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NOTE: At the time of publication, the author, Dr. John Landis, was affiliated with the University of California. As of November 2007, he is a faculty member in the School of Design at the University of Pennsylvania.

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Regression analysis is used to identify the contribution of traditional supply and demand factors, such as job growth, income, and residential construction, as well as new economy indicators, to housing market outcomes. Rather than being fundamentally different, new economy housing markets are found to be faster and more extreme versions of traditional housing markets.

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Keywords: Affordability; Homeownership; New economy

Introduction

The past 25 years have given rise to what has come to be called the "new economy," which is less a single thing and more a process of fast-paced economic evolution with information technology at its core. Among the changes that have either accompanied or been fostered by the growth of the new economy are the rise of high-tech industries, particularly microelectronics and telecommunications; the increasing globalization of economic activity, including both manufacturing and services; increasing global trade; the globalization of capital and securities markets; the shift from analog to digital communications and information processing; the advent of new forms of retailing and service delivery; an ever-widening revolution in biotechnology; and, most recently, the growing use of the Internet for all forms of consumer-to-business and business-to-business transactions.

Driven largely by technological innovation, the rise of the new economy has also been accompanied by important social, demographic, and political shifts, including increased international migration; changes in the

relative political and economic power of corporations, labor unions, and governments; and, most ominously, increasing inequality of income and wealth, both within and across countries.[1]

The restructuring of the U.S. economy has been accompanied by a transformation of U.S. housing markets. The most notable change has been financial: Where sources of housing capital were once largely divorced from other capital markets, today they are almost completely integrated. Yet even as the economy and capital markets have gone global, housing markets have gone local. Particularly with respect to prices and rents, U.S. housing markets differ far more from region to region than they did a generation ago.

To date, the relationships between the transformation of the U.S. economy and U.S. housing markets have not been systematically explored. Although there have been many stories in the popular press about the effects of the high-tech and Internet booms of the late 1990s on surging home prices in Silicon Valley, Manhattan, and Washington, DC—all centers of the new economy—as well as the reemergence of gentrification in reviving urban cores, the research community has yet to systematically address these relationships.

Viewed in context, these dynamics are not all that unusual. Housing prices and rents have long been known to follow economic activity: rising during periods of job growth and then remaining static or even falling during periods of job decline. Between 1990 and 1993, for example, Los Angeles County lost 400,000 jobs, or roughly 10 percent of its employment base (California Employment Development Department 2001). Measured in constant dollars, median home prices during this period declined by nearly 20 percent. Thus, the question is not whether regional housing market outcomes follow economic trends—of course they do. Rather, it is whether relationships between the housing market and the economy are different in new economy regions than in other types of economies.

There is reason to think they should be. On the demand side, new economy metropolitan areas are characterized by higher levels of capital investment and liquidity, by higher rates of job turnover, by higher wage and productivity levels, and (at least in theory) by increasing inequality of income. On the supply side, some notable new economy regions such as San Francisco and Washington, DC, are also

[1] These shifts have been widely documented in the pages of *The Economist*, as well as through yearly census reports and special studies.

characterized by natural or imposed constraints on the housing supply.[2] Both sets of relationships suggest that housing prices and rents should be higher and more unequally distributed, as well as potentially more volatile, in new economy housing markets than elsewhere.

The issue is not simply one of prices and rents. After generations of decline, overcrowding in many U.S. housing markets is again increasing. Whether this is because of a general lack of housing supply or whether it is because immigrant households are willing, at least temporarily, to tolerate higher levels of crowding than long-time residents remains an open question. Crowding is just one measure of housing welfare. Although increasing overall, homeownership rates continue to vary widely between and among metropolitan areas. Housing cost burdens have also been rising, particularly for renters.

This article seeks to determine whether and how new economy housing markets differ from their more traditional counterparts. The remainder of the article is divided into four parts. The first considers the sparse literature linking metropolitan economic structure and housing market outcomes. The second outlines our approach and presents different schemas for identifying new economy metropolitan areas. The third presents the results of a series of empirical tests comparing housing market outcomes and the degree to which large U.S. metropolitan areas are participating in the new economy. The last part offers conclusions and policy implications.

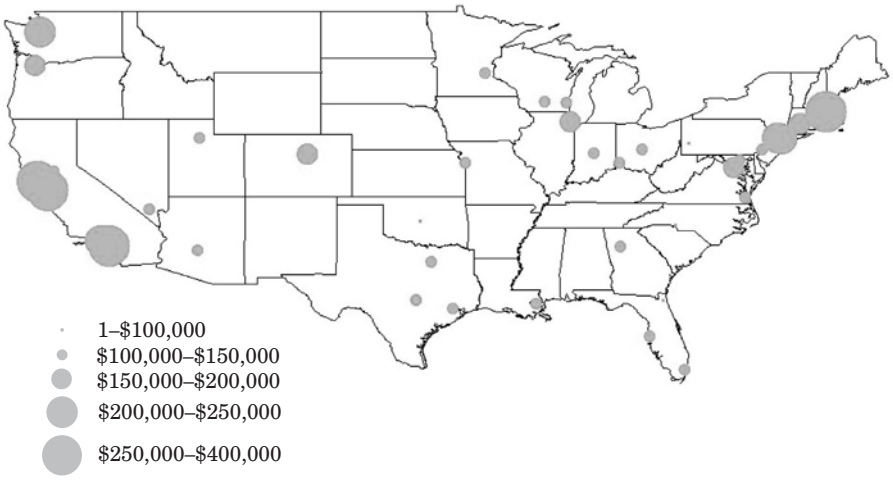
Linking metropolitan economies and housing markets—A review of the literature

Figures 1 and 2 compare 1998 median existing home prices by metropolitan statistical area (MSA) with the number of dot-com firms per worker—one measure of new economy activity. The two figures are nearly identical. To what extent is this coincidence?

Generally, housing market outcomes should reflect market fundamentals: the closer the balance between housing supply and demand and the more competitive the market, the lower the price of housing. Similarly, land prices tend to be lower in markets in which supplies are plentiful and higher in markets in which supplies are dear.

[2] Local land use regulations limit housing construction throughout California, but especially in the Bay Area. Bay Area developers are also limited by terrain. Montgomery County, MD, pioneered slow-growth in the Washington, DC, area. It has recently been joined in this respect by Loudoun County, long the population growth center of Northern Virginia.

Figure 1. **Median Housing Prices in Selected Large MSAs, 2000**



Source: Data from National Association of Realtors 2001.

Figure 2. **Dot-Com Firms per Thousand Jobs in Selected Large MSAs, 1998**

Source: Zook 2000.

Even so, forces and factors can overlap between markets. On the demand side, one would expect the greater capital availability and liquidity associated with new economy markets to quickly work its way through to higher average housing prices and rents. New economy housing prices and rents should also be higher to the extent that labor productivity and wages are higher in new economy regions. When and

where new economy businesses disproportionately compensate their workers with stock options or other liquid capital assets, there should be a positive wealth effect on housing prices in new economy regions. The flip side of the higher wage levels associated with new economy markets is that the income distribution may also be more unequal (Reich 1991).

To the extent that new economy metropolitan areas are more demographically and socially diverse, local housing markets may also be more diverse. Housing types and neighborhoods may be more distinct, prices and rents may vary more, and housing welfare levels (e.g., housing cost burdens and overcrowding) may also vary more widely. In short, the housing market may be characterized by a greater number of more varied submarkets.

On the supply side, economic geographers such as Joel Kotkin (2000) and Richard Florida (2001), as well as demographer Dowell Myers (1987), have argued that new economy workers place a higher value on place-based community and environmental quality-of-life attributes than old economy workers do. To the extent that continued development is seen as degrading those attributes, there may be strong pressure to limit further growth by capping new construction or by placing threatened areas off-limits to development. Alternatively, new development may be required to pay its own way through increased impact fees and exactions. The housing market's response to diminished construction opportunities and higher costs is almost certain to be higher prices and rents (Fischel 1989; Katz and Rosen 1987; Landis 1986).

Intermetropolitan differences in housing market outcomes have long been documented. Going back to the 1970s, increases in housing prices were strongest among western metropolitan areas, where nominal increases in home values were almost twice those of other regions. More recently, the bicoastal economic boom of the 1980s resulted in further price increases—and in some places, mostly speculative price increases—in the major metropolitan areas of the Northeast, Mid-Atlantic, and West (Hughes 1996).

The effects of the 1990–92 recession on the housing market were also mostly bicoastal. Abraham and Hendershott (1996) estimate that real housing prices rose 50 percent more in coastal housing markets than elsewhere between 1984 and 1990 and then fell by 15 percent more between 1990 and 1993. Among northeastern cities, real prices rose by 92 percent from 1983 to 1988, but then declined by 25 percent through 1993.

Two other studies pursue the theme of regional housing market outcomes. Applying a K-means clustering algorithm to an index of housing price returns in 30 metropolitan areas from 1977 to 1992, Abraham, Goetzmann, and Wachter (1994) found persistent and meaningful differences between West Coast, East Coast and "Middle America" MSAs. In a similar vein, Dielemann, Clark, and Duerloo (2000) used rent and price data from the 1985 and 1995 American Housing Surveys to classify the 27 largest MSAs into three groups: (1) East and West Coast MSAs, characterized by high and volatile price levels; (2) Northeast and northwestern MSAs, characterized by somewhat higher but stable price levels; and (3) Midwest and southern MSAs, characterized by lower and stable price levels.

A number of authors have tried to isolate the causes of these differences. With few exceptions, most have concluded that differences in housing market outcomes have their origins on the demand side, with metropolitan housing price levels tracking most closely with income levels. Green (2002) finds that household capital asset levels affect housing consumption levels and also contribute to escalating prices, especially at the upper end of the housing market.

Recent research into spatial and temporal variations in homeownership rates have also tended to focus on demand-side explanations (Gyourko 1998; Hughes 1996) and specifically on age-related demographic factors. In related work, Myers, Megbolugbe, and Lee (1998) used cohort analysis to explore homeownership rates among immigrants and concluded that aging and the duration of U.S. residence are important factors. Starting with Rosen and Rosen (1980), national and MSA-level studies have long included job growth, unemployment rates, and interest rates as determinants of homeownership, but measures of local economic structure have been largely absent.

On the supply side, Potepan (1996), using pooled cross-sectional and time-series data from the American Housing Survey, also identified differences in construction costs as contributing to intermetropolitan housing price differentials. Other researchers, most notably Malpezzi (1996) and Malpezzi, Chun, and Green (1998), have focused on housing price effects of supply constraints such as regulation. In a brief analysis of the largest 60 metropolitan areas, Landis and Deng (2000) found that lower rates of housing construction relative to job growth between 1995 and 1999 were strongly correlated with increased housing prices. This was particularly true among coastal metropolitan areas like San Jose (CA); Washington, DC; Los Angeles; Boston; Oakland (CA); and Orange County (CA).

To our knowledge, there is no research that explicitly relates regional or metropolitan industrial structure to housing outcomes. Dielemann, Clark, and Duerloo (2000) allude to these factors but do not explicitly incorporate them into their analysis.

Data and approach

To more fully explore the impact of the new economy on metropolitan housing markets, we focus our analysis on the 47 largest U.S. metropolitan areas—those with a 1998 population of a million or more. The core data used for this effort come from the State of the Nation's Cities (SONC) database, which is maintained by Rutgers University and combines metropolitan-area census data from 1970 through 1996 and MSA-level data compiled by the Bureau of Economic Research into the Regional Economic Information System (REIS) through 1997. The SONC/REIS database was updated by the authors to 1998, and additional MSA data were added as noted. The time period of the study was restricted for the 1993–98 period, principally because of data availability. Significantly, this period corresponds to the first two-thirds of the longest economic expansion in U.S. history. It was also a period in which the productivity benefits associated with the new economy first became noticeable.

Three types of housing outcome variables are of interest: those measuring housing market transactions and activity levels, principally prices; those measuring housing welfare; and those measuring the intra-MSA distribution of housing prices and costs.

1. *Transactions and activity measures.* Three sets of housing market transaction measures were considered: (a) MSA median home prices, as compiled by the National Association of Realtors (NAR), and adjusted for inflation[3]; (b) the rate of increase or decrease in MSA median home prices, also generated from NAR data; and (c) home price volatility, as indicated by the coefficient of variation of real home prices between 1993 and 2000.[4]

[3] Unfortunately for this effort, the NAR does not distinguish between the several primary MSAs (PMSAs) within the San Francisco Bay Area. We used the sales price for the entire Bay Area for both the San Francisco PMSA and the San Jose (CA) PMSA. The Oakland (CA) PMSA was coded missing.

[4] The coefficient of variation is the ratio of the standard deviation to the mean. When calculated over time, higher coefficients of variation are associated with greater volatility.

2. *Housing welfare measures.* Of the five measures commonly used to measure housing welfare levels,[5] we selected three for analysis: (a) metropolitan homeownership rates between 1993 and 1998, as obtained from the U.S. Bureau of the Census; (b) average MSA housing cost burdens, measured as the ratio of the median MSA home price to MSA per capita income, for the years 1993 to 1998; (c) overcrowding, measured as the average number of persons per room by MSA for 1985 and 1995, as compiled from the American Housing Survey national core data (U.S. Bureau of the Census and HUD 1991, 1997).

3. *Distributional measures.* To explore the effects of the new economy on the distribution of housing outcomes within MSAs, we used American Housing Survey national core data (U.S. Bureau of the Census and HUD 1991, 1997) to generate housing value, cost, and rent Gini coefficients for 1985 and 1995. Gini coefficients measure the deviation from a perfectly equitable distribution, defined as occurring when a particular good or item is possessed by each member of the population in equal proportions. Gini coefficients vary from zero to one. Larger Gini coefficients, closer to 1, indicate greater inequality; smaller Gini coefficients, closer to 0, indicate less inequality.

Identifying new economy MSAs

Analysts agree that information technology has given rise to new forms of industrial organization known collectively as the new economy. New economy industries are distinguished from their older counterparts by the newness of their products and services, by their rates of technical and product innovation, and by their intense use of information technology in all phases of operation (Bosworth and Triplett 2000). Practically speaking, new economy businesses are distinguished by the speed of their product cycles, by their complicated and nontraditional supply chains, by their reliance on ongoing research and development (R&D), and by the increasing importance of highly educated technical employees and contractors to their core business functions. Common examples of new economy industries include semiconductor manufacturing, computer and computer equipment manufacturing, nanotechnology enterprises, telecommunications, aerospace and defense manufacturing, air transport, certain types of communications and entertainment media, biotechnology, and advanced business and financial services (Markusen and Chapple 2001).

[5] U.S. housing policy has traditionally focused on five complementary measures of housing welfare: cost burden, structural quality, crowding, neighborhood quality, and homeownership. Data at the metropolitan level were not readily available for the structural quality of the unit and the quality of the neighborhood.

Just as important as the emergence and growth of new industries has been the increasing use of information technology and advanced production techniques by traditional industries. Indeed, technically speaking, many old economy industries are more advanced than their new economy counterparts.

Most metropolitan economies include both new and old economy industries. The traditional approach to classifying and comparing metropolitan economies, whether new or old, is to calculate some form of location quotient that compares local employment or output in various industries with national (or international) employment and output in those same industries (Dunn 1971; Markusen, Hall, and Glasmeier 1986; Noyelle and Stanback 1984; Perry and Watkins 1977). Yet location quotients have their limitations. They are typically derived from economic data organized using the Standard Industrial Classification (SIC) system. Originally developed in the 1940s and modified several times, the SIC system (or NAIC, as it is now known) is oriented around the production, sale, and distribution of material goods. Despite periodic attempts to update it to better account for service, information, and knowledge-based activities, the SIC/NAIC system remains strongly anchored in its manufacturing and goods production tradition and is thus likely to understate the importance of new economy industries.[6]

A second issue is more fundamental. The new economy consists of more than clusters of technology and knowledge-based industries. Rather, it consists of entirely different business models in which instantaneous flows of information between producers and between producers and consumers both substitute for and complement slower and more traditional product and service flows. Thus, the greater value added that is associated with the new economy is based on its ability to quickly access and organize and then reaccess and reorganize financial capital, physical capital, labor resources, market information, and consumer and producer preferences. Amazon.com and EBay, the two companies most frequently cited as the harbingers of the new economy, are not simply replacements for existing old economy businesses. They present fundamentally new models for communicating and organizing consumer-producer relationships.[7]

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[6] New Growth Theory economists such as Romer, Lucas, Grossmand, and Jaffee are working to develop a theoretical and empirical structure to measure and estimate how investment decisions and economic institutions affect the production of new technology, which may help.

[7] It should be noted, however, that EBay charges a commission for each transaction—an "old economy" method that has made it possible for it to survive the shakeout in dot-com startups. And Amazon.com's SIC code puts it in the retail book sector.

Economists and economic geographers have developed a number of practical systems for identifying the size and strength of the new economy in metropolitan economies, based on (1) jobs in R&D activities as a share of firm employment, (2) high-tech output, (3) venture capital funding, and (4) Internet business activity. Among the most notable of these systems are the following:

1. *R&D employment.* Researchers have long recognized the central role of R&D activities in innovative and high-tech economies. A variety of indicators of R&D activity, using various combinations of three- and four-digit SIC codes, are available at the metropolitan level. The most venerable of these is the one developed by Daniel Hecker (1999) to identify high-tech industries. Using three-digit SIC data published by the Bureau of Labor Statistics, he identifies high-tech industries as those business establishments in a metropolitan area in which the percentage of R&D employees is above the mean for all industries. (See the appendix for a listing of the industries and SIC codes using this definition.)

   The strength of the Hecker (1999) index is its transparency and ease of construction from commonly available data. Its weakness is that it cannot distinguish between facilities and businesses because it is establishment- rather than firm-based. A metropolitan area with numerous state-of-the-art computer manufacturing plants (and manufacturing employees) but few research and development facilities will be classified as old tech, whereas a metropolitan area with many R&D facilities but few manufacturing plants will be classified as high tech.

2. *Electronics industry employment.* A similar classification system was developed by researchers at the American Electronics Association (AEA). Assuming that electronics workers are disproportionately employed in high-tech firms, the AEA distinguishes metropolitan areas and states according to their relative percentages of workers employed in electronics and related industries (AEA 2001). The strength of the AEA system is that it is enumerated at the four-digit SIC level. Its weakness, of course, is that when it comes to identifying high-tech industries and metropolitan areas, workers in radio manufacturing plants count the same as next-generation computer programmers. (The AEA codes are listed in the appendix.)

3. *Output of R&D-intensive industries.* Ross DeVol of the Milken Institute has developed what he calls a "TechPole" indicator that combines traditional employment-based location quotients with actual output levels to classify metropolitan areas (1999). Based on a more specific set of SIC codes than Hecker's index and available only for

1998, DeVol's index was used by HUD in its recent analysis of the comparative strength of metropolitan economies (2000). (See the appendix.)

4. *Dot-com businesses.* One of the most visible exemplars of the new economy has been the rise of Internet-based businesses, more popularly known as dot-coms. Celebrated—perhaps prematurely, it turns out—as heralds of the new economy, dot-com businesses established themselves first among the technology and media centers of the West and East Coasts and then expanded inland. Because of the speed of the dot-com proliferation, longitudinal and comprehensive information on dot-com employment at the metropolitan level remains sketchy. As a proxy for dot-com activity, Zook (2000) classified metropolitan areas according to the number of registered Internet domain names.[8] Covering the years between 1993 and 1998, Zook's data series is normalized by private sector employment to account for differences in metropolitan area size. These data can be accessed at the Zooknic Internet Geography Project at <http://www.zooknic.com>.

5. *Venture capital funding* is a specialized form of finance supporting small privately owned companies judged to have the potential for fast growth. Although there are many different types of venture capitalists and venture capital deals, most involve exchanging upfront investment capital for equity shares. With the emergence of the modern venture capital system in the late 1970s, the venture business came of age in the 1990s in support of high-tech start-ups, mostly in and around Palo Alto (CA). According to Venture One, a venture capital consulting firm, venture capital investments rose from $6.8 billion in 1995 to $11.3 billion in 1998. As the magnitude of venture capital funding increased, so did the geographic distribution of capital sources and investments. Data on both the number of venture capital transactions and the total dollar amount for this effort for U.S. metropolitan areas from 1995 through 1998 come from Venture One. These data were provided to the authors as part of another research effort.

Table 1 ranks the largest MSAs according to each of the above classification systems as of 1998. (Only MSAs with a population of a million or more were ranked.) The results of these rankings are not particularly

[8] The data were developed by using an Internet utility called "whosis," which returns the registration information for domain names that were then coded to a metropolitan area according to registration ZIP code. Although data are available after 1998, the number of domain names increased again exponentially after that time not just for dot-com businesses, but for all types of personal and business endeavors. This makes it less useful as an indicator of dot-com businesses and more indicative of the use of the Internet by a large variety of businesses in both the old and new economies.

Table 1. **MSA New Economy Measures and Quartiles**

	MSA	Hecker: Percentage of High-Tech Workers, 1995	MSA	AEA Workers per 1,000 Jobs, 2001*	MSA	Milken TechPole Index, 1998	MSA	Dot-Com Firms per 1,000 Workers, 1998	MSA	Venture Capital Funding per 1,000 Workers, 1998 ($)
Top quartile	San Jose, CA	24.2	San Jose, CA	22.6	San Jose, CA	23.7	San Francisco	24.3	San Jose, CA	20,482,378
	Detroit	10.0	Austin, TX	11.0	Dallas	7.1	San Jose, CA	23.4	San Francisco	12,063,459
	Orange County, CA	8.8	Dallas	8.5	Los Angeles	6.9	Oakland, CA	15.4	Oakland, CA	4,986,423
	Boston	8.1	Washington, DC	6.9	Boston	6.3	San Diego	14.4	Boston	3,818,383
	Washington, DC	8.1	Boston	6.9	Seattle	5.2	Orange County, CA	14.2	Austin, TX	3,130,613
	Minneapolis–St. Paul	7.4	Portland, OR	6.2	Washington, DC	5.1	Denver	13.7	San Diego	2,767,429
	San Diego	7.2	Oakland, CA	6.0	Chicago	3.8	Seattle	13.4	Denver	2,651,751
	Cincinnati	7.2	Orange County, CA	5.9	New York	3.7	Austin, TX	12.9	Seattle	2,555,063
	Newark, NJ	7.1	Denver	5.8	Atlanta	3.5	Los Angeles	12.8	Orange County, CA	1,657,326
	Oakland, CA	7.0	Minneapolis	5.5	Phoenix	2.6	Washington, DC	12.1	Washington, DC	1,481,759
	Milwaukee	6.9	Atlanta	5.2	Orange County, CA	2.6	Miami–Dade County	12.0	Atlanta	1,227,888
2nd quartile	Hartford, CT	6.7	Phoenix	5.2	Oakland, CA	2.2	New York	11.9	Dallas	1,219,773
	Los Angeles	6.6	Seattle	5.1	Philadelphia	2.2	Portland, OR	11.3	Philadelphia	1,157,500
	Buffalo, NY	6.6	Sacramento, CA	5.1	San Diego	1.9	Boston	10.9	Baltimore	1,026,055
	Charlotte, NC	6.5	San Francisco	5.1	Denver	1.8	Sacramento, CA	10.6	New York	1,024,826
	Chicago	6.0	San Diego	4.7	Newark, NJ	1.8	Baltimore	9.6	Minneapolis–St. Paul	978,234
	San Francisco	5.8	Kansas City, KS/MO	4.2	San Francisco	1.6	Newark, NJ	9.4	Hartford, CT	868,987
	Kansas City, KS/MO	5.6	Chicago	4.1	Houston	1.6	Kansas City, KS/MO	9.4	Chicago	827,763
	St. Louis	5.5	Newark, NJ	4.1	Portland, OR	1.3	Dallas	9.3	Tampa–St. Petersburg, FL	803,575
	Portland, OR	5.3	Salt Lake City	4.1	Indianapolis	1.1	Minneapolis	9.1		
	Indianapolis	5.1	Columbus, OH	3.7	Kansas City, KS/MO	1.0	Atlanta	8.9	Columbus, OH	772,992
	Dallas	4.9	Charlotte, NC	3.7	Minneapolis–St. Paul	1.0	Phoenix	8.9	Los Angeles	745,952
	Fort Worth, TX	4.8	Tampa–St. Petersburg, FL	3.6	St. Louis	0.9	Philadelphia	8.8	Phoenix	724,037
									Fort Worth, TX	709,467

Table 1. **MSA New Economy Measures and Quartiles** *(continued)*

	MSA	Hecker: Percentage of High-Tech Workers, 1995	MSA	AEA Workers per 1,000 Jobs, 2001*	MSA	Milken TechPole Index, 1998	MSA	Dot-Com Firms per 1,000 Workers, 1998	MSA	Venture Capital Funding per 1,000 Workers, 1998 ($)
3rd quartile	Columbus, OH	4.8	Philadelphia	3.6	Sacramento, CA	0.8	Tampa–St. Petersburg, FL	8.2	Houston	692,314
	Atlanta	4.7	Los Angeles	3.4	Detroit	0.8	Las Vegas	8.1	Newark, NJ	691,490
	Denver	4.6	Houston	3.2	Fort Worth, TX	0.7	Salt Lake City	8.1	St. Louis	631,035
	Salt Lake City	4.6	Baltimore	3.2	San Antonio	0.5	Houston	7.8	Nashville, TN	606,095
	Cleveland	4.6	Milwaukee	3.1	Pittsburgh	0.5	Chicago	7.6	Sacramento, CA	601,573
	Phoenix	4.5	San Antonio	2.9	Tampa–St. Petersburg, FL	0.4	Nashville, TN	6.6	Milwaukee	567,666
	Philadelphia	4.4	St. Louis	2.8	Columbus, OH	0.4	Cleveland	6.5	New Orleans	509,696
	Seattle	4.3	Oklahoma City	2.8	Salt Lake City	0.4	Cincinnati	6.2	San Antonio	471,878
	Sacramento, CA	4.1	Fort Worth, TX	2.8	Birmingham, AL	0.4	New Orleans	6.1	Cleveland	419,701
	Houston	4.1	New York	2.7	Baltimore	0.4	Columbus, OH	6.1	Buffalo, NY	414,769
	Newport News, VA	4.0	Hartford, CT	2.7	Cincinnati	0.3	Hartford, CT	6.1	Salt Lake City	404,678
			Detroit	2.7			Indianapolis	6.0	Oklahoma City	397,113
Bottom quartile	Baltimore	3.8	Cleveland	2.6	Hartford, CT	0.3	Milwaukee	5.8	Miami	358,753
	Pittsburgh	3.7	Norfolk, VA	2.5	Charlotte, NC	0.3	Fort Worth, TX	5.7	Portland, OR	325,153
	Oklahoma City	3.4	Pittsburgh	2.4	Milwaukee	0.3	St. Louis	5.6	Kansas City, KS/MO	310,134
	New York	3.1	Indianapolis	2.2	Cleveland	0.2	Oklahoma City	5.2	Indianapolis	261,873
	Miami	2.9	Cincinnati	2.2	Miami–Dade County	0.1	Charlotte, NC	5.2	Charlotte, NC	251,607
	Birmingham, AL	2.8	Miami–Dade County	2.2	Oklahoma City	0.1	Buffalo, NY	5.2	Cincinnati	214,681
	Tampa–St. Petersburg, FL	2.8			Newport News, VA	0.1	Detroit	5.1	Jacksonville, FL	197,272
	New Orleans	2.5			Providence, RI	0.1	Pittsburgh	5.1	Pittsburgh	193,548
	Providence, RI	2.4			Buffalo, NY	0.1	San Antonio	5.0	Detroit	95,475
	Memphis, TN	1.7			New Orleans	0.1	Jacksonville, FL	4.9	Norfolk, VA	73,497
	San Antonio	1.5			Memphis, TN	0.1	Norfolk, VA	4.6	Memphis, TN	4,253
							Memphis TN	4.3		

*These are 1998 data published by the AEA in 2001.

surprising. With a few minor exceptions, most of the metropolitan areas that rank highly in one classification system also rank highly in the others. San Jose (CA) and Boston appear most frequently among the top five MSAs in all five classification systems. Other MSAs that appear at least twice among the top five are Austin, TX; Dallas; Washington, DC; Oakland, CA; and Orange County, CA.

In addition to rankings, table 1 lists actual measurement values, which are also instructive. Within the top quartile of MSAs ranked using the Hecker index, the index value for the top MSA (San Jose, CA) is nearly four times that of the lowest-ranked MSA (Milwaukee). Among the top quartile of MSAs, ranked according to the Milken TechPole index, the value of the top-ranked MSA (San Jose again) is almost 12 times that of the lowest ranked MSA (Orange County, CA). The gap within the top quartile between the top and bottom venture capital MSAs (San Jose and Atlanta) is greater still. Whether in terms of R&D employment, high-tech output, dot-com businesses, or venture capital funding, some MSAs are leaders, others are laggards, and a few are super-leaders.

As expected, the five new economy measures are highly correlated (table 2). The three employment-based measures—the Hecker index, the number of AEA employees, and the the Milken TechPole index—are strongly correlated. The number of dot-com firms per thousand jobs is strongly correlated with venture capital funding, but less strongly correlated with the three employment-based measures.

Table 2. **Correlation Coefficients Comparing New Economy Indexes**

	Dot-Com Firms per 1,000 Jobs, 1998	Venture Capital Funding per 10,000 Jobs, 1998	Milken TechPole Index, 1998	1998 AEA Workers/ Total Jobs	1995 Hecker High-Tech Employees/ Total Jobs
Dot-com firms per 1,000 Jobs, 1998	1.00	0.80	0.62	0.69	0.53
Venture capital funding per 10,000 Jobs, 1998	—	1.00	0.79	0.79	0.75
Milken TechPole Index, 1998	—	—	1.00	0.85	0.80
1998 AEA workers/ total jobs	—	—	—	1.00	0.81
1995 Hecker high-tech employees/total jobs	—	—	—	—	1.00
Mean	9.14	$1,625,018.90	2.08	4.10	5.49
Standard deviation	4.40	$3,401,312.50	3.72	3.56	3.43
N	47	47	47	47	47

Which measure by itself is the best indicator of the new economy? None is perfect. As noted previously, the Hecker, AEA, and Milken indexes are all measures of high-tech employment rather than industrial structure. Venture capital funding, while interesting, is far too skewed toward just a handful of places. To the extent that the new economy is as much about new models of business as about factor inputs, we believe that the number of dot-come firms per thousand jobs is the most suitable. Workers in dot-com businesses are likely to be highly educated. Dot-coms require high levels of liquidity and capitalization, only some of which is provided by venture capitalists. The dot-com index is also the most multifaceted. Like the Hecker and AEA indexes, it incorporates aspects of industrial structure. Like the R&D funding and venture capital measures, it also captures aspects of the technological and entrepreneurial nature of the new economy. Last, but not least, and in retrospect, the 2001 collapse of the dot-com industry heralded what at least temporarily has come to be seen as the end of the first stage of the new economy.

The new economy and metropolitan housing market outcomes

Summary comparisons

Table 3 summarizes the means of the various housing outcome variables for the 47 largest MSAs, as well as by dot-com quartile. At first glance, and without accounting for other factors, median home prices look to be significantly higher in new economy housing markets than elsewhere. According to the NAR, the median home price among the top quartile new economy metropolitan areas in 2000 was about $235,000, versus an average of only $128,600 in the second, third, and fourth quartiles. Housing prices also rose faster in new economy markets: Real home prices in the top dot-com quartile increased 23.7 percent between 1993 and 2000, versus only 13 percent in the second, third, and bottom quartiles. Price volatility was also greater in new economy markets. Measured as the coefficient of variation of home prices between 1993 and 2000, home prices were 25 percent more volatile in the top quartile of new economy markets than in the second, third, or bottom quartiles.

What of housing welfare? Among MSAs with a population of a million or more, homeownership increased from 60.1 percent in 1993 to 63.7 percent in 1998 (see table 3). Homeownership rates in the top quartile new economy MSAs were lower in 1993 and in 1998 and increased less than in other MSAs. Among the top quartile new economy MSAs, the 1998

Table 3. **Housing Outcome Measures by Dot-Com Firms per Thousand Jobs Quartile**

Housing Outcome Measures		Source	All Metropolitan Areas	Top Dot-Com Quartile	2nd Dot-Com Quartile	3rd Dot-Com Quartile	Bottom Dot-Com Quartile
Price measures	Median MSA housing price, 2000 (in 1998$)	NAR	$156,640	$235,568	$151,294	$128,999	$98,012
	Median MSA housing price, 1993 (in 1998$)	NAR	$131,531	$190,818	$127,092	$113,273	$95,345
	Percent change in MSA housing price, 1993–2000	NAR	9.1%	23.7%	10.5%	11.1%	7.5%
	Median MSA housing price Coefficient of variation, 1993–2000	NAR	7.4	9.841	8.259	6.395	4.992
Housing welfare measures	1998 MSA homeownership rate	U.S. Bureau of the Census	63.70%	56.9%	64.2%	66.8%	67.2%
	1993 MSA homeownership rate	U.S. Bureau of the Census	60.10%	54.9%	62.3%	59.8%	63.2%
	1998 Median housing price-to-income ratio	Calculated	4.7	5.9	4.5	4.2	3.8
	1993 Median housing price-to-income ratio	Calculated	4.9	6.5	4.7	4.3	4.0
	1995 average persons per room	American Housing Survey	0.48	0.52	0.48	0.47	0.46
Distributional measures	1995 housing cost Gini coefficient	American Housing Survey	0.344	0.340	0.336	0.343	0.361
	1995 housing value Gini coefficient	American Housing Survey	0.302	0.270	0.300	0.307	0.343
	1995 rent Gini coefficient	American Housing Survey	0.212	0.188	0.212	0.219	0.237

Sources: NAR 2001; U.S. Bureau of the Census 2001; U.S. Bureau of the Census and HUD 1997 (for the American Housing Survey).

homeownership rate was only 56.9 percent, compared with an average of 66 percent in the second, third, and bottom quartiles. This difference is not too surprising, given previous findings that housing prices are also systematically higher in new economy markets.

The ratio of housing price-to-family income is a reasonable, albeit imperfect surrogate for burden and affordability.[9] Nationwide, housing price-to-income ratios fell during the 1990s—the result of rising family incomes and plentiful construction. Among MSAs with a population of a million or more, the average ratio of housing prices to income fell from 4.9 in 1993 to 4.7 in 1998 (HUD 2000). The decline was largest among new economy markets, although 1998 housing prices were still much higher compared with incomes in new economy markets than elsewhere. Among the top quartile new economy MSAs, median home prices were nearly six times as large as median incomes in 1998, compared with about four times as large in the second, third, and bottom new economy quartiles.

A housing unit is considered overcrowded if the ratio of persons to rooms exceeds 1.0. Among MSAs with a population of a million or more, the average number of persons per room in 1995 was 0.48. At 0.52, the average number of persons per room in new economy MSAs was slightly higher than for all large MSAs. Generally speaking, the more traditional the economic base, the less overcrowding there is.

Average and median housing outcomes are of little interest to the very wealthy or the very poor. Poor households are no more able to afford the median-priced home than the most expensive one. Likewise, for a wealthy household, the median-priced home would typically hold about the same interest as the least expensive home. For most households, it is the distribution of housing prices, rents, and burdens that matters, not the average or median.

Among MSAs with a population of a million or more, the average 1995 *housing value* Gini coefficient was 0.302.[10] At 0.270, the average housing value Gini coefficient among new economy MSAs was considerably lower, indicating that the distribution of values was more equal in new economy MSAs than in more traditional economies—at least as of 1995.

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[9] Housing price-to-income ratios are slightly different from housing cost burdens. Price-income ratios apply only to ownership housing and do not account for financing. Cost burden is the ratio of yearly or monthly housing cost to yearly or monthly income and can be calculated for both owner-occupants and tenants.

[10] Because they are self-reported, individual estimates of housing values as reported in the American Housing Survey and the decennial census are likely to be biased, particularly in low-turnover markets and at the upper end of the distribution.

Indeed, among the 47 MSAs analyzed, housing values, when ranked on the strength of the dot-com measure, were the most unequal among the bottom quartile of metropolitan areas.

The American Housing Survey asks detailed questions about housing cost, defined as a household's total monthly outlay for mortgage payments, insurance, and utilities.[11] Among MSAs with a population of a million or more, the average 1995 monthly housing cost Gini coefficient was 0.344.[12] Unlike the 1995 housing value Gini, the *housing cost* Gini did not vary by new economy quartile. The 1995 distribution of housing costs was about the same in both new economy and old economy MSAs.

What about rents and renters? Are renters in new economy housing markets facing a more or less equal distribution of rents than their counterparts in traditional economy markets? Because rents are less sensitive to length of tenure and can change by contract, rent distributions provide a more accurate assessment of current housing market conditions than either housing value or housing cost distributions. Among MSAs with a population of a million or more, the average 1995 *monthly rent* Gini coefficient was 0.212.[13] Like housing values, rent distributions were far more equal among new economy MSAs than among more traditional economies. The 1995 Gini coefficient for rents in the top new economy quartile was only 0.188, versus a much higher 0.237 for the bottom new economy quartile. Readers should remember that Gini coefficients measure distributions, not magnitudes. This means that housing prices can be as evenly distributed—or for that matter, as unevenly distributed—within expensive housing markets as they are in inexpensive ones. Put another way, both high- and low-cost housing markets can have a similar Gini coefficient.

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[11] As with several previous measures, the housing value Gini coefficient does not explicitly account for length of tenure. What this means is that the distribution of housing values in any given year may be very different than the cumulative distribution. These problems notwithstanding, the housing value Gini coefficient still has merit as a cross-MSA comparative measure.

[12] Among the sample MSAs, the distribution of monthly housing costs in 1995 was significantly less equal than the distribution of housing values.

[13] Among the sample MSAs, the distribution of monthly rents was much more equal than the distribution of either housing costs or housing values. We cannot say whether this is (1) because rental housing markets are fundamentally less bifurcated than ownership markets, (2) because housing value and cost estimates (as reported in the American Housing Survey) are not adjusted for length of tenure, or (3) because renters are mostly at the lower end of the housing expenditure continuum.

Regression results

How much of the difference in housing market outcomes can reasonably be attributed to the new economy versus other factors? To find out, we used regression analysis to compare the various housing outcome measures summarized above with several MSA-level measures of housing supply and demand, as well as new economy indicators. As noted previously, our principal measure of the new economy is the number of dot-com domains in an area per thousand private workers.

Residential permits were used as the principal supply indicator. To better account for metropolitan size differences, we divided the total number of new residential building permits issued between 1993 and 1998 (obtained from the U.S. Bureau of the Census) by the change in the number of jobs during the same period. Labeled SUPPLY-FLEX, this measure is a sort of political elasticity of supply: All else being equal, the more responsive the housing construction sector is to job growth, the lower the expected median home price or rate of price increase.

To keep things simple, amounts and rates of metropolitan job growth between 1993 and 1998, and per capita income in 1993—both obtained from the U.S. Bureau of Economic Analysis—were used as principal measures of demand. All else being equal, we would expect median housing prices to be higher in wealthier metropolitan areas—that is, those that started the decade with higher per capita incomes.

Four regression models were tested for each outcome measure: the first without any new economy variables, the second including the number of dot-com firms per thousand total jobs, the third including a dummy variable indicating whether the metropolitan area was in the top quartile of dot-com workers per thousand jobs, and a fourth in which the top dot-com quartile dummy variable was allowed to interact with measures of housing supply and demand.

Housing price regressions. The price model results are reported in table 4. Among the 41 MSA observations, the three demand and supply variables alone explained 67 percent of the variation in year 2000 median home prices.[14] Per capita income, as expected, had a strongly positive influence on median home prices: for every $1,000 difference between metropolitan areas in 1993 per capita income, median housing prices in 2000 were $12,000 higher. Ease of construction—measured as the ratio of building permits to job growth—had the expected negative effect: the more new homes constructed per additional job, the lower the MSA median home price in 2000. After accounting for both income

[14] Six MSAs fell out of the analysis because of missing data.

Table 4. **Median Housing Price Regression Model Results**

Model		Coefficient Estimates and Probability Levels			
		Type I: No New Economy Variables	*Type II:* Includes Dot-Com Firms per 1,000 Workers	*Type III:* Includes Top Dot-Com Firm Quartile Dummy Variable	*Type IV:* Includes Dot-Com Interaction Effects
Dependent variable: 2000 MSA median home price					
Independent variables					
PCINC93	1993 MSA per capita income (in thousands)	12.607***	5.328***	10.791***	4.652**
%JOBCH	1993–98 percent job change	1.142	–0.540	0.973	–0.627
SUPPLY-FLEX	1993–98 residential building permits/ job growth	–2.028***	–0.868**	–1.606**	–0.706*
NE-INDEX	Dot-com firms per 1,000 workers		10.519***		11.691***
NE-DV	Top quartile MSAs based on dot-com firms per 1,000 workers			44.416**	
Income interaction term	(PCINC × NE-DV)				0.52
SUPPLY-FLEX interaction term	SUPPLY-FLEX × NE-DV				–0.958
Constant		–115.06*	–39.662	–92.705	–34.444
R-squared		0.67	0.83	0.72	0.83
Observations		41	41	41	41

*p = 0.10. **p = 0.05. ***p = 0.01.

and supply effects, MSA job growth rates were not correlated with housing price levels.

Adding the number of dot-com domain names per thousand jobs in 1998 (Model Type II) significantly improved the overall model fit, boosting the R-squared from 0.67 to 0.83. The new economy effect was both large and significant: For every additional dot-com domain name per thousand workers, the MSA median home price in 2000 increased by $10,000. And although their relative contributions declined, the signs and significance levels of the supply and demand variables did not change. Controlling for the contributions of housing supply and demand factors, median home prices in the top new economy MSA quartile (Model Type III) were $44,000 higher than in other MSAs.

The new economy clearly supercharges housing prices, but how does it affect housing market dynamics? That is, are supply-demand-price dynamics fundamentally different in new economy markets than in other markets? To find out, we multiplied the top new economy quartile dummy variable by 1993 MSA per capita income and by the ratio of residential permits to job change. The results are presented in the final column of Table 4 as Model Type IV. The estimated coefficients of these interaction-effect variables were not statistically significant. Coefficient magnitudes and significance levels were otherwise comparable to those of Model Type II. This result suggests that at least when it comes to price levels, the dynamics of new economy housing markets are more extreme than those of traditional economies, but not fundamentally different.

Housing price changes and volatility. Homes are clearly more expensive in new economy markets than elsewhere, but to what extent have they also appreciated more? And what about price volatility? Do home prices typically fluctuate more year by year in new economy markets than elsewhere? To answer these two questions, we duplicated the previous housing price analysis, changing the dependent variable from median sales price, first to percentage change in sales price, and second to the sales price coefficient of variation. Both measures span the years between 1993 and 2000. Basic economic theory suggests that price appreciation rates should be positively correlated with income levels and negatively correlated with SUPPLY-FLEX, the ratio of residential building permits to job growth. For much the same reason, we would also expect SUPPLY-FLEX to be negatively correlated with price volatility. Median 1993 home sales prices were included in both model sets to account for scale effects. Since job growth is a major driver of housing demand, the rate of job growth between 1993 and 1998 (%JOBCH) was also included in the appreciation model.

Table 5 presents the results of both the appreciation and volatility models. Among the 41 MSA observations, the SUPPLY-FLEX and %JOBCH variables explained 36 percent of the variation in 1993–98 median home price appreciation rates. The coefficients of both variables were of the expected signs: positive in the case of %JOBCH and negative for SUPPLY-FLEX. Neither the initial housing price level nor per capita income coefficients were statistically significant.

Adding the number of dot-com businesses per thousand jobs in 1998 (Model Type II) improved the overall model fit, boosting the R-squared from 0.36 to 0.45.

Housing welfare results. Has the growth of the new economy led to improving or declining housing conditions? Housing prices are a good indicator of the shifting market balance between supply and demand, but by themselves do little to measure economic welfare—that is, whether housing conditions are improving or declining. In theory, changes in housing welfare should track changes in incomes and housing prices. When housing prices and rents rise relative to incomes, households must pay more for housing (increased burdens and/or home-to-work travel times), double up (increased crowding), delay becoming homeowners, or turn to some combination of the three.

In practice, there is usually a considerable time lag between changes in relative housing prices and aggregate housing welfare outcomes. With less than 20 percent of households actively involved in the housing market in any given year, there is considerable inertia in most housing markets. Especially on the ownership side, average housing cost burdens, homeownership rates, and levels of crowding are as much the result of housing decisions made in previous years as of current housing market conditions. Still, because everything in the new economy seems to happen faster, it is possible that housing welfare also responds faster to changing housing market and economic conditions in new economy markets.

We first consider homeownership. On the one hand, to the extent that home prices in new economy markets are typically higher than elsewhere, we might expect homeownership rates to be lower. On the other, the greater liquidity and possibility of wealth creation in new economy markets suggest that, over the long term, they might have a greater potential for homeownership because wealth and income may also be higher. To find out how much of the difference in MSA-level homeownership rates is associated with the new economy, we used regression analysis to compare 1998 homeownership rates among the 44 largest metropolitan areas with 1993 homeownership rates. We also used various measures of housing demand and supply and two measures of the

Table 5. **Housing Price Change and Volatility Regression Results**

Model		Coefficient Estimates and Probability Levels			
		Type I: No New Economy Variables	*Type II:* Includes Dot-Com Firms per 1,000 Workers	*Type III:* Includes Top Dot-Com Firm Quartile Dummy Variable	*Type IV:* Includes Dot-Com Interaction Effects
Dependent variable: Percent change in median home price, 1993–98					
Independent variables					
PRICE93	1993 median home price	–0.060	–0.191**	0.091	–0.139
PCINC93	1993 MSA per capita income (in thousands)	1.084	0.686	1.138	0.274
%JOBCH	1993–98 percent job change	0.874**	0.490*	0.851***	0.300
SUPPLY-FLEX	1993–98 residential building permits/ job growth	–0.578**	–0.460***	–0.557***	0.195
NE-INDEX	Dot-com firms per 1,000 workers		2.90***		3.962***
NE-DV	Top quartile MSAs based on dot-com firms per 1,000 workers			5.77	
Income interaction term	PCINC × NE-DV				–0.54
SUPPLY-FLEX interaction term	SUPPLY-FLEX × NE-DV				0.195
Constant		4.757	11.968	5.381	–11.628
R-squared		0.36	0.45	0.36	0.32
Observations		41	41	41	41

Table 5. **Housing Price Change and Volatility Regression Results** *(continued)*

Model		Coefficient Estimates and Probability Levels			
		Type I: No New Economy Variables	*Type II:* Includes Dot-Com Firms per 1,000 Workers	*Type III:* Includes Top Dot-Com Firm Quartile Dummy Variable	*Type IV:* Includes Dot-Com Interaction Effects
Dependent variable: 1993–98 median home price coefficient of variation					
Independent variables					
PRICE93	1993 median home price	0.016	–0.023	0.01	–0.015
SUPPLY-FLEX	1993–98 residential building permits/ job growth	–0.090**	–0.060	–0.083*	
NE-INDEX	Dot-com firms per 1,000 workers		0.630***		0.919***
NE-DV	Top quartile MSAs based on dot-com firms per 1,000 workers			1.26	
Income interaction term	PCINC × NE-DV				–0.118
SUPPLY-FLEX interaction term	SUPPLY-FLEX × NE-DV				0.016
Constant		8.8***	7.03**	9.104***	1.77
R-squared		0.18	0.33	0.18	0.31
Observations		44	44	44	44

*p = 0.10. **p = 0.05. ***p = 0.01.

new economy: the number of dot-com domain names per thousand jobs and a dummy variable indicating whether an MSA was in the top quartile of the number of dot-com firms per thousand jobs. The results are presented in the top block of table 6.

Among the 44 MSA observations, initial homeownership rates and the two demand and supply measures (EMP98/POP98, the ratio of 1998 employment to population, and SUPPLY-FLEX, the ratio of permits to job growth) alone explained 68 percent of the variation in 1998 homeownership rates. The coefficients of all three independent variables were statistically significant. Adding the number of dot-com domain names per thousand jobs (Model Type II) improved the overall model fit, boosting the R-squared to 0.73, but reduced the significance level of the SUPPLY-FLEX variable below the 0.10 probability threshold. As in previous models, the new economy effect was both large and significant: For every additional dot-com firm per thousand workers, the MSA median homeownership rate declined by about half a percentage point between 1993 and 1998. Among the top quartile of new economy MSAs (Model Type III), 1998 homeownership rates were nearly 3.5 percent lower in 1998 than in 1993. The results of the Type IV model indicate that while 1998 homeownership rates were systematically lower in new economy markets, the relationships between local supply and demand factors and homeownership rates are no different there than elsewhere. This is the model in which the top quartile new economy dummy variable is allowed to interact with the supply and demand variables. However, the direction of causation overall between the new economy markets and homeownership needs further research.

What of the relationship between the new economy and housing burdens? As noted previously, among MSAs with a population of a million or more, the ratio of median housing price to median income fell during the 1990s—the result of both rising family incomes and plentiful construction. And although the decline was greatest in new economy markets, 1998 housing prices were still much higher in those markets than elsewhere. Digging deeper, we use regression analysis to compare changes in housing price-to-income ratios between new and old economy MSAs, controlling for employment as a measure of demand and the ratio of new construction to employment growth as a measure of supply. The results are presented in the middle block of table 6.

Among the 43 MSA observations for which data were available, the initial 1993 price-to-income ratio and the two demand and supply measures (EMP98/POP98, the ratio of 1998 employment to population, and SUPPLY-FLEX, the ratio of permits to job growth) explained 88 percent of the variation in the later 1998 price-to-income ratio. The coefficients of all three independent variables were of the expected signs, but

Table 6. **Homeownership, Burden, and Overcrowding Regression Model Results**

Model		Coefficient Estimates and Probability Levels			
		Type I: No New Economy Variables	*Type II:* Includes Dot-Com Firms per 1,000 Workers	*Type III:* Includes Top Dot-Com Firm Quartile Dummy Variable	*Type IV:* Includes Dot-Com Interaction Effects
Dependent variable: 1998 MSA homeownership rate					
Independent variables					
HO_RATE93	1993 homeownership rate	0.827***	0.792***	0.764***	0.817***
EMP98/POP98	Jobs-population ratio in 1998	0.203*	0.327**	0.231**	0.331**
SUPPLY-FLEX	1993–98 residential building permits/ job growth	0.107**	0.03	0.074	0.012
NE-INDEX	Dot-com firms per 1,000 workers		–0.528**		–0.532*
NE-DV	Top quartile MSAs based on dot-com firms per 1,000 workers			–3.465*	
Demand interaction term	EMP98/POP98 × NE-DV				–0.036
SUPPLY-FLEX interaction term	SUPPLY-FLEX × NE-DV				0.066
Constant		–2.715	–0.644	–1.441	–1.789
R-squared		0.68	0.73	0.70	0.77
Observations		44	44	44	44

Table 6. **Homeownership, Burden, and Overcrowding Regression Model Results** *(continued)*

Model		Coefficient Estimates and Probability Levels			
		Type I: No New Economy Variables	*Type II:* Includes Dot-Com Firms per 1,000 Workers	*Type III:* Includes Top Dot-Com Firm Quartile Dummy Variable	*Type IV:* Includes Dot-Com Interaction Effects
Dependent variable: 1998 housing price-to-income ratio					
Independent variables					
PRICE/INCOM93	1993 median housing price-to-median income ratio	0.770***	0.795***	0.797***	0.832***
EMP98/POP98	Jobs-population ratio in 1998	0.013	0.017	0.0155	0.021
SUPPLY-FLEX	1993–98 residential building permits/ job growth	–0.0122**	–0.0128**	–0.0128**	–0.017**
NE-INDEX	Dot-com firms per 1,000 workers		–0.0131		0.023
NE-DV	Top quartile MSAs based on dot-com firms per 1,000 workers			–0.158	
Demand interaction term	EMP98/POP98 × NE-DV				–0.019*
SUPPLY-FLEX interaction term	SUPPLY-FLEX × NE-DV				0.028*
Constant		0.538	0.329	0.331	–0.18
R-squared		0.88	0.88	0.88	0.89
Observations		43	43	43	43

Table 6. **Homeownership, Burden, and Overcrowding Regression Model Results** *(continued)*

Model		Coefficient Estimates and Probability Levels			
		Type I: No New Economy Variables	*Type II:* Includes Dot-Com Firms per 1,000 Workers	*Type III:* Includes Top Dot-Com Firm Quartile Dummy Variable	*Type IV:* Includes Dot-Com Interaction Effects
Dependent variable: Change in persons per room, 1985–95					
Independent variables					
PRICE/INCOM95	1995 median housing price-to-median income ratio	–0.012***	–0.018***	–0.016***	–0.018***
SUPPLY-FLEX, 1990–95	1990–95 residential building permits/job growth	0.000	0.000	0.00	0.00
NE-INDEX	Dot-com firms per 1,000 workers		0.048**		0.02
NE-DV	Top quartile MSAs based on dot-com firms per 1,000 workers			0.030**	
Demand interaction term	PRICE/INCOM95 × NE-DV				0.004
SUPPLY-FLEX interaction term	SUPPLY-FLEX × NE-DV				0
Constant		0.079***	0.098***	0.092***	0.097
R-squared		0.15	0.25	0.27	0.24
Observations		42	42	42	42

*p = 0.10. **p = 0.05. ***p = 0.01.

only two, the initial ratio (PRICE/INCOM93) and SUPPLY-FLEX, were statistically significant. As with the results of previous models, there is a consistent and strongly negative relationship between new construction and burden. To those who argue that new construction is not at least a partial antidote to the problem of housing prices that are too high, this evidence strongly suggests otherwise.

Adding the number of dot-com firms per thousand jobs (Model Type II) does little to improve the overall model fit or change the contributions of supply and demand. Similarly, controlling for supply and demand, housing price-to-income ratios in 1998 were no higher among the top quartile of new economy MSAs than among the others (Model Type III).

While the two new economy variables are not themselves statistically significant, the interactions between the new economy dummy variable and supply and demand terms are. Controlling for other factors, the 1998 ratio of housing prices to incomes was consistently smaller—indicating that housing was relatively more affordable—in new economy markets with greater household labor force participation (as measured by the ratio of jobs to population). On the supply side, housing was slightly less affordable in new economy markets with higher levels of new construction. Both effects were slight. What these results suggest is that controlling for other factors, new economy housing markets are very slightly more elastic on the demand side and inelastic on the supply side than traditional housing.

One way households respond to the higher housing prices of new economy markets is to crowd up. To further investigate the relationship between the new economy and overcrowding, we used regression analysis to compare the number of persons per room in 1985 and 1995. The results are presented in the bottom block of table 6. By themselves, SUPPLY-FLEX and the housing price-to-income ratio explain only 15 percent of the change in crowding between 1985 and 1995. Because crowding is mostly a function of immigration, this result is not really surprising. What is more surprising is that the SUPPLY-FLEX variable is not statistically significant, suggesting that crowding—at least when measured in terms of persons per room—is less a matter of supply than demand.

Adding the number of dot-com firms per thousand jobs (Model Type II) substantially improved the overall model fit, boosting its R-squared from 0.15 to 0.25. For every additional dot-com firm per thousand workers, the ratio of persons to rooms, evaluated at the mean, increased by about 10 percent. This is not say that dot-com firms cause overcrowding, but rather that the housing stock in new economy MSAs is consistently more crowded than in traditional economy MSAs. This interpretation is

confirmed by the results of the Type III model, which includes a dummy variable indicating whether or not a particular MSA is in the top quartile when ranked according to the number of dot-com firms per thousand jobs.

Equality and distributional measures. Metropolitan housing markets by their very nature are highly segmented—by location, structure type and age, tenure, and, of course, price. Controlling for other factors, are new economy housing markets more or less segmented by housing price and rent than other metropolitan housing markets? To find out, we used regression analysis to compare a series of housing value, cost, value, and rent Gini coefficients across 44 new and old economy MSAs, holding various supply and demand measures constant. As noted previously, separate price, value, and rent Gini coefficients were constructed for 1985 and 1995, using data from the American Housing Survey (U.S. Bureau of the Census and HUD 1991, 1997). Gini coefficients vary between 0 and 1, and higher values indicate greater inequality.

Regression results comparing 1995 housing value Gini coefficients with housing supply and demand indicators are presented in the top block of table 7. Also included is the housing price Gini coefficient for 1985. By themselves, the demand and supply measures—1985 per capita income, the rate of job change between 1985 and 1995, and the SUPPLY-FLEX variable—together with the 1985 housing value Gini coefficient—explained 77 percent of the variation in the 1995 housing value Ginis. The estimated coefficients for the 1985 housing value Ginis and per capita income were statistically significant, although the SUPPLY-FLEX and job change variables were not. These results suggest that at the MSA level, it is income, not job growth or housing construction, that most affects the distribution of housing values.

Adding the different new economy measures did little to improve the fit of the model or change the contribution of the other independent variables. Simply put, while housing values as of 1995 may have been somewhat more equally distributed in new economy MSAs than elsewhere, they did not grow proportionately more equal between 1985 and 1995. In fact, it should be noted that overall, Gini values for all housing cost indicators became more unequal from 1985 to 1995.

Likewise, controlling for other factors (including the 1985 distribution of housing costs), there was no statistically significant difference as of 1995 in the distribution of housing costs among new and old economy housing markets (see the middle block of table 7). The intra-MSA distribution of housing costs is affected, however, by income and job growth: All else being equal, the distribution of housing costs in 1995 was slightly more equal in MSAs that were either wealthier or adding jobs at a faster rate.

Table 7. **Housing Value and Cost Gini Coefficient Regression Results**

Model		Coefficient Estimates and Probability Levels			
		Type I: No New Economy Variables	*Type II:* Includes Dot-Com Firms per 1,000 Workers	*Type III:* Includes Top Dot-Com Firm Quartile Dummy Variable	*Type IV:* Includes Dot-Com Interaction Effects
Dependent variable: Gini coefficient for housing value, 1995					
Independent variables					
HSGVAL_GINI85	Housing value Gini coefficient, 1985	0.882**	0.883***	0.886***	0.882***
PCINC85	1985 MSA per capita income (in thousands)	–0.005**	–0.005*	–0.004*	–0.004**
%JOBCH	1985–95 percent job change	0.00	0.00	–0.000	0.00
SUPPLY-FLEX	1990–95 residential building permits/ job growth	0.00	0.00	0.00	–0.00
NE-INDEX	Dot-com firms per 1,000 workers		0.002		–0.001
NE-DV	Top quartile MSAs based on dot-com firms per 1,000 workers			0.004	
Income interaction term	PCINC × NE-DV				0.00
SUPPLY-FLEX interaction term	SUPPLY-FLEX × NE-DV				0.00
Constant		0.126**	0.128*	0.132*	0.131*
R-squared		0.77	0.76	0.76	0.75
Observations		44	44	44	44

Table 7. **Housing Value and Cost Gini Coefficient Regression Results** *(continued)*

Model		Coefficient Estimates and Probability Levels			
		Type I: No New Economy Variables	*Type II:* Includes Dot-Com Firms per 1,000 Workers	*Type III:* Includes Top Dot-Com Firm Quartile Dummy Variable	*Type IV:* Includes Dot-Com Interaction Effects
Dependent variable: Gini coefficient for monthly housing cost, 1995					
Independent variables					
HSGCOST_GINI85	Housing cost Gini coefficient, 1985	0.728***	0.748***	0.729***	0.749***
PCINC85	1985 MSA per capita income (in thousands)	–0.003*	–0.002	–0.002	–0.002
%JOBCH	1985–95 percent job change	–0.001***	–0.001**	–0.001**	–0.001**
SUPPLY-FLEX	1990–95 residential building permits/ job growth	0.00	0.00	0.00	0.00
NE-INDEX	Dot-com firms per 1,000 workers		–0.014		–0.024
NE-DV	Top quartile MSAs based on dot-com firms per 1,000 workers			–0.001	
Income interaction term	PCINC × NE-DV				0.00
SUPPLY-FLEX interaction term	SUPPLY-FLEX × NE-DV				0.00
Constant		0.178**	0.153**	0.176**	0.162**
R-squared		0.49	0.49	0.48	0.47
Observations		44	44	44	44

Table 7. **Housing Value and Cost Gini Coefficient Regression Results** *(continued)*

Model		Coefficient Estimates and Probability Levels			
		Type I: No New Economy Variables	*Type II:* Includes Dot-Com Firms per 1,000 Workers	*Type III:* Includes Top Dot-Com Firm Quartile Dummy Variable	*Type IV:* Includes Dot-Com Interaction Effects
Dependent variable: Gini coefficient for monthly rent, 1995					
Independent variables					
RENT_GINI85	Rent Gini coefficient, 1985	0.310***	0.291***	0.318***	0.279***
PCINC85	1985 MSA per capita income (in thousands)	–0.003**	–0.002	–0.003	–0.002
%JOBCH	1985–95 percent job change	–0.000	–0.000	–0.000	–0.000
SUPPLY-FLEX	1990–95 residential building permits/ job growth	0.00	0.00	0.00	0.00
NE-INDEX	Dot-com firms per 1,000 workers		–0.022		–0.027
NE-DV	Top quartile MSAs based on dot-com firms per 1,000 workers			–0.008	
Income Interaction term	PCINC × NE-DV				0.00
SUPPLY-FLEX interaction term	SUPPLY-FLEX × NE-DV				0.00
Constant		0.228***	0.206***	0.208***	0.212***
R-squared		0.41	0.43	0.41	0.4
Observations		44	44	44	44

*p = 0.10. **p = 0.05. ***p = 0.01.

Turning to rents, the story is much the same. The intrametropolitan distribution of rents in 1995 closely followed the rent distribution in 1985 and was also slightly affected by income levels. It is interesting to note that higher income levels as of 1985 were associated with less rent inequality in 1995, not more. There are several reasons why this might be the case, the most likely being rent truncation on both ends of the spectrum. The 1995 distribution of apartment rents was not associated with the rate of job growth, relative housing supplies, or the presence of dot-com firms.

Caveats

These results are subject to numerous caveats. The research design suffers from several limitations. Like all results based on single-equation regression models, these should properly be interpreted as indicative rather than causal. The empirical results are based on an analysis of a small number of relatively large MSAs. As such, their applicability to smaller metropolitan areas may be limited. In trying to avoid obvious endogeneity problems—by ensuring that the independent variables precede the dependent ones—we have overlooked possible simultaneity. Because of various data limitations, not all data series are available for exactly the same periods, and the periods examined may not reflect the true start of the new economy. While we would have liked our comparisons to begin and end at the top of the business cycle—from 1989 to 1999—data availability prevented this.

Nor are the data foolproof. Estimates of housing values are likely biased because of self-reporting. The housing welfare and distribution models consider total housing market outcomes, rather than outcomes at the margin, as is more appropriate. Residential construction permits are not disaggregated between owner-occupied and rental units. Per capita incomes are a less appropriate measure of housing demand than household income.

These caveats notwithstanding, the model results all point in the same general direction: Rather than being radically transformed, new economy housing markets are instead speeded-up versions of old economy housing markets.

Conclusions and implications

Summary of findings

The results of our analysis suggest that while there are significant differences between housing outcomes in new and old economy markets, the structure and logic of these markets have not changed.

1. Housing prices in new economy markets are higher, peakier, and more volatile than in their more traditional counterparts. However, this is principally due to higher income levels, higher rates of job growth, and lower levels of housing production and only partly due to the industrial base.

2. Homeownership rates in 1998 were lower among new economy MSAs than elsewhere, but they were also lower five years earlier, before the Internet boom began. The dot-com explosion may have exacerbated housing affordability problems and led to reduced rates of homeownership in certain areas, but it was not the root cause of these problems.

3. Whether new or old, the type of metropolitan economy had little effect on the relationship between per capita income levels and housing prices. Built into the operation of all housing markets is a mortgage underwriting mechanism that prevents housing prices from getting too far ahead of incomes.

4. Housing in new economy MSAs was generally more crowded than elsewhere. This is not to say, however, that the new economy causes crowding. Instead, the higher number of persons per room in new economy markets, all else being equal, is probably due to the concentrated presence of international immigrants, many of whom are used to denser patterns of residency.

5. The new economy does not seem to be directly associated with higher or rising levels of housing inequality within MSAs. Rather, the principal source of housing inequality, as measured using Gini coefficients, would seem to be differences in income levels between MSAs. The lower the income level in the metropolitan area, the greater the degree of value, rent, and housing cost inequality.

In sum, new economy housing markets *are* different. They are prone to higher home prices and, to a certain extent, more overcrowding. These differences notwithstanding, the ways in which new economy housing markets operate—and the primacy of the relationships between supply and demand in shaping housing market outcomes—are not fundamentally different. Rising incomes and employment have much the same effect on housing prices, homeownership rates, overcrowding, and the intrametropolitan distribution of housing costs and rents in new economy MSAs as in old economy ones. Likewise, the positive effects of increased housing production on homeownership rates and housing affordability are much the same in old economy markets as in new economy ones.

Conclusions and policy implications

Three major conclusions, each of which has important policy implications, stand out from this research.

1. Metropolitan industrial structure does indeed affect housing market outcomes. (Until now, the link between industrial structure and housing markets has been implicit rather than explicit.) All else being equal, homes in new economy MSAs are likely to be more expensive and more crowded than homes in old economy MSAs. Homeownership appears to be more difficult to attain, although the data do not reveal why this should be the case. We suspect that it is because housing markets by their very nature are slower to adjust to changes in demand than labor and product markets. Whereas employees can be added or laid off fairly quickly and production can be ramped up or down the next day, it typically takes between six months and two years (depending on the location) to construct a new home.

   The implication of this finding is that federal housing policies need to be more responsive to changes in local housing market conditions, particularly with respect to low-income renters. Rapid increases in housing prices of the type recently experienced in new economy markets heighten the affordability burdens faced by all low- and moderate-income households, especially renters. New economy markets change so quickly that by the time local housing data are collected, digested, and understood, it may simply be too late.

2. Metropolitan industrial structure does not appear to affect the distribution of outcomes within housing markets. The distribution of housing values, housing costs, and rents is neither more equal nor

more unequal in new economy MSAs than in others. It seems to be income, rather than industrial structure, that determines the intra-market distribution of housing outcomes, with higher per capita incomes associated with a more equal distribution of housing, values, costs, and rents. While this result flies in the face of the literature on wage structure at the MSA level, we nonetheless believe it to be valid.

The policy implication of this finding is that eligibility for federal housing subsidies should continue to be based on income, rather than on place or product. Demand-side programs, which began on the rental side with the introduction of the Section 8 program in 1974 and on the ownership side with the expansion of mortgage credit during the early 1990s, still hold the greatest promise of reducing housing cost burdens, even in fast-change housing markets.

3. Supply matters. This research concludes that the more responsive the home building industry and permitting process are to increases in MSA employment, the lower the median price of housing, rate of price appreciation, and housing price burden, and the higher the rate of homeownership. Predicted by theory, and thus not totally unexpected, it is reassuring to find that with all their idiosyncrasies, housing markets still function the way they are supposed to.

   This finding suggests that long-term federal and state interest in reducing barriers to the construction of additional housing supplies—whether market-rate or affordable—should continue and that there may be appropriate roles for federal, state, and local policy makers in broadening the housing supply pipeline.

Appendix

High-tech definitions by SIC code

Milken Institute

High-Tech Manufacturing Industries

- 283 Drugs
- 357 Computer and Office Equipment
- 366 Communications Equipment
- 367 Electronics Components and Accessories
- 372 Aircraft and Parts
- 376 Guided Missiles, Space Vehicles, and Parts
- 381 Navigation and Aeronautical Systems and Equipment
- 382 Laboratory Apparatus and Optical Equipment
- 384 Surgical, Medical, and Dental Instruments

High-Tech Service Industries

- 481 Telephone Communications Services
- 737 Computer Programs, Data Processing
- 781 Motion Picture Production and Services
- 871 Engineering and Architectural Services
- 873 Research, Development, and Testing Services

Hecker 1999

SIC Industry Definition

- 281 Industrial Inorganic Chemicals
- 282 Plastic Materials and Synthetics
- 283 Drugs
- 284 Soap, Cleaners, and Toilet Goods
- 285 Paints and Allied Products
- 286 Industrial Organic Chemicals
- 287 Agricultural Chemicals
- 289 Miscellaneous Chemical Products
- 291 Petroleum Refining
- 348 Ordnance and Accessories
- 351 Engines and Turbines
- 353 Construction and Related Machinery
- 355 Special Industry Machinery
- 356 General Industrial Machinery
- 357 Computer and Office Equipment
- 361 Electric Distribution Equipment
- 362 Electical industrial Apparatus
- 365 Household Audio and Video Equipment
- 366 Communications Equipment
- 367 Electronic Components and Accessories
- 371 Motor Vehicles and Equipment
- 372 Aircraft and Parts
- 376 Guided Missiles, Space Vehicles
- 381 Search and Navigation Equipment
- 382 Measuring and Controlling Devices
- 384 Medical Instruments and Supplies
- 386 Photographic Equipment and Supplies
- 737 Computer and Data Processing Services
- 871 Engineering and Architectural Services
- 873 Research and Testing Services
- 874 Management and Public Relations

AEA

Computers and Office Equipment
- 3571 Electronic Computers
- 3572 Computer Storage Devices
- 3575 Computer Terminals
- 3577 Computer Peripherals
- 3578 Calculating and Accounting Machines
- 3579 Office Machines

Consumer Electronics
- 3651 Household Audio and Video Equipment
- 3652 Records, Prerecorded Tapes/Disks

Communications Equipment
- 3661 Telephone and Telegraph Equipment
- 3663 Radio and TV Broadcast and Comm Equipment
- 3669 Other Communications Equipment

Electronic Components and Accessories
- 3671 Electron Tubes
- 3672 Printed Circuit Boards
- 3675 Electronic Capacitors
- 3676 Electronic Resistors
- 3677 Electronic Coils, Transformers, Inductors
- 3678 Electronic Connectors
- 3679 Other Electronic Components

Semiconductors
- 3674 Semiconductors and Related Devices

Industrial Electronics
- 3821 Laboratory Apparatus
- 3822 Environmental Controls
- 3823 Process Control Instruments
- 3824 Fluid Meters and Counting Devices
- 3825 Instruments to Measure Electricity
- 3826 Laboratory Analytical Instruments
- 3829 Other Measuring and Controlling Devices

Photonics
- 3827 Optical Instruments and Lenses
- 3861 Photographic Equipment and Lenses

Defense Electronics
- 3812 Search and Navigation Systems

Electromedical Equipment
- 3844 X-Ray Apparatus
- 3845 Electromedical Apparatus

Communication Services
- 4812 Radiotelephone Communications
- 4813 Telephone Communications
- 4822 Telegraph and Other Message Communicaitons
- 4841 Cable and Other Pay TV Services
- 4899 Other Communications Services

Software Services
- 7371 Computer Programming Services
- 7372 Prepackaged Software
- 7373 Computer Integrated Systems Design

Data Processing and Information Services
- 7374 Computer Processing and Data Preparation
- 7375 Information Retrieval Services
- 7376 Computer Facilities Management Services

Rental, Maintenance, and Other Computer-Related Services
- 7377 Computer Rental and Leasing
- 7378 Computer Maintenance and Repair
- 7379 Other Computer-Related Services

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