How to Play the Lottery Stocks

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This study examines the performance of lottery stocks sifted by net current asset value (NCAV) strategy and investigates the relation between deep value stocks and lottery-type stocks.

From previous studies, the lottery-type stocks are perceived to be sold at low cost with a small probability of huge excess returns in the future. They are featured as value stocks, small-cap stocks and attention-grabbing stocks which are connected to people's gambling propensity and identified as the cause of underperformance in portfolios. As for the net-nets portfolios, which are generated by the application of deep value investing strategy, we test its consistency of outperformance in the American stock markets during 1970 to 2017 and compare it with a lottery-type stock portfolio to obtain an overlapping part.

We find that the lottery-type stocks portfolio would outperform after applying the NCAV criteria and aim to gain a deeper understanding of the mechanisms that generate contrasting performance in these two portfolios. Several risk factors and firm characteristics, such as liquidity, holding period, weighting scheme, turnover, and firm size are considered to be the source of different outcomes. Interestingly, the small-firm factor, in comparison with insignificant value factor, is extremely significant in the net-nets portfolio.

This study will not only contribute to the literature of risk-taking propensity and deep value investing but also combine the safety of capital with the potential for consistent exceptional positive returns.

Skeleton

1. Introduction

Lottery-type stocks are perceived to have a small probability of huge excess returns in the future with low current selling costs. However, as the state lottery buyers, the probability to win lottery stocks are considerably small. Furthermore, Kumar (2009) demonstrates that lottery-type stocks are the cause of underperformance in the portfolios and the level of underperformance increases with an incremental lottery-type stocks weighting scheme.

Lottery stocks are generally identified with low price, high idiosyncratic volatility and high idiosyncratic skewness and previous research target the lottery-type stocks as value stocks, small-cap stocks, no-dividend-paying stocks. What is more, lottery stocks tend to have considerably lower liquidity and lower analyst coverage and therefore, they are preferred by individuals while institutions exhibit a relative revision.

Relatively, net-nets portfolios, which is generated by net current asset value (NCAV) strategy, perform similar features as lottery-type stocks portfolios, such as small market capitalization, high-value ratios, low analyst coverage and low liquidity. While the net-nets portfolios show a consistent outperformance through the time. The NCAV strategy, or so-called deep value investing strategy, is originated from Ben Graham in 1920s and still play a pivotal role in investment strategy. It is constructed by only focusing on the value of total current assets net of total liabilities and net of preferred stock. Briefly speaking, the deep value investors just buy assets whose prices are below the net current asset value of the company.

We are inspired by the consistent outperformance of net-nets stocks, the likelihood of lottery-type stocks to gain high profits with low costs and their similar characteristics. Thus, we attempt to apply a consistent profitable investing strategy-Net Current Assets Value strategy upon lottery-type stocks, aiming to find out the approach to win the stock market stocks. And the lottery-type stocks are deduced to outperform with NCAV

strategy.

Table 1. Characteristics comparison of lottery-type stocks and NCAV stocks

	Lottery-Type Stocks	**NCAV stocks**
Stock type	Value stocks	Deep Value stocks
Value-related ratio	High book-to-market ratios	High book-to-market (B/M)
Market Capitalisation	Small-cap stocks	Micro-cap stocks
Dividend-paying	Non-dividend-paying stocks	Not sure (confounding)
Attention	Attention-grabbing (Individual preferred)	Neglected
Analyst Coverage	Low analyst coverage	Low analyst coverage
Liquidity	Lower liquidity	Lower liquidity

Ref: Kumar (2009), Graham (1976), Oppenheimer (1986); Vu (1988); Oxman et al., (2012).

We identify the lottery-type and net-nets stocks in the American stock markets with an expanded period from 1970 to 2017, then explore the overlapping stocks in lottery-type stock portfolios and NCAV portfolios. We are dedicated to gain a deeper understanding of the mechanisms that generate different performance, so compare the performance of lottery-type stocks, net-nets stocks and the overlapping and non-overlapping parts of these two portfolios.

Up to now, it is found that i) net-nets stocks outperform in both equally and value-weighted portfolios; ii) the lottery-type stocks are discovered to underperform in the value-weighted portfolio within the 48-year period which is consistent to Kumar (2009); iii) Alpha of net-nets portfolios drops if removing lottery stocks no matter when equally and value weighted, though removing net-net stocks from the lottery portfolio makes

little difference; iv) The alphas of net-nets stocks are almost doubled after applying a secondary lottery stock filter. Interestingly, the small-firm factor, in comparison with insignificant value factor, is extremely significant in the net-nets portfolio.

Next step, several risk factors and firm characteristics, such as holding period, weighting scheme, turnover, liquidity and firm size are considered to examine the mechanism to the abnormally high returns of net-nets stocks with lottery characteristics. This study will not only contribute to the literature of risk-taking propensity and deep value investing but also combine the safety of capital with the potential for consistent exceptional positive returns.

2. Literature review

Kumar (2009) analyses salient features of state lotteries which are mainly performed as the huge reward compared with the low cost. Although in the stock market, it is unlikely to trade specific stocks possessing extremely high reward to cost ratio, qualitative features can be shared between state lotteries and lottery-type stocks. Therefore, three characteristics are considered to identify the lottery-type stocks: (i) the stock price; (ii) the stock-specific or idiosyncratic volatility (iii) idiosyncratic skewness. Generally speaking, stocks which have cheap prices, high idiosyncratic volatility and high idiosyncratic skewness are more likely to be considered in gambling transactions in the stock market. As with lotteries, investors who prefer lottery-type stocks bet on a low price for a huge return in the future. And in the set of low-priced stocks, the stocks with high idiosyncratic skewness are more attractive because of their occasional extreme positive returns which cannot be justified by the market movements. As for the high stock-specific volatility, it can amplify the estimate of idiosyncratic skewness and the past extremely positive returns are expected to reoccur in the future rather than considered to be outliers.

Kumar demonstrates that the lottery-type stocks are more likely to be value stocks,

small-cap stocks, non-dividend-paying stocks, and attention-grabbing stocks for which individuals show preferences and Institutions exhibit a relative revision. Thus, they have considerably lower liquidity and lower analyst coverage. And there is a high concentration of lottery-type stocks among energy, mining, technology, bio- technology and financial institutions, in contrast with industries consisting of utilities, consumer goods, and restaurants with the lowest concentration. Lottery-type stocks occupy 1.25% of the total stock market capitalization as a group, while in terms of the total number, they represent around 13% of the overall market.

By comparing the lottery stocks with non-lottery stocks (high price, low idiosyncratic volatility and skewness) and other stocks, the lottery stocks are claimed to be the component leading to the underperformance of portfolios and amplifies the investors' behavioural biases. And two factors, the weights of and the holding periods of lottery-type stocks, are considered to impact the performance of portfolios. The degree of underperformance shows an almost monotonically increasing trend with incremental weights of lottery-type stocks. While Kumar mentions the potential role of holding periods for lottery-type stocks, there are fewer specific tests estimating the effect of on the portfolio performance. Vague evidence in this research shows the positive relationship between the level of underperformance and trading intensity.

The outperformance of value stocks compared with glamour stocks are confirmed in the local and global stocks market including America, Canada and Japan. (Basu, 1977; Chan, Hamao and Lakonishok, 1991; Fama and French, 1993; Lakonishok, Shleifer and Vishnu, 1994; Chan and Lakonishok, Athanassakos, 2012.). And this outperformance is consistent throughout the business cycle, regardless the economic conditions (bad times or good times, contraction or expansion, market going down or going up) (Kwag and Lee, 2006). Additionally, the tones of news stories have very few effects on its performance which is understandable because the value stocks generally have a smaller market cap and gain lower attention.

According to the efficient market theories, value stocks achieve abnormal high returns to compensate their exposure to higher risk, and the investors require superior returns to compensate for their high-risk ownership (Fama and French, 1993, 1998). While Vu (1988) confirms that the NCAV stocks on average show above average systematic risk, Athanassakos (2012) claims the value stocks portfolios gain exceptional higher risk-adjusted returns with lower risk which is opposite to the efficient market theories. Yee (2009) argues that the market inefficiency is not the necessary requirement for the existence of mispricing, since there is high possibility that market participants hold heterogeneous beliefs and believe in private information, while the latter factor may differ from individual and institutional investors who are believed to own different level of sophistication and sources of insider information. Therefore, the valuation of the business is influenced and diverged from its fundamentals. And Yee emphasizes that if mispricing is sufficiently large, the deep-value investors who anticipate into buying or shouting of the undervalued assets will unwind their position with excessive returns.

To sum up, investors can obtain a consistently reliable source of high returns by constructing value-oriented portfolios with high valuation related metrics, including high book-to-market (B/M) ratio, earnings-to-price (E/P) ratio, cash flow-to-price ratio as well as high dividend yields. These valuation ratios indicate the market expectation for the company and value stocks are categorized with high valuation ratios because the market predicts their firms to shrink in the future, while for the growth companies, the market holds a high expectation for its future growth and performance. The risk of the portfolio is generally measured by beta, standard deviation, the Sharpe, Treynor and the information ratios are applied to estimate the total risk-adjusted, market risk-adjusted and portfolio-specific risk-adjusted performance which compares the performance of value and growth stocks portfolios, respectively.

As for the deep value investing, Ben Graham in his book *Security Analysis* clarifies a strategy bringing high profits in the early twentieth century which underlying principle

is to invest in the companies trading below its true value. Briefly speaking, the net current asset value (NCAV) strategy is just buying assets whose prices are below the NCAV or 2/3 NCAV of the company (Graham and Dodd,1934; Graham,1976.) The portfolio constructed following the NCAV selection rule is called net-nets portfolio because the value investors only focus on the value of total current assets net of total liabilities and net of preferred stock because the value of liabilities must be real though the value of assets can be doubtful on the balance sheet. According to the NCAV strategy, the long-term fixed and intangible assets are stripped away and only the assets, such as cash, inventories and receivables, which can relatively easier to be converted into cash is considered. Graham demonstrates that the NCAV stocks priced at significant discounts can provide not only protections through the highly conservative measure of the liquidation value of the company, which is the money when the owner gets out of the business, but also remunerative promises to investors with favourable prospects in price and practical evidence of average annual returns.

In the application of deep value investing, it involves at least three steps: the first is to distinguish potentially undervalued stocks by estimating fundamentals, such as book value of equity, firm earnings, cash flow and dividend paying. A lot of investors stop at this stage and find a considerable number of stocks in the market selling below its liquidation value. However, indeed some firms passing the selection test are truly undervalued, while there are companies close to bankruptcy with no-promising future. Therefore, another objective is to distinguish the truly undervalued stocks from companies under risk of liquidation. To make a list of investing bargains, apart from the stock price below liquidation value, undervalued companies can be identified with several attractive statistical characteristics, such as satisfactory current earnings and dividends or a high average earning power in the past. These features indicate the firms are not in the danger of assets dissipation and have formerly shown a large earning power on the market price. And the sign of positive future performance can be perceived from changes in operating policies.

The second step is to measure the intrinsic value of filtered stocks and identify their margin of safety, which is the room for error imprecision, bad luck, or the vicissitudes of the economy and stock market because anything could go wrong (Athanassakos, 2012). Empirical results demonstrate that mispricing may persist for several months and even for years (Ou and Penman,1989; Lee, Shleifer, and Thaler, 1991; Sloan, 1996). And Yee (2008) explains the function of margin of safety is to avoid excessive trading. Besides the market risk, three types of uncertainties and risks confront the deep-value investors. First is the occasional media news which prematurely disrupts her private valuation, and it is uncertain that how precise and reliable the private valuation is, plus the market timing to sell out value stocks which do not meet the selection rule anymore. And the last step is to just buy in the undervalued companies whose stock price is below its intrinsic value. It can be seen that the NCAV strategy is conservative and about being contrarians who are careful with valuation risk and pick stocks with a long-term perspective.

Although there is little research studying into the NCAV strategy originated from almost one century ago, this strategy is still profitable with evidence of exceptional risk-adjusted returns during the time periods 1970 to 2010 (Oppenheimer,1986; Vu,1988; Oxman et al., 2012) These researchers examine the method to construct net-nets portfolios with more consistent returns and the aggregate outperformance of net-nets stocks is found through the whole period, however, there are mixed conclusions about short-term performance and deficient setting to construct NCAV portfolio.

Graham (1973) in his book *Security Analysis t*ests the NCAV rule by buying one share of each of the 85 companies passing selection on 31st December 1957 and hold them for two years and a 75 percent average return is gained from the net-nets portfolio against 45 percent of S&P's 425 companies. And he claims the outperformance of the portfolio for the time period 1927 to 1957. Afterwards, Oppenheimer (1986) test the effectiveness of NCAV rule form the NCAV stock portfolio by arbitrarily choosing

stocks which closing price in November is smaller than two-thirds net current assets value in December from December 1970 to December 1982 and the mean returns of the NCAV portfolio are compared with two benchmarks: the NYSE-AMEX index and the small-firm index. The results show that in general, 13-year risk-adjusted returns of the NCAV portfolio were significantly greater than NYSE-AMEX index by 1.46 percent per month, and small-firm index by 0.67 percent per month. Specifically, the most undervalued group of stocks with the smallest purchase price gain the largest profits, while the outperformance of net-nets is not stable over time with several years of underperformance. Furthermore, the dividend policy of companies is taken into consideration and it is found in the NCAV portfolio, companies with positive earnings but different dividend policy had different performance, and specifically, firms which did not pay dividends outperform than companies paying dividends.

Though the higher average means returns of net-nets during 1970-1982 is confirmed by Vu (1988). However, he argues that the research of Oppenheimer can be biased because his NCAV portfolio may wrongly exclude stocks which meet the NCAV selection criteria in other months rather than December. And for the stocks entering the portfolio in November, there is a possibility that their price is no longer below the NCAV in the month of interest (December).

Additionally, in the setting of Oppenheimer, stocks can be unlimitedly included in the portfolio as long as they meet the NCAV selection rule. However, the systematic risk, beta, can be biased because excess returns are repeatedly reported in the same period. Vu develops the NCAV selection method which includes stocks selling below the liquidation value at any time and each stock can only enter the portfolio only once at the end of each month during the two-year period. However, it ignores a high transaction fee with high frequent transactions of stocks passing selection rule.

More recently, Oxman, Mohanty and Carlisle (2012) emphasises the persistence of NCAV criteria from 1970 to 2010 and conclude the driving factors and firm

characteristics related to the outperformance. It is found that market risk, market liquidity, distress factor and the overreaction factor explain the abnormal returns in deep value investing, in addition to the firms with a lower price per share, lower turnover and lower analyst coverage.

Bildersee, Cheh and Zutshi (1993) test the relaxed NCAV rule which allows the NCAV/ Market Value ratio greater one in the Japanese stock market from 1975 to 1988 and shows that the average market-adjusted return of the net-nets portfolio is about 13 percent per year. Similarly, Xiao and Arnold (2008) study the corporations whose NCAV/MV ratio greater than 1.5 in London market between 1981 and 2005. The NCAV strategy is also profitable in the UK with up to 19.7 percent annual returns.

Research summarizes that market participants can gain profits from net-nets portfolios from turnarounds, takeovers and liquidation. Because markets tend to overestimate the distress costs, managers in the undervalued companies are under the pressure of shareholders and they are expected to take corrective actions to save their companies and establish a higher market price. And acquirers with private information are more likely to identify the undervalued assets and pay value premiums to existing shareholders. Even when the companies are going to bankruptcy, the stocks selling below its liquidating price promises the leftovers distributed to equity holders because the fixed assets to pay off all creditors are not considered in the calculation.

3. Datasets and Methodology

The research period is from 1st January 1970 to 31st December 2017 and we gather general information in American stock market such as monthly stock return, price and the number of shares outstanding from the Centre for Research on Security Prices (CRSP) and annual accounting data are from COMPUSTAT.

Considering previous research only claims the underperformance of lottery stocks from 1991 to 1996, we test the aggregate performance of lottery stocks in a long-run. And the performance of net-nets stocks is also tested in the expanded period between 1970 and 2017. All standard common CRSP stocks traded on the NYSE, AMEX and NASDAQ with the share code of 10 or 11 are included. Because we focus on the American stock market, only the common stocks are kept and the ADRs, foreign companies traded in the U.S. market, are excluded.
Considering the characteristics of net-nets stocks, financial institutions, resources and energy sectors are excluded from CRSP stocks, and the selection of lottery-type stocks is consistent with this filter.

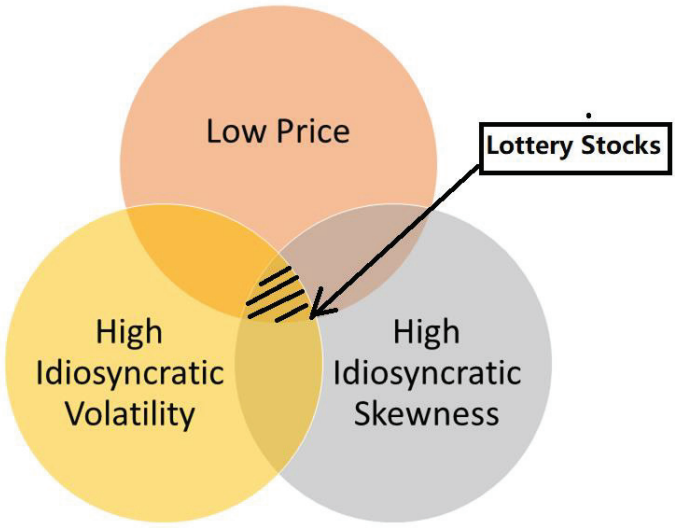
The monthly stock return is adjusted for delisting to avoid survivorship bias according to Shumway (1997), and the potential effects of liquidation, merger and acquisition are also examined in the following research. Stock returns with dividends are adjusted for stock repurchases, stock splits and rights issues.

To analyse the portfolio performance and identify net-nets stocks, we compute the market capitalisation at time t by multiplying the number of shares outstanding and share price. There are cases when the same firm has two or more securities at the same date. Thus, we aggregated all market capitalisation for a given company, date. This aggregated market capitalisation will be assigned to the firm with the largest Market capitalisation.

To detect lottery-type stocks, three criteria, low price, high idiosyncratic volatility and high idiosyncratic skewness, are applied independently. The idiosyncratic volatility and skewness at the end of month t are measured using previous six months of daily return data (month *t-6* to *t-1*). Specifically, the Fama - French Three-factor and momentum factor (*FF3M*) model is employed with monthly time series data from Kenneth R. French's data library. Following Ang, Hodrik, Xing and Zhang (2006), the idiosyncratic volatility is the standard deviation of the residuals from the four-factor regression with previous 180 days daily return data. The estimates of idiosyncratic volatility start in May 1969 and the idiosyncratic volatility in month *t-1* is matched to month *t* returns from June 1969 to December 2017.

Additionally, the stock-specific skewness is calculated with daily stock returns by fitting a two-factor model where the two factors are the excess market returns and the squared excess market returns (Harvey and Siddique, 2000).

The cheap stocks are identified as the lowest price in kth percentile with k=50 at the end of month *t-1*. Though Kumar states that results are similar when k equals to 50 or 33, I find a significant difference in my test. As for the high idiosyncratic and high volatility sorts, we keep the k equal to 50 percentiles. Therefore, the lottery-type stocks are supposed to occupy around 12.5 percent by number (=50%*50%*50%) in the market.



The stocks which meet the NCAV criteria takes two rounds of netting from current assets, hence the term “net-nets”. The sort for the NCAV stocks are intuitive and straightforward- identify stocks which NCAV exceeds their market capitalisation (MktCap). To calculate the NCAV, balance sheet statistics including total current assets, total current and long-term liabilities and preferred stocks are collected from COMPUSTAT. What should be noticed in the selection is that the scale of the number of shares outstanding in the CRSP is thousand, while the statistics computed from the COMPUSTAT is in million unit. The scale is unified to the unit of million to avoid biases.

Oppenheimer (1986) form the NCAV stock portfolios by arbitrarily choosing stocks which closing price in November is smaller than two-thirds net current assets value in December from December 1970 to December 1982. Though their result of higher average means returns in net-nets stocks is confirmed by Vu (1988), Vu argues that the research of Oppenheimer can be biased because his NCAV portfolio may wrongly exclude stocks which meet the NCAV selection criteria in other months rather than December. And for the stocks entering the portfolio in November, there is a possibility that their price is no longer below the NCAV in the month of interest (December). Additionally, in the setting of Oppenheimer, stocks can be unlimitedly included in the portfolio as long as they meet the NCAV selection rule. However, the systematic risk, beta, can be biased because excess returns are repeatedly reported in the same period. Vu develops the NCAV selection method which includes stocks selling below the liquidation value at any time and each stock can only enter the portfolio only once at the end of each month during the two-year period. However, it indicates a high transaction fee with high frequent transactions of stocks passing selection rule. Oxman et al. (2012) discount net receivables and inventory by 0.75 and 0.5, respectively.

Here we directly sum up all liabilities and preferred stocks and subtracted them from firms’ total current assets. There are different approaches to compute the NCAV. The

monthly stock returns, stock prices, number of shares outstanding and SIC are obtained from the CRSP, and the return is adjusted by delisting. The annual accounting data, including total asset value, the value of preferred stock and the value of the total liability, are gathered from the COMPUSTAT to compute the NCAV.

$$NCAV = Total\ Current\ Assets - Total\ Liabilities - Preferred\ Stock \qquad [eq1]$$

We form the net-nets portfolios at end June year *t* and match with NCAV in June of last year *t-1* to avoid look-ahead bias. There is a twelve-month lag between the market capitalisation and NCAV which is to ensure related information is accessible for investors even in the case of delay in publication. Both equally-weighted and value-weighted are formed to analyse the performance and for the net-nets stocks, the equally-weighted portfolio is expected to outperform the value-weighted because value weighting represents the antithesis of a value focussed strategy, in particular, it would mean buying more as the margin of safety declined.

4. Discussion

We compare the frequency of stocks in each portfolio (Table 1; Figure 1). It can be found that the number of lottery stocks which occupies around 13 percent of the aggregate market is much more than the stocks sifting by NCAV strategy. Specifically, the total number of lottery-type stocks in the full sample through the observing period is 13761 and the total number of net-nets stocks is 3035, respectively. The overlapping part, which is the net-nets stocks sifted by lottery characteristics have 1552 stocks and there are 2302 net-nets stocks without lottery characteristics and 13645 lottery stocks failing to pass the NCAV selection.

According to descriptive statistics (Table 2), net-nets stocks are generally value stocks in small or micro companies with small market-to-book ratio, especially for the NCAV stocks with lottery characteristics which have smallest mean and median ratios. Lottery

stocks are relatively glamour stocks in small firms, though the average sizes of companies in lottery portfolios are larger than net-nets stocks, with high growth prospects and negative net current assets value. And we find stocks with lottery characteristics tend to have negative earnings during observing period. While the lowest average and median price fall in to the overlapping portfolio of net-nets stocks and lottery stocks, the differences in price between it and other portfolios are not as significant as we assume. Additionally, net-nets stocks with lottery characteristics are less volatile than others and have more positive right-tail skew than other net-nets stocks.

By comparing the alphas of FF3M model, we find that firstly, the net-nets stocks show an aggregate outperformance in both equally and value weighted portfolios in observing years (Table 4); Secondly, the lottery-type stocks are discovered to underperform in the value-weighted portfolio within the 48-year period which is consistent with the conclusion of Kumar (2009); Thirdly, alphas of net-nets portfolios drops if removing lottery stocks no matter when equally and value weighted, though removing net-net stocks from the lottery portfolio makes little difference; What is the most important is the alphas of net-nets stocks are almost doubled after applying a secondary lottery stock filter, with the monthly 2.3% for EW portfolio and 0.4% for VW portfolio. And it is confirmed that the equally-weighted portfolio outperforms the value-weighted for portfolios with NCAV stocks (Table 3).

Interestingly, the small-firm factor, in comparison with insignificant value factor, is extremely significant in the net-nets portfolio. The heavy and consistent loads on the size factor in portfolios with net-nets stocks indicates that though the NCAV strategy is originated as the deep value investing method, the profitable key is a small capitalisation strategy.

To explain the abnormal excess returns in the net-nets portfolio sifter by lottery

characteristics, we undertake an analysis of how stocks exit the various portfolios so as to compare the incidence of corporate turnaround, acquisitions and liquidations in the various categories and we argue three catalysts might be the trigger for the value realisation: firstly, takeovers can reward investors because sophisticated acquirers with private information understand the true value of NCAV companies and they spot the chance of merging assets with cheap price, therefore, existing shareholders are paid with premiums through merger and acquisitions. Secondly, the market may overestimate the probability of distress due to representativeness and narrow framing bias and causes the selling price of net-nets stocks below its liquidation value. Management under the pressure will try to improve operating performance of undervalued companies and brings a promising prospect to the shareholders. Thirdly, even though net-nets company enter liquidation stage, the residual asset value is enough to pay off all creditors and equity holders can be distributed with leftovers. We will analyse the possible influence of catalysts on the NCAV effects with lottery characteristics, and the potential negative effect brought by cash burn, losses on receivables, obsolete inventories booked at greater than true value and costly liquidation will also be considered. And we find that there are little differences between the status of stocks among five portfolios: over 40 percent stocks in each portfolio are dropped in the end of period; around 30 percent companies are merged and the proportions are higher in the portfolio with lottery characteristics; and we are surprised to find that fewer stocks show turnaround in the overlap portfolio which outperform any other portfolios. (Table 3)

5. Future work plan

It is very inspiring to find that net-nets stocks with lottery stocks obtain significantly high returns which even outperform the aggregate net-nets portfolio. We next will analyse whether the outperformance is consistent in consecutive periods, which is also to examine the potential effect of the business cycle. Besides, we plan to extend the value-based analysis to include more standard value-based multiples, such as book to

market and price to earnings ratios. Doing so would allow us to use two-dimensional portfolio sorting across the entire group of lottery stocks rather than just focussing on those which are net nets

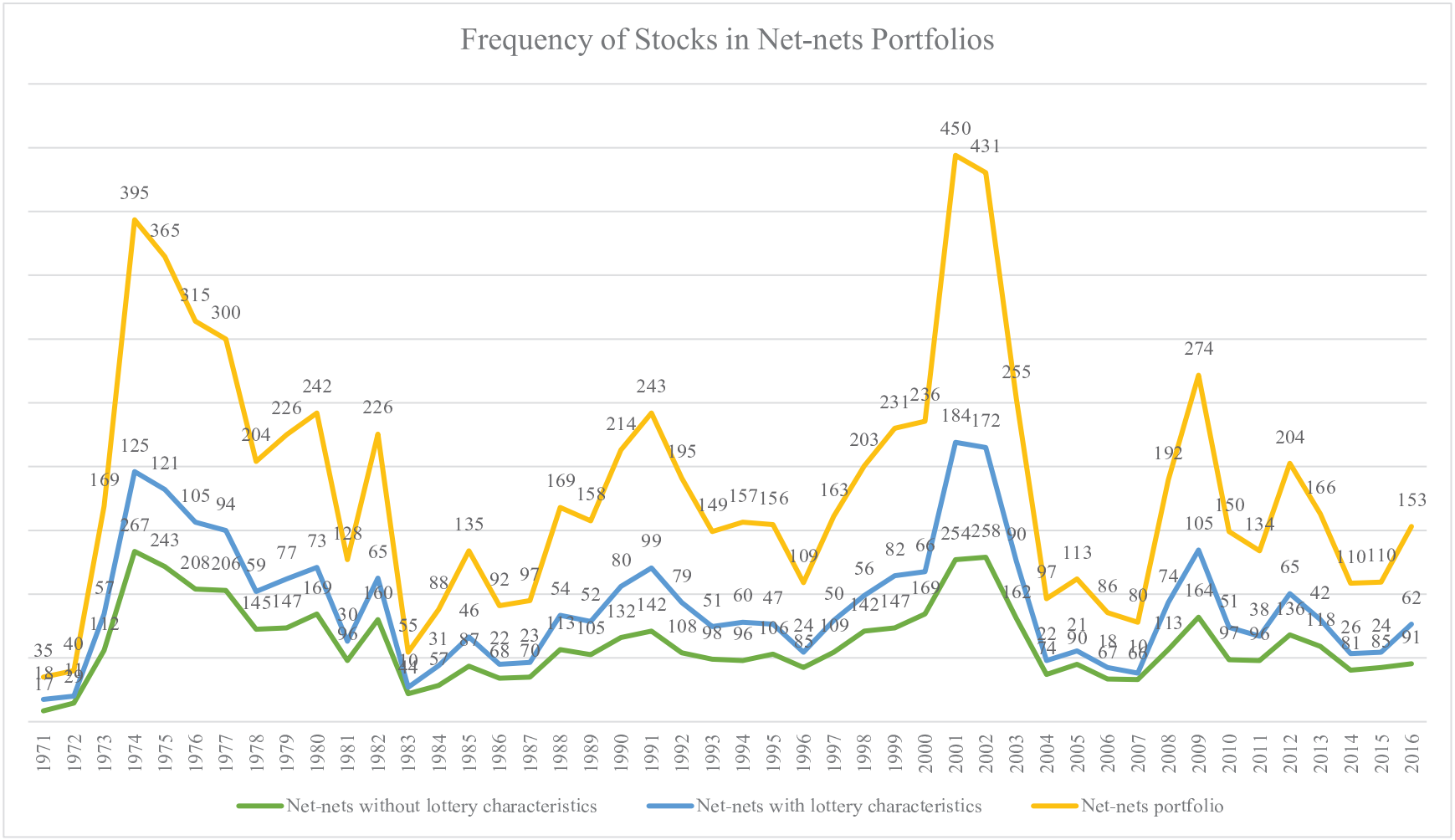
We carry out tests for statistical differences in firm fundamentals between portfolios with a view to looking at differences in fundamental risk exposures. We aim to figure out whether the outperformance we find looks to be driven by risk, behavioural factors or a combination of both. Several other risk factors and firm features may also explain the difference in performance and the reason for undervaluation. It is clear that many of those stocks in the overlapping portfolio are micro-caps. Therefore, I plan to undertake an analysis of the liquidity issues, more specifically, by examining trading costs and price impact with the measure of liquidity by the number of zero volume days, bid-ask spreads and Amihud price impact.

And we will investigate the relation between small firm effect and the outperformance of net-nets portfolios by using size-control portfolios. If the return premium decreases or even disappear after controlling for size, it might be the evidence to explain the abnormally high returns of NCAV strategy. And the cheap stock price may also be one of explanation for the outperformance, so the price stratification will be applied on portfolios. Though the lottery-type stocks relate to state lotteries by their salient features that lottery investors and lottery players expect to bet a low cost for a huge return in the future, the stock price might be just relatively lower than average, but still higher than its true value or have a limited margin of safety. Additionally, the NCAV stocks require time to realize returns but lottery investors may transact frequently in the cost of high transaction fees and low returns.

By far, we only focus on the U.S. stock market but neglect that there is a gap of worldwide analysis about NCAV strategy. In the further research, we will look into the performance of NCAV strategy with lottery characteristics across countries and try to gain a deeper and more elaborate understanding about the mechanism of different

performance in lottery stocks and NCAV stocks as well as the relationship between deep value investing strategy and small-cap strategy. Beyond that, this study will provide a straightforward and intuitive strategy to investors, especially individual investors who might be less sophisticated to gain high profits in s the stock market.

Figure 1. Frequency of stocks in each portfolio by Portfolio Formation Year



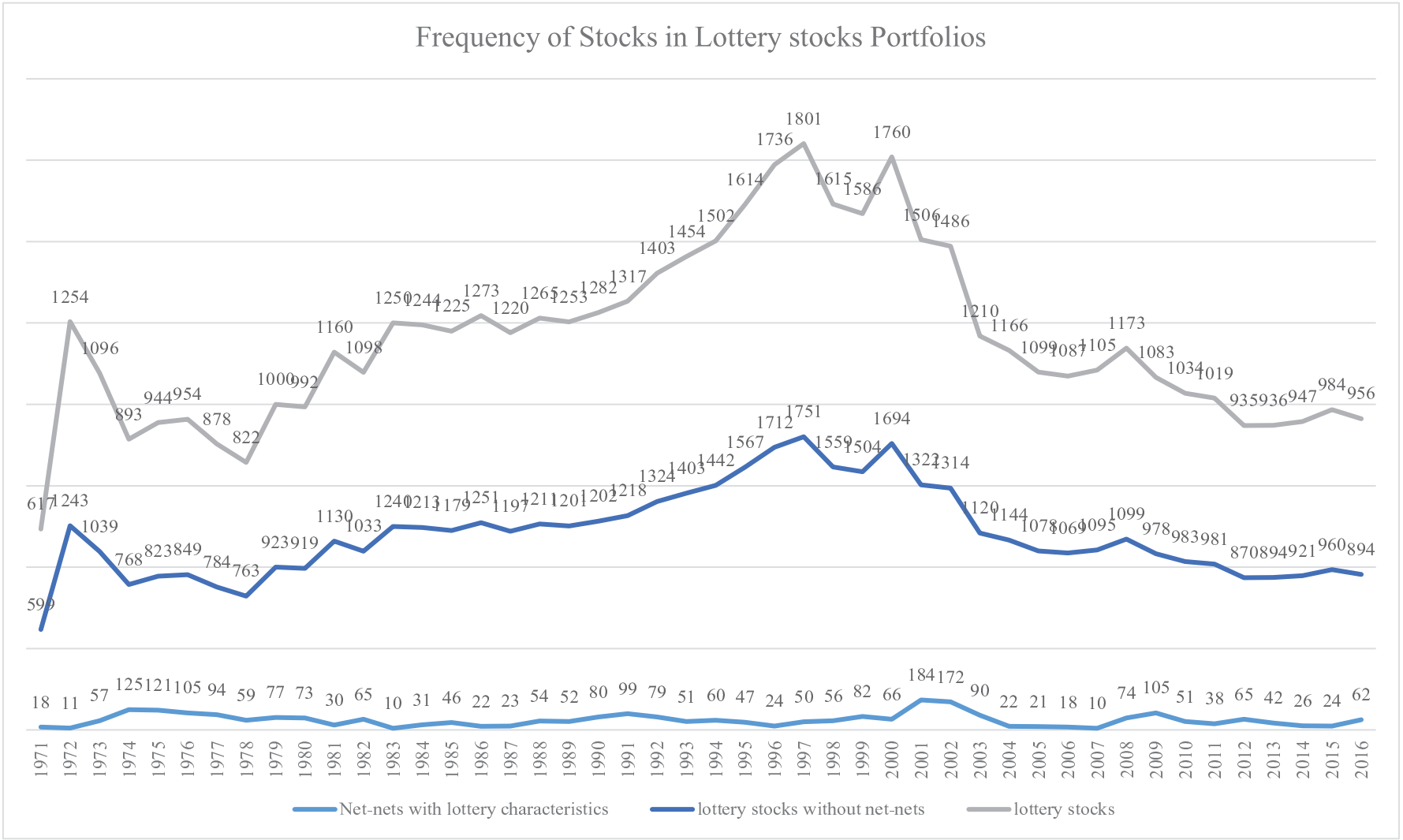

Frequency of Stocks in Lottery stocks Portfolios
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016
Net-nets with lottery characteristics
lottery stocks without net-nets
lottery stocks

Table 1. Frequency of stocks in each portfolio by Portfolio Formation Year

Portfolio formation year	Net-nets portfolio	Net-nets with lottery characteristics	Net-nets without lottery characteristics	lottery stocks	lottery stocks without net-nets
1971	35	18	17	617	599
1972	40	11	29	1254	1243
1973	169	57	112	1096	1039
1974	395	125	267	893	768
1975	365	121	243	944	823
1976	315	105	208	954	849
1977	300	94	206	878	784
1978	204	59	145	822	763
1979	226	77	147	1000	923
1980	242	73	169	992	919
1981	128	30	96	1160	1130
1982	226	65	160	1098	1033
1983	55	10	44	1250	1240
1984	88	31	57	1244	1213
1985	135	46	87	1225	1179
1986	92	22	68	1273	1251
1987	97	23	70	1220	1197
1988	169	54	113	1265	1211
1989	158	52	105	1253	1201
1990	214	80	132	1282	1202
1991	243	99	142	1317	1218
1992	195	79	108	1403	1324
1993	149	51	98	1454	1403
1994	157	60	96	1502	1442
1995	156	47	106	1614	1567
1996	109	24	85	1736	1712
1997	163	50	109	1801	1751
1998	203	56	142	1615	1559
1999	231	82	147	1586	1504
2000	236	66	169	1760	1694
2001	450	184	254	1506	1322
2002	431	172	258	1486	1314
2003	255	90	162	1210	1120
2004	97	22	74	1166	1144
2005	113	21	90	1099	1078
2006	86	18	67	1087	1069

2007	80	10	66	1105	1095
2008	192	74	113	1173	1099
2009	274	105	164	1083	978
2010	150	51	97	1034	983
2011	134	38	96	1019	981
2012	204	65	136	935	870
2013	166	42	118	936	894
2014	110	26	81	947	921
2015	110	24	85	984	960
2016	153	62	91	956	894

Table 2. Descriptive Statistics

Portfolios	Market Capitalization		NCAV		MktCap/ NCAV		Book Value		Market /Book Ratio	
	Mean	**Median**	**Mean**	**Median**	**Mean**	**Median**	**Mean**	**Median**	**Mean**	**Median**
Net-nets stocks	61.0917	10.6378	181.6815	17.5300	0.6368	0.6852	9.3315	5.9546	9.7371	1.8550
Net-nets without lottery characteristics	79.9561	12.3273	253.1535	21.6585	0.6079	0.6605	10.9369	6.8463	11.2577	1.7867
Net-nets with lottery characteristics	21.7894	8.0448	32.6996	12.6630	0.6969	0.7166	5.9949	4.6740	6.5764	1.9976
Lottery stocks	165.1455	28.9590	-80.9559	1.6990	8.09E+12	1.4038	3.6170	2.4273	87.0493	2.6707
Lottery stocks without net-nets	174.4903	31.6563	-88.5818	1.2035	8.64E+12	1.6596	3.4617	2.2890	92.3186	14.3568

Table 2. Descriptive Statistics

Portfolios	Earnings		Price		Idiosyncratic Volatility		Idiosyncratic Skewness	
	Mean	**Median**	**Mean**	**Median**	**Mean**	**Median**	**Mean**	**Median**
Net-nets stocks	57.9465	0.4080	4.9979	2.0000	3.5216	3.4100	0.5128	0.4254
Net-nets without lottery characteristics	89.4961	0.7950	6.1100	2.0000	3.2096	2.9415	0.4897	0.4208
Net-nets with lottery characteristics	-7.7392	0.0100	4.1715	4.3470	2.2410	2.0000	0.5608	0.4373
Lottery stocks	-13.5160	-0.2170	5.5453	4.0000	3.8777	3.9690	0.6367	0.5174
Lottery stocks without net-nets	-13.8925	-0.2340	5.7190	4.1250	3.8586	3.9405	0.6424	0.5223

Table 3. Status of stocks in portfolios

Status	Net-nets		Net-nets without lottery		Overlap		Lottery		Lottery without net-nets	
	Frequency	Percent	Frequency	Percent	Frequency	Percent	Frequency	Percent	Frequency	Percent
Active: Still in Portfolio	83	1.00%	57	1.04%	26	0.92%	814	1.71%	761	1.69%
Active: Turnaround	1527	18.36%	1104	20.06%	423	15.02%	9765	20.49%	9311	20.74%
Liquidations	157	1.89%	108	1.96%	49	1.74%	345	0.72%	301	0.67%
Mergers	2679	32.20%	1708	31.04%	971	34.48%	16740	35.13%	15772	35.12%
Dropped	3518	42.29%	2254	40.96%	1264	44.89%	19304	40.51%	18163	40.45%
Exchange	355	4.27%	272	4.94%	83	2.95%	682	1.43%	596	1.33%

Table 4. Performance comparison

Net-nets portfolio	**Equally Weighted Portfolio**						
	Dependent Variable	Type	Alpha	Mktrf	SMB	HML	UMD
	ewxsret	Coefficient	0.012837	0.777097	1.095227	0.107334	-0.346717
	ewxsret	T-Stat	7.539556	19.56616	19.80167	1.777156	-8.910788
	Value Weighted Portfolio						
	vwxsret	Coefficient	0.002723	0.864796	0.736937	0.114057	-0.150558
	vwxsret	T-Stat	1.998496	27.20594	16.64744	2.359556	-4.834628
Lottery portfolio	**Equally Weighted Portfolio**						
	Dependent Variable	Type	Alpha	Mktrf	SMB	HML	UMD
	ewxsret	Coefficient	0.001324	1.040829	1.440262	0.054312	-0.369917
	ewxsret	T-Stat	0.746738	25.40099	25.01684	0.864728	-9.124926
	Value Weighted Portfolio						
	vwxsret	Coefficient	-0.020146	1.261609	1.275081	-0.033697	-0.452905
	vwxsret	T-Stat	-12.9673	35.05172	25.25261	-0.612822	-12.76456
Overlap	**Equally Weighted Portfolio**						
	Dependent Variable	Type	Alpha	Mktrf	SMB	HML	UMD
	ewxsret	Coefficient	0.022947	0.821466	1.479821	-0.010849	-0.39177
	ewxsret	T-Stat	7.702978	11.90761	15.24539	-0.103181	-5.75342
	Value Weighted Portfolio						
	vwxsret	Coefficient	0.004243	0.919892	1.482635	0.062067	-0.33524
	vwxsret	T-Stat	1.689228	15.81433	18.11517	0.700073	-5.838888
Net-nets & no lottery	**Equally Weighted Portfolio**						
	Dependent Variable	Type	Alpha	Mktrf	SMB	HML	UMD
	ewxsret	Coefficient	0.007766	0.758093	0.872029	0.163144	-0.320049
	ewxsret	T-Stat	5.024256	21.02486	17.36635	2.975363	-9.060207
	Value Weighted Portfolio						
	vwxsret	Coefficient	0.002461	0.850052	0.610528	0.121666	-0.108196
	vwxsret	T-Stat	1.746229	25.85806	13.33593	2.43376	-3.35948
Lottery & no net-nets	**Equally Weighted Portfolio**						
	Dependent Variable	Type	Alpha	Mktrf	SMB	HML	UMD
	ewxsret	Coefficient	0.000279	1.052046	1.435186	0.057119	-0.365251
	ewxsret	T-Stat	0.157263	25.66766	24.9218	0.909165	-9.007343
	Value Weighted Portfolio						
	vwxsret	Coefficient	-0.020531	1.265951	1.271082	-0.0352	-0.45448
	vwxsret	T-Stat	-13.15942	35.02491	25.06785	-0.637473	-12.75524

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