Urban Economic Base as a Catalyst for Movements in Real Estate Prices

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Abstract: Recent studies involving the analysis of housing prices have found evidence that housing prices are affected by local urban economic variables like growth in the labor market within a particular MSA. We create and employ new forward looking employment growth indices that measure the urban economic strength of an MSA and find that it explains house price movements with large statistical and economic significance. We further split the urban economic growth into various industries and track the attribution of the growth in various industries to that of housing prices over time. Interestingly, we find that some MSAs have urban economic growth, and as a result, home prices driven by the same industries over time, whereas for others, home prices are driven by a totally new set of industries in the later quarters.

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Introduction

The demand for residential housing in a city is inexorably linked to conditions in the local labor market and the income generated in that market. There is a fairly large literature that tries to explain the link between local economic conditions and housing prices including Abraham and Hendershott (1996), Malpezzi (1999), Capozza et al. (2002), and Jud and Winkler (2002). In a pair of notable recent papers Hwang and Quigley (2006) and Gallin (2006) find that changes in local economic conditions, particularly income and employment affect local housing markets.

There are generally two missing elements in this line of research. The first is that housing is partly an investment decision; housing prices are asset prices. This implies that current housing prices should not merely be a function of current local economic conditions, but should also reflect forward looking expectations about the future economic health of the region. More specifically, it implies that expectations about future employment and income trends are important in the formation of housing prices in addition to consumer confidence in the region (Dunn and Mirzaie (2006). Ideally, housing prices would be appropriately tied to other asset prices that reflect the health of the local economy.

The second missing element is the process by which local economic income and employment trends are generated. The fundamentals of urban economic growth are not parsimoniously represented by the aggregates but by the so-called "base" sectors of the metropolitan area. The leading theory of short run movements in urban economic aggregates has been the *base multiplier model*. Clearly influenced by the Keynesianism of the era, the base multiplier model, beginning with Hoyt and Weimer (1939) (and even before) the multiplier

model suggests a bifurcation of city employment into basic, or export employment, and local employment. The former is, as its name suggests, oriented largely toward a national or international market; demand for the product of those firms generates revenue that is a kind of autonomous capital infusion into the community. This revenue goes partly to the workers in the city who spend a portion on locally produced goods and services. The employees of these establishments also do the same thing, so that the initial stimulus in the basic sector has a *multiplier effect* on the local economy. The Keynesian flavor of this cannot be mistaken. Where fiscal policy might have served as the source of the autonomous injection in the textbook macroeconomic version of the model, national and international exports now serve as the primary stimulant, but the mechanics are the same (Coulson, 2006).

The primary problem in implementing this theory as a tool for the study of local economic fluctuations is that the sectors and/or the firms that comprise the economic base of a local economy are not easily identified although casual observation does suggest some rules. The automobile industry is an important part of the base of Detroit, the entertainment industry in various forms plays a similar role for Los Angeles and Las Vegas, and high technology is a fundamental economic driver of the economies of Seattle and San Jose. But there are cases which do not easily fit into a particular side of the base/local bifurcation. Is the banking sector an exporter in Detroit or does it only serve local customers? A priori reasoning does not reveal a definitive answer. Various attempts to use data to aid in this bifurcation (particularly the use of location quotients) have met with varying degrees of success (see, e.g. Brown, Coulson and Engle, 1992)). An alternative strategy is to avoid identifying sectors, per se, as being basic or local and to instead use econometric techniques to isolate the autonomous portions of

employment, using location quotients, or other decomposition techniques borrowed from the literature on vector autoregressions (Coulson (1999), Carlino, Defina and Sill (2001)).

Although the reliance on sectoral data for identifying a city's economic base is based on data availability, it has been long recognized (Tiebout, 1962) that the identification of basic employment is most accurately accomplished at the firm level. Focus on the firm, along with the first lacuna mentioned above, suggests the use of share prices of local export-oriented firms would be an ideal causal indicator for local housing markets. Our goal is to employ such a strategy.

In particular, we employ the strategy of examining key firms in key export sectors using the Bloomberg Regional Indices to mimic movements in the economic base of a city. The Bloomberg regional index for a particular MSA is a price-weighted index designed to measure the performance of the MSA's economy. The index is created by selecting publicly traded corporations with the highest equity market capitalizations that have significant exposure to a particular MSA. We use the components (corporations) of each of the Bloomberg Regional Indices to form various urban economic base indices based on realized earnings and earnings projections of the corporations.

In summary, we address two primary questions. What are the industries in each MSA that drive economic growth and in turn real estate prices and what are the magnitudes for each type of industry? To address these questions, we employ both a panel data methodology and attribution analysis. The rest of the paper proceeds as follows: Section 2 discusses the data sources and the data collection procedure. Section 3 discusses the preliminary econometric procedures to check for robustness of the variables in the sample. Section 4 explains the

attribution analysis approach in the literature and how it is modified to fit this study. Section 5 explains the estimation results and Section 6 concludes the paper.

2. Data

Our sample consists of 12 U.S Metropolitan Statistical Areas (MSA) including Atlanta, Boston, Chicago, Cleveland, Dallas, Las Vegas, Los Angeles, Miami, San Diego, San Francisco, Tacoma and Tampa. The sample period starts in 1985 and ends in 2005. For each metropolitan area ("city") we obtain the repeat sales index from the Office of Federal Housing Enterprise Oversight (OFHEO). This is our measure of home price movements for these cities. We use a snapshot of the components of the Bloomberg Regional Indices (which we will elaborate on subsequently) to identify publicly traded corporations that are the key drivers of the urban economic bases of these cities. We obtain industry level employment data for each city in our sample from the Bureau of Labor Statistics. Price and Return data are obtained from the Center for Research in Security Prices (CRSP). Earnings per share (EPS) realizations and year ahead analysts' forecasts of EPS are obtained from I/B/E/S.

Table 1 illustrates the major firms associated with a particular city during the beginning and the end of our sample period. To identify the industry category we use the 2-digit SIC code obtained from CRSP during the observation period. Of the MSAs that we examine, Atlanta and Las Vegas are the least diversified in terms of the number of industries at the beginning of our sample, with 2 and 3 industries respectively. Cleveland is the only city that has not increased the number of industries throughout the sample period, which could indicate stagnation in new sources of income for the city. All other cities in our sample have experienced an influx of new industries. At the maximum, they have up to approximately four times the number of industries

at the end of the 2005 relative to the beginning of 1985. At the end of our sample, Las Vegas still had the lowest number of industries in its economic base portfolio.

Table 2 reports the market value of firms with operations in a particular MSA. Atlanta and Las Vegas had the lowest number of firms in their portfolios at the beginning of our sample, in comparison to Dallas and San Francisco which had the largest number of firms during the same period with 43 and 47 corporations respectively. At the end of our sample, Las Vegas continued to have the least amount of firms along with Miami whereas Boston and San Francisco had the highest number of corporations operating in their cities with 165 and 216 respectively. In terms of market value, Atlanta and San Diego had the smallest average sized firm during the beginning and at the end of the sample. The size of an average firm is the largest in Dallas, Tampa and Tacoma at the beginning and at the end of the sample. In terms of total market value of the portfolio of firms in a particular city, Atlanta and Las Vegas had the lowest aggregate value during the beginning and the end of the sample period. In contrast, Chicago, Dallas and San Francisco had the highest total market value of the portfolio of corporations at the beginning and the end of the sample period.

Table 3 provides a snapshot of the variables that represent the strength of the urban economic base for each MSA. We construct a price index for each city by obtaining the stock price for each firm in the MSA's portfolio from Center for Research in Security Prices (CRSP). We also obtain the number of shares outstanding from the same source and use the product of the two to obtain the market value of the firm. We then calculate the market-value weighted average price of the MSA's portfolio of firms every calendar quarter, using the price and number of shares outstanding at the end of each period. We similarly construct a return index of a city by using quarterly returns of firms from CRSP and calculating the value-weighted average of

returns for every calendar quarter. The general equation that represents a value-weighted index at any point in time t is as follows:

$$\text{Value - weighted Index}_t = \sum \frac{w_{it}}{w_t} X_{it} \quad (1)$$

w_{it} represents the market value of firm *i* at time *t*, and W_t represents the total market value of all firms in a particular MSA. X_{it} represents the earnings per share (EPS), actual or realized, annual or quarterly, price and return based on the type of value-weighted index. For example, X_{it} represents the market price of firm *i*'s equity at time *t*, if we are forming a value-weighted price index time-series.

Table 3 also illustrates the earnings potential for each MSA in our sample. An MSA's earnings potential is calculated by alternatively using one period ahead forecasts by analysts[1] and also realizations obtained from I/B/E/S. We initially form four series for the earnings potential; two based on quarterly EPS realizations and the other two based on quarterly forecasts. For the realized EPS series, we simply calculate a market-value weighted average of the actual EPS values on a quarterly or annual basis. For the quarterly earnings-potential series, we include all the quarterly EPS estimates by analysts during the current calendar quarter. The quarterly EPS estimates represent the forecast of the EPS for the next calendar quarter. We similarly calculate the annual (one-year ahead) earnings potential every quarter.

The important assumption underlying the market-value weighting for constructing these series is that the size of a firm is proportional to its exposure to a particular MSA. To ensure that we capture a firm's exposure to a particular MSA as accurately as possible, we use as an alternative weighting variable, the labor employed by an MSA's firms, at the 2-digit SIC industry level, to come up with an alternative one year ahead forecasted series of EPS. In

[1] Analyst forecasts of earnings are partly based on the earnings forecast by a firm's management

addition to the forecasted series, we also form a labor weighted series for realization of annual earnings. A summary of the values are in table 4. The general equation that represents a labor-weighted index at any point in time t is as follows:

$$\text{Labor - weighted Index}_t = \sum \frac{l_{it}}{L_t} X_{it} \tag{2}$$

l_{it} represents the industry employment weight of industry i at time t, and L_t represents the total employment of all industries in a particular MSA. X_{it} represents the earnings per share (EPS), actual or realized, recorded at an annual frequency.

3. Preliminary analysis

We undertake some preliminary analysis of the data. Our first task is to examine the panel- time series properties of the six series (Price index of corporations of an MSA, Quarterly return index of corporations of an MSA, Realized quarterly EPS index, Realized annual EPS index, Estimated quarterly EPS index, and Estimated Annual EPS index) by examining the various series for stationarity. For convenience we consider each of these series as a panel, assuming that the time series properties are the same for each member of the panel (i.e. each city). We employ the Im, Peseran and Shin (2003) test for unit roots in panels. The basic idea of the IPS test is to take the average of the Dickey-Fuller tests for each member of the cross-section, and on the assumption that the stationary properties of the panel members are the same, the average will be an improved estimate of the true value of the (overall) Dickey-Fuller test. IPS provide test-statistics and Barnhorst and Baum (2001) develop Stata code for its implementation. We include 4 lags and a deterministic trend in the regressions and the results are displayed in Table 5. Interestingly but not surprisingly, the OHFEO price index contains a unit root; however its differenced value (calculated as a growth rate) is stationary. Quarterly returns are also stationary. Among the

earnings variables it is interesting to note that all four of the tests reject the null of stationary, but the two annual earnings variables have much weaker prob-values[2].

Our next step is to use regression analysis to examine the conditional correlations between the city portfolios and housing prices, as displayed in Table 6. We regress the growth rate of the OFHEO index on each of the six indicator series (individually) along with an intercept term, city fixed effects and a time trend. The growth rate is appropriate due to the results in Table 5. Moreover, the interpretation of the results in Table 6 is cleaner, since the regressand and the regressor of interest are now both flow variables. The inclusion of fixed effects is indicated by their joint significance in the regressions. Given their inclusion, whatever fit arises between the portfolio indicator and the housing price growth rate is purely due to within city variation[3].

The results in Table 6 indicate that all of the indicators are significantly correlated with the growth rate in housing prices, with the exception of the quarterly return.

4. Attribution analysis

Attribution analysis has been used widely in finance in the management of the stock and bond portfolios to determine which elements of a manager's strategy is responsible for performance results[4]. The analysis segments investment returns into returns due to style allocation, sector allocation, stock selection, and activity. It is essentially the return decomposition of a portfolio. One can think of the various industries of a particular metropolitan statistical area (MSA) also

[2] The series from San Diego had to be omitted from the test on Estimated Annual EPS index, and San Diego, Tampa and Las Vegas from the test on Estimated Quarterly EPS index, because of missing observations.
[3] The t-stat of the indicators when the city fixed effects are removed is always lower than what is displayed in Table 5.
[4] This technique was first applied by Brinson, Hood and Beebower (1986). Hamilton and Heinkel (1995) and Liang et. al. (1999), have applied this methodology to the attribution of commercial real estate returns.

known as the economic base as analogous to this portfolio with the return on the economic base proxied by return on the housing market. Consequently, we decompose the housing market return of each of our MSAs using changes in the earnings growth outlook for each industry in that MSA as our explanatory variables. The coefficients reveal the magnitude of the effect of growth of a certain industry on the house price index return. Specifically, we find the pattern of economic base multipliers of each industry for a particular MSA over time.

The implementation of attribution analysis involves regressing the housing returns of an MSA on the changes in quarterly earnings per share for each industry having a presence in the MSA. The resulting coefficients are constrained to sum up to 1, with individual coefficients constrained to be positive. The rationale for this positive constraint is to prohibit the scenario where we have to short a particular industry or certain industries. This constraint is consistent with the notion that basic industries should have a positive impact on house price movements. The regression along with the constraints used in an attribution analysis is as follows:

$$R_t = \sum \hat{b}_i X_{it} \, Rt \quad \text{where } \sum \hat{b}_i = 1 \tag{3}$$

In the above analysis, b_i represents the attribution percentage, X_{it} represents the average projected EPS for a 2-digit SIC industry i and R_t represents the return of the OFHEO index of an MSA.

The analysis uses a rolling estimation window of 3 years for most MSAs. More specifically, each quarter we obtain the attribution coefficients by regressing the MSA return for that quarter and 3 prior years on the growth rate in earnings. We then move to the next quarter and perform the same logic process (look back 3 years) to obtain the time-series of attribution coefficients. The results are robust to the look back periods of 4 and 5 years. We settled with a 3

year look back period for the rolling windows since we might lose more periods / quarters at the beginning because of the lags.

The above analysis differs from the traditional way that attribution analysis is done. The usual method [for example, Liang et. al., (1999)] is to run one regression with the preceding constraints using the entire time-series. Using a rolling window, however, provides us with a good insight into the changing nature of the economic base of MSAs. For example, while house prices in San Diego (see Figure 1f) tended to co-move with the Engineering and Management Services industry until the end of 2001, within the past 6 years Chemicals and Allied Products industry and Electronic Components (High Tech) Retail have been dominant industries

5. Discussion

The results of a fixed effects panel data estimation of the impact on home prices is displayed in Table 7. The nominal EPS indices were constructed by weighting EPS realizations and projections (quarterly and annual) from I/B/E/S database with the dollar value of labor employed by each industry. Table 7a is an MSA fixed-effects regression of log change in real housing price index, the dependent variable, on the realized EPS of the firms in a particular MSA, the independent variable. The real housing price index is computed by subtracting CPI from the nominal OFHEO index for each MSA. The regression also controls for the time trend which explains most of the variation in housing prices, but the EPS variable per se doesn't have much explanatory power. The results are the same for the Annual EPS realizations, which suggest that home prices react more to expectations in the earnings growth (growth in EPS) of the dominant industries in an MSA's urban economic base. In other words, house prices may already incorporate this information on realized earnings. As a result, we test if the estimated earnings growth projections by financial analysts have any impact on home prices.

Tables 7c and 7d shows fixed-effect estimates (controlled for time-trends) of the impact of estimated EPS indices on log real change in OFHEO indices. Even after controlling for time-trends, the variation in the estimated earnings growth of salient industries that comprise an MSA's economic base has a significant amount of explanatory power, both in terms of annual and quarterly urban economic growth forecasts. The R-squareds for the estimations range from 0.31 to a maximum of 0.50.

One possible explanation is that the projected earnings growth of an urban economic base forecasts the demand for labor which in turn anticipates the demand for residential housing for the new laborers. Another explanation is that a higher growth potential reflects increased wages for the existing employees who may try to upgrade from a smaller home to a larger home. This could lead to increase in trade-up housing demand, which in turn could lead to increase in home prices. The above results are thus consistent with the notion in the prior literature that urban economic growth influences home prices.

To further examine the impact of the estimated industrial growth of an MSA on home prices, we conduct an attribution analysis of OFHEO home price appreciation using the estimated growth rates of the various industries that comprise the economic base of each respective MSA. Tacoma and Dallas are excluded from our analysis due to the unavailability of the OFHEO house price index for the earlier years. For the other 10 cities included in our sample, the results of the attribution analysis are presented in Figure 1 and Table 8. Figure 1 displays the results of the dynamic attribution analysis. The number of lags used in the rolling window of the dynamic attribution analysis depends upon the number of 2-digit SIC industries. If an MSA has a higher number of industries, a higher number of lags is necessary to implement

the rolling regressions. The results of the attribution analysis presented in Table 8 and Figure 1 for each city are as follows:

Atlanta (45 quarters): Four industries - Chemicals, Industrial Machinery, Electrical Equipment and Instruments and Related appear to account for 94% of Atlanta's growth in the home prices with Electrical equipment the earliest generator of job growth, during the mid 1990s. Industrial Machinery then became the primary driver of employment growth during the late 1990s, followed by Instruments and Related industries. Over the last 2 years of our sample, the Chemical industry has been the dominant force underlying housing growth.

Boston (38 quarters): Fabricated Metal, Instruments, Durable Wholesale Trade and most notably Depository Institutions appear to be the primary drivers of Boston's economic base. These industries have appear to account for about 78% of growth in Boston's home prices. In earlier times, Wholesale trade was the primary driver of jobs in Boston probably due to its proximity to a harbor which would facilitate exports, followed by the Instruments industry. However, Depository institutions have dominated growth in the last 5 years of our sample.

Chicago (8 quarters[5]): Like Boston, Depository Institutions have been a key component of the growth in Chicago's house price. Together with Educational Services, and to a lseser extent Food and Kindred Products, these industries account for about 51% of growth in the home prices.

Tampa (34 quarters): In terms of economic base analysis using the attribution technique, about 75% of Tampa's house price appreciation is attributable to Health Services and Durable Wholesale Trade. Both industries have been consistent creators of jobs over time.

[5] Due to the large number of industries and the unavailability of EPS due to the lack of analyst following for certain industries

San Francisco (41 quarters): Like Tampa, the growth in San Francisco's housing prices appears to have been driven by 2 industries: Depository Institutions, Security, Commodity Brokers and Services. About 66% of growth in the home prices are associated with these industries.

San Diego (33 quarters): About 75% of growth in the home prices is attributable to the anticipated growth in earnings of three industries: Chemicals and Allied Products, Electrical and Electronic Equipment and Engineering and Management Services with the Electrical and Electronic equipment industry the earliest creator of job growth. Engineering and Management services then became the next generator of growth. Over the last 4 years of our sample, Chemicals and Allied Products have been the dominant driver of growth.

Miami (35 quarters): The forecasted earnings growth of three industries, Lumber and Wood products, Durable Wholesale Trade and Automotive Repair, Services and Parking, appear to account for the majority (87%) of Miami's housing appreciation. All three industries have continued to play a dominant role in the MSA's growth. To explain in more detail, what Automotive Repair, Services and Parking industry would entail, a deeper analysis using 4-digit SIC code was conducted. We found that it is essentially the Truck Rental and Leasing industry.

Los Angeles (20 quarters): The economic base of Los Angeles has been primarily driven by 2 industries: Heavy Construction Contractors and Transportation Equipment which have contributed about 80% of growth in the home prices. Heavy Construction Contractors has been the primary growth engine. Recently (2004-2005) the Transportation Equipment industry has also become a driver of growth.

Las Vegas (48 quarters): Surprisingly, potential earnings growth in the Amusement and Hotel Industries accounts for only a small portion (7%) of Las Vegas's housing price appreciation. Instead, approximately 90% of the growth in housing prices correspond to the anticipated

earnings growth in Insurance and Miscellaneous Manufacturing over time. This is because while the former is a big employer, its contribution to economic growth over this particular time period is muted; it employed a more or less constant proportion of the local labor force.

Cleveland (57 quarters): The Depository Institutions industry has played a dominant role in the movement of home prices in the Cleveland MSA. Together with Instruments and Related Products, these two industries have contributed to about 75% of growth in the home prices. Industrial Machinery and Equipment Manufacturing contribute an additional 5% towards house price appreciation.

In summary, for the MSAs which we examine, the earnings growth corresponding to two to four key industries in a given economic base appear to be the primary drivers of the growth rate in an MSA's house prices. This suggests that the economic base multiplier is typically associated with only a couple of basic industries. However, these basic industries do not necessarily remain a constant dominant force over time. As our findings indicate, home prices for some MSAs such as Boston are driven by a new set of industries over time while other MSAs like Chicago have had a relative stationary set of basic industries, whose earnings potential have accounted for the majority of that MSA's house price appreciation.

6. Conclusion

This study first confirms evidence of a large body of work that supports the hypothesis that home prices are driven by idiosyncratic economic variables. We create and employ new forward looking industrial growth indices that measure the urban economic strength of an MSA and find that these explain house price movements. We further split the urban economic growth into various industries and track the attribution of the growth in various industries to that of housing prices over time which yields interesting results. There are old cities like Cleveland that have had

the same industry as its growth driver for the last 15 years. On the other hand, there are cities like San Diego where new industries are born almost every 5 years which exert new influences on the entire housing market. All the above results are consistent with two hypotheses: Home prices are driven by local economic growth variables and from an investment perspective, home prices do follow future growth prospects of an urban economy.

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Table 1: Industrial composition of an MSA's economic base

The number of industries associated with each MSA's urban economic base is calculated using the 2-digit SIC codes from Center for Research in Security Prices (CRSP). The list of corporations in each city is obtained from the Bloomberg regional indices for 2005. 1985 and 2005 are the first and last years of the sample.

MSA	Year	Number of Industries (2-digit SIC)
Atlanta	1985	2
Atlanta	2005	9
Boston	1985	16
Boston	2005	31
Chicago	1985	20
Chicago	2005	36
Cleveland	1985	20
Cleveland	2005	20
Dallas	1985	25
Dallas	2005	33
Las Vegas	1985	3
Las Vegas	2005	5
Los Angeles	1985	25
Los Angeles	2005	41
Miami	1985	4
Miami	2005	10
San Diego	1985	6
San Diego	2005	22
San Francisco	1985	15
San Francisco	2005	30
Tacoma	1985	8
Tacoma	2005	13
Tampa	1985	7
Tampa	2005	18

Table 2: Size of an MSA's urban economic base portfolio

The list of corporations in each city is obtained from the Bloomberg Regional Indices for 2005. Market value for each firm is the product of price per share and the number of shares outstanding. Data for both are obtained from the Center for Research in Security Prices. Average market value is the average market value of firms in a particular city. Total market value represents the sum of equity market values of the corporations that have exposure to a particular urban economic base.

MSA	Year	Number of Firms	Average Market Value (in $millions)	Minimum Size (in $millions)	Maximum Size (in $millions)	Total Market Value (in $millions)
Atlanta	1985	3	60	19	82	180
Atlanta	2005	16	532	13	3536	8510
Boston	1985	32	167	2	926	5347
Boston	2005	165	1783	5	35630	294131
Chicago	1985	43	1261	12	6992	54216
Chicago	2005	122	5472	56	70114	667558
Cleveland	1985	36	1268	8	21122	45661
Cleveland	2005	51	4065	25	46094	207317
Dallas	1985	43	1822	6	42282	78338
Dallas	2005	80	7990	10	332887	639210
Las Vegas	1985	4	180	50	385	720
Las Vegas	2005	12	4561	99	15216	54728
Los Angeles	1985	41	416	1	5356	17043
Los Angeles	2005	143	2209	4	78422	315945
Miami	1985	4	377	9	1332	1507
Miami	2005	15	4914	57	36477	73716
San Diego	1985	10	97	11	496	970
San Diego	2005	77	1372	5	61289	105661
San Francisco	1985	47	906	15	13385	42590
San Francisco	2005	216	5868	6	139796	1267575
Tacoma	1985	9	1619	31	6808	14571
Tacoma	2005	17	25251	130	285932	429262
Tampa	1985	7	1674	11	9053	11721
Tampa	2005	22	6837	22	98547	150418

Table 3: Urban economic base indices for various MSA's (market-value weighted)

Market value for each firm is the product of price per share and the number of shares outstanding. Data for both are obtained from the Center for Research in Security Prices. *Price* is the end of the quarter market value weighted average price of the portfolio of firms that have exposure to a particular city. The firms in an MSA's portfolio are obtained from the Bloomberg Regional Indices. *Qtly. Return* represents the market value-weighted average quarterly returns of firms in a particular city. *EPS – Qtly, Actual* and *EPS – Ann, Actual* represents the market-value weighted average of realized quarterly earnings per share of firms in a city's portfolio. *EPS – Qtly, Actual* and *EPS – Ann, Forecast* represent the market-value weighted average of forecasted quarterly and annual earnings per share of firms respectively, in a city's portfolio. Actual Earnings per share and EPS forecasts are obtained from I/B/E/S. EPS values presented are in dollars.

MSA	Year	Qtr	Price	Qtly. Return	EPS - Qtly, Actual	EPS - Ann, Actual	EPS - Qtly, Forecast	EPS - Ann, Forecast
Atlanta	1988	1	4.61	-0.15	0.00	0.02	0.01	0.02
Atlanta	2005	4	29.14	0.04	0.30	1.06	0.37	1.36
Boston	1985	1	29.69	0.21	0.19	0.41	0.07	0.30
Boston	2005	4	37.62	0.06	0.46	1.67	0.41	1.60
Chicago	1985	1	47.77	0.21	0.16	0.43	0.09	0.36
Chicago	2005	4	51.39	0.02	0.63	2.32	0.66	2.39
Cleveland	1985	1	55.78	0.18	1.22	3.96	1.12	4.45
Cleveland	2005	4	51.02	-0.01	0.63	2.44	0.59	2.05
Dallas	1985	1	52.30	0.11	0.25	1.20	0.30	1.31
Dallas	2005	4	51.14	-0.04	1.16	3.83	1.17	3.97
Las Vegas	1985	1	25.34	0.08	0.66	1.05	0.00	1.28
Las Vegas	2005	4	46.85	0.07	0.46	1.95	0.44	2.27
Los-Angeles	1985	1	32.75	0.12	0.02	1.03	0.36	1.48
Los-Angeles	2005	4	57.05	0.03	1.00	3.10	0.85	3.26
Miami	1985	1	31.03	0.21	0.45	1.64	0.46	1.70
Miami	2005	4	44.35	0.08	0.57	2.83	0.41	2.88
San Diego	1985	1	20.75	0.31	0.03	0.28	0.10	0.46
San Diego	2005	4	40.60	0.00	0.44	1.32	0.37	1.43
San-Francisco	1985	1	32.84	0.16	-0.01	-0.10	0.01	0.09
San-Francisco	2005	4	58.16	0.05	0.58	2.02	0.75	2.39
Tacoma	1985	1	43.10	0.18	0.25	0.83	0.25	0.82
Tacoma	2005	4	37.46	0.04	0.43	1.81	0.43	1.87
Tampa	1985	1	91.73	0.24	0.31	1.10	0.34	1.19
Tampa	2005	4	32.97	-0.01	0.61	2.35	0.60	2.43

Table 4: Urban economic base indices for various MSA's (Industry-employment weighted)

The firms in a city's portfolio are obtained from the Bloomberg Regional Indices.

EPS, actual, annual and *EPS, forecast, annual* represent the industry-employment weighted average of the actual and forecasted earnings per share of firms respectively, in an MSA's portfolio. Earnings per share realizations and forecasts are obtained from I/B/E/S. The industry level employment data has been obtained from the Bureau of Labor Statistics web site (http://www.bls.gov/sae/home.htm).

MSA	Year	Qtr.	EPS, actual, annual	EPS, forecast, annual
Atlanta	1990	1	-0.08	0.01
Atlanta	2005	4	-0.04	0.25
Boston	1990	1	0.13	0.13
Boston	2005	4	0.17	0.28
Chicago	1990	1	0.13	0.19
Chicago	2005	4	0.37	0.56
Cleveland	1990	1	0.20	0.34
Cleveland	2005	4	0.03	0.49
Dallas	1990	1	0.34	0.15
Dallas	2005	4	0.28	0.44
Las Vegas	1990	1	1.05	0.03
Las Vegas	2005	4	0.64	0.51
Los Angeles	1990	1	-0.48	0.15
Los Angeles	2005	4	0.46	0.56
Miami	1990	1	0.07	0.09
Miami	2005	4	0.09	0.36
San Diego	1990	1	0.04	-0.05
San Diego	2005	4	0.18	0.42
San Francisco	1990	1	0.07	0.10
San Francisco	2005	4	0.16	0.33
Tacoma	1990	1	0.50	0.21
Tacoma	2005	4	0.95	0.52
Tampa	1990	1	-0.07	0.07
Tampa	2005	4	0.46	0.42

Table 5: IPS tests for panel stationarity

The 1% critical value for the test statistic in this case is -1.810, therefore all of the series reject the null except for the OHFEO index. Test regressions include four lags and a time trend.

Variable	IPS test levels	IPS test differences
OHFEO Index	3.244	-4.555
Price Index (of firms)	-3.145	-9.348
Quarterly Return Index (of firms)	-8.122	-9.072
Actual EPS Index Quarterly(Value-weighted)	-5.069	-8.999
Actual EPS Index Annual (Value-weighted)	-2.391	-8.983
Estimated EPS Index Quarterly (Value-weighted)	-4.314	-9.267
Estimated EPS Index Annual (Value-weighted)	-2.348	-9.242

Table 6: Preliminary Regression Analysis

The table contains coefficients and t-ratios of the row variable in a regression of the OFHEO index of residential housing prices. The regressions always include a time trend and metropolitan fixed effects.

Variable	Coefficients	t-ratio
Price Index (of firms)	0.0002	-2.98
Quarterly Return Index (of firms)	-0.0003	-0.31
Actual EPS Index Quarterly(Value-weighted)	0.0024	4.90
Actual EPS Index Annual (Value-weighted)	0.0070	5.44
Estimated EPS Index Quarterly (Value-weighted)	0.0023	4.36
Estimated EPS Index Annual (Value-weighted)	0.0007	5.80

Table 7: Fixed-Effects Regression Analysis of OFHEO index on Labor-weighted EPS indices

a. Realized EPS (Quarterly):

Variable	**Coefficient**	**Std. Err**	**T-stat**	**P-value**
Real (Deflated) Value of EPS Qtly.	0.599	0.45	1.34	0.18
Time	0.001	0.00	17.54	0.00
Constant	-0.013	0.00	-10.53	0.00
Fixed Effect	Within	Between	Overall	
R-square	0.34	0.33	0.32	

b. Realized EPS (Annual):

Variable	**Coefficient**	**Std. Err**	**T-stat**	**P-value**
Real (Deflated) Value of EPS Ann.	0.195	0.14	1.43	0.15
Time	0.001	0.00	17.05	0.00
Constant	-0.013	0.00	-10.36	0.00
Fixed Effect	Within	Between	Overall	
R-square	0.34	0.33	0.32	

c. Estimated EPS (Quarterly):

Variable	**Coefficient**	**Std. Err**	**T-stat**	**P-value**
Real (Deflated) Value of EPS Qtly.	0.824	0.42	1.95	0.05
Time	0.001	0.00	17.81	0.00
Constant	-0.013	0.00	-10.68	0.00
Fixed Effect	Within	Between	Overall	
R-square	0.34	0.50	0.32	

d. Estimated EPS (Annual):

Variable	**Coefficient**	**Std. Err**	**T-stat**	**P-value**
Real (Deflated) Value of EPS Qtly.	0.340	0.12	2.76	0.01
Time	0.001	0.00	17.48	0.00
Constant	-0.014	0.00	-10.74	0.00
Fixed Effect	Within	Between	Overall	
R-square	0.35	0.40	0.31	

Table 8: Attribution of Real Estate Returns by Industry:

a. Atlanta:

Industry (4-digit SIC)	Mean Attribution	T-stat	P-value	No. of Qtrs
Chemicals	16.85%	3.66	0.00	45
Industrial Machinery	14.65%	5.29	0.00	
Electrical Equipment	28.74%	5.17	0.00	
Instruments and Related	34.01%	6.15	0.00	
Business Services	3.44%	5.75	0.00	
Health Services	2.31%	3.55	0.00	

b. Boston

Industry (4-digit SIC)	Mean Attribution	T-stat	P-value	No. of Qtrs
Heavy Construction	1.35%	4.82	0.00	38
Printing & Publishing	1.26%	2.44	0.02	
Chemicals	2.37%	5.88	0.00	
Leather	1.86%	4.29	0.00	
Fabricated Metal	11.81%	7.02	0.00	
Industrial Machinery	0.67%	5.16	0.00	
Electrical	1.04%	5.93	0.00	
Instruments	11.87%	6.56	0.00	
Electric, Gas & Sanitary	0.36%	3.39	0.00	
Wholesale Trade-Durable	21.45%	5.69	0.00	
Miscellaneous Retail	0.03%	1.56	0.13	
Depository Institutions	33.06%	6.03	0.00	
Security, Commodity Brokers & Svcs	5.44%	10.57	0.00	
Personal Svcs	4.62%	4.04	0.00	
Business Svcs	1.47%	5.59	0.00	
Engineering and Management Svcs	1.35%	5.54	0.00	

c. Chicago

Industry (4-digit SIC)	Mean Attribution	T-stat	P-value	No. of Qtrs
Nonmetallic minerals, except fuels	2.20%	11.34	0.00	8
Food and kindred products	11.59%	7.65	0.00	
Apparel and other textile products	1.01%	3.55	0.01	
Printing and publishing	3.32%	2.19	0.07	
Chemicals and allied products	1.45%	8.02	0.00	
Rubber and miscellaneous plastics	1.25%	10.11	0.00	

products				
Fabricated metal products	1.48%	6.68	0.00	
Industry (4-digit SIC)	**Mean Attribution**	**T-stat**	**P-value**	**No. of Qtrs**
Industrial machinery and equipment	5.75%	3.81	0.01	8
Electrical and electronic equipment	0.13%	1.11	0.30	
Transportation equipment	1.41%	6.80	0.00	
Instruments and related products	2.88%	8.94	0.00	
Miscellaneous manufacturing industries	0.58%	3.02	0.02	
Communications	1.32%	10.26	0.00	
Electric, gas, and sanitary services	0.20%	1.05	0.33	
Wholesale trade--durable goods	1.71%	7.36	0.00	
Wholesale trade--nondurable goods	0.00%	1.00	0.35	
Eating and drinking places	1.90%	4.40	0.00	
Miscellaneous retail	8.99%	5.41	0.00	
Depository institutions	28.55%	6.43	0.00	
Insurance carriers	0.67%	2.95	0.02	
Real estate	1.64%	11.11	0.00	
Holding and other investment offices	3.56%	5.24	0.00	
Business services	0.98%	2.75	0.03	
Motion pictures	1.08%	5.97	0.00	
Health services	3.41%	5.42	0.00	
Educational services	10.72%	11.78	0.00	
Engineering and management services	2.22%	3.17	0.02	

d. Tampa:

Industry (4-digit SIC)	**Mean Attribution**	**T-stat**	**P-value**	**No. of Qtrs**
Apparel	6.12%	3.98	0.00	34
Printing & Publishing	0.31%	3.56	0.00	
Electrical	6.28%	3.51	0.00	
Misc. Manufacturing	1.08%	3.90	0.00	
Wholesale Trade-Durables	17.10%	7.97	0.00	
Security, Commodity Brokers and Svcs.	7.52%	4.58	0.00	
Business Services	2.76%	3.05	0.00	
Health Services	58.83%	12.56	0.00	

e. San Francisco:

Industry (4-digit SIC)	Mean Attribution	T-stat	P-value	No. of Qtrs
Heavy Construction Contractors	1.11%	8.36	0.00	41
Chemicals	1.86%	2.98	0.00	
Primary Metals	1.90%	8.96	0.00	
Industrial Machinery	0.71%	4.89	0.00	
Electrical Equipment	3.24%	4.59	0.00	
Instruments	2.62%	5.94	0.00	
Electric, Gas and Sanitary Svcs	3.21%	5.89	0.00	
Food Stores	2.04%	3.63	0.00	
Automotive and Gas Stations	1.03%	5.78	0.00	
Apparel stores	0.28%	3.17	0.00	
Furniture stores	1.11%	8.10	0.00	
Miscellaneous Retail	1.00%	6.49	0.00	
Depository Institutions	44.12%	16.79	0.00	
Security, commodity brokers and services	22.50%	12.47	0.00	
Holding and other investment offices	2.55%	4.06	0.00	
Business services	8.53%	8.60	0.00	
Engineering and management services	2.20%	7.62	0.00	

f. San Diego:

Industry (4-digit SIC)	Mean Attribution	T-stat	P-value	No. of Qtrs
Chemicals and allied products	35.79%	5.58	0.00	33
Industrial machinery and equipment	6.34%	5.11	0.00	
Electrical and electronic equipment	24.92%	4.40	0.00	
Instruments and related products	8.95%	4.18	0.00	
Miscellaneous retail	8.47%	2.81	0.01	
Hotels and other lodging places	0.38%	2.79	0.01	
Engineering and management Svcs	15.15%	3.96	0.00	

g. Miami:

Industry (4-digit SIC)	Mean Attribution	T-stat	P-value	No. of Qtrs
Heavy construction contractors	6.26%	3.93	0.00	35
Lumber and wood products	14.87%	7.19	0.00	
Chemicals and allied products	1.04%	3.06	0.00	
Wholesale trade--durable goods	46.44%	16.74	0.00	
Business services	5.90%	4.73	0.00	

Automotive repair, services, and parking	25.48%	8.25	0.00	

h. Los Angeles:

Industry (4-digit SIC)	Mean Attribution	T-stat	P-value	No. of Qtrs
Oil and gas extraction	0.90%	8.04	0.00	20
General building contractors	1.45%	4.53	0.00	
Heavy construction contractors	72.40%	24.69	0.00	
Chemicals and allied products	1.39%	10.79	0.00	
Fabricated metal products	0.61%	4.01	0.00	
Transportation equipment	5.79%	2.53	0.02	
Miscellaneous manufacturing industries	0.59%	2.31	0.03	
Electric, gas, and sanitary services	2.75%	4.37	0.00	
Wholesale trade--durable goods	0.75%	6.65	0.00	
Food stores	0.89%	2.12	0.05	
Insurance carriers	1.34%	9.96	0.00	
Insurance agents, brokers, and service	0.25%	1.29	0.21	
Holding and other investment offices	2.05%	2.85	0.01	
Hotels, rooming houses, camps, and other lodging places	1.59%	8.49	0.00	
Business services	1.01%	4.09	0.00	
Motion pictures	1.65%	15.61	0.00	
Amusement and recreational services	0.82%	4.70	0.00	
Health services	1.21%	11.57	0.00	
Engineering and management services	2.56%	4.12	0.00	

i. Las Vegas:

Industry (4-digit SIC)	Mean Attribution	T-stat	P-value	No. of Qtrs
Miscellaneous manufacturing industries	28.76%	5.92	0.00	48
Electric, gas, and sanitary services	1.01%	6.17	0.00	
Insurance carriers	62.79%	13.23	0.00	
Hotels, rooming houses, camps, and other lodging places	2.42%	3.29	0.00	
Amusement and recreational services	5.01%	6.73	0.00	

j. Cleveland:

Industry (4-digit SIC)	Mean Attribution	T-stat	P-value	No. of Qtrs
Metal mining	0.50%	7.16	0.00	57
Printing and publishing	0.41%	5.96	0.00	
Chemicals and allied products	1.17%	3.86	0.00	
Rubber and miscellaneous plastics products	2.27%	5.34	0.00	
Primary metal industries	2.84%	3.32	0.00	
Fabricated metal products	3.27%	9.24	0.00	
Industrial machinery and equipment	5.10%	6.48	0.00	
Electrical and electronic equipment	0.38%	5.81	0.00	
Transportation equipment	0.89%	5.50	0.00	
Instruments and related products	14.92%	9.00	0.00	
Building materials, hardware, garden supplies	0.26%	3.34	0.00	
Depository institutions	60.65%	32.34	0.00	
Insurance carriers	7.33%	4.77	0.00	

Figure 1: Attribution Analysis

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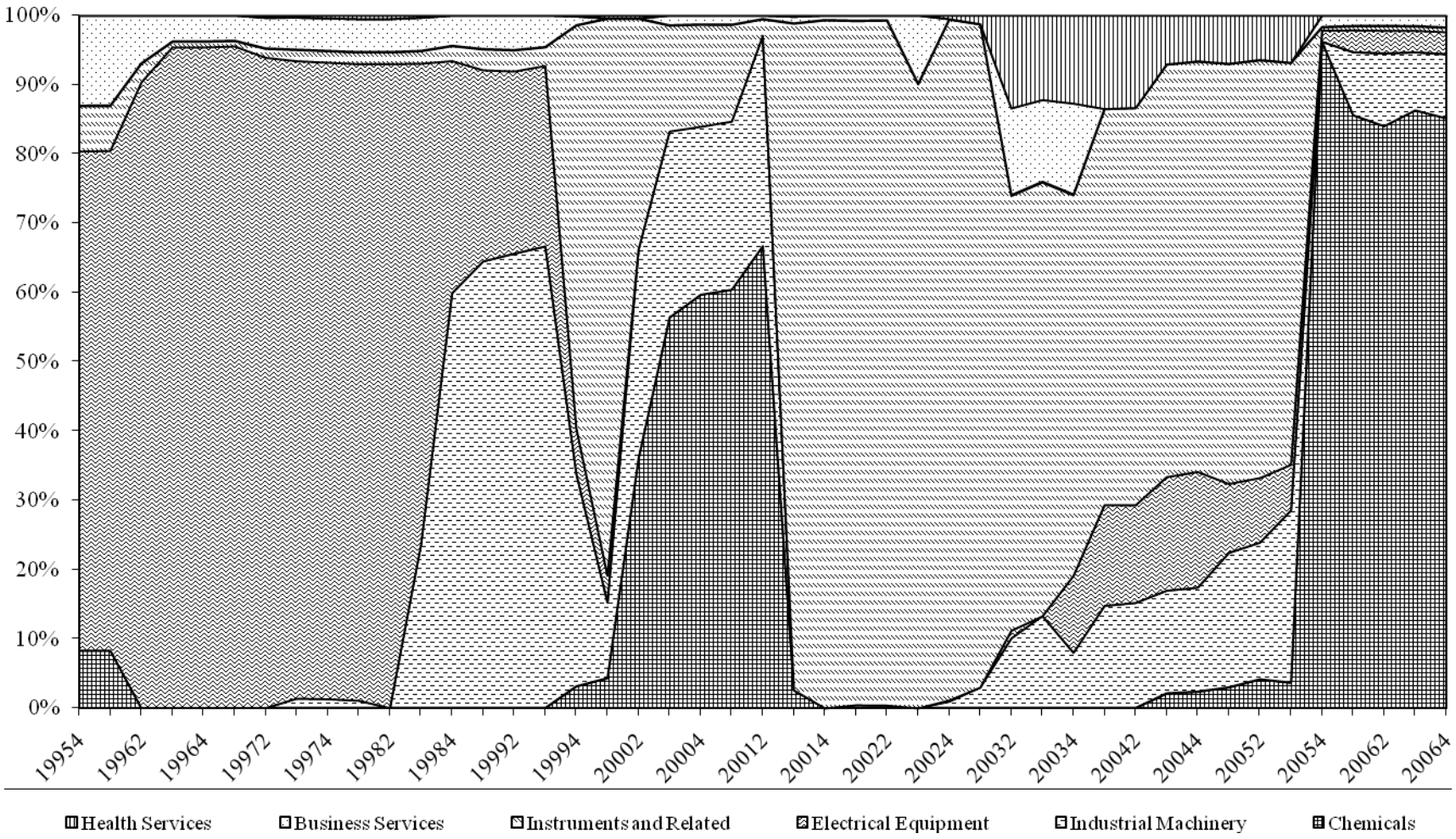

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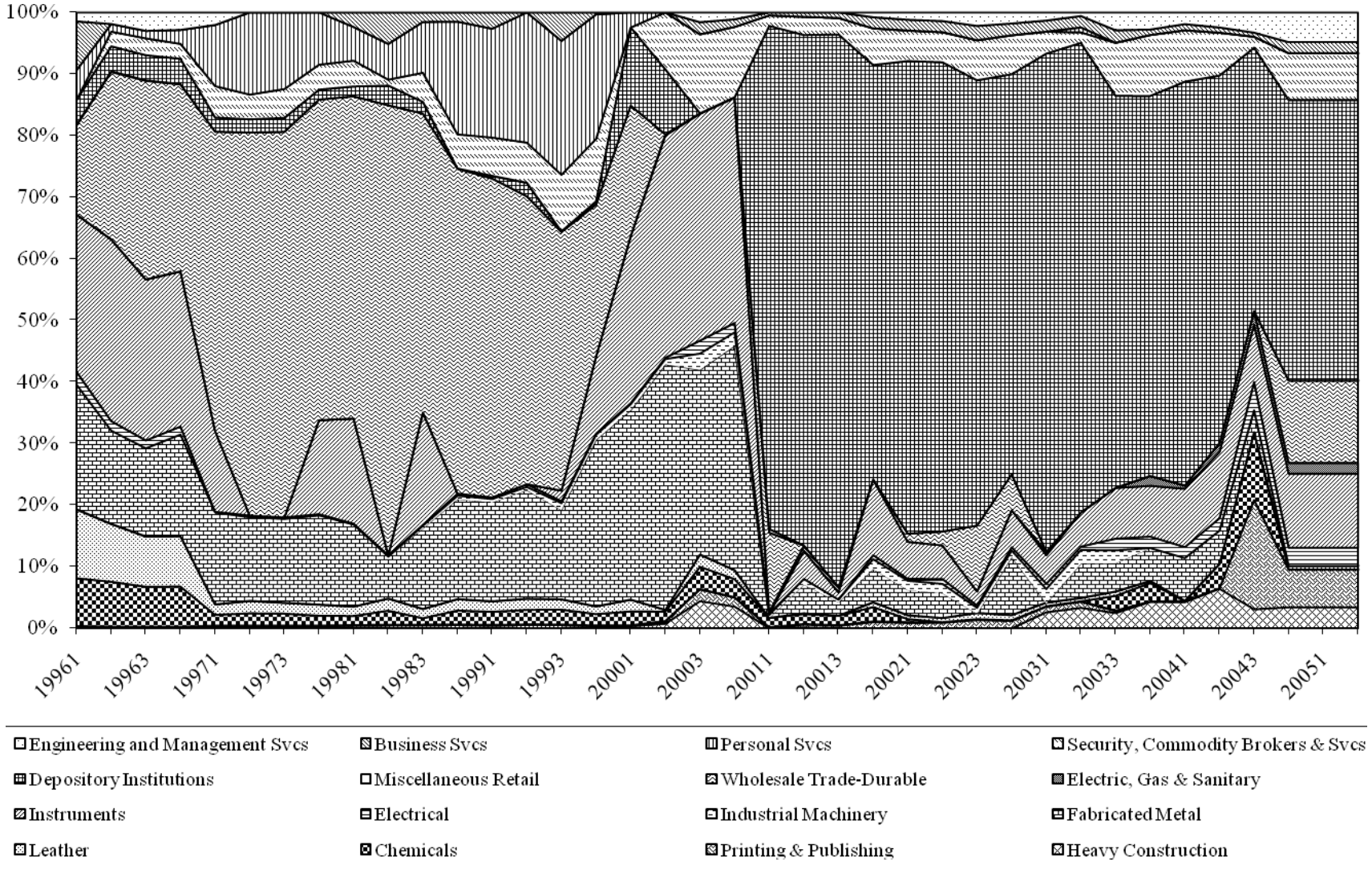
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Engineering and Management Svcs
Business Svcs
Personal Svcs
Security, Commodity Brokers & Svcs
Depository Institutions
Miscellaneous Retail
Wholesale Trade-Durable
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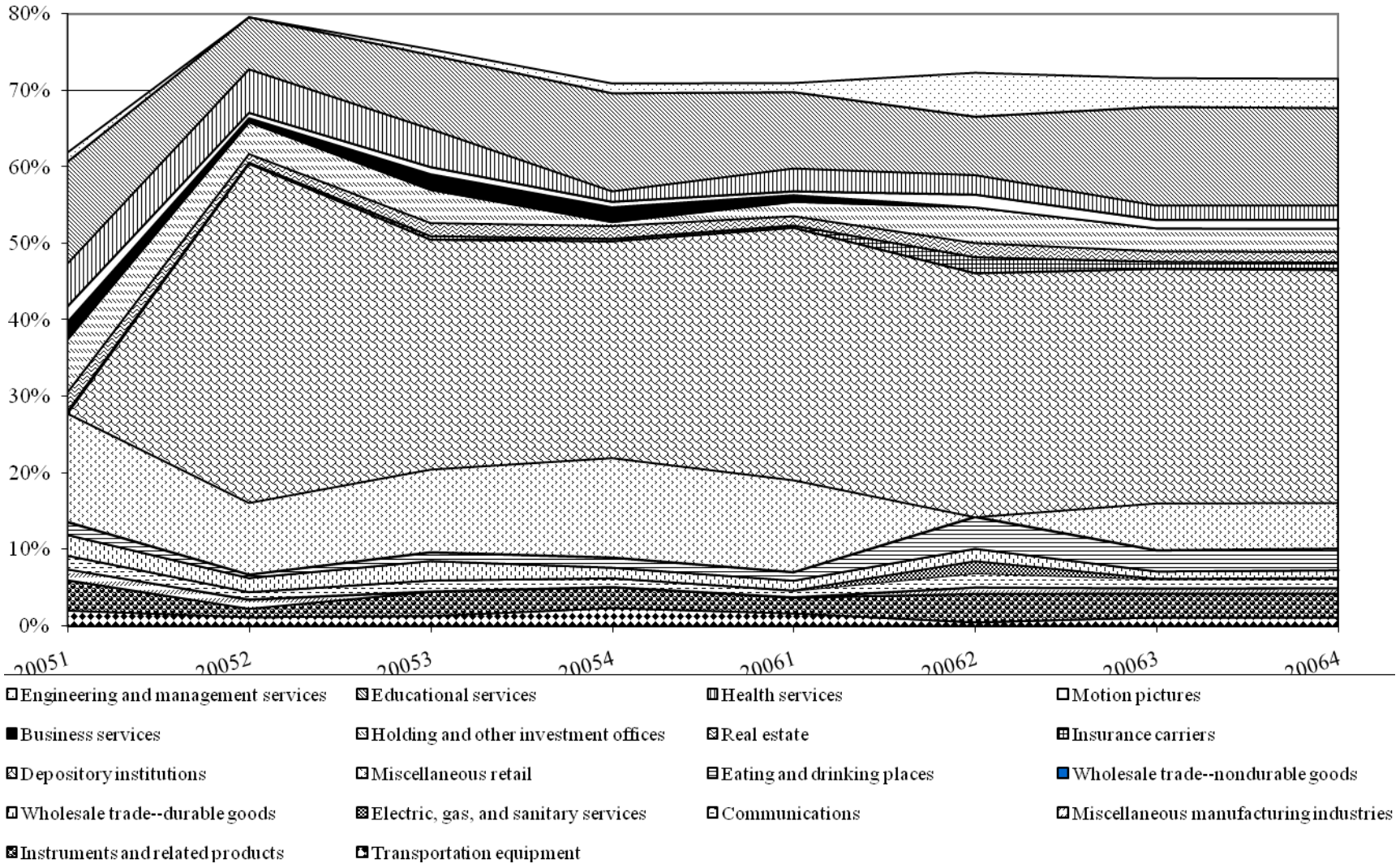
Instruments
Electrical
Industrial Machinery
Fabricated Metal
Leather
Chemicals
Printing & Publishing
Heavy Construction

c. Chicago: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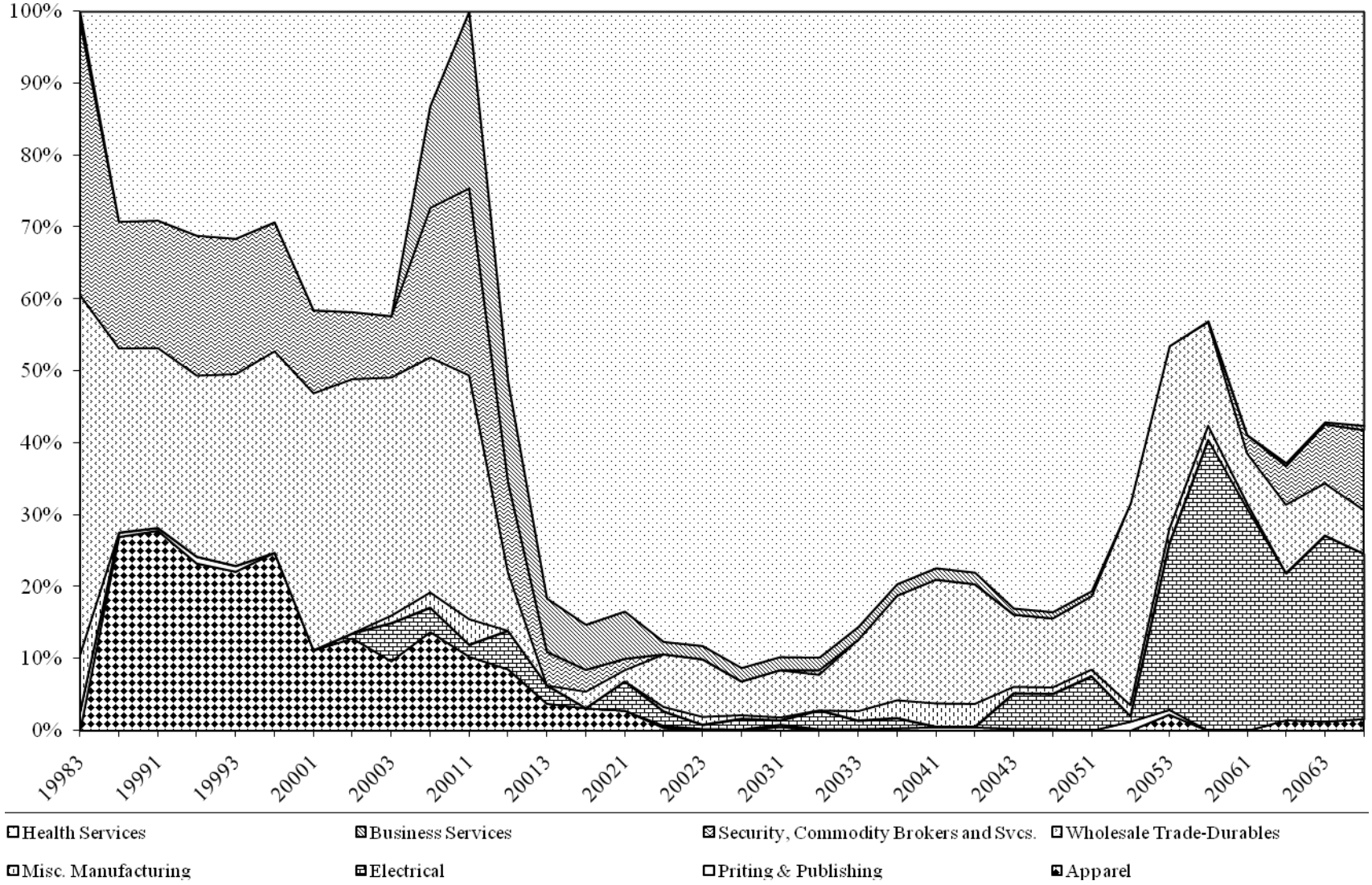
Engineering and management services
Educational services
Health services
Motion pictures
Business services
Holding and other investment offices
Real estate
Insurance carriers
Depository institutions
Miscellaneous retail
Eating and drinking places
Wholesale trade--nondurable goods
Wholesale trade--durable goods
Electric, gas, and sanitary services
Communications
Miscellaneous manufacturing industries
Instruments and related products
Transportation equipment

d.Tampa: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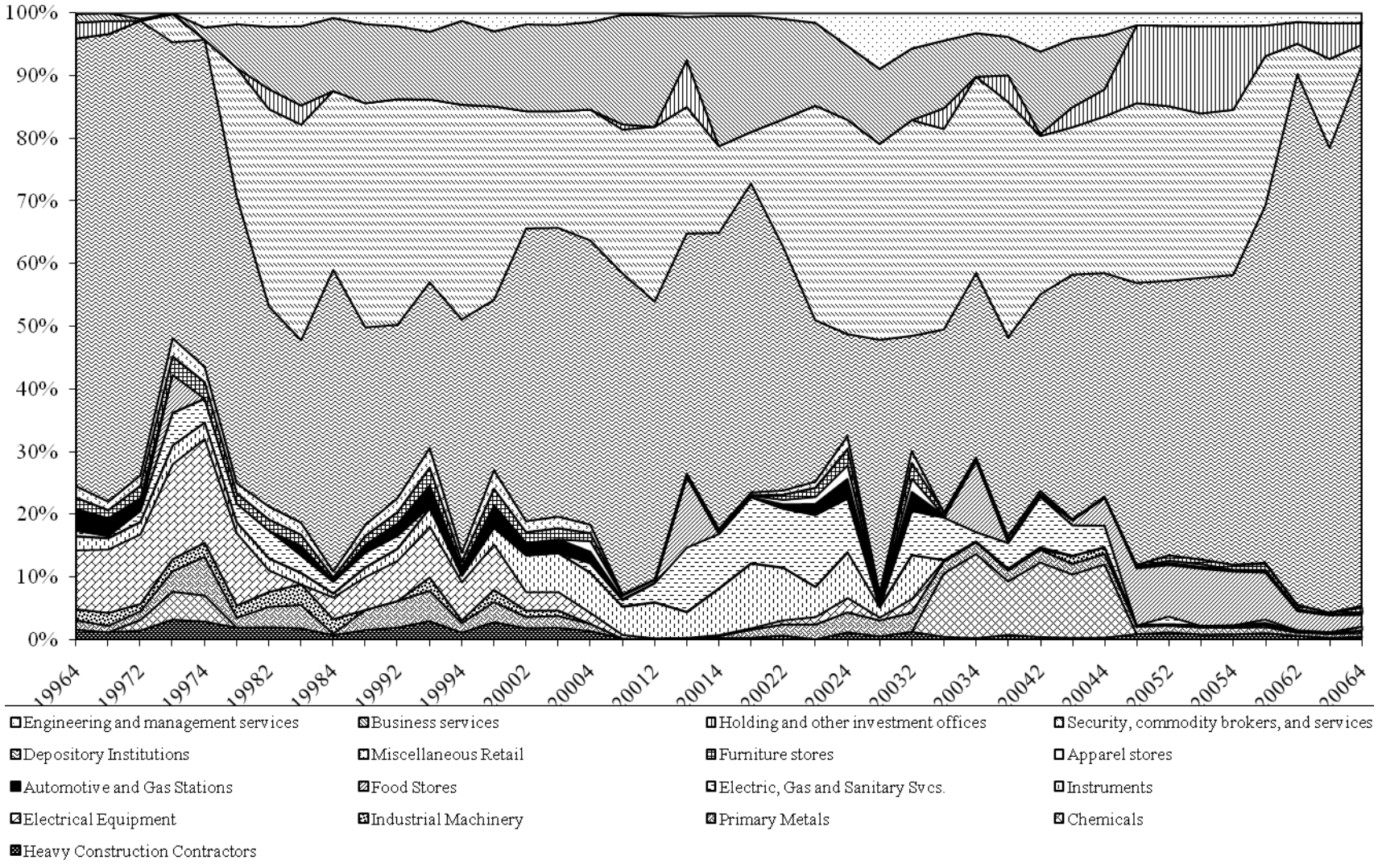
Wholesale Trade-Durables
Misc. Manufacturing
Electrical
Priting & Publishing
Apparel

e. SanFrancisco:



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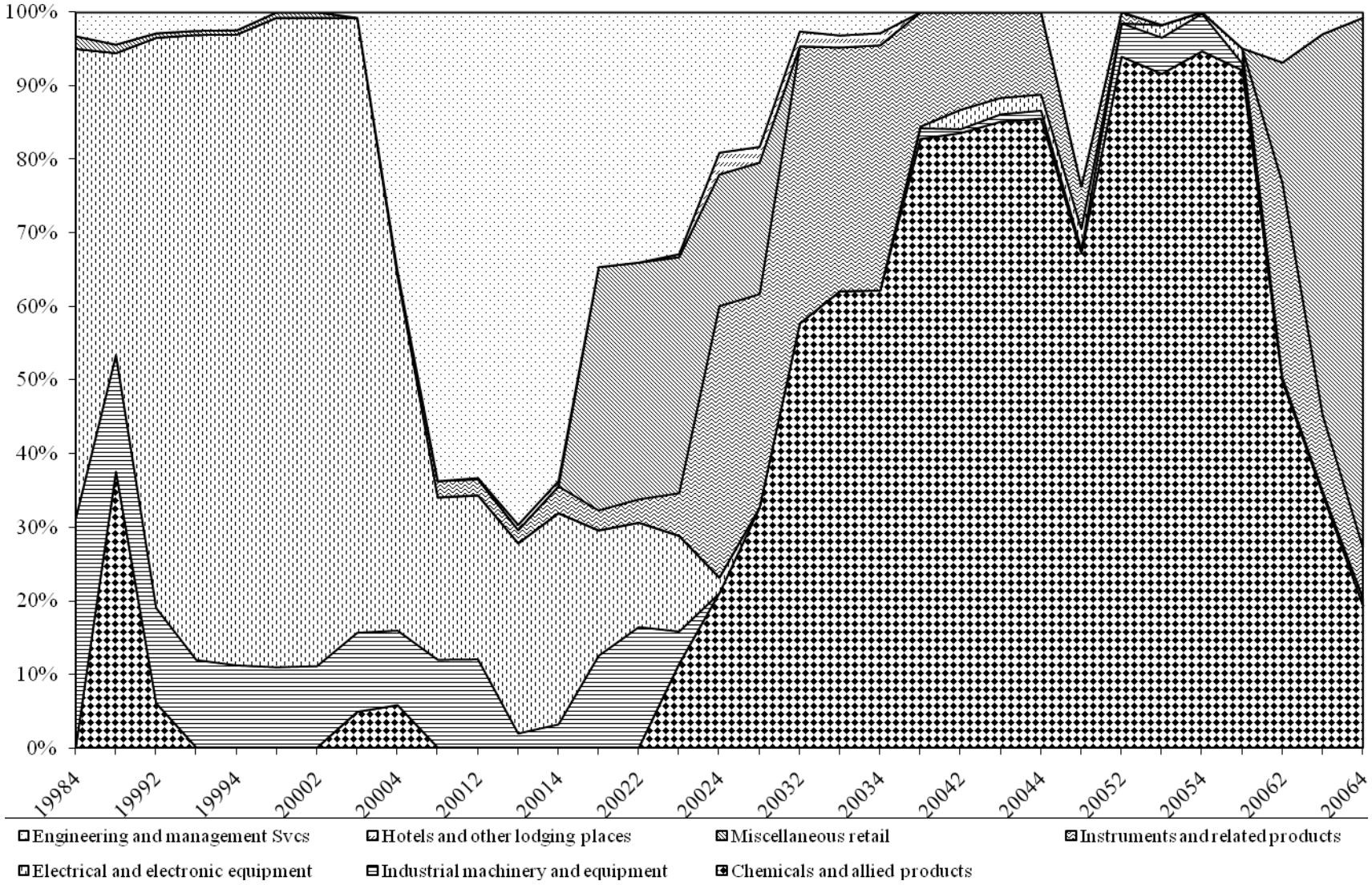
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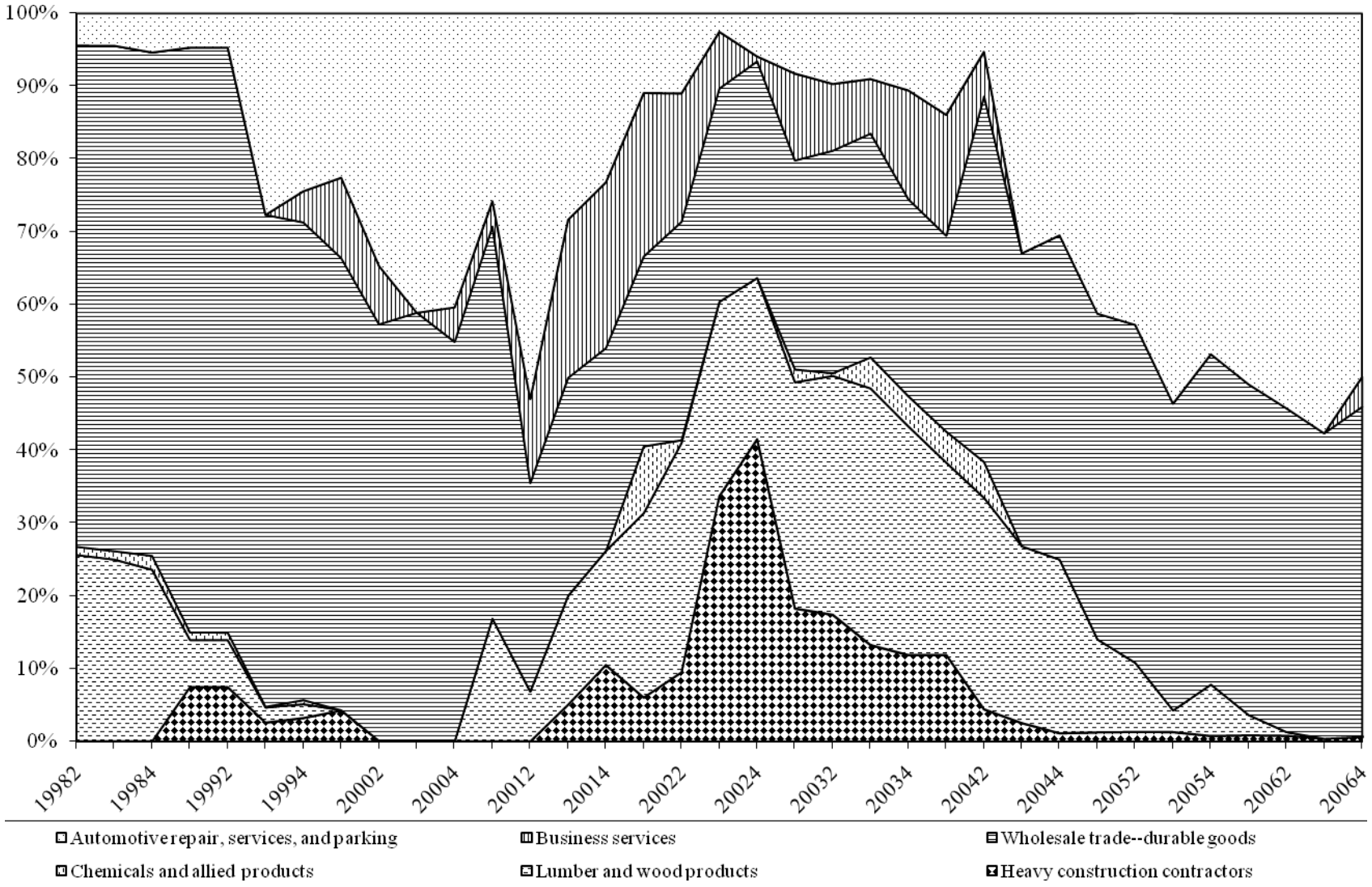
Engineering and management Svcs
Hotels and other lodging places
Miscellaneous retail
Instruments and related products
Electrical and electronic equipment
Industrial machinery and equipment
Chemicals and allied products

g. Miami: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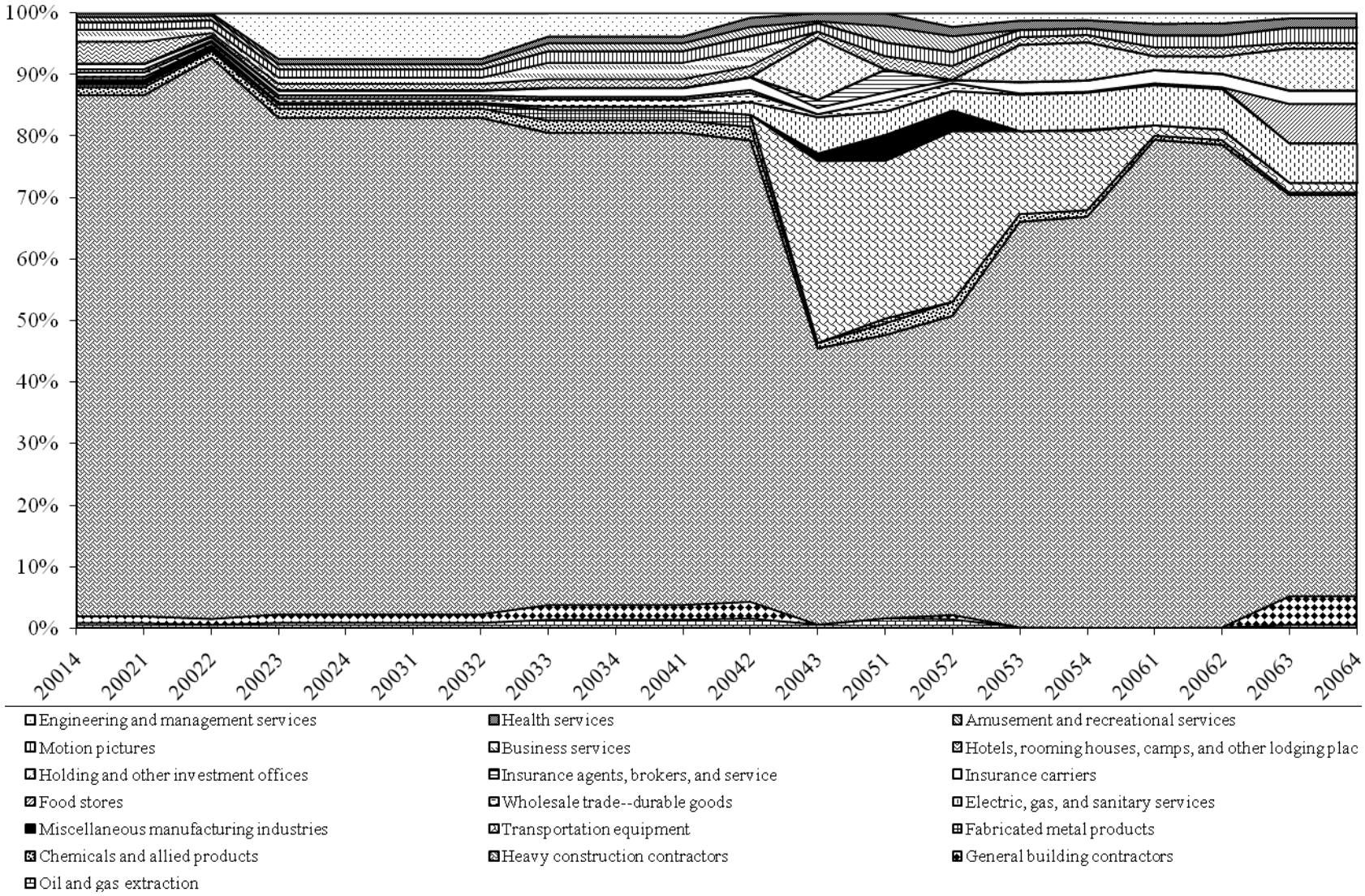
Automotive repair, services, and parking
Business services
Wholesale trade--durable goods
Chemicals and allied products
Lumber and wood products
Heavy construction contractors

h. LosAngeles:



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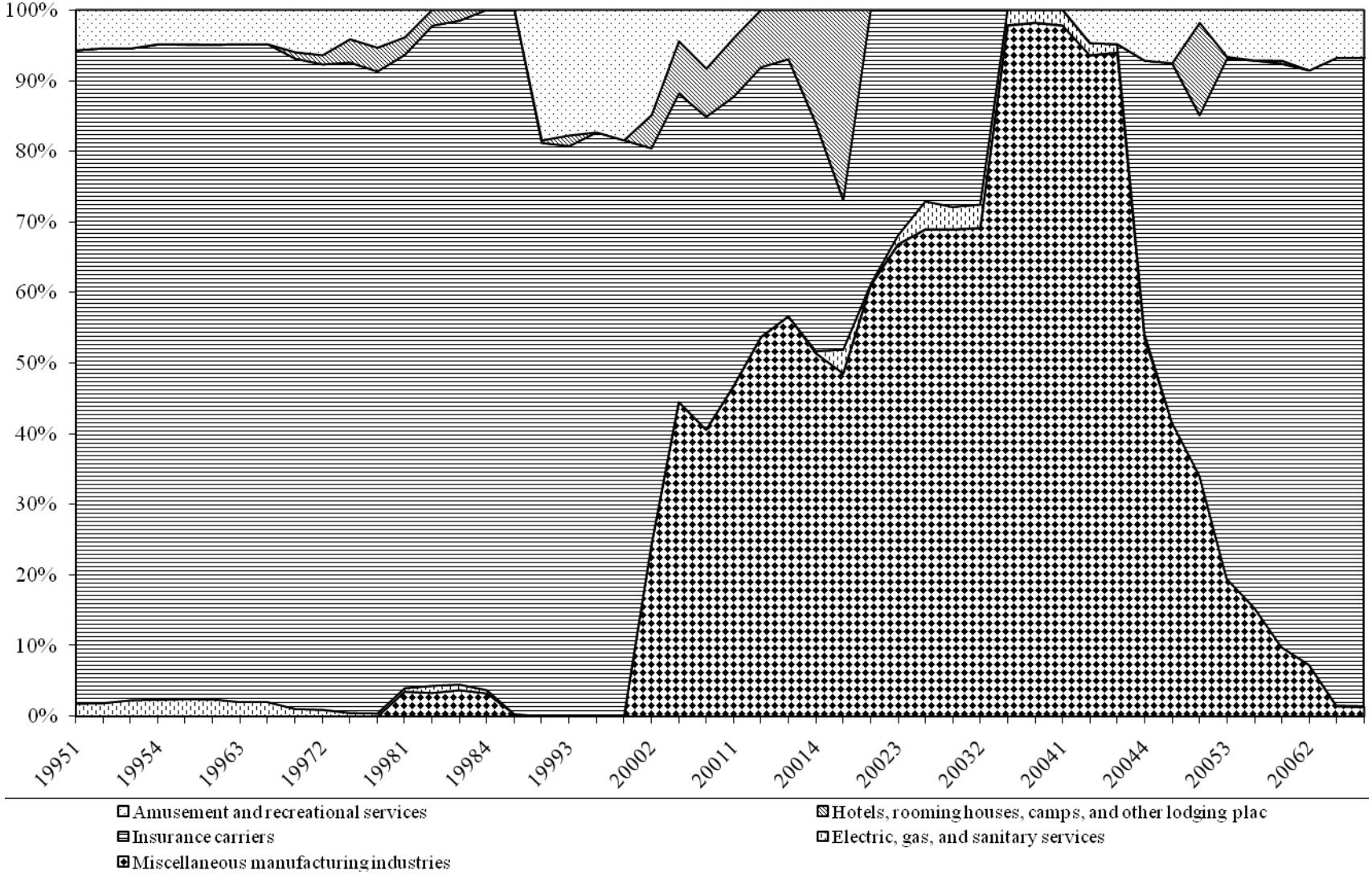
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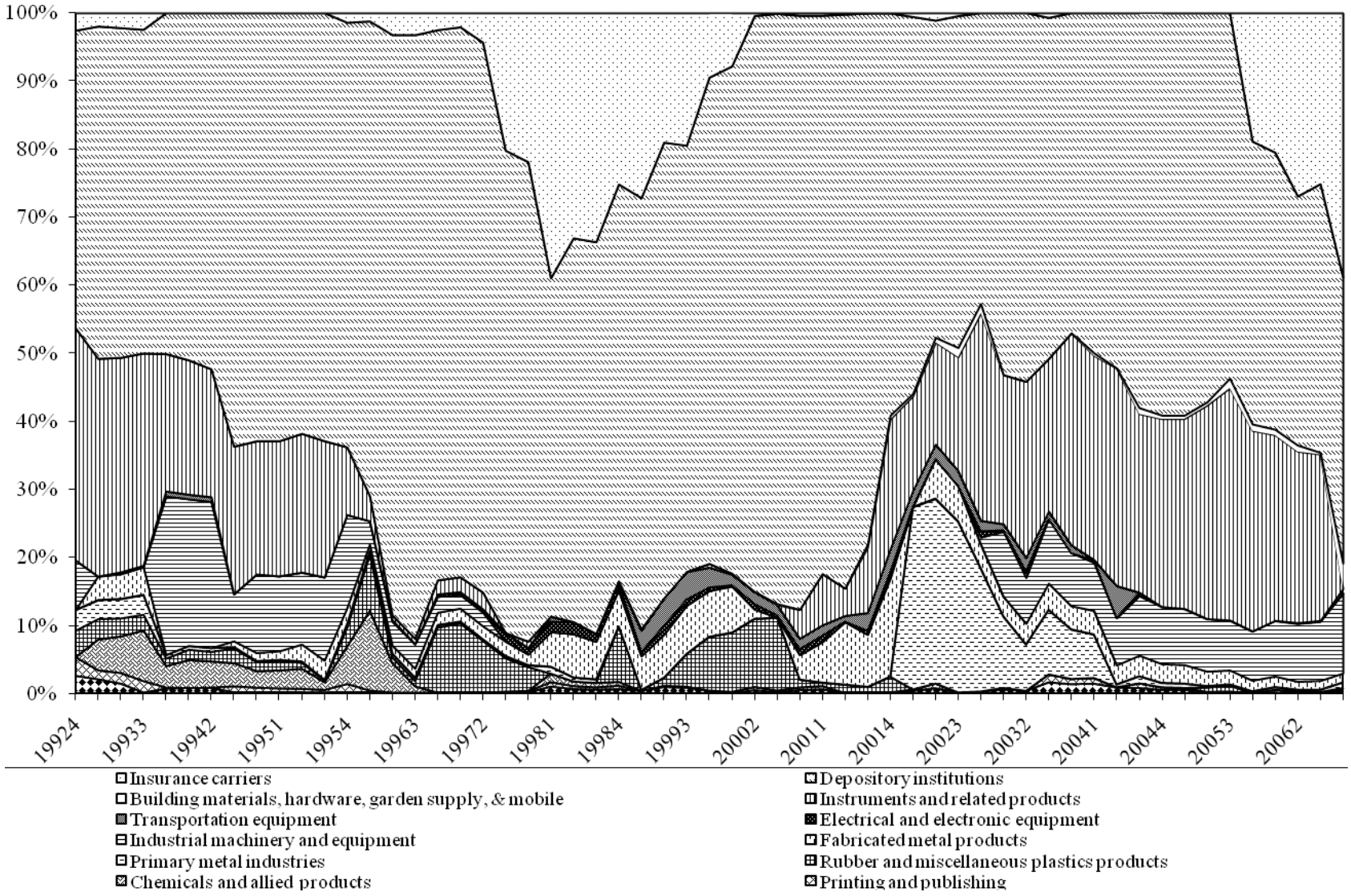
Insurance carriers
Electric, gas, and sanitary services
Miscellaneous manufacturing industries

j. Cleveland: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Insurance carriers
Building materials, hardware, garden supply, & mobile
Transportation equipment
Industrial machinery and equipment
Primary metal industries
Chemicals and allied products
Depository institutions
Instruments and related products
Electrical and electronic equipment
Fabricated metal products
Rubber and miscellaneous plastics products
Printing and publishing