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Article *in* The Journal of Real Estate Finance and Economics · February 2000

DOI: 10.1023/A:1007887725508 · Source: RePEc

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September 2, 1997

[1]We are grateful to Mike Miles and Joseph Mahoney for providing data. William Hulcher provided guidance on Census of Governments data. Jessie Yang assisted with the research. We received useful comments on an earlier draft from many colleagues, including David Hartzell and Richard Green. However, none of these individuals is responsible for our remaining errors.

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Abstract

This paper confirms and extends prior results regarding tilting of institutional investment in common stock towards quality. The evidence presented here suggests that, while both Real Estate Investment Trusts and institutional investors tilt their real estate holdings toward quality, the tilt is much more pronounced in the case of institutional investors. Controlling for quality, there is further evidence that institutional investors overweight locations where the share of local employment in business services, finance, insurance, and real estate, and transportation is relatively high (compared to national averages). This evidence is consistent with the hypothesis that significant sector tilting by institutional investors is induced by the constraints of the prudent man rule.

1 Introduction

In a recent paper, Del Guercio (1996) advances the idea that institutional investors purposefully tilt their stock portfolios toward high-quality stocks. Her tests compare the equity portfolio weights of bank managers on high-quality versus low-quality stocks to the weights chosen by mutual fund managers. Del Guercio finds that bank managers tilt their stock portfolios toward quality stocks more than mutual fund managers.[1]

The Del Guercio study is motivated by the belief that it not very important to anyone but the plan manager (and, possibly, to pension beneficiaries and to the government, if the plan is government insured) how much market risk the private trust or pension fund stock portfolio has. This is because the private trust or pension fund is a corporate asset, and is normally a relatively small part of the total value of the corporation. Moreover, since the corporate shares are themselves owned by individuals who hold other assets in their portfolios as well, corporate shareholders will simply take whatever risk they find into account in adjusting the risk of their total portfolio (see e.g. Black (1976)). The plan manager, however, is potentially liable when

[1] Del Guercio's results are consistent with a prior study by Badrinath, Gay, and Kale (1989), which finds a significant and positive relation between the aggregate level of institutional ownership and the "prudence" of a security. Del Guerio's analysis also is consistent with studies by Shefrin and Statman (1995), and Lakonishok, Shleifer, and Vishny (1992 and 1994).

an investment does badly.[2] As a consequence, plan managers have an incentive to protect themselves from liability by tilting their portfolios toward high-quality assets that are easy to defend in court.

Del Guerico's results imply that pension fund assets are probably inefficiently diversified, since most investment decisions are typically judged either high-risk or low-risk by the courts without regard to the role that the proposed investments play within the overall plan portfolio. Further, this reduced level of diversification will lessen the value of the claim that the pension beneficiaries have on the corporation (particularly if there is a chance that the corporation will go out of business and leave a pension fund that is not large enough to pay the promised benefits), and will increase the value of the claim the pension beneficiaries have on government insurance. Del Guercio argues that since bank trust managers of private trusts and pension funds are the most legally constrained investor type, they should weight their portfolio heavily with high-quality stocks, compared to other investors.

[2]Pension fund managers are governed either under common-law prudence-standards if they are a bank trust department or under ERISA (Employees Retirement Income Security Act) if they are a life insurance company or an independent investment manager. Both sets of standards often hold pension fund managers personally liable for losses on individual investments that most would not consider to be imprudent ex ante. However, as Del Guercio (1996, p. 33-36) recognizes, there is some variation in exposure to legal liability across the different types of investment managers.

In this study, we extend Del Guercio's results by demonstrating that institutional investors purposefully tilt their real estate holdings toward quality, too. The Del Guercio study focused on the equity market, and of course this is only a portion–albeit a major portion–of investable wealth (Ibbotson, Siegel, and Love (1985)). This study uses real estate portfolio weightings to test if institutional investors tilt their portfolios toward quality. The results below demonstrate conclusively that significant differences exist between public and institutional managers in their propensity to tilt their real estate portfolios toward quality.

Our experimental design follows Del Guercio as closely as possible, given the differences in available data. Del Guercio had data on the stock portfolio holdings of various institutional managers, which she obtained from CDA Investment Technologies Spectrum data base. Her data were from the June 1988 filings of the 13F disclosure forms reported quarterly to the SEC (Securities and Exchange Commission). To test for differences between bank and other institutional managers in their propensity to tilt their stock portfolios toward high-quality stocks, Del Guercio stratifies her sample by manager type and examines the portfolio weights in three categories of stocks: S&P 500 stocks, stocks ranked A+, and NR stocks. In addition, Del Guercio tests whether manager portfolio weights vary with stock characteristics (e.g., dividend yield, and book-to-market ratio) and a proxy variable for stock quality.

We possess data on public and institutional real estate equity holdings by location for 1996. We then ask whether public and institutional managers tilt these holdings to less speculative locations. We use several reasonable proxies for more versus less speculative locations, including past variability in local employment and income. The evidence we report below is consistent with Del Guercio's results. We argue that the common lesson of these two seemingly distinct studies is that institutional investors tilt their portfolios toward quality, whatever the investment vehicle. This result is, of course, not unexpected. The argument that the prudent-man rules and guidelines established by ERISA cause institutional managers to tilt their real estate portfolios toward real estate assets that they perceive as prudent is closely allied to the argument that prudent-man laws compel these same institutional managers to tilt the composition of their portfolios away from real estate and other assets that present valuation difficulties.[3] The latter argument helps to explain why total real estate equity investments by

[3]Ennis and Burik (1991, p. 44) summarize this notion in this way: "Single-factor portfolio selection models that use risk (return volatility) as the sole factor are unlikely to yield reliable optimal allocations to real estate for pension funds. Pension fund investment in real estate is influenced by factors other than risk. These include the divisibility of ownership interests, liquidity, information availability, conflicts of interest, investor liability, and owner involvement. Collectively, these non-risk factors constitute a significant impediment to the acquisition of real estate by pension funds."

most institutional investors have never exceeded $3\frac{1}{2}\%$ to $4\frac{1}{2}\%$ of total assets, and why this allocation is considerably less than the 10-15% indicated by most mean-variance portfolio models (see e.g. Firstenberg, Ross, and Zisler (1987), Fogler (1984), Hartzell, Heckman, and Miles (1986), Ibbotson and Siegel (1984), Miles and McCue (1984), and others).

2 Public versus Institutional Real Estate Investors

2.1 Public Investors

The variety of real estate investment programs available make it possible to compare portfolio holdings for public and institutional investors. The quintessential public real estate investor is a Real Estate Investment Trust (REIT). REITs are income-oriented investment vehicles that derive most of their earnings from real estate activities.[4] REITs have the power to make contracts, incur liabilities, and borrow money. They can issue bonds, notes, and other obligations and secure them by mortgage or deed of trust of all or any part of their assets. They can acquire by purchase or in any other manner and take, receive, own, hold, use, improve, encumber, and otherwise deal with any interest in real and personal property, wherever

[4]REITs tend to be oriented toward cash flow than appreciation because of the requirement that they distribute 95% of their income every year. REITs also must satisfy such constraints as having a minimum of one hundred shareholders, no significant concentration of ownership, and at least 70% of their assets and income in qualified real estate.

located. REITs can elect or appoint trustees, officers, and agents of the trust, define their duties, and determine their compensation. They can make and alter bylaws not inconsistent with law or with their declarations of trust. They can exercise these powers, including the power to take, hold, and dispose of the title to real estate in the name of the trust, without the filing of any bond; and they can generally exercise the powers set forth in their declarations of trust which are not inconsistent with law.

The fiduciary duties of REIT managers/trustees are similar to those possessed by the directors of a corporation, including the power to delegate discretionary authority to an agent (see Rev. Rul. 72-254, 1972-1 C.B. 207). IRS rulings permit shareholders to require the REIT managers to call shareholders meeting to elect or remove managers, to terminate the trust, and to ratify trust instrument amendments proposed by the REIT managers. Also, shareholders may vote to approve or refuse an increase in the rate of compensation of REIT managers, and to approve or refuse a merger of the REIT into another organization.

2.2 Institutional Investors

So-called National Council of Real Estate Investment Fiduciaries (NCREIF) investors are pension fund investors with direct real estate ownership interests. NCREIF investors are managed by trustees, usually a bank or trust company, some plans designate an individual or a group of individuals as trustee. The duties of the trustee generally include responsibility for holding, investing, and accounting for plan assets. Trustees of single-employer sponsored pension plans, as well as the trustees of multi-employer plans, are governed by ERISA. Public fund trustees are not bound by ERISA, although many operate under similar fiduciary rules.

ERISA requires pension plan trustees to discharge their duties with "the care, skill, prudence and diligence that a prudent person acting in a like capacity would apply in the conduct of an enterprise of a like character and with like aims" (ERISA, Section 404(a)(1)(B)). ERISA also requires that plan assets be managed for the exclusive benefit of plan participants. Plan managers may expend assets of the trust to compensate a staff to assist them in managing investments. They may also retain investment managers, consultants, and attorneys to help them. But, in the end, the plan managers themselves may be held personally liable for breaches of their fiduciary duty that result in a loss to their trust (Section 409(a)).

This standard of care under which plan managers operate is considerably higher than that required of REIT managers. Consequently, it is often safer for NCREIF investors, who fear personal liability for losses arising from breaches of their fiduciary duty under ERISA, to limit their exposure to real estate. Also, it generally is safer for NCREIF investors and their advisors to tilt whatever funds that are invested in real estate toward the more prudent sector of the real estate market. NCREIF investors also prefer to hold more of an asset if it is traded in an active market. This is problematic when it comes to real estate, since there is general agreement that real estate assets are considerably less liquid than stocks and bonds. There also is general agreement that real estate is quite heterogeneous, and that some properties are relatively more illiquid than others. Localized competition, for example, is often stronger for residential properties than for commercial and industrial investment properties. In addition, wide fluctuations in value and in the number of transactions can occur from region to region as well as from market to market. Of course, this means that pension fund managers (given their desire for liquidity) may prefer property in or near major real estate markets where there will be active competition on the other side of virtually all trades.[5] This argument differs from Firstenberg, Ross, and

[5]We should note also the possibility of illiquidity in real estate becoming a self-fulfilling prophecy. Suppose the preference for liquidity leads pension trustees and their advisors to avoid investing in real estate markets they perceive as being illiquid. But local markets will be the most illiquid precisely where the majority of pension fund managers choose not to invest. Thus there is a circularity that tends to keep real estate markets illiquid once they are characterized as being illiquid. We can liken this situation to the location of economic activity within countries. Krugman (1991, p. 15) argues that manufacturing firms choose a location with large local demand. But local demand will be large precisely where the majority of manufacturing firms choose to locate. Thus there is a circular

Zisler's (1988) oft-cited discussion of liquidity. Firstenberg, Ross, and Zisler point out that we know very little about the effect of illiquidity on investment returns beyond the intuition that liquidity is certainly no worse than illiquidity. Firstenberg, Ross, and Zisler also point out that general liquidity concerns should not cause investors to forgo the diversification benefits of real estate, because real estate constitutes a small percentage of most portfolios. But Firstenberg, Ross, and Zisler do not explicitly consider an institutional investor's preference for pricing fairness.

Several other factors also tilt institutional real estate equity investments towards quality. Real estate buyers and sellers usually meet in private, and, as a rule, their offering and agreed prices are not freely disseminated. Moreover, transactions are not made in a central marketplace. In both time and money, the costs of buying and selling real estate are high. Unlike stocks and bonds, real estate is not researched by cadres of research analysts. Most markets comprise many small and heterogenous properties which makes extensive research coverage of real estate impractical. Lack of information makes it difficult to analyze and measure the expected return and risk on real estate assets in many market areas, which raises questions about the

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relationship in which the location of demand determines the location of production, and vice versa.

ability to obtain a "fair" return, and whether individual trustees and their advisors are operating under a strict requirement of prudence. There is no effective information system commonly available that concerns proposed or prospective development projects. Consequently, each project sponsor proceeds as though no others are going after the same share of the market, which encourages overbuilding. Even when such information is available, the volatility of demand, the length of the construction period, and the lure of earning a monopolistic profit may lead to periods of construction bursts (see Grenadier (1996)).

Given these considerations it is not surprising that the academic literature finds that real estate markets are not efficient. Case and Shiller (1990), and Ross and Zisler (1987) have shown that there is persistence (i.e., positive autocorrelation) in real estate returns, indicating that tomorrow's return can be predicted by today's property performance. Knowledgeable buyers and sellers may be able to exploit uninformed and less astute investors, and that considerably ambiguity surrounds transaction prices and trades (which can be quite distressing to pension fund managers). There also is the fear that, by investing in real estate, pension fund managers may become embroiled in protracted, expensive, and personal legal proceedings should an investment go badly.

A "bottom-line" that emerges from these arguments is this: it would not be surprising to find that institutional investors tilt their portfolios toward high-quality real estate assets relative to the average REIT investor. Of interest on their own terms, such a finding would also strengthen the more general argument about the flight to quality found in Del Guercio. The remainder of this study uses real estate portfolio weightings of REIT and NCREIF investors to test if institutional investors do indeed tilt their real estate portfolios toward quality.

3 Some Pairwise Comparisons of Institutional Investors and REITs

3.1 Methodology

For the purpose of determining if institutional investors tilt their real estate portfolios toward quality, we begin with pairwise comparisons of the portfolio holdings of REIT and NCREIF investors. For this test we calculate two alternative portfolio weights w_{ij} (i = K, P) for each type of investor j = REIT, or NCREIF. Since we are focusing on location decisions, we require this data by metropolitan area (MA).

Each weight is based on the ratio between (1) the share of investment in a particular market (location), and (2) the share of the total market that location represents. Our two values of w_{ij} (K and P) differ in how the total market (the denominator) is measured. One measure uses the stock of investible real estate capital (K), and the other uses population (P). The next few paragraphs discuss each variable in a little more detail.

The value of w_{Kj} is denoted as the "Portfolio Weight Based on Real Estate Capital." This is the investment in a particular market divided by the metropolitan area's share of all metropolitan income-producing property. The sources of these data are discussed below. For now we note several relevant points.

First, the value of w_{Kj} is akin to a location quotient, a widely used measure of locational concentration (Isard (1960)). This construction lends itself to a natural interpretation of "tilt." If a given investor type literally "buys the market," each metropolitan area will attract the same proportion of total investment from that investor class as its proportion of investible real estate. Each metropolitan area will have a weight of 1, and the distribution will be unskewed. An "untilted" market would thus necessarily have a mean weight of 1.

One problem we discuss in some detail below is that data on the stock of investible real estate capital, by metropolitan area, are not readily available. We therefore estimate this stock. Three related issues arise. First, it is well known that even the best estimates of capital stock are subject to nontrivial errors, as discussed in Usher (1980), for example. Second, while we are able to estimate the capital stock for about 240 metropolitan areas, the required data are unavailable for another 70. Third, one other study which examines the location of real estate investment in a broadly similar way normalizes REIT and NCREIF investment using metropolitan population as a proxy for the extent of the market (Mahoney *et al.* (1996)). For all these reasons we construct an alternate pair of weights, w_{Pj}, using population as the basis for normalization.

The value of w_{Pj} is denoted as "Portfolio Weight Based on Population." The numerator for w_{Pj} is the same as that for w_{Kj}, but the denominator is simply the ratio of each location's population to total metropolitan population.

Two versions of the prudent-man hypothesis follow naturally from the definition of these portfolio weights. The first version is that the weights differ from one, i.e. that investors do not simply "buy the market:"

$$\overline{w_{i,j}} \neq 1;\ \text{for } i = K,\ P;\ j = NCREIF,\ REIT$$

The bar above the symbol for weights denotes the average over the metropolitan area. This hypothesis can be readily examined by forming a t-test that the mean weight is one, and examining the skewness of the distribution.

Rejecting the hypothesis that these weights are uniformly one is necessary but not sufficient for a tilt to quality. This more specific hypothesis suggests forming a test of the hypothesis that the weights are greater in high quality than low quality locations:

$$\overline{w^H_{i,j}} > \overline{w^L_{i,j}}; \text{ for } i = K,\ P;\ j = NCREIF,\ REIT$$

where H denotes high quality locations and L denotes low quality locations. Further, by the logic of our discussion of the prudent man rule and the differences between REIT and NCREIF investors we hypothesize:

$$\overline{w^L_{i,NCREIF}} < \overline{w^L_{i,REIT}}; \text{ for } i = K,\ P$$

in low-quality, L, locations; and

$$\overline{w^H_{i,NCREIF}} > \overline{w^H_{i,REIT}} \text{ for } i = K,\ P$$

in high-quality, H, locations.

To test these hypotheses, it is necessary to assume some definition for H and L-type locations. The most commonly used measure in studies of equities or the debt market is some external rating, such as that by Standard and Poor's or Moody's. Such investment rating schemes are based on a multidimensional evaluation of expected risks by the rating firm. However, the exact definition of each classification is kept deliberately vague. For example, Standard and Poor's definition of a AAA-rated security is one for which "the obligor's capacity to meet its financial commitment is extremely strong" (Standard and Poor's 1996, p. 11). Other rating classifications are defined in similarly ambiguous language. Standard and Poor's (1996) presents a lengthy discussion of their approach to rating securities, including the committee process they use to review ratings, and a list of numerous financial ratios they examine. But there is no set formula or unambiguous definition of a given rating. Significant weight is placed on the judgments of analysts and review committees as well as on "objective" indicators of investment quality.

In fact, the literature contains no truly rigorous definition of, or framework for the measurement of, investment "quality" as such, apart from the measurement of expected risk and return. This is not surprising, as a rigorous and consistent definition of quality is problematic throughout economic analysis. There is a wide divergence between the lemons model of Akerlof (1970), the hedonic model of Griliches (1971), or the waiting time model of De Vany and Saving (1983), for example. Bowbrick (1992) lists eight different concepts of quality in his review, and notes that his list is not exhaustive.

Thus, even high-quality papers such as Del Guercio (1996) skirt the precise definition of quality. Del Guercio's initial definition of quality is based on Standard and Poor's ratings. She notes that while such ratings are widely accepted as a measure of quality, other measures are possible, so in pp. 42 ff. she adds a number of other variables to her regression model in an ad hoc alternative specification.

Del Guercio can sidestep this issue because the focus of her paper is on the effect of the prudent man rule, and there are legal and other precedents that suggest equity and bond market participants accept ratings such as S&P's as a measure of quality despite their fuzzy nature. Several papers such as Shleifer (1986), and Holthausen and Leftwich (1986) demonstrate that S&P and Moody's ratings have real price effects (although debate continues about their size and persistence).

Analysts of real estate markets are not so fortunate. There is no consensus rating or measurement of the "quality" of real estate investments analogous to the S&P or Moody's ratings for equities and bonds. There is, however, consensus that location of real estate investment is more critical than property type.[6] The natural basis for a rating of real estate quality

[6]See Corgel and Gay (1987), Hartzell, Shulman, and Wurtzebach (1987), and Zisler

would thus be the quality of the market's location. We start with this insight as the foundation for our own quality measure.

Principal components analysis is then used to construct $p = Za'$, where Z is a matrix whose columns consist of n observations on K variables and a' is a K-element vector of eignenvalues. We choose the a's so that the variance of p is maximized subject to the condition that $a_1 + a_2 + \cdots + a_K = 1$ (which is our normalization condition). Six economic fundamentals are chosen as elements of Z:

Z_1 = Average Employment, 1969-1994
Z_2 = Growth in Employment
Z_3 = Semi Standard Deviation of Growth in Employment
Z_4 = Average Real Income Per Capita Income
Z_5 = Growth in Real Per Capita Income
Z_6 = Semi Standard Deviation of Growth in Real Per Capita Income.

These variables $Z_1, Z_2, \ldots, Z_6$ can be thought of as the metropolitan area analogues of elements frequently mentioned in Standard and Poor's discussion of their stock ratings, i.e. size, level and growth in dividends and earnings, and the variance in key variables (Standard and Poor's (1996)). The metropolitan area is of course the unit of observation. The resulting value of p is our summary way of distinguishing large, high growth, high income, low variance metropolitan areas–in short, high quality.

(1990).

In what follows, we will use this quality index p for our regression analyses in its original cardinal form. For our differences in means tests we will arbitrarily categorize MAs as "high quality" or "low quality" based on whether the metropolitan area in question has an index value above or below the median. The terms "high" and "low" are for convenience and should not be taken literally.

3.2 Measurement of the Variables

The hypotheses presented in section 3.1 are tested on cross-sections of real estate investment data for 1996. We require three basic measures of real estate investment: real estate held by REIT investors, that held by NCREIF investors, and the total real estate capital stock by metropolitan area.

The data on real estate held by REIT investors by metropolitan area are obtained from Fidelity Investments' REIT data base. Fidelity's REIT data base has property-specific information, with city and value data necessary to investigate location differences between private and public real estate markets. The data base consists of 131 companies, with a total of $90 billion of real estate investment, $84 billion of which could be broken out by metropolitan area.[7]

[7] For a description of this data see Mahoney *et al.* (1996). All data used in this study can be downloaded from www.wisc.edu/bschool/re.

Our source for real estate held by institutional investors is NCREIF. The NCREIF data base consists of more than 1600 institutionally owned real estate properties located throughout the U.S., including apartment buildings, research and development buildings, offices, retail properties and warehouses. The properties are either owned by commingled funds on behalf of qualified pension and profit-sharing trusts, or owned directly by these trusts and managed on a separate account basis. Fourteen managers provided the initial property base of 234 properties at the start of 1978. Since that time, the property base has been expanded through the addition of properties acquired by all NCREIF members contributing property data. Generally the NCREIF data base is segmented by four geographic regions and eight regional divisions, but recently NCREIF has provided information at the metropolitan level which permits the tests of our hypothesis. The NCREIF data base consists of $51 billion of real estate investment, $44 billion of which can be broken out by metropolitan area. Mahoney *et al.* (1996) cite a *Pension and Investment Age* estimate of total institutional real estate investment of $125 billion, so our location data represent about 86% of NCREIF investment, and NCREIF in turn represents about 41% of total institutional investment.

National income accounts sources do not present the total real estate capital stock for metropolitan areas or other disaggregated geographic entities. We therefore estimated the value of the private income property stock, year by year, by metropolitan area, using a variant of the perpetual inventory method. Income property includes office, retail, hotel, and industrial property, and multifamily housing. Baseline estimates of the stock are constructed from 1982 Census estimates, and "grown" using Census building permits data, net of depreciation. Depreciation estimates are derived from Hulten and Wykoff (1980).[8]

The metropolitan employment and income per capita are from the Bureau of Economic Analysis' Regional Economic Information Systems. Income data are deflated using the GDP implicit price deflator. All values are expressed in terms of 1994 dollars.

We now turn to our measure of p. The technique used in this paper, principal components analysis, recognizes that the best proxy variables for high-quality metropolitan locations may not be known *a priori* and it lets the data determine which proxy or proxies best describe $Z_1, Z_2, \ldots, Z_6$. The

[8]The construction of these stock data is described in detail in Malpezzi, Shilling and Yang (1997). Our estimate of the total private income property stock over the 242 metropolitan areas for which we can construct it is approximately $3 trillion. These metro areas contain about three-fourths of the U.S. population, and, given their size, a presumably somewhat higher fraction of the total income property stock. Malpezzi, Shilling and Yang (1997) compare these estimates to other data. In brief, they are consistent with national income accounts data and other estimates of the capital stock such as Hartzell *et al.* (1995).

analysis is performed using 310 metropolitan areas. The first eigenvectors of the estimate of $Z'Z$ is:

Eignvector	Z_j
0.369	Average Employment, 1969-1994
-0.015	Growth in Employment
-0.494	Semi Standard Deviation of Growth in Employment
0.309	Average Real Income Per Capita Income
0.413	Growth in Real Per Capita Income
-0.593	Semi Standard Deviation of Growth in Real Per Capita Income

These eigenvectors are the correlation between each of the original variables and the resultant index. Notice that five of the six factor loadings are substantial, and in accord with expectations: a larger level of employment and income, faster growth in income, and lower variance in employment and income growth. One variable does not correspond to expectations: employment growth is negative, but close to zero.

In a sense, it is remarkable that the first principal component corresponds so well to prior expectations of what denotes a "high quality" metropolitan area. After all, the method of principal components is basically atheoretic. While the method imposes a certain linear structure, there is no ex ante dependent variable to develop a theory about. In the event, our index provides a summary way of distinguishing large, high growth, high income, low variance metropolitan areas–in short, high quality. The mean of the quality index is 0 (by construction), with a maximum of 4.8 and a minimum of -5.2.

3.3 Differences in Mean Portfolio Weights by Investor Type

Table 1 presents summary statistics on w_{ij} (i = K, P) for each type of investor. As alluded to above, there are a number of metropolitan areas which have no measured REIT investment, and quite a few metropolitan areas which have no measured NCREIF investment. Therefore Table 1 presents two sets of statistics for each variable. The first set is based on all observations including observations which have zero REIT or NCREIF investment. These are the data on which tests are based. A set of complementary statistics are presented for the subset of metropolitan areas which have non-zero REIT or NCREIF investment.[9]

Very few institutional investors fully exploit the low covariance between different regions and cities that is known to exist in the U.S. real estate market. This lack of geographic diversification can be seen directly in Table 1. The average portfolio for NCREIF investors across all MAs is about .35, when we would expect a value of one if investors diversified completely. The average weight for REITs is actually fairly close to one. We interpret these

[9]We began with 310 metropolitan areas. Two metropolitan areas, Altoona and Jersey City, were consistent outliers in preliminary analyses, and were dropped. However, all analyses reported in this paper were rerun including these cities, and all qualitative results remain the same. We were able to construct capital stock data for 242 metropolitan areas. Two metropolitan areas did not have economic structure data.

findings as prima facie evidence that REITs are much more diversified in their real estate portfolios than NCREIF investors.

Another way to make this same point is to examine the maps in Figures 1-3. Figure 1 presents a map of the United States with pies showing the portfolio weights for each metropolitan area for which NAREIT reports positive investment. The area of each pie is proportional to the portfolio weight of REIT investment based on the stock of income property in each metropolitan area. Figure 2 presents a similar map for the NCREIF data. For reference, figure 3 presents a map of metropolitan population. These figures are intended to provide a rough indication of spatial patterns in portfolio weights between REIT and institutional investors. As can be seen, there are marked differences in the compositions of NCREIF and REIT real estate portfolios.

The top five private investor portfolio weights (based on capital) are found in the metropolitan areas San Francisco (4.1), Washington, D.C. (4.1), Norfolk, VA (2.6), Charlotte, NC (2.5) and Memphis, TN (2.3). The top five public investor portfolio weights are found in the metropolitan areas Atlanta (4.0), Richmond, VA (3.3), Saginaw, MI (3.3), Raleigh, NC (2.9) and Allentown, PA (2.8). No metro area makes the top five of both lists. Only Atlanta, Washington, Nashville and Indianapolis make the top 15 of both lists. Overall, the correlation between the private and public portfolio weights is a modest 0.33.[10]

We are not the first to note that institutional real estate investors may weight some locations more than others in their portfolio. Shilton, Stanley and Tandy (1996) examined private (NCREIF) investment by county, and noted that the top 30 counties (of 3140 total counties) accounted for over sixty percent of NCREIF real estate investment. Shilton and Stanley (forthcoming) estimated a stepwise logit model to predict which counties have positive NCREIF investment; they found larger and richer counties more likely to attract investment, and (perhaps more surprisingly) they found denser counties less likely to attract investment, ceteris paribus. They also estimated a stepwise least squares model for square footage of NCREIF investment (conditional on positive investment), for warehouses, office, and research and development parks. Results varied somewhat by property type but were broadly consistent with the logit results.

Mahoney et al. (1996) is the first paper to compare the locational decisions for REITs to those of private NCREIF investors. As we have noted

[10]The five metropolitan areas with the largest dollar value of private institutional investment are Washington, Los Angeles, Chicago, New York and San Francisco. The top five public metro areas are Atlanta, Washington, Chicago, Dallas and Phoenix. However, these are also among the metro areas with the largest income property stock; the top five are Los Angeles, New York, Chicago, Houston and Dallas.

elsewhere, their concentration variable is essentially the same as our portfolio weight based on population. Mahoney et al. adopt the metropolitan area as the unit of analysis (as do we, and as do the majority of institutional investors, according to conversations with industry participants). Their descriptive paper was the first to document that private NCREIF investment is more heavily concentrated than public REIT investment.

Table 2 illustrates how REIT and institutional investors weight high- versus low-quality locations in their portfolios. High quality in this case is defined as above the median of the quality index, p, and low quality below median. It is not surprising that both public and private investors weight high quality locations more than low quality locations, as confirmed by both parametric and nonparametric tests of equality across quality levels. What is more to the point is the relative ranking of private NCREIF investors and public REIT investors. NCREIF investors weight high quality locations five times as much as a typical low quality location; the tilt of REIT investors, while of the expected direction and significant, is smaller in magnitude. These results are consistent with the tilt towards quality by private investors documented by Del Guercio.

We can test the hypothesis that locations have the same portfolio weights across investor types. We carried out standard t-test for differences between REIT and NCREIF weights, as well as nonparametric sign tests. The null was rejected in all cases, with reported probabilities of observing such test statistics under the null of less than one in ten thousand. The differences are economically as well as statistically significant: based on investible capital, the average portfolio weight for private investors was 0.6 less than that of public investors, reflecting the much stronger concentration of NCREIF investment in relatively few locations. The corresponding difference for weights based on population was 0.4. In consequence, these results support our fundamental behavioral proposition: compared to public real estate, private real estate is more concentrated in high-quality locations.

Obviously, these simple difference in means tests make no attempt to control for other variables. One example of a possible bias is the area's specialization of production relative to the diversity of its demand. The more specialized an area's production, the greater will be its propensity to trade; and the greater its propensity to trade, the greater its future employment or income growth (and hence real estate returns). It is also possible that markets may have different expectations about future employment or income growth depending on whether the bulk of the employment is in, say, public administration, manufacturing, trade, or some other sector.[11]

[11]See Kusmin's (1994) review, especially pp. 64-65. Kusmin does note there are surpris-

4 A Multivariate Analysis to Test for Tilting

4.1 Econometric Method

The Tobit model serves as the basis of estimation reported here (see Tobin (1958)). Specifically, we estimate

$$\begin{aligned} w_{ij} &= b_0 + b_1 p + X\beta + u \quad \text{if } b_0 + b_1 p + X\beta + u > 0 \\ &= 0 \qquad\qquad\qquad\quad\;\; \text{if } b_0 + b_1 p + X\beta + u \leq 0 \end{aligned} \tag{1}$$

where p is our quality index, X is a vector of explanatory variables, like percent local employment in finance, insurance, and real estate relative to percent national employment in the same industry, or percent local employment in professional services relative to percent national employment in the same industry, and so forth, and u is an independently distributed error term assumed to be normal with zero mean and constant variance σ^2 (individual subscripts other than those on w_{ij} are omitted for notational convenience). The model assumes that there is an underlying index equal to $(b_0 + b_1 p + X\beta + u)$ which is observed only when it is positive, and hence qualifies as an unobserved, latent variable. The inclusion of our quality index, p, as a determinant of w_{ij} is meant to capture the effect of tilting. The

ingly few careful empirical studies of the effect of industry mix on regional development. To confirm our prior and the somewhat sketchy results in the literature, we computed trend growth rates of employment and real income per capita for each of 310 metropolitan areas, pre and post 1980. Simple autoregressive models forecast employment and income reasonably well, which is unsurprising. But when we added economic structure in 1980, forecast performance doubled.

economic structure variables are meant to capture, and test for, under and over-weightings of certain industries by REIT and NCREIF investors.

The last point we consider here is this: the Tobit model is applied here because a number of metropolitan areas have no NCREIF investment, and a few MAs have no REIT investment. With such a truncated dependent variable, Tobit models will generally outperform ordinary least squares regression models.

4.2 Measurement of Economic Structure Variables

The measure of X that is used in the estimation includes ten categories of 1990 census employment for each metropolitan area:

$$
\begin{aligned}
X_1 &= \text{Location Quotient for Finance, Insurance, and Real Estate} \\
X_2 &= \text{Location Quotient for Professional Services} \\
X_3 &= \text{Location Quotient for Public Administration} \\
X_4 &= \text{Location Quotient for Agriculture} \\
X_5 &= \text{Location Quotient for Manufacturing} \\
X_6 &= \text{Location Quotient for Mining} \\
X_7 &= \text{Location Quotient for Construction} \\
X_8 &= \text{Location Quotient for Transportation} \\
X_9 &= \text{Location Quotient for Business Services} \\
X_{10} &= \text{Location Quotient for Personal Services}
\end{aligned}
$$

with the left-out category being Location Quotient for Wholesale and Retail Trade.

Table 3 presents summary statistics on all these independent variables (including Location Quotient for Wholesale and Retail Trade). The data on economic structure are percentages and therefore self-explanatory. Among the categories, Wholesale and Retail Trade is consistently a large fraction of employment in almost every metropolitan area. Its size and relative stability makes it a natural base against which to measure the effects of other economic structure variables.

4.3 Empirical Results

Table 4 presents tobit models for each investor class. There are two pairs of dependent variables. For each dependent variable, we present two models. One model is exceedingly simple and comprises our quality index and an intercept term. The alternative model adds the vector of 10 economic structure variables described above. Each model is estimated twice: once using private (NCREIF) real estate data, and once using public (REIT) real estate data.

If investors hold an "equally-weighted" real estate portfolio by location (or close to it), our portfolio weights would be, by definition, equal across metropolitan areas (and in fact, equal to one). Thus, if there were no "tilt to quality," the results would yield an intercept of one, and zero coefficients on all other variables. If there is a tilt to quality, then the quality variable would have a positive and significant coefficient. If the economic structure variables are significant, this would be consistent with the joint hypothesis of a tilt to quality and that economic structure is part of the information set predicting future risk and return.

The tobit results in table 4 confirm the simpler results in tables 1 and 2. Both investor types buy into higher quality markets. The major result is easy to characterize: across models, and across dependent variables, higher quality metropolitan areas attract somewhat more public investment, and a lot more private investment. But note that the private investors, subject to prudent man rules, tilt much more to quality. The coefficient and Chi-square are always larger for the NCREIF models.

To facilitate comparisons across models, given the fact that there are lower average weights for one class of investor, we also present standardized coefficients, i.e., coefficients calculated after both dependent and independent variables are standardized to have unit variance (Snedecor 1967, p. 398). In each and every case, the effect of quality on private investment is larger in absolute value and of a higher degree of statistical significance than the corresponding effect on public investors. Thus these results are consistent with our discussion of the prudent man hypothesis.

Our own preferred measure in table 4 is the weight based on investible capital. Note that standardized coefficients of the quality index in the private real estate adjusted Tobit models are over 5 times the standardized coefficients of the public models. Adding the vector of economic structure variables improves the fit of the model, and lessens the importance of the quality index per se. In fact, in the large public model the coefficient of the quality index is no longer significantly different from zero. But the relative size effect of quality is always much greater for private investors than public.

The coefficients on the quality variable are consistent across both models. There is somewhat more variation in the results for economic structure variables. This may be because all these economic structure results are conditional on a quality variable that already controls for a number of economic fundamentals; and in general these structure variables are highly intercorrelated, by construction.

For example, in the public models, the only sector with a positive and significant effect on investment in all four relevant regressions is Business Services. Construction is significant in both public regressions, but is insignificant in both private models. Other structure variables that are significant in one public regression, but not significant in the other include Professional Services, Agriculture, Public Administration, Manufacturing, and Personal Services. Both Professional Services and Manufacturing are overweighted based on population-adjusted portfolio weights; Public Administration and Personal Services are overweighted based on capital-adjusted portfolio weights; and, lastly, Agriculture is underweighted in the population-adjusted regression. In the private models, FIRE, Business Services, and Personal Services all have positive and significant effects in both the capital and population-adjusted regressions.

Table 4 also presents log-likelihood statistics. These statistics are not directly comparable across different dependent variables.

However, they do permit us to test the contribution of the economic structure variables to explain each dependent variable in turn. In all six pairs of regressions the null hypothesis is rejected. Economic structure matters. We also present pseudo R^2s. These are calculated once, naively, permitting predicted weights to be negative; and once with a nonnegativity constraint imposed (there is no easy way to "short" a metropolitan area). In all cases the fit is better for the private models, again consistent with a stronger flight to quality.

5 Potential Effects on Returns

Ideally we would also like to examine the effect such a "tilt to quality" has on risk and return. We have a strong presumption that such a bias would lower returns for a given level of risk. Unfortunately, as noted above, little reliable data is available on commercial real estate returns in general, and in particular by location (Fisher, Geltner and Webb, 1994).

Del Guercio, on the other hand, had the advantage of the wealth of data available on stock market returns. She found that private investors (banks), who tilted more to quality, had lower average returns than public investors (mutual funds) in 14 of 22 years studied (her Table 6). The difference was substantial: the average of 22 annual differences between public and private investor returns was 100 basis points. Del Guercio further finds that much of this difference was due to different portfolio weights, specifically to differences between small capitalization (low quality) and large cap (high quality) stocks. Del Guercio's result strengthens our prior, but direct tests must await the development of better real estate return data.

6 Conclusion

Our principal conclusions are straightforward. Neither public (REIT) investors nor private (NCREIF) investors "buy the market." Both tilt towards quality, but the tilt is much more pronounced in the case of private investors. Both public and private investors may be affected by the higher cost of acquiring information in low quality locations. We have argued that private investors are typically more affected by the prudent man rule, which would account for the relative strength of the bias for the two investor types.

Our study confirms and extends prior results regarding tilting investment in common stocks towards quality by Del Guercio (1996). Taken together, our study and Del Guercio's study imply that the prudent man rule may lead to significant departures from the optimum portfolio for institutional investors. A more precise quantification of the size of such departures remains an important area for future research.

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Figure 1

REIT Portfolio Weights, Adusted by Income Property Stock

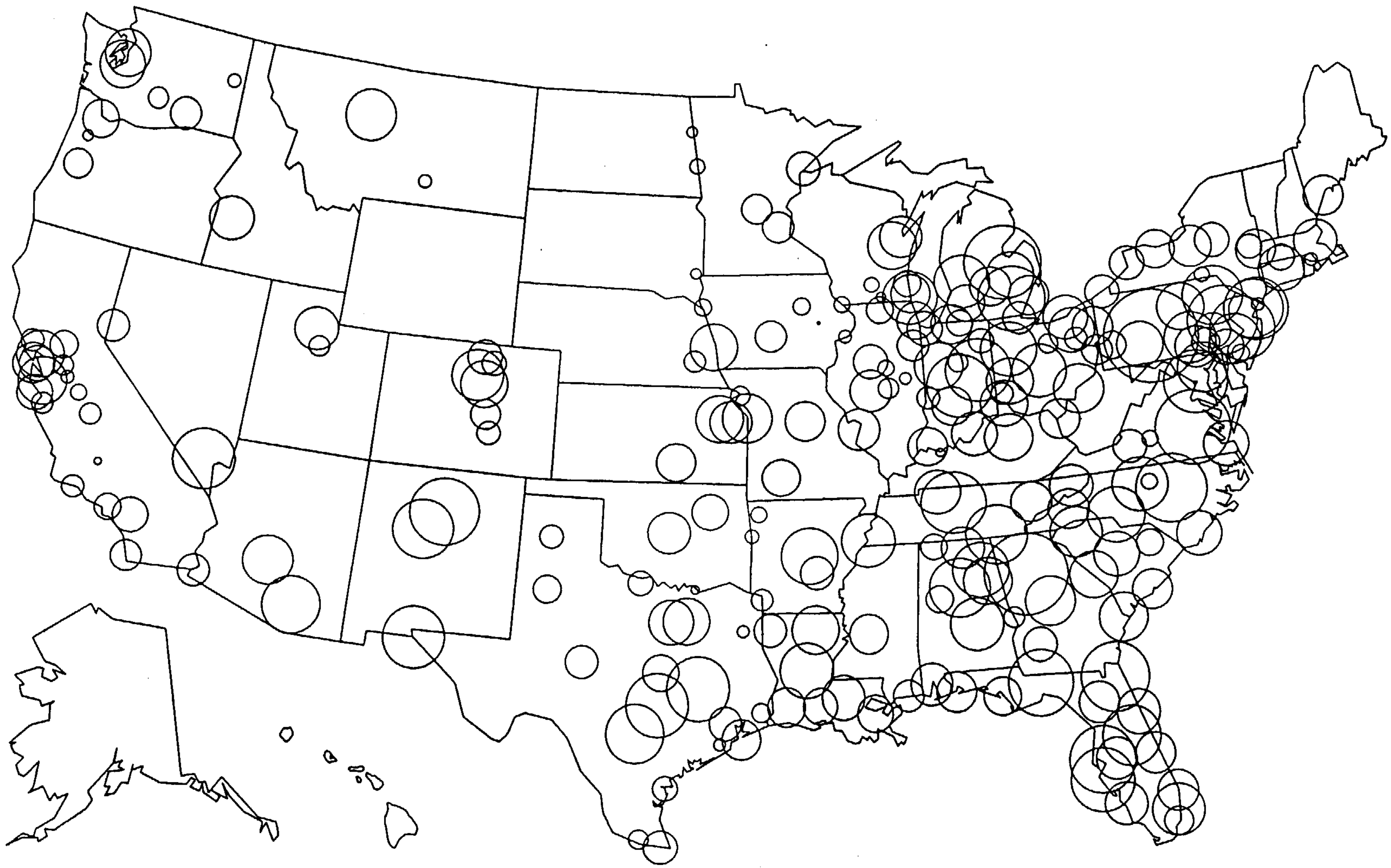

Figure 2

NCREIF Portfolio Weights, Adusted by Income Property Stock

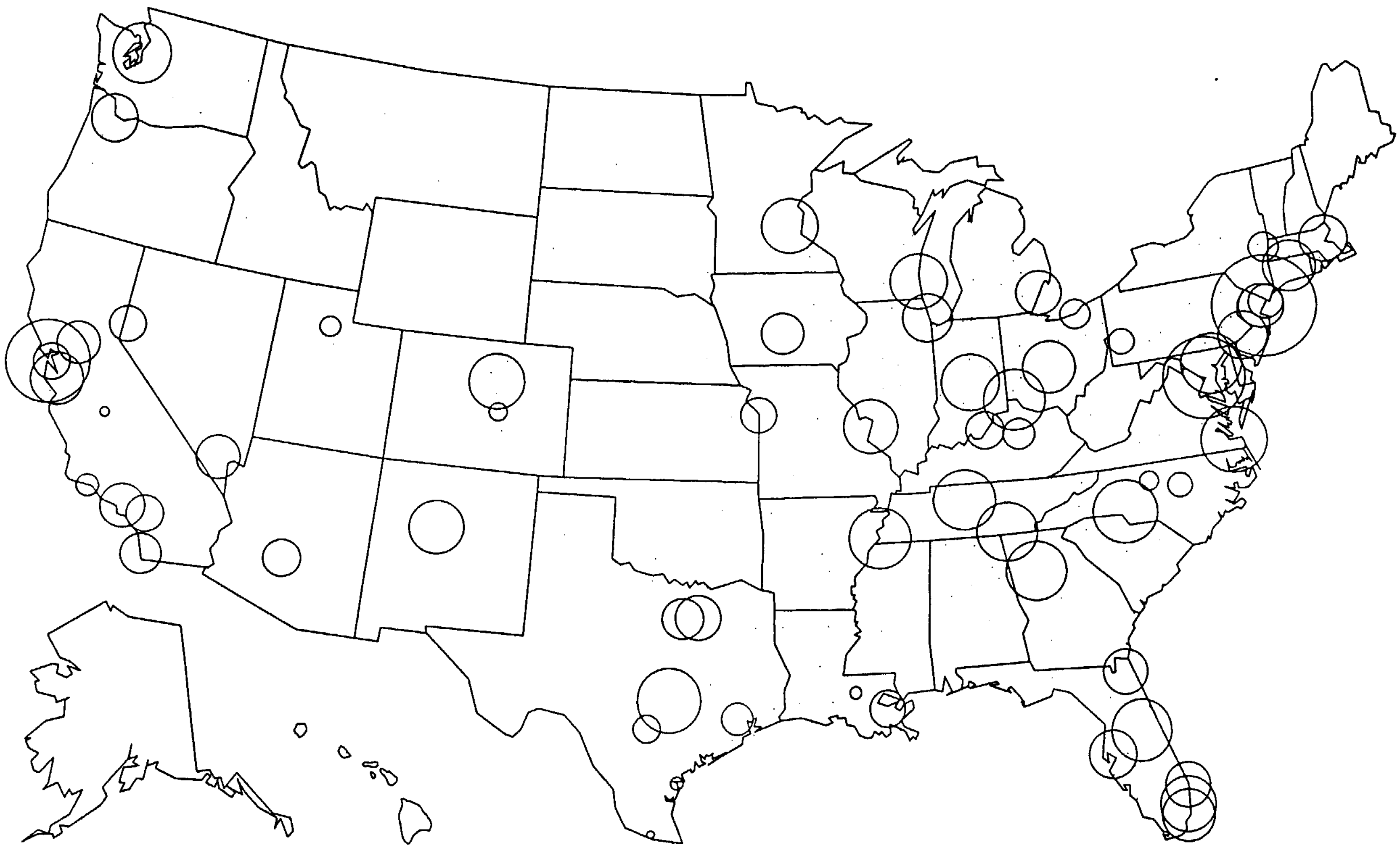

Figure 3

1990 Population for U.S. Metro Areas

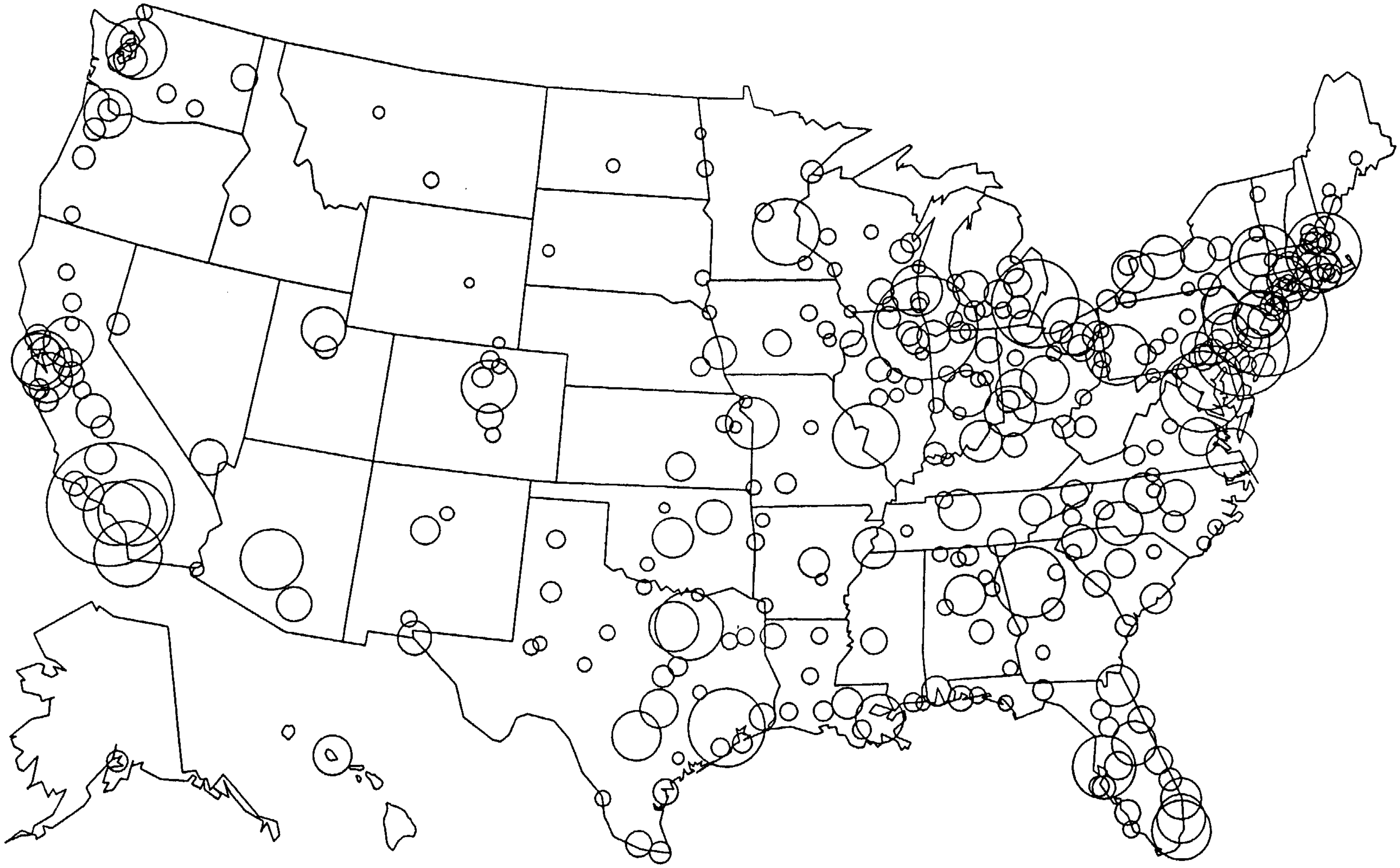

Table 1. Distribution of Dependent Variables

	Mean	Standard Deviation	Skewness	Median	Interquartile Range	N	Test of H_0: Portfolio Weight=1 Based on Mean	Test of H_0: Portfolio Weight=1 Based on Median
Portfolio Weights, Based on Capital Stock								
Public (REIT)								
All Obs.	0.94	0.74	1.07	0.85	0.96	240	0.1926	0.0006
Nonzero Obs.	0.97	0.73	1.09	0.87	0.92	232		
Private (NCREIF)								
All Obs.	0.35	0.73	2.40	0.00	0.15	240	0.0001	0.0001
Nonzero Obs.	1.31	0.86	0.97	1.18	1.12	64		
Portfolio Weights, Based on Population								
Public (REIT)								
All Obs.	0.66	0.57	1.49	0.53	0.65	308	0.0001	0.0001
Nonzero Obs.	0.69	0.56	1.51	0.56	0.67	295		
Private (NCREIF)								
All Obs.	0.26	0.62	2.92	0.00	0.00	308	0.0001	0.0001
Nonzero Obs.	1.18	0.82	1.10	1.18	1.19	67		

Table 2. Portfolio Weights By Quality Level

	Weights Based on Capital Stock		Weights Based on Population	
	Public (REIT)	Private (NCREIF)	Public (REIT)	Private (NCREIF)
High Quality				
Mean	1.11	0.57	0.77	0.41
Standard Deviation	0.78	0.88	0.62	0.76
N	124	124	154	154
(Mean, Nonzero Obs.)	1.15	1.40	0.80	1.23
(N, Nonzero Obs.)	120	50	148	52
Low Quality				
Mean	0.75	0.11	0.54	0.10
Standard Deviation	0.65	0.40	0.49	0.38
N	116	116	154	154
(Mean, Nonzero Obs.)	0.78	0.95	0.57	1.04
(N, Nonzero Obs.)	112	14	147	15
Test Equality Across Quality Levels				
Parametric Test				
t-statistic	-3.88	-5.17	-3.64	-4.55
Prob > |t|	0.0001	0.0001	0.0003	0.0001
Nonparametric Test				
χ^2	13.0	24.4	13.3	26.0
Prob > χ^2	0.0003	0.0001	0.0003	0.0001

Table 3. Economic Structure of 306 Metropolitan Areas

	Percentage Employment, Metropolitan Areas	Mean of 306 Location Quotients	Standard Deviation of Location Quotients	Skewness of Location Quotients	Median of 306 Location Quotients	Interquartile Range of Location Quotients
Finance, Insurance and Real Estate	7.6%	0.81	0.26	1.42	0.76	0.30
Professional Services	23.7%	1.03	0.20	1.71	0.99	0.19
Public Administration	4.9%	1.03	0.60	2.02	0.84	0.61
Agriculture	1.8%	1.53	1.34	3.48	1.13	0.91
Manufacturing	16.9%	1.01	0.44	0.69	0.96	0.62
Mining	0.4%	1.57	3.58	5.35	0.40	0.86
Construction	6.1%	1.02	0.25	1.16	0.97	0.31
Transport	7.3%	0.92	0.21	0.58	0.90	0.29
Wholesale, Retail Trade	21.5%	1.03	0.10	0.27	1.03	0.13
Business Services	5.3%	0.85	0.17	0.47	0.83	0.23
Personal Services	4.7%	0.98	0.48	6.78	0.88	0.24

Data are from 1990 Census. Percentage Employment is aggregate percentage across all 306 metropolitan areas.
Location quotients are calculated separately for each metropolitan area.

Table 4. Tobit Model Results

		Portfolio Weights Based on Capital Stock				Portfolio Weights Based on Population			
		Public (REIT)		Private (NCREIF)		Public (REIT)		Private (NCREIF)	
		Quality Index Only	Quality and Economic Structure	Quality Index Only	Quality and Economic Structure	Quality Index Only	Quality and Economic Structure	Quality Index Only	Quality and Economic Structure
Quality Index	Coef.	0.161	0.064	0.863	0.355	0.108	0.018	0.862	0.307
	S.E.	0.035	0.045	0.131	0.125	0.023	0.027	0.129	0.109
	χ^2	20.6	2.0	43.1	8.1	21.5	0.4	44.4	8.0
	Prob > χ^2	0.0001	0.1530	0.0001	0.0044	0.0001	0.5055	0.0001	0.0046
	Std. Coef.	0.302	0.120	1.651	0.680	0.263	0.044	1.932	0.688
FIRE Location Quotient	Coef.		-0.016		1.407		0.258		1.018
	S.E.		0.280		0.693		0.176		0.598
	χ^2		0.0		4.1		2.1		2.9
	Prob > χ^2		0.9539		0.0423		0.1432		0.0885
	Std. Coef.		-0.006		0.497		0.117		0.421
Professional Services Location Quotient	Coef.		0.584		-0.382		0.758		0.149
	S.E.		0.627		1.899		0.376		1.578
	χ^2		0.9		0.0		4.1		0.0
	Prob > χ^2		0.3517		0.8407		0.0439		0.9250
	Std. Coef.		0.154		-0.103		0.260		0.047
Public Administration Location Quotient	Coef.		0.235		0.466		0.109		0.253
	S.E.		0.122		0.320		0.075		0.281
	χ^2		3.7		2.1		2.1		0.8
	Prob > χ^2		0.0546		0.1446		0.1481		0.3684
	Std. Coef.		0.191		0.387		0.115		0.245
Agriculture Location Quotient	Coef.		-0.095		0.139		-0.007		0.093
	S.E.		0.057		0.162		0.033		0.139
	χ^2		2.7		0.7		0.0		0.4
	Prob > χ^2		0.0985		0.3892		0.8425		0.5050
	Std. Coef.		-0.172		0.257		-0.016		0.200
Manufacturing Location Quotient	Coef.		0.446		1.480		0.491		1.235
	S.E.		0.395		1.058		0.237		0.898
	χ^2		1.3		2.0		4.3		1.9
	Prob > χ^2		0.2592		0.1620		0.0380		0.1693
	Std. Coef.		0.263		0.890		0.377		0.869
Mining Location Quotient	Coef.		-0.032		-0.079		-0.006		-0.046
	S.E.		0.021		0.075		0.010		0.064
	χ^2		2.3		1.1		0.3		0.5
	Prob > χ^2		0.1279		0.2894		0.5715		0.4717
	Std. Coef.		-0.157		-0.389		-0.036		-0.266
Construction Location Quotient	Coef.		0.453		0.422		0.521		0.135
	S.E.		0.270		0.724		0.157		0.606
	χ^2		2.8		0.3		11.1		0.0
	Prob > χ^2		0.0939		0.5600		0.0009		0.8233
	Std. Coef.		0.151		0.144		0.227		0.054
Transport Location Quotient	Coef.		0.097		1.716		0.205		1.112
	S.E.		0.336		0.895		0.204		0.761
	χ^2		0.1		3.7		1.0		2.1
	Prob > χ^2		0.7726		0.0553		0.3139		0.1438
	Std. Coef.		0.028		0.504		0.077		0.383
Business Services Location Quotient	Coef.		1.091		5.195		1.603		5.463
	S.E.		0.347		0.904		0.213		0.788
	χ^2		9.9		33.0		56.4		48.2
	Prob > χ^2		0.0017		0.0001		0.0001		0.0001
	Std. Coef.		0.255		1.235		0.487		1.521
Personal Services Location Quotient	Coef.		0.172		0.649		0.298		0.067
	S.E.		0.160		0.345		0.094		0.292
	χ^2		1.2		3.6		10.1		5.3
	Prob > χ^2		0.2799		0.0600		0.0015		0.0211
	Std. Coef.		0.111		0.426		0.250		0.052
Intercept	Coef.	0.90115	-1.844	-1.313	-11.149	0.645	-3.298	-1.536	-10.236
	S.E.	0.04743	1.945	0.238	5.461	0.032	1.184	0.242	4.629
	χ^2	360.9279	0.9	30.3	4.2	395.2	7.8	40.2	4.9
	Prob > χ^2	0.0001	0.3430	0.0001	0.0412	0.0001	0.0054	0.0001	0.0270
Log Likelihood		-264.62	-248.20	-186.93	-141.99	-265.62	-213.22	-202.91	-148.21
Psuedo-R^2 (Unconstrained)		0.28	0.45	0.43	0.64	0.26	0.58	0.38	0.64
Psuedo-R^2 (Constrained)		0.28	0.46	0.44	0.63	0.26	0.58	0.40	0.70
N		240	240	240	240	308	306	308	306
N, Left Censored		8	8	176	176	13	13	241	239

Notes: Metropolitan area is the unit of observation. Omitted category for economic structure variables is percentage of employment in wholesale and retail trade. To construct dependent variables, we first divide measured real estate investment by investor type in a given metropolitan area, by total metropolitan investment by that investor type. We construct similar metropolitan shares of real estate capital stock, and of population. The first pair of portfolio weights are then the share of real estate investment by each repective given investor type, divided by the share of all income real estate capital stock in that metro area. The second pair of portfolio weights are the same numerators divided by each metropolitan area's corresponding population share. Quality index is constructed by principal components, using data on level, growth and semivariance of employment and income per capita.