STANDARD INVESTMENT
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Should You Add TOP-20 To Your Asset Mix?

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We analyse the risk-return performance of a one-month investment in a TOP-20 Index mimicking portfolio, the most efficient way to add Mongolian equities to an asset mix. We forecast the distribution of returns, together with the proper amount of resources to face potential losses, and then assess the overall quality of the position.

Overview

Is it a good strategy, from a risk-return standpoint, to invest in Mongolian equities? We set up a portfolio mimicking TOP-20 Index, Mongolia's main stock market indicator, to find out. Buying shares of TOP-20 constituents, in proportions equal to those implied by the index, is generally preferable to picking single stocks, for at least two reasons:

1. the availability[a] of a consistent stream of daily price data on the index, facilitating performance assessment and risk monitoring; and
2. the relative inexpensiveness, despite frequent rebalancing, of the strategy, as only twenty securities are involved, and these are among the most actively traded on the MSE (Table 1).

Since forecasts are more precise in the short run, we consider investments of a one-month period (21 trading days). First, we have a look at their performance over the past few years. Then, we open a position today (January 29, 2017), and try to predict the distribution of returns from the strategy, together with the right amount of resources to set apart in order to face potential losses. Finally, we assess the overall quality of the position using the Sharpe ratio, a measure of the excess return per unit of risk that eases comparison across assets.

Table 1: Current TOP-20 constituents

Company	Ticker	Industry
Apu	APU	Beverages
Tavan Tolgoi	TTL	Mining
Gobi	GOV	Cashmere
Talkh Chikher	TCK	Bakery products
Darkhan Nekhii	NEH	Apparel
Mongol Post	MNP	Postal service
Bayangol Hotel	BNG	Hotel
Suu	SUU	Dairy products
Hermes Center	HRM	Building materials
Sharin Gol	SHG	Mining
Arig Gal	EER	Cashmere
Makhimpex	MMX	Meat products
Aduun Chuluun	ADL	Mining
Ulsiin Ikh Delguur	UID	Shopping center
Baganuur	BAN	Mining
Materialimpex	MIE	Building materials
Remicon	RMC	Concrete
Merex	MRX	Concrete
Khukh Gan	HGN	Metal products
UB-Buk	BUK	Concrete

Source: mse.mn

Data

We use TOP-20 Index daily returns over the most recent nine and a half years (August 13, 2007 – January 27, 2017), a time frame that should faithfully represent Mongolia's current stock market conditions. We feed the

data into computational algorithms to simulate possible return paths for the next 21 trading days (January 30 – February 27), then aggregate the outcomes in each path to obtain hypothetical monthly returns. The results must be considered:

- *price returns* (not total returns): they will only reflect capital appreciation, i.e. the gain or loss resulting from a variation in the index close price, and will not include dividends;
- *gross returns* (not net returns): they will be before fees, expenses, and taxes.

Point one may understate actual returns over the period; point two overstate them. We advise to take both issues into account when evaluating the results and prior to making any investment decisions.

Historical monthly performance

One-month investments in index-mimicking portfolios have performed very differently over time (Figure 1).

On average, positions taken before Spring 2011 led to a small gain (1.24%), those taken after this period led to a small loss (–0.75%) (Table 2). However, the first term was characterised by greater uncertainty, with a high level of volatility (the degree of dispersion of actual returns around the average value) increasing the frequency of extreme events, both negative and positive (~35%), as well as the expected return in case one such event took place.

This high risk period ended a few months after April 8, 2011. On that day, an agreement between MSE and London Stock Exchange to bring the «infrastructure, technology, and human resources of the Mongolian partner to international standards»[b] reduced market uncertainty, cutting volatility to one third of its initial value, and lowering both the frequency (~8%) and the size of extreme returns.

Over the whole time interval, an investor taking a one-month position in TOP-20 Index would have expected to make, on average, a small gain (0.05%), even though the actual

Figure 1: TOP-20 Index Monthly Returns

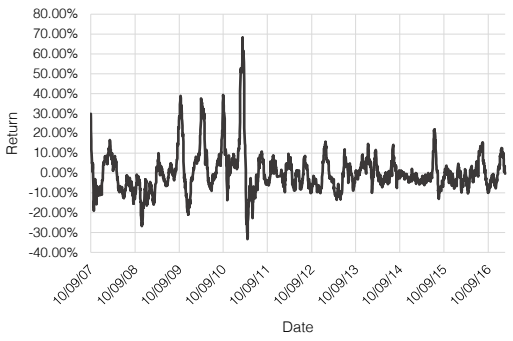


Table 2: TOP-20 historical monthly performance %	
August 13, 2007 – May 31, 2011	
Average return	1.24
Volatility	14.73
Min/Max	–33.33; 68.19
Neg./pos. return frequency	53.02; 46.98
Average if neg./pos.	–8.73; 12.49
Freq. returns beyond ±10	17.50; 16.44
Average if beyond ±10	–15.46; 26.51
June 1, 2011 – January 27, 2017	
Average return	–0.75
Volatility	5.74
Min/Max	–13.52; 22.00
Neg./pos. return frequency	61.92; 38.08
Average if neg./pos.	–4.31; 5.03
Freq. returns beyond ±10	3.00; 5.15
Average if beyond ±10	–11.32; 13.33
Whole period	
Average return	0.05
Volatility	10.39
Neg./pos. return frequency	58.35; 41.65
Average if neg./pos.	–5.93; 8.42
Freq. returns beyond ±10	8.84; 9.70
Average if beyond ±10	–14.62; 22.33

return would have probably been very distant from this figure due to the significant risk involved (volatility ~10.5%). The expectation reflected the greater chance of ending up with a large gain, as opposed to a large loss, despite the clear prevalence of negative outcomes (60-40), and it is evidence of right skewness, an asymmetry in the distribution of returns towards large positive values.
As we use past data to predict future returns, these features – a slightly negative mean return, and a level of volatility in line with that of recent years (~5.5%); a higher frequency of small negative, as opposed to small positive, returns; and right skewness – will likely be preserved.

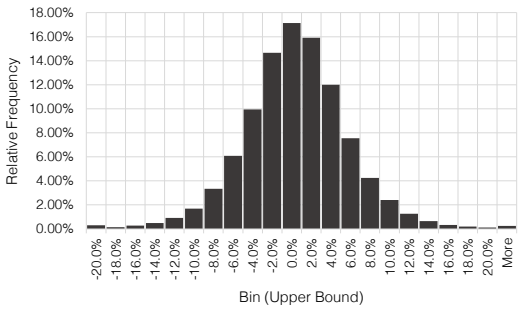
One-month ahead forecast

For an accurate and well-balanced forecast, we draw conclusions from two complementary algorithms [1] [2]: filtered historical simulation, a backward-looking model that randomly draws from existing data to compute future returns, and Monte Carlo, a forward-looking technique that generates brand new returns from a distribution calibrated on past data. To improve the accuracy and stability of the results, we simulate 100,000 paths per day, 21 trading days. We also bet on a small rise in volatility[c]. As we found the skewness of the simulated distribution of returns to oscillate between negative and positive values in repeated experiments, we choose to consider only structures that preserve its positivity, in line with empirical evidence.

Filtered historical simulation – The average return on the strategy should be slightly negative, around –0.55%, although the outcome will generally differ from this value due to the moderate risk involved (volatility ~5.5%) (Table 3). About one-third of actual returns will

Table 3: FHS-predicted investment statistics, %	
Average return	–0.57
Volatility	5.53
Neg./pos. return frequency	55.04; 44.96
Average if neg./pos.	–4.27; 3.96
Freq. returns beyond ±10	3.88; 2.84
Average if beyond ±10	–13.83; 13.87

Figure 2: One-Month Ahead Forecast of the Distribution of Returns, FHS



stay in the ±2% band, ~60% in ±4%, and ~80% in ±6%. Also, an investor will less frequently gain on the position (about 45% of the times), and the average gain will usually be smaller (~4.00%) than the average loss (~4.25%). However, in case an extreme event takes place (actual return beyond the ±10% band, ~6.7% chance: ~3.85% negative and ~2.85% positive), expected losses and gains will have similar size, ~±13.85%, a consequence of the right skewness in the distribution of returns, which pushes towards large positive values (Figure 2).

Monte Carlo simulation – We calibrate past data to a density[d] that accounts for a reasonable level of risk (volatility ~5.5%) and for the high frequency of extreme events.
Model-predicted mean return is almost null (between ±0.02%), risk is in line with expectations (~5.7%) (Table 4). About one-third of actual returns will be in the ±2% band, ~60% in ±4%, and ~80% in ±6%. Gains and losses on the position are equally probable (50-50),

average payoffs likely the same (~±4.10%). Also, if an extreme event takes place (~6.7% chance, equally split), gains and losses will have similar size (~14.4-14.45%), and both payoffs will generally be ~0.5-0.6% higher than those predicted by FHS (Figure 3).

Overall assessment – We believe the average return from the strategy to be small and slightly negative (between –0.5% and 0%), although actual returns will differ from this value due to the significant uncertainty (volatility ~5.5-5.7%). Losses should be more frequent than gains (about 55% of the times), but many of them should be very small: one-third smaller than 2%, 60% smaller than 4%, 80% smaller than 6%. The average loss should be ~4.2%, about 0.05-0.15% higher than the average gain (~4.05%). The frequency of extreme returns, both negative and positive, should be close to 6.7%, slightly in favour of the former. The average payoff in case of extreme event should be ~±14%.

Value at Risk and Expected Shortfall

To quantify the amount of resources to set apart in order to face potential losses, we introduce two measures: Value at Risk, which is the loss likely to be surpassed only very few times during the investment period (here we choose 1%), and Expected Shortfall, the average loss in case the actual return is worse than the VaR.

Filtered historical simulation – Total Value at Risk for the next trading month should be around 14.7-15%, or ~MNT 137,000-139,000 for each MNT 1,000,000 invested in the portfolio (Table 5). 99% of the times, an investor will not face a greater loss, should one occur, during the period. In the remaining 1%, the investor should expect to lose around 19.5-20%, or ~MNT 177,000-181,000. Also, 99% of the times daily losses will not go beyond 3-3.4% (~MNT 30,000-33,500); otherwise, the average daily loss will be around 3.9-5% (~MNT 39,000-49,000) (Figure 4).

Table 4: MCS-predicted investment statistics, %	
Average return	0.01
Volatility	5.70
Neg./pos. return frequency	49.76; 50.24
Average if neg./pos.	–4.09; 4.07
Freq. returns beyond ±10	3.35; 3.26
Average if beyond ±10	–14.46; 14.47

Figure 3: One-Month Ahead Forecast of the Distribution of Returns, Monte Carlo

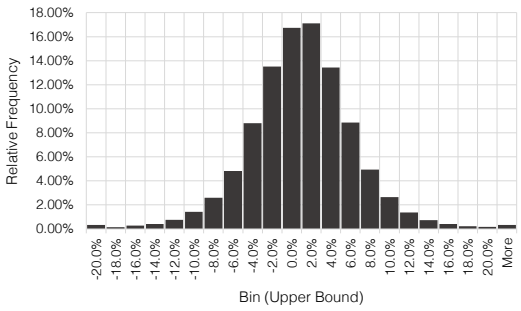
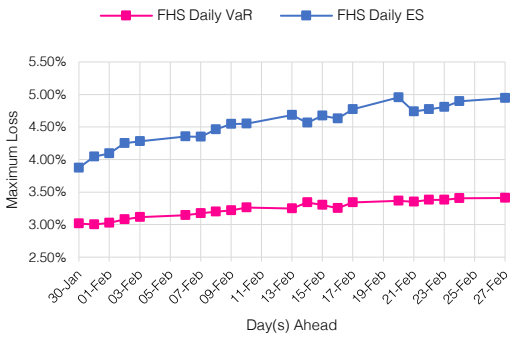


Table 5: FHS-predicted one-month VaR and ES	
Value at Risk, 99%	14.81%
Expected Shortfall, 99%	19.54%
Portfolio Value	MNT 1,000,000
MNT Value at Risk	MNT 137,638.09
MNT Expected Shortfall	MNT 177,511.94

Figure 3: Term Structure of VaR-ES, FHS



Monte Carlo simulation – Total Value at Risk is forecast at ~14.5-14.8% (~MNT 135,000-137,500), total Expected Shortfall at ~20.3-21% (~MNT 184,000-189,500) (Table 6).
Daily losses should not go beyond 3-3.6% (~MNT 30,000-35,500). If so happens, however, the expected loss will be ~4.1-5.5% (~MNT 40,000-53,500) (Figure 5).

Overall assessment – We believe the maximum potential loss on portfolio value that investors could face, 99% of the times, during a one-month period, to be in the range 14.7-14.9% (~MNT 137,000-138,500), or ~3-3.5% per day (~MNT 29,500-34,500) (conservative estimates). This does not mean investors will necessarily lose on the position, just that it is very unlikely for actual returns to go beyond the ranges provided. However, in case of a particularly negative outcome (1% of the times), investors should expect to lose ~20-20.5% (~MNT 181,000-185,500) on the position, or ~4.0-5.2% per day (~MNT 39,000-50,500).

Investment quality

We assess the overall quality of a one-month investment in a TOP-20 portfolio by means of the Sharpe ratio, a measure of the excess return per unit of risk that allows comparison across different kinds of assets.
On the numerator is the difference between the average monthly return on the strategy and the risk-free rate of equivalent maturity. On the denominator, the risk (volatility) of the investment. Assets with negative Sharpe ratios are less attractive than risk-free options, such as government bills; assets with positive ratios, more valuable. We derive one month ahead distributions of Sharpe ratios from the distributions of simulated returns previously analysed. As a proxy for the one-month risk-free rate, we use the most recent annualised three-month government bill rate (Table 7).

Table 6: MCS-predicted one-month VaR and ES	
Value at Risk, 99%	14.68%
Expected Shortfall, 99%	20.77%
Portfolio Value	MNT 1,000,000
MNT Value at Risk	MNT 136,521.63
MNT Expected Shortfall	MNT 187,572.48

Figure 5: Term Structure of VaR-ES, MC

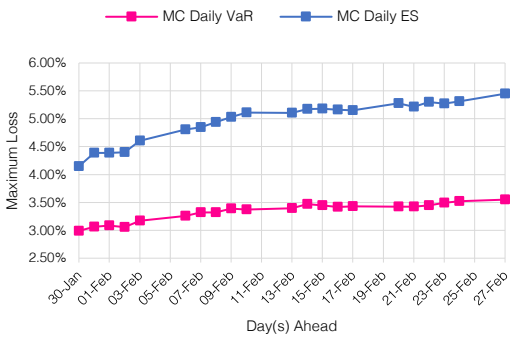
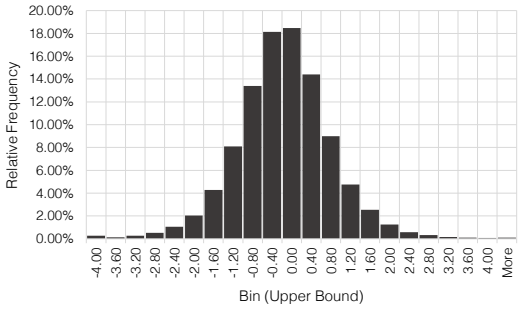


Table 7: Risk-free rate, %	
Annualised risk-free rate, 3m	17.00
Risk-free rate, 1m	1.42

Table 8: FHS-predicted Sharpe Ratio statistics	
Average ratio	–0.36
Neg./pos. ratio frequency	66.66%; 33.34%
Average if neg./pos.	–0.87; 0.66
Freq. of ratios beyond ±2	4.31%; 1.36%
Average if beyond ±2	–2.68; 2.79

Figure 6: One-Month Ahead Forecast of the Distribution of Sharpe Ratios, FHS



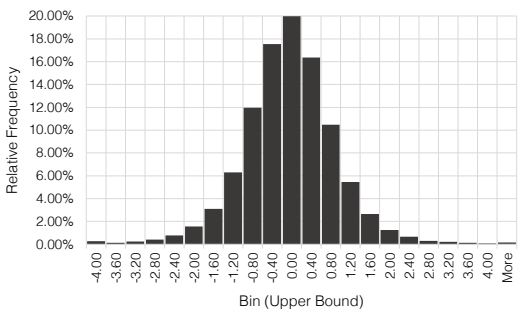
Filtered historical simulation – The predicted average Sharpe ratio is slightly negative, between –0.36 and –0.35 (Table 8). This means that, on average, a risk-free alternative of equivalent maturity will be more profitable than a TOP-20 portfolio, even though the actual Sharpe ratio for the strategy might greatly differ from this value. Two-thirds of the ratios will be negative (average –0.87), one-third positive (average 0.66). About one-third of them will stay in the ±0.4 band, 60% in ±0.8, and 80% in ±1.2. The chance to end up with a large ratio (beyond ±2) is ~5.6-5.7%, although 3:1 in favour of negative values (~4.2-4.3%, compared to ~1.4%). However, the expected values in case of extreme ratios will be similar in size, ~±2.7, again a consequence of the right skewness in the distribution of returns (Figure 6).

Monte Carlo simulation – Model-predicted average Sharpe ratio is still negative, though smaller than before (–0.25) (Table 9). About two-thirds of actual ratios will be negative (average –0.8), one-third positive (average 0.66). About 34% of them will stay in the ±0.4 band, 64% in ±0.8, and 80% in ±1.2. The chance of unusually large ratios is ~5%, about 2:1 in favour of negative values (~3.4%, compared to ~1.6%). However, in case of extreme event, the average outcome, if positive, will usually be ~0.1 larger in size (~2.9) (Figure 7).

Overall assessment – We believe the average Sharpe ratio to be slightly negative, around –0.30. This is not equivalent to saying that TOP-20 portfolios are bad investments, because the actual outcome may be considerably different. The ratio should be negative two-thirds of the times (average –0.85), and positive one-third (average 0.66). One-third of the outcomes should stay in the ±0.4 band, two-thirds in ±0.8, and 80% in ±1.2. The chance to end up with unusually large ratios should be ~5.5%, approximately 2:1 in favour of negative values due to the negative average. Yet, extreme positive ratios should be ~0.1 larger in size (~2.8).

Table 9: MCS-predicted Sharpe Ratio statistics	
Average ratio	–0.25
Neg./pos. ratio frequency	62.25%; 37.75%
Average if neg./pos.	–0.80; 0.66
Freq. of ratios beyond ±2	3.36%; 1.54%
Average if beyond ±2	–2.78; 2.93

Figure 7: One-Month Ahead Forecast of the Distribution of Sharpe Ratios, Monte Carlo



Should you invest now?

Lately, we have witnessed a rapid growth in the trading of shares of TOP-20 constituents. Thanks to the rise in coal and copper prices, mining companies have been the best performers [3] [4], followed by Mongol Post, the first of a series of state-owned enterprises to be sold to the public in 2016[e], and Gobi. Frequent trading led to a 15-50% increase in share price for these firms (~25-50% for mining companies, ~22-22.5% for Mongol Post, and 15-17.5% for Gobi), and contributed to a spike in volatility that has yet to fully cool down, especially in view of possible future privatisations. The combined effect of strong prices – we believe index level to either stay

close to MNT 12,000 or to go up – and significant volatility may be good news for the investors, as it raises the chance of ending up with a large gain on the position.
It is this very chance that makes us say that, within the context of a well-diversified portfolio, TOP-20 Index should be a good investment opportunity at this moment.

Conclusion

We analysed the risk-return performance of one-month investments in TOP-20 Index mimicking portfolios, the most efficient way to add Mongolian equities to an asset mix.
We found investment risk to have decreased over time (volatility is now ~5.5%, down two-thirds from the previous figure of ~15%), making returns slightly less difficult to forecast.
We predict the average return (price return, gross) on a one-month position starting today, January 29, 2017, to be small and mildly negative, between –0.5% and 0%. However, due to volatility, the actual return might greatly differ from this value. Losses on the position should occur 55% of the times (average loss ~4.2%, ~0.05-0.15% higher than average gain), but the majority should be very close to 0.
The frequency of extreme returns (those beyond ±10%) is forecast at ~6.7%, slightly in favour of negative ones. If one such event takes place, we expect the average payoff to be ~±14%.
Should any losses occur on the position, we believe that, 99% of the times, investors will not lose more than 14.7-14.9% on portfolio value (~MNT 137,000-138,500), or about 3-3.6% per day, on crash days (~MNT 29,500-35,500). In the remaining 1%, we expect average loss to be ~20-20.5% (~MNT 181,000-185,500), ~4.0-5.5% per day, on crash days (~MNT 39,000-53,500).
We predict average Sharpe ratio, a measure of the excess return of the strategy per unit of risk, to be slightly negative (close to –0.30) although, as we said before, the actual ratio at the end of the period might greatly differ from this value. Ratios should be negative two-thirds of the times (average –0.85), and positive one-third (average 0.66). One-third of them should stay in the ±0.4 band, two-thirds in ±0.8, and 80% in ±1.2. The chance of ending up with an unusually large ratio (beyond ±2) should be ~5.5%, approximately 2:1 in favour of negative values. However, positive ratios should be ~0.1 larger (~2.8) than negative ones.
The predicted imbalance towards negative outcomes does not necessarily make TOP-20 portfolios bad investments. On the contrary, the combined effect of recently strong prices – we believe index level to either stay close to MNT 12,000 or to go up – and high volatility might push towards large positive returns. For this reason, we believe TOP-20 portfolios make a very nice addition to a well-diversified asset mix.

The report is made for Standard Investment LLC by Federico M. Massari, a long distant volunteer risk analyst, using the sources provided.

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[a] mse.mn/content/list/2/0#
[b] asiaetrading.com/master-services-agreement-has-been-signed-between-the-mongolian-stock-exchange-and-the-london-stock-exchange/
[c] We multiply the most recent level of conditional variance by 1.5 (conditional volatility = 1.12%), see [2].
[d] We use $t_{4.12}$, the Standardised Student's t distribution with 4.12 degrees of freedom, with a GARCH(1,1)-VT (Variance Targeting) conditional variance model, [2].
[e] mongolianeconomy.mn/mn/i/8618

Bibliography

[1] Christoffersen, P.F.: *Elements of Financial Risk Management*, 2nd Ed., 2012. Academic Press, Elsevier.

[2] Massari, F.M.: *Mongolia's TOP-20 Index Risk Analysis*, 2017, Standard Investment LLC. Available on *standardinvestment.mn*.

[3] *Mongolia Investors Cockpit, November 2016*, Standard Investment LLC. Available on *standardinvestment.mn*.

[4] *Mongolia Investors Cockpit, December 2016*, Standard Investment LLC. Available on *standardinvestment.mn*.

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