California State University, Northridge

Does Distance Affect Performance? Investigating the Relationship Between Spatial Proximity of Stock Holdings and Mutual Fund Performance

A thesis submitted in partial fulfillment of the requirements for the

Degree of Master of Arts in Geography - GIS Program

By Mark J. McPherson

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Dedication

All my thanks go to my mother, for she has helped put me through school and has taken care of all the necessities to ensure that I could successfully complete my college endeavor.

I also express my gratefulness to the many professors who have spent time answering my (sometimes endless) questions. Being able to have one-on-one time has been of invaluable help, as learning simply requires that.

I am also grateful that I have been able to focus my intellectual attention on a subject that is of interest to me: stocks and mutual funds. I have learned skills which have helped me to interpret stock market actions with a geographic lens and, hopefully, will financially benefit both me and those whom I love.

Table of Contents

Dedicationiii
List of Figures
Abstract vii
Introduction
Literature Review
"Local" Defined7
Niche Findings 10
Hypothesis11
Data and Methodology
Longitudinal Assessment: Spatial, not Temporal 20
Results
Statistical Tests
Discussion
Conclusion 60
Works Cited 61

List of Figures

Figure 1 The location of funds and stocks are spatially shown
Figure 2 The number of stocks held by multiple funds 14
Figure 3 Spatial locations of funds in top-20 largest metropolitan statistical areas (MSAs)
and smaller cities (non-MSAs) 17
Figure 4 ArcMap ModelBuilder script to produce the distance between funds and their
holdings (Euclidean miles) 18
Figure 5 Python script to concatenate ModelBuilder data into one layer
Figure 6 Using a 100-mile distance scale (X axis), the frequency (count) of stocks held
by funds is represented by the blue line (Y axis on the left)
Figure 7 Within a 250-mile radius, 1,795 stocks (14 percent of all holdings) are held by
205 funds (92 percent of all funds)
Figure 8 The standard deviation of annual returns, by distance group. The sigma is large
because there is so much variation in the returns themselves
Figure 9 The count of holdings and average annual returns, by state, shows that the fewer
the number of stocks held, the greater the "swings" in annual return
Figure 10 Stocks within MSAs, including average annual return and count held by funds.
Holding decrease as distance increases, yet annual returns have substantial variation 30
Figure 11 Non-MSA stocks, including average annual return and count held by funds.
Holdings tend to decrease as distance increases
Figure 12 The annual average returns within MSAs and outside of MSAs (non-MSAs)
are contrasted here, using longitude instead of distance groups
Figure 13 Fund headquarters showing annual returns

Figure 14 Fund size and returns
Figure 15 The median fund size is 70 million with a median return of 24 percent
Figure 16 Fund annual returns are shown by longitude. Each point shows the annual
return of each fund at each meridian (and does not reflect spatial location)
Figure 17 Fund average annual returns within MSAs and non-MSAs are displayed by
longitude 40
Figure 18 ACWIX fund: distance to its holdings and their returns
Figure 19 ACWIX Fund: Number of stocks held and their returns by distance
Figure 20 GVMCX Fund, distance to its holdings and returns
Figure 21 GVMCX Fund: Number of stocks held and their returns by distance
Figure 22 RIMMX Fund: distance to its holdings and returns
Figure 23 RIMMX Fund: Number of stocks held and their returns by distance
Figure 24 TORLX Fund: distance to its holdings and returns
Figure 25 TORLX Fund: Number of stocks held and their returns by distance 50
Figure 26 Observed stocks compared with randomly selected stocks. Results shows that
with the geographically most proximate group (1 to 100 miles), the number of purchases
is over 7 standard deviation above what is expected
Figure 27 The number of holdings and returns generated are examined by state.
Louisiana-based funds invests locally the most frequently

Abstract

Does Distance Affect Performance? Investigating the Relationship Between Spatial Proximity of Stock Holdings and Mutual Fund Performance

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GIS is used to examine how geographic proximity between the headquarters locations of mutual funds and the headquarters of the companies whose stocks are held by mutual funds (i.e. holdings) and the return on investment. Various studies find that the returns of holdings that are geographically proximate to their funds generate higher returns than holdings that are distantly located. It is hypothesized that as the distance between funds and their holdings increases, the returns will decrease. It is found that the number of stock purchases does decrease as distance increases; however, returns only marginally decrease as distance increases up to a point (about 1000 miles) before, rising substantially further.

Introduction

From a geographic perspective, the first question of study is *where*. A geographically informed analysis of stock valuations seeks not only to understand where companies are located, but also where their investors are—specifically mutual fund investors—and the spatial relationship between mutual funds' capital investments and the performance of their stock holdings. In this study, I use GIS to examine how geographic proximity between the headquarters locations of mutual funds and the headquarters locations of companies held in the mutual funds' portfolios of stock holdings influence the return on investment among mutual funds. Only the headquarters locations for mutual funds (herein "funds") and stock firms (herein "stocks") are used, under the reasonable assumption that headquarters locations are likely the decision-making centers of these businesses.

The question of what makes a stock price go up or down has been examined, presumably, since the inception of the New York Stock Exchange in 1792 (Terrell 2012). Stocks are sold to investors to raise capital (Wójcik 2009) by creating shares, a piece of ownership of the company, whose value, or price, is partly determined by its demand; thus, the more investors want—and buy—the more a stock's price goes up (or so it should). However, what seems technically accurate does not always translate into similar results; stock prices act, sometimes, as if they have "a will of their own." Many tools are employed to predict how stock prices will move in the future, including examining the past performance of a stock, the performance of its industry (e.g. automobiles, high tech), trading volume (how many shares have been traded over time), among others. A multitude of analysts, experts, economists, and mathematicians, many of whom are paid

handsomely to predict how a stock will move over time, use all the tools mentioned above along with gut instincts and a variety of non-conventional predictive tools.

A stock market is where stocks are bought and sold (Wójcik 2009). In the United States, there are three major stock markets: The New York Stock Exchange (NYSE), American Stock Exchange (AMEX), and National Association of Securities Dealers Automated Quotations (NASDAQ)¹. These U.S. stock markets, alone, list about 8,000 stocks in the United States and are inextricably linked to the economy. To give an idea of the magnitude of the financial relevance of stocks, and the markets which maintain them, Wójcik (2009) indicates that as of the year 2000, there are over 100 stock markets worldwide listing tens of thousands of individual stocks, with a combined market value of approximately 36 trillion dollars (GDP 2014). When these markets crash, massive unemployment and lagging economies ensue and can persist for years (Feldstein 1991).

From time to time, companies need to raise money which can be obtained either through loans, which must be paid back with interest, or they can offer stock, an "ownership interest in the company [whose value] will rise and fall according to the success of the underlying business" (Morningstar 2014). Businesses benefit from stocks because they provide income for capital investments, but unlike loans, do not have to be paid back. Investors can benefit from the profits made by their held stocks either through increased stock prices or dividends.

Mutual funds are collections of stocks, owned in bundles called portfolios, which are run by professional money managers whose primary goal is to select stocks, or other

¹ Over-the-Counter stocks (OTC) may be considered a fourth market which carries stocks (e.g. "penny stocks") that are too small for the standard market exchanges.

equities, which will produce positive returns. The term "mutual fund" is used informally to refer to companies that hold bundled stocks, and more precisely to the bundles of stocks themselves. Funds hold (i.e. have a stock ownership interest in) dozens, or even hundreds, of stocks at a time. After expenses, the profits and losses from their investments are aggregated into a single indicator of the fund's overall performance called a "return." In 2013, mutual funds enjoyed an exceptionally prosperous year, when the return for domestic equity funds (i.e. funds that invest mostly in stocks headquartered in the United States) was 25.18 percent, which is substantially higher than the average of returns from 2010-2012 at 14.59 percent (Morningstar 2014).

Individual investors may choose either to utilize mutual funds which "offer the advantages of diversification and professional management" (Mutual Funds: A Guide for Investors 2007), or develop their own investment strategies. For individuals who choose not to actively participate in the stock market, it is likely that they are already invested in the stock market, whether through a 401(k) plan or money market accounts through their local bank or credit union, as these "feed" into the stock market.

The potential to gain or lose money in the stock market, or even mutual funds, correlates with the degree of risk one is willing to take, since investments can range from low-to-high risk (Managing Investment Risk n.d.). But even small investments can potentially result in large gains, thanks to the leverage provided by margin accounts in which investors obtain a loan through their broker allowing them to buy more shares. Profitable returns result from an increase in the value of each share (e.g. stock bought at \$20/share and sold for \$25/share), while other stocks offer dividends, payments made to the shareholder based on the stocks' earnings distributed throughout the year

(Investopedia n.d.). The amount paid, the dividend yield, is determined by the individual stock firm's board of directors.

Literature Review

Many theories exist of what makes a stock price move, including the belief that stock prices have a momentum, therefore once a stock begins to increase (or decrease) in value, it should continue to do so. Conversely, another belief postulates that "what goes up must come down." Heavy volume, an indication that there is a lot of trading of a stock, can convey the perception that something important is happening and can fuel dramatic price movements, whether up or down, affirming that investors are largely driven by emotion and not factual data (de Aenlle 2009). The media can convey stock recommendations to a large audience, which may also increase share prices. Contrarian strategies, on the other hand, follow the opposite direction from the perceived group mentality, creating yet another way to interpret and predict stock price movement. Finally, simply holding on to quality stocks, regardless of market conditions, is a timetested way that has worked extremely well for some investors, most notably for Warren Buffett, although he is a noted contrarian investor as well (Virk 2003). Buffett prefers "to buy [stocks] when they are weeds" and have not yet reached public awareness (Hagstrom 2013, xii).

Investors are not aware of all stocks on the market. When stocks experience a lack of recognition from investors, Merton's (1987) *investor recognition hypothesis* argues that stocks offer higher returns in order to attract investors in order to compensate for this lack of recognition in the marketplace. Merton (1987) posits that stock returns rise based on the degree to which investors recognize a stock. In other words, poorly known stocks need to stand out so investors will buy them; higher returns help to assuage investors' doubts about unfamiliar companies. While information about a stock is desirable, information is a vague term, as all stocks provide varying degrees of information, including federally required public reports disclosing their fiscal health. But, publicly available information is *old news* in terms of investment counsel. Books, magazines and other media relate that which has already happened. One of the most common axioms in the stock market is that *past performance does not guarantee future results*; yet, investors are saturated with such performance histories.

Many stocks are examined by stock analysts, who ultimately issue ratings to investors either to buy, hold, or sell. Analysts often work for investment firms which solicit some of the very stock firms they are examining, which can, and does, lead to a conflict of interest, because stock firms want beneficial reviews (Bruce 2002). In a 2002 study, it is noted that "almost 50% of all [analyst] recommendations were to buy while less than 1% were to sell" (Bruce 2002, 198). With such a bias toward buying stocks, one must wonder about the quality and validity of analyst recommendations.

For all funds, the paramount concern is developing profitable investment choices. How do they do that? It is necessary to speculate on the tactics funds employ in order to achieve a financial advantage, given that the two most prominent sources of information—publicly available information and stock analyst reports—are suspect in terms of their effectiveness. Publicly available information is essentially *too little, too late,* as funds that base their investment strategies upon such information are likely buying stocks at already-higher prices, thereby mitigating returns, while funds that rely upon stock analyst reports receive potentially dubious information. It is inferred, then,

that funds acquire access to non-public information; in other words, they must obtain information about a stock that the general public does not yet have. Generally, an individual who profits from non-public information—insider trading—is considered illegal, but non-public information obtained on behalf of a mutual fund or a stock analyst may be perceived as acceptable business practices and not as nefarious behavior. For funds considering an investment in a given stock, sometimes, only a paucity of information exists; or, no information exists at all because many stocks, if not most, are poorly known. Thus, poorly known stocks, smaller stocks, newer stocks, and perhaps initial public offerings (IPOs) might get lost in the chaos of Wall Street and remain underreported—or unreported. Fund managers who actively seek out such stocks may gain informational advantages from them, perhaps because fund managers are in the right place and at the right time, but more importantly, actively investigating these kinds of stocks might be the sole means to discover current, relevant information about them.

Stocks which have little, or no, media coverage tend to earn higher returns than stocks with higher levels of coverage (Fang and Peress 2009). Additionally, 58 percent of all NASDAQ stocks were given no newspaper coverage in 2002; 83 percent of stocks without media coverage in a particular month remained without media coverage the following month (Fang and Peress 2009). While measuring a fund's direct access to nonpublic information is not possible, observing and measuring which companies they invest in and the returns generated, from a geographic perspective, is possible. Concurring with Merton's (1987) investor recognition hypothesis, stocks that are not well known (recognized) must offer higher returns in order to attract investors because of the higher risk involved with investing in relatively unknown companies (Lehavy and Sloan 2008).

The returns are notable, as stocks with no media coverage often earn annualized returns 8 to 12 percent higher than media-covered stocks (Fang and Peress 2009).

"Local" Defined

Coval and Moskowitz (2001) indicate that funds earn higher rates on their local investments and can exploit informational advantages of stocks within a 100km (62 mi) radius, implying that such informational advantages stem from the development of social relationships between fund managers and stock firm decision-makers because of their close geographical proximity. The benefits are mutual: stock firms enjoy higher stock prices and greater investor recognition, while funds generate increases on their returns. The average fund manager invests about 7 percent locally and generates an additional 2.67 percent per year more in returns from local holdings than non-local holdings. For the few funds that invest up to 25 percent locally, these funds tend to generate the largest gains, as much as 5 percent more than non-local holdings annually (Coval and Moskowitz 2001). Funds in small or remote cities that invest locally enjoy the highest returns at up to 8.49 percent annually (Coval and Moskowitz 2001). Ironically, the highest returns come from funds that are smaller, older, and have fewer holdings (Coval and Moskowitz 2001). Local institutional investors (i.e. funds and banks) are found to have a "significant information advantage over non-local institutional investors" (Baik, Kang and Kim 2010, 83) resulting in more profitable trades generated by local investors.

The term "local" is qualitatively different for García and Norli (2012) who define local as stock firms that have business operations (e.g. factories, warehouses, offices, or stores) in no more than two states, while "dispersed" firms have business operations in three or more states. For example, Chipotle Restaurants (CMG) is highly dispersed, as it

has locations in 43 states; Steve Madden Limited (SHOO) has locations in 12 states and is moderately dispersed; Summer Infant Incorporated (SUMR) has locations in only one state and is classified as local. García and Norli (2012) demonstrate that there is an inverse relationship between local and dispersed stocks and their respective returns. For local stocks that have smaller market capitalizations (i.e. the company size is small) and struggle to attract investors, these stocks tend to offer higher returns in order to assuage investor's concerns over the stock's lack of recognition and the potentially higher risk associated with them. Larger, more dispersed stocks already have investor recognition; thus, they presumably have less incentive to offer higher returns as a means to offset risk.

In the United States, Ivković and Weisbenner (2005) find that local stock investments, defining local as stocks within 250 miles of an investor, represent about 30 percent of all stock investments, while Seasholes (2013) shows that 19 percent of portfolio investments are from investors within a 62 mile radius of their investments. Malloy (2005) points out that the recommendations by local stock analysts, especially those who work in remote areas (i.e. at least 250 miles from the 20 most populated U.S. cities) tend to have the most superior forecasts, earning up to an additional \$0.14 per share, because they have an informational advantage about local stocks through strong social relationships. Because geographically remote stocks have more difficulty attracting investors, John, Knyazeva and Knzazeva (2011) argue that such stocks pay dividends more often and with higher yields. Conversely, stocks in the largest U.S. cities tend to offer lower returns than stocks located in smaller cities (El Ghoul, et al. 2013).

The relationship between locality and stock price is not unique to the United States. Chinese investors often invest in stocks that are geographically close to them

(Liao, et al. 2012). While there is not necessarily an informational advantage in doing so, Liao (2012) provides evidence that it is familiarity itself with a stock that induces investment. Chinese investors who live near a stock's headquarters tend to buy or sell as a group; surprisingly, while geographically distant investors also buy or sell homogenously, their trading positions are often the opposite from the local group, even though the trades are done within the same time frame. In Germany, Hau (2001) comments that investors near a stock's headquarters outperform distantly located traders, while Swedish investors also earn higher returns from local investments (Bodarnuk 2004), thus affirming that the relationship between proximity and return is not limited to the United States.

Pirinsky and Wang (2006) show that stocks in the same geographic area tend to exhibit price movements along a similar direction, called positive covariance. When a stock relocates its headquarters (i.e. when it moves to a new area), its price tends to adapt to the covariant structure of the new area. In other words, stock price movements tend to follow the trend of the surrounding area. Covariance tends to decrease as the distance increases between stocks, called negative covariance (Farooq and Hassani 2013). Lastly, covariance exists irrespective of industry type, and cannot be explained by local economic fundamentals (Pirinsky and Wang 2006).

In areas where fewer stocks compete per capita for investor dollars, like within the Deep South, the lack of competition leads to an "only game in town effect" in which these stocks can demand higher prices (Hong, Kubik and Stein 2008). Stock prices follow the supply-and-demand model: with fewer local stocks available to investors, the higher the price. For example, hotel room prices are cheaper in areas where they are abundantly available, but are priced higher when in short supply (Hong, Kubik and Stein 2008).

Niche Findings

While the majority of the literature focuses solely stock price, dividends are another means by which company earnings are shared with its investors. Dividend paying stocks are often owned by senior citizens, age 65 and over (Becker, Ivković and Weisbenner 2011). Funds and banks pay particular attention to areas with high senior population densities because seniors account for about 40 percent of all stock investments, hold more than 90 percent of checking and savings accounts, and 20 percent of certificate of deposit (CDs) or money market accounts (Becker, Ivković and Weisbenner 2011). Seniors typically invest their money with local banks, which in turn, invest in local stocks and other local businesses. Because seniors have less "investment turnover" (i.e. they tend not to move their money around), banks attract seniors by offering consistent dividends with high yields.

Brown, et al. (2008) note that individuals invest more frequently in the stock market when there is a higher level of investment by the surrounding community. The most likely causative factor for this is "word of mouth" in which family, friends, and coworkers exchange information.

While the majority of the available literature indicates that there is a relationship between geographic proximity and profit, Seasholes and Zhu (2010) find that investors who live within a 250-mile radius of a stock do not have abnormally high returns; however, the radius used is unusually large and may dampen the granularity of other research. While mutual fund managers tend to overweight their portfolios with local

stocks, Pool, Stoffman, and Yonker (2012) point out that such funds do not outperform other holdings, but add excessive riskiness because of the disproportionately local investments.

Hypothesis

The existing literature for employing geographic proximity as a variable for stock price returns comes largely from economists. The results of their geographical research are shown mostly in statistical tables, but sorely lack the cartographic representation that could more effectively demonstrate the relationships among the principals involved. If the returns from funds' geographically proximate stocks are consistently greater than from their distant investments, it is possible to infer that funds have an informational advantage about local stocks; therefore, it is hypothesized that the profitability of returns decreases as the distances between funds and the headquarters of the companies that collectively constitute their portfolios increase. Alternatively, if there is a negative correlation, or no significant correlation, between the distances between funds and their stock holdings, then it can be argued that spatial proximity does not equate to an informational advantage.

Data and Methodology

In the United States, the mutual fund market is a \$13 trillion industry, with 493 companies—fund families—that maintain over 7,400 unique funds (Investment Company Institute 2013) investing primarily in U.S. stocks, called *domestic equity funds*, the only types of funds studied here. In order to collect a reasonably representative sample of fund information, the headquarters address for each fund family was obtained through the Securities and Exchange Commission (SEC) website², then geocoded with a geographic information system (ArcGIS 10.1). S&P Capital IQ³ provided additional mutual fund data, including ticker symbol, fund name, fund family name, portfolio manager tenure, fund inception date, fund size (in millions, as of 12/31/2013), and minimum initial investment amount. Because fund families can contain dozens, even hundreds, of unique funds, only one fund per fund family was chosen at random. Additionally, a stratified sampling of 226 small capitalization funds (i.e. smaller sized funds) was obtained, using only no more than ten funds per state, when available, within the contiguous United States.

The 226 funds in the sample collectively own 2,612 unique stocks (Figure 1) many of which are owned by multiple funds (Figure 2). For example, the company Apple, (listed by its NASDAQ ticker symbol, AAPL) is held by 47 separate funds. The stocks that are held by funds frequently aggregate along the coasts (e.g. Los Angeles and New York). While a few stocks are disproportionally held by multiple funds, 89 percent of held stocks are held by fewer than 3 funds each.

² http://www.sec.gov/foia/docs/invafoia.htm

 $^{^{3}\} http://www.netadvantage.standardandpoors.com.libproxy.csun.edu/NASApp/NetAdvantageUSEquityFunds.do$



Figure 1 The location of funds and stocks are spatially shown



Figure 2 The number of stocks held by multiple funds

Both the stock holdings for each fund, as well as data on the funds themselves, were obtained through Morningstar.com, a subscription-based website. The data includes the name and ticker of all the stocks held by each fund; portfolio weighting, the percentage of ownership of individual stocks in a portfolio; the date the stock was first bought by the fund; how many shares are owned; when the stock was purchased; the current price; the stock exchange to which it belongs (e.g. Nasdaq); its industry sector (e.g. Technology, Energy, Finance); its market capitalization (i.e. the size of the company). Additional data about each fund also includes its net asset value (NAV), its share price; turnover, the degree to which existing holdings are replaced with new ones, per year; total assets, the financial size of the fund; finally, the total return, ranging from as little as one day up to 15 years. Only the 1-year returns are examined here.

Due to a limitation in the data obtained from Morningstar, the information regarding returns used in this study may not have been held for all the time periods in question. Thus, the stock return data used in this study is treated as if the stock were owned by the fund for a full year. A review of the dataset indicates that out of the 12,997 stocks examined, only 6.5 percent were purchased for the first time during December 2012 to December 2013 study period. Because the setback in the data is minor, the full dataset, including these stocks purchased less than one year ago, are included to determine profit or loss for their respective funds.

With respect to the funds sampled, because the original sampling was limited to about ten funds per state (when available), it was difficult to obtain a proper sampling of funds from California, partly because there are so many funds and because large distances separate major cities, especially Los Angeles and San Francisco. Funds were chosen in diverse locations; thus, fund companies in Los Angeles are underrepresented in the study.

Determining the distances between funds and their holdings is essential so that the spatial relationships between proximity and stock purchases, as well as proximity and returns generated, can be fully measured. The number of holdings and the average annual returns were also determined per state.

Because Coval and Moskowitz (2001) find that stocks headquartered in smaller cities perform better than stocks from larger cities, both the frequency of stocks held and their annual returns were analyzed, using the distances of the holdings from their respective funds. Funds headquartered among the top twenty metropolitan statistical areas (MSAs) were analyzed separately and compared to funds held in smaller cities (Figure 3). The straight line distances between each fund and each of the stocks in its holdings were grouped at every 100-mile increment, thereby providing a means with which to measure both the quantity of holdings by "distance group" and also the annual average returns. This was done to "smooth" the data, a useful technique that helps the analysis focus on the effect of relative distance while mitigating the effect of single stocks held at unique distance intervals.

In order to calculate the distance between a fund and its holdings, a distance model was created, using ArcMap Model Builder (Figure 4), resulting in a "distance" column, providing the Euclidean-mile distance between funds and their respective holdings. This was then concatenated using Python script to produce a single point layer (Figure 5). ArcMap Business Analyst was also employed to create spider diagrams, connecting funds and their holdings through line data.



Figure 3 Spatial locations of funds in top-20 largest metropolitan statistical areas (MSAs) and smaller cities (non-MSAs)



Figure 4 ArcMap ModelBuilder script to produce the distance between funds and their holdings (Euclidean miles)

```
# Final Project
     # Created by: Mark McPherson
2
3
     # Description: Determine distance between mutual funds and its holdings
 4
 5
     import arcpy, sys, traceback
 6
7
      # set geoprocessing environment: a) set the workspace environment
     arcpy.env.workspace = r"C:\A Thesis\0 - DOCUMENTATION\ModelBld Results"
 8
9
10
     # set geoprocessing environment
11
     arcpy.env.overwriteOutput = False
12
13
     listTable = arcpy.ListTables()
14
15 - try:
16
17
18
         arcpy.Merge management(listTable, "DistancesStkFnd.dbf")
19
         print "done"
20
21 - except:
22
         # Code to run when an error occured
23
         print "\n" + arcpy.GetMessages()
         # Get the traceback object
24
25
        tb = sys.exc info()[2]
         tbinfo = traceback.format tb(tb)[0]
26
27
         # Concatenate information together concerning the error into a message string
28
         pymsg = "PYTHON ERRORS:\nTraceback info:\n" + tbinfo + "\nError Info:\n" + str(sys.exc info()[1])
29
         msgs = "ArcPy ERRORS:\n" + arcpy.GetMessages(2) + "\n"
         # Print Python error messages for use in Python / Python Window
30
31
         print "\n" + pymsg + "\n"
32
         print msgs
33
34 -else:
35
         # Message when there was no error
         print "\nNo Error occurred"
36
37
     # Script end message
     print "\n------ End of script ------"
38
```

Figure 5 Python script to concatenate ModelBuilder data into one layer

The distances between funds and their holdings were banded together into 100mile "distance groups," thus allowing an analysis between the frequency with which stocks are held and their annual average returns. Aggregating the holdings into 100-mile distance groups gave the opportunity to analyze potential changes in purchasing trends as well as the returns generated, with distances ranging from 1 to 2600 miles.

The financial temperaments of funds were studied through both fund size, the total assets held by the fund, as well as the annual returns generated in 2013. Measuring fund size and annual return together can demonstrate whether larger funds, which have greater assets and buying power, have higher returns than smaller funds, or whether fund size is a relevant factor with respect to returns.

Longitudinal Assessment: Spatial, not Temporal

Separate analyses of the holdings and their returns provided the ranges of annual returns based upon longitude—in spatial terms (not temporally). The longitude of all holdings was rounded to the nearest integer; then, their annual returns were averaged and displayed according to the median line in which they were classified. The first analysis displayed each fund, both by longitude and by its annual return. The second study averaged all fund returns, by longitude, then parsed the funds based on their proximities within, or outside of, MSAs. This procedure tests whether the population of a city influences the annual returns funds generate. Out of the 226 sampled funds, four were found to have been operating for less than one year and could not yet provide an annual return figure; therefore, they were excluded from further review, leaving 113 funds within the top 20 MSAs (i.e. big city funds) and 109 from non-MSAs, (i.e. smaller cities that are not located within the top 20 MSAs), totaling 222 funds. Among the 12,997

stocks held by funds, 7,539 (58 percent) were headquartered within MSAs, while the remaining 5,458 (42 percent) of held stocks were located in non-MSAs (i.e. smaller cities).

In order to demonstrate the spatial relationships between funds, their holdings, and each holding's annual return, it is beneficial to employ *spider diagrams* because they provide a topographic view of where funds invest and how well their investments perform, a perspective only available through geographic means. Four funds were chosen to illustrate the buying patterns and annual returns geographically. Each fund is headquartered in different parts of the country; specifically, ACWIX, a small capitalization fund located in Chicago, IL; TORLX, a large capitalization fund headquartered in Fresno, CA; GVMCX, a mid-capitalization fund in Mobile, AL; and RIMMX, a mid-capitalization fund based in Seattle, WA. Two of the funds are located within large city MSAs; the others in smaller cities. While fund size was not specifically considered, it is noted that fund sizes range from 35.9 million to 950 million dollars.

Results

There is a propensity for funds to purchase geographically proximate stocks, with the number of holdings decreasing as the distance between them increases. At the 1 to 100-mile distance group—the geographically most proximate group—exactly 800 stocks (6 percent of all holdings) are held by 174 funds (77 percent of all funds) (Figure 6). Within a 250-mile radius, 1,795 stocks (14 percent of all holdings) are held by 205 funds (92 percent of all funds) (Figure 7). Using 250-mile distance increments, the largest number of stock purchases are made in the 501 to 750-mile distance group in which 2,167 stocks (17 percent of all stocks) are held by 222 funds (98 percent of all funds). This is in marked contrast to the 1,661 holdings (13 percent of all holdings) that are 2,000 to 2,750 miles from their funds which are held by only 128 funds (57 percent of all funds). This denotes that funds disproportionally own stocks that are geographically closer (i.e. within 750 miles of the fund headquarters), although not necessarily the geographically most proximate (i.e. within the first 250 miles of the fund).

When the returns of funds' holdings are examined geographically and within 100mile increments, returns tend to decrease as distance increases, approximately for the first 1000 miles, but then experience a prominent rise and drop between 1500 to 2200 miles. The returns ultimately ascend to their zenith at 51 percent at the 2401 to 2500-mile distance group (Figure 6), the approximate distance between states that line the western and eastern coasts, despite the fact that only 248 stocks are held in this distance group, while the average number of stocks held per distance group is 500 and the median number of stocks per distance group is 458.



Figure 6 Using a 100-mile distance scale (X axis), the frequency (count) of stocks held by funds is represented by the blue line (Y axis on the left). The percentage annual returns from stocks are averaged and represented by the red line (Y axis on right). As distance increases, the number of stocks owned by fund decreases; however, while stock returns decrease for the first 1000 miles, the returns climb despite the paucity of fund ownership



Figure 7 Within a 250-mile radius, 1,795 stocks (14 percent of all holdings) are held by 205 funds (92 percent of all funds)

Within the 1 to 100-mile distance group, holdings generate a 46 percent return; the 101 to 200-mile distance group generates returns of 43 percent; the 1001 to 1100-mile distance group yields returns at 33 percent. The cities involved at this distance interval tend to be Midwestern and East Coast, or Mountain States and Midwestern states. Florida cities are also generally around 1000 miles from both Midwestern and New England cities. However, after fund-to-stock distance becomes greater than 1000 miles, returns exhibit much greater variance and do not continue the downward trend, despite the increasing distance. In fact, after significant dip in returns for stocks held at 1000 miles, there is a general trend upward, with a secondary peak at 1700 miles and the most significant peak at the 2600 (bi-coastal) distance. The 1700 mile band is largely made up of stock/fund combinations involving Midwestern and West Coast cities.

The annual returns of all the stocks held by funds have been averaged (by distance group) in order to show how returns are influenced by geographic proximity; however, the standard deviation of these returns are abnormally high (Figure 8). This is occurring because there is tremendous variability in the returns themselves. For example, within the 1 to 100-mile distance group, the annual returns range from a low of -58 percent (Ticker: FIO) to a high of 975 percent (Ticker: ICPT), resulting in a very high sigma ($\sigma = 0.63$).

Studying purchases and returns at 100-mile increments provides a granular means to study funds' buying behaviors and their outcomes. However, among all of the holdings, the average distance between funds and their holdings is 1,003 miles, with a median distance of 866 miles. The average return is 41 percent, with a median of 34 percent, and a standard deviation of 0.47%.



Figure 8 The standard deviation of annual returns, by distance group. The sigma is large because there is so much variation in the returns themselves

When holdings are examined within 1 to 500 miles of their respective funds, 219 funds (97 percent of all the sampled funds) hold 3,489 stocks (27 percent of all the sampled holdings). These geographically proximate holdings generate an average 42 percent return, with a median return of 34 percent and have an average (median) distance of 243 (241) miles from their respective funds, but a standard deviation of 0.52.

The holdings farthest away from their respective funds, between 2000 to 2600 miles, include 128 funds (57 percent of all funds) and hold 1,661 stocks (13 percent of all holdings). These distantly held stocks yield an average return of 44 percent, with a median return of 35 percent and have an average (median) distance of 2,278 (2,288) miles from their respective funds.

When 500 holdings are randomly selected from the entire set, it is found that the average return is reduced to 39 percent, with a median return of 35 percent. The average fund-to-stock distance is 1038 miles, with a median distance of 899 miles. When comparing this spatially "expected" portfolio with the two "observed" portfolios (i.e. 1 to 500 miles and 2000 to 2600 miles), both the geographically most proximate and most distant holdings marginally outperformed the expected results.

The rise of returns among coastal areas suggests that calculating the distance between funds and their holdings might not be an adequate model for measuring potential informational advantages. It could very well be that investors in cities along the coasts obtain informational advantages over investors from non-coastal cities because of the political, cultural and economic ties that have developed over the years among these cities. For example, it would stand to reason that fund managers in the Silicon Valley region of California may be very well informed about stocks offered by Boston-area tech

firms simply because of interconnectedness of the tech sectors in Silicon Valley and the 128 Corridor region in New England.

The median number of holdings within each state is 113, with median returns at 41 percent. States with fewer holdings exhibit substantially greater variability in terms of performance on this measure. For example, among the 12,997 holdings, Wyoming has only six intrastate holdings and shows a negative 12 percent average (and negative 12 percent median) return, while Vermont's seven intrastate holdings result in a whopping (positive) average return of 86 percent (median 93 percent). Texas, despite its 1,499 intrastate holdings, it generates only a 30 percent average return, with a 23 percent median return. California is home to the largest number of intrastate holdings, at 2,050, and generates a 45 percent average return, with a median 33 percent return, lower than the national average (Figure 9). This makes some sense given the boom or bust nature of many tech stocks, many of which are offered out of California's Silicon Valley region. Oregon, with demonstrably fewer intrastate holdings, at 113, produces even higher returns averaging 49 percent (median 44 percent).

The analysis of fund behaviors among the 20 largest MSAs reflects a similar pattern as the overall sample. Stocks purchases among funds headquartered in the top 20 MSAs display several rises and falls within the first 1,000 miles (Figure 10), but ultimately pursue a downward trend. This effect suggests that funds may be more likely to hold more stocks from cities that are nearby. Funds in New York are more likely to hold stock in companies from nearby New York for example. There appears to be a tendency to hold stock in companies that are regionally proximate as well.



Figure 9 The count of holdings and average annual returns, by state, shows that the fewer the number of stocks held, the greater the "swings" in annual return



Figure 10 Stocks within MSAs, including average annual return and count held by funds. Holding decrease as distance increases, yet annual returns have substantial variation

So, it may be that funds in Chicago would hold stock in companies in Detroit, Cleveland and Milwaukee. The returns from these holdings reasonably follow the purchases, up to the 1001 to 1100-mile distance group, at which point the returns spike and drop; ultimately, the returns reach their zenith at the 2401 to 2500-mile group, which represents a coastal cooperation zone, beyond which the quantity of purchases fall as available city combinations (Miami-Seattle) begin to disappear.

The holdings purchased by funds in non-MSAs (i.e. smaller cities) first rise in frequency up to the 501 to 600-mile distance group; then, purchasing decreases steadily (Figure 11). The returns from these small city funds are relatively flat, but spike at the 1601 to 1700-mile distance group, followed by a dramatic drop to their nadir at the 2101 to 2200-mile distance group, culminating with a striking rise to their zenith at the 2401 to 2500-mile distance group. This latter rise is an unexpected result, given the substantially fewer purchases made in this geographically distant group. While no causal explanation can be provided, a "back of the envelope" calculation indicates that funds in the largest cities tend to invest either in the same city or in other large-city hubs. For example, funds based in Atlanta invest in Atlanta-based stocks about 5 percent of the time. It also has similar levels of investments in Chicago, Houston, Minneapolis, New York, and San Jose, implying that funds from larger cities tend to disproportionally invest in larger cities, including their own cities. Smaller cities, on the other hand, have fewer funds whose holdings tend to more dispersed among various cities. For example, among the funds in Scottsdale, Arizona, only Houston has a slightly higher proportion of Scottsdale's holdings, while the remaining holdings are greatly dispersed.



Figure 11 Non-MSA stocks, including average annual return and count held by funds. Holdings tend to decrease as distance increases, while annual returns are somewhat flat until the 1501 to 1600-mile distance group, from which point, there is great variation

When the average annual returns of holdings are exhibited both by longitude and by urban profile, the overall strength or weakness of the returns can be contrasted (Figure 12). The longitudinal results shown in this figure are not "time based", nor do the lines reflect any spatial positioning; rather, the average annual returns for holdings within MSA and non-MSAs are illustrated by their proximity to the nearest geographic meridian. Different return patterns emerge, based upon whether the holdings are headquartered west or east of the 97th meridian, which is the approximate central, vertical dividing line within the contiguous United States. Among the 7,539 holdings located within MSAs, there are 2,108 holdings west-and-inclusive-of the 97th meridian and 5,431 holdings east of the 97th meridian. There are 5,458 holdings headquartered outside of MSAs, from which 1,800 are west of the 97th meridian and 3,658 east of the 97th meridian.

Holdings west-and-inclusive-of the 97th meridian, "west-meridian" funds, exhibit substantially greater swings in their returns, especially for holdings that are within smaller cities; however, there are 50 percent fewer west-meridian funds than "eastmeridian" funds outside of MSAs (similarly, there are 40 percent fewer west-meridian funds within MSAs). Fewer stocks means that the variance from the mean can swing more wildly. East-meridian funds tend to have less return movement, except toward the east coast, in which the returns vacillate tremendously.

The annual returns of the funds themselves show that some of the highest returns tend to come from coastally-based funds. It is worth noting that there is no particular area that either dominates, or loses, although southern states (i.e. Texas to West Virginia) tend to generate similar returns ranging from 21 to 30 percent (Figure 13).



Figure 12 The annual average returns within MSAs and outside of MSAs (non-MSAs) are contrasted here, using longitude instead of distance groups. The lines represent annual average returns based upon each stock's proximity to the nearest meridian line. West of the 97th meridian has fewer holdings, but more variance among small-city stocks. East-meridian stock returns are more stable irrespective of MSA proximity; however, substantial return variation occurs closer to the east coast



Figure 13 Fund headquarters showing annual returns

It is worth noting that mutual funds in the Deep South (i.e. AL, GA, LA, MS, and SC) average a 19 percent return, and perform only slightly worse than funds in the Northeast (i.e. CT, DE, MA, MD, ME, NH, NJ, NY, PA, RI, and VT) which average a 24 percent return. A difference of only 5 percent is surprising given that the Northeast is comprised overall several states well-known for their financial sectors.

Fund size—the total assets held by each fund—vary greatly (Figure 14 and 15), as do the annual returns they generate. Fund sizes range from 1.4 million to 8.1 billion dollars. There are 26 funds (12 percent) with assets over one billion dollars, generating a median annual return of 24 percent, headquartered in New York (8.1 bil.), San Francisco (5.4 bil.), Kansas City, MO (4.8 bil.), and Atlanta (3.5 bil.). Among the smaller funds with total assets under 50 million—89 of them (40 percent) have a median annual return of 23 percent. When fund size and annual return (rounded to two decimal places) are compared, there is a 10 percent correlation (r=.10) between funds with total assets less than 50 million dollars and their annual returns, and a 12 percent correlation (r=.12) for funds with assets from 1 to 3 billion dollars and their annual returns. Thus, fund size is not a relevant indicator of its performance, since both the smallest and largest funds generate essentially the same returns.

Funds examined by longitude show substantial variation in their returns (Figure 16 and 17). Thus, location itself is insufficient to predict the performance of a fund. When fund returns are examined based upon their proximity to MSAs, funds in smaller cities generate slightly higher returns, at 25 percent, than funds within MSAs, at 24 percent. Funds in non-MSAs tend to have more dramatic price swings than their "within MSA" counterparts which likely results from the lack of quantity of funds in smaller



Figure 14 Fund size and returns. While the largest funds tend to be along the coasts, funds with the highest returns are often found elsewhere. Thus, larger fund size does not denote higher returns



Figure 15 The median fund size is 70 million with a median return of 24 percent



Figure 16 Fund annual returns are shown by longitude. Each point shows the annual return of each fund at each meridian (and does not reflect spatial location)



Figure 17 Fund average annual returns within MSAs and non-MSAs are displayed by longitude. Each vertex shows the annual return of each fund at each meridian (and does not reflect spatial location)

cities because the majority of smaller cities typically have only one fund, thereby skewing the results to an individual fund. Within MSAs, however, some of the best and worst performing funds are often geographically nearby, implying that geographically proximate funds do not necessarily share similar profits.

The year 2013 has been stellar for the majority of funds, with respect to their annual returns. The median annual return for all funds is 24 percent, ranging from 3 to 50 percent. Mapping the distances between funds and their holdings using a topological perspective shows the spatial relationships between these businesses. In order to show these relationships, four funds were randomly selected from various parts of the country including GVMCX, a Mobile, AL fund that generated 31 percent returns in 2013; ACWIX, a Chicago, IL fund which earned a 43 percent return. In Fresno, CA, TORLX gained a 38 percent return; in Seattle, WA, RIMMX provided a 30 percent return.

ACWIX fund is located within an MSA and owns 66 stocks (Figures 18 and 19). This fund's highest count of purchases (there are 28) fall within 500 to 800 miles from its headquarters and generate an average 82 percent return, although its median return is 30 percent. It has 15 geographically distant holdings over 1500 miles away, 15 percent of its portfolio, but deliver average returns of 83 percent, or a median 53 percent, consistent with coastal holdings.

GVMCX, a non-MSA fund, has the majority of its purchases, 66 percent, made within a 500 to 1100-mile radius of its headquarters, producing an average 36 percent (median 35 percent) return (Figures 20 and 21). Its 13 distantly held investments in California and Washington provide an average/median return of 29/28 percent respectively.



Figure 18 ACWIX fund: distance to its holdings and their returns



Figure 19 ACWIX Fund: Number of stocks held and their returns by distance



Figure 20 GVMCX Fund, distance to its holdings and returns



Figure 21 GVMCX Fund: Number of stocks held and their returns by distance

RIMMX fund is within an MSA and has 20 percent of its holdings invested on the east coast, producing average returns of 38 percent, or median 29 percent (Figures 22 and 23). Except for its east coast investments, this fund has well-dispersed purchases with largely strong returns across the board, but unlike the preceding funds, its coastal investments do not generate substantially higher returns.

The last fund, TORLX, is a non-MSA fund which invests 41 percent of its portfolio (31 holdings) along the east coast, generating an average 50 percent return (median 49 percent). The remainder of its holdings, while fewer in number, also generate similar returns (Figures 24 and 25).

When fund annual returns are viewed by longitude (Figures 16 and 17), there are 52 funds located west-and-inclusive-of the 97th meridian and 170 funds east of the 97th meridian. "West-meridian" funds have an average return rate of 39 percent, while eastmeridian funds have 31 percent. Among the west-meridian funds, there is an inverse correlation between longitude and annual return of -11 percent, meaning that as longitude decreases (moves eastward), returns marginally increase.

"East-meridian" funds have an inverse correlation of -17 percent, signifying that the farther eastward the fund is headquartered (i.e. longitude is decreasing), the higher the return. However, several longitudes have only a handful of funds, especially west of the 97th meridian, thus enabling fewer funds to exhibit higher returns.

Statistical Tests

Two final statistical tests were employed in order to determine whether the returns generated occurred due to astute investing strategies by fund managers or mere



Figure 22 RIMMX Fund: distance to its holdings and returns



Figure 23 RIMMX Fund: Number of stocks held and their returns by distance



Figure 24 TORLX Fund: distance to its holdings and returns



Figure 25 TORLX Fund: Number of stocks held and their returns by distance

randomness. The first test compares the observed (actual) count of stocks held, by distance group, with three sets of randomly chosen stocks (Figure 26). With the first 100-mile distance group of funds to their stock holdings, there are 760 stocks (note that figure differs slightly from prior results due to rounding), with an average random stock count of 673. The z-score is 7.02, meaning that the observed count of stocks within this geographically proximate group is dramatically larger than the count expected (no other distance group has such a high z-score). When the *returns* are compared, the 100-mile distance group is 4 standard deviations above average, thus demonstrating that the returns for this geographically proximate group far exceed expectation. The most extreme standard deviations for returns occur in the 1000 to 1100-mile (z = -8.75) and the 1600 to 1700-mile (z = 8.36) distance groups, with indicating that stocks in these groups far poorer (or better) returns than expected.

The second test examines distance and returns at the state level to ascertain whether both the quantity of investments held and the returns generated, by state, result from a propensity toward local investment or due to randomness. It is found that the state with the highest frequency of geographically "close" purchases, Louisiana, with an average fund-to-stock distance of 480 miles, generates returns that are 2.18 standard deviations higher than expected (i.e. using three sets of random returns for comparison) (Figure 27). Washington State, however, has an average fund-to-stock distance of 1749 miles, the geographically most distant, yet generates only average return (z=0.22). Texas, though, with a relatively average fund-to-stock distance of 1063 miles, suffers from a -9.68 standard deviation of its returns. The returns generated within the small state of Delaware, however, are over 9 standard deviations that what is expected.

10		115 Mar 1					
Distance Gro	oups Observed stocks count	Count of RND1BAND	Count of RND2BAND	Count of RND3BAND	RAND_AVG	STDDEV	Zscore
0	760	663	670	687	673.333333	12.3423391	7.021899681
100	606	540	562	529	543.666667	16.8027775	3.709704134
200	623	609	598	643	616.666667	23.4591844	0.269972443
300	614	579	585	574	579.333333	5.50757055	6.29436634
400	702	683	700	684	689	9.53939201	1.362770288
500	674	717	742	679	712.666667	31.7227573	-1.21889362
600	870	896	889	895	893.333333	3.7859389	-6.16315634
700	835	892	874	870	878.666667	11.7189306	-3.72616481
800	681	689	678	691	686	7	-0.71428571
900	816	807	773	785	788.333333	17.2433562	1.604482697
1000	659	694	703	716	704.333333	11.06044	-4.09869167
1100	449	467	463	495	475	17.4355958	-1.49120227
1200	401	386	412	422	406.666667	18.5831465	-0.3049358
1300	339	386	387	359	377.333333	15.8850034	-2.41317753
1400	486	477	509	463	483	23.5796522	0.127228339
1500	365	368	415	403	395.333333	24.4199372	-1.24215444
1600	318	334	322	312	322.666667	11.0151411	-0.42365927
1700	356	351	374	347	357.333333	14.571662	-0.0915018
1800	291	290	265	290	281.666667	14.4337567	0.646632301
1900	263	281	263	295	279.666667	16.0416126	-1.03896454
2000	166	230	198	232	220	19.078784	-2.83036906
2100	251	238	228	230	232	5.29150262	3.590662494
2200	183	158	156	163	159	3.60555128	6.656402355
2300	287	313	283	276	290.666667	19.655364	-0.18654789
2400	534	489	476	489	484.666667	7.5055535	6.572910757
2500	343	334	348	340	340.666667	7.02376917	0.332205299
2600	107	109	110	115	111.333333	3.21455025	-1.3480372
2700	18	17	14	13	14.66666667	2.081666	1.601281538
Grand Total	12997	12997	12997	12997			

Figure 26 Observed stocks compared with randomly selected stocks. Results shows that with the geographically most proximate group (1 to 100 miles), the number of purchases is over 7 standard deviation above what is expected

				-		~			1. A A A A A A A A A A A A A A A A A A A	
	Count of	Average of	Average of	Average of	Average of	Average of				
State	OBS_Return	OBS_dist	OBS_Return2	RND1RET2	RND2RET	RND3RET	AVG	STDEVS	Zscore	-
LA	110	479.4669	0.4488	0.3329	0.3947	0.3912	0.3729	0.0347	2.1854	-
он	417	762.0448	0.4529	0.4130	0.3785	0.4455	0.4123	0.0335	1.2107	-
TN	268	776.2920	0.4174	0.3671	0.4858	0.4445	0.4325	0.0603	-0.2508	
IN	248	814.6912	0.4335	0.3938	0.4105	0.3947	0.3996	0.0094	3.6042	-
IA	172	822.9953	0.3492	0.4340	0.4433	0.4772	0.4515	0.0228	-4.4934	-
KS	232	855.7932	0.3378	0.4372	0.3899	0.3830	0.4034	0.0295	-2.2205	
IL	583	862.2167	0.4912	0.3616	0.4231	0.4193	0.4013	0.0344	2.6092	-
OK	188	868.5690	0.3120	0.4076	0.3680	0.3937	0.3898	0.0201	-3.8656	_
MO	518	870.3033	0.4516	0.3995	0.4017	0.4196	0.4070	0.0110	4.0427	_
MI	326	871.5970	0.3767	0.4128	0.3984	0.4256	0.4123	0.0136	-2.6102	
MN	506	893.0052	0.3754	0.4420	0.4030	0.3731	0.4060	0.0346	-0.8861	1
GA	543	915.1716	0.4499	0.3908	0.4016	0.3828	0.3917	0.0094	6.1705	
WI .	564	917.3113	0.4262	0.4301	0.4028	0.4213	0.4181	0.0140	0.5829	
VA	514	927.1401	0.3258	0.4144	0.3930	0.3849	0.3974	0.0152	-4.7033	_
AL	114	930.0748	0.3206	0.4206	0.4951	0.4391	0.4516	0.0388	-3.3814	
NE	177	939.7689	0.3066	0.4056	0.4128	0.3630	0.3938	0.0269	-3.2401	
MD	516	941.9697	0.4038	0.4060	0.4004	0.4114	0.4059	0.0055	-0.3866	
NC	127	984.8317	0.3936	0.4065	0.3646	0.3535	0.3749	0.0280	0.6706	
WV	71	1018.8620	0.4142	0.3893	0.5191	0.3333	0.4139	0.0953	0.0033	
PA	588	1019.9428	0.4587	0.4217	0.3843	0.4123	0.4061	0.0194	2.7045	
TX	558	1022.0297	0.3600	0.4161	0.4275	0.4275	0.4237	0.0066	-9.6828	
NJ	434	1036.4000	0.3217	0.3673	0.4043	0.4019	0.3911	0.0207	-3.3510	
DC	75	1044.4243	0.3452	0.3370	0.3345	0.4521	0.3745	0.0672	-0.4362	
SC	61	1055.7880	0.3648	0.4100	0.3846	0.4391	0.4112	0.0273	-1.7020	
CT	721	1074.1147	0.4741	0.3846	0.3916	0.4052	0.3938	0.0105	7.6617	
NY	518	1093.2671	0.5093	0.4054	0.3734	0.3774	0.3854	0.0174	7.1121	
VT	154	1108.6918	0.2955	0.4249	0.4277	0.3985	0.4170	0.0161	-7.5291	
NH	82	1125.3916	0.2995	0.4102	0.4718	0.4848	0.4556	0.0398	-3.9199	
DE	273	1125.5562	0.6069	0.4415	0.4440	0.4096	0.4317	0.0192	9.1289	
MA	535	1126.8710	0.4157	0.4332	0.4058	0.3915	0.4101	0.0212	0.2629	
NM	42	1141.7229	0.3028	0.4324	0.3370	0.3457	0.3717	0.0528	-1.3043	
CO	488	1150.5241	0.4052	0.4208	0.4620	0.3982	0.4270	0.0323	-0.6751	
ND	44	1155.7966	0.2440	0.4975	0.5515	0.4416	0.4969	0.0549	-4.6047	
ME	33	1162.9429	0.2294	0.3907	0.3493	0.4310	0.3903	0.0408	-3.9411	
FL	351	1257.0161	0.3159	0.4229	0.3619	0.3819	0.3889	0.0311	-2.3482	
MT	64	1290.8998	0.2938	0.4270	0.4021	0.3810	0.4034	0.0231	-4.7549	
UT	177	1295.3276	0.3029	0.4544	0.3339	0.4172	0.4018	0.0617	-1.6039	
NV	93	1411.1341	0.6080	0.3426	0.4010	0.4347	0.3928	0.0466	4.6183	
AZ	204	1413.8043	0.3404	0.3926	0.4416	0.3825	0.4056	0.0316	-2.0600	
OR	494	1700.9468	0.3794	0.3858	0.3895	0.4236	0.3996	0.0208	-0.9700	
CA	385	1715.6037	0.3726	0.3982	0.4484	0.4216	0.4227	0.0251	-1.9974	
WA	429	1749.4325	0.4182	0.4201	0.4147	0.4180	0.4176	0.0027	0.2184	
Total	12997	1063.2703	0.4069	0.4069	0.4069	0.4069	0.4069	0.0000	0.8000	

Figure 27 The number of holdings and returns generated are examined by state. Louisiana-based funds invests locally the most frequently. Washington State-based funds invest the most distantly, yet Louisiana generates returns over 2 standard deviations from what is expected, while Washington generates only average returns.

Lastly, the returns among the ten states which invest "the closest" generate an average return of 41 percent, while the ten states which invest "the most distantly" generate a 35 percent return.

Discussion

The finding by Coval and Moskowitz (2001) that holdings which are geographically proximate to their respective funds earn higher returns is largely substantiated; however, their study focused upon local stocks, defined as fund-to-stock distances of 100 kilometers or less, while greater fund-to-stock distances were lumped together as distantly held stocks. Results show a finer granularity when fund-to-stock distance are examined at 100-mile distances (as with this study) and show the effects of coastal investments, a finding not found in Coval and Moskowitz's (2001) study. When fund-to-stock holdings are displayed by 100-mile distance increments, the relationship between proximity and purchases is unambiguous, as the trend shows that funds disproportionately buy stocks that are geographically closer to them, with purchases decreasing as the distance between them increases. The annual average returns display a partial downward trend in that returns tend to decrease as the distance between funds and their holdings increases, at least for the first 1,000 miles. After that, returns vacillate substantially, but ultimately peak at the 2401 to 2500-mile distance group (i.e. approximately the distances between west-coast states, including CA, OR, and WA, and their east-coast counterparts, including CT, FL, MA, NJ, NY, and RI).

Despite the high returns at the 2401 to 2500-mile distance group, there is a striking dearth of purchases here. In other words, while the highest returns occur at the coasts, the fewest number of funds are buying them. Why? It is presumed that fund managers are aware of these high return stocks, yet funds are not collectively showing an interest in purchasing them. The absence of such purchases is puzzling. While it is possible that stock returns have momentarily outpaced funds' ability to "catch up" with

these high performing—but geographically distant—stocks, it seems unlikely because the returns provided are annual; additionally, it is the intrinsic nature of funds to replace poor performing stocks with ones they expect will rise in value, thereby producing a reasonably similar stocks-held to stock-return proportion. Thus, while a few funds might not have "caught on" to the high returns emanating from the largely coastal states, the results show a paucity of fund investments. One interpretation, based solely upon speculation, is that the large gap between purchases and returns may stem from funds' intentional choices not to buy in largely coastal states, possibly because these (coastal) stocks are overpriced; thus savvy funds simply ignore them. It may also be a sign that a market correction is due for coastal states, especially since the tremendous purchasing power of funds—13 trillion dollars—is not showing its financial support in these areas.

It should be noted that the distance between funds and their geographically proximate stocks does not denote that *all* nearby stocks are included; in fact, the majority of stocks are not owned by *any* fund. For example, there are approximately 7,300 stocks available in the United States stock market, but only 2,612 (36 percent) of them are held by funds. This does not imply that the remaining 64 percent of stocks are performing poorly (perhaps they are), but two-thirds of the potential market is avoided, or ignored, by funds.

When stocks are studied based upon proximity to MSAs, stocks within MSAs are purchased by geographically proximate funds twice as often as stocks from non-MSAs. Within MSAs, as distance increases, stock purchases decrease for about 500 miles, but then a dramatic increase in purchases occurs, creating a parabolic effect with an almostperfect "U" shape (Figure 6). This is in marked contrast to stocks from non-MSAs, in

which purchases increase as distance increases, creating a rough "A" shape (Figure 11), but only for the first 500 miles; then, purchases consistently decrease while distance increases. From the macro perspective, the trend lines are largely the same; yet, at geographically proximate distances, arbitrarily chosen at around 500 miles or less from fund headquarters, the trends are essentially reversed.

Fund managers tend to buy substantial quantities of MSA-based stocks provided that they are within 200 miles of the fund headquarters; however, fund managers exhibit considerably more caution about MSA-based stocks as distance only slightly increases, given the dramatic drop in purchases over the next several hundred miles. There may be a perceived "safety" in buying locally, as long as *local* also means MSA—big city stocks; or, there may have an *informational advantage*, as Coval and Moskowitz (2001) infer. However, purchases of MSA-based stocks rise again—and peak—at the 601 to 700-mile distance group. This "U"-shaped purchasing-over-distance phenomenon appears to be relatively commensurate with the returns provided by MSA-based stocks.

Contrasted with the aforementioned behavior, fund managers that buy geographically proximate stocks from smaller cities progressively buy them in greater quantities as distance from the fund increases, peaking at the 600-mile radius and diminishing only after 1000 miles. The returns from smaller-city stocks are relatively stable, despite the diminishing purchases as distance increases. The exception to this is after 1500 miles in which the returns vacillate dramatically, while purchasing continues to plummet.

The differences fund managers make in their purchasing choices between stocks headquartered within MSAs, or in non-MSAs, is subtle but since the goal is to ascertain

whether distance is a salient factor in determining profitability, it is found that funds purchase local stocks with greater frequency which generate good returns in smaller cities and even better returns within MSAs. The term "good returns" is somewhat arbitrary, especially since the year 2013 has had abnormally high returns overall, and since returns are exceptionally high at the coasts. With respect to Coval and Moskowitz's (2001) finding that smaller cities generate higher returns than larger cities, the findings here indicate that within a 400-mile radius of funds, MSA-based stocks initially have higher returns but then quickly drop, whereas smaller-city stocks have more stable returns over a larger radius from funds.

When viewed by longitude, funds in non-MSAs perform better, although occasionally worse, than funds within MSAs. Funds in smaller cities tend to generate higher returns than funds within MSAs; however, there are several meridians which have only one or two funds, thus creating greater peaks and valleys of returns since no median or average can be utilized. Given this skew, smaller-city funds outperform funds within MSAs, except between the 96th to 90th meridians (roughly Topeka, Kansas to Madison, Wisconsin) in which the returns from funds within MSAs produce superior returns. The returns could be statistically weighted by count-per-meridian so that an apples-to-apples calculation could be given; however, this is eschewed because a "raw" longitude-based study reveals a true assessment of which areas (i.e. meridians) generate greater, or poorer, returns. An increased fund sample size would have mitigated this dilemma and would have provided a more accurate picture of the returns viewed by longitude. Additionally, only twenty MSAs were used for this study, an arbitrary choice that has pros and cons. On one hand, fewer MSAs allow for greater contrast of returns between larger and

smaller cities; on the other hand, additional MSAs would have filled in more areas, especially west of the 97th meridian which has only seven MSAs, as there simply is too much "blank space."

The results from the distance-based and state-based statistical tests clearly demonstrate that there is a measurable benefit from investing locally, given that there is six percent greater return among states that invest locally. Implicit in this is the realization that social connection (i.e. face-to-face interaction) lies at the heart of this phenomenon, given that social and business relationships can be developed and maintained when all parties are geographically proximate.

Conclusion

After studying the relationship between funds, stocks, distance, and returns, is the practical question of what to buy, or geographically speaking, where to buy. While a full treatise for purchasing funds or stocks cannot be offered here, there are several geographic considerations that can be employed which may mitigate risk and increase opportunity for success. First, examine local funds and stocks. Fund managers buy local stocks more frequently than distant stocks and generate higher returns. They likely have information advantages about local stocks (i.e. they have information about a stock that is not yet publicly available). Funds are also required to publish their portfolio of holdings (i.e. the stocks they own) either quarterly or annually. There is a significant lag-time before their holdings are published; therefore, it is unknown whether buying what they already bought months ago, would generate salient profits, but studying the companies they purchased may help in understanding market or industry trends, at least within a relatively small radius. On the other hand, even if the fund-to-stock distances are higher, a fund may have several purchases in similar locations, thus implying a "heads up" attitude towards these distant areas as well.

Nothing should substitute for a Warren Buffett-style approach of value investing in which stocks are examined for their intrinsic worth and then compared with market price. If a particular stock is undervalued—but otherwise sound—it is a worthwhile investment. However, I believe that by employing certain geographic elements, including fund-to-stock distances and longitude-based assessments, the *search* for potentially worthwhile stocks may be narrowed.

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