



# Technical Note

---

## Use of employment data to estimate office space demand

NATHAN SCHLOSS

Changes in employment data are fundamental to regional economic analysis and urban planning. Typically, regional population and employment are assumed to reflect the state of a region's economy.<sup>1</sup> This is a basic assumption underlying this technical note, which seeks to show how employment data can be used to estimate the demand for office space in a subnational area, such as a Standard Metropolitan Statistical Area.<sup>2</sup>

This article reports on the author's recent study of the demand for office space and office employment. On the basis of this study, we conclude that our methodology provides realistic projections of commercial office space demand in a SMSA and represents an improvement over present methods, which for the most part relate demand for space to historical trends with perhaps some adjustment for expected local area growth. Improved methodologies for estimating office space demand are important because the average annual expenditure for commercial office buildings for 1979 through 1983 approximated \$17 billion, according to the U.S. Department of Commerce.

Our discussion will proceed in three stages: definition and clarification of commercial office space and the demand for it; data sources, assumptions, and method of calculation of demand; and application of the methodology to estimate demand in a specific area: the Chicago Standard Metropolitan Statistical Area.<sup>3</sup>

### Space defined

In this article, we define commercial office space as that part of building structures used *primarily* for business or professional purposes. Space used for industrial or residential purposes is excluded. Retail and service space (such as that used for restaurants, newsstands, card and gift shops, apparel shops and airline ticket counters) is often included

in buildings primarily used for business and professional activities and is counted in the space totals. The purpose of including retail and service establishments in these buildings is to attract office space tenants.

Demand for office space is the sum of the demand for new and replacement space. (Replacement demand is, of course, that part of total demand that results from existing space becoming unusable because of physical deterioration, locational obsolescence, and similar reasons.) The concept of estimating total office space demand is analogous to estimating the average annual job openings by occupation; that is, total average openings equal the number of job openings arising because of economic growth and the number resulting from labor force separations.

The space occupied by office employees is typically calculated in terms of square feet of net rentable area per employee. Thus, if one can estimate employment in office buildings and the average square footage devoted to each employee, projections of office employment can be made and future demand for office space determined.

### Demand model established

The demand for commercial office space in a certain area at a particular time can be determined by using a simple market equilibrium model for which the following factors are determined: the number of office employees, the amount of commercial office space available and the amount occupied, and the assumed market equilibrium occupancy level.

The demand for office space in a given area is expressed in the following two equations:

$$(1) \quad W_i = \frac{Z_i}{0.95}(Y_i)$$

where:  $W_i$ , the equilibrium demand in square feet of net rentable space in year  $i$ , is equal to

$Z_i$ , occupied space per office employee in year  $i$ , divided by

0.95, a parameter that reflects the assumption that the market in equilibrium will typically have an occupancy level of 95 percent (or a vacancy rate of 5 percent), multiplied by

$Y_i$ , office employment in year  $i$ ; and

---

Nathan Schloss is vice president-treasurer and corporate economist of the Real Estate Research Corporation, Chicago, Illinois. He is a member of the Business Research Advisory Council to the Bureau of Labor Statistics and is chairperson of its committee on employment and unemployment.

$$(2) \quad Z_i = \frac{X_i}{Y_i}$$

Where occupied space per office employee in year  $i$  ( $Z_i$ ) equals  $X_i$ , occupied office space in year  $i$ , divided by office employment in year  $i$  ( $Y_i$ ).

These equations capsule our concept of demand for office space and underlie our estimates of demand for office space in the Chicago area.

### Extracting office employment

For larger metropolitan areas, reasonably reliable data are available relating to inventory and occupancy levels of what the commercial building market calls competitive rental space; that is "high quality" structures with at least 50,000 to 70,000 square feet of rentable space. (Buildings are ranked from A through D with buildings in the A and B categories classified as "high quality.")

An experienced analyst in this field can determine the occupancy levels and area of other categories of space occupied by office employees. Aside from smaller and qualitatively lower ranking class C and D rental buildings, there is single user/owner occupied space, governmental space, and office space in distribution warehouses (typically 7 to 12 percent), manufacturing facilities, and so forth.

The last requirement in constructing estimates of office space are reliable data sources so that reasonable estimates can be made of office employment. Data used are imperfect. For example, there is no economic census specifically relating to employment in office buildings and, for that matter, detailed occupational data are not readily available by metropolitan area. However, the Bureau of Labor Statistics publishes national data relating to employment by detailed occupation and industry sector which can be used to estimate

office employment.<sup>4</sup> The basic data source was the *BLS Handbook of Labor Statistics*. Additional BLS sources included *Employment and Earnings* and *Employment, Hours and Earnings, States and Areas, 1939-82*.

Data obtained from the Bureau of Labor Statistics were used to estimate office employment for the 1975-82 period. Table 1 illustrates our estimates of office employment for one major occupational category—managers and administrators, except farm. First, total employment is shown for the major category. Succeeding data show proportions of workers excluded from the estimates. Total office employment minus excluded employment equals estimated net office employment. Net office employment for 11 major occupational categories<sup>5</sup> was derived in this manner.<sup>6</sup> (See table 2.) Only employees occupying rentable space have been included; therefore, craftworkers such as carpenters, electricians, and plumbers who move from place to place have been excluded.

The Bureau also publishes employment data by industry. The two industry divisions which best reflect office employment are the finance, insurance, and real estate division and the service division. Table 2 shows estimated office equipment and employment in the combined finance, insurance, and real estate and service divisions for the 1975-82 period. Although the office employment data are derived from the household survey and finance, insurance, and real estate and service employment figures are taken from the establishment survey,<sup>7</sup> the two sets of data have a high correlation for our purposes. Using simple regression the calculated  $r^2$  is 0.99.

An annual office prone employment *multiple* provides the basis for calculating the 1983 employment figure in the Chicago SMSA. The multiple is derived by dividing total office employment by total employment in the finance, insurance, and real estate and service divisions:<sup>8</sup>

**Table 1. Estimated office prone employment of managers and administrators, 1975-82**

[In thousands]

Occupational category	Proportion excluded	Employed							
		1975	1976	1977	1978	1979	1980	1981	1982
Managers and administrators, except farmworkers	—	9,006	9,452	9,821	10,286	10,719	11,138	11,540	11,493
Exclusions	—	2,979	3,099	3,221	3,332	3,502	3,651	3,748	3,741
Bank officials and financial managers	30.0	158	167	166	176	190	198	209	219
Buyers and purchasing agents	60.0	224	229	227	226	275	276	286	284
Credit and collection managers	30.0	17	16	17	15	17	21	20	19
Health administrators	80.0	123	131	142	149	150	170	175	182
Inspectors, except construction and public administration	100.0	113	115	104	98	106	111	110	107
Officials and administrators; public administration, n.e.c.	50.0	182	186	203	213	210	216	238	215
Restaurant, cafeteria, and bar managers	70.0	358	354	393	424	455	484	509	538
Sales managers and department heads, retail trade	95.0	304	311	333	332	330	344	329	335
Sales managers, except retail trade	20.0	62	62	65	67	71	72	75	74
School administrators, college	100.0	104	116	127	110	118	135	139	130
School administrators, elementary and secondary	100.0	264	283	266	277	301	300	291	293
All other managers and administrators	20.0	1,070	1,129	1,178	1,245	1,279	1,324	1,367	1,345
Net office employment, managers and administrators	—	6,027	6,353	6,600	6,954	7,217	7,487	7,792	7,752

n.e.c. = Not elsewhere classified.

NOTE: Dashes indicate "not applicable."

**Table 2. Estimated office employment, by selected occupations, in finance, insurance, and real estate and service industry divisions, 1975-82**

[In thousands]

Occupation	1975	1976	1977	1978	1979	1980	1981	1982
Total office employment	24,285	25,282	26,332	27,897	29,235	30,204	30,874	31,153
Professional and technical	5,159	5,474	5,703	6,171	6,554	6,868	7,117	7,462
Managers and administrators, except farmworkers	6,027	6,353	6,600	6,954	7,217	7,487	7,792	7,752
Salesworkers	2,175	2,208	2,319	2,467	2,579	2,584	2,654	2,730
Clerical workers	10,777	11,105	11,558	12,136	12,709	13,093	13,138	13,028
Craft and kindred workers	—	—	—	—	—	—	—	—
Operatives, except transport	—	—	—	—	—	—	—	—
Transport equipment operatives	—	—	—	—	—	—	—	—
Nonfarm laborers	—	—	—	—	—	—	—	—
Private households	—	—	—	—	—	—	—	—
Service workers, except private households	147	142	152	169	176	172	173	181
Farmworkers	—	—	—	—	—	—	—	—
Finance, insurance, real estate and service combined	18,057	18,822	19,770	20,976	22,087	23,050	23,917	24,404

NOTE: Dashes indicate no office employment.

1975	1.34
1976	1.34
1977	1.33
1978	1.33
1979	1.32
1980	1.31
1981	1.29
1982	1.28
Arithmetic mean	1.32
Standard deviation	0.02
r <sup>2</sup>	0.92
1983 estimate	1.28

The implicit assumption is that use of the multiple provides a reasonable estimate of 1983 office employment when multiplied by the 1983 combined finance, insurance, and real estate and service employment in a given SMSA or labor market area, where the two are not coextensive. Moreover, one would expect the multiple to be greater than one because workers using office space also come from industry sectors other than finance, insurance, and real estate and service (for example, manufacturing, government, and so forth). At the same time, the multiple would be expected to exhibit a secular decline because service sector employment is increasing more rapidly than manufacturing and government employment, for example (sectors which also use office space), but at a decreasing rate.

Table 3 presents the percentage change from the previous year for office employment and employment in the finance, insurance, and real estate and service divisions. The percentage-point difference provides a realistic basis for projecting office employment from 1983 to 1990. The year-to-year percentage change in employment is relatively volatile; for this reason, we use the percentage-point differential in the average rate of change as being representative of the average annual differential percentage-point change in total office employment and in combined finance, insurance, and real estate and service employment. As shown in the table,

the average difference is 0.8 percent less. This means that if we expect a 3.0-percent average annual rate of change in finance, insurance, and real estate, and service employment between 1983 and 1990, then the anticipated annual change in office employment would be 2.2 percent (or a -0.8-percentage-point difference).

The final step is to establish the parameter for expected occupancy when a market is in equilibrium and the anticipated occupied space per office employee. Most analysts assume that at the point of market equilibrium the occupancy rate for office space will approximate 95 percent. Typical space use per employee will range between 150 and 210 square feet of net rentable area for all categories of office space combined. Moreover, the midpoint of the range, or 180 square feet per employee represents a good estimate of median market area usage. That is so because between 45 percent and 55 percent of a major Standard Metropolitan Statistical Area space inventory typically consists of competitive rental space where space use per employee averages about 195 square feet.

**Table 3. Annual percentage change in office employment and employment in finance, insurance, and real estate and service industry divisions, 1976-82**

Year	Office employment	Finance, insurance, and real estate and service employment	Percentage-point difference
1976	4.1	4.2	-0.1
1977	4.2	5.0	-0.8
1978	5.9	6.1	-0.2
1979	4.8	5.3	-0.5
1980	3.3	4.4	-1.1
1981	2.2	3.8	-1.6
1982	0.9	2.0	-1.1
Arithmetic mean	3.6	4.4	-0.8
Standard deviation	1.7	1.3	—
r <sup>2</sup>	0.93	—	—

NOTE: Dashes indicate "not applicable."

## Estimating demand in the Chicago area

Over the past decade (December 1972 to 1982), net demand for competitive rental space in the Chicago Standard Metropolitan Statistical Area has averaged about 4,500,000 square feet of rentable area per year. As of midyear 1983, the area's inventory of competitive rental space was 125,150,000 square feet. Of this total, 110,020,000 square feet, or 87.9 percent were occupied.<sup>9</sup> Although the demand estimates in this example are limited to competitive rental space, the methodology can be adapted to estimate demand for all categories of office space.

Table 4 presents occupied space per employee, at a 95-percent occupancy level, for the Chicago Standard Metropolitan Statistical Area, 1979-83. The data show that occupied space per employee has been increasing each year by about 4 square feet (assuming a 95-percent occupancy level). Recall that we estimated the median space usage per office employee at approximately 180 square feet. At the 95-percent occupancy level, the area increases to 189.5 square feet. Similarly when all office employees are divided into the competitive rental total, the space occupied per employee (92.4 square feet) is about 49 percent of the median. We have the choice of either relating office employment to total market area office space or, alternatively, using the competitive rental space inventory and grossing up to total market area space.

In the Chicago area, competitive rental space has been increasing its market share of total market area office space construction and this trend will probably continue. We therefore regressed 1979 through 1983 space per employee against time<sup>10</sup> and assumed that each employee would occupy about 103 square feet of area for the rest of the decade.

The final step necessary to estimate average annual space demand in the Chicago area is to determine the estimated net average annual increase in office employment during 1983-90, our forecast time frame. The following tabulation

compares the annual rate of change in employment for the finance, insurance, and real estate division, the service division, and the two divisions combined in the Chicago Standard Metropolitan Statistical Area and the Nation for selected periods, 1969-82:<sup>11</sup>

	1969-79	1975-79	1975-82	1979-82
<i>Chicago SMSA</i>				
Finance, insurance, and real estate .....	2.2	3.1	3.2	3.4
Service .....	2.4	3.0	3.4	4.0
Total.....	2.3	3.0	3.4	3.9
<i>United States</i>				
Finance, insurance, and real estate .....	3.5	4.5	3.6	2.4
Service .....	4.4	5.4	4.6	3.7
Total.....	4.2	5.2	4.4	3.4
<i>Chicago percent of U.S</i>				
total .....	55	58	77	115

It shows that Chicago's performance has been dramatically improving, relative to the performance in the United States. For example, during the 1969-79 decade, the average annual rate of change in Chicago was 2.3 percent, or less than that in the United States (4.2 percent). However, during 1979-82, a period of back-to-back recessions, Chicago's annual rate of change (3.9 percent) was 115 percent of that in the United States. Future employment growth in the finance, insurance, and real estate and service divisions in the Chicago area will probably equal the average annual rate of change between 1975 and 1982, or at least 3.4 percent a year. This estimated growth rate is optimistic, when compared with unpublished estimates made by the Illinois Department of Employment Security and the Illinois Bureau of the Budget. However, we believe Chicago is achieving greater relative dominance as a regional financial and service center and that this trend will persist.

We now have enough information to estimate the anticipated net increase in office employment between 1983 and 1990 and the resultant demand created for competitive rental space in the Chicago area. The calculations follow:

- The estimate of 1983 office employment in the Chicago area is 1,253,200 workers. (See table 4.)
- The average annual increase in finance, insurance and real estate and service divisions employment is estimated at approximately 3.4 percent a year for the 1983-90 period. Thus, expected average annual change in office employment is 2.6 percent (or 0.8 percent less than that in the finance, insurance, and real estate and service divisions).
- The net change in office employment during the 7-year projection period is:

$$Y = X[(1 + i)^n - 1]$$

**Table 4. Estimates of occupied rental space per office employee in Chicago SMSA, 1979-83**

(In thousands, except space per employee)

Year	Finance, insurance, and real estate and service employment	Office employment <sup>1</sup>	Occupied space <sup>2</sup>	Occupied space per office employee <sup>3</sup>
1979 .....	863.9	1,140.4	81,332.4	75.1
1980 .....	895.9	1,173.6	89,581.6	80.3
1981 .....	942.5	1,215.8	96,007.3	83.2
1982 .....	967.8	1,238.8	100,283.3	85.2
1983 .....	979.1	1,253.2	110,017.4	92.4

<sup>1</sup>Calculated by multiplying the finance, insurance, and real estate and service employment figure by the corresponding multiple (for 1983, 979.1 × 1.28).

<sup>2</sup>In square feet.

<sup>3</sup>Calculated at the 95-percent occupancy level in square feet.

where:

- Y = Net change in office employment.  
 X = Office employment in first year of period.  
 n = Number of years in the future in the time period.  
 i = Average annual rate of change expressed as a decimal.

The Chicago area computation is:

$$Y = 1,253,200 [(1.026)^7 - 1]$$

$$= 1,253,200 (0.19683) = 246,664$$

- The net change in office employment is expected to be 246,664 or 35,238 workers per year over the 1983-90 period.
- Each office worker is expected to occupy approximately 103 square feet in competitive rental space, resulting in an average annual demand of 3,629,500 square feet of new space. (Note that we have made no separate calcu-

lation for the replacement of obsolescent space. The impact of obsolescent space is reflected in the annual estimate of occupied space per employee.)

ESTIMATION OF OFFICE EMPLOYMENT, its net increase over time, and the resultant effect on office demand is complex and requires an understanding of a multitude of factors relating to regional economic growth. In addition, limited historical data were available for model testing. For example, only since 1978 have reliable annual data been available on the quantity and occupancy levels of suburban office space. However, using estimates made from incomplete data, the model was tested in the Milwaukee, Detroit, and Tampa-St. Petersburg SMSA's, and it produced satisfactory results. Nonetheless, even with these caveats, employment data provide a useful methodology for estimating commercial office space demand. Information on future demand for office space would be valuable in a highly cyclical industry such as nonresidential building construction, where supply and demand are often not in equilibrium. □

—FOOTNOTES—

<sup>1</sup> For a more comprehensive understanding of the factors considered and methods employed in making economic growth and employment projections see *BLS Handbook of Methods*, Bulletin 2134-1 (Bureau of Labor Statistics, December 1982), chs. 18-20; and *Employment Projections for 1995*, Bulletin 2197 (Bureau of Labor Statistics, March 1984).

<sup>2</sup> State and area unemployment and establishment data appear monthly in *BLS Employment and Earnings*. Annual averages and area definitions are contained in the May issue. In addition, each issue contains the addresses of cooperating State agencies in the Current Employment Statistics Program (CES) and State and Local Area Unemployment Statistics Program (LAUS). These agencies can advise readers of the availability of additional labor market information relating to their respective states.

<sup>3</sup> The Chicago SMSA consists of Cook, DuPage, Kane, Lake, McHenry, and Will Counties in Illinois.

<sup>4</sup> *Handbook of Labor Statistics*, Bulletin 2175 (Bureau of Labor Statistics, 1983). Additional sources were *Employment and Earnings and Employment Hours and Earnings, States and Areas, 1939-82*, Bulletin 1370-17 (Bureau of Labor Statistics, January 1984).

<sup>5</sup> The proportion of employees to be excluded from office employment in each of the major occupational categories was estimated by the author. While estimates were judgmental, they were based on data from *BLS Handbook of Labor Statistics* which also contains data on employment by industry which is classified by occupation; and employment surveys relating to the industrial and occupational mix of employees in downtowns, office buildings, office-industrial parks, and manufacturing facilities.

<sup>6</sup> Significant revisions were made in the Current Population Survey beginning in January 1983. See Gloria Peterson Green, Khoan tan Dinh, John A. Priebe, and Ronald R. Tucker, "Revisions in the Current Pop-

ulation Survey Beginning in January 1983," *Employment and Earnings* February 1983, pp. 7-15.

<sup>7</sup> The finance, insurance, and real estate and service totals are taken from table 67 of the *BLS Handbook of Labor Statistics*. For an analysis of quantifiable and conceptual differences between the two surveys, see John F. Stinson, Jr., "Comparison of Nonagricultural Employment Estimates from Two Surveys" *Employment and Earnings*, March 1984, pp. 6-9.

<sup>8</sup> In order to estimate the 1983 multiple, an estimating equation was determined by regressing the office employment multiple against time. The equation is:

$$Y_c = 1.357 - 0.009X$$

where:  $Y_c$  = the estimated office employment multiple.  
 $X$  = time. (1983 = year 9)

<sup>9</sup> Chicago SMSA industry employment is from *BLS Employment, Hours and Earnings, States and Areas, 1939-82*, and *Employment and Earnings* (May 1984). Occupied competitive rental space is based on public records, brokers' surveys, and utility data which were verified by inspection and phone validation.

<sup>10</sup> The regression equation is  $Y = 71.39 + 3.95X$ ; where  $Y$  = occupied space at the 95-percent occupancy level and  $X$  = time. For example, in 1986 (year 8), space use is estimated at 102.99 square feet per employee.

<sup>11</sup> Chicago SMSA industry employment data are from *Employment, Hours and Earnings, States and Areas, 1939-82*. U.S. industry employment figures are from table 67. "Employees on nonagricultural payrolls by industry division, selected years, 1919-82," *BLS Handbook of Labor Statistics*. Average annual rates of change were calculated by the author.