The Price of a Vote: Modern Portfolio Theory and Diversification in Early 18th Century English Stock Markets*

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October 4, 2012

Abstract

The secondary market in shares of trading companies grew rapidly in volume of trades and individuals involved as the market evolved in the early 18th century. Investors used the market for shares to diversify their wealth and holdings from traditional instruments such as land and mortgages, and once having reached a certain level of investment, were eligible to vote and serve on the board of the trading companies, a powerful and important position. In this paper, we explore the opportunity cost of consolidating wealth in a single asset in order to vote, which would preclude many investors from diversifying away idiosyncratic risk in the market. Using prices from 1716-1723, we show how individual investors' failed to diversity their holdings within the market for shares as predicted by modern portfolio theory, taking on additional risk to do so. We calculate the price of a vote in company proceedings by quantifying the increased riskiness of holding shares in a way that does not reflect the "optimal portfolio" by modern investing standards. We find that, for most companies, holding a block of shares in a single company resulted in 8-13 basis points lower risk-adjusted returns, or 10-20% of annualized returns, while the South Sea Company actually offered superior risk-adjusted returns to a CAPM style index.

Keywords: Finance, Financial History, Economic History

*Preliminary and incomplete. Please do not cite. We thank Ann Carlos and Larry Neal for the use of data collected.

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1 Introduction

By the early 18th century, it was possible for anyone with the requisite capital to become part owner in one of the joint-stock, limited liability trading companies. A secondary market in shares was well established in England by the end of the 17th century such that those unable to or unwilling to buy initial offerings of shares could obtain the rights to ownership–and with enough investment, rights to vote or sit on the Board of Directors–of a number of publicly traded companies. Financial broadsheets were published at least biweekly and prices posted outside trading centers such as Jonathan's and Garroway's coffeehouses, providing potential investors with full information on the prices of various assets and at least the theoretical ability to determine returns, risk, and variance associated with investment.

Despite the relative sophistication of the market and transparent pricing, diversification–a pillar of modern portfolio theory–was rarely sought as a means of minimizing idiosyncratic risk in purchasing financial instruments (Carlos, Fletcher and Neal 2012). Reasons for this are unclear and have been hypothesized to stem from any number of shareholder concerns. Carruthers (1996) posits that the political leanings of certain companies could have contributed to shareholder concentration in those firms aligned with more Whig or more Tory interests. In contrast, Carlos, Fletcher and Neal (2012) suggest that the fact that investors failed to diversify among the various available assets was a result of shareholders attempting to own enough shares to earn a vote in company proceedings or the eligibility to sit on the board.

These two explanations are in fact, linked, as the ability to vote in company proceedings was an expression of political power. Gaining a voice in proceedings or the ability to serve on the board also meant that, in at least a limited way, one could steer the company's direction to be in line with the voter's favored party or commercial interests. Carruthers'

explanation relies on networks of buyers and sellers and loses explanatory power in the face of an established and transparent secondary market with few restrictions on who could invest. Even women, who were traditionally less likely to venture out to the coffeehouses, could enlist a surrogate, jobber, or broker to buy and sell on their behalf, and were thus well-represented in the market (Carlos, Fletcher, and Neal, 2012).

In either case, modern portfolio theory suggests that investors would pay a premium in terms of increased risk, and possibly in decreased returns, by not holding a diversified portfolio. Modern portfolio theory dictates that in order to protect an investor against idiosyncratic risk–though not systematic risk–shares should be purchased in multiple companies whose fortunes are not necessarily linked (Markowitz 1952). We calculate that the approximate price of a vote, in terms of lost annualized returns averaged over the period 1716-1723 is between 10 and 20%, depending on the asset considered and the time period. We consider this paper a first pass at examining the returns to various portfolios in the early 18th century and hope to shed some light on how investors used the market. Ex ante, we know that investors engaged in very little diversification within the stock market during this time period (Carlos, et.al., 2012).

We use modern portfolio theory to determine the foregone returns to diversifying as the approximate premium paid for the right to vote in company proceedings. Most investors during the time period 1716-1723 were unlikely to hold more than one asset, but often held many shares of those assets (Carlos, et.al., 2012). Thus, we examine each asset and various measures of its risk as an entire portfolio and compare it to a market capitalization index.

The wealth of an investor is also an important constraint in assessing the number of shares any individual would buy. The amount of capital necessary to obtain a vote in a particular company is, of course, highly dependent on the price. During the time period for

which we have data–around the South Sea Bubble–, for example, the price at which shares were trading in the South Sea Company was 10 times higher than the prices at which shares were trading in the Royal African Company.

We present a simple model under which an individual investor faces the choice to purchase one or more stocks. We create a market capitalization index of the stocks an investor could purchase during the period 1716-1723 using prices compiled from John Castaing's *Course of the Exchange*. This is also approximately the period for which we have investor data on purchases and sales of shares. These data are explored in more depth in Carlos, et. al., (2012). We refer to those findings and highlight particular examples of investors who diversified and who did not, for illustrative purposes.

In order to determine the relative worth of purchasing a block of shares in a single company versus diversifying in the "optimal manner" as prescribed by the CAPM method, we regress the daily returns of each asset on the index return. Classical finance textbooks require that the risk-free return be subtracted from the individual and index returns. Here, we assume that the risk-free return is zero. This is both for simplicity and the apparent lack of a risk-free asset in the class of financial assets.

This paper is structured as follows. In Section **??**, we explicate the voting rules for the class of assets available in the 18th century burgeoning English stock market. In Section **??**, we explain the data used and present descriptive statistics. Section **??** outlines a simple model of portfolio choice, while Section **??** delves further into portfolio construction, calculation of financial betas and alphas, and measurements of risk, while Section **??** holds findings. Sections **??** and **??** discuss and offer conclusions and avenues for further research.

2 Background

The shareholding rules that governed each company's voting provided an incentive for investors with sufficient wealth to consolidate their shareholding in a single asset. Most investors during this time period only held one asset. While we do not explore whether the voting rules definitively caused investors to consolidate their shares in a single company, the voting rules did provide a non-pecuniary benefit to purchasing large blocks of shares. The voting rules are described in more detail below.

It is important to note that the face value of a share, £100, was not a trivial sum of money during this time period. The PPP value of £100 in 2010 is close is £12,000, or almost half of Britain's 2010 GDP per capita[1]. Purchasing five shares of one of these assets to gain a vote, even when the prices were much lower than the face value, was still an expensive undertaking and limited to those with substantial assets.

Each joint-stock company was run by an elected subset of shareholders called the Court of Assistants -or in modern parlance, a Board of Directors. Eligibility to vote for or to be elected to the Court, or to be Governor or Deputy Governor, was conditional on owning a specific face-value of shares, as laid out in the company charter. In the 1690s, a person had to own at least five shares or a £500 face value block of shares to vote in the annual election. This increased to £1000 face value for many companies by the second decade of the eighteenth century. If a shareholder wanted to be elected to the board of directors or the Court of Assistants, or to be Governor or Deputy Governor, he had to own at least £1500 to £2000 book value of shares to be a Board member and up to £4000 face value to be elected governor/deputy governor. Each company closely monitored share ownership to ensure eligibility. These rules meant that companies were governed and monitored by their

[1] 2010 values calculated using www.eh.net's "How Much is That?" tool.

own shareholders, ameliorating the principal-agent problem that might arise with salaried managers.

For some companies, the face value of shares owned determined the number of votes a shareholder could cast. Not all companies had a "one shareholder one vote" rule. The East India Company, for instance, allowed one vote per specified block of shares held. With the amalgamation of the Old and New East India companies in 1708, an upper bound was placed on the number of votes. Shareholders now needed to own £1000 face value for one vote to a maximum of ten votes with £10,000 face value of shares owned. Concerns over engrossing the stock h led to a one-person one-vote rule in the Bank of England charter. But a shareholder needed to own a face value of £500 of stock to vote, £2000 face value to be a director and £4000 face value to be elected Governor. The South Sea Company required a face value of £1000 stock to vote, with two votes for 3000 face value to a maximum of four votes with £10,000 face value owned. £3000 face value was required to be elected to the Board of Directors (Scott, vols 2 and 3). Thus the voting rules in their various manifestations created an incentive to own blocks of shares in a single company as we see in the transfer activity in table 9 and would reduce diversification of an individuals share portfolio.

3 Data

We exploit two relatively unused data sets that contain information on financial transactions from the early 1700s in the nascent English stock market; John Castaing's *Course of the Exchange* and collected information on transactions and holdings of English stocks around the time of the South Sea Bubble.

Price information reported by John Castaing's *Course of the Exchange* was accessed through the European State Finance Database, which has the daily trading prices of six

Table 1: Correlation Matrix for Daily Returns, 1719-1724

	South Sea	Million Bank	BofE	RAC	EIC	Index
South Sea	1					
Million Bank	0.586	1				
Bank of England	0.618	0.819	1			
Royal Africa Company	0.370	0.344	0.364	1		
East India Company	0.692	0.792	0.908	0.361	1	
Index	0.974	0.708	0.776	0.417	0.826	1

stocks beginning in 1698.[2] Castaing's financial broadsheets were published twice weekly during this period with the prevailing prices of the limited-liability joint-stock companies available for sale on the secondary market. Figure **??** shows the daily prices of six stocks from September, 1698 to the end of 1736. The South Sea Bubble is clearly seen right of center in 1720. Prices for the Royal African Company Engrafted stock, which traded at a price below that of the Senior stock, were only available for the year 1720.[3] Each broadsheet contained the previous three days' prices. They were available for delivery and were posted in the coffeehouse of Jonathan's and Garroway's coffeehouses in Exchange Alley, London, where many of the secondary trading transactions took place (Neal, 1988).[4]

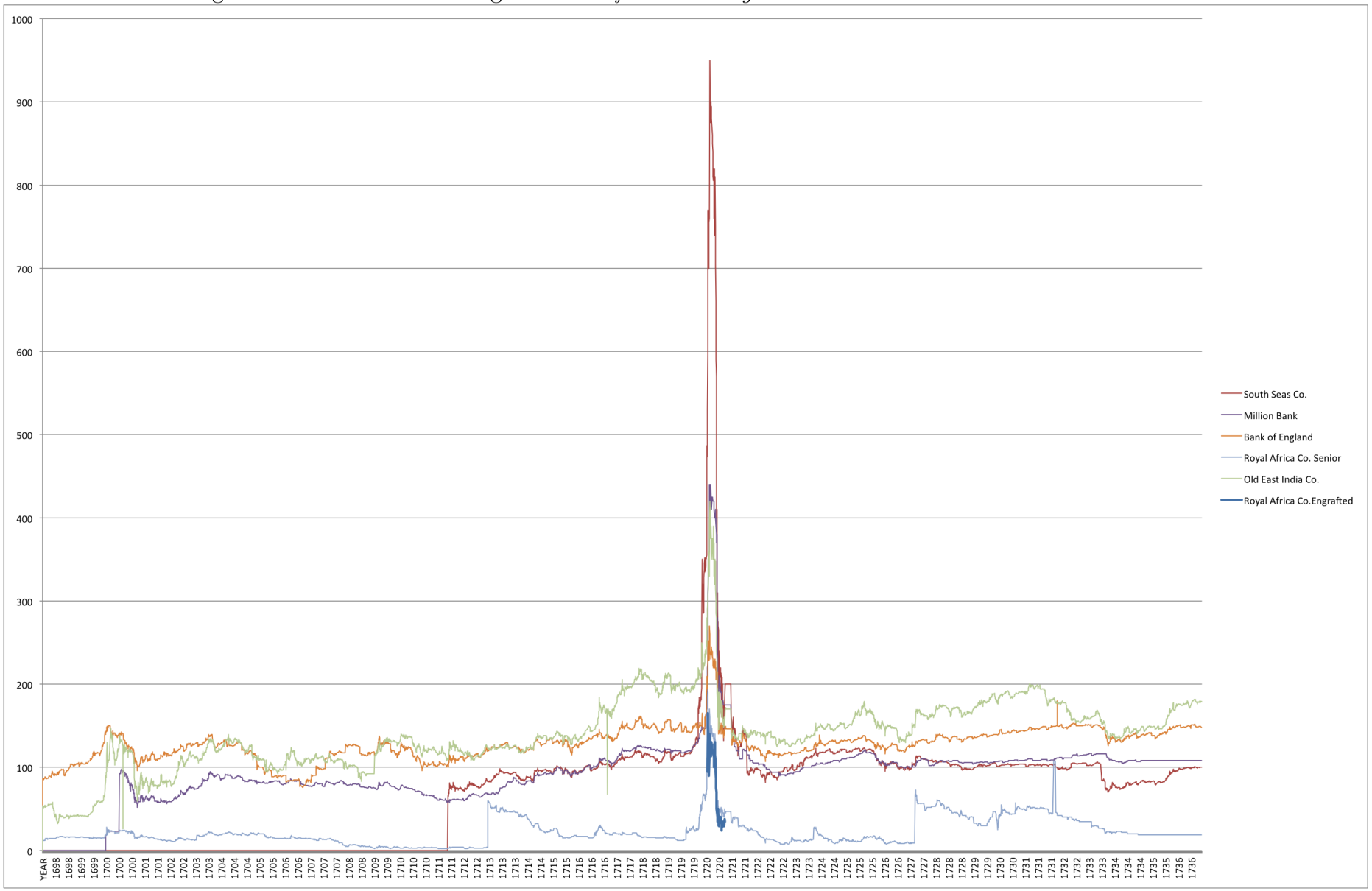
For each of these assets, we calculate daily returns and create an index to represent the return of an optimized portfolio. Given the significant volatility of prices and overwhelming effect of the South Sea Bubble in the year 1720, returns on the five assets analyzed are all positively correlated, though some more strongly than others (See Table **??**). The South Sea Company represents the largest share of the index, and thus its return is most highly correlated with the index $\rho = 0.974$.

[2]These prices were collected and digitized by Larry Neal and are not available at http://esfdb.websites.bta.com/.

[3]We do not include RAC engrafted in the index at this time.

[4]These prices do not include dividend information, so returns are calculated without taking into account dividends. Dividends are available in Scott (1950).

Figure 1: Prices from Castaing's *Course of the Exchange*. Six Stocks 1698 to 1736



4 Model

Here, we elaborate a simple model of portfolio choice whereby the investor may choose to invest all of his wealth (or all of the wealth he intends to put in the market) into a single asset in order to earn a vote or a seat on the board, or invest in some diversified portfolio. The diversified portfolio, in theory, could consist of any combination of assets. Our method for determining an optimal portfolio are discussed in detail below.

We follow the model set up by Merton (1973), adding an additional variant, the vote. Investors maximize their utility through maximizing return and minimizing risk. In our model, investors would rather have a vote than not have a vote, so for any given level of return and risk, a portfolio providing the investor with the ability to vote in company proceedings, ceteris paribus, offers more utility. We do not distinguish between the relative value of a vote in one company versus another. While it may be argued that political affiliation of the investor and the company's political leanings could interact to provide more or less utility to the investor, we do not have information on the investors' political affiliations. In addition, we assume the following:

1. An investor's utility is increasing in returns;

$$\frac{dU}{dR_i} > 0 \tag{4.1}$$

2. decreasing in risk;

$$\frac{dU}{drisk_i} < 0 \tag{4.2}$$

3. and strictly greater for a portfolio that grants a vote than one that does not.

$$\frac{dU}{dvote_i} > 0 \tag{4.3}$$

5 Methods

5.1 The Diversified or Optimal Portfolio

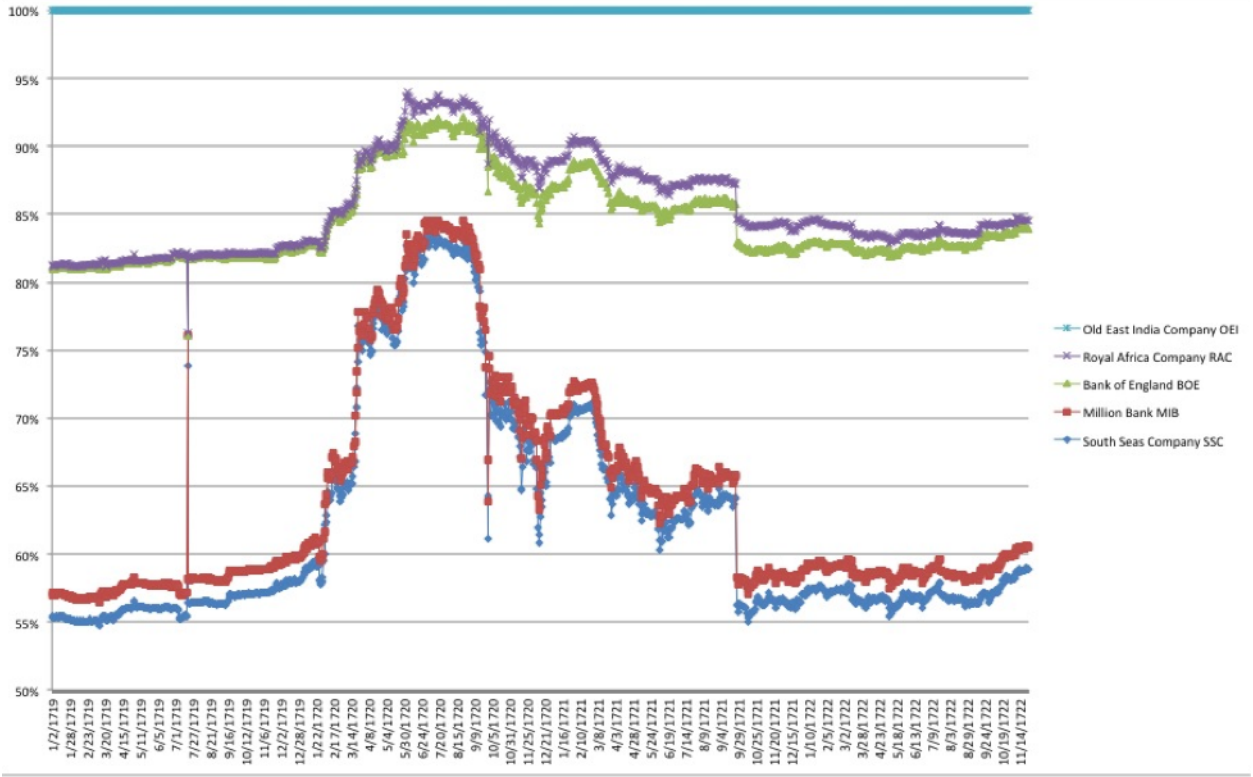
In order to create an optimal portfolio, we create a diversified index using the Market Capitalization method using prices and available shares of each of the five assets for which we have pricing information (Merton, 1973). This is an approximation of the current-day S&P 500 in the sense that we calculate the proportions using market capitalization (CAPM) and make the (perhaps very heroic) assumption that the returns on the index represent the best that one could do by buying a variety of any assets, not just financial assets. The S&P 500 is believed to account for the returns in all assets, including land, bonds, and other assets not included in the list, but closely linked to it or some element of it. From this, we assume that the index created diversifies away all idiosyncratic risk of individual elements of the index.

5.2 Index Construction

The role of each company in the index, or it's weight W_i, is the ratio of the market capitalization of the company, given by the multiplication of daily price by the capital stock, divided by the sum of the market capitalizations of all companies in the index (see Equation **??**). The index return is then calculated by the sum of weighted historical return on the asset given by the daily change in price multiplied by the asset's weight in index. Once the index is constructed, and using traditional arguments for efficient portfolios constructed as broad based indexes as a good proxy for all available choices for capital, we estimate asset returns using a CAPM regression, where the regression coefficient β_i takes the role of a systematic risk scaling factor for each asset.

$$W_i = \frac{P_i Cap_i}{\sum_{i=0}^{n} P_i Cap_i} \tag{5.1}$$

Figure 2: Portfolio composition over Time, 1716-1723



$$R_i = \sum t = 0t = T \sum_{i=0}^{n} (p_t - p_{t-1}) W_i \tag{5.2}$$

We calculate daily returns for each asset using Castaing's *Course of the Exchange* and multiply daily returns of each asset by the capital stock for each asset. Given that capital stock for each asset is constant over the period in question–except for the South Sea Company–changes in the composition of the CAPM portfolio are mostly due to fluctuations in the price of assets. Figure **??** shows how an optimal portfolio would change over time during the period surrounding the South Sea Bubble.

Since this was a time of high volatility for prices, particularly for the South Sea Company, but for all available assets on the market, the optimal portfolio was also subject to much

volatility. The proportionally much higher prices demanded for shares in the South Sea Company results in a larger share of the portfolio being apportioned to the South Sea Company.

While there are many valid criticisms of the CAPM pricing model, one in particular makes the model particularly problematic to apply to these early financial markets. First, the small number of assets makes it unlikely that we are capturing all types of risk in the market as assumed by the S&P500.

How the value of a given portfolio changes over time is tantamount to understanding the rewards associated with investing in that portfolio. Figure **??** shows how one pound invested in the market in 1698 increases in value over the period of available data 1698-1736. The South Sea Bubble of 1720 is apparent just right of the center of the figure, and shows the potential for great gains during this period, but also how losses could have accumulated as the market came down off the bubble. The value of one pound invested in 1698 was over two by the time the bubble came along, but less than two in the years immediately following.

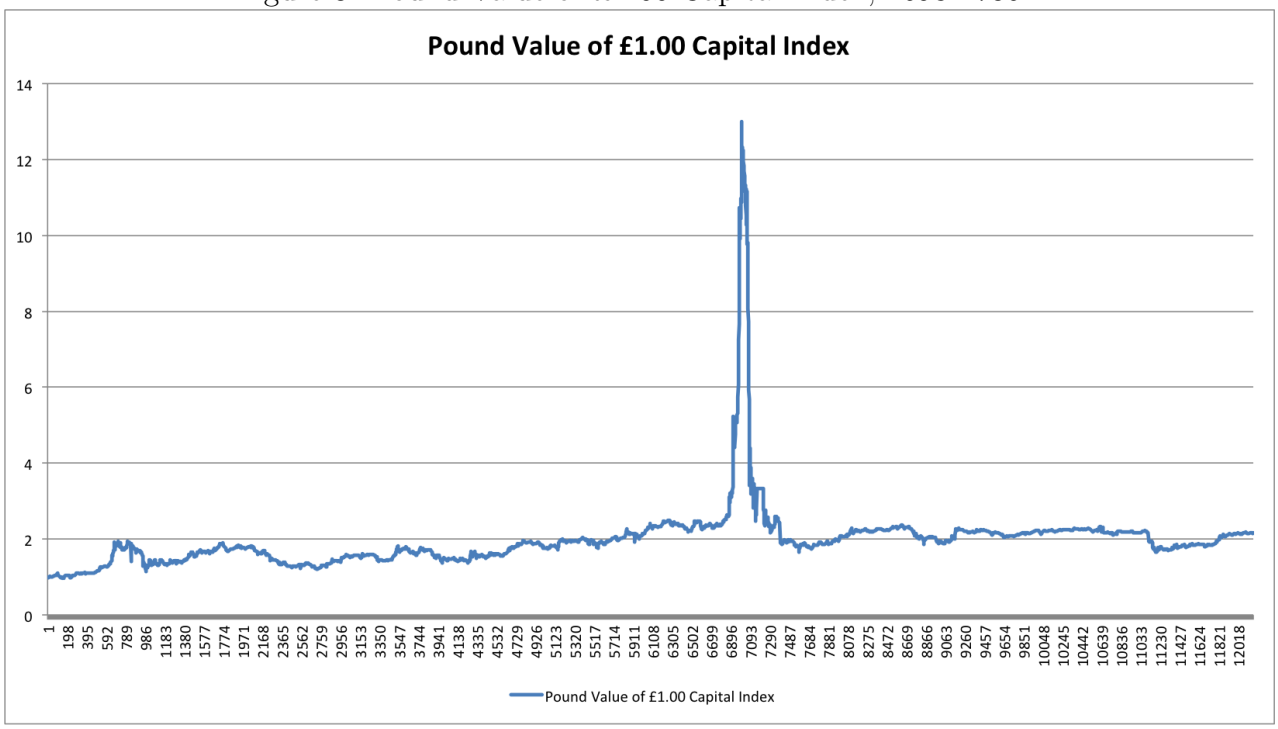
5.3 Regression Specification

The regression specification is as follows:

$$R_{i,t} = \alpha + \beta(R_{index,t} - R_{rf,t}) + \epsilon \tag{5.3}$$

Where $R_{i,t}$ is the daily return on an individual asset, such as the South Sea Company, and $R_{index,t}$ is the return on the CAPM index return and $R_{rf,t}$ is the return on a risk-free asset. The constant, or α, represents how much better or worse a particular individual asset performed over the time period than the index. The slope of the regression line, β, represents how closely the index returns and individual asset returns track each other.

Figure 3: Pound Value of £1.00 Capital Index, 1698-1736



Similarly, it shows how the "portfolio" of an investor who invested in a single asset would differ in returns from an investor who chose the theoretically optimal portfolio.

The risk-free asset is the theoretical return on an asset which does not present risk to the investor. While this return is often approximated with the return on a government asset such as treasury bonds, no such asset exists during this time period. The Bank of England is the likely candidate for this asset, but it was too volatile over the Bubble. We argue that there was no risk-free asset within this class of assets, and take holding cash as the riskless asset.

5.4 The Price of a Vote

We employ the β_i as estimated above to calculate risk adjusted returns through Treynor's Ratio. The observed asset returns are divided by each portfolio's estimated β_i yields sys-

tematic risk-adjusted returns. Treynor's measure of an asset's role in a diversified portfolio, which can be compared to the annualized return on the index since the index's β value is equal to one, by definition. We observe that most people investing only held one asset, so this measure of risk adjusted return minus the index return will be a close approximation to comparative cost of a vote in comparison to an optimized portfolio.

$$T = \frac{R_i - R_f}{\beta_i} \tag{5.4}$$

Where R_i is a portfolio's return, R_f is the risk-free rate, and β_i is the portfolio's beta coefficient as estimated by equation .

6 Results

6.1 The Price of a Vote During The South Sea Bubble

Table **??** shows results for a regression following equation **??** using daily prices from 1716 to 1723. This time period is rather unique because it encompasses the South Sea Bubble. For this reason, and the immense number of shares emitted by the South Sea Company compared to the other companies, the β value for the South Sea company shows a strong relationship between the index return and the return on the South Sea company. However, the α values, or constants, indicate that no single asset performed better or worse than the index we created. All α values are statistically insignificant (except SSC) and close to zero.

The South Sea Bubble of 1720 resulted in significantly increased trading of all stocks, even those that were priced very low. The increased activity drove prices up of all stocks, with the most significant effect on the price of the South Sea Annuities, which rose to roughly £900 for a £100 face value share. The high correlation of price movement during this time period shows high systemic risk in the stock market , which could not have been mitigated

through diversification. A diversified portfolio, no matter how optimally determined, can only protect against idiosyncratic risk.

We first examine the period in the years just prior to and just after the Bubble.

The coefficients on the index, or X value, are the betas; they indicate how the return on each single-asset portfolio changed when the return on the index changed. Regression one in Table **??** shows that when the return on the index increased by 1 percentage point, the return on a portfolio of only South Sea stock would increase by 1.15 percentage points. This reflects the fact that the South Sea company made up a significant proportion of the index and was the source of much systematic risk in the market around the time of the Bubble.

During this time period then, the price of a vote was essentially zero for those choosing to invest in the companies that saw slower price rises over the period of the Bubble. The low betas, particularly for the Million Bank and the Bank of England, indicate that despite high correlations in price, these companies were responding less to the systemic risk in the market. From a risk to return perspective, putting all of one's shares into the Bank of England was perhaps even a better prospect than the index or diversified optimal portfolio we present. Stock prices in the in these companies were volatile over the Bubble, but daily returns did not fluctuate as much as those of the index. Those who controlled enough physical wealth to buy at least five shares of any given company would have been strictly better off purchasing in the Bank rather than diversifying as defined by the CAPM framework given the nature of risk that defined the market during the South Sea Bubble. We show this using Treynor's Measure of Risk-Adjusted Returns, the results are in Table .

Despite the fact that the largest price swings during the Bubble came through South Sea Company stock, the other assets were the ones presenting significant idiosyncratic risk that could have been mitigated through diversification. Investors choosing to purchase only in

Table 2: Betas for Five Assets, 1716-1723

VARIABLES	(1) SSC	(2) Million	(3) BofE	(4) RACsenior	(5) EIC
Index	1.154***	0.638***	0.646***	0.807***	0.925***
	(0.00641)	(0.0121)	(0.0109)	(0.0313)	(0.0235)
Constant	0.000219	-0.000155	-0.000215	0.000682	0.000244
	(0.000172)	(0.000324)	(0.000293)	(0.000840)	(0.000630)
Observations	2,504	2,504	2,504	2,504	2,504
R-squared	0.928	0.528	0.583	0.210	0.383

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

the South Sea Company actually faced lower levels of risk vis-a-vis returns than they could have achieved in the index. The returns for overweighting in the South Sea Company were about 6 basis points better than the index, or about 10% of the annualized return (See Table **??**). We suggest that the price of a vote in the South Sea Company is actually negative, with 10% higher returns over a year period, averaged over the period 1716-1723. In the Bank of England, the price of a vote, or consolidating one's shareholdings, was about 13 basis points, or 20% of annualized returns. In the East India Company, the price was about 8 basis points or about 13%.

Diversifying during this period according the the CAPM strategy was not the best proposition, but it was better than consolidating shares in most of the other assets. Higher risk-adjusted returns–as well as straight annualized returns–were available by purchasing in the South Sea Company.

7 Investors' Portfolios

While our analysis above suggests that obtaining and holding an optimal portfolio over this particular time was not the most profitable decision, about 20% of investors bought in

Table 3: Treynor's Measure 1716-1723

	Index	South Seas	Million	BofE	RAC	EIC
Annualized Returns	0.01228	0.02152	0.00096	0.00059	0.04168	0.00437
Beta		1.154	0.638	0.646	0.807	0.925
Risk-Adjusted Return	0.01228	0.01865	0.00150	0.00092	0.05165	0.00473

Returns do not include dividend payments

multiple stocks. In this section, we examine the set of transactions, holdings, and portfolios of investors to see if anyone actually held a portfolio similar to the optimal one.

8 Discussion

Lower betas, or estimated coefficients on the index in each regression, indicates that the single-asset portfolios are subject to less systematic risk than a portfolio . The results suggest that Bank of England and other stocks were more stable, slower to accelerate and slower to lose, as evidenced by the price changes visible in Figure **??**. The observed betas are much lower for the banks than for the South Sea Company, which represented a large part of the index.

9 Conclusion

The period surrounding the South Sea Bubble was a tumultuous time for investors in the English stock market. Those who got in early and sold at the peak of the Bubble could have increased their holdings by more than 900%. Along with it, however, went the prices of the other available assets for sale on the secondary market: the Bank of England stock, East India Company, Royal African Company, and the Million Bank. The extreme price volatility during the early 18th century meant that even the now common advice to diversify one's holdings did not do much to protect the investor over the period of the Bubble. Everyone who entered the market in 1720 stood to lose significant value in their shares.

We show that diversifying along a CAPM framework was substantially better than choosing a portfolio with only a single asset. Though returns for the period examined are positive, they are small over the period 1716-1723. If we look at a shorter time period, 1719-1722, all returns (without accounting for dividends) were negative. Though the majority of risk in the market appears to be systematic, idiosyncratic risk still did play a part and investors could have mitigated this risk by buying shares in multiple companies where individual wealth constraints allowed.

And yet, they didn't. As exemplified by the small proportion of investors who chose to buy in more than one stock, investors in the early part of the 18th century were loath to diversify. Carlos, et.al. (2012) argue that the voting rules and share holdings to obtain a place of power within a company created incentives to hold in one company and that the utility associated with a vote or the ability to sit on the board exceeded the risk mitigation provided by diversification where the wealth constraint allowed for either. This investor behavior lead many investors to hold significantly more risky assets, losing upwards of 20% of the annualized returns in the index, when the single asset held was not the South Sea Company. Holding solely in the South Sea Company during this time period was actually better for investors, who received about 28 basis points higher annualized returns than the index.

The exact timing a buyer's entrance into the market, of course, has a significant impact on the exact returns earned, and thus the price of a vote. If we add or subtract years right around the bubble, the results are largely the same, with investors in a single asset faring substantially worse than one who invested in our theoretical optimal portfolio, unless that asset was the South Sea Company. Over a longer time period, the advice of where to invest seems to switch. Though we do not formally discuss the results here, preliminary

analysis over the whole of the 1698-1736 time period suggests that investors could have done much better in terms of risk-adjusted returns in any of the companies except the South Sea Company. We will explore this further.

Although the CAPM style index perhaps is a poor measure of an optimal portfolio in a market with very few possible assets, high prices of individual shares of stock, and where the stakes for government contracts are very high. Investors seeking a position of power or a vote took on substantially more risk by holding large blocks of shares (in most cases 5 or more shares) in a single company than they otherwise would have if they had diversified.

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