Economies Of Scale

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[Sidebar: Economies of scale finally arrive in the real estate industry.]

As we enter the new millennium, headlines trumpet record levels of mergers and the global consolidation in different industries. The primary driving force behind this consolidation is one of the most fundamental concepts in economics–economies of scale. Defined as the decline in long-run average cost as operation size increases, economies of scale today incorporate much more than just the old style "Henry Ford" production process.

Long ago, Adam Smith formally recognized the value of capitalizing on economies of scale in his classic analysis of pin manufacturing. Later, the first Secretary of the U.S. Treasury Alexander Hamilton argued that it would be almost impossible for the U.S. economy to develop in a system of free and open trade because of the economies of scale already in place in Great Britain. Unfortunately, the analytic tools available to economists frequently lacked the precision necessary to clearly identify most economies of scale. Even today, statistical realities make it very difficult for a 1-2 percent economy of scale effect to be identified as statistically significant even though this change represents a large competitive advantage over the long run.

HISTORICAL EXAMPLES

Economies of scale imply that efficiency grows in production and operations as size increases. The incentive to capture scale economies by expansion has invariably led to consolidation as larger firms merge and grow. Examples are such diverse industries as railroads, commercial airlines, cement, steel, oil and gas refining, and brewing.

Railroads were one of the first capital-intensive industries created by the industrial revolution. The industry began highly localized and fragmented, but quickly realized the value of capitalizing on the production and capital market efficiencies arising from economies of scale, as well as the importance of eliminating redundant overhead. By 1920, the Interstate Commerce Commission (ICC) began allowing railroad consolidation with the goal of lowering operating costs. The ICC estimated that significant cost savings would result as firms developed larger rail networks and reduced redundant capital and overhead. In 1933 it was estimated that railroad consolidation meant annual savings of about $9.4 billion (in year 2000 dollars). The consolidation of the railroads led to larger rail networks promoting longer hauls, faster and more centralized switching, and the abandonment of excess capital. During 1955-1974, returns to scale were substantial, particularly in view of the increases in shipping distances. During this period the number of railroads decreased by approximately one-third, while productivity increased by approximately 2 percent per annum and average real total costs fell by approximately 4.5 percent per annum.

More recent examples of railroad consolidation include the acquisition of Santa Fe by Southern Pacific in September 1983. News of this merger prompted estimates of 5 percent lower operating costs due to the larger rail network size. In addition, the combined firm had lower overhead ratios could compete more effectively for capital. In 1994 Union Pacific Corporation reported that its merger with Southern Pacific Rail Corporation was expected to reap annual savings and revenue gains of $750 million. In June 1998 federal regulators approved the acquisition of Conrail by the CSX and Norfolk Southern railroads. Most recently, the Canadian National Railway announced its desire to merge with the Burlington Northern Santa Fe Corporation, an American railroad. This merger would not only create the largest railroad on the North American continent, but it would also create the first international railroad, serving 32 states and 8 Canadian provinces, and producing expected annual revenues of $12.5 billion. These mergers explain why the number of Class I freight lines has declined from 26 in 1980, to just 7 in 2000.

Airlines are another capital-intensive industry that has seen substantial consolidation since the Airline Deregulation Act of 1978. During this 22-year period, the number of airlines operating in the United States has fallen from 31 to 14 while the market controlled by the top 8 firms has risen from 81 percent to 91 percent. One measure of increased efficiency is that the proportion of trips requiring a change of airlines since 1978 fell from 11.2 percent to 1.2 percent, while the average cost per passenger-mile fell from 31.1 to 13.4 cents (in year 2000 dollars). Airlines have not only achieved efficiency gains from consolidation. Mergers have also increased their ability to control prices. For example, the merger between Northwest and Republic Airlines is estimated to have increased ticket prices at Minneapolis / St. Paul airport by about 11 percent.

The cement industry has also achieved significant scale economies in labor and capital usage. A United Nations study estimates that capital costs can decline more than 50 percent as capacity increases from 100,000 to 1,000,000 tons; the ten-fold increase in capacity requires only a doubling of labor. The steel industry is similar to the cement industry: as steel production doubles, costs increase by only 5 to 10 percent. This has driven firms to both expand and consolidate. Since the early 1900s, the number of firms producing steel has fallen by a third while the portion of the market controlled by the top 4 firms climbed from 62 percent to 75 percent over the same period.

Since the end of World War II, significant consolidation has likewise occurred in the U.S. brewing industry. This industry was once localized and fragmented, with each city being dominated by several local brewers. Between 1950 and 1983, the number of breweries declined from 369 to 34, while the top national 4 firms controlled 20 percent of the market in 1950, they controlled 75 percent in 1983. This consolidation resulted from the significant economies of scale available in the brewing process as well as scale effects in both marketing and access to capital. Brewing companies realized that producing a variety of alcoholic beverages increased switchover costs while longer production runs of a specific variety using dedicated production facilities for a specific beverage eliminates these costs. For example, in 1978 it was estimated that a brewery needed to produce 18 million barrels to minimize long-run average costs, which meant that over 92 percent of breweries were too small to be efficient. This inefficiency was the main source of the 170 mergers in this industry since the end of Prohibition.

Economies of scale also exist in oil and gas refining. For example, the twenty largest companies (out of 5,000) in the oil and gas refining industry control over 80 percent of the world's capacity. Economies of scale are such that firms can increase output by 100 percent with only a 5 percent increase in average costs. This, as well as the drive to eliminate redundant overhead, has spurred continuous consolidation of this industry.

SOURCES AND TYPES

The standard definition of economies of scale refers to long run average costs. However, the sources and types of economies of scale are numerous. Economies of scale are present in overhead, personnel, sales, marketing, advertising, risk analysis, capital costs, service capacity, and solvency. Economies of scale lead to long run productivity growth and revenue enhancement. As firm size increases, sales and accounts receivable also increase. Scale economies are present in the credit-risk-assessment function of many large firms, since larger firms invest more in specialized credit-administration personnel and are more likely to operate on a decentralized basis. This combination leads to a better-managed accounts receivable division which lowers bad debt expenses. Similar personnel-related economies exist with respect to human resources, management quality, technological support, legal support, and marketing departments.

A common belief about economies of scale relates to recruitment and retention of employees. Generally, a large firm has a more recognizable name within the industry and receives job applications from a broader range of individuals. Moreover, larger firms have a competitive advantage in hiring because they offer more benefits and options. An applicant may be more likely to take a job with a large firm that boasts stock options, high growth prospects, and opportunities for advancement. In addition, a firm obtaining cost or revenue economies of scale can afford to hire sophisticated talent. This can lead to a self-fulfilling cycle as better management allows firms to recognize and capitalize on economies of scale in other areas, which translates into expansion opportunities and gives the firm the ability to attract better talent. General Electric, a firm known for its innovations and scale economies, was recently proclaimed as America's Most Admired Company by *Fortune* magazine. In addition, GE ranked second in management quality and fourth in overall employee quality. In a world where recruitment and training costs are high, and people are the key to adding value, a greater ability to attract, train, promote, and retain talented employees becomes a critical dimension of the benefits of scale.

Economies of scale are also present in the issuance of corporate debt and equity; larger companies are better accepted by financial institutions, investors, and the general public, leading to lower debt costs. Moreover, smaller firms issue more long-term debt while larger firms can also rely on more liquid, short-term debt. Issuance costs for public debt issues have a large fixed component, hence, smaller firms must rely to a greater extent on private debt. Large multinational firms can issue debt in foreign markets. Because most of these markets are less liquid than their U.S. counterparts, multinational firms are more likely to issue short-term debt. Surveys of Wall Street investment banks indicate that current long-term debt underwriting fees are approximately 50 basis points

higher than for short-term debt fees, reflecting the liquidity premium associated with longer-term debt.

In terms of equity issuance, larger firms tend to place larger offerings, which are achieved at narrower underwriting spreads, smaller equity bid-ask spreads, and lower placement fees. Surveys of investment banks suggest that current equity underwriting fees (as a percentage of market offering) decline by about 8 percent as the offering size doubles. Thus, as the equity offering size increases from $10 million to $100 million, the average underwriting spread declines from about 7.8 percent to roughly 5.6 percent, a reduction of approximately 30 percent. This equates to savings of $2.26 million in underwriting fees for the company offering $100 million dollars in equity to the public. In this way, larger firms can enjoy substantial savings in raising capital.

Large firms also gain economies of scale in retention and reduction of lost training costs. For example, in today's mobile society, firms with offices in several cities provide employees with greater opportunities to remain with the firm while transferring from one location to another. This provides savings to the firm through the training costs invested in the employee, while the employee has greater opportunities for advancement.

The U.S. Internal Revenue Service (IRS) discovered an intriguing example of scale economies in the late 1980s. They realized that for the past twelve years large corporations had derived tax advantages through transfer pricing methods. In 1989, the IRS stated that the average multidivisional company was underpaying taxes by as much as 24 percent due to the use of losses from one division offsetting gains in others. This use of transfer pricing to lower overall corporate tax payments through the ability to price goods and services sold from one division to another to minimize both federal and state taxes is now more closely regulated by the IRS, but demonstrates the possibility of achieving economies of scale even with regulation.

Larger multinational firms realize economies of scale in the reduction of exchange rate risk and tax expense through the use of corporate hedging activities. The source of the scale economies lies in the volume of forward contracts, futures, or options purchased, and the ability to afford the specialized managerial talent required. Furthermore, the use of these derivative contracts provides firms with investment tax credits, foreign tax credits, or tax-loss carry forwards that reduce overall tax expenses. For example, Coca-Cola, which deals in 50 different currencies, generates sufficient cash flows from around the world to realize economies of scale in its hedging activities. In 1998, the Coca-Cola Corporation held over $1.6 billion in forward contracts and over $1 billion in foreign currency options. These hedging activities provided Coca-Cola with approximately $43 million of realized losses and $52 million of realized gains on settled contracts while smoothing cash flow volatility.

Economies of scale are also present in the ability of firms to innovate. Larger firms typically have greater resources for research and development due to their greater cash flows and lower capital costs. As in the case of personnel expenses, an innovation on a small base does not justify the cost for high quality managerial talent. Large firms, such as General Electric, have an advantage given the high correlation between innovations and funding for research and development departments. In general, the number of innovations increases with firm size. For example, the four largest oil and petroleum producers provided almost half of the total innovations in the industry. In the coal industry, a 100 percent increase in production yields a 115 percent increase in

innovations. Although it is often very small, entrepreneurial firms that are the home of big breakthroughs, once a breakthrough is achieved, the small firm is either driven by scale economies to grow large (e.g. Microsoft) or, more typically, forced to sell to a larger firm. Large firms can more effectively exploit breakthroughs due to their deeper talent pool, more sophisticated production and marketing teams and techniques, and lower capital costs--economies of scale.

One of the most beneficial aspects of large size is increased brand recognition and market power. In the airline industry, mergers can lead to both greater visibility and pricing power at specific airports. For example, a merger gave Northwest control of over half the gates at the Minneapolis / St. Paul airport, which resulted in an increase in the average price premium on flights departing or arriving at Minneapolis / St. Paul of 31.5 percent.

THE BANKING INDUSTRY

Until the late 1970s, U.S. banks operated under regulations that prevented the realization of economies of scale. However, as a result of deregulation in the 1980s and 1990s, the number of U.S. banks has declined significantly. Overall, in the 1990s the number of banks in the U.S. declined by 30 percent. For example, in 1984 there were 14,483 banks in the United States. By 1989 this number had declined to 12,744, and it further dropped to 9,308 in 1997. The number of banks with assets over $10 billion doubled between 1984 and 1997. Furthermore, banks with assets under $100 million decreased notably over the period. The evidence suggests that $100 million is the minimum effective size level for achieving economies of scale. Evidently, the consolidation within the banking industry has resulted from the desire to capitalize on economies of scale.

One of the most significant bank mergers was the 1996 merger of Chase Manhattan and Chemical Bank which created the largest banking organization in the United States at the time. It was estimated that the merger, with assets over $300 billion, would generate annual cost savings of $1.5 billion through the consolidation of operations and reduction in staff. Another example of cost synergies was the merger of Wells Fargo and First Interstate, also in 1996. This merger was expected to save over $1 billion annually through the elimination of redundant branches and personnel. Revenue synergies are also common examples of economies of scale. For example, the merger of NationsBank and BankAmerica in 1998 was expected to achieve revenue diversification due to the lack of overlap of the branch networks of the two systems. The consolidated bank has branches in 22 states.

The consolidation of the banking industry has important ramifications for the real estate industry. Both banks and real estate holdings were extremely localized in the 1970s and early 1980s. Interestingly, just as banks consolidated following deregulation and local institutional knowledge became less important, consolidation also began in the real estate industry. Two factors were at work. First, as banks consolidated across county and state borders, their real estate developer customers have been forced to expand as well due to fewer local bankers. Second, as bank consolidation has moved loan underwriting from local offices to regional or national headquarters, the relationship between the "friendly" local banker, who was part of the same community, and his customers has changed. As a result, real estate developers and investors must now obtain

capital from farther afield. This increase in distance between lenders and borrowers has increased asymmetric information and reduced--although not eliminated--the value of relationships in lending. As a result, the 1990s have witnessed a remarkable growth in non-relationship debt securitization through the introduction of the commercial mortgage backed security (CMBS). With the advent of the CMBS market, borrowers no longer rely on relationships with local lenders, but now tap directly into the anonymous capital market. In the process, borrowers no longer always have the luxury of knowing their lender on a first name basis.

As noted earlier, economies of scale are frequently found to be economically significant while statistically insignificant. This is true in the banking industry. For example, before the large mergers, economies of scale were not present for commercial banks, most of which were constrained by regulators to be small. On the other hand, an inability to find scale economies may be related to the measurement of output for financial institutions. Research in the *Journal of Money, Credit, and Banking* suggests that the appropriate output measure for financial institutions is the number of deposit and loan accounts, while other research suggests the use of dispersion of costs instead of the average cost function. Efficiency studies based on these output measures find dramatic cost differences of 20 percent or more across banks in a given size category--community, statewide, regional, or national.

REAL ESTATE

Following the banking deregulation in the 1980s, real estate investment surged largely by using debt provided by banks, and savings and loans. However, as 100 percent loans have disappeared and large amounts of equity were needed to own and operate real estate, it is likely that the real estate industry will follow the example of other capital-intensive industries and enter a period of significant consolidation, with publicly traded companies leading the consolidation efforts. Examples of this consolidation trend are present in every property sector. For example, in September 1997, Equity Office Properties (EOP) announced a $4 billion merger with Beacon Properties that added 18.8 million square-feet of property to EOP. The combined holding of 33.4 million square-feet of office space made EOP the largest office owner in the U.S., with 245 properties in 21 states and the District of Columbia. More recently, in February 2000, EOP announced a $4.6 billion merger agreement with Cornerstone Properties. In another transaction, in April 1998 Security Capital Pacific Trust of Denver announced its intent to acquire Security Capital Atlantic Inc. for $1.6 billion. This merger created the third-largest apartment REIT in the country, Archstone Communities, which has 90,166 apartments and a total expected investment of $5.6 billion in apartment communities. Another example of REIT consolidation was the September 1998 $5.8 billion acquisition of Corporate Property Investors by Simon Property Group. At the completion of the merger, Simon held 241 properties in 35 states, and $1.3 billion EBITDA. More recently, in October 1999, Equity Residential Properties Trust acquired Lexford Residential Trust in a merger valued at about $732.8 million.

As was the case for banking and other industries in the early phases of their consolidation, little research documents either the presence of economies of scale in real estate or a large-scale drive toward consolidation. Furthermore, given the relatively small

and similar size of most REITs and their recent integration, the statistical technology available to measure economies of scale is not sufficiently precise to fully capture variations across firms. For example, firms cannot expand from $10 million in size to $100 billion in size overnight. The efforts required to expand and capture scale economies are difficult and time consuming with the pain of integration occurring in the first year or two and the benefits thereafter. Thus evaluating recent mergers understates the benefits of scale. Also, as leading firms merge, their competitors respond, making it difficult to capture the effect of scale economies cross sectionally. For example, as Simon Properties Group increased in size, its competitors (General Growth Properties, Macerich Companies, and Westfield America) likewise grew. Thus, traditional research relying on accounting data reported at discrete intervals is subject to specification errors that bias the analysis toward statistically insignificant findings of scale economies. Not surprisingly, most studies of real estate only find limited statistical evidence of scale economies based on data from the 1970s and 1980s, a period when debt was plentiful and the largest players were small by today's standards. However, the 1990s saw a significant shift in the real estate market--and in economies of scale.

Research conducted in the 1980s found positive REIT stock price movements in reaction to merger announcements, suggesting that the resulting larger REITs achieved economies of scale through better asset utilization. However, these results were countered by other studies that examined the impact on REIT share prices of announcements concerning property acquisitions. For example, researchers using data from both the 1970s and 1980s reported no positive price reaction to asset acquisitions on the part of REITs or other non-real estate corporations. As a result, the early evidence appeared to suggest that significant consolidation of property assets had not clearly created significant gains in shareholder wealth.

This line of research focused on the set of small REIT stocks from the early 1970s and 1980s that had limited ability to achieve the large-scale economies suggested by modern REITs. For example, in the 1970s and early 1980s the average equity REIT had a market capitalization of only $28 million. By 1990, the average equity REIT had a market capitalization of $95 million (in real terms). Furthermore, regulations during this earlier period (such as shareholder concentration rules) severely restricted the ability of REITs to raise sufficient capital to expand and capture any meaningful economies of scale. It is not surprising that researchers using REIT data from the same period find positive stock price reaction to announcements of asset sales and attributed this to the belief that scale economies do not exist for REITs.

More recent research that utilizes data from the 1980s as well as the early 1990s appears to suggest that scale economies do exist, at least for larger REITs. These more recent studies attempt to isolate the effect of economies of scale in REIT expenses, revenue growth, and capital costs. For example, evidence indicates that the non-discretionary component of general and administrative (G&A) expenses increases at a decreasing rate as REIT size increases. Other evidence indicates that scale economies exist in REIT management fees. However, the studies that examine various REIT expense items (G&A, interest, management fees, operating expenses) find that economies of scale are most present in smaller expense items, suggesting that while economies of scale exist, the gains from realizing these economies may not be sufficient to lead to massive consolidation in the REIT industry.

A recent study compared REIT income growth and profitability to changes in the overall market for evidence of economies of scale using data from the 1990s. The results indicate that small REIT net operating income (NOI) growth rates exceed average growth rates in the markets in which they held properties and thus small REITs appear to be generating revenue and operating economies. However, this does not seem to be the case for the largest REITs. Research indicates that NOI gains, relative to the market, were large prior to 1996, but are no longer so, with REITs today outperforming the market primarily via revenue enhancement not cost reduction. Thus, the results from this study call into question the ability of large REITs to generate sufficient economies of scale based on income growth. However, this conclusion must be interpreted with caution since the study was based on a small sample of residential REITs.

Additional research has tested for economies of scale in REIT capital costs. This research improves on previous studies by examining REITs that invest in multiple property segments (residential, industrial/office, and retail) and focusing on the primary driver of REIT expansion capital. Since REITs are very capital intensive and the primary source of REIT expansion lies in their ability to access capital, significant consolidation may be motivated by scale economies in capital costs. Based on capital costs for equity REITs from 1997 and 1998, this evidence indicates that the REIT industry continues to enjoy significant scale economies with respect to capital costs. Although all REITs appear to generate scale economies in capital, the results from this study find that the scale economies in capital for large REITs are almost twice as large as the scale economies for small REITs. The natural implication is that large REITs may be in a position to utilize their economies of scale in capital costs–their main input cost–to further consolidate the real estate industry.

In reconciling the conflicting research regarding REIT scale economies, it seems clear that capital costs are the primary factor determining REIT growth. Thus, consistent with research that focused on other capital-intensive industries, it appears that large REITs do have scale economies in capital costs. As a result, additional growth potential exists within the REIT sector to capitalize on this advantage.

In conclusion, it is important to note that it is difficult to find statistical evidence for economies of scale in REITs because they are all roughly the same size and going through the same evolution process. The situation is analogous to professional basketball. Being 6'-10" does not guarantee an individual a career in the National Basketball Association, but being five feet tall almost eliminates professional basketball as a career choice. If a player wants to survive in the NBA he needs to be quick, agile, explosive, disciplined, aggressive, athletic, hard working, talented--and tall. The same is true in real estate. The fast company may be able to survive in the industry longer than a slow moving company; the aggressive company may beat out the timid competitor. But eventually the company that combines speed and aggressiveness with size and economies of scale will beat them all.

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