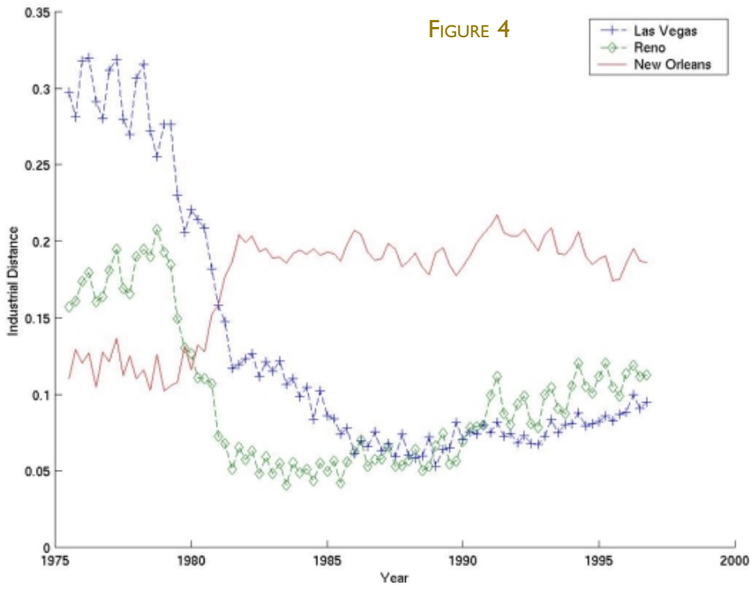
different types of physical proximity; relative location implies more than the driving time between two cities. In general, changes in inflation, interest rates, and the federal tax code have a nation-wide impact on housing prices. Broad migratory trends such as the exodus from the Midwest to the Sunbelt or to the Rocky Mountain states are region-wide phenomena, and should have distinct effects on housing prices in the affected regions. State tax and expenditure policies directly and indirectly influence house prices within a state's borders. Neighboring metropolitan areas may experience similar co-movements in housing prices not because of similar industrial compositions, but rather because of competition for location. In this sense all houses within commuting distance can be viewed as imperfect substitutes---the degree of substitutability depending in no small part on the distance between the metropolitan areas. For example, the success of Silicon Valley has been felt in every part of the San Francisco Bay Area, including the Central Valley city of Tracy, a city very far from San Jose in many dimensions, but not distance. In this case, housing price correlation is driven by physical proximity and not the underlying structure of the local economy.

FIGURE 4




## V. Results & Conclusions

The results of this research indicate strong support for the hypothesis that industrial composition systematically influences the correlation of movements in aggregate house prices between metropolitan areas *independent* of physical proximity. (See Redfearn (2000) for more details.) This relationship is consistent with the theory that aggregate industry shocks are transmitted to local economies as a function of the types of economic activity undertaken by an urban area. The research also underscores the evolutionary nature of the relationship between metropolitan areas. As illustrated in the case of Atlantic City, it is clear that historical correlations in real estate markets may be misleading.

The lesson for an investor looking to diversify his real estate holdings is simple to state but more difficult to practice. That is, understanding portfolio risk in residential real estate requires understanding the industry risk to which metropolitan areas are exposed The practice of using backward-looking correlations is unwise because of the industrial dynamics within metropolitan areas. But, how then should portfolios be constructed? Testing the efficacy of a diversification strategy that exploits the systematic nature of the relationship between industrial similarity and outcomes in real estate markets in the next step in this line of research. (Keep an eye out for another Lusk brief with the results in the near future!)

Clearly more work is necessary to understand and control for the influence of spatial proximity. Additional research is also under way to characterize regional business cycles and the way in which shocks are propagated across industries. It is likely that the marginal propensity to consume owner-occupied housing differs across industries, suggesting that the implicit weighting scheme used in calculating the industrial similarity between cities could be improved upon. A more relevant measure would account for asymmetries along these lines. Advances in the treatment of these variables should only increase the reliability of the results. However, the results presented here strongly suggest that the exposure to common industry shocks systematically influences outcomes in residential housing markets.

## VI. References


Case, K. E., and R. J. Shiller (1989): "The Efficiency of the Market for Single-Family Homes," *American Economic Review*, 79(1), 125-37.

Redfearn, C. L. (2000): "Industrial Composition and the Correlation of Outcomes in the Markets for Owner-Occupied Housing," *Lusk Center for Real Estate Working Paper*, 1-30.


[1] Another way to view the information shown in Figures 1 and 2 is to compare the correlation coefficients for the two groups of cities. For the entire sample period, from 1975 to the third quarter of 1996, the average of the correlations between Atlantic City and the five other New Jersey metropolitan area is 0.37; between Atlantic City and the "destination cities" it is 0.21. However, from 1978-1985 the average correlation with the Las Vegas, Reno, and New Orleans rose to 0.47, while the average correlation with the five New Jersey metro areas weakened slightly to 0.34.

[2] Industrial distance is simply the Euclidean distance between the industrial two metropolitan areas in employment-share space. That is, the industrial distance between city *i* and city *j* is defined as

$$ID_{ij} = \left( \sum_{k} \left( share_{ikt} - share_{jkt} \right)^2 \right)^{1/2}$$

where *k* and *t* index industry and time, respectively. $share_{ikt}$ is the proportion of total metropolitan area *i* employment involved in industry *k* at time *t*.


# Real Estate Research Brief

Winter 2000


# The Composition of Metropolitan Employment and The Correlation of Prices across Metropolitan Areas

## I. Introduction

Which real estate portfolio is better diversified: one with properties in the San Francisco Bay Area and Greater Los Angeles, or one with properties in Tokyo and Honolulu? In other words, is geographical distance the crucial element that determines the level of systematic risk shared between two real estate markets? Not necessarily. Consider that the Japanese economy of the late 1980s produced a surge of tourism to and investment in Hawaii, so much so that the impact of Japan's subsequent recession is still being felt there. This economic link allowed movements in Tokyo's real estate markets to echo in Hawaii's, despite the ocean, languages, currencies, and national borders that separate them.

This stylized example illustrates the key insight developed in Redfearn (2000) and previews its initial results. Real estate is a derived demand and, as such, changing local fundamentals, such as employment, income, population, etc., generate changes in market conditions. The degree of correlation between outcomes in any two real estate markets is a function of the extent to which their economic fundamentals---of which location is one---are similar. An implication of this relationship is that diversification strategies need to be more sophisticated than simply spreading investment across great distances, as the example of Tokyo and Honolulu demonstrates. Rather, successful diversification requires an understanding of market fundamentals and the systematic risk shared by real markets independent of their physical proximity.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The research reported in this Lusk Center Research Brief quantifies several important dimensions of similarity among U.S. metropolitan areas and measures their influence on the correlation of aggregate price movements in their respective owner-occupied housing markets. In particular, the research identifies the independent influences of industrial similarity and relative location. The results strongly suggest that while physical proximity is an important determinant of co-movements in housing prices, so too is the degree of similarity in industrial structure.

## II. Traded Goods and the Transmission of Shocks

The basis for this research is a model in which metropolitan areas are viewed as small open economies. Consider an increase in the world price for a single traded good. Metropolitan areas that produce the traded good for export will earn higher profits, while metropolitan areas that use the traded good as in input into the production of goods that they in turn export will suffer: the costs of production will increase, but the prices they charge for their export goods will not, so profits are squeezed. Other cities, ones for which the traded good plays an insignificant economic role, will see no direct impact from the price change of the traded good. Shocks to the prices of common imports and exports can then spill into real estate markets as prices for traded goods fluctuate.

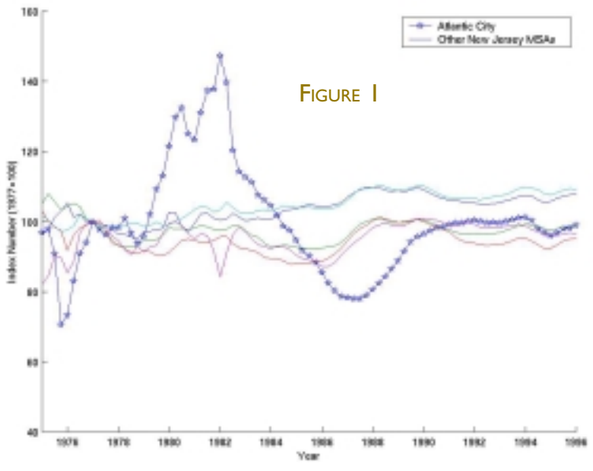


Figure 1

In the case of cities that produce and export the traded good, the rise in its price causes marginal production to become profitable, and demand for labor increases. As wages rise, so does the demand for housing. The opposite holds in the case of the cities that import and use the traded good: housing prices decline as demand for locally produced goods---and the labor required to manufacture them---falls in the face of lower profits. In this model, aggregate shocks are transmitted to real estate markets through the demand for labor. Moreover, the propagation of the shock will vary with the relative economic importance of the traded good in the local economy.

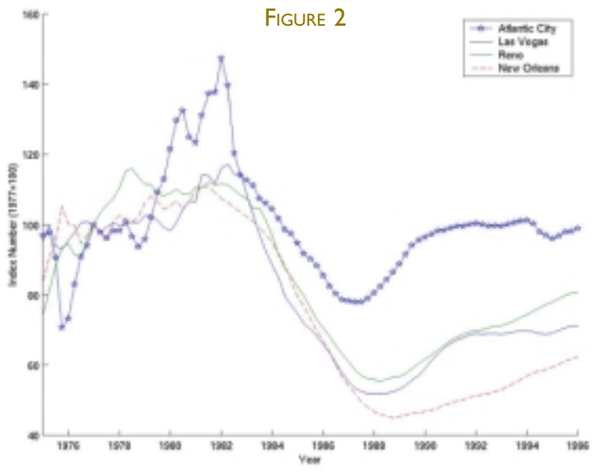


Figure 2

Two metropolitan areas, separated by great distances but linked by common economic fundamentals, might therefore experience correlated outcomes in their real estate markets. Consider the example of Alaska and Texas during the 1970s and 1980s: the significant portion of local income derived from oil in each state during this period meant that shocks to world oil prices were transmitted in a similar fashion to each of these economies, and in turn to their real estate markets. Now, 20 years later, the economy of Texas is substantially more diverse relative to Alaska, and as a result their real estate markets are much less likely to be as highly correlated. The central point is that a shock to world energy prices will be transmitted to a greater extent to those metropolitan economies more heavily involved in the energy sector, be it as a net importer or net exporter.

## III. Case Study: Atlantic City

In 1978 gambling was legalized in Atlantic City. This legislative act quickly altered the city's employment structure, shifting it toward service jobs in hotels and casinos. Over the next five to seven years, housing prices in Atlantic City behaved remarkably unlike the those in other five metropolitan areas within New Jersey, and more like those in three metropolitan areas that have legalized gambling and that are well outside the state and region: New Orleans, Las Vegas, and Reno (referred to below as "destination cities.") Figures 1 and 2 illustrate the point. Figure 1 compares the prices of owner-occupied housing in six New Jersey metropolitan areas (Atlantic City, Bergen-Passaic, Middlesex-Hunterdon-Somerset, Monmouth-Ocean City, Newark, and Trenton) relative to the aggregate state housing price index. A rise in a line indicates that owner-occupied housing prices rose faster in the associated metropolitan area than in the state as a whole. Figure 2 shows the same relationships for Atlantic City and the three "destination cities." Compared New Jersey's other major metropolitan areas, the idiosyncratic movement of Atlantic City's housing prices is striking. Beginning in 1979, the evolution of prices in Atlantic City diverged from the rest of the state; they did not return to a pattern typical of the other New Jersey cities until more than a decade later. In the interim, housing prices followed a path similar to those of the "destination cities."[1]

The case of Atlantic City suggests that industry structure is a source of risk that may or may not be diversified by spreading investment over wide geographic areas. Surprising as it seems, an investor with properties in Atlantic City and the adjacent metropolitan area of Monmouth-Ocean City would have been better diversified than one with properties in Atlantic City and the major cities of Nevada. In this specific case, it seems clear that industrial composition contributes to shared risk. The issue addressed in this research is the extent to which industrial composition systematically influences the correlation of outcomes in real estate markets.

## IV. Data & Research Design

Research in this area faces two es: first, to construct a measure of similarity for an outcome in real estate markets; and second, to characterize both industrial similarity and physical proximity correctly. The research presented here uses the correlation of movements in aggregate metropolitan housing prices as a metric of market similarity. It employs the cross-section of metropolitan employment as a proxy for industrial mix and defines several measures of relative location in order to estimate the influence of different types of physical proximity.

The time series used to capture the evolution of metropolitan house prices are the Conventional Mortgage Home Price Indexes. Based on the combined history of mortgages purchased by Fannie Mae and Freddie Mac, these indexes are constructed using the weighted repeat sales method described in Case and Shiller (1989), and so hold quality constant. The strength of the Fannie Mae/ Freddie Mac indexes is the breadth of their coverage. The data include indexes for all 50 states and the District of Columbia, as well as 151 metropolitan areas. The indexes are published quarterly, beginning in 1975. The indexes employed in this paper extend though the third quarter of 1996.

The employment data are drawn from the Bureau of Labor Statistics (BLS) historical time series, which include aggregate employment data by state and metropolitan area at several levels of industrial detail. These range from broad divisions, such as services, manufacturing, and finance, to very specific categories like "hotels and motels," "automotive stampings," and "national commercial banks." The length of the time series is, in general, inversely related to its specificity, with very little comprehensive data existing for most of the finer classifications. For the broad employment categories the data are excellent; the time series employed in this research are widely available monthly from as early as 1939. They are mining, construction, manufacturing, utilities and transportation, trade, finance and insurance, services, and government.

From the employment shares, the "industrial distance" between each pair of cities is calculated for each quarter for the years 1976 to 1996.[2] This variable captures the similarity between the employment structure of two metropolitan areas. Analogous to physical distance, industrial distance increases as dissimilarity increases. For example, the most similar metropolitan areas - in terms of employment - during the sample period are Nashua, NH and Rockford, IL with an industrial distance of .05. The most dissimilar metropolitan areas are Nashua, NH and Honolulu, HI; the industrial "distance" between these two is 0.556.

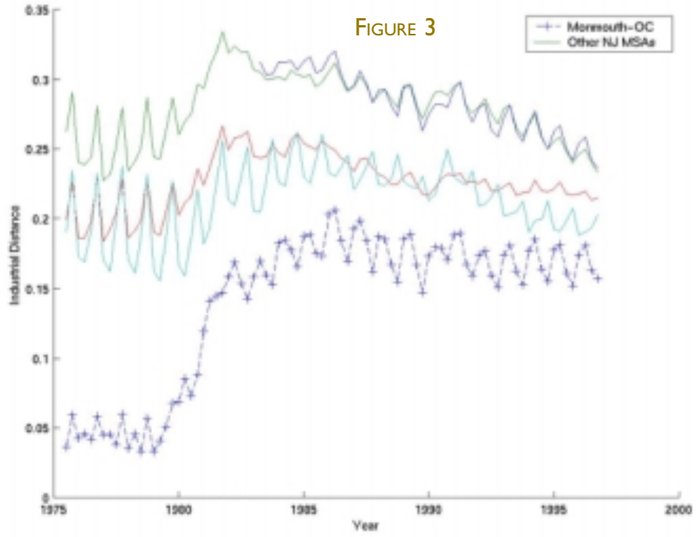


Figure 3

Figure 3 illustrates the effect of legalizing gambling on the industrial distances between Atlantic City and its neighboring metropolitan areas, while Figure 4 maps the change in industrial distances with the "destination cities." Recall that metropolitan areas that share similar industrial bases will have a lower value of industrial distance, or be "less distant" along this dimension. Figure 3 shows how Atlantic City's cross-section of employment diverged from the rest of the state---how much greater the industrial distance became---as the employment in Atlantic City evolved rapidly after the legalization of gambling. Note in particular, the significant increase in the industrial distance between Atlantic City and Monmouth-Ocean City; these metropolitan areas are adjacent to one another! Conversely, Figure 4 demonstrates how this measure became smaller---the industrial distance narrowed between Atlantic City and the cities of Nevada---as their employment cross sections became more similar.

The final piece of data used in this analysis is the set of geographical centers of 130 Metropolitan Statistical Areas (MSAs) in the United States. The MSAs are defined by the U.S. Census, and have boundaries that are economic in nature rather than political. The statistical areas used in this research are the MSAs and Primary Metropolitan Statistical Areas (PMSAs). PMSAs are the component parts of the largest urban areas or Consolidated Metropolitan Statistical Areas (CMSAs). For example, Los Angeles is a CMSA with PMSAs of Los Angeles, Orange, San Bernardino and Riverside, as well as Ventura counties. The location data are used to construct several measures of physical proximity of metropolitan areas. These variables are the linear distance between them and indicators of whether or not a pair of metropolitan areas is in the same CMSA, state, and region. These measures are necessary to capture the effects associated with