

ACTL3182: Asset-liability and Derivative Models
Term 3 2023 Assignment



z5366642

Selection of the 25 stocks from the Tokyo Stock Exchange

In order to combat the issues of the ageing population in Japan which arise from increasing medical costs and the inability to work due to poor physical conditions as one ages, the 25 stocks selected from the Tokyo Stock Exchange (TSE) were done using a criteria that ensures that the Japanese population in retirement are financially secure. As a result, the portfolio made from the TSE must contain stocks that: show optimistic prospects, advocate for a sustainable future in order to ensure that the clients are able to meet their needs during retirement, and the portfolio as a whole must be diversified to reduce the unsystematic risk so the client can expect a sustainable return for their investment in retirement. Thus, the 25 stocks were selected to ensure that the portfolio as a whole captures at least 12 unique industries. Below are the clear and concise justifications of why each individual stock was selected, grouped by their industry:

Technology

The four stocks selected from the technology sector are Lasertec Corp, CyberAgent Inc, Daifuku Co Ltd and MARUWA Co Ltd.

Lasertec Corp was selected as they contribute to the improvement of Apple products, a brand that is highly successful and will likely continue to be in the future (Alpeyev, Pavel and Furukawa, Y. 2019). As a result, Lasertec Corp has a great chance for future success. CyberAgent Inc shows optimistic prospects with their partnership with Dell in order to improve efficiency of operations (Technologies, D. 2023). Improvement in the efficiency of operations suggest lower internal costs and higher output to meet increasing technological demand, which can result in increasing profits. Finally, Daifuku Co Ltd and MARUWA Co Ltd were selected due to an increase in demand in their respective fields. Daifuku Co Ltd is expected to witness stunning growth as a result of increasing demand in robotics (Report, H.M. 2023). Similarly MARUWA Co Ltd has optimistic prospects due to an increase in demand in AI and Electric vehicles (Tamura, Y. and Terukina, A. n.d.).

Finance

From the finance industry, the selected stock from the TSE was Mitsubishi UFJ Financial Group Inc as they were the highest rated company in the banks with a score of 79 suggesting that they score better than 79% of the market. In addition, Mitsubishi UFJ Financial Group is up 71% in 2023 alone (InvestorsObserver 2023). Therefore, looking at their statistics overall, Mitsubishi UFJ financial Group is a good and secure candidate for a resilient portfolio.

Automotive

Toyota Motor Corp and Mitsubishi Motors Corp were selected from the automotive industry. Toyota Motor Corp was selected due to their outstanding returns as they were able to go up as the market took a dip (Equity, Z. 2023). This implies that Toyota Motor Corp is a good candidate for the portfolio in terms of diversification as

having stocks that move opposite to the market can help remove unsystematic risk. Mitsubishi Motors Corp was selected due to their goal of a sustainable future as they decided to exit vehicle production in China to meet demands of electric vehicles (SHIMBUN, T.A. 2023).

Airway

ANA Holdings Inc was selected due to their expansion and provision of new services in South East Asia to meet post-pandemic demands (Nippon.com 2023). The ability to expand and meet demands makes ANA a good candidate for the portfolio and increase their chance for future success.

Health (Pharmaceutical, healthcare and probiotics)

The three stocks selected from the health industry are Sysmex Corp, Kobayashi Pharmaceutical Co Ltd and Yakult Honsha Co Ltd. Sysmex Corp was selected due to their innovative vision as they made breakthroughs in the health industry by creating a blood test kit that can detect markers of Alzheimer's (Matsuyama, K. 2022). Kobayashi and Yakult were selected due to optimistic prospects as a result of expansion to meet an increase in demand (Kawano, Y. 2023) and growth of the industry by 5.8% until 2027 respectively (MarketsandMarkets Research Pvt. Ltd. 2023).

Construction

Daiwa House Industry Co Ltd and Takeuchi Mfg Co Ltd were selected from the construction industry. Daiwa House Industry Co Ltd was selected due to optimistic prospects which even attracted large asset owners (Daiwa 2023). Takeuchi Mfg Co Ltd was selected due to their vision for a sustainable future, as they expand production by creating 100% renewable factories (Takeuchi 2023).

Food

All stocks chosen from the food industry were done so due to the high likelihood of future success. These stocks involve Yamazaki Baking Co Ltd who are expected to gain from the 118 Billion USD expected growth of the bread market up to 2027 (PR Newswire 2023), Monogatari Corp who are experiencing steady growth, and Nissin Foods Holdings Co Ltd who are to gain from the 55% expected growth in the instant noodles market until 2027 (PR Newswire 2023).

Retail

Both Seven & i Holdings Co Ltd and Lawson Inc are expected to grow into 2024, Lawson Inc in particular looking to expand to China due to the increase in demands for consumption (Dong Cao 2023).

Chemical

The three selected stocks from the chemical industry are Tosoh Corp, Kao Corp and Asahi Yukizai Corp. Tosoh and Asahi Yukizai were selected due to high chance of future success and they aim to meet the increase in demand and are in industries with high market growth into 2030 by 2.69 Billion USD respectively (The Insight

Partners 2023). Kao Corp is chosen due to their vision of becoming the lead in the global suncare category through innovation (Lim A. 2023).

Printing

Dai Nippon Printing Co Ltd was selected due to good prospects. The industry they specialise in being the thermal transfer ribbon market is expected to cross 5 Billion USD in revenue by 2035 (Research Nester 2023).

Manufacturing

Lion Corp and Tokai Carbon Co Ltd were selected from the manufacturing industry due to good prospects. Lion Corp looks to expand into the pet market in Thailand following their high experience in pet food from Japan which makes this strategy very likely to succeed (Jitpleechep P. 2023). Tokai Carbon Co Ltd is a key participant of the Carbon Black Market which is expected to grow by 5 billion USD in 5 years (Technavio 2023).

Real Estate

Japan Real Estate Investment Corp was selected from the TSE as the real estate market is expected to grow by 333 Billion USD by 2027. This makes Japan Real Estate Investment Corp a good candidate for our portfolio as it promises secure returns into the future due to their good prospects (PR Newswire 2023).

Selection of the 5 stocks from the Vietnamese Stock Exchange

Similar to the criteria used to select stocks from the Tokyo Stock Exchange, the 5 Vietnamese stocks were also selected with diversification (across 4 industries), good prospects, stability and sustainability in mind to ensure that clients at retirement are able to live a life of financial freedom and security, and are able to meet their needs. Below are the clear and concise justifications of why each individual stock was selected, grouped by their industry:

Manufacturing

CSM and APH were selected from the Vietnamese Stock Exchange. CSM was selected as they were willing to expand and produce tyres and tubes to increase revenues due to increased demand which implies that they have good potential for growth and good prospects (Asia News Network 2021). On the other hand, APH was selected as they are leading in sustainable production of environmentally-friendly plastic (APH n.d.).

Insurance

BMI was selected from the insurance industry as their credit ratings were good and stable according to AM Best's audit (Business Wire 2022). Due to the stability of BMI, it is clear that they are a good investment in the long run.

Banking

From the banking sector, SSB from the Vietnamese Stock Exchange proved to be attractive to foreign investors in July of this year (Vietnamnet Global 2023). They continue to show good prospects for growth and future success.

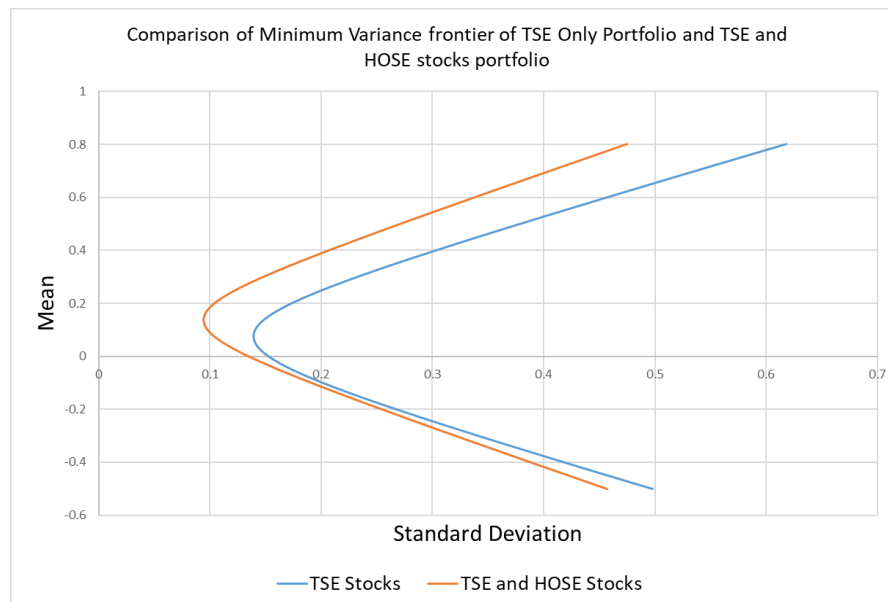
Furniture

TNA was selected from the furniture sector as, according to Yahoo Finance, their revenues have been increasing since at least as far back as 2019, the biggest increase in revenue being from 2021 to 2022 (TNA.VN Yahoo 2023). As a result, we understand from the trend that TNA is finding increasing success and will be profitable into the long future. Therefore, TNA is a good candidate for our investment portfolio.

Summary of Key Findings

Expanding the portfolio to involve stocks from global markets help reduce risk

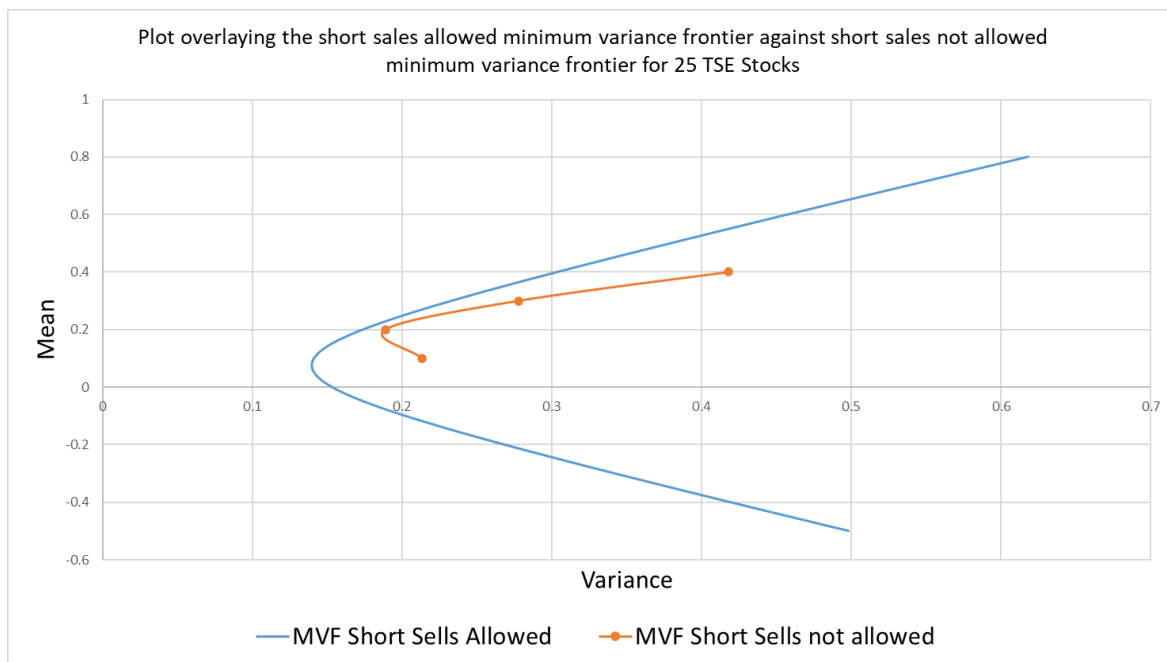
The first key finding from the analysis was from the reduction in risk that was evident by incorporating Vietnamese stocks into the portfolio that originally only contained Japanese stocks. Just from adding 5 additional stocks from the Vietnamese Stock exchange, the volatility of the original portfolio of 25 TSE stocks were reduced by 38% where a return of 15% was expected. Here are the minimum variance frontiers of a portfolio with 25 TSE stocks and another portfolio with the same 25 TSE stocks with 5 additional stocks from the Vietnamese Stock Exchange.



It is clearly visible from the plot that at any given return, the portfolio containing the additional 5 vietnamese stocks have lower risk. In addition, as the return increases, the amount of risk that is reduced from the original portfolio with 25 TSE stocks continues to increase.

Adding additional restrictions to weights on the portfolio results in suboptimal minimum variance frontier

When analysing the minimum variance frontier and risk at particular returns when comparing to a more restricted portfolio, it was evident that additional restrictions resulted in less optimal minimum variance frontiers, and with additional risk at the same returns. This is most evident when we compare the minimum variance frontier of the 25 TSE stocks with and without short selling.



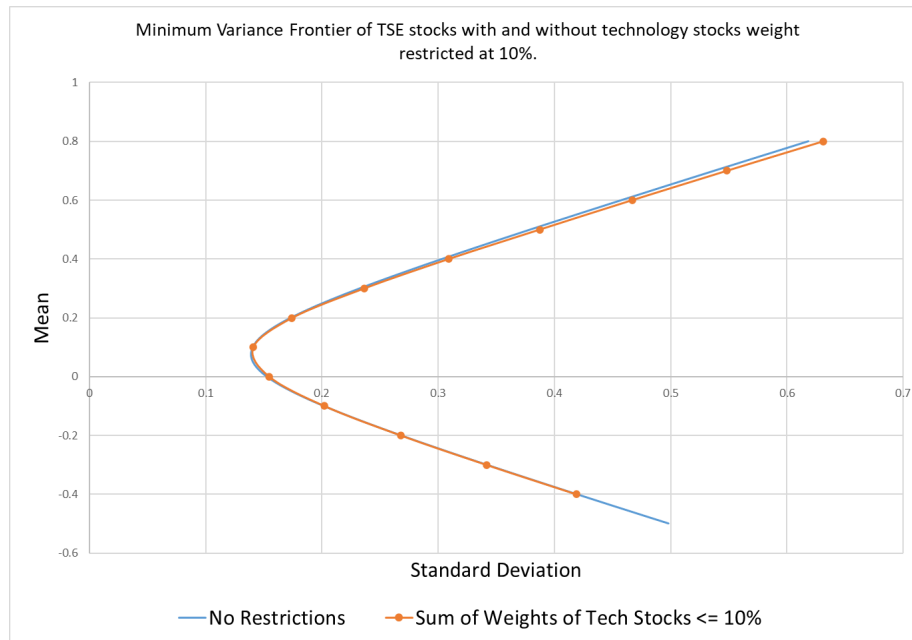
According to the plot, at any given return, disallowing short selling always increases the risk. For more context, at a return of 20%, the increase in risk for disallowing short selling is 8.7% at the minimum, but at a return of 40%, the increase in risk for disallowing short selling is 37.53%. This phenomena is also true even when weights have more loose restrictions. If interested, consider the plot in **Appendix 1.1**, which compares two portfolios that allow short selling, but the latter restricts the weights of technology stocks to be at most 10%.

The importance in diversification in reducing unsystematic risk

When analysing the decomposition of total risk into systematic and unsystematic risk for each individual stock, it was clear that each individual stock's risk was mostly unsystematic risk. This means that the majority of the total risk was associated with the individual company, industry or sector, rather than the whole market. Statistically, for the 30 stocks that were selected, on average the systematic risk was 16% whereas the unsystematic risk was 84%. Therefore, it was clear that in order to reduce the risk of the portfolio, it was paramount to diversify as much as possible as each additional stock was added. To help visualise why this is the case, the figure in **Appendix 1.2** from Investopedia illustrates how the unsystematic risk can be reduced.

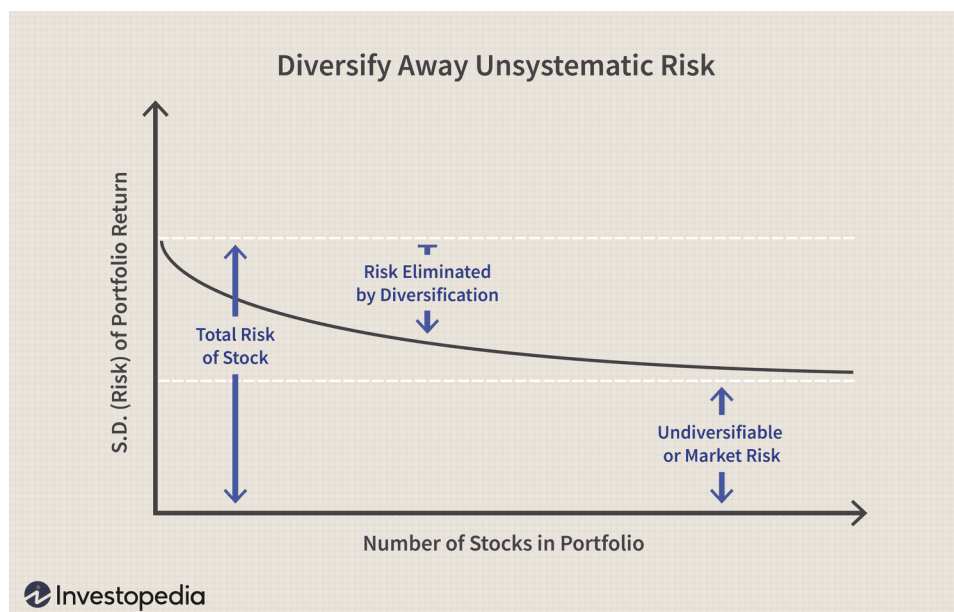
The Appendix

1.1 Minimum Variance Frontier of TSE stocks with and without technology stocks weight restricted at 10%



It is clear that the minimum variance frontier for the restricted portfolio is suboptimal because, for equal return, the risks associated are greater than or equal to when compared to the portfolio with no restrictions.

1.2 Investopedia: Diversify away unsystematic risk



References

Alpeyev, Pavel and Furukawa, Y. (2019) *Apple's iPhones are improving each year thanks to this Japanese firm, HT Tech*. Available at:

<https://tech.hindustantimes.com/tech/news/apple-s-iphones-are-improving-each-year-thanks-to-this-japanese-firm-story-rrm8F9JDC2j8BAiMsR1tcM.html> [Accessed: 06 November 2023].

An Phát Holdings. (n.d.). *An Phat Holdings - Home*. [online] Available at:

<https://anphatholdings.com/en/> [Accessed 6 Nov. 2023].

Asia News Network (2021). *Vietnam Rubber Group to expand production of tyre, tube to up revenues*.

[online] www.phnompenhpost.com. Available at:

<https://www.phnompenhpost.com/business/vietnam-rubber-group-expand-production-tyre-tube-revenues> [Accessed 6 Nov. 2023].

Business Wire (2022). *AM Best Affirms Credit Ratings of Bao Minh Insurance Corporation*. [online]

Yahoo Finance. Available at:

<https://finance.yahoo.com/news/am-best-affirms-credit-ratings-145000988.html> [Accessed 6 Nov. 2023].

Cao, D. and Chan, V. (2023). *Lawson Weighing Options for China Unit Including Partnership, Sources Say*. *Bloomberg.com*. [online] 9 Feb. Available at:

<https://www.bloomberg.com/news/articles/2023-02-09/lawson-said-to-mull-options-for-china-unit-including-partnership> [Accessed 6 Nov. 2023].

Daiwa House Industry sells a hotel portfolio to ADIA included Investor Group (2023) *SWFI News*.

Available at:

<https://www.swfinstitute.org/news/98625/daiwa-house-industry-sells-a-hotel-portfolio-to-adia-included-investor-group> [Accessed: 06 November 2023].

Dyer, G. (2023). *Seven Group Holdings: Strong growth, 2024 profit outlook cautious*. [online]

ShareCafe. Available at:

<https://www.sharecafe.com.au/2023/08/17/seven-group-holdings-strong-growth-2024-profit-outlook-cautious/> [Accessed 6 Nov. 2023].

Equity, Z. (2023) *Toyota Motor Corporation (TM) rises as market takes a dip: Key facts, Yahoo! Finance*. Available at:

https://finance.yahoo.com/news/toyota-motor-corporation-tm-rises-215020290.html?guccounter=1&guce_referrer=aHR0cHM6Ly93d3cuZ29vZ2xlLmNvbS8&guce_referrer_sig=AQAAAE6aWw2Czy18W_QWDIELGM5Xq772jJyTJWmVkZrKWQ88wkn1vDIZ2YcLX4AubZ_K3jutfb5EEUp1lQ_uSaibm6z-URDaxQ-flajMjSUUbiJZjGP21daVuhy5IsnZAvbL4eBKX804RuLTzDOZWOXpflYlt0lZBoRoQqV_TuwYjZHg [Accessed: 06 November 2023].

finance.yahoo.com. (n.d.). *Thien Nam Trading - Import Export Joint Stock Company (TNA.VN) Stock Price, News, Quote & History - Yahoo Finance*. [online] Available at: <https://finance.yahoo.com/quote/TNA.VN/> [Accessed 6 Nov. 2023].

InvestorsObserver (2023) *Should Mitsubishi UFJ Financial Group Inc (MUFG) stock be in your portfolio?*, *InvestorsObserver*. Available at: <https://www.investorsobserver.com/news/stock-update/should-mitsubishi-ufj-financial-group-inc-mufg-stock-be-in-your-portfolio-7> [Accessed: 06 November 2023].

Jitpleechep, P. (2023). Lion to expand into pet market. *Bangkok Post*. [online] 6 Jun. Available at: <https://www.bangkokpost.com/business/general/2585816/lion-to-expand-into-pet-market> [Accessed 6 Nov. 2023].

Kawano, Y. (2023) *Kobayashi Pharma to tap Southeast Asian demand with New Plant: COO, Nikkei Asia*. Available at: <https://asia.nikkei.com/Editor-s-Picks/Interview/Kobayashi-Pharma-to-tap-Southeast-Asian-demand-with-new-plant-COO> [Accessed: 06 November 2023].

Lim, A. (2023). *Sunny potential: Kao Corp hedges bets on Bioré to dominate sun care globally*. [online] [cosmeticsdesign-asia.com](https://www.cosmeticsdesign-asia.com). Available at: <https://www.cosmeticsdesign-asia.com/Article/2023/10/10/Kao-Corp-hedges-bets-on-Biore-to-dominate-sun-care-globally> [Accessed 6 Nov. 2023].

MarketsandMarkets Research Pvt. Ltd. (2023) *Japan probiotics market size to grow at a cagr 5.8% from 2022 to 2027 Yahoo! Finance*. Available at:

<https://finance.yahoo.com/news/japan-probiotics-market-size-grow-230000661.html> [Accessed: 06 November 2023].

Matsuyama, K. (2022) *Japan approves Sysmex's blood test-based kit to detect alzheimer's disease*, *Bloomberg.com*. Available at:
<https://www.bloomberg.com/news/articles/2022-12-22/japan-approves-sysmex-s-blood-test-based-kit-to-detect-alzheimer-s-disease> [Accessed: 06 November 2023].

Nippon.com (2023) *Ana Eyes Southeast Asian market with new LCC brand AirJapan nippon.com*. Available at: <https://www.nippon.com/en/news/kd1064717581414187785/> [Accessed: 06 November 2023].

PR Newswire (2023) *Bread market size to grow by USD 118.37 billion between 2022 and 2027; AB Mauri Ltd., Agrofert as among others, identified as key vendors - technavio, Yahoo! Finance*. Available at: <https://finance.yahoo.com/news/bread-market-size-grow-usd-223000492.html> [Accessed: 06 November 2023].

PR Newswire (2023). *REIT Market size to grow by USD 333.01 billion from 2022 to 2027, Market is fragmented due to the presence of prominent companies like Automotive Properties REIT, CapitaLand Integrated Commercial Trust Management Ltd., Dexus Group, and many more - Technavio*. [online] Yahoo Finance. Available at:
<https://finance.yahoo.com/news/reit-market-size-grow-usd-213000143.html> [Accessed 6 Nov. 2023].

Report, H.M. (2023) *Warehouse robotics market to witness stunning growth: KUKA, Daifuku, ABB, Enterprise Apps Today*. Available at:
<https://www.enterpriseappstoday.com/news/warehouse-robotics-market-to-witness-stunning-growth-kuka-daifuku-abb.html> [Accessed: 06 November 2023].

Research Nester (2023). *Thermal Transfer Ribbon Market revenue to cross USD 5 Billion by 2035, says Research Nester*. [online] Yahoo Finance. Available at:
<https://finance.yahoo.com/news/thermal-transfer-ribbon-market-revenue-093000191.html> [Accessed 6 Nov. 2023].

SHIMBUN, T.A. (2023) *Rising EV sales push Mitsubishi Motors out of Chinese market: The Asahi Shimbun: Breaking News, Japan news and analysis, The Asahi Shimbun*. Available at: <https://www.asahi.com/ajw/articles/15033117> [Accessed: 06 November 2023].

SkyQuest Technology Consulting Pvt. Ltd. (2023). *Caustic Soda Market is expected to reach \$62.27 Billion by 2028 | Rising Demand for Caustic Soda in the Pharmaceutical Industry*. [online] Yahoo Finance. Available at: <https://finance.yahoo.com/news/caustic-soda-market-expected-reach-121400803.html> [Accessed 6 Nov. 2023].

Takeuchi expand production with new 100% renewable factory (2023) Agg. Available at: <https://agg-net.com/news/takeuchi-expand-production-with-new-100-renewable-factory> [Accessed: 06 November 2023].

Tamura, Y. and Terukina, A. (no date) *A top japan fund manager snaps up Chip Stocks on AI, EVS demand, Yahoo! Finance*. Available at: <https://finance.yahoo.com/news/top-japan-fund-manager-snaps-015703825.html> [Accessed: 06 November 2023].

Technavio (2023). *Carbon Black Market to grow by USD 4.86 billion from 2022 to 2027|Abu Dhabi National Oil Co., Aditya Birla Management Corp. Pvt. Ltd., Bridgestone Corp. and more among the major companies in the market - Technavio*. [online] www.prnewswire.com. Available at: <https://www.prnewswire.com/news-releases/carbon-black-market-to-grow-by-usd-4-86-billion-from-2022-to-2027abu-dhabi-national-oil-co-aditya-birla-management-corp-pvt-ltd-bridgestone-corp-and-more-among-the-major-companies-in-the-market---technavio-301963369.html> [Accessed 6 Nov. 2023].

Technologies, D. (2023) *Cyberagent selects Dell Technologies for developing generative AI and Machine Learning Infrastructure for digital advertising, PR Newswire: press release distribution, targeting, monitoring and marketing*. Available at: <https://www.prnewswire.com/news-releases/cyberagent-selects-dell-technologies-for-developing-generative-ai-and-machine-learning-infrastructure-for-digital-advertising-301932617.html> [Accessed: 06 November 2023].

The Insight Partners (2023). *Reclamation Sand Market worth \$ 2.69 Billion by 2030 - Exclusive Report by The Insight Partners*. [online] Yahoo Finance. Available at:
<https://finance.yahoo.com/news/reclamation-sand-market-worth-2-132900755.html> [Accessed 6 Nov. 2023].

The Monogatari Corporation reports sales results for the month ended August, September and first quarter 2023 (2023) MarketScreener. Available at:
<https://www.marketscreener.com/quote/stock/THE-MONOGATARI-CORPORATIO-6814860/news/The-Monogatari-Corporation-Reports-Sales-Results-for-the-Month-Ended-August-September-and-First-Qua-45036738/> [Accessed: 06 November 2023].

VIETNAMNET GLOBAL (2023). *Báo VietnamNet*. [online] VietNamNet News. Available at:
<https://vietnamnet.vn/en/vietnamese-banks-prove-attractive-to-foreign-investors-2168168.html>
[Accessed 6 Nov. 2023].