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Are Capital Market Parameters Estimated from Yahoo Finance and Nasdaq Data the Same?

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Abstract

Empirical studies need good data sources; yet such data sources are expensive; either in the time that is dedicated to gathering information or in the actual funds expended to obtain user friendly databases such as those provided by Wharton Research (wrds.) at the University of Pennsylvania. Many authors must expend the time to obtain data because funding is not available to obtain more expensive databases. The question then becomes "Which publicly available data source should one use or are the data obtained from different publicly available sources the same?" This study compares parameters estimated from daily returns for a sample of firms using data obtained from NASDAQ with the same parameters estimated from data obtained from Yahoo Finance. Expectations were that the results would be quite similar and, with minor exceptions, expectations are correct.

I. Introduction

Empirical studies are as robust or as weak as the data source that serves to underpin the study. Even before Markowitz (1952, 1959) showed that risk should be analyzed in a portfolio context, the availability of data was immensely important to participants in the financial markets. One need only observe the long history of finance and economic data available in government and private sector databases to understand the importance attached to such data. The Center for Research in Security Prices (CRSP) data is available monthly from 1926 and daily from 1962. The Bureau of Labor Statistics provides monthly inflation data from 1913 and seasonally adjusted monthly employment data from 1948. Other data sources

provide comparable historical periods. For example, the Federal Reserve provides daily information on Treasury Bill interest rates dating from 1954 while monthly T-Bill rates are available from 1931. The Federal Reserve also reports monthly Aaa and Baa corporate bond yields from 1919, conventional mortgage rates dating from 1971, and other interest rate series that were established in the 1950s.

Empiricists wishing to use data provided by information clearinghouses will usually have three choices. If they are conducting research at a business or institution with sufficient resources to have purchased the necessary databases, the empiricist will simply use the data available from the purchased source. Wharton Research Data Services (WRDS) at the University of Pennsylvania is the platform used to access many of the existing data bases, such as the CRSP and S&P Capital IQ data bases, utilized in many empirical studies in finance. For many smaller, regional, educational institutions with limited resources, purchasing access to WRDS data is not an option due to the cost. Empiricists affiliated with such institutions must either team with someone from an institution that does have the appropriate resources and access (the second choice) or gather the data that they use from an alternative source (the third choice).

Studies of the equity market abound. As mentioned above, Markowitz opened the floodgates more than fifty years ago to empirical studies that utilize financial data for parameter estimates. Such studies examine virtually all aspects of the financial markets. Accurate data that inspires trust in its quality is of paramount importance. Starting with the work of Sharpe (1963), Lintner (1965a,

1965b), and Mossin, (1966) who developed the relationships between risk and return through the beta coefficient; Fama and Blume (1966) who provided the footings for the development of the efficient market hypothesis; and Hamada (1969, 1972), who examined the role of leverage in the determination of systematic risk, data was, and is, vital to the findings and understanding of markets. When Jacob (1971) and Black, Jensen, and Scholes (1972) sought to conduct empirical tests of capital asset based parameters, data was, again, of overbearing importance. When Fama, Fisher, Jensen, and Roll (1969) and later Fama (1970, 1991) considered the impact of information on equity values in the financial markets, accurate market data was fundamental to their findings, and to the implications that continue to guide our understanding of market efficiency.

Not only is access to data extremely important, but the validity and reliability of that data are equally as important. As shown by Author (20xx), parameter estimates generated from data obtained from CRSP (WRDS.) and data obtained from Yahoo Finance are essentially the same. The purpose of this paper is to empirically examine whether parameter estimates generated with data from NASDAQ are the same as parameter estimates generated with data obtained from Yahoo Finance. This is important because both Yahoo Finance and NASDAQ data are publicly and readily available to empiricists who do not have access to commercially provided data. The paper is structured as follows. Section II considers some of the more recent literature and the data demands of empiricists. Section III outlines the data selection process for this paper and establishes the

empirical analysis to be conducted. Section IV explains the empirical results while section V provides conclusions.

II. Recent Literature

Most academic publications oriented toward financial and economic matters publish manuscripts based on financial data. From the theoretical empirics of the *Journal of Finance* and the *Journal of Financial Economics* to the more practitioner oriented guidance provided by the *Journal of Portfolio Management* and the *Journal of Applied Finance*, the familiar use of financial data is undeniable. For instance, recent issues of the *Journal of Finance* (October and November 2016) contain empirically based articles analyzing such topics as the impact of fraudulent activity by a firm on household equity holdings (Giannetti and Wang, 2016), and the implications of capital investment in innovative capacity on future stock returns (Kumar and Li, 2016). In the same time frame, the *Journal of Financial Research* offers empirically based manuscripts that include Livingston and Zhou's (2016) study of the marginal impact of Fitch ratings on at-issue yields of industrial and utility bonds and Banti's (2016) study of illiquidity in the stock and foreign exchange markets. These studies, and untold numbers of others, rely on accurate and reliable financial data. Many well-funded empiricists rely on the equity market data from CRSP while other data is taken from a variety of established data sources, including Compustat and Global Financial Data (GFD). Data sources such as these are typically available at a price that exceeds the research budget of small practitioners and teaching oriented academic institutions. In recent years,

however, data sources have become available without a financial cost via the internet. These sources vary in terms of their ease of use and accessibility, and questions about the accuracy of the data provided by the various sources remain unresolved. Among the free-access data providers are Yahoo Finance and NASDAQ. In this paper, we address the reliability of data provided by these two providers.

III. Yahoo Finance and NASDAQ Data Sources

Yahoo Finance provides a comprehensive array of financial data that includes corporate fundamentals, major domestic and international market indices, real-time and historical price quotes, exchange rate information, trading volume analyses, and commodity futures quotes. For this paper, our focus will be on historical price quotes and daily returns adjusted for dividends and stock-splits. The historical quotes and daily returns available through Yahoo Finance are supplied by Commodity Systems, Inc. (CSI). The following description of the company and its offerings is provided from the CSI website:[1,2]

> CSI is a low cost information vendor of summary world financial market data…Individual users can view substantial historical time series on world markets that extend backward to the middle of the 20th century.
>
> CSI's historical coverage includes all commodity markets gathered from over 80 futures exchanges traded worldwide. More than 99% of the markets in CSI's inventory extend from the very first day of trading. The breadth of futures information includes, grains, currencies, world stock indices, metals, mercantiles, financials, energy and more.
>
> CSI also supplies daily summary data on all New York Stock Exchange stocks, nearly all American, and NASDAQ stocks, and virtually all 25,000 US mutual funds. U.S. government series

[1] The CSI website is http://www.csidata.com/csi/.
[2] In addition to Yahoo Finance, CSI also supplies data to the Microsoft Network Money and Google Finance websites.

are supplied on CPI, PPI, unemployment, the national debt, M1, M2, M3, etc. and updated daily as such information is released. Most security time series extend backward to the first day of trading, and all Initial Public Offerings (IPOs) are added to the daily and historical data archives as they are launched by their underwriters.

Empiricists who wish to use the CSI data may simply download prices from the Yahoo Finance web site, one company at a time, and utilize the data as they complete their studies. This approach is free. An alternative approach is to access the data directly from CSI by subscribing to their service for a nominal fee.[3] The advantage of a CSI subscription is that users gain access to the CSI interface and may download data in bulk, as opposed to the one-company-at-a-time approach required by Yahoo Finance.

The Nasdaq website provides historical price and volume data for roughly 3,100 NASDAQ stocks, 370 AMEX stocks, and 3,150 NYSE stocks.[4] Daily opening and closing prices, daily high and low prices, and daily trading volume are provided for a maximum of 10 years. Data from the oldest day (10 years ago) is automatically deleted when data from the most recent day is added so researchers wishing to cover a 10-year period should collect data for all firms selected in one day.

The data source supplying the Nasdaq website is EDGAR Online, a division of R. R. Donnelley & Sons Company. Despite its name, EDGAR Online is not

[3] The subscription fee for the CSI service for equities is $285 per year for 10 years worth of historical data and $600 per year for 30 years of historical data. The more expensive package also includes foreign stocks and mutual fund data.

[4] These numbers were taken from the Security List files on the Nasdaq website. Note that these security lists change frequently and no effort was taken to check the actual availability of data for each firm.

affiliated with the United States Securities and Exchange Commission. From their website:

> *As the leader in delivering intelligent solutions in financial disclosures, EDGAR Online is uniquely positioned to leverage proprietary technology to create robust, timely and accurate data sets, distributing high quality, interactive financial data and services to the investment community.*

EDGAR Online does not provide details of the proprietary technology used to create their data sets. Specifically, for daily stock market data, closing prices should be adjusted for actions that result in any type of dilutive effect on the number of shares outstanding or the firm's earnings per share. Closing prices from different data sources can be different depending on the method used to adjust for such occurrences. Since EDGAR Online does not disclose whether, how, or when they adjust historical data for any share altering activities, it is desirable to test the quality of the resulting data against a publicly available benchmark with a proven record of accuracy. For this study, the benchmark that the Nasdaq website data is tested against is the data obtained from the Yahoo Finance website.

The initial sample consisted of 128 firms listed as NASDAQ Large-cap firms on the Nasdaq website in October of 2015.[5] The selection of the large cap firms was subjective and convenient, given that the number of firms falling into that classification provided the approximate sample size desired. Additionally, large firms are more likely to be actively traded during the complete observation period, so missing or partial data issues are minimized. Large-cap is defined as firms with

[5] When we began this study, the availability of historical price data was limited to Nasdaq firms.

a market capitalization from $10 billion to $200 billion. There are currently only six firms on the NASDAQ that have market capitalization values greater than $200 billion, and they are classified as Mega-cap firms. Those six firms were not included in the sample.

The testing period is the 10-year period January 1, 2006 to December 31, 2015; a total of 2,517 trading days. Daily closing prices for the period were downloaded from the Nasdaq website while daily adjusted closing prices were downloaded from the Yahoo Finance website. Thirty-eight firms that did not trade for the entire 10-year period were eliminated from the study yielding a final sample size of 90 firms. Appendix A provides a list of these 90 firms along with their respective ticker symbols.

The raw numbers appeared to be clearly different, particularly during the early days of the observation period. This is likely due to differing treatments of dividends, stock splits, mergers, and acquisitions occurring over time. Neither website reveals how they adjust their historical data for such events. Regardless of the raw numerical price differences, our concern is the daily returns resulting from each set of numbers. As such, daily holding period returns (HPR) were computed for each firm in the sample for the entire 10-year window using equation 1.

$$HPR_t = \frac{P_t}{P_{(t-1)}} - 1 \qquad (1)$$

where HPR_t = the daily holding period return,

P_t = the daily closing price,

$P_{(t-1)}$ = the previous day's closing price,

IV. Results

The initial test of the two data sources was a single factor analysis of variance to determine if the means of the two populations of HPRs are identical. With a sample of 90 firms and HPRs for 2,517 days for each firm, each group contained 226,530 observations. Using Microsoft Excel to perform the calculations, the results of the analysis of variance is as follows (Table 1):

Table 1: ANOVA

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
Column 1	226,530	174.84	0.000772	0.000601
Column 2	226,530	182.5193	0.000806	0.000601

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	0.0001302	1	0.00013	0.216547	0.641684	3.841479
Within Groups	272.32638	453,058	0.000601			
Total	272.32651	453,059				

Clearly there is a difference between the sum of the daily HPRs and the average of the daily HPRs for the two data sources. To test whether the differences are statistically significant the following hypothesis is examined:

H_0: the mean of group 1 (μ_1) = the mean of group 2 (μ_2)

H_1: $\mu_1 \neq \mu_2$.

ANOVA provides an F-statistic of 0.216547 and a critical F of 3.841479, indicating that the null hypothesis that the mean HPRs computed from the Nasdaq website are the same as the mean HPRs computed from the Yahoo Finance website cannot be rejected. Therefore, data from the two websites appear to provide the same information.

Since the daily holding period returns are statistically the same, other relevant parameters may be computed from the daily price data and compared. Specifically estimated are the standard deviation of the daily returns, the average β coefficient for all firms during the period studied versus the S&P 500 return, and the average excess return (α) for each firm. The individual α for each firm was estimated from each data source using equation 2.

$$HPR_t - r_{ft} = \alpha + \beta\left(HPR_{Mt} - r_{ft}\right) + \varepsilon \qquad (2)$$

where HPR_t = the daily holding period return,

r_{ft} = the daily market yield on 13-week treasury bills,

HPR_{Mt} = the daily holding period return on the S&P 500 index,

α and β are the parameters to be estimated and ε is the error term.

The results from these additional parameter estimates, along with the mean daily holding period returns are presented in Table 2.

Table 2

Parameter Estimates for Daily Holding Period Returns					
Yahoo		**NASDAQ**		**Yahoo – NASDAQ**	
Average	0.000805718	Average	0.000771818	Average	0.000033900
Std. Dev.	0.023669704	Std. Dev.	0.023662854	Std. Dev.	0.000006850
Beta	1.046584307	Beta	1.046077169	Beta	0.000507138
Alpha	0.000512534	Alpha	0.000478762	Alpha	0.000033772

In Table 2, the first column presents the parameter estimates for the sample firms computed using data from the Yahoo Finance website. The second column provides the same parameter estimates computed using data from the Nasdaq website. The third column shows the difference between the parameter estimates computed in the first two columns.

From first examination, it appears that the computations from the two data sources are not the same. However, these numbers are based on 226,530 daily holding period returns computed from two completely different data sources, thus some variance is to be expected. The third column showing the differences between the parameter estimates indicates how similar the two data sources truly are. The difference in the average daily holding period return is 0.0000339, and the difference in the computed standard deviations is only 0.00000685. The differences in the computed α and β coefficients are also small; for α the difference is

0.00003377 and for β it is 0.000507. None of these differences are significantly different from zero based on standard t-tests.[6]

The complete parameter estimates for each of the 90 firms in the sample are included in Table B1 in Appendix B. It shows that while there are some slight differences in the aggregated raw numbers that are not statistically significant, none of the firms in the sample have computed parameter estimates that are remarkably different when computed from either data source. Thus, one can be confident in concluding that the daily returns computed from both data sources are the same.

Conclusion

As market data from an increasing number of sources becomes freely and publicly available, there exists a need to verify that the data being offered is accurate and reliable. For many years, the Center for Research in Security Prices (CRSP) was the only legitimate source of market data for academic researchers. However, access to CRSP data is price prohibitive for many researchers at institutions with severely constrained budgets, so the new low-cost or free data sources are a welcome alternative so long as the data is shown to be sound. Our tests of the historical price data found on the Nasdaq website indicate that their data is sound and should provide research conclusions that are consistent with other, more well established data sources.

[6] Test results available from the authors upon request.

One interesting observation from this study is that there were zero days with missing data from the Nasdaq website. This observation is a bit surprising as it is not unusual for studies using either CRSP or Yahoo Finance data to reduce the sample size due to missing daily data. Perhaps this is a result of limiting the data to the recent 10-year period or due to the large capitalization value of the firms in the sample. The lack of missing data is certainly a positive aspect of the Nasdaq data; however, the 10-year limit of data availability may prove be too short for some empirical studies. Both Yahoo Finance daily data and CRSP daily data extend as far back as 1962 and CRSP monthly data is available from 1926.

Another consideration when deciding upon a data source is the ease of data retrieval. For the Nasdaq data, one can simultaneously request data for a maximum of 25 firms at one time by simply typing their ticker symbols into a form. The data is provided in 25 separate CSV files – one for each firm. It is a somewhat laborious process to merge the individual files into a single, workable file. The process is similar with the Yahoo Finance data, except that data can only be requested for one firm for each download. The request yields a single CSV file that ultimately must to be merged with the files from the other firms in the sample. CRSP is much more convenient in that a single query will return data for a sample of firms in a single, manageable file.

As new data sources become available to academic researchers, each may present unique advantages and disadvantages. CRSP, for example, is easy to use and provides the most complete data for the longest period of time. However, CRSP

is also an extremely expensive data source. This study of the data provided on the Nasdaq website reveals it to be free from missing data and somewhat easier to access than data from the Yahoo website. Yet, the limited time frame for available data is a definite shortcoming. Regardless of the various strengths and weaknesses, a data source must first and foremost provide accurate data. Based on this analysis, the data available at the Nasdaq website meets that criteria.

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Appendix A

Name	Symbol	Name	Symbol	Name	Symbol
Activision Blizzard, Inc	ATVI	Ericsson	ERIC	PACCAR Inc.	PCAR
Adobe Systems Inc.	ADBE	Expedia, Inc.	EXPE	Paychex, Inc.	PAYX
Akamai Technologies	AKAM	Express Scripts	ESRX	PowerShares QQQ Trust	QQQ
Alexion Pharm., Inc.	ALXN	Fastenal Company	FAST	Qualcomm, Inc.	QCOM
America Movil	AMOV	Fifth Third Bancorp	FITB	Regeneron Pharm., Inc.	REGN
Amgen Inc.	AMGN	Fiserv, Inc.	FISV	Ross Stores, Inc.	ROST
Analog Devices, Inc.	ADI	Gilead Sciences, Inc.	GILD	SanDisk Corporation	SNDK
Applied Materials, Inc.	AMAT	Henry Schein, Inc.	HSIC	SBA Communications Corp.	SBAC
ARM Holdings	ARMH	Hologic, Inc.	HOLX	Seagate Technology	STX
Autodesk, Inc.	ADSK	Illumina, Inc.	ILMN	Shire PLC	SHPG
Automatic Data Processing	ADP	Incyte Corporation	INCY	Sirius XM Holdings Inc.	SIRI
Baidu, Inc.	BIDU	Intel Corporation	INTC	Skyworks Solutions, Inc.	SWKS
Biogen Inc.	BIIB	Intuit Inc.	INTU	Starbucks Corporation	SBUX
BioMarin Pharm. Inc.	BMRN	Intuitive Surgical, Inc.	ISRG	Stericycle, Inc.	SRCL
Broadcom Corporation	BRCM	Lam Research Corp.	LRCX	Symantec Corporation	SYMC
C.H. Robinson Worldwide	CHRW	Liberty Global	LBTYA	T. Rowe Price Group, Inc.	TROW
Celgene Corporation	CELG	Liberty Global	LBTYK	Texas Instruments, Inc.	TXN
Cerner Corporation	CERN	Linear Technology Corp.	LLTC	The Priceline Group Inc.	PCLN
Check Point Software Tech	CHKP	Marriott International	MAR	Tractor Supply Company	TSCO
Cisco Systems, Inc.	CSCO	Maxim Integrated Prod.	MXIM	21st Century Fox, Inc.	FOX
Citrix Systems, Inc.	CTXS	Medivation, Inc.	MDVN	21st Century Fox, Inc.	FOXA
Cognizant Tech Solutions	CTSH	Micron Technology, Inc.	MU	Vertex Pharm., Inc.	VRTX
Comcast Corporation	CMCSA	Mondelez International, Inc.	MDLZ	Viacom Inc.	VIA
Costco Wholesale Corp.	COST	Monster Beverage Corp.	MNST	Viacom Inc.	VIAB
DISH Network Corp.	DISH	Mylan N.V.	MYL	Walgreens Boots Alliance	WBA
Dollar Tree, Inc.	DLTR	NetEase, Inc.	NTES	Western Digital Corp.	WDC
eBay Inc.	EBAY	Netflix, Inc.	NFLX	Whole Foods Market, Inc.	WFM
Electronic Arts Inc.	EA	Northern Trust Corporation	NTRS	WPP PLC	WPPGY
Endo International	ENDP	NVIDIA Corporation	NVDA	Xilinx, Inc.	XLNX
Equinix, Inc.	EQIX	O'Reilly Automotive, Inc.	ORLY	Yahoo! Inc.	YHOO

Appendix B

TABLE B1: Individual Firm Parameter Estimates Using NASDAQ HPR Data and Yahoo HPR Data

NASDAQ	S&P 500	ATVI	ADBE	AKAM	ALXN	AMOV	AMGN	ADI	AMAT	ARMH	ADSK
Average	0.0003	0.0009	0.0006	0.0009	0.0017	0.0003	0.0004	0.0004	0.0002	0.0011	0.0004
Std. Dev.	0.0131	0.0229	0.0217	0.0305	0.0234	0.0250	0.0171	0.0192	0.0212	0.0261	0.0246
Beta	1.0000	0.9359	1.1237	1.2867	0.8892	1.1752	0.7165	0.9622	1.0954	1.1915	1.2346
Alpha		0.0007	0.0003	0.0005	0.0015	0.0000	0.0002	0.0001	-0.0001	0.0008	0.0001
Yahoo	**S&P 500**	**ATVI**	**ADBE**	**AKAM**	**ALXN**	**AMOV**	**AMGN**	**ADI**	**AMAT**	**ARMH**	**ADSK**
Average	0.0003	0.0010	0.0006	0.0009	0.0017	0.0004	0.0005	0.0005	0.0003	0.0012	0.0004
Std. Dev.	0.0131	0.0229	0.0217	0.0305	0.0234	0.0251	0.0171	0.0192	0.0212	0.0261	0.0246
Beta	1.0000	0.9359	1.1235	1.2867	0.8892	1.2010	0.7165	0.9661	1.0953	1.1928	1.2346
Alpha		0.0007	0.0003	0.0005	0.0015	0.0000	0.0003	0.0002	0.0000	0.0008	0.0001
Yahoo - NASDAQ	**S&P 500**	**ATVI**	**ADBE**	**AKAM**	**ALXN**	**AMOV**	**AMGN**	**ADI**	**AMAT**	**ARMH**	**ADSK**
Average	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0001	0.0001	0.0000	0.0000
Std. Dev.	0.0000	0.0000	0.0000	0.0000	0.0000	0.0002	0.0000	0.0001	0.0000	0.0000	0.0000
Beta	0.0000	0.0000	-0.0002	0.0000	-0.0001	0.0259	0.0000	0.0039	-0.0001	0.0013	0.0000
Alpha		0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0001	0.0001	0.0000	0.0000

TABLE B1 Continued: Individual Firm Parameter Estimates Using NASDAQ HPR Data and Yahoo HPR Data

NASDAQ	ADP	BIDU	BIIB	BMRN	BRCM	CHRW	CELG	CERN	CHKP	CSCO
Average	0.0004	0.0019	0.0010	0.0013	0.0006	0.0004	0.0010	0.0009	0.0007	0.0004
Std. Dev.	0.0135	0.0333	0.0223	0.0269	0.0256	0.0199	0.0223	0.0198	0.0174	0.0194
Beta	0.7945	1.2512	0.8302	0.9867	1.1104	0.9568	0.9339	0.7931	0.7974	1.0507
Alpha	0.0002	0.0016	0.0008	0.0010	0.0003	0.0001	0.0008	0.0006	0.0005	0.0001
Yahoo	**ADP**	**BIDU**	**BIIB**	**BMRN**	**BRCM**	**CHRW**	**CELG**	**CERN**	**CHKP**	**CSCO**
Average	0.0005	0.0019	0.0010	0.0013	0.0006	0.0005	0.0010	0.0009	0.0007	0.0004
Std. Dev.	0.0135	0.0333	0.0223	0.0269	0.0257	0.0199	0.0223	0.0198	0.0174	0.0194
Beta	0.7951	1.2511	0.8301	0.9868	1.1114	0.9578	0.9339	0.7931	0.7975	1.0509
Alpha	0.0003	0.0016	0.0008	0.0010	0.0003	0.0002	0.0008	0.0006	0.0005	0.0001
Yahoo - NASDAQ	**ADP**	**BIDU**	**BIIB**	**BMRN**	**BRCM**	**CHRW**	**CELG**	**CERN**	**CHKP**	**CSCO**
Average	0.0001	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000
Std. Dev.	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Beta	0.0006	-0.0001	-0.0001	0.0000	0.0010	0.0010	0.0000	0.0000	0.0000	0.0002
Alpha	0.0001	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000

TABLE B1 Continued: Individual Firm Parameter Estimates Using NASDAQ HPR Data and Yahoo HPR Data

NASDAQ	CTXS	CTSH	CMCSA	COST	DISH	DLTR	EBAY	EA	ENDP	EQIX
Average	0.0007	0.0009	0.0007	0.0006	0.0006	0.0011	0.0004	0.0004	0.0005	0.0011
Std. Dev.	0.0241	0.0241	0.0196	0.0145	0.0243	0.0190	0.0224	0.0251	0.0213	0.0251
Beta	1.1192	1.2607	1.0921	0.7042	1.0890	0.5864	1.0977	1.0807	0.7338	1.1791
Alpha	0.0004	0.0006	0.0004	0.0004	0.0003	0.0009	0.0001	0.0001	0.0003	0.0008
Yahoo	**CTXS**	**CTSH**	**CMCSA**	**COST**	**DISH**	**DLTR**	**EBAY**	**EA**	**ENDP**	**EQIX**
Average	0.0007	0.0009	0.0007	0.0007	0.0007	0.0011	0.0004	0.0004	0.0005	0.0012
Std. Dev.	0.0241	0.0241	0.0195	0.0144	0.0243	0.0190	0.0224	0.0251	0.0214	0.0251
Beta	1.1192	1.2605	1.0919	0.7051	1.0904	0.5865	1.0973	1.0807	0.7334	1.1794
Alpha	0.0004	0.0006	0.0004	0.0005	0.0004	0.0009	0.0001	0.0001	0.0003	0.0008
Yahoo - NASDAQ	**CTXS**	**CTSH**	**CMCSA**	**COST**	**DISH**	**DLTR**	**EBAY**	**EA**	**ENDP**	**EQIX**
Average	0.0000	0.0000	0.0001	0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000
Std. Dev.	0.0000	0.0000	0.0000	-0.0001	-0.0001	0.0000	0.0000	0.0000	0.0000	0.0000
Beta	0.0000	-0.0002	-0.0002	0.0009	0.0015	0.0001	-0.0004	-0.0001	-0.0004	0.0003
Alpha	0.0000	0.0000	0.0001	0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000

TABLE B1 Continued: Individual Firm Parameter Estimates Using NASDAQ HPR Data and Yahoo HPR Data

NASDAQ	ERIC	EXPE	ESRX	FAST	FITB	FISV	GILD	HSIC	HOLX	ILMN
Average	0.0001	0.0011	0.0008	0.0005	0.0006	0.0007	0.0010	0.0006	0.0006	0.0018
Std. Dev.	0.0249	0.0285	0.0196	0.0211	0.0420	0.0158	0.0197	0.0144	0.0236	0.0300
Beta	1.2511	1.2044	0.8779	1.1094	1.8953	0.9173	0.7905	0.7697	1.0130	0.9566
Alpha	-0.0003	0.0007	0.0005	0.0002	0.0001	0.0004	0.0008	0.0004	0.0003	0.0015
Yahoo	**ERIC**	**EXPE**	**ESRX**	**FAST**	**FITB**	**FISV**	**GILD**	**HSIC**	**HOLX**	**ILMN**
Average	0.0002	0.0010	0.0008	0.0006	0.0007	0.0007	0.0010	0.0006	0.0006	0.0018
Std. Dev.	0.0249	0.0293	0.0196	0.0211	0.0419	0.0158	0.0197	0.0144	0.0236	0.0300
Beta	1.2544	1.2029	0.8779	1.1104	1.8930	0.9172	0.7901	0.7696	1.0130	0.9566
Alpha	-0.0002	0.0006	0.0005	0.0003	0.0002	0.0004	0.0008	0.0004	0.0003	0.0015
Yahoo - NASDAQ	**ERIC**	**EXPE**	**ESRX**	**FAST**	**FITB**	**FISV**	**GILD**	**HSIC**	**HOLX**	**ILMN**
Average	0.0001	-0.0001	0.0000	0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000
Std. Dev.	0.0000	0.0008	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Beta	0.0033	-0.0015	0.0000	0.0010	-0.0023	0.0000	-0.0004	-0.0001	0.0000	0.0000
Alpha	0.0001	-0.0001	0.0000	0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000

TABLE B1 Continued: Individual Firm Parameter Estimates Using NASDAQ HPR Data and Yahoo HPR Data

NASDAQ	INCY	INTC	INTU	ISRG	LRCX	LBTYA	LBTYK	LLTC	MAR	MXIM
Average	0.0019	0.0003	0.0007	0.0010	0.0006	0.0008	0.0008	0.0002	0.0005	0.0002
Std. Dev.	0.0368	0.0188	0.0180	0.0278	0.0249	0.0227	0.0215	0.0175	0.0220	0.0206
Beta	1.4391	1.0319	0.8888	1.0918	1.2154	1.1754	1.0894	0.8938	1.2511	0.8573
Alpha	0.0015	0.0000	0.0004	0.0007	0.0003	0.0004	0.0005	0.0000	0.0002	0.0000
Yahoo	**INCY**	**INTC**	**INTU**	**ISRG**	**LRCX**	**LBTYA**	**LBTYK**	**LLTC**	**MAR**	**MXIM**
Average	0.0019	0.0004	0.0007	0.0010	0.0006	0.0008	0.0008	0.0003	0.0006	0.0004
Std. Dev.	0.0368	0.0188	0.0180	0.0278	0.0249	0.0227	0.0215	0.0175	0.0220	0.0206
Beta	1.4391	1.0307	0.8889	1.0934	1.2153	1.1761	1.0899	0.8922	1.2511	0.8577
Alpha	0.0015	0.0001	0.0004	0.0007	0.0003	0.0005	0.0005	0.0001	0.0002	0.0001
Yahoo - NASDAQ	**INCY**	**INTC**	**INTU**	**ISRG**	**LRCX**	**LBTYA**	**LBTYK**	**LLTC**	**MAR**	**MXIM**
Average	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0001
Std. Dev.	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Beta	0.0000	-0.0012	0.0000	0.0016	-0.0001	0.0006	0.0005	-0.0017	-0.0001	0.0004
Alpha	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0001

TABLE B1 Continued: Individual Firm Parameter Estimates Using NASDAQ HPR Data and Yahoo HPR Data

NASDAQ	MDVN	MU	MDLZ	MNST	MYL	NTES	NFLX	NTRS	NVDA	ORLY
Average	0.0027	0.0006	0.0004	0.0015	0.0006	0.0013	0.0020	0.0004	0.0009	0.0010
Std. Dev.	0.0466	0.0353	0.0132	0.0295	0.0220	0.0258	0.0356	0.0231	0.0305	0.0181
Beta	1.1756	1.5742	0.6021	0.9344	0.9409	0.8348	0.8936	1.3674	1.3909	0.7789
Alpha	0.0024	0.0002	0.0002	0.0012	0.0004	0.0011	0.0017	0.0000	0.0005	0.0008
Yahoo	**MDVN**	**MU**	**MDLZ**	**MNST**	**MYL**	**NTES**	**NFLX**	**NTRS**	**NVDA**	**ORLY**
Average	0.0027	0.0006	0.0005	0.0015	0.0006	0.0014	0.0020	0.0005	0.0009	0.0010
Std. Dev.	0.0466	0.0353	0.0131	0.0295	0.0220	0.0258	0.0356	0.0231	0.0305	0.0181
Beta	1.1755	1.5737	0.6036	0.9344	0.9411	0.8355	0.8939	1.3689	1.3912	0.7789
Alpha	0.0024	0.0002	0.0004	0.0012	0.0004	0.0011	0.0017	0.0001	0.0005	0.0008
Yahoo - NASDAQ	**MDVN**	**MU**	**MDLZ**	**MNST**	**MYL**	**NTES**	**NFLX**	**NTRS**	**NVDA**	**ORLY**
Average	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000
Std. Dev.	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Beta	-0.0001	-0.0004	0.0015	0.0000	0.0002	0.0006	0.0003	0.0015	0.0003	0.0000
Alpha	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000

TABLE B1 Continued: Individual Firm Parameter Estimates Using NASDAQ HPR Data and Yahoo HPR Data

NASDAQ	PCAR	PAYX	QQQ	QCOM	REGN	ROST	SNDK	SBAC	STX	SHPG
Average	0.0004	0.0002	0.0005	0.0003	0.0019	0.0010	0.0007	0.0010	0.0007	0.0009
Std. Dev.	0.0233	0.0144	0.0136	0.0199	0.0320	0.0186	0.0344	0.0231	0.0303	0.0197
Beta	1.4054	0.8117	0.9594	0.9808	1.1760	0.8345	1.3192	1.1903	1.1461	0.7593
Alpha	0.0001	0.0000	0.0002	0.0000	0.0016	0.0007	0.0003	0.0006	0.0004	0.0006
Yahoo	**PCAR**	**PAYX**	**QQQ**	**QCOM**	**REGN**	**ROST**	**SNDK**	**SBAC**	**STX**	**SHPG**
Average	0.0006	0.0004	0.0005	0.0003	0.0019	0.0010	0.0007	0.0010	0.0008	0.0009
Std. Dev.	0.0232	0.0144	0.0136	0.0199	0.0320	0.0186	0.0344	0.0231	0.0303	0.0197
Beta	1.4061	0.8142	0.9597	0.9806	1.1754	0.8350	1.3184	1.1903	1.1425	0.7595
Alpha	0.0002	0.0001	0.0003	0.0000	0.0016	0.0008	0.0003	0.0006	0.0005	0.0007
Yahoo - NASDAQ	**PCAR**	**PAYX**	**QQQ**	**QCOM**	**REGN**	**ROST**	**SNDK**	**SBAC**	**STX**	**SHPG**
Average	0.0001	0.0001	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000
Std. Dev.	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Beta	0.0007	0.0024	0.0003	-0.0001	-0.0006	0.0004	-0.0008	0.0000	-0.0036	0.0002
Alpha	0.0001	0.0001	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000

TABLE B1 Continued: Individual Firm Parameter Estimates Using NASDAQ HPR Data and Yahoo HPR Data

NASDAQ	SIRI	SWKS	SBUX	SRCL	SYMC	TROW	TXN	PCLN	TSCO	FOX
Average	0.0006	0.0016	0.0008	0.0007	0.0003	0.0006	0.0004	0.0020	0.0010	0.0005
Std. Dev.	0.0409	0.0324	0.0210	0.0157	0.0210	0.0250	0.0184	0.0268	0.0219	0.0211
Beta	0.9556	1.2568	1.0659	0.6766	0.9501	1.5897	0.9399	1.0744	0.8851	1.2897
Alpha	0.0004	0.0012	0.0005	0.0005	0.0000	0.0002	0.0001	0.0017	0.0007	0.0001
Yahoo	**SIRI**	**SWKS**	**SBUX**	**SRCL**	**SYMC**	**TROW**	**TXN**	**PCLN**	**TSCO**	**FOX**
Average	0.0006	0.0016	0.0008	0.0007	0.0003	0.0007	0.0005	0.0020	0.0010	0.0005
Std. Dev.	0.0411	0.0324	0.0210	0.0157	0.0210	0.0251	0.0184	0.0268	0.0219	0.0211
Beta	0.9613	1.2566	1.0654	0.6766	0.9498	1.5927	0.9408	1.0744	0.8850	1.2899
Alpha	0.0004	0.0013	0.0005	0.0005	0.0001	0.0002	0.0002	0.0017	0.0007	0.0001
Yahoo - NASDAQ	**SIRI**	**SWKS**	**SBUX**	**SRCL**	**SYMC**	**TROW**	**TXN**	**PCLN**	**TSCO**	**FOX**
Average	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0001	0.0000	0.0000	0.0000
Std. Dev.	0.0002	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Beta	0.0058	-0.0001	-0.0005	-0.0001	-0.0004	0.0030	0.0009	0.0000	-0.0001	0.0002
Alpha	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0001	0.0000	0.0000	0.0000

TABLE B1 Continued: Individual Firm Parameter Estimates Using NASDAQ HPR Data and Yahoo HPR Data

NASDAQ	FOXA	VRTX	VIA	VIAB	WBA	WDC	WFM	WPPGY	XLNX	YHOO
Average	0.0005	0.0011	0.0002	0.0002	0.0004	0.0008	0.0003	0.0005	0.0004	0.0003
Std. Dev.	0.0228	0.0341	0.0197	0.0211	0.0176	0.0277	0.0263	0.0199	0.0196	0.0257
Beta	1.3827	0.9803	1.0398	1.1236	0.7500	1.2399	1.0243	1.1512	0.9567	0.9612
Alpha	0.0002	0.0009	-0.0001	-0.0001	0.0002	0.0005	0.0000	0.0002	0.0002	0.0000
Yahoo	**FOXA**	**VRTX**	**VIA**	**VIAB**	**WBA**	**WDC**	**WFM**	**WPPGY**	**XLNX**	**YHOO**
Average	0.0006	0.0011	0.0003	0.0003	0.0005	0.0009	0.0003	0.0006	0.0005	0.0003
Std. Dev.	0.0228	0.0341	0.0197	0.0211	0.0176	0.0277	0.0263	0.0199	0.0195	0.0257
Beta	1.3827	0.9806	1.0396	1.1235	0.7497	1.2403	1.0246	1.1512	0.9552	0.9612
Alpha	0.0002	0.0009	0.0000	0.0000	0.0003	0.0005	0.0001	0.0003	0.0003	0.0000
Yahoo - NASDAQ	**FOXA**	**VRTX**	**VIA**	**VIAB**	**WBA**	**WDC**	**WFM**	**WPPGY**	**XLNX**	**YHOO**
Average	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0001	0.0001	0.0001	0.0000
Std. Dev.	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Beta	0.0000	0.0003	-0.0002	-0.0002	-0.0003	0.0004	0.0003	0.0000	-0.0015	0.0000
Alpha	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0001	0.0001	0.0001	0.0000