ISSN: 2688-9323

Capital Asset Pricing Model (CAPM) Analysis on the Investment Decisions of Standard Chartered Group (HK2888)

Peinan Wu[1, a, *], Mengyuan Chen[2, b], Qiuyu Luo[3, c]

[1]Faculty of Arts and Social Science, The University of Sydney, Sydney, 2006, Australia

[2]School of Tourism and Hospitality, Management Development Institute of Singapore, Singapore, 148951, Singapore

[3]School of International Trade, Universidad Complutense Madrid, Madrid, 28015, Spain

[a, *]pewu5578@uni.sydney.edu.au, [b]SIDI2103051982@students.mdis.edu.sg,

[c]agnes1123lqy@163.com

Abstract

The Capital Asset Pricing Model (CAPM) describes the relationship between systematic risk, or the general perils of investing, and expected return for assets, particularly stocks. CAPM evolved as a way to measure this systematic risk. It is widely used throughout finance for pricing risky securities and generating expected returns for assets, given the risk of those assets and cost of capital. This paper mainly analyses the historical data of Standard Chartered Group (HK2888), so as to draw relevant conclusions about its investment decisions. In terms of data, this paper mainly uses the relationship between the monthly data of Standard Chartered Bank from May 2020 to May 2021 and the Hang Seng Index, uses the CAPM model to evaluate Standard Chartered Group, verify hypotheses, and make analysis.

Keywords

Capital Asset Pricing Model (CAPM); Investment Decisions; Standard Chartered Group; Development Analysis.

1. Background

The basic content of capital asset pricing model (CAPM) is to study the quantitative relationship between the expected return rate of assets and risky assets in the stock market. The practical significance of capital asset pricing model is that it is applied to asset valuation, capital cost budget and resource allocation, etc (Almaainah 2021). It is the pillar of modern financial market price theory’s model has been widely recognized in the security theory circle. This model mainly analyses the sensitivity of stock returns and market portfolio returns to help investors decide whether the additional returns they get match the risks.

In the CAPM model, the relationship between the target company's stock return rate and the market index return rate to explore the specific extent can be analysed to which the company's stock return rate is affected by the market. In this way, we can find the expected return rate of the target company through this linear relationship, and we can also look for investment opportunities from the difference between the expected and actual data.

The expected return of an asset at a given risk is calculated by the following Formula 1:

$$R_i = R_f + \beta_i(R_m - R_f) \tag{1}$$

where R_i is the expected return rate of the stock, R_f is the risk-free interest rate, β_i is the systematic risk coefficient. When the beta coefficient is greater than 1, it indicates that the

ISSN: 2688-9323

volatility and risk degree of the stock are greater. When compared with the overall market dynamics in the same period, it indicates that the risk of the stock is greater than the market risk, and vice versa. $(R_m - R_f)$ is the market risk premium. The expected return of the market under the risk-free interest rate can be obtained by multiplying the beta coefficient of the stock by the market risk premium. Through the above formula, investors can calculate the value of assets, so as to make a reasonable and effective investment.

2. Data Source

The specific data of Standard Chartered Group from May 2020 to May 2021 is obtained from Yahoo Finance. The data type is past share price, using monthly as the data frequency. Meanwhile, in the CAPM model of Standard Chartered Group, we take the Hang Seng Index as the market index. The 10-year Treasury yield of the United States are also referred as the risk-free rate, because the yield of the 10-year Treasury is more stable and has higher liquidity, and the risk rate of the Treasury is more reflective of the risk-free rate.

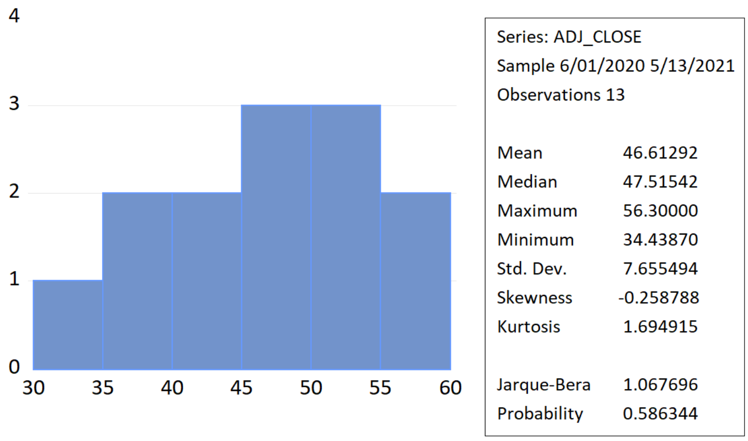

Figure 1. Data source obtained from Standard chartered PLC data.

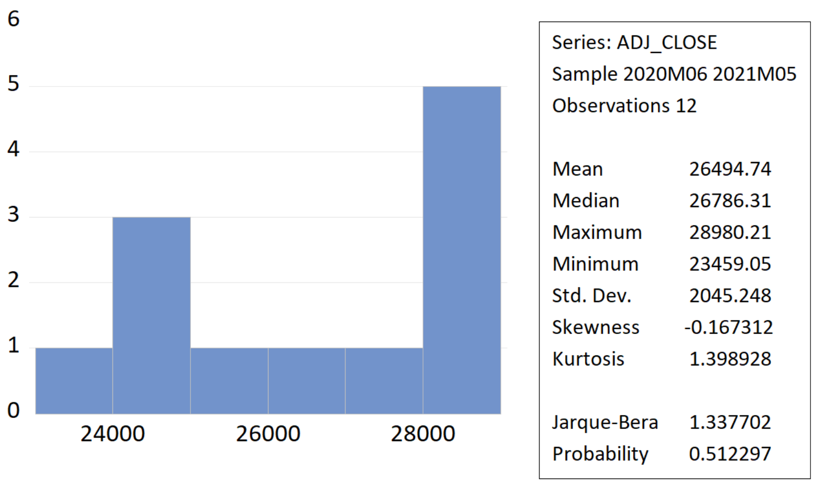

Figure 2. Data source obtained from the HANG SENG index.

ISSN: 2688-9323

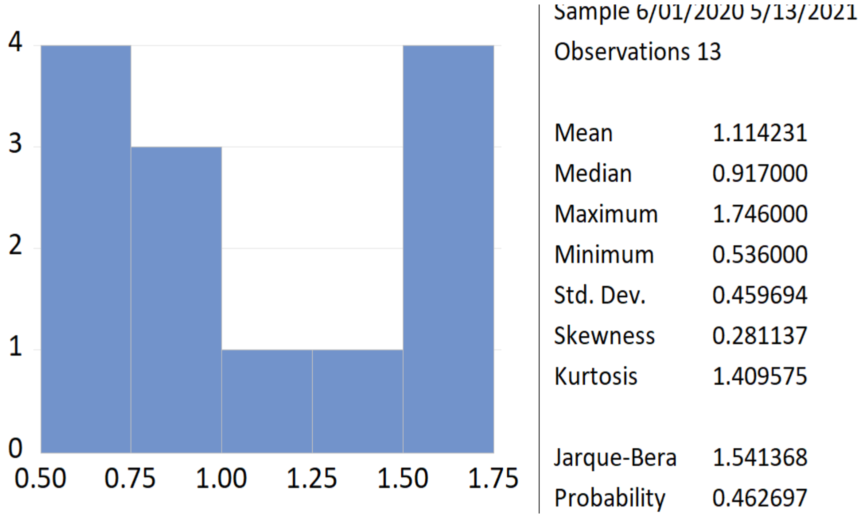

Figure 3. Data source obtained from the Treasury Bonds.

3. Analytical Methodology and Results

The analytical method may follow the following steps:

Step1: Calculate R_f, market return rate (R_m) and stock return rate respectively through the above data, and then convert the excess return rate into the model for hypothesis test. Then calculate the monthly R_f, market rate of return (R_m) and stock rate of return in a year by logarithmic rate of return algorithm (Table 1 and Table 2).

Since the risk-free rate does not fluctuate much, we can use the average monthly yield of the US 10-year Treasury bond as the total risk-free rate. From the summary from Table 1 to Table 4, the average of R_f = The average yield on 10 - year US Treasury bonds = 0.0342 (Li et al. 2020).

Table 1. Logarithmic rate of return

Date	Open	High	Low	Close	Adj Close	Volume	Rm
2020/6/1	23539.91	25303.78	23539.91	24427.19	24427.19	4.01E+10	LOG(F2)
2020/7/1	24563.57	26782.62	24526.91	24595.35	24595.35	4.87E+10	0.010152
2020/8/1	24566.81	25847.11	24167.79	25177.05	25177.05	3.53E+10	-0.03069
2020/9/1	25085.67	25254.14	23124.25	23459.05	23459.05	3.86E+10	0.01184

Table 2. Values for corresponded R_m (Average value of R_f = The average yield on 10-year US Treasury bonds = 0.0342).

Date	Open	High	Low	Close	Adj Close	Volume	Rm
2020/6/1	23539.91	25303.78	23539.91	24427.19	24427.19	4.01E+10	0.002979
2020/7/1	24563.57	26782.62	24526.91	24595.35	24595.35	4.87E+10	0.010152
2020/8/1	24566.81	25847.11	24167.79	25177.05	25177.05	3.53E+10	-0.03069
2020/9/1	25085.67	25254.14	23124.25	23459.05	23459.05	3.86E+10	0.01184
2020/10/1	24039.39	24970.59	23674.52	24107.42	24107.42	3.78E+10	0.03849
2020/11/1	24274.83	27040.41	24232.66	26341.49	26341.49	5.62E+10	0.014425
2020/12/1	26422.71	27340.99	25998.87	27231.13	27231.13	5.46E+10	0.016471
2021/1/1	27087.13	30191.16	27079.24	28283.71	28283.71	7.34E+10	0.010565
2021/2/1	28457.85	31183.36	28382.26	28980.21	28980.21	5.59E+10	-0.00911
2021/3/1	29457.89	29912	27505.08	28378.35	28378.35	6.79E+10	0.005271
2021/4/1	28594.55	29405.12	28274.27	28724.88	28724.88	3.91E+10	-0.00753
2021/5/1	28659.91	28884.03	27897.47	28231.04	28231.04	1.69E+10	

Table 3. Average value of R_i.

Date	Open	High	Low	Close	Adj Close	Volume	Ri
2020/6/1	36	46	36	41.1	41.02697	74576664	-0.00585
2020/7/1	41.1	44.85	39.85	40.55	40.47795	41677255	-0.00811
2020/8/1	39.95	44.2	37.7	39.8	39.72928	38450321	-0.06206
2020/9/1	39.95	40.15	33.3	34.5	34.4387	34404136	0.012409
2020/10/1	34.5	40.25	34.5	35.5	35.43692	38005804	0.127379
2020/11/1	35.5	49.75	35.5	47.6	47.51542	67234857	0.013475
2020/12/1	47.15	51.35	47	49.1	49.01275	24511617	-0.01622
2021/1/1	49.1	54.45	47	47.3	47.21595	30995201	0.033135
2021/2/1	47.3	55.8	46.4	51.05	50.95929	37217759	0.021574
2021/3/1	51.5	54.6	49.75	53.65	53.55467	27036598	0.021711
2021/4/1	53.7	56.85	51.2	56.3	56.3	13395210	-0.00582
2021/5/1	56.2	56.7	54.5	55.55	55.55	5079802	-0.0063
2021/5/13	55.55	55.55	54.7	54.75	54.75	257736	

Table 4. Average value of R_f.

Date	Open	High	Low	Close	Adj Close	Volume	Rf
2020/6/1	0.667	0.957	0.619	0.653	0.653	0	-0.08575
2020/7/1	0.681	0.724	0.528	0.536	0.536	0	0.111568
2020/8/1	0.559	0.746	0.504	0.693	0.693	0	-0.01014
2020/9/1	0.72	0.729	0.606	0.677	0.677	0	0.10391
2020/10/1	0.701	0.872	0.653	0.86	0.86	0	-0.00816
2020/11/1	0.854	0.975	0.748	0.844	0.844	0	0.036027
2020/12/1	0.857	0.986	0.857	0.917	0.917	0	0.076251
2021/1/1	0.935	1.187	0.907	1.093	1.093	0	0.125733
2021/2/1	1.079	1.614	1.06	1.46	1.46	0	0.077691
2021/3/1	1.451	1.765	1.403	1.746	1.746	0	-0.02959
2021/4/1	1.705	1.745	1.529	1.631	1.631	0	0.016716
2021/5/1	1.651	1.695	1.471	1.695	1.695	0	-0.00386
2021/5/13	1.69	1.7	1.68	1.68	1.68	0	

Step 2: The arithmetic works out the Beta Value. Calculate the covariance of stock return rate and market return rate =0.000577.

$$\sigma_{im} = Cov(r_i, r_m) \tag{2}$$

Calculate the variance of the market return rate = 0.00028 via Formula 2 (Ding et al. 2020).

$$\sigma_m^2 = Var(r_m) \tag{3}$$

Beta Value = 0.8443 / 0.9455 = 2.06 via Formula 3..

Step 3: Use least squares to estimate the parameters of the CAMP model by Eviews (Figure 4) (Jennifer 2020).

Dependent Variable: RI-0.0342
Method: Least Squares
Date: 05/13/21 Time: 22:18
Sample (adjusted): 2020M06 2021M04
Included observations: 11 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.036511	0.017969	2.031899	0.0727
RM-0.0342	2.062290	0.544016	3.790863	0.0043

R-squared	0.614901	Mean dependent var	-0.022235
Adjusted R-squared	0.572113	S.D. dependent var	0.046119
S.E. of regression	0.030168	Akaike info criterion	-4.001108
Sum squared resid	0.008191	Schwarz criterion	-3.928764
Log likelihood	24.00610	Hannan-Quinn criter.	-4.046711
F-statistic	14.37064	Durbin-Watson stat	1.925055
Prob(F-statistic)	0.004277		

Figure 4. Parameter settings for the CAMP model by Eviews

From the above regression output table, we can get the whole regression model, and according to the relevant statistical indicators of the whole model, it can help to verify and analyse the specific content and statistical significance of the whole model (Fu et al. 2020).

The regression model is as follows:

$$R_i - 0.0342 = 0.036 + 2.06 \times (R_m - 0.0342) \tag{4}$$

Step 4: Diagnostic checking. The purpose of this step is to verify that the error term of the CAMP model is the white noise disturbance term.

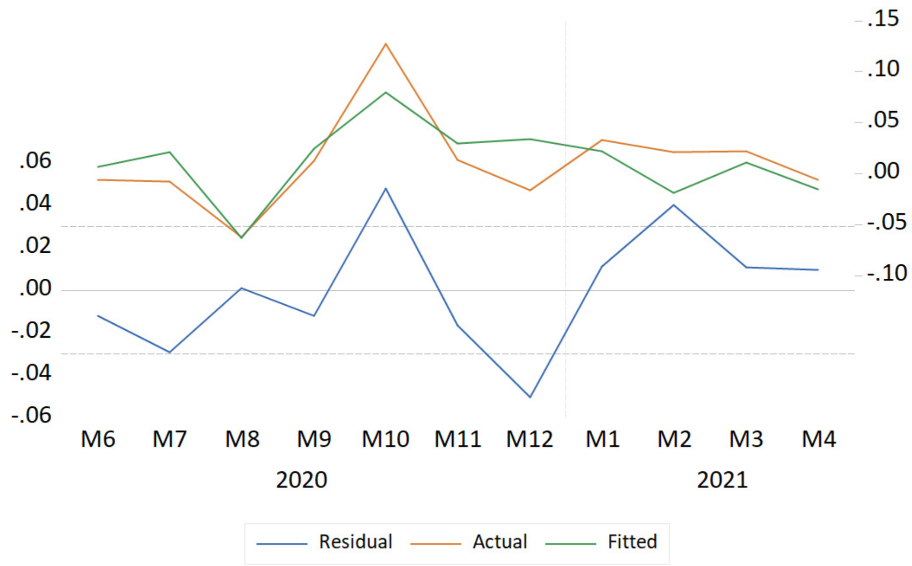

Figure 5. Residual figure of the raw data

ISSN: 2688-9323

The CAPM and the SML make a connection between a stock's beta and its expected risk. Beta is found by statistical analysis of individual, daily share price returns compared with the market's daily returns over precisely the same period (Harada et al. 2021). A higher beta means more risk, but a portfolio of high-beta stocks could exist somewhere on the CML where the tradeoff is acceptable, if not the theoretical ideal (Li et al. 2021).

The ideal residuals should be uniformly distributed on both sides of 0, and the smaller the offset, the better result it might indicate (Figure 5). However, some residuals in this figure exceed the confidence interval, indicating the possibility of heteroscedasticity. Therefore, White's test is used to test the heteroscedasticity (Zolmax 2021).

Heteroskedasticity Test: White
Null hypothesis: Homoskedasticity

F-statistic	1.868073	Prob. F(1,9)	0.2049
Obs*R-squared	1.890749	Prob. Chi-Square(1)	0.1691
Scaled explained SS	0.939980	Prob. Chi-Square(1)	0.3323

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 05/13/21 Time: 23:00
Sample: 2020M06 2021M04
Included observations: 11

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.000481	0.000336	1.430083	0.1865
RM^2	0.845019	0.618257	1.366775	0.2049

R-squared	0.171886	Mean dependent var	0.000745
Adjusted R-squared	0.079874	S.D. dependent var	0.000952
S.E. of regression	0.000913	Akaike info criterion	-10.99672
Sum squared resid	7.50E-06	Schwarz criterion	-10.92437
Log likelihood	62.48194	Hannan-Quinn criter.	-11.04232
F-statistic	1.868073	Durbin-Watson stat	2.652966
Prob(F-statistic)	0.204863		

Figure 6. Parameter settings for the CAMP model by White's test.

The statistical data of White Test appears in the model window to test the existence of heteroscedasticity. The F statistic and R squared of the test statistic both give the same conclusion, indicating that there is no heteroscedasticity because the p value is much greater than 0.05 (Hui et al. 2020).

Still, several assumptions behind the CAPM stimulation have been shown not to hold up in reality. Modern financial theory rests on two assumptions: investment markets are very competitive and efficient (Li et al. 2022), These markets are dominated by rational, risk-averse investors, who seek to maximize satisfaction from returns on their investments. As a result, it's not entirely clear whether CAPM works. The big sticking point is beta. When professors Eugene Fama and Kenneth French looked at share returns on the New York Stock Exchange, the

ISSN: 2688-9323

American Stock Exchange, and Nasdaq, they found that differences in betas over a lengthy period did not explain the performance of different stocks. The linear relationship between beta and individual stock returns also breaks down over shorter periods of time (Chohra 2019). These findings seem to suggest that CAPM may be wrong. Despite these issues, such CAPM reuslt and formula are still valid enough because it is simple and allows for easy comparisons of investment alternative (D'Amato et al. 2020).

4. Conclusion and Positions

Considering the critiques of the CAPM and the assumptions behind its use in portfolio construction, it might be difficult to see how it could be useful. However, using the CAPM as a tool to evaluate the reasonableness of future expectations or to conduct comparisons can still have some value (Li et al. 2022). The values of beta coefficient obtained by the calculation method and CAPM regression method are roughly the same, both of which are 2.06. When the beta value >1, it belongs to the cyclical stock, and the fluctuation range of its return rate is larger than the market average return rate. At the same time, the Beta is 2.06, meaning that the Hang Seng yield increases by 10%, the Standard Chartered stock yield should increase by 20.6%, and vice versa (Zolmax 2021). The p value of Beta is 0.0043, close to 0, indicating that Beta has statistical validity as a system risk factor.

In addition, the R square of the model is equal to 0.614901, indicating that 61.5% of the changes in the stock return rate of Standard Chartered Group can be explained by the changes in the market index return rate, and the remaining 38.5% of the fluctuations are determined by the factors of Standard Chartered Group itself. This also shows that CAPM model has empirical significance for stock earnings forecast (Li et al. 2021).

We can also assess the value of the purchase by calculating the actual and projected return of Standard Chartered Bank. Calculations are made using the closing prices for the first and last two months of the entire year, May 2020 and May 2021. The predicted rate of return needs to be put into the CAPM formula (Clavis. 2022). The index of Hang Seng in that year is 0.1557, and the predicted rate of return is 0.32. The actual rate of return = (55.55-41.1) /41.1=0.35, which is not much different from the predicted value of CAPM model.

The investor could use this observation to reevaluate how their portfolio is constructed and which holdings may not be on the SML (Birch et al. 2012). This could explain why the investor's portfolio is to the right of the CML. If the holdings that are either dragging on returns or have increased the portfolio's risk disproportionately can be identified, then the investor can make changes to improve returns. Not surprisingly, the CAPM contributed to the rise in the use of indexing, or assembling a portfolio of shares to mimic a particular market or asset class, by risk-averse investors. This is largely due to the CAPM message that it is only possible to earn higher returns than those of the market as a whole by taking on higher risk (beta) (Zolmax 2021).

References

[1] Almaainah. (2021). Multiple Perspectives of a Knowledge-Based Innovation Ecosystem: The Case of Khalifa Fund for Enterprise Development in the UAE. ProQuest Dissertations Publishing.

[2] Birch, Levidow, L., & Papaioannou, T. (2012). Self-Fulfilling Prophecies of the European Knowledge-Based Bio-Economy: The Discursive Shaping of Institutional and Policy Frameworks in the Bio-Pharmaceuticals Sector. Journal of the Knowledge Economy, 5(1), 1–18. https:// doi.org/ 10.1007/ s13132-012-0117-4.

[3] Chohra. (2019). A critical review of the academic entrepreneurial ecosystem in developing countries: The case of Algeria. The International Journal of Technology Management & Sustainable Development, 18(3), 243–259. https://doi.org/10.1386/tmsd_00008_1.

ISSN: 2688-9323

[4] Clavis Nwehfor Fubah, & Menisha Moos. (2022). Exploring COVID-19 Challenges and Coping Mechanisms for SMEs in the South African Entrepreneurial Ecosystem. Sustainability (Basel, Switzerland), 14(4), 1944–. https://doi.org/10.3390/su14041944.

[5] D'Amato, Bartkowski, B., & Droste, N. (2020). Reviewing the interface of bioeconomy and ecosystem service research. Ambio, 49(12), 1878–1896. https://doi.org/10.1007/s13280-020-01374-0.

[6] Ding. (2018). Pharma Industry 4.0: Literature review and research opportunities in sustainable pharmaceutical supply chains. Process Safety and Environmental Protection, 119, 115–130. https://doi.org/10.1016/j.psep.2018.06.031.

[7] Festa, Rossi, M., Kolte, A., & Marinelli, L. (2021). The contribution of intellectual capital to financial stability in Indian pharmaceutical companies. Journal of Intellectual Capital, 22(2), 337–359. https://doi.org/10.1108/JIC-03-2020-0091.

[8] Fu, Wu, F., & Zhang, S. (2022). Evolutionary Path and Innovative Development of Pharmaceutical Industrial Cluster-A Case Study of Shijiazhuang, China. International Journal of Environmental Research and Public Health, 19(5), 2928–. https://doi.org/10.3390/ijerph19052928.

[9] Harada, Wang, H., Kodama, K., & Sengoku, S. (2021). Drug Discovery Firms and Business Alliances for Sustainable Innovation. Sustainability (Basel, Switzerland), 13(7), 3599–. https:// doi.org/ 10.3390/ su13073599.

[10] Hui, Mohammed, B., Donyai, P., McCrindle, R., & Sherratt, R. S. (2020). Enhancing Pharmaceutical Packaging through a Technology Ecosystem to Facilitate the Reuse of Medicines and Reduce Medicinal Waste. Pharmacy, 8(2), 58–. https://doi.org/10.3390/pharmacy8020058.

[11] Jennifer Markarian. (2020). Improving Efficiency for Sustainable Pharmaceutical Facilities. Pharmaceutical Technology Europe, 32(3), 38–39.

[12] Li, Y., Fang, C., Zhuang, WQ. et al. Antimicrobial enhancement via Cerium (II)/Lanthanum (III)-doped TiO2 for emergency leak sealing polyurea coating system. npj Mater Degrad 6, 41 (2022). https:// doi.org/10.1038/s41529-022-00249-x.

[13] Li, Y.; Li, X.; Hao, Y.; Liu, Y.; Dong, Z.*; Li, K. Biological and Physiochemical Methods of Biofilm Adhesion Resistance Control of Medical Context Surface, International Journal of Biological Science, 2021 (17), 1769-.

[14] Li, Y.; Xiao, P.; Dai, Z.; Bi, B.; Fu, D.; Hao, Y. Opportunities and Challenges Faced by the Online Educational Services in the Post-COVID-19. In Proceedings of the 2nd International Symposium on Education and Social Sciences (ESS 2021), Xi'an, China, 22–23 May 2021; pp. 148–159.

[15] Li, Y.; Xiao, P.; Wang, Y.; Hao, Y. Mini-Review of the Mechanisms and Control Measures of Mature Biofilm Resistance to Antimicrobial Agents in the Clinical Context, ACS Omega, 2020 (5), 22684–22690.

[16] Li, Y.; Xu, Z.; Hao, Y.; Xiao, P.; Liu, J. Psychosocial Impacts of Mobile Game on K12 Students and Trend Exploration for Future Educational Mobile Games. Front. Educ. 2022, 7, 843090.

[17] Say. Introduction to Political Economy [M]. Beijing: The Commercial Press, 1963.

[18] Schumpeter. History of Economic Analysis (Volume|Volume) [M].Beijing: Commercial Printing Museum, 1992.

[19] Wu Liang. Marketing strategy of Air China in Anhui -- on the application of public relations marketing in marketing mix [J]. Air transportation commerce, 2012 (1): 7.

[20] Zolmax.com - American Consumer News: Air China Limited (OTCMKTS:AICAF) Short Interest Down 66.9% in November. (2021). In Newstex Global Business Blogs. Newstex.

[21] Zolmax.com - American Consumer News: Air China Limited (OTCMKTS:AICAF) Short Interest Update. (2021). In Newstex Global Business Blogs. Newstex.

[22] Zolmax.com - American Consumer News: Air China Limited (OTCMKTS:AICAF) Receives Average Rating of "Buy" from Analysts. (2021). In Newstex Global Business Blogs. Newstex.