.20	34.04	76.84	12.09
2018/4/01	401.60	6.33	57.79	63.40	63.83	…	8.82	25.56	33.98	77.54	11.78
2018/4/08	403.78	6.52	59.57	66.22	66.62	…	9.64	26.58	34.44	82.01	12.38
2018/4/15	396.06	6.43	59.04	66.65	64.35	…	8.51	27.56	33.48	76.15	11.68
2018/4/22	384.38	6.45	60.29	67.18	65.20	…	8.59	25.76	32.75	79.63	11.96
2018/4/29	378.84	6.37	58.96	65.05	64.26	…	8.58	24.69	32.75	80.80	11.81
2018/5/06	404.57	6.54	59.65	67.31	68.80	…	8.90	26.83	33.81	83.49	12.27
2018/5/13	406.75	6.52	59.28	67.05	68.04	…	9.44	26.44	33.88	82.14	12.51
2018/5/20	400.68	6.45	58.19	67.55	66.62	…	9.02	25.71	34.58	83.17	11.90
2018/5/27	400.68	6.35	58.24	66.59	67.73	…	9.44	27.32	34.64	87.26	11.97
2018/6/03	411.59	6.45	59.03	67.11	68.68	…	9.05	28.11	33.67	90.43	13.16
2018/6/10	406.63	6.21	57.99	66.94	66.44	…	8.93	26.93	33.17	93.29	13.25
2018/6/17	394.13	5.89	56.71	65.23	65.48	…	8.54	27.42	32.04	90.86	12.79
2018/6/24	390.56	5.78	57.54	64.53	65.48	…	8.51	26.05	31.14	90.81	11.29
2018/7/01	383.42	5.70	57.46	63.65	64.58	…	8.31	25.71	30.92	85.65	10.57
2018/7/08	377.87	5.54	56.96	64.26	65.01	…	8.90	26.15	31.22	91.84	10.65
2018/7/15	373.51	5.75	56.55	64.18	64.67	…	8.36	24.78	31.14	92.31	10.36
2018/7/22	369.93	5.96	57.70	65.62	65.53	…	8.95	24.44	32.34	90.20	10.73
2018/7/29	346.93	5.83	57.17	63.39	63.19	…	7.87	22.33	31.25	85.51	8.90
2018/8/05	366.96	5.88	59.31	63.65	66.10	…	7.99	22.92	31.52	88.79	9.70
2018/8/12	334.23	5.69	60.51	61.46	62.91	…	8.56	21.15	30.73	86.26	9.08
2018/8/19	351.09	5.79	60.18	61.52	63.14	…	8.23	22.48	30.92	89.92	9.69
2018/8/26	337.21	5.83	60.92	61.03	64.62	…	8.15	22.18	31.14	96.58	9.55
2018/9/02	314.20	5.59	64.01	59.57	61.14	…	7.18	22.77	29.38	90.90	8.83
2018/9/09	327.29	5.54	65.07	60.19	61.86	…	6.89	22.38	30.76	89.88	8.98
2018/9/16	331.65	5.78	64.52	61.83	65.02	…	7.25	25.32	30.46	93.45	9.58
2018/9/23	320.54	5.73	65.28	61.34	67.03	…	7.28	25.51	29.89	95.74	8.24
2018/9/30	302.49	5.35	65.62	60.68	61.13	…	6.90	23.65	29.43	89.54	8.10
2018/10/07	286.03	5.21	66.00	58.55	60.36	…	6.64	22.53	28.37	82.73	7.06
2018/10/14	279.68	5.20	65.87	57.26	59.74	…	6.73	22.67	28.64	79.01	6.87
2018/10/21	257.86	5.17	61.81	54.25	56.96	…	6.85	22.53	27.57	79.05	6.97
2018/10/28	301.10	5.52	62.66	59.54	61.61	…	7.80	24.48	28.75	89.93	7.95
2018/11/04	276.91	5.39	61.68	57.97	60.08	…	7.90	23.99	28.37	87.88	7.25
2018/11/11	288.01	5.47	65.03	59.36	61.95	…	7.96	24.48	29.09	89.40	7.62
2018/11/18	288.81	5.43	64.22	59.10	61.13	…	7.97	23.70	29.13	89.59	7.53
2018/11/25	309.44	5.59	65.70	59.99	61.23	…	8.24	23.70	30.54	90.59	8.03
2018/12/02	308.05	5.44	65.62	57.12	60.46	…	8.46	23.36	30.27	94.17	7.71
2018/12/09	306.26	5.40	63.42	57.48	61.42	…	8.26	23.99	30.27	93.45	8.01
2018/12/16	312.61	5.33	63.76	57.88	62.14	…	7.99	23.02	29.74	88.69	7.60
2018/12/23	307.45	5.33	62.53	57.17	61.52	…	8.23	23.36	29.28	84.54	7.48
2018/12/30	308.05	5.37	64.98	57.71	60.84	…	8.39	22.97	30.88	83.63	7.56
2019/1/06	328.48	5.52	67.69	58.65	64.54	…	8.95	24.29	32.21	87.64	7.81
2019/1/13	334.23	5.56	68.41	58.60	67.03	…	9.59	24.92	32.78	88.26	8.11
2019/1/20	340.97	5.72	68.66	59.10	66.65	…	9.37	24.73	33.73	87.07	8.58
2019/1/27	345.14	5.87	70.36	59.27	67.03	…	9.73	23.36	33.76	91.55	9.25

2019/2/03	342.76	5.79	69.68	59.05	71.01	…	10.09	23.21	33.99	92.41	9.43
2019/2/10	331.06	5.70	70.48	59.50	70.19	…	9.84	24.68	33.95	90.36	8.75
2019/2/17	341.17	5.82	71.92	57.75	73.41	…	10.47	25.02	34.49	96.03	8.98
2019/2/24	333.44	5.86	70.99	59.04	75.76	…	11.16	24.48	33.76	97.75	8.90
2019/3/03	344.15	5.78	68.75	59.09	71.92	…	10.92	24.19	33.76	96.60	8.86
2019/3/10	356.05	5.87	72.72	59.64	75.28	…	11.37	24.39	34.11	99.84	9.43
2019/3/17	362.00	5.82	69.30	59.55	73.93	…	12.49	26.10	36.20	102.51	10.18
2019/3/24	358.03	5.64	67.69	58.77	74.94	…	12.12	28.60	37.90	100.32	10.23
2019/3/31	372.91	5.83	67.27	61.16	76.71	…	12.55	28.70	38.02	102.70	10.18
2019/4/07	390.56	5.81	65.15	61.53	76.04	…	13.20	28.30	37.94	98.41	10.98
2019/4/14	388.38	5.92	64.05	62.17	76.43	…	13.95	27.77	37.87	99.65	10.80
2019/4/21	380.84	5.79	63.50	61.62	76.62	…	14.15	27.81	36.61	98.70	10.37
2019/4/28	384.61	5.86	62.87	64.10	80.02	…	14.44	30.16	36.65	102.70	10.63
2019/5/05	378.86	5.42	61.01	61.53	74.75	…	13.30	29.04	36.12	98.03	9.95
2019/5/12	352.88	5.27	61.39	60.29	73.89	…	12.73	29.53	36.61	96.89	9.45
2019/5/19	323.01	5.24	62.11	60.86	72.35	…	12.28	28.45	37.03	90.69	8.81
2019/5/26	324.21	5.20	57.92	59.60	70.71	…	12.77	28.06	33.84	88.16	9.13
2019/6/02	328.58	5.18	60.72	59.84	71.34	…	13.22	28.35	36.01	88.97	9.08
2019/6/09	328.19	5.31	58.91	59.37	70.86	…	14.15	29.63	35.70	93.65	9.87
2019/6/16	352.45	5.51	61.24	60.16	79.40	…	14.91	29.98	37.43	100.63	10.16
2019/6/23	350.66	5.64	61.37	60.30	80.89	…	18.23	29.83	38.13	103.43	10.23
2019/6/30	357.82	5.26	61.15	60.91	82.81	…	18.21	31.36	38.98	104.97	10.22
2019/7/07	353.05	5.53	60.29	60.67	82.04	…	18.95	30.92	38.53	102.85	9.84
2019/7/14	359.81	5.53	60.93	60.53	84.97	…	19.16	31.31	38.71	106.03	9.79
2019/7/21	368.16	5.48	58.13	59.79	80.84	…	19.90	31.75	37.56	106.31	9.54
2019/7/28	353.84	5.24	56.10	57.84	75.03	…	18.55	30.57	35.21	99.57	8.73
2019/8/04	336.54	5.04	55.97	55.84	72.78	…	18.79	30.52	33.71	101.79	8.35
2019/8/11	324.61	5.07	56.97	52.58	72.97	…	20.19	30.47	33.88	106.22	8.14
2019/8/18	332.36	5.12	57.61	53.86	74.65	…	22.03	32.30	33.48	108.82	8.27
2019/8/25	323.01	5.15	56.02	53.11	73.21	…	22.92	30.67	32.33	102.56	8.40
2019/9/01	341.51	5.33	58.36	54.62	76.52	…	22.92	30.13	33.48	108.24	8.92
2019/9/08	347.68	5.52	59.60	57.26	77.81	…	22.12	30.42	34.67	109.33	9.04
2019/9/15	335.74	5.28	57.04	56.60	73.05	…	21.88	29.53	34.27	100.98	8.95
2019/9/22	327.59	5.23	56.51	56.50	71.65	…	22.62	28.80	32.88	99.72	8.71
2019/9/29	321.03	5.23	57.39	54.95	71.21	…	23.26	29.58	32.52	100.98	9.16
2019/10/06	323.01	5.42	58.80	55.61	70.92	…	25.29	30.67	33.55	103.40	9.25
2019/10/13	329.18	5.53	58.40	58.23	72.96	…	26.43	30.67	34.13	103.50	9.57
2019/10/20	314.86	5.56	56.90	58.95	72.38	…	25.99	31.06	34.18	102.92	9.43
2019/10/27	319.83	5.62	56.73	56.99	76.98	…	26.33	31.36	35.39	105.25	9.83
2019/11/03	325.40	5.72	56.77	57.42	79.78	…	25.29	29.73	35.48	105.93	10.20
2019/11/10	318.24	5.49	54.03	55.17	74.56	…	24.75	29.14	33.06	100.59	9.52
2019/11/17	331.77	5.60	54.12	55.60	74.85	…	25.34	28.99	34.00	101.75	9.60
2019/11/24	329.98	5.51	52.09	55.55	75.91	…	24.85	29.53	33.82	100.20	9.62
2019/12/01	333.75	5.56	52.36	54.93	75.48	…	25.84	30.18	34.09	104.86	9.83
2019/12/08	359.02	5.76	54.39	57.71	80.03	…	23.86	30.92	34.76	105.25	10.45
2019/12/15	373.14	5.85	56.46	58.09	77.36	…	24.05	31.51	34.27	104.38	10.63
2019/12/22	381.89	5.98	57.74	58.18	78.38	…	23.51	31.41	34.27	107.77	10.98
2019/12/29	380.89	5.94	56.86	57.75	82.50	…	23.21	31.36	34.18	110.20	11.11
2020/1/05	396.41	5.94	56.68	57.23	83.27	…	26.53	31.95	34.22	109.72	10.93
2020/1/12	396.81	5.99	58.45	57.52	83.85	…	27.42	31.70	35.03	113.89	10.66
2020/1/19	383.68	5.68	61.54	56.18	80.36	…	25.49	31.11	33.28	108.36	9.66
2020/1/26	370.95	5.26	56.68	54.36	75.28	…	22.82	28.40	31.62	100.78	8.79
2020/2/02	400.19	5.59	59.42	55.27	77.65	…	21.93	30.67	32.83	105.35	9.04
2020/2/09	412.72	5.76	57.48	57.04	78.09	…	22.57	29.39	33.41	103.02	9.73
2020/2/16	398.80	5.71	58.36	54.17	76.59	…	22.87	29.14	32.38	100.98	9.34
2020/2/23	383.88	5.57	54.12	50.82	74.46	…	20.29	27.56	32.11	92.97	9.11
2020/3/01	393.62	5.61	53.42	48.61	73.64	…	21.68	28.84	32.74	99.91	9.23
2020/3/08	362.99	5.61	46.71	43.86	66.91	…	19.95	26.33	30.23	81.61	8.38
2020/3/15	357.62	5.40	48.38	45.11	62.89	…	17.44	25.74	26.95	78.11	7.55
2020/3/22	380.30	5.56	49.93	43.58	66.57	…	22.47	25.39	26.32	80.44	8.02
2020/3/29	374.33	5.42	53.55	36.38	67.97	…	20.39	26.72	26.99	75.64	8.11
2020/4/05	389.25	5.54	54.39	39.35	69.33	…	23.96	27.86	28.97	85.05	8.47
2020/4/12	407.35	5.41	53.24	37.91	70.30	…	24.01	27.76	28.97	91.12	8.63

2020/4/19	404.17	5.31	53.90	37.19	67.34	…	23.16	27.07	27.89	84.52	8.45
2020/4/26	414.71	5.59	55.14	38.63	69.67	…	24.20	27.27	28.47	87.72	8.82
2020/5/03	415.90	5.45	52.18	37.96	67.44	…	25.94	27.22	27.40	88.70	8.83
2020/5/10	418.88	5.39	49.97	36.57	66.08	…	26.08	27.81	26.81	87.00	8.73
2020/5/17	411.28	5.32	49.57	34.41	61.97	…	24.75	26.92	24.88	83.99	8.12
2020/5/24	409.28	5.38	47.77	34.41	60.85	…	25.74	27.32	24.84	89.47	8.46
2020/5/31	433.02	5.65	49.78	38.87	69.33	…	27.02	29.24	27.85	99.04	8.99
2020/6/07	439.80	5.48	49.41	35.80	70.09	…	24.85	29.38	26.54	93.70	9.08
2020/6/14	459.15	5.53	49.41	35.85	70.48	…	25.39	30.23	28.96	95.81	9.20
2020/6/21	483.68	5.45	48.64	35.23	72.74	…	24.92	29.78	27.70	94.73	8.98
2020/6/28	523.07	5.43	49.78	35.95	73.58	…	25.47	31.02	28.73	92.03	9.53
2020/7/05	545.01	5.98	50.01	34.94	73.72	…	25.17	34.54	28.12	91.69	9.70
2020/7/12	519.58	5.73	49.32	35.47	70.83	…	24.77	34.99	27.51	93.26	9.24
2020/7/19	526.56	5.49	48.73	34.55	70.58	…	24.72	34.40	26.76	89.28	9.08
2020/7/26	532.55	5.32	48.37	33.55	68.77	…	24.87	36.08	27.18	90.75	9.14
2020/8/02	526.07	5.33	49.05	31.48	69.85	…	27.16	35.19	27.04	95.17	9.18
2020/8/09	505.12	5.43	53.42	33.31	73.72	…	31.45	35.14	28.17	106.06	9.42
2020/8/16	516.59	5.42	53.19	32.30	73.68	…	32.10	34.10	28.68	107.24	9.48
2020/8/23	539.03	5.29	50.83	32.63	79.17	…	34.34	38.91	28.87	124.60	8.97
2020/8/30	516.59	5.09	49.70	31.77	76.57	…	32.64	37.52	27.42	123.62	8.89
2020/9/06	514.60	5.05	49.70	30.95	78.88	…	32.64	36.88	27.74	125.19	8.82
2020/9/13	523.57	4.98	49.05	29.71	78.89	…	36.93	34.89	27.55	127.87	8.63
2020/9/20	502.13	4.70	47.08	27.07	76.57	…	34.74	35.64	27.35	126.09	8.65
2020/9/27	510.11	4.70	46.24	28.60	74.85	…	35.88	36.03	27.16	128.96	8.92
2020/10/04	538.03	4.70	46.71	30.19	78.54	…	37.63	37.17	27.55	133.80	9.37
2020/10/11	555.49	5.21	46.76	28.94	76.72	…	38.77	36.83	27.31	132.42	9.05
2020/10/18	559.97	5.43	47.60	30.95	77.06	…	39.62	38.76	27.64	138.35	9.31
2020/10/25	589.39	5.01	44.09	30.81	72.04	…	39.87	36.18	26.12	132.32	8.97
2020/11/01	612.83	5.47	47.46	33.31	79.38	…	44.90	39.95	28.26	140.92	10.25
2020/11/08	600.36	5.60	46.76	35.75	83.57	…	42.26	40.95	29.31	133.41	10.31
2020/11/15	586.40	5.49	43.90	37.34	88.26	…	45.60	40.90	29.78	139.04	9.88
2020/11/22	581.41	5.71	44.47	40.31	87.27	…	42.81	39.66	30.73	133.80	9.93
2020/11/29	586.90	5.70	43.72	41.99	87.76	…	43.16	42.83	29.83	132.12	9.36
2020/12/06	586.40	5.44	41.43	39.98	88.01	…	45.00	41.29	29.69	137.16	9.48
2020/12/13	578.42	5.38	42.59	39.50	88.26	…	46.15	42.88	29.02	139.73	9.46
2020/12/20	555.98	5.32	41.52	38.58	89.88	…	49.99	44.32	28.26	148.23	9.44
2020/12/27	564.46	5.52	41.47	39.02	94.12	…	53.08	46.51	28.92	149.51	10.05
2021/1/03	571.44	5.55	38.81	41.66	97.62	…	54.17	50.92	29.78	149.22	9.56
2021/1/10	643.25	5.79	44.04	41.22	102.95	…	50.64	47.45	29.83	143.78	9.36
2021/1/17	689.12	5.67	44.51	41.46	99.01	…	50.34	45.96	30.73	152.97	9.52
2021/1/24	679.65	5.51	44.23	39.30	92.45	…	48.39	45.91	30.16	150.30	8.81
2021/1/31	731.01	5.56	43.86	40.02	98.61	…	50.74	47.94	29.31	169.08	8.82
2021/2/07	754.94	5.82	44.47	40.94	101.96	…	53.03	48.64	29.69	179.06	8.72
2021/2/14	738.99	5.76	50.26	43.72	100.09	…	51.83	48.49	30.59	179.85	8.73
2021/2/21	660.70	5.83	50.22	45.40	95.70	…	43.46	42.09	32.06	159.20	9.08
2021/2/28	677.15	6.08	53.16	44.25	96.74	…	44.06	40.45	31.83	158.60	8.74
2021/3/07	648.73	5.99	48.63	43.91	94.67	…	44.36	42.19	32.25	160.38	8.74
2021/3/14	626.29	6.05	49.51	46.04	96.34	…	47.30	44.02	32.02	168.29	8.94
2021/3/21	618.31	6.06	47.46	44.12	94.42	…	51.28	45.17	31.97	147.24	9.15
2021/3/28	652.22	6.10	47.74	44.62	93.58	…	51.48	44.62	33.16	161.37	9.44
2021/4/04	618.81	6.10	46.99	45.80	96.44	…	53.78	44.47	32.97	165.13	9.25
2021/4/11	630.28	6.12	47.88	44.47	97.58	…	59.81	44.62	33.44	174.51	9.12
2021/4/18	630.28	6.12	49.05	44.08	96.49	…	63.19	42.93	33.30	170.96	9.03
2021/4/25	621.31	5.76	48.63	48.06	97.53	…	63.19	41.29	32.87	168.78	8.70
2021/5/02	598.37	5.85	46.76	48.31	100.09	…	68.28	41.19	33.87	175.21	8.94
2021/5/09	581.41	5.83	46.99	47.96	100.78	…	64.09	42.39	33.35	172.83	8.80
2021/5/16	586.90	5.77	48.25	47.77	100.29	…	65.89	43.97	33.87	192.20	9.21
2021/5/23	599.86	5.99	47.67	49.98	101.77	…	71.17	45.56	35.59	202.78	9.30
2021/5/30	611.50	5.83	46.85	47.77	97.55	…	73.56	44.22	35.49	187.36	8.83
2021/6/06	596.00	5.86	47.04	46.83	95.21	…	73.81	45.20	37.76	190.45	9.31
2021/6/13	603.00	5.81	45.83	46.44	94.81	…	79.44	46.80	37.86	189.76	8.72
2021/6/20	598.50	5.81	47.91	45.35	96.76	…	82.60	47.80	37.12	191.55	8.75
2021/6/27	574.50	5.68	46.31	44.12	95.41	…	90.55	45.60	36.09	190.06	8.40

2021/7/04	538.50	5.20	45.20	42.85	94.17	…	91.70	44.55	35.89	180.51	7.97
2021/7/11	564.00	5.58	46.51	43.04	95.76	…	92.75	43.95	35.99	165.60	8.05
2021/7/18	531.00	5.46	48.49	42.26	94.52	…	83.85	43.95	35.54	167.39	8.01
2021/7/25	479.00	5.42	46.31	42.35	92.72	…	81.90	42.15	34.26	170.57	7.38
2021/8/01	453.60	5.45	47.62	42.50	91.73	…	83.30	44.95	34.46	178.72	7.58
2021/8/08	470.20	5.60	50.18	43.49	92.47	…	87.40	43.35	35.30	176.14	8.28
2021/8/15	425.40	5.63	48.97	41.37	95.21	…	89.20	42.25	34.71	183.00	7.91
2021/8/22	466.40	5.64	45.93	41.85	94.86	…	98.25	46.35	34.41	159.64	8.29
2021/8/29	488.00	5.67	48.25	41.30	92.32	…	99.90	46.40	34.26	171.27	8.50
2021/9/05	490.00	5.77	48.80	40.75	95.30	…	104.80	48.35	34.40	175.05	8.22
2021/9/12	461.80	5.65	47.80	40.10	88.10	…	104.90	50.00	33.35	169.80	6.76
2021/9/19	460.20	5.42	47.20	39.55	86.50	…	88.70	49.45	28.75	161.00	7.49
2021/9/26	461.40	5.58	46.95	40.80	89.95	…	90.15	50.15	29.85	165.80	8.05
2021/10/03	481.80	5.49	48.30	43.69	90.00	…	80.95	47.50	32.30	153.00	7.75
2021/10/10	495.60	5.47	48.65	45.88	87.80	…	85.15	45.50	32.35	163.30	7.69
2021/10/17	509.50	5.43	48.95	46.33	89.40	…	92.95	46.25	32.60	172.50	8.16
2021/10/24	481.00	5.29	48.25	46.98	87.85	…	86.50	49.55	32.60	167.80	7.31
2021/10/31	467.40	5.17	48.70	45.28	86.15	…	93.00	48.75	32.80	159.70	6.85
2021/11/07	485.20	5.24	47.45	45.13	83.20	…	96.10	46.60	33.55	171.00	7.70
2021/11/14	496.00	5.21	47.35	45.88	84.60	…	94.05	46.50	33.75	165.00	7.30
2021/11/21	463.40	5.10	46.90	44.19	84.60	…	86.30	44.65	33.05	155.10	7.04
2021/11/28	462.60	5.33	46.70	44.69	81.30	…	87.45	44.45	32.65	154.20	7.06
2021/12/05	463.40	5.30	46.20	45.03	81.80	…	93.75	45.65	33.65	158.20	7.52
2021/12/12	438.00	5.31	46.45	46.23	79.65	…	84.00	44.85	32.55	149.90	7.14
2021/12/19	460.80	5.37	47.75	46.28	78.95	…	81.70	44.75	33.15	150.80	7.02
2021/12/26	456.80	5.40	46.80	46.73	78.60	…	85.35	44.20	33.20	149.90	6.92

Annex 2: Covariance matrix of Markowitz model (in-sample period)

	TCEHY	CCB	CMCC	HSBC	AIA	HKEX	PNGAY	ICBC	BHKLY	HSNGY	COLI	CMB	SUHJY	CRL
TCEHY	0.0014	0.0005	0.0003	0.0004	0.0005	0.0006	0.0007	0.0006	0.0004	0.0003	0.0008	0.0006	0.0004	0.0007
CCB	0.0005	0.0011	0.0004	0.0005	0.0005	0.0008	0.0010	0.0009	0.0005	0.0004	0.0008	0.0011	0.0005	0.0009
CMCC	0.0003	0.0004	0.0007	0.0003	0.0003	0.0004	0.0004	0.0004	0.0002	0.0002	0.0005	0.0004	0.0003	0.0005
HSBC	0.0004	0.0005	0.0003	0.0008	0.0004	0.0005	0.0006	0.0005	0.0005	0.0003	0.0005	0.0006	0.0004	0.0006
AIA	0.0005	0.0005	0.0003	0.0004	0.0009	0.0006	0.0007	0.0005	0.0004	0.0003	0.0007	0.0005	0.0004	0.0006
HKEX	0.0006	0.0008	0.0004	0.0005	0.0006	0.0015	0.0010	0.0008	0.0006	0.0004	0.0009	0.0009	0.0006	0.0009
PNGAY	0.0007	0.0010	0.0004	0.0006	0.0007	0.0010	0.0018	0.0011	0.0007	0.0005	0.0012	0.0013	0.0006	0.0013
ICBC	0.0006	0.0009	0.0004	0.0005	0.0005	0.0008	0.0011	0.0012	0.0005	0.0004	0.0009	0.0011	0.0005	0.0009
BHKLY	0.0004	0.0005	0.0002	0.0005	0.0004	0.0006	0.0007	0.0005	0.0008	0.0003	0.0006	0.0006	0.0004	0.0006
HSNGY	0.0003	0.0004	0.0002	0.0003	0.0003	0.0004	0.0005	0.0004	0.0003	0.0005	0.0004	0.0004	0.0004	0.0004
COLI	0.0008	0.0008	0.0005	0.0005	0.0007	0.0009	0.0012	0.0009	0.0006	0.0004	0.0021	0.0010	0.0007	0.0019
CMB	0.0006	0.0011	0.0004	0.0006	0.0005	0.0009	0.0013	0.0011	0.0006	0.0004	0.0010	0.0018	0.0005	0.0010
SUHJY	0.0004	0.0005	0.0003	0.0004	0.0004	0.0006	0.0006	0.0005	0.0004	0.0004	0.0007	0.0005	0.0009	0.0007
CRL	0.0007	0.0009	0.0005	0.0006	0.0006	0.0009	0.0013	0.0009	0.0006	0.0004	0.0019	0.0010	0.0007	0.0025
BOC	0.0006	0.0009	0.0004	0.0005	0.0005	0.0008	0.0010	0.0010	0.0005	0.0004	0.0008	0.0011	0.0005	0.0009
CLC	0.0006	0.0007	0.0003	0.0005	0.0006	0.0007	0.0011	0.0007	0.0005	0.0003	0.0013	0.0010	0.0005	0.0014
BYD	0.0009	0.0008	0.0004	0.0006	0.0006	0.0010	0.0010	0.0009	0.0006	0.0004	0.0010	0.0011	0.0006	0.0010
MTR	0.0003	0.0003	0.0002	0.0002	0.0002	0.0004	0.0004	0.0003	0.0002	0.0002	0.0003	0.0003	0.0003	0.0004
ANTA	0.0003	0.0003	0.0002	0.0002	0.0003	0.0004	0.0004	0.0002	0.0002	0.0001	0.0005	0.0002	0.0002	0.0006
CITIC	0.0004	0.0007	0.0003	0.0004	0.0004	0.0008	0.0010	0.0007	0.0004	0.0003	0.0007	0.0008	0.0005	0.0008
CKHUY	0.0005	0.0005	0.0003	0.0004	0.0005	0.0005	0.0007	0.0005	0.0004	0.0004	0.0007	0.0006	0.0006	0.0007
TTI	0.0003	0.0003	0.0001	0.0001	0.0002	0.0003	0.0002	0.0002	0.0002	0.0002	0.0003	0.0003	0.0002	0.0004
GEG	0.0010	0.0007	0.0003	0.0007	0.0007	0.0008	0.0010	0.0007	0.0008	0.0005	0.0008	0.0007	0.0006	0.0009
CLP	0.0002	0.0002	0.0002	0.0001	0.0002	0.0003	0.0003	0.0002	0.0002	0.0002	0.0003	0.0002	0.0003	0.0003
HOKCY	0.0003	0.0003	0.0002	0.0002	0.0003	0.0004	0.0003	0.0003	0.0003	0.0003	0.0004	0.0003	0.0003	0.0004
LN	0.0007	0.0005	0.0001	0.0003	0.0004	0.0006	0.0008	0.0006	0.0004	0.0002	0.0007	0.0006	0.0003	0.0008
MN	0.0004	0.0004	0.0003	0.0003	0.0003	0.0003	0.0005	0.0003	0.0003	0.0002	0.0003	0.0003	0.0003	0.0004
HLDCY	0.0005	0.0006	0.0004	0.0004	0.0005	0.0006	0.0007	0.0006	0.0005	0.0004	0.0008	0.0006	0.0008	0.0009
SIG	0.0004	0.0002	0.0001	0.0002	0.0002	0.0002	0.0002	0.0002	0.0001	0.0002	0.0003	0.0002	0.0001	0.0003
CG	0.0006	0.0007	0.0004	0.0005	0.0005	0.0008	0.0010	0.0008	0.0005	0.0003	0.0016	0.0009	0.0005	0.0018

	BOC	CLC	BYD	MTR	ANTA	CITIC	CKHUY	TTI	GEG	CLP	HOKCY	LN	MN	HLDCY	SIG	CG
TCEHY	0.0006	0.0006	0.0009	0.0003	0.0003	0.0004	0.0005	0.0003	0.0010	0.0002	0.0003	0.0007	0.0004	0.0005	0.0004	0.0006
CCB	0.0009	0.0007	0.0008	0.0003	0.0003	0.0007	0.0005	0.0003	0.0007	0.0002	0.0003	0.0005	0.0004	0.0006	0.0002	0.0007
CMCC	0.0004	0.0003	0.0004	0.0002	0.0002	0.0003	0.0003	0.0001	0.0003	0.0002	0.0002	0.0001	0.0003	0.0004	0.0001	0.0004
HSBC	0.0005	0.0005	0.0006	0.0002	0.0002	0.0004	0.0004	0.0001	0.0007	0.0001	0.0002	0.0003	0.0003	0.0004	0.0002	0.0005
AIA	0.0005	0.0006	0.0006	0.0002	0.0003	0.0004	0.0005	0.0002	0.0007	0.0002	0.0003	0.0004	0.0003	0.0005	0.0002	0.0005
HKEX	0.0008	0.0007	0.0010	0.0004	0.0004	0.0008	0.0005	0.0003	0.0008	0.0003	0.0004	0.0006	0.0003	0.0006	0.0002	0.0008
PNGAY	0.0010	0.0011	0.0010	0.0004	0.0004	0.0010	0.0007	0.0002	0.0010	0.0003	0.0003	0.0008	0.0005	0.0007	0.0002	0.0010
ICBC	0.0010	0.0007	0.0009	0.0003	0.0002	0.0007	0.0005	0.0002	0.0007	0.0002	0.0003	0.0006	0.0003	0.0006	0.0002	0.0008
BHKLY	0.0005	0.0005	0.0006	0.0002	0.0002	0.0004	0.0004	0.0002	0.0008	0.0002	0.0003	0.0004	0.0003	0.0005	0.0001	0.0005
HSNGY	0.0004	0.0003	0.0004	0.0002	0.0001	0.0003	0.0004	0.0002	0.0005	0.0002	0.0003	0.0002	0.0002	0.0004	0.0002	0.0003
COLI	0.0008	0.0013	0.0010	0.0003	0.0005	0.0007	0.0007	0.0003	0.0008	0.0003	0.0004	0.0007	0.0003	0.0008	0.0003	0.0016
CMB	0.0011	0.0010	0.0011	0.0003	0.0002	0.0008	0.0006	0.0003	0.0007	0.0002	0.0003	0.0006	0.0003	0.0006	0.0002	0.0009
SUHJY	0.0005	0.0005	0.0006	0.0003	0.0002	0.0005	0.0006	0.0002	0.0006	0.0003	0.0003	0.0003	0.0003	0.0008	0.0001	0.0005
CRL	0.0009	0.0014	0.0010	0.0004	0.0006	0.0008	0.0007	0.0004	0.0009	0.0003	0.0004	0.0008	0.0004	0.0009	0.0003	0.0018
BOC	0.0012	0.0007	0.0009	0.0003	0.0002	0.0007	0.0005	0.0003	0.0007	0.0002	0.0004	0.0006	0.0004	0.0006	0.0001	0.0008
CLC	0.0007	0.0020	0.0010	0.0002	0.0005	0.0007	0.0005	0.0002	0.0008	0.0002	0.0003	0.0008	0.0002	0.0006	0.0002	0.0015
BYD	0.0009	0.0010	0.0047	0.0003	0.0008	0.0010	0.0007	0.0004	0.0013	0.0002	0.0003	0.0015	0.0007	0.0006	0.0005	0.0010
MTR	0.0003	0.0002	0.0003	0.0004	0.0002	0.0003	0.0003	0.0002	0.0003	0.0002	0.0002	0.0002	0.0002	0.0003	0.0001	0.0003
ANTA	0.0002	0.0005	0.0008	0.0002	0.0033	0.0006	0.0003	0.0003	0.0005	0.0001	0.0002	0.0016	0.0003	0.0002	0.0002	0.0007
CITIC	0.0007	0.0007	0.0010	0.0003	0.0006	0.0016	0.0005	0.0001	0.0006	0.0002	0.0002	0.0008	0.0004	0.0005	0.0002	0.0007
CKHUY	0.0005	0.0005	0.0007	0.0003	0.0003	0.0005	0.0009	0.0003	0.0007	0.0002	0.0003	0.0005	0.0003	0.0006	0.0002	0.0006
TTI	0.0003	0.0002	0.0004	0.0002	0.0003	0.0001	0.0003	0.0015	0.0004	0.0001	0.0002	0.0003	0.0001	0.0003	0.0002	0.0003
GEG	0.0007	0.0008	0.0013	0.0003	0.0005	0.0006	0.0007	0.0004	0.0028	0.0002	0.0004	0.0008	0.0007	0.0007	0.0003	0.0006
CLP	0.0002	0.0002	0.0002	0.0002	0.0001	0.0002	0.0002	0.0001	0.0002	0.0003	0.0002	0.0001	0.0002	0.0003	0.0001	0.0002
HOKCY	0.0004	0.0003	0.0003	0.0002	0.0002	0.0002	0.0003	0.0002	0.0004	0.0002	0.0004	0.0002	0.0002	0.0004	0.0001	0.0002
LN	0.0006	0.0008	0.0015	0.0002	0.0016	0.0008	0.0005	0.0003	0.0008	0.0001	0.0002	0.0046	0.0005	0.0003	0.0004	0.0009
MN	0.0004	0.0002	0.0007	0.0002	0.0003	0.0004	0.0003	0.0001	0.0007	0.0002	0.0002	0.0005	0.0017	0.0004	0.0003	0.0002
HLDCY	0.0006	0.0006	0.0006	0.0003	0.0002	0.0005	0.0006	0.0003	0.0007	0.0003	0.0004	0.0003	0.0004	0.0011	0.0001	0.0006
SIG	0.0001	0.0002	0.0005	0.0001	0.0002	0.0002	0.0002	0.0002	0.0003	0.0001	0.0001	0.0004	0.0003	0.0001	0.0016	0.0002
CG	0.0008	0.0015	0.0010	0.0003	0.0007	0.0007	0.0006	0.0003	0.0006	0.0002	0.0002	0.0009	0.0002	0.0006	0.0002	0.0028

Annex 3: The weights and return of assets under scenario of CVaR.

The weights of CVaR

	TCEHY	CCB	CMCC	HSBC	AIA	HKEX	PNGAY	ICBC	BHKLY	HSNGY	COLI	CMB	SUHJY	CRL
weight	0.00%	0.00%	17.35%	1.34%	1.19%	0.00%	0.00%	0.00%	4.29%	0.02%	0.00%	0.00%	0.00%	0.00%

BOC	CLC	BYD	MTR	ANTA	CITIC	CKHUY	TTI	GEG	CLP	HOKCY	LN	MN	HLDCY	SIG	CG
0.00%	0.00%	0.00%	2.18%	0.00%	0.00%	0.00%	13.57%	0.00%	46.70%	2.69%	0.00%	0.25%	0.00%	10.42%	0.00%

Return of assets under scenario

TCEHY	CCB	CMCC	HSBC	AIA	HKEX	PNGAY	ICBC	BHKLY	HSNGY	COLI	CMB	SUHJY	CRL	BOC
0	0	0.00126209	0.00012385	-0.0001229	0	0	0	0.00336523	7.0844E-07	0	0	0	0	0
0	0	0.00125291	0.00100408	0.00096873	0	0	0	0.00184197	1.0758E-05	0	0	0	0	0
0	0	0.00520206	0.00022833	0.00025262	0	0	0	0.00020777	4.966E-06	0	0	0	0	0
0	0	0	0.00025512	-0.0001124	0	0	0	-0.0003102	-2.892E-06	0	0	0	0	0
0	0	-0.000549	0.00046064	4.5406E-05	0	0	0	0.00208285	-6.543E-07	0	0	0	0	0
0	0	0.00660858	0.00025172	0.00018092	0	0	0	0.00049661	4.1053E-06	0	0	0	0	0
0	0	-0.0006366	-9.504E-06	0.00073511	0	0	0	-0.0001964	6.4082E-07	0	0	0	0	0
0	0	0.00053252	-9.51E-06	0.00037759	0	0	0	0.00039454	7.0221E-06	0	0	0	0	0
0	0	0.0053083	-0.0003902	-0.0007522	0	0	0	-0.001466	1.8367E-06	0	0	0	0	0
0	0	-0.0009271	0.00033326	0.00045582	0	0	0	0.00050597	-7.114E-06	0	0	0	0	0
0	0	-0.0011393	3.0363E-05	-0.0002508	0	0	0	-0.0003	2.1221E-06	0	0	0	0	0
0	0	0.00469141	-0.0001454	0.00027761	0	0	0	0.00030216	-4.77E-07	0	0	0	0	0
0	0	-0.0036543	-0.0015487	-0.0001252	0	0	0	0.00030004	-1.913E-06	0	0	0	0	0
0	0	0.00228126	0.00165131	-0.0003585	0	0	0	0.00198642	2.7424E-06	0	0	0	0	0
0	0	0.00552666	0.00029599	0.00030444	0	0	0	0.00056956	2.2214E-06	0	0	0	0	0
0	0	-0.0071414	9.6581E-06	-0.000424	0	0	0	0.00196733	7.8272E-07	0	0	0	0	0
0	0	0.01034443	0.00025081	0.0005277	0	0	0	0.00044788	2.9605E-06	0	0	0	0	0
0	0	-0.0038073	-0.000445	-0.0007158	0	0	0	-0.0016843	-4.286E-06	0	0	0	0	0
0	0	-0.0075859	-0.0009109	-0.0001966	0	0	0	-0.0023991	-4.086E-06	0	0	0	0	0
0	0	-0.0074108	-8.555E-05	-0.0005282	0	0	0	-0.0005864	6.0701E-07	0	0	0	0	0
0	0	4.98E-05	-0.0003953	0.00026438	0	0	0	-0.0001982	-2.272E-06	0	0	0	0	0
0	0	-0.000334	0.00047342	0.00014107	0	0	0	0.00129282	-2.469E-07	0	0	0	0	0
0	0	0.00502017	0.00080818	0.00020911	0	0	0	0.00327002	6.3443E-06	0	0	0	0	0
0	0	0.00260216	0.00013038	-6.85E-05	0	0	0	9.2073E-05	-1.111E-06	0	0	0	0	0
0	0	0.00758425	0.00021851	0.00029855	0	0	0	0.00045939	4.7924E-06	0	0	0	0	0
0	0	0.00184221	-1.955E-05	0.00060486	0	0	0	-9.09E-05	1.7075E-06	0	0	0	0	0
0	0	-0.0004051	-0.0003719	-0.0002771	0	0	0	-0.0011843	-1.997E-06	0	0	0	0	0
0	0	0.00568445	7.0468E-05	0.00030556	0	0	0	0.00168629	3.1104E-06	0	0	0	0	0
0	0	0.00127769	-0.0005508	-0.0004894	0	0	0	-0.0004507	-1.374E-06	0	0	0	0	0
0	0	-0.0017562	0.00030286	0	0	0	0	0.00036439	2.3088E-06	0	0	0	0	0
0	0	0.00532256	0.00057191	0	0	0	0	0.00108396	5.1609E-06	0	0	0	0	0
0	0	-0.0134841	0.00013712	0.00025554	0	0	0	0.0001762	1.4716E-07	0	0	0	0	0
0	0	-0.0012443	-2.082E-05	-0.0001964	0	0	0	0.00026324	-8.896E-07	0	0	0	0	0
0	0	-0.0005222	-0.0002354	-4.439E-05	0	0	0	-8.722E-05	2.987E-07	0	0	0	0	0
0	0	-0.0010475	0.00035943	0.00064601	0	0	0	-0.0014856	1.9375E-06	0	0	0	0	0
0	0	0.00543406	0.00073898	0.00042253	0	0	0	0.00153372	3.6826E-06	0	0	0	0	0
0	0	0.00500416	0.00025803	-0.0002652	0	0	0	0.00053632	2.7375E-06	0	0	0	0	0
0	0	0.00070927	-0.0002079	0.0001878	0	0	0	0.000618	3.9683E-06	0	0	0	0	0
0	0	-0.0001009	0.00025714	0.00043138	0	0	0	0.00043517	0	0	0	0	0	0
0	0	-0.0031303	-2.703E-05	-0.0002775	0	0	0	-0.0013785	-6.92E-07	0	0	0	0	0
0	0	0.00041134	0.00042436	0.00026385	0	0	0	-0.0002671	1.5287E-06	0	0	0	0	0
0	0	0.00246211	-0.0001138	0.0003971	0	0	0	-8.957E-05	-5.507E-07	0	0	0	0	0
0	0	0.00414724	0.00048851	0.00034582	0	0	0	0.00053857	1.2472E-06	0	0	0	0	0
0	0	-0.0032601	-0.0006102	-0.0005974	0	0	0	-0.0009752	-4.428E-06	0	0	0	0	0
0	0	-0.0026178	-8.105E-05	-3.931E-05	0	0	0	-0.0004536	-1.138E-06	0	0	0	0	0
0	0	0.006338	0.00058886	9.8612E-05	0	0	0	0.00128354	3.7233E-06	0	0	0	0	0
0	0	0.00128207	0.00026901	-7.824E-05	0	0	0	-0.0005341	1.2603E-06	0	0	0	0	0
0	0	-0.0008811	8.5075E-05	-5.907E-05	0	0	0	0.00036057	-5.559E-07	0	0	0	0	0
0	0	0.00147597	0.0002536	0.00065303	0	0	0	0.00062572	-1.395E-07	0	0	0	0	0
0	0	0.00243921	4.9781E-05	-0.0005064	0	0	0	-0.0006167	1.2561E-06	0	0	0	0	0
0	0	0.00019245	0.00014052	0	0	0	0	0.00017877	-4.155E-07	0	0	0	0	0
0	0	0.00076884	1.636E-05	0.00023512	0	0	0	0.00133526	1.3885E-06	0	0	0	0	0
0	0	-0.0015309	0.00030229	-0.000365	0	0	0	0.00017268	-1.377E-07	0	0	0	0	0
0	0	-0.0042476	0.00023171	-9.911E-05	0	0	0	0.0017197	0	0	0	0	0	0
0	0	-0.007224	0.00018849	0.00045974	0	0	0	0.00082671	7.0281E-06	0	0	0	0	0
0	0	0.00206517	0.00023235	-5.773E-05	0	0	0	0.00064888	3.5684E-06	0	0	0	0	0
0	0	0.0009184	-0.0002512	0.00036741	0	0	0	0	-3.881E-07	0	0	0	0	0
0	0	0.00060908	0.00018621	-0.0002251	0	0	0	0.00015978	-9.077E-07	0	0	0	0	0
0	0	0	-0.0003979	0.00034415	0	0	0	-0.0017513	-5.215E-07	0	0	0	0	0
0	0	-0.0024277	5.5207E-05	0.00061317	0	0	0	0.00074692	5.2317E-07	0	0	0	0	0
0	0	-0.0007181	-5.498E-05	7.0672E-05	0	0	0	0.00016314	4.9545E-06	0	0	0	0	0
0	0	-0.0033995	0.00018138	0.0002459	0	0	0	8.1264E-05	-1.139E-06	0	0	0	0	0
0	0	-0.0022065	-0.0004669	-0.0002925	0	0	0	-0.0003244	-6.755E-06	0	0	0	0	0
0	0	0.00149002	4.5082E-05	0.00012349	0	0	0	-0.0005721	3.5341E-06	0	0	0	0	0
0	0	-0.0004221	-0.0001062	-0.0003667	0	0	0	-0.0008283	-1.322E-06	0	0	0	0	0
0	0	0.0020098	0.00011529	9.0084E-05	0	0	0	0.0006757	2.1317E-06	0	0	0	0	0
0	0	-0.001673	-0.0001551	3.5765E-05	0	0	0	-0.0002495	-3.946E-07	0	0	0	0	0
0	0	0.00411781	0.00037999	0.00033872	0	0	0	0.00125458	5.1418E-06	0	0	0	0	0
0	0	0.00144388	0.00029722	-1.733E-05	0	0	0	0.00073137	1.2786E-07	0	0	0	0	0
0	0	0.002864	0.00044008	0.0006249	0	0	0	0.0017578	2.1718E-06	0	0	0	0	0
0	0	-0.0010062	0.00011413	-0.0002968	0	0	0	-0.0006908	-3.783E-07	0	0	0	0	0
0	0	-0.0056678	-0.0003999	3.2228E-05	0	0	0	-0.0005461	-4.17E-06	0	0	0	0	0
0	0	-0.0009417	0.00010809	-0.0001359	0	0	0	-0.0019754	-1.104E-06	0	0	0	0	0
0	0	-0.0079953	-0.0002957	-0.0006358	0	0	0	-0.0004972	-7.766E-06	0	0	0	0	0
0	0	-0.003196	-0.0001671	0.00012708	0	0	0	-0.0009458	-2.349E-06	0	0	0	0	0
0	0	0.0028589	-0.0004029	-0.0001976	0	0	0	-0.0007913	-4.205E-06	0	0	0	0	0
0	0	0.00877504	9.968E-05	0.00012786	0	0	0	-0.0001792	4.3153E-07	0	0	0	0	0
0	0	-0.0007495	0.00032982	0.00014457	0	0	0	0	2.4387E-06	0	0	0	0	0

0	0	0.00193582	0.00023337	0.00048207	0	0	0	0.00080956	1.4136E-06	0	0	0	0	0
0	0	0.00031911	0.00031638	-1.716E-05	0	0	0	-0.0003531	-2.242E-06	0	0	0	0	0
0	0	0.00371582	0.00021636	0.00044675	0	0	0	0.00062312	4.4048E-06	0	0	0	0	0
0	0	-0.0006237	0.00010646	0.00043055	0	0	0	0.00105292	2.6293E-06	0	0	0	0	0
0	0	-0.0012518	-0.0006111	-0.0004634	0	0	0	-0.0001713	2.1794E-06	0	0	0	0	0
0	0	0.00241671	0.00022134	0.00023082	0	0	0	0	5.2427E-06	0	0	0	0	0
0	0	-0.0011399	-0.000381	-0.0005732	0	0	0	-0.0008599	-6.774E-06	0	0	0	0	0
0	0	0.00041734	-0.0001508	-0.0001549	0	0	0	0	6.2323E-07	0	0	0	0	0
0	0	0.00551538	0.00071079	0.0003487	0	0	0	0.00193036	5.735E-06	0	0	0	0	0
0	0	0.00606441	-6.207E-05	3.3881E-05	0	0	0	-0.0011755	2.3751E-06	0	0	0	0	0
0	0	0.00069311	0.00031178	0.00065868	0	0	0	0.00155079	1.4308E-06	0	0	0	0	0
0	0	0.00039451	-0.0003961	3.2002E-05	0	0	0	-8.514E-05	-1.032E-06	0	0	0	0	0
0	0	-0.0081671	-0.000157	-3.192E-05	0	0	0	-0.0005118	9.0835E-07	0	0	0	0	0
0	0	0.0022717	2.3829E-05	0.00028803	0	0	0	0.000518	2.5809E-07	0	0	0	0	0
0	0	-0.0010192	5.5498E-05	0.00064053	0	0	0	0.0002559	9.0194E-07	0	0	0	0	0
0	0	-0.0092275	1.5793E-05	-0.0003854	0	0	0	-0.0009327	-1.538E-06	0	0	0	0	0
0	0	0.00194918	0.00019423	0.0003064	0	0	0	0.00069344	3.1135E-06	0	0	0	0	0
0	0	-0.0010709	0	-0.0004928	0	0	0	-0.000853	-3.073E-06	0	0	0	0	0
0	0	0.00107751	3.1374E-05	0.00015582	0	0	0	0.00130548	-1.435E-06	0	0	0	0	0
0	0	-0.0011779	0.00015653	0.00012304	0	0	0	0.00135138	1.8428E-06	0	0	0	0	0
0	0	0.00657678	0	9.1333E-05	0	0	0	0	1.3018E-07	0	0	0	0	0
0	0	0.00238924	-0.0003713	-0.000287	0	0	0	-0.0010645	-5.203E-07	0	0	0	0	0
0	0	-0.0068653	-0.0002546	-0.0002632	0	0	0	-0.0013434	-2.61E-06	0	0	0	0	0
0	0	-0.0029873	-9.733E-05	9.4985E-05	0	0	0	-0.0004334	1.0607E-06	0	0	0	0	0
0	0	0.00238824	0.00031046	0.00015705	0	0	0	0.00070052	9.2214E-07	0	0	0	0	0
0	0	-0.00514	-0.0001517	4.6501E-05	0	0	0	-0.0008616	-2.358E-06	0	0	0	0	0
0	0	-0.0017657	0.00039575	-0.0002625	0	0	0	-0.0001758	-1.329E-06	0	0	0	0	0
0	0	0.00011152	7.0598E-05	0.00036315	0	0	0	0.00017657	2.0098E-06	0	0	0	0	0
0	0	-0.0037882	-0.0002263	-0.0005362	0	0	0	-0.0005275	-2.383E-06	0	0	0	0	0
0	0	-0.004784	-0.0005477	-0.0004011	0	0	0	-0.0008902	-1.343E-06	0	0	0	0	0
0	0	-0.0022256	-0.0002731	-3.321E-05	0	0	0	-0.000909	-4.604E-06	0	0	0	0	0
0	0	0.00177989	0.0004731	0.00031639	0	0	0	0.0013002	6.2696E-06	0	0	0	0	0
0	0	0.00023492	0.0003672	0.00022708	0	0	0	0.00081127	2.4158E-06	0	0	0	0	0
0	0	-0.0004692	-0.0003336	0.0002069	0	0	0	-0.0012386	1.8517E-06	0	0	0	0	0
0	0	-0.0008233	-0.0001548	-0.0002034	0	0	0	0	-1.831E-06	0	0	0	0	0
0	0	-0.0092174	-0.0005933	-0.0004934	0	0	0	-0.0010931	-6.481E-06	0	0	0	0	0
0	0	-0.0124803	4.821E-05	-0.0002159	0	0	0	-9.349E-05	1.8409E-06	0	0	0	0	0
0	0	0.01452357	0.00035007	0.00062579	0	0	0	-0.0022484	5.5447E-06	0	0	0	0	0
0	0	0.00297816	0.00010235	0.00041773	0	0	0	0.00217499	3.7548E-06	0	0	0	0	0
0	0	0.00853961	0.00027932	0.00043458	0	0	0	0.00094094	3.2777E-06	0	0	0	0	0
0	0	-0.0061624	-9.121E-05	-0.0001797	0	0	0	-0.001197	-2.185E-06	0	0	0	0	0
0	0	-0.0069921	-0.0002504	-0.0003649	0	0	0	-0.000663	-2.736E-06	0	0	0	0	0
0	0	0.01017486	5.9555E-05	0.00012547	0	0	0	0.00086583	2.2522E-06	0	0	0	0	0
0	0	0.00332242	-0.0002033	-0.0002328	0	0	0	-0.0010373	-1.699E-06	0	0	0	0	0
0	0	0.00454065	0.0005934	0.00023746	0	0	0	0.00057983	3.3014E-06	0	0	0	0	0
0	0	0.00181532	-0.0001235	5.8354E-05	0	0	0	9.5339E-05	-1.424E-06	0	0	0	0	0
0	0	-0.0031439	0.00032015	0.00021786	0	0	0	0.00152218	4.0722E-06	0	0	0	0	0
0	0	0.00300584	-9.834E-05	-6.112E-05	0	0	0	-0.0003675	1.2856E-07	0	0	0	0	0
0	0	0.00057404	3.3018E-05	0.00019968	0	0	0	-9.268E-05	5.1375E-07	0	0	0	0	0
0	0	0.00011445	-9.058E-05	-3.021E-05	0	0	0	0.00067853	-1.921E-06	0	0	0	0	0
0	0	-0.0005718	-0.0002902	6.0579E-05	0	0	0	-0.0007462	1.2956E-06	0	0	0	0	0
0	0	0.00114734	0.00022882	6.0269E-05	0	0	0	0.00142388	-2.571E-07	0	0	0	0	0
0	0	0.00113981	-0.0003	-8.995E-05	0	0	0	0.00018376	5.1497E-07	0	0	0	0	0
0	0	0.01132349	0.00012785	7.5528E-05	0	0	0	0.00027446	6.4173E-07	0	0	0	0	0
0	0	0.00520853	0.00039682	0.00055538	0	0	0	0.00090904	1.9178E-06	0	0	0	0	0
0	0	0.00257995	0.0001722	0.00018641	0	0	0	0.0005341	1.1374E-06	0	0	0	0	0
0	0	0.00040674	-0.0001295	-0.0001835	0	0	0	0.00017585	-8.786E-07	0	0	0	0	0
0	0	0.01602881	0.00031883	0.00044453	0	0	0	0.00078808	1.388E-06	0	0	0	0	0
0	0	0.00297175	-0.0001118	0.00015576	0	0	0	0.00171971	1.3764E-06	0	0	0	0	0
0	0	0.00255653	0.00019854	-0.0002876	0	0	0	0.00016534	-7.393E-07	0	0	0	0	0
0	0	0.00683823	-8.012E-06	0.00028069	0	0	0	0.00049412	1.257E-06	0	0	0	0	0
0	0	0.00108514	-0.0001603	-0.0001508	0	0	0	-0.0011398	-1.497E-06	0	0	0	0	0
0	0	-0.0050663	0.00025954	0	0	0	0	0.00098809	-1.007E-06	0	0	0	0	0
0	0	-0.0066583	-0.0003262	-0.0004305	0	0	0	0	-2.027E-06	0	0	0	0	0
0	0	0.0002807	-0.0005709	0	0	0	0	-0.0016695	-3.078E-06	0	0	0	0	0
0	0	-0.0009341	-4.259E-05	0	0	0	0	-0.0002606	9.1483E-07	0	0	0	0	0
0	0	-0.0007514	-8.545E-05	-2.882E-05	0	0	0	0.00096125	2.5994E-06	0	0	0	0	0
0	0	-0.0036789	8.5985E-06	0.00024555	0	0	0	8.5471E-05	7.6768E-07	0	0	0	0	0
0	0	0.01252882	0.00029011	0.00036794	0	0	0	0.00110891	4.2455E-06	0	0	0	0	0
0	0	0	-0.0001529	-8.235E-05	0	0	0	-0.0006652	-1.753E-06	0	0	0	0	0
0	0	0.00026966	-1.719E-05	0.00055288	0	0	0	0.00346294	1.5189E-06	0	0	0	0	0
0	0	-0.0032308	-0.0002324	-0.0002641	0	0	0	-0.001016	-3.637E-06	0	0	0	0	0
0	0	0.0012803	9.6332E-05	0.00022963	0	0	0	0.0009606	1.1542E-06	0	0	0	0	0
0	0	-0.0009078	0	-5.301E-05	0	0	0	0	-1.401E-06	0	0	0	0	0
0	0	-0.0080305	-0.0003304	-0.0003727	0	0	0	-0.0021923	-1.156E-06	0	0	0	0	0
0	0	-0.0007655	-0.000312	-0.0001924	0	0	0	-0.0017328	6.4678E-07	0	0	0	0	0
0	0	0.00230664	0.00015516	0.00013968	0	0	0	0.00146174	1.6751E-06	0	0	0	0	0
0	0	-9.484E-05	-4.511E-05	0.00026231	0	0	0	0.00041577	6.3778E-07	0	0	0	0	0
0	0	0.00692764	-0.0005251	-0.0002701	0	0	0	0.00024707	-3.176E-06	0	0	0	0	0
0	0	0.00511026	-0.0001696	0.00046995	0	0	0	0.00040942	4.6641E-06	0	0	0	0	0
0	0	0.01178965	0.00055351	7.9776E-05	0	0	0	0.00048665	2.8977E-06	0	0	0	0	0
0	0	-0.0033201	-0.0001191	7.9243E-05	0	0	0	0.00080199	3.5904E-06	0	0	0	0	0
0	0	0.00575437	7.3974E-05	-0.0002755	0	0	0	-7.872E-05	9.5719E-06	0	0	0	0	0
0	0	0.00212952	-0.0002023	6.7155E-05	0	0	0	0.00015774	-1.947E-06	0	0	0	0	0
0	0	-0.0004855	3.7348E-05	1.3357E-05	0	0	0	-0.0001572	3.1286E-06	0	0	0	0	0
0	0	-0.0024342	-0.0004004	0.00030683	0	0	0	0.00023661	-3.752E-06	0	0	0	0	0
0	0	-0.0067481	-0.0003839	0.00075426	0	0	0	-0.0014904	-3.491E-07	0	0	0	0	0
0	0	-0.0023975	-0.0002616	-0.0004647	0	0	0	0	-6.53E-06	0	0	0	0	0
0	0	-0.0026915	0.00029889	0.00034359	0	0	0	0.00089389	7.0471E-06	0	0	0	0	0
0	0	0.00282214	0.00018148	0.00021026	0	0	0	0.0019901	1.894E-06	0	0	0	0	0
0	0	0.00494657	-6.963E-05	0.00012153	0	0	0	-0.0001521	0	0	0	0	0	0
0	0	0.01316256	0.00043996	0.0010586	0	0	0	0.00129789	3.1597E-06	0	0	0	0	0
0	0	-0.0045487	0.0002614	-0.0001104	0	0	0	0.00133388	1.952E-06	0	0	0	0	0
0	0	0.01191945	0.00061724	-0.0003122	0	0	0	0.0019405	6.8085E-06	0	0	0	0	0
0	0	-0.0066316	0.0005719	-1.145E-05	0	0	0	-0.001444	3.2687E-07	0	0	0	0	0
0	0	-0.0039177	-6.965E-05	-0.0001261	0	0	0	-0.0004981	2.2838E-06	0	0	0	0	0
0	0	0.00128262	-0.0001575	0.00025484	0	0	0	0.00115186	4.9341E-06	0	0	0	0	0
0	0	-0.0050929	-8.856E-05	-8.084E-05	0	0	0	0.00357555	9.3722E-07	0	0	0	0	0
0	0	-0.0060668	-3.946E-05	-0.0001379	0	0	0	-0.0016179	-2.282E-06	0	0	0	0	0
0	0	0.00033985	-0.0001897	-6.978E-05	0	0	0	0.00047077	-1.903E-06	0	0	0	0	0

0	0	0.00128821	2.7494E-05	-5.849E-05	0	0	0	6.6514E-05	2.1391E-07	0	0	0	0	0
0	0	-0.0036673	-0.0001372	0.00019985	0	0	0	-0.0001993	-7.479E-07	0	0	0	0	0
0	0	0.00043561	-0.0001016	0.00010405	0	0	0	0.00104696	-1.073E-06	0	0	0	0	0
0	0	0.00026073	-0.0004469	-0.0001834	0	0	0	-0.0003979	-5.401E-07	0	0	0	0	0
0	0	-0.0071161	-0.0002793	-0.0003376	0	0	0	-0.0019412	-2.276E-06	0	0	0	0	0
0	0	0.00307678	0.00043286	0.00028754	0	0	0	0.00196305	5.166E-06	0	0	0	0	0
0	0	0.00471255	-0.0002192	-3.509E-05	0	0	0	-0.0001341	1.9182E-06	0	0	0	0	0
0	0	0.00225072	0.00010657	-2.346E-05	0	0	0	-0.0008743	2.8442E-06	0	0	0	0	0
0	0	-0.0010255	0.00025952	-7.053E-05	0	0	0	0.00041191	1.6568E-06	0	0	0	0	0
0	0	-0.002493	-0.0005752	-0.0005676	0	0	0	-0.0029239	-6.869E-06	0	0	0	0	0
0	0	0.00113381	-0.0004648	-0.0010145	0	0	0	-0.0035026	-1.594E-05	0	0	0	0	0
0	0	-0.0143841	-0.0007742	-0.0001363	0	0	0	-0.000874	2.3072E-07	0	0	0	0	0
0	0	-0.0005669	-0.0003834	-0.0004413	0	0	0	-0.0039743	-7.149E-07	0	0	0	0	0
0	0	9.4786E-05	0.00023685	0.00027212	0	0	0	0.00053632	9.5733E-06	0	0	0	0	0
0	0	0.00409647	-4.433E-05	0.00022402	0	0	0	-0.0002648	-5.654E-07	0	0	0	0	0
0	0	0.0042357	-0.0003336	-0.0007146	0	0	0	-0.001227	-3.518E-06	0	0	0	0	0
0	0	-0.0001838	0.00013684	0.00057026	0	0	0	0.00074783	-4.638E-07	0	0	0	0	0
0	0	-0.004967	0.00074501	0.00058599	0	0	0	0.00404259	9.3032E-07	0	0	0	0	0
0	0	0.00492401	2.1385E-05	0.00041217	0	0	0	0.00075569	3.4686E-07	0	0	0	0	0
0	0	-0.0015653	-0.0003523	0.00014135	0	0	0	8.2515E-05	2.4231E-06	0	0	0	0	0
0	0	-0.0010221	0.00014657	-0.0002921	0	0	0	-0.0018942	-1.127E-06	0	0	0	0	0
0	0	0.00093468	-2.196E-05	0.00057283	0	0	0	0.00043079	-6.923E-07	0	0	0	0	0
0	0	-0.0051132	3.3003E-05	-3.726E-05	0	0	0	-0.0004265	-4.635E-07	0	0	0	0	0
0	0	0.00229896	0.000417	6.2293E-05	0	0	0	-0.0006893	3.0213E-06	0	0	0	0	0
0	0	-0.0055777	-0.0002022	-0.000347	0	0	0	-0.000613	-3.88E-06	0	0	0	0	0
0	0	0.00293031	-0.0001081	0.00049791	0	0	0	-0.0002665	2.5709E-06	0	0	0	0	0
0	0	-0.0013448	-0.0003159	-0.0004534	0	0	0	-0.0013408	9.205E-07	0	0	0	0	0
0	0	-0.0029042	0.00032354	1.2741E-05	0	0	0	0.00073818	9.1542E-07	0	0	0	0	0
0	0	0.00088605	0.00014161	8.908E-05	0	0	0	0.00063499	2.5034E-06	0	0	0	0	0
0	0	-0.002057	-5.39E-05	-0.000101	0	0	0	-0.0005363	7.8452E-07	0	0	0	0	0
0	0	-0.010805	-0.0009741	-0.0007261	0	0	0	-0.0019915	-1.06E-05	0	0	0	0	0
0	0	-0.0033829	-0.0003035	-0.0003528	0	0	0	-0.0017087	-6.796E-06	0	0	0	0	0
0	0	0.00474394	-0.0007762	-0.0001818	0	0	0	-0.0030648	-1.169E-05	0	0	0	0	0
0	0	0.0064017	0.00041832	0.00029825	0	0	0	0.00074527	7.4974E-06	0	0	0	0	0
0	0	-0.0022267	-0.0005286	-0.0009559	0	0	0	-0.0016325	6.4025E-07	0	0	0	0	0
0	0	-0.0049213	-0.0010878	-0.0006479	0	0	0	-0.0016101	-6.25E-06	0	0	0	0	0
0	0	0.00453744	0.00059891	0.00066936	0	0	0	0.00135638	2.9169E-06	0	0	0	0	0
0	0	0.00020564	-0.0001867	0.00039225	0	0	0	0.00092036	7.5561E-06	0	0	0	0	0
0	0	0.00256772	0.00018929	0.00040892	0	0	0	0.00268167	7.2243E-06	0	0	0	0	0
0	0	-0.0004048	0.00045669	0.00026824	0	0	0	0.00040383	-7.756E-06	0	0	0	0	0
0	0	-0.0008116	-7.991E-05	-8.284E-05	0	0	0	0.00200031	8.3954E-06	0	0	0	0	0
0	0	-0.0036693	-0.0003216	-0.0002363	0	0	0	-0.0004778	-2.801E-06	0	0	0	0	0
0	0	0.00489402	-0.0002334	0.00036882	0	0	0	0.0015462	3.5931E-06	0	0	0	0	0
0	0	0.00141772	-0.0005449	2.7515E-05	0	0	0	-0.0001865	-2.183E-06	0	0	0	0	0
0	0	0.00703149	0.00096122	0.00046669	0	0	0	0.00243575	6.5129E-06	0	0	0	0	0
0	0	0.00279954	0.00077458	0.00048866	0	0	0	0.00017729	1.7731E-06	0	0	0	0	0
0	0	-0.0044651	-8.993E-05	-2.537E-05	0	0	0	-0.001854	3.5084E-07	0	0	0	0	0
0	0	-0.0060458	-0.0008924	-0.000572	0	0	0	-0.0021223	-4.551E-06	0	0	0	0	0
0	0	-0.0038393	-0.000291	-0.0003873	0	0	0	-0.0008737	-5.401E-06	0	0	0	0	0
0	0	0.00092986	0.00039659	0.00017939	0	0	0	0.00158546	2.6058E-06	0	0	0	0	0
0	0	0.00565242	0.00081894	0.00046777	0	0	0	0.00152896	4.4547E-06	0	0	0	0	0
0	0	0.001891	-1.318E-05	0.00034415	0	0	0	0.00147636	3.4779E-06	0	0	0	0	0
0	0	0.00422159	-0.0003824	0.00012863	0	0	0	-0.0006244	-3.758E-06	0	0	0	0	0
0	0	-0.0080845	-0.000448	-0.0005218	0	0	0	-0.0009256	-8.293E-06	0	0	0	0	0
0	0	-0.0023498	-7.022E-05	3.9933E-05	0	0	0	0.00047569	-2.531E-07	0	0	0	0	0
0	0	0.01014966	-2.824E-05	0.00042452	0	0	0	0.00075275	3.1691E-06	0	0	0	0	0
0	0	-0.0023483	-0.0001415	-0.0001281	0	0	0	-0.0001849	-7.462E-07	0	0	0	0	0
0	0	0.01140643	0.00078648	0.0005697	0	0	0	0.00213605	3.2484E-06	0	0	0	0	0
0	0	0.00623544	0.0002026	0.0002471	0	0	0	0.00141547	3.3079E-06	0	0	0	0	0
0	0	-0.0016171	5.3227E-05	-0.0002421	0	0	0	0.00068514	1.8015E-06	0	0	0	0	0
0	0	0.0014509	0.00078193	0.00029652	0	0	0	0	-5.346E-06	0	0	0	0	0
0	0	0.00458645	0.00027549	2.4108E-05	0	0	0	0.00160162	7.3676E-07	0	0	0	0	0
0	0	-0.0005257	0.00026725	-0.0002493	0	0	0	-0.0005688	1.4669E-06	0	0	0	0	0
0	0	-0.0043061	0.00024406	7.4052E-05	0	0	0	-8.235E-05	5.9608E-07	0	0	0	0	0
0	0	-0.0021629	0.00074305	0.00038024	0	0	0	0.0026404	2.1906E-06	0	0	0	0	0
0	0	0.00820794	0.00018168	0.0003209	0	0	0	0.00272052	4.0835E-06	0	0	0	0	0
0	0	-0.0061956	-0.0003249	-0.0002199	0	0	0	-0.0004386	-1.875E-06	0	0	0	0	0
0	0	0.00339607	-6.889E-05	0.00034193	0	0	0	-0.0033232	4.7419E-07	0	0	0	0	0
0	0	-0.0045012	-0.0002077	-5.73E-05	0	0	0	9.028E-05	-8.274E-07	0	0	0	0	0
0	0	0.00480596	0.00042201	0.00055278	0	0	0	0.00057318	3.4452E-06	0	0	0	0	0
0	0	-0.0046764	-0.0001023	-0.0004071	0	0	0	-0.0006464	-4.654E-07	0	0	0	0	0
0	0	-0.0034196	6.8714E-05	0.00014813	0	0	0	0.00131263	0	0	0	0	0	0
0	0	-0.0071653	7.4416E-05	-0.0003039	0	0	0	0.00087565	-1.063E-06	0	0	0	0	0
0	0	-0.0017701	-0.0002067	-0.0008316	0	0	0	-0.0003901	2.6042E-06	0	0	0	0	0
0	0	-0.0060607	0.00086294	0.00013661	0	0	0	0.00157456	1.8645E-06	0	0	0	0	0
0	0	0.00072063	-1.095E-05	-0.0003683	0	0	0	-0.0003038	2.535E-06	0	0	0	0	0
0	0	-0.0014354	0.00010964	0.00011404	0	0	0	0.0013002	3.1773E-06	0	0	0	0	0
0	0	0.00082708	-9.788E-05	-0.000502	0	0	0	-0.0003712	-2.226E-06	0	0	0	0	0
0	0	-0.0014405	0.00100793	-0.0004194	0	0	0	0.00104833	2.4827E-06	0	0	0	0	0
0	0	-0.0048764	-0.0003668	0.00019019	0	0	0	-0.0024121	-1.112E-06	0	0	0	0	0
0	0	-0.0016013	-0.0003667	-0.0001203	0	0	0	0.00015489	-3.47E-06	0	0	0	0	0
0	0	0.00366344	1.0773E-05	-5.403E-05	0	0	0	-7.717E-05	4.574E-07	0	0	0	0	0

CLC	BYD	MTR	ANTA	CITIC	CKHUY	TTI	GEG	CLP	HOKCY	LN	MN	HLDCY	SIG	CG
0	0	0.00030496	-4.17E-10	5.0935E-09	0	0.00761681	0	-0.0168525	-0.0004139	7.7402E-08	-2.549E-05	0	0.00061082	0
0	0	4.2972E-05	-8.026E-11	6.8909E-09	0	0.0073724	0	-0.0098344	0.00051041	1.0651E-08	0.00018799	0	0.00222657	0
0	0	0.00030015	1.1561E-10	6.6513E-09	0	-0.0012161	0	0.00186034	-0.0001179	9.1393E-08	-1.198E-05	0	0.00515278	0
0	0	0.00029608	-7.198E-10	3.5995E-09	0	-0.0021474	0	0.00074118	5.9187E-05	-7.508E-09	0.00014445	0	0.01019781	0
0	0	0.00016691	1.246E-09	4.2902E-09	0	0.01324759	0	0.00703038	-5.906E-05	1.3838E-07	-2.277E-05	0	0.00378445	0
0	0	0.00053836	-3.937E-10	-1.012E-08	0	0.00766778	0	0.00874844	0.00106542	-3.853E-08	1.7233E-05	0	0.00398386	0
0	0	-4.041E-05	-7.979E-11	-1.824E-09	0	-0.0067202	0	0.00858776	0.0003701	1.0143E-08	-8.558E-05	0	0.00527619	0
0	0	0.00024292	2.2984E-11	-4.999E-09	0	0.0022625	0	0.01229761	0.00047741	2.5026E-08	-1.181E-05	0	-0.0004566	0
0	0	0.00052055	5.8473E-10	-7.025E-09	0	-0.0008345	0	-0.0044507	5.5181E-05	-8.077E-10	-5.934E-06	0	-0.0007642	0
0	0	-0.0001173	-2.163E-10	-1.963E-09	0	0.00531799	0	0.00834608	0.00027537	2.2643E-08	0.00010111	0	0.00739101	0
0	0	-0.0005112	-5.42E-10	-6.801E-09	0	-0.0026934	0	-0.0158408	0.0004634	-7.069E-08	-0.0001429	0	-0.0027319	0
0	0	0.00060396	-2.46E-10	8.815E-10	0	0.00851865	0	0.01069374	-0.000268	-5.105E-08	0.0002425	0	0.00590622	0
0	0	-0.0005093	2.8841E-10	-1.462E-09	0	0.00181	0	-0.0010454	0.00074433	-2.967E-08	2.7648E-05	0	0.00055892	0
0	0	-4.011E-05	-5.019E-10	-1.768E-09	0	-0.0084205	0	-0.0087316	-0.0003292	-1.35E-08	6.5633E-05	0	0.00125096	0
0	0	0.00028133	1.481E-10	1.4875E-09	0	-0.0021763	0	0.00854214	6.6662E-05	-1.964E-09	-6.929E-05	0	-0.0081033	0
0	0	-0.0001587	-7.507E-11	-5.018E-09	0	-0.0051148	0	-0.0052428	-0.0006517	-5.119E-08	0.00011511	0	0.00163813	0
0	0	0.00055956	-2.522E-10	-3.032E-10	0	0.00991183	0	0.00600921	0.00019081	-3.059E-08	-1.572E-05	0	0.00117294	0
0	0	-0.0014418	-1.165E-09	-8.198E-09	0	-0.0140568	0	-0.0094229	-0.0009744	-2.857E-08	-7.384E-05	0	-0.0020298	0
0	0	-6.27E-05	-9.116E-10	-8.248E-09	0	-0.0065709	0	-0.0089045	-0.0015726	-1.255E-08	-0.0001413	0	-0.0017744	0
0	0	-0.0002131	1.4601E-10	-6.962E-09	0	0.01726287	0	-0.002905	0.00038771	-6.962E-08	-8.06E-05	0	0.00225638	0
0	0	-4.304E-05	1.4385E-10	1.4196E-08	0	-0.0050837	0	-0.0010961	-2.94E-05	1.404E-08	5.9476E-06	0	-0.0032392	0
0	0	-0.0003882	-2.52E-10	-1.052E-08	0	-0.0056927	0	-0.0065924	-0.0008035	-8.774E-08	-6.527E-05	0	0.00596869	0
0	0	0.00039525	-2.749E-10	2.4346E-09	0	0.00243766	0	0.01215603	0.00099136	-6.653E-08	-0.0001036	0	0.00268443	0
0	0	0.00021567	-7.654E-10	8.5858E-09	0	0.00014967	0	0.00365094	-0.0003253	-2.945E-08	0.00013977	0	-0.0053794	0
0	0	0.00081151	-1.282E-09	9.8612E-10	0	0.00971771	0	0.00941879	9.8769E-05	-6.61E-08	-4.306E-05	0	-0.001533	0
0	0	0.0005353	2.9119E-10	3.9239E-09	0	-0.0032089	0	0.01242854	0.00157456	9.3521E-08	0.00015454	0	0.00093354	0
0	0	-0.0006832	-6.462E-10	-5.768E-09	0	0	0	-0.0183324	-3.099E-05	-7.234E-08	0.00012812	0	0.00092525	0
0	0	0.00066386	-6.273E-10	-6.608E-10	0	0.00614443	0	0.00684064	0.00071361	-8.509E-08	-9.975E-05	0	-0.0015285	0
0	0	-0.0002013	3.237E-10	-9.946E-09	0	0.00177718	0	-0.000355	-0.0003023	-1.954E-09	9.8098E-05	0	0.001241	0
0	0	0.00032512	-4.699E-10	3.8468E-09	0	0.0010795	0	0.00781227	0.00033626	7.8344E-09	-1.666E-05	0	-0.0027594	0
0	0	0.00036037	1.3872E-09	1.0284E-08	0	0.00749698	0	0.00314334	0.00042269	1.3959E-07	1.6773E-05	0	0.00047238	0
0	0	0.00043329	0	-9.434E-09	0	0.0063434	0	-0.0117955	0.00041616	-4.428E-08	1.6662E-05	0	-0.0001567	0
0	0	-0.0001931	4.7332E-10	-6.844E-10	0	0.00121207	0	-0.003559	-0.0001171	-2.263E-08	1.1035E-05	0	-0.0119316	0
0	0	7.6882E-05	-2.657E-10	-2.833E-08	0	0.00576628	0	-0.0032278	-5.881E-05	-9.864E-08	4.944E-05	0	0.00904159	0
0	0	0.00031343	6.9983E-10	-5.846E-09	0	0.00714466	0	-0.0010836	0.00017679	3.2938E-08	7.0036E-05	0	0.00505723	0
0	0	0.00073381	1.2662E-09	1.5204E-08	0	0.01445066	0	0.00896936	0.00079038	4.3422E-08	-8.386E-05	0	0.00077796	0
0	0	3.7368E-05	-1.401E-10	-1.958E-10	0	0.0011458	0	0.00465535	0.00063284	-7.471E-09	0	0	-0.0015444	0
0	0	0.00014919	8.5261E-10	-8.82E-09	0	0.00374888	0	0.00035448	0.00055932	1.3204E-08	0	0	0	0
0	0	7.4087E-05	7.0228E-10	7.1914E-09	0	-0.0101764	0	0.00035437	8.2187E-05	9.4567E-08	-1.084E-05	0	0.00062707	0
0	0	-0.0001846	5.9409E-10	-9.901E-10	0	0.00249079	0	-0.0053105	5.4633E-05	3.1359E-08	-5.99E-05	0	0.00373969	0
0	0	0.00011171	1.5793E-10	9.7537E-09	0	0.00957987	0	0.00286478	2.7256E-05	-5.232E-08	6.1364E-05	0	0.00225637	0
0	0	0.0004075	-9.183E-10	-5.682E-09	0	-0.0024751	0	0.00284735	0.00091224	-7.488E-08	3.2674E-05	0	0.00471163	0
0	0	0.00014546	1.2011E-09	7.027E-09	0	0.00659352	0	0.00106129	6.5849E-05	6.4132E-08	-5.375E-06	0	0.00676179	0
0	0	-0.000289	-1.041E-09	-5.648E-09	0	0.00055481	0	-0.0035297	-0.0005912	-2.437E-08	-9.697E-05	0	-0.0034395	0
0	0	-3.66E-05	3.1099E-11	1.1641E-09	0	-0.0003684	0	0.00355658	0.00020148	0	-5.043E-05	0	-0.0023257	0
0	0	0.00040338	-6.975E-10	-1.35E-09	0	0.01200499	0	0.00635313	0.00086661	-3.955E-08	-4.574E-05	0	0.0005597	0
0	0	0.00050407	-2.838E-10	-1.165E-09	0	-0.0062784	0	0.00626784	0.00019374	1.1373E-08	1.1648E-05	0	-0.0004175	0
0	0	-0.0002111	4.9873E-10	4.1033E-09	0	-0.004092	0	-0.0065284	6.4128E-05	2.615E-08	-0.0001681	0	0.00195632	0
0	0	0.00017767	7.5254E-10	1.4921E-08	0	0.00110068	0	-0.0093241	0.00025588	1.174E-07	1.8637E-05	0	0.01069876	0
0	0	-0.0002467	1.9741E-10	-1.065E-09	0	-0.0018197	0	-0.0064507	-0.0003802	4.6982E-08	0.00014183	0	0.00385629	0
0	0	-3.566E-05	3.1256E-10	9.9928E-09	0	-0.0011066	0	0.00399741	0.00038565	8.8534E-09	7.0049E-05	0	0.00335886	0
0	0	0.00017855	1.1537E-09	4.1379E-08	0	0.00111574	0	0.00288231	-0.0001267	8.4604E-08	-2.84E-05	0	0.00011618	0
0	0	0.00031877	4.6414E-10	-6.971E-09	0	-0.00166	0	-0.0010742	0	2.7585E-08	0.00021253	0	-0.0061525	0
0	0	6.9815E-05	7.2605E-10	-5.498E-09	0	0.01400434	0	-0.0007179	0.00019101	1.0143E-07	0	0	-0.0012337	0
0	0	3.4797E-05	-1.844E-09	-4.767E-09	0	-0.002539	0	0.00251648	0.0003161	-1.724E-07	-7.415E-05	0	0.0106117	0
0	0	0.00034741	3.9557E-10	-2.75E-09	0	-0.0044847	0	0.00464809	0.00074982	1.445E-09	2.183E-05	0	0.00645864	0
0	0	0	4.4801E-10	-1.55E-09	0	0.00249736	0	0.00460222	-0.0009119	-9.086E-08	-9.198E-05	0	0.00672199	0
0	0	6.839E-05	5.0616E-10	-1.563E-09	0	0.00227708	0	-0.0017527	0.00025169	1.8E-08	5.6162E-06	0	0.00425998	0
0	0	-0.0001364	-5.182E-10	-8.509E-09	0	-0.001895	0	0.00351886	0.00012469	-3.517E-08	-3.362E-05	0	-0.0040927	0
0	0	0.00017152	-3.518E-10	-5.607E-09	0	0.00209652	0	0.00488943	-6.207E-05	3.8542E-08	-4.543E-05	0	0.00676586	0
0	0	0.00051053	-1.352E-10	-1.087E-08	0	0.0096349	0	-0.0038018	0.00068417	2.8718E-08	0.00011567	0	-0.0004706	0
0	0	-0.001297	-4.798E-10	-1.171E-08	0	0.00963895	0	0.00362077	0.00012131	-6.92E-08	-0.0001216	0	-0.0026002	0
0	0	7.0728E-05	4.3264E-11	9.5937E-10	0	0.0024	0	0.00561319	-0.0001208	3.3813E-09	-4.067E-05	0	0.00145455	0
0	0	-3.525E-05	-2.01E-10	1.1455E-09	0	0.00353739	0	0.00450671	0.00054591	3.3661E-09	0.00011812	0	0.00023912	0
0	0	-0.0003883	-2.052E-10	-1.158E-08	0	-0.0061769	0	-0.0072105	-0.0002973	-4.86E-08	-8.462E-05	0	-0.0004771	0
0	0	0.0003954	-1.947E-10	5.2519E-09	0	0.0051169	0	0.00697467	0.00054104	-1.789E-08	0.00014593	0	-0.0011982	0
0	0	-0.0005296	3.9421E-10	-3.932E-09	0	-0.0073966	0	-0.0061847	0.00023572	9.1605E-09	-8.828E-05	0	-0.0031516	0
0	0	0.00094079	7.4304E-11	-4.015E-10	0	0.0059822	0	0.00766081	0.00035052	-5.793E-08	-4.003E-05	0	0.00424978	0
0	0	0.00038154	-7.374E-11	0	0	0.003379	0	0.00308329	0	9.793E-09	9.2967E-05	0	0.00480389	0
0	0	0.00037498	6.9847E-10	1.0661E-08	0	0.00114678	0	0.00204199	0.00023068	3.2876E-08	0.00018491	0	0.00574033	0
0	0	-0.0004357	2.6345E-10	-3.811E-09	0	0.00241646	0	-0.0027108	-0.0002859	1.298E-08	4.1758E-05	0	0.00152339	0
0	0	0.0002985	4.8602E-10	-9.331E-09	0	0.00139657	0	0.00545355	-0.0001156	5.8348E-08	0.00020025	0	0.00450441	0
0	0	-0.0007204	-4.758E-10	2.2171E-09	0	0.00352508	0	-0.0252683	-0.001393	1.3046E-07	5.7071E-05	0	0.00452343	0
0	0	-0.0012772	5.4078E-10	-7.493E-09	0	-0.0008315	0	-0.0095579	-0.0013735	-4.343E-08	6.0456E-05	0	0.00019111	0
0	0	-0.0003392	-8.325E-10	-1.018E-08	0	-0.0089954	0	-0.0051314	-0.0003125	-6.292E-08	-7.72E-05	0	-0.0071346	0
0	0	-0.0004594	-4.762E-10	-7.093E-09	0	-0.0027733	0	-0.0088945	-0.0001451	-2.843E-08	7.5559E-05	0	-0.0114882	0
0	0	0.00058661	2.7979E-10	6.416E-09	0	0.00253318	0	0.00717817	0.00072945	-9.204E-08	2.2872E-05	0	0.00239094	0
0	0	0.00011425	-5.726E-11	-2.299E-10	0	-0.001024	0	0.00297658	0.00079544	9.8685E-09	5.8931E-05	0	-0.0009349	0
0	0	0.00045459	1.3679E-09	5.985E-09	0	0.01201249	0	0.00554595	0.00019316	4.0921E-08	1.7718E-05	0	-0.0066037	0
0	0	-0.0003711	1.2751E-09	2.2321E-09	0	-0.0061612	0	-0.0021924	-0.0008493	3.6996E-08	0.00019793	0	0.00830932	0
0	0	0.000151	-4.8E-10	1.5444E-09	0	-0.0045391	0	0.00550662	0.00127302	7.0582E-09	3.2621E-05	0	0.0051306	0
0	0	0.00026244	6.9277E-10	-5.909E-09	0	0.00675074	0	0.0036283	0.00035115	1.0665E-07	9.6611E-05	0	-0.0077794	0
0	0	-0.0001482	1.4031E-09	5.1944E-09	0	-0.0036349	0	-0.0046806	-0.0002666	3.6833E-08	-7.753E-06	0	0.00624508	0
0	0	0.0001865	-2.012E-10	1.0994E-08	0	-0.0074697	0	0.00109118	0.00020198	7.6142E-08	-5.055E-05	0	0.00679854	0
0	0	-0.0007766	-2.25E-10	-4.782E-09	0	0.00547248	0	-0.0185042	-0.0020984	-2.664E-08	-5.952E-05	0	-0.0040421	0
0	0	0.00065195	4.9657E-10	0	0	0.00336086	0	0.00151124	-0.0009567	4.0015E-08	0.00015039	0	0.00730375	0
0	0	0.000633	-3.206E-10	8.7435E-09	0	-0.0021389	0	0.00489552	0.00060115	-9.179E-09	-2.685E-05	0	-0.0006205	0
0	0	0.00040074	-1.306E-10	1.256E-08	0	0.00449118	0	0.00740912	0.0001176	-1.195E-08	8.5285E-05	0	-0.0012484	0
0	0	0.00028661	-3.258E-10	2.9013E-09	0	0.00875726	0	0.00703019	0.00014637	-2.157E-08	2.9996E-05	0	-0.0004212	0
0	0	0.00010609	8.2169E-10	-2.096E-09	0	-0.0016555	0	-0.0018225	0.00038194	6.5205E-08	0.00011116	0	0.00613203	0
0	0	-3.52E-05	1.7486E-10	2.3309E-08	0	0.00067039	0	-0.0058553	-2.89E-05	8.9495E-09	7.0971E-05	0	0.00399402	0
0	0	-0.0003877	1.2406E-09	-6.869E-10	0	-0.0039357	0	-0.003706	-0.0004339	1.1373E-07	-6.557E-05	0	0.000577	0
0	0	-0.0002871	5.0787E-11	-1.379E-09	0	-0.0023357	0	-0.003362	-0.000147	3.1909E-08	5.6696E-05	0	-0.0007651	0

0	0	-0.0003273	-7.747E-10	-1.111E-08	0	-0.0023766	0	-0.0045154	-0.0003252	-3.486E-08	-4.852E-05	0	-0.0013488	0
0	0	0.00033227	7.5017E-10	5.8972E-09	0	-0.0002846	0	0.00797897	0.00029924	5.644E-08	-0.0001343	0	-0.0019521	0
0	0	-0.0004364	3.3975E-11	2.8604E-09	0	-0.0014259	0	-0.0059771	-0.0002664	-8.761E-08	-0.0001829	0	0.00139256	0
0	0	0.00022265	-6.264E-10	-3.875E-09	0	0.00158512	0	-0.0018921	-8.966E-05	4.6554E-09	0.00018115	0	0	0
0	0	0	3.4376E-10	1.0068E-08	0	0.00669484	0	0.01139853	0.00032988	6.9408E-09	8.6367E-05	0	0.00255212	0
0	0	0.00036733	-1.922E-10	-3.416E-10	0	0.00576933	0	0.00445072	0.00014814	1.7196E-08	5.8087E-05	0	0.00804829	0
0	0	-0.0002529	-3.744E-10	1.4715E-08	0	-0.0045575	0	-0.00845	-0.0002652	4.5971E-08	3.5485E-05	0	-0.0040915	0
0	0	-0.0002558	-3.152E-10	-2.224E-09	0	-0.0033011	0	-0.0009779	-0.0002678	-4.231E-08	-7.698E-05	0	0.0012961	0
0	0	-0.0004808	-8.239E-10	-3.215E-10	0	0.00890724	0	-0.0105869	-0.0007214	-3.695E-08	5.4144E-05	0	-0.0029262	0
0	0	0.00049163	2.6166E-10	0	0	0.00259186	0	0.00928486	0.00058681	-5.058E-08	4.5937E-05	0	0.00338701	0
0	0	-0.0005547	9.4791E-10	-9.339E-09	0	-0.000318	0	-0.0094833	-0.0005743	5.9199E-08	-2.082E-05	0	0.00346266	0
0	0	-0.0001138	6.1302E-10	-1.659E-08	0	0.00350526	0	0.00116159	-0.0002471	6.4305E-08	1.3997E-05	0	-0.0051152	0
0	0	-0.0003815	4.8932E-10	-1.854E-09	0	-0.0049702	0	0.00695229	-0.0001247	-4.207E-08	8.0036E-05	0	-0.0068631	0
0	0	-3.883E-05	-4.659E-10	-6.925E-09	0	-0.0099958	0	-0.0102754	-0.001096	-4.679E-08	-5.059E-05	0	0.00258128	0
0	0	-0.0004279	1.7476E-10	-2.913E-09	0	0.00382882	0	-0.0108956	-0.0008487	-9.725E-09	-5.507E-05	0	-0.0005813	0
0	0	-0.0001587	-4.464E-10	-1.775E-09	0	-0.0049425	0	-0.0031875	-0.000809	1.2314E-09	7.3894E-05	0	-0.0037021	0
0	0	7.9939E-05	-3.059E-10	8.5594E-09	0	-0.0007026	0	0.01123259	0.00090351	-1.229E-08	0.00011281	0	0.0034344	0
0	0	0.00027875	4.2725E-10	1.6385E-08	0	-0.0012713	0	0.00509267	0.00043709	-3.748E-09	4.5804E-05	0	-0.0019558	0
0	0	0.00035387	9.4314E-10	4.914E-09	0	0.01112229	0	0.00232503	0.00072787	-1.632E-08	4.1771E-05	0	0.00378706	0
0	0	-3.869E-05	6.3271E-10	-6.844E-10	0	0.00164741	0	0.00308487	-6.443E-05	6.2856E-08	6.3214E-05	0	-0.0076933	0
0	0	-0.0002326	-5.332E-10	9.2726E-09	0	-0.0089197	0	-0.0226008	-0.000549	-8.417E-08	-0.0001603	0	-0.0024919	0
0	0	0.00011754	8.058E-11	6.5511E-09	0	0.01477344	0	-0.0062611	-0.0006593	2.7969E-08	-5.928E-05	0	0.00510583	0
0	0	0.00031174	4.3155E-10	2.4386E-08	0	-0.0025139	0	0.01949114	0.00138542	-1.118E-07	0.0001349	0	-0.0046646	0
0	0	0.00057627	-4.745E-10	7.5843E-09	0	0.01120567	0	0.00955409	0.00086771	-2.859E-08	7.6822E-05	0	0.00233544	0
0	0	0.00044912	4.3441E-10	1.0807E-09	0	0.00177451	0	0.01248333	0.0008095	6.2515E-09	0.00010561	0	0.00249188	0
0	0	-0.0003667	-5.391E-10	-5.105E-09	0	0.00496283	0	0.00227966	3.0227E-05	4.6506E-09	-7.452E-05	0	0.00669273	0
0	0	-0.0001119	-2.409E-10	5.5204E-10	0	-0.0002816	0	-0.0105869	-0.0008454	5.5471E-08	1.536E-05	0	0.00209633	0
0	0	0.00014997	3.3624E-11	-5.505E-09	0	0.00818445	0	0.01315375	0.0007481	7.1838E-09	-1.832E-05	0	0.00037363	0
0	0	-0.0002606	-3.518E-10	-5.668E-10	0	-0.0063882	0	-0.0030102	-0.0004246	-3.559E-08	-0.000123	0	-0.0022338	0
0	0	-0.0001884	5.2146E-10	4.5478E-09	0	0.00307252	0	0.01211898	0.00095523	4.4784E-08	-3.881E-05	0	0.00209249	0
0	0	0.00051698	-6.599E-11	8.584E-11	0	-0.0081941	0	0.00221476	0.00083324	-2.398E-08	5.2551E-05	0	-0.0061539	0
0	0	0.00053221	-2.658E-10	0	0	0.00639504	0	0.00183693	0.00011545	2.9118E-08	-6.756E-05	0	0.00297274	0
0	0	-7.422E-05	3.4155E-11	-1.695E-09	0	-0.0003395	0	-0.0022883	-0.0002788	1.4025E-09	-3.967E-05	0	0.00038536	0
0	0	0.00014894	-1.702E-11	-1.14E-09	0	0.00139946	0	0.00482156	0.00029732	6.7201E-08	-0.000131	0	-0.0011796	0
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0	0	0.00018491	3.2997E-10	1.1386E-09	0	0.0076561	0	0.0036827	0.00028924	4.8938E-08	8.2196E-05	0	0.00342776	0
0	0	-7.334E-05	3.5106E-10	0	0	0.0025087	0	-0.0036539	-3.18E-05	-9.946E-09	-8.306E-05	0	-0.0001952	0
0	0	0	6.1608E-11	3.9617E-09	0	-0.0024632	0	0.00110481	0	-7.683E-08	4.6525E-05	0	0.00195582	0
0	0	0	-4.591E-10	9.9804E-09	0	0.0019512	0	0.00220444	3.1839E-05	-7.56E-08	0.0001511	0	-0.0026877	0
0	0	0.00051513	2.7306E-10	2.3713E-09	0	-0.0030227	0	0.00109699	-0.000159	-5.747E-08	-1.657E-05	0	-0.0047294	0
0	0	0.00014378	2.0312E-10	6.7668E-09	0	-0.0044969	0	0.00145914	0.00031984	2.1832E-08	2.6694E-05	0	-0.0070184	0
0	0	-0.0001428	1.5152E-09	1.106E-08	0	0.00610434	0	0.00109112	0.00015805	4.7353E-08	-3.302E-05	0	-0.0017706	0
0	0	0.00032351	1.4568E-10	4.2773E-09	0	-0.0050071	0	0.0072565	0.00040853	-3.998E-08	6.6913E-05	0	0.00225147	0
0	0	0.00038961	2.6096E-10	-7.205E-09	0	0.00202178	0	0.017149	0.00145491	-4.867E-08	-5.54E-05	0	-0.0008815	0
0	0	-0.0003828	-1.149E-10	-9.178E-09	0	-0.0011384	0	-0.0148185	-0.001116	-1.733E-08	-0.00012	0	0.00311179	0
0	0	0.00085006	7.8499E-11	-2.537E-09	0	-0.0025829	0	0.00569466	0.00061278	6.0272E-08	7.6982E-05	0	0.0008633	0
0	0	-0.000309	-1.168E-10	-8.999E-09	0	-0.0017554	0	-0.0064464	-0.0003894	-3.615E-08	-4.074E-05	0	-0.0017125	0
0	0	3.4851E-05	1.3136E-10	-3.507E-09	0	-0.0013507	0	-0.007549	-0.0006079	0	-9.318E-05	0	-0.0004353	0
0	0	0.00038276	3.8884E-11	-4.947E-09	0	-0.0027089	0	-0.0003653	0.00040407	-4.829E-08	-0.000129	0	0.00305959	0
0	0	-0.0005129	7.2295E-10	-8.266E-09	0	-0.0009214	0	-0.0091418	-0.0008946	1.8409E-09	-0.000102	0	0.00106154	0
0	0	-0.0003152	4.206E-10	4.7232E-09	0	0.00834903	0	0.00820526	0.00102109	-1.653E-08	9.4494E-05	0	0.00273223	0
0	0	-0.0001421	-6.912E-10	-5.762E-10	0	-0.0046609	0	0.00916326	0.00027669	-3.754E-09	-5.692E-05	0	0.00368643	0
0	0	0.00032191	-4.836E-10	3.7565E-09	0	0.00150831	0	0.00287575	0.00039561	5.6589E-09	-3.106E-05	0	0.00356054	0
0	0	0.00049346	1.8268E-10	1.1335E-09	0	0.00895048	0	0.01000366	0.00020994	3.7449E-09	0.0001769	0	-0.0019127	0
0	0	-0.0006549	-1.153E-10	-3.381E-09	0	0	0	0.00279828	0.00014878	-1.677E-08	-0.0002057	0	-0.0001949	0
0	0	0.00078176	2.5923E-10	3.7283E-09	0	-0.0008397	0	0.00556311	0.00079907	1.524E-08	-6.8E-05	0	-0.0023426	0
0	0	-0.0004803	2.3988E-10	-1.041E-08	0	0.00028164	0	-0.0109952	0	-1.307E-08	4.9332E-05	0	-0.0011982	0
0	0	7.0151E-05	1.6018E-10	9.8174E-09	0	0.00365367	0	0.00774155	-0.0005174	-2.09E-08	2.016E-05	0	0	0
0	0	3.4967E-05	-1.406E-09	9.6212E-09	0	-0.0008211	0	-0.0045	-0.0006447	-1.368E-08	-9.6E-05	0	0.00121217	0
0	0	0.00027927	2.9754E-10	-1.051E-08	0	0.00826057	0	-0.0049695	-0.0005104	-1.034E-07	0	0	-0.0025961	0
0	0	-0.0001723	-2.062E-10	-8.553E-10	0	-0.0031147	0	-0.0003562	-0.0005203	-3.22E-08	-0.0001123	0	-0.0008192	0
0	0	0.00027793	-3.792E-10	-2.291E-09	0	0.00106258	0	0.0139017	0.00049931	5.0414E-08	0.00020893	0	0.0008257	0
0	0	0.00010291	1.4615E-10	5.7967E-09	0	-0.003163	0	-0.0013845	0.00027575	1.0521E-07	6.0285E-05	0	-0.0004096	0
0	0	0.00040971	-1.008E-10	1.9692E-09	0	0.00053972	0	-0.0031246	-6.065E-05	-7.2E-08	9.8125E-05	0	0.00493464	0
0	0	0.00043566	1.455E-10	-1.671E-09	0	-0.0043009	0	0.00943694	-0.0001216	-3.371E-08	9.4441E-05	0	0.00137422	0
0	0	0.00026284	-1.147E-10	-1.405E-09	0	0.00555209	0	0.00411105	0.00027482	3.5268E-08	3.6405E-06	0	0.00406904	0
0	0	0.00058433	1.7408E-10	-2.83E-09	0	-0.0002667	0	0.00305642	-3.023E-05	5.2981E-08	5.4536E-05	0	0.0009324	0
0	0	-3.161E-05	-2.85E-10	-2.011E-09	0	0.0013361	0	-0.010122	-0.0005447	-8.334E-08	7.1172E-05	0	0.00406628	0
0	0	0.00050657	1.3801E-09	-2.322E-09	0	-0.0013231	0	-0.0013793	-0.0002162	1.5164E-08	2.0764E-05	0	0.00533675	0
0	0	-0.0002166	1.2859E-11	2.0569E-09	0	0.00240499	0	0.00449661	0.00031135	3.4697E-08	-2.403E-05	0	0.00118459	0
0	0	0.0007188	2.8251E-10	6.6865E-09	0	0.0052514	0	0.01096302	0	-3.793E-08	-9.01E-05	0	-0.0015059	0
0	0	-0.0010891	6.2397E-10	-5.056E-09	0	0.00227511	0	-0.0170715	9.2328E-05	6.7351E-08	7.9071E-05	0	0.00101867	0
0	0	0.00079615	-2.815E-10	-2.02E-09	0	-0.0024862	0	-0.0145925	-0.0006135	2.9807E-08	-1.742E-05	0	0.00168138	0
0	0	0.00036868	4.8306E-11	4.0824E-09	0	0.0032924	0	0.00998783	0.00065916	2.5159E-07	2.8071E-05	0	-0.0006619	0
0	0	0.00015106	-2.524E-10	-3.997E-09	0	-0.0034617	0	0.01069358	0.00036767	-4.485E-08	0.00015616	0	0.01515376	0
0	0	0.00075009	-5.428E-10	9.6229E-09	0	-0.0010149	0	-0.0108029	0.00021158	2.1175E-08	0.00010456	0	0.00523404	0
0	0	0.00081214	7.4475E-10	2.1656E-08	0	-0.0035791	0	0.01962009	0.0012596	4.6361E-08	0.00020391	0	0.00276872	0
0	0	-0.0002237	5.8635E-10	-6.235E-09	0	0.00446369	0	-0.0020539	0	-4.371E-08	-0.0001306	0	-0.0026971	0
0	0	-2.825E-05	1.956E-10	7.7342E-10	0	0.00813474	0	0.00412621	-0.0002006	-1.03E-08	0.00011019	0	0.0001384	0
0	0	-0.0001697	-1.015E-10	8.2165E-09	0	-0.0035976	0	-0.0037493	-0.0002309	-1.74E-08	-0.0002141	0	-0.0031799	0
0	0	-0.0003707	9.1184E-10	-1.723E-09	0	-0.0039419	0	0.0051541	8.7344E-05	-6.233E-08	0.00012179	0	-0.0022817	0
0	0	0.00020303	-3.648E-10	-3.478E-09	0	0.00177616	0	0.00203901	0.00026119	1.0663E-07	1.8342E-05	0	0.00408228	0
0	0	-5.748E-05	7.3627E-10	1.0121E-09	0	0.00400733	0	0	-5.749E-05	5.616E-08	6.9802E-05	0	0.00322695	0
0	0	7.7917E-05	-6.845E-10	-3.02E-09	0	-0.0055954	0	-0.0081209	0	-4.598E-08	9.7448E-05	0	0	0
0	0	-0.0001466	2.1655E-10	-4.348E-09	0	0.00016104	0	-0.002755	-0.0006337	-9.277E-08	-7.107E-05	0	-0.0084375	0
0	0	5.9031E-05	-5.931E-10	2.578E-09	0	-0.0051033	0	-0.0122351	-0.000682	-4.223E-08	-9.947E-05	0	0.00024944	0
0	0	0.00017661	-5.64E-11	-5.495E-09	0	0.00344675	0	0.00717306	0.00023595	-4.672E-08	4.6631E-05	0	0	0
0	0	-0.0006424	3.6304E-10	-2.694E-09	0	-0.0005171	0	-0.0028259	-6.683E-05	-8.653E-09	-0.0001539	0	0.00835145	0
0	0	-0.000692	-9.843E-11	-5.465E-09	0	0.00311468	0	0.00035538	0	-1.094E-08	-0.000135	0	-0.0042802	0
0	0	-0.0003107	0	2.2504E-09	0	-0.0040598	0	-0.0046163	-0.0007369	-3.552E-08	2.0372E-05	0	0.00201577	0
0	0	0.00050438	3.8671E-10	-1.39E-09	0	0.01098544	0	0.00573829	0.00034439	2.0949E-08	5.7257E-05	0	0.00310756	0
0	0	-9.243E-05	8.0762E-10	1.6804E-09	0	-0.0031457	0	-0.0010628	-3.4E-05	8.8363E-08	-9.879E-06	0	0.00589803	0
0	0	-0.0004022	1.9623E-11	1.3882E-09	0	-0.0002477	0	0.00071011	0	1.2188E-08	-0.0001984	0	0.00155783	0
0	0	0.0005359	-8.813E-11	3.5832E-09	0	0.00248169	0	-0.000709	-3.405E-05	1.9994E-09	-0.0001184	0	-0.0049884	0
0	0	0.0008307	4.694E-10	1.0823E-08	0	0.0031683	0	0.01065306	-0.0001023	8.5755E-08	3.7659E-06	0	0.00403005	0

0	0	-0.0008298	-8.72E-10	-1.332E-08	0	0	0	-0.0159703	-0.0014715	-6.277E-08	-0.0001805	0	-0.0062081	0
0	0	-0.0002773	3.3929E-10	8.5324E-09	0	0.00023814	0	-0.00683	-0.0005068	-5.079E-08	-0.0001904	0	0.00151275	0
0	0	-0.0005002	-1.827E-10	-2.345E-08	0	-0.0019019	0	-0.011674	-0.0001845	2.0923E-09	-0.0002586	0	0.00094893	0
0	0	0.00077221	1.6551E-10	2.3423E-08	0	0.00804072	0	0.0169193	0.00074294	4.382E-08	8.3049E-05	0	0.00134335	0
0	0	6.2153E-05	-8.137E-11	3.2104E-09	0	-0.0016024	0	0.00692062	7.23E-05	-5.132E-08	0.0001135	0	0.00212203	0
0	0	-0.0005268	4.5131E-10	-3.693E-09	0	-0.0018532	0	0.00323023	-0.0001468	-7.404E-08	-4.525E-05	0	-0.0014298	0
0	0	-0.000127	3.872E-10	5.6739E-09	0	0.00070459	0	0.00570334	-0.0002193	9.1335E-08	0.00015667	0	0.00105431	0
0	0	-0.0002236	-2.121E-10	-6.822E-09	0	-0.0044393	0	-0.0014086	0.00040526	1.0462E-08	8.6755E-05	0	-0.0095242	0
0	0	0.0005486	-4.048E-10	5.17E-09	0	0.00096616	0	0.01518838	0.00097998	3.5091E-08	-7.38E-05	0	0.00172304	0
0	0	0.00053512	9.0501E-11	2.1196E-09	0	0.00239839	0	0.00478931	0.00091055	-2.566E-08	0.00011405	0	0.0032488	0
0	0	-0.0001536	1.1009E-09	-1.31E-09	0	-0.0016497	0	-0.00982	-0.000271	6.1265E-08	-2.645E-05	0	0.00054794	0
0	0	0.00027847	-4.475E-11	0	0	0.01407588	0	-0.0058802	-0.0002053	2.08E-08	-0.0002205	0	0.00558694	0
0	0	-0.0001528	2.6976E-10	-7.124E-09	0	-0.0036747	0	-0.0066558	-0.0001034	-1.105E-08	-1.831E-05	0	-0.0010347	0
0	0	0.00098453	6.3435E-10	-5.481E-10	0	0.00577653	0	0.00675204	0.00041539	3.3621E-08	-2.951E-05	0	0.00039192	0
0	0	-0.0005887	-4.107E-10	-3.298E-09	0	-0.0019179	0	-0.0087577	-0.0005795	-3.221E-08	-0.0001754	0	0.00182198	0
0	0	0.00027228	2.5729E-10	3.356E-09	0	-0.0069171	0	-0.003213	-0.0002787	1.1207E-08	8.4265E-05	0	-0.0003837	0
0	0	-2.988E-05	-6.266E-10	-4.397E-09	0	0.00204989	0	0.00283658	-0.0006337	-4.234E-08	-3.494E-05	0	0.00487843	0
0	0	0.00017952	-7.144E-10	1.4065E-09	0	0.00291689	0	-0.0003603	-0.0001803	-7.794E-09	0	0	-0.0007358	0
0	0	0.00026709	6.9872E-10	8.3777E-10	0	0.00109831	0	0.00396647	0.00029036	4.1342E-08	-1.181E-05	0	0.00432293	0
0	0	0.00073293	-1.574E-10	-5.561E-10	0	0.00196104	0	0.00393295	0.00035908	1.8678E-08	-1.582E-05	0	0.00142312	0
0	0	-0.0009927	-2.056E-10	-1.673E-08	0	-0.0032219	0	-0.0138279	-0.0008505	3.6466E-09	-0.0001632	0	-0.0088918	0
0	0	-2.972E-05	-4.062E-10	-1.803E-08	0	-0.0028602	0	-0.0040193	-0.0003293	-9.255E-08	-0.0002086	0	-0.0055	0
0	0	-0.0011903	-9.646E-10	-7.422E-09	0	-0.0033713	0	-0.0011056	-0.0018893	-1.651E-08	2.7851E-05	0	0.00189045	0
0	0	0.00031478	3.5691E-10	7.0193E-10	0	-0.0006914	0	0.01403832	0.00019919	-8.439E-09	-5.05E-05	0	0.00610082	0
0	0	0.00021721	-5.216E-10	-5.945E-09	0	-0.0013899	0	0.00860753	0.00031638	-2.133E-08	0.00016398	0	-0.0036335	0
0	0	6.1447E-05	6.1733E-10	-8.662E-09	0	-0.0044469	0	-0.0003522	-0.0002345	-1.755E-08	-5.718E-05	0	-0.0035051	0
0	0	0.00027573	1.0366E-10	1.0207E-08	0	0.00024199	0	0.00493382	0.0005126	3.8178E-08	0.00011702	0	0.00564209	0
0	0	0.00069583	-5.539E-10	4.6656E-09	0	0.01038646	0	0.01046213	3.8692E-05	-4.064E-08	-6.451E-05	0	0.00063721	0
0	0	-0.0004691	1.6314E-10	1.5766E-08	0	0.00224378	0	0.00648083	0.00011592	3.8403E-08	-9.269E-05	0	-0.0044333	0
0	0	0	3.102E-10	8.0918E-09	0	-0.005739	0	-0.0084107	-7.695E-05	2.5814E-08	-4.582E-06	0	0.00066144	0
0	0	0.00092884	-2.177E-10	-5.59E-09	0	0.00207427	0	0.01624457	0.00042442	4.1621E-09	9.1819E-06	0	0.00262914	0
0	0	-0.0002012	-2.439E-10	-1.919E-09	0	0.00522109	0	-0.0023532	-0.0001519	-1.449E-08	-1.83E-05	0	0.00192331	0
0	0	0.00023204	-1.849E-10	-1.939E-09	0	-0.003279	0	0.0077713	0.0003438	-1.688E-08	0.00029491	0	-0.0008813	0
0	0	0.00040179	1.1308E-09	-2.285E-09	0	-0.00112	0	0.00166177	0	4.3145E-09	4.1241E-06	0	-0.0011428	0
0	0	-5.636E-05	-2.483E-10	1.0903E-08	0	0.00271047	0	0.01059766	0.00116929	-4.29E-09	0.00027589	0	-0.0014122	0
0	0	-5.65E-05	1.2168E-09	-2.188E-09	0	-0.0055362	0	0.00259061	-0.0005422	-3.02E-08	0	0	0.00039042	0
0	0	-2.833E-05	-7.096E-10	-1.17E-08	0	-0.0011544	0	-0.0048307	-0.0002214	-6.737E-09	-7.05E-05	0	0	0
0	0	8.5088E-05	-2.551E-10	-6.399E-09	0	0.00069856	0	0.00325405	-0.0002976	-6.797E-09	-0.000168	0	-0.000389	0
0	0	-0.0001695	-7.054E-11	-1.045E-09	0	0.00926611	0	-0.0145419	0	-4.801E-08	0	0	-0.0087196	0
0	0	-0.0012244	-1.238E-09	-3.503E-10	0	-0.0032528	0	0.0106733	0.00018806	2.195E-08	-1.227E-05	0	0.00184628	0
0	0	0.00142658	1.163E-10	3.1589E-09	0	0.00111086	0	0.00978265	0.000635	-2.134E-08	0.000111	0	0.0062798	0
0	0	0.00057007	-6.091E-10	6.906E-10	0	0.00349076	0	0.00447152	0.00120424	2.4388E-09	0.00015749	0	-0.0039487	0
0	0	0.00043858	9.8076E-11	1.3762E-09	0	-0.001299	0	0.02151492	-0.0001118	3.6467E-08	8.1517E-05	0	-0.0002911	0
0	0	-0.0004586	-5.462E-10	-6.49E-09	0	0.00021861	0	-0.0103632	-0.0009676	-2.321E-08	-0.0001393	0	0.00069217	0
0	0	0.00014639	-4.886E-10	6.7182E-09	0	-0.0037102	0	0.00748128	0.00032496	8.1367E-08	-5.001E-05	0	-0.0034381	0
0	0	0.00101788	7.5814E-10	4.8692E-09	0	0.00897512	0	0.01779457	0.0014449	5.6246E-08	0.00012952	0	0.00227544	0
0	0	0.00016671	-3.894E-10	-3.731E-09	0	0.00210463	0	-0.0005911	-0.0004571	2.2168E-08	-7.466E-05	0	0.00361866	0
0	0	0.00143379	1.7008E-09	1.0723E-08	0	0.00082899	0	0.00917345	0.00050375	2.9379E-08	8.0786E-05	0	0.00820504	0
0	0	0.00033632	2.6729E-10	6.5511E-10	0	0.00123594	0	0.00870652	0.00053254	1.509E-08	-5.591E-05	0	0.00087283	0
0	0	0.00058597	-3.685E-10	0	0	-0.001633	0	-0.0065526	-7.46E-05	-1.48E-08	-4.574E-05	0	-0.0030915	0
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0	0	-0.0008234	6.7309E-10	1.1692E-08	0	-0.0002011	0	0.00644504	0.0004883	1.1338E-07	8.4893E-05	0	0.00661868	0
0	0	0.00025932	-9.686E-11	1.5304E-09	0	-0.0128901	0	-0.0063573	-0.0002583	2.7524E-08	-6.719E-05	0	0.00035906	0
0	0	-2.563E-05	-4.891E-11	-6.073E-10	0	0.00200286	0	0.00761659	0.0002235	4.5324E-08	0.00044105	0	0.015744	0
0	0	0.00023213	1.7206E-10	-8.834E-09	0	-0.002851	0	-0.0057649	0	1.328E-08	-3.916E-05	0	0.00165795	0
0	0	0.00061288	6.5215E-10	7.3451E-09	0	-0.000224	0	0.00923404	0.00040637	2.9008E-08	1.3259E-05	0	0.00438604	0
0	0	-0.0008693	-4.98E-10	-1.199E-08	0	-0.0027163	0	-0.0132592	-0.0002548	-2.096E-08	-8.573E-05	0	-0.0022513	0
0	0	-5.174E-05	2.0489E-10	-1.682E-09	0	-0.000461	0	0.00919682	0.00059056	0	-4.096E-05	0	0.00480203	0
0	0	0.00036304	2.6115E-10	-6.677E-09	0	0.00439392	0	-0.0005819	-0.0003987	-2.873E-09	-1.735E-05	0	-0.0009564	0
0	0	0	0	5.8806E-09	0	-0.000224	0	-0.009613	3.6798E-05	2.3075E-08	8.3864E-05	0	-0.0017374	0
0	0	0.00015304	-6.335E-10	-4.363E-09	0	0	0	-0.006246	0.00022044	-4.2E-09	-6.763E-06	0	-0.0041226	0
0	0	0.00017729	4.0558E-10	1.3737E-09	0	0.00291691	0	0.00452183	0.0002551	5.2086E-08	3.3907E-05	0	0.00132861	0
0	0	-0.0002764	1.0209E-09	-1.705E-09	0	-0.0087863	0	-0.0017914	0.0001444	-1.714E-08	1.0037E-05	0	-0.0024219	0
0	0	-0.0001272	-2.579E-10	0	0	-0.0023486	0	0.00179828	0.00017955	-2.292E-08	-6.998E-05	0	-0.0012398	0
0	0	-0.0003328	4.4146E-11	5.1608E-09	0	0.000717	0	-0.0131368	-0.0008561	1.2508E-08	0.00010626	0	-0.0052279	0
0	0	-0.0014297	-1.538E-10	4.3551E-09	0	0.00071322	0	-0.0141317	-0.0001474	-1.367E-09	-3.618E-05	0	0.00176126	0
0	0	-0.0002504	-3.572E-10	6.2236E-09	0	0.00307445	0	0.00380173	-0.0001482	-6.85E-09	0.00020688	0	-0.0054125	0
0	0	-0.0004784	5.5623E-10	-4.441E-09	0	0.00555019	0	-0.0043994	-0.0006332	6.9117E-09	-0.0001542	0	0.005138	0
0	0	0.00060428	4.3846E-11	1.2991E-09	0	-0.0057765	0	0.00899569	3.8144E-05	-8.631E-08	0.00011824	0	-0.0001088	0
0	0	-0.00056	1.746E-10	-5.484E-09	0	-0.0039449	0	-0.0112897	-0.0006476	-5.25E-08	-0.0001631	0	0.00185177	0
0	0	-0.0003448	-1.715E-10	-1.03E-08	0	-0.0023899	0	-0.0067489	-0.0003903	1.3261E-08	-0.0001107	0	-0.0024616	0
0	0	0.00023359	3.7102E-10	3.5099E-09	0	-0.0004866	0	-0.0022826	0.00027723	2.77E-08	0.00010527	0	0.00328848	0