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Houston Business

A Perspective on the Houston Economy

Urban Agglomeration and Urban Growth: Houston Among the Cities

Why do firms in the same industry cluster together?

[T]here is considerable evidence that large cities are highly productive....But is the advantage derived from the virtues of the city as a large-scale organization... or does industry-specific clustering simply take root more easily in large cities?

Urban economists have long noted and closely studied the ability of clusters of interrelated and highly competitive firms to shape the hierarchy of cities. Among the most visible U.S. clusters of industries are those for autos in Detroit, entertainment in Hollywood, financial services in New York and microelectronics in Silicon Valley. Many more examples can be drawn from home and around the world, as this author illustrates:

> The vast majority of Italy's woolen textile producers, for example, are located in two towns....British auctioneers are all within a few blocks in London. Basel is the home base for all three Swiss pharmaceutical giants. Danish windmill producers are centered in Herning. In America, many leading U.S. advertising agencies are concentrated on Madison Avenue in New York City. Large-scale computer manufacturers Control Data, Cray Research, Burroughs (now part of Unisys) and Honeywell are in or near Minneapolis, Minnesota. Pharmaceutical and related companies...are based in the New Jersey/Philadelphia area. General aviation aircraft producers are concentrated in Wichita, Kansas, and minicomputer producers in Boston.[1]

The life cycle of urban clusters has attracted growing interest in recent years. In no small part, this interest stems from the role of these centers in America's "rolling recession" of the 1980s. As the economic pendulum swung against the Rust Belt's heavy industry, then Southwestern energy and, most recently, defense and computers in New England and California, American corporations cut costs through layoffs, plant closings, consolidation, automation and relocation. This restructuring often highlighted the correlation between the health of cities and the health of their industries, particularly

when urban economies proved dependent on the narrow base of an industry cluster.

This article describes how urban clusters arise and how they fit into some popular theories of urban growth. Houston, of course, is among the widely recognized urban clusters, primarily because of its oil and gas producers, oil services and machinery firms, pipeline companies, refineries and petrochemical plants. This article explains Houston's oil cluster in the context of these broader concepts.

ECONOMIES OF AGGLOMERATION

Why do firms in the same industry cluster together? Clustering is typically explained as *economies of agglomeration*, or external economies that lower the costs of firms that choose to locate in the city. In turn, economies of agglomeration are divided into *economies of localization* that are generated by clustering many firms from a specific industry in one place and *economies of urbanization* that accrue simply to increased city size. At an aggregate level, there is considerable evidence that large cities are highly productive (thus, allowing them to pay higher wages). But is this advantage derived from the virtues of the city as a large-scale organization and economies of urbanization? Or does industry-specific clustering simply take root more easily in large cities, thus letting cities capture economies of localization? Recent studies of manufacturing in the United States and Brazil and of fast-growing service and manufacturing industries in the United States indicate that localization economies overshadow the role of city size and are thus the key generator of urban agglomeration economies.

What specific events or processes give rise to localization economies? Three examples of potential advantage from industry clustering might be input–output relationships, comparison shopping and information exchange. *Input–output clustering* can result simply from A buying input from B and B's product being expensive to ship. Or it might arise from more extensive commonalities, such as those shared by refineries and petrochemical facilities along the ship channel. They share the same hydrocarbon input; chemicals may require intermediate refinery products as input; the similar continuous-process technology of these facilities lets them share construction, equipment and maintenance suppliers; and both rely on a similar infrastructure of pipelines for input or product, air separation plants and good rail and water transportation.

Comparison-shopping clusters allow easy visual inspection of merchandise and face-to-face negotiation. The Dallas Trade Mart is one regional example. In Houston, many of the world's oil companies maintain offices that annually buy billions of dollars' worth of local oil services and equipment.

Information clusters enable those facing similar problems in production, finance, taxation and regulation to exchange information. As the oil industry shrank after 1982, Houston became a magnet for the relocation and consolidation of oil company headquarters. The relocating companies cited a need to be close to the heart of the industry and a growing burden of travel cost to Houston. The turbulence and hard times experienced by the industry enhanced the value of every bit of information and accelerated the consolidation process.

Urbanization economies, in contrast to economies of localization, arise for all firms in all industries in a city. For example, a large city offers sophisticated and specialized advantages, such as research universities, a medical quarter, a large financial center or an array of legal and business services.

AGGLOMERATION AND URBAN GROWTH

Any theory of urban growth must accommodate changes in the demand for a city's products (shifts in taste, new regulatory regimes, new and evolving technologies or the shifting regional politics of public spending) and factor-supply issues (capital adequacy or labor quantity and quality). And, as is increasingly recognized, a theory of urban growth *must* incorporate agglomeration economies. There is no synthesis of urban growth theory, but many elements and alternative approaches are available to piece together as partial explanations of the growth process. Rather than catalog all the possibilities, this section presents two building blocks of urban growth theory—the growth pole and flexible specialization. They were chosen because they accommodate and feature agglomeration, and because they offer important applications to Houston.

Growth poles. A growth pole is a unique development opportunity for a region that leads to self-sustaining growth. It may be a firm, an industry or infrastructure, such as a port, highway, airport or university. The growth pole must

be relatively large, have extensive linkages to the rest of the nation, and be capable of acting with a cumulative effect on the region that produces agglomerative economies.

The key growth pole in the development of Houston's oil industry cluster was the Port of Houston and the ship channel. The original stimulus for the ship channel was the export of cotton, and in 1914 the channel was dredged to a depth of 25 feet to make Houston a deepwater port. By 1920, Houston was the greatest inland cotton market in the world; by 1930, it passed Galveston as the nation's greatest cotton port. After the Spindletop oil discovery in nearby Beaumont in 1901, the search for oil moved on to Sour Lake, Humble and other Texas cities. As the new oil industry sought an administrative home, a location for headquarters and a production center for oil field equipment, it turned to the nearby cotton market in Houston for administrative and financial skills. The port quickly became a major outlet for Texas oil as well as cotton.

The port proved crucial again during World War II, as Texas and Louisiana became a focal point for expanded refining capacity to meet demands for aviation fuel, gasoline and diesel. The ship channel also became the center of the new and evolving technology of petrochemical production, providing critical supplies of plastic and synthetic rubber for wartime consumption. This early start kept Houston at the center of the petrochemical industry, as witnessed by the billions of dollars in new facilities built along the Gulf Coast in the 1980s.

Houston's other large growth poles are the Texas Medical Center and the Johnson Space Center. The medical center has been the more successful of the two, using a combination of patient care, education and research to maintain a high rate of growth. The space center and the aerospace complex many in Houston hoped would develop around it have never reached the critical mass required to produce localization economies for new firms.

Flexible specialization. Flexible specialization describes a form of industrial organization that is an alternative to the assembly line and mass production. In particular, the concept describes organization through a web of small, flexibly organized firms that provide highly specialized batch or custom inputs. One example is the making of motion pictures in Hollywood. Through its early history, the motion picture business was a classic assembly line process with the sound stage as factory. New technology developed between 1950 and 1970 freed the industry to leave the sound stage and film on locations all over the world. The demise of Hollywood was widely predicted. Instead, as the sound stages closed, Hollywood changed organizationally into a complex of small, highly flexible firms that coalesced around each project and provided specialized and customized inputs. Transformed organizationally, Hollywood thrived as the center of the industry, the place where movie makers rubbed elbows, struck deals and found technical expertise to produce their films.

Houston provides at least one perfect example of flexible organization in its oil service and machinery industry. The reasons for oil services to organize flexibly into many small firms are much the same as those for Hollywood: complex problems and a need for customized service on many individual projects, scale economies captured by serving many companies, and unstable demand driving big, integrated oil companies to shift some of the risk to suppliers. Certainly, as domestic oil drilling declines and as drilling moves abroad, the analogy to Hollywood is more compelling. As technological and geological challenges abroad grow, American oil expertise and equipment remain the best in the world. Houston-based companies should continue to thrive. Once these flexible agglomerations are formed, they become highly immobile, with huge amounts of fixed and human capital in place. Houston will remain as the central place where oil deals are made and expertise is packaged for global projects.

CONCLUSION

Urban agglomeration economies are increasingly recognized as a key ingredient of urban growth. It is the size of the industry cluster, not the size of the city that houses the cluster, that creates most of the agglomeration economies that bind firms to the city. Houston's great petrochemical cluster is a classic example of urban agglomeration; the ship channel is an equally good example of how a growth pole attracts the agglomeration. As this look at oil services and machinery suggests, the better analysts understand the glue that holds these clusters together, the better they can forecast their future when industry is placed under stress.

[1] Porter, Michael E. (1990), *The Competitive Advantage of Nations* (New York: The Free Press, 154-55).

Houston's economic condition remains stagnant, with February data providing no clear sign of expansion or contraction. The latest data show employment is down seasonally but otherwise flat. Retail and auto sales weakened in February. The number of rigs drilling for oil and gas approached record lows, despite stronger prices for both oil and natural gas. Houston's refineries and petrochemical plants face weak demand and poor margins.

RETAIL AND AUTO SALES

Retail sales held up well for several weeks after Christmas but weakened in February. Retailers with operations in other parts of Texas report that Houston is consistently turning in the weakest performance in the state. Auto sales tell a similar story; December and January auto and truck sales were up nearly 10 percent over a year earlier, but February's numbers fell by 3 percent.

WOOD AND LUMBER

The price of lumber and other building supplies rose sharply because of supply restrictions and a strong national housing market. Higher prices make East Texas lumber mill owners happy, but there were rumors of coming allocations, especially for longer boards. As redwood and cedar have become unavailable, the demand for treated yellow pine as a decking material has increased. Also, shortages of wood shingles have caused demand to surge for high-quality fiberglass shingles.

UPSTREAM OIL AND NATURAL GAS

Energy prices improved over the past few weeks. OPEC moved to rein in production and raise its target price range to $18–$22 per barrel. West Texas Intermediate moved to more than $20 per barrel, but the markets remain skeptical of how long the OPEC accord will last; the futures market expects price to decline in coming months. Natural gas prices did not collapse in February 1993 as they did in February 1992, nor are they likely to do so in the near future. The futures price for natural gas has remained quite flat and at satisfactory levels, near $1.75 per thousand cubic feet through spring and summer months.

Despite improved prices, the rig count continued to slide, falling to nearly 600 and toward record-low levels. After a peak of 935 in mid-December, a seasonal decline is expected, but there are no signs yet that the rig count has bottomed out. The losses have been heavily weighted to natural gas, largely because of expired tax incentives to drill for gas.

One bright spot for drilling is the Gulf of Mexico. Rigs that can drill in shallow waters are in short supply and day rates are up sharply. Improved activity is the result of higher natural gas prices, remedial work after Hurricane Andrew and a major drilling program by Mexico.

REFINING AND PETROCHEMICALS

The story is unchanged here, as margins remain weak for chemical producers and refineries. Although domestic demand has turned around, poor exports to Europe hurt chemical demand; growing excess chemical capacity on the Gulf Coast raises the prospect of continued poor margins once markets improve. Refining margins continue to be squeezed. Several refineries continue to shut in capacity or leave capacity in extended turnaround programs.

REAL ESTATE

Real estate in Houston, especially office space downtown and in the Galleria area, is becoming less liquid as the city struggles with corporate restructuring and a lack of growth. These local problems are compounded by difficulties in national real estate markets. Institutions that would have financed real estate in the past, such as life insurance companies and pensions funds, now find too much real estate on their books or are intimidated by rating agencies that frown on owning too much real estate.

New-home sales were off sharply from January 1992, primarily because a sales spike occurred after the Persian Gulf war; 1993 sales were actually at respectable levels and comparable to the previous two or three Januarys. The existing-home market continues to carry a large inventory, but low interest rates have sales off to a better start than last year. Lower-priced homes are selling best.

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Bill Gilmer • Houston Branch • Federal Reserve Bank of Dallas
P.O. Box 2578 • Houston, Texas 77252

facility for manned space flight. Space shuttle operations, astronaut training and the space station constitute its major activities and funding sources. Cancellation of the space station project would be a serious blow to the scale of operations at JSC, forcing significant local job losses and spending cuts. Looming behind the immediate question of cancellation or cutbacks is an even more important, longer term issue for JSC: the future of manned space flight if there is no space station for the shuttle to build and service.

NEW TAXES AND SPENDING CUTS

Houston could be caught up in a number of the Clinton administration's proposed new taxes and spending cuts. The local economy can be described as comprising four growth poles: the administrative, technical and manufacturing complex that supports a global search for oil; the downstream refining and petrochemical complex along the ship channel; the Texas Medical Center; and the Johnson Space Center. Proposals for a broadly based tax on energy, especially with a 130 percent higher tax rate on oil, would hurt upstream and downstream energy operations. Combine this scenario with prospects for ongoing health care reform and a review of the space station project, and many questions arise about Houston's economic future.

The status quo is always comfortable, and economic change is often scary. But the Clinton proposals should bring Houston benefits as well as losses. Local benefits might stem from the broader goal of federal deficit reduction and stronger national growth. A seemingly credible and conservatively estimated plan to reduce (if not eliminate) the deficit has already brought important reductions in long-term interest rates. If uncertainties—from domestic politics to international events—don't impair the proposed deficit reduction plans, the stimulus from lower interest rates could offset much of the fiscal drag that spending cuts and new taxes inevitably will impose on the national economy.

Will Houston benefit from a stronger national economy? The answer is clearly yes. Houston has always been responsive to national economic conditions, although the relationship has often been disguised by volatile oil markets. Indeed, the national economy's local role has grown with recent diversification, and strong national growth has been a key to Houston's revival from the oil bust. However, in contrast to specific local spending cuts or energy taxes, the macroeconomic benefits to Houston are diffuse and difficult to pinpoint. Indeed, the politics of the federal budget deficit revolve around exactly this issue: local resistance to spending cuts or new taxes when only broad and problematical national benefits are offered in return.

NASA AND THE JOHNSON SPACE CENTER

Less than a month after NASA's creation in 1958, the new agency formed the Space Task Group to manage Project Mercury and put man into space. In 1961, the task group was reformulated to handle all manned projects, renamed the Manned Spacecraft Center and located about halfway between Houston and Galveston. Later renamed the Johnson Space Center (JSC), it rose to the status of other key NASA facilities: the agency headquarters was in Langley, Va.; the Jet Propulsion Laboratory in Pasadena, Calif., did tracking and telemetry in deep space; the Marshall Space Flight Center in Huntsville, Ala., developed rockets; the Goddard Space Flight Center in Greenbelt, Md., was the space science center; and Cape Canaveral (now the Kennedy Space Center) in Florida handled launch operations. The role of all these centers has evolved and shifted over time, but the Johnson Space Center remains responsible for planning, organizing and training for manned space flight.

THE JOHNSON SPACE CENTER AND HOUSTON

The space station project substantially increased NASA funding. Unlike past programs, which typically were phased in to replace completed projects, the space station needed continued shuttle operations. Space station funding was added to JSC's existing shuttle operations budget. New obligational authority for JSC was $1.54 billion in 1985. Without the space station, it would have been $1.89 billion in 1992; with space station funding, the budget jumped to $2.83 billion in 1992.

JSC spends just under half its budget in Houston. Since space station funding began in 1985, the share of JSC budget spent locally has risen from 40 to 46 percent. Most JSC spending in Clear Lake and Houston is for employment, with over 90 percent of the budget for wages, salaries and benefits. JSC employment of civil service, prime contractors and other direct contractors jumped from 11,960 in 1985 to 17,000 in

1991. Local procurement of goods and services in Houston reached $102 million in 1991 but was only 8.1 percent of local spending, or 3.7 percent of JSC's total budget.

Many visitors to JSC remark that the facility looks like a college campus, with a quadrangle area, duck ponds and colonnaded walkways. Its economic impacts are also similar to those of a college, with a high proportion of spending tied to wages and salaries for a highly skilled and educated work force. Local procurement is tied mostly to institutional operations.

Robert F. Hodgin at the University of Houston at Clear Lake has exploited this analogy by applying a well-known model of the economic impact of colleges and universities to JSC.[1] The model is quite conservative in estimating impacts, going to some lengths to avoid controversy, and if it errs it is probably on the side of missing multiplier effects in the local community.

Hodgin's figures show that the space station added 4,500 jobs and $189 million in personal income to the Clear Lake area last year. After the multipliers are accounted for in the model, the space station is responsible for 13,200 regional jobs and $350 million in personal income throughout the Clear Lake–Houston area. The incremental jobs produced through the multiplier process are much less well-paid than those affiliated directly with JSC, presumably because they are dominated by retail and part-time work. The conservatism of the model in estimating multiplier effects may play a role as well.

The economic impact of canceling the space station would center on the Clear Lake area. About 26 percent of the Clear Lake labor force works in aerospace—that is, mostly JSC-related activities. The remainder is divided into local petrochemical (10 percent), tourism (25), marine (2), and those who use Clear Lake as a bedroom community (36). Hodgin's figures show that space station cancellation would entail a population loss of 10,000 for Clear Lake, with attendant negative impacts on retail sales, retail and office space, the housing market and school enrollments. The current slow growth experienced throughout the Houston area would exacerbate the problem, leaving residents to ask where new jobs would come from to replace lost space station jobs.

RETHINKING THE SPACE STATION

The scientific panel now reviewing the space station concept will soon submit its final report to the National Space Council and Vice President Gore; a decision from the administration is expected early this summer. A favorable decision will put the project before Congress. Some reduction in resources is certain; how cutbacks will be shared among NASA's various centers depends on the final design selection.

Diverse and incommensurate priorities shape the space station debate and make the outcome impossible to predict. For example, with the end of the Cold War, there is not a strong military impetus to maintain technological superiority in space flight. The Russian's Mir space station did not provoke an urgent U.S. response, such as Mercury or Apollo. Another consideration is the economic value of the station as a service base for satellite repair, material processing, military or weather observation. These services were touted highly in early space station proposals, but their value is now swamped by recent cost estimates.

Also shaping the debate is the long-running feud between advocates of manned space flight and those in the scientific community who see little or no science involved in putting man into space. Robots, it is claimed, can do the science required, and manned space flight is belittled as an engineering stunt. One reply, of course, is that when expensive experiments in space don't work, an astronaut might be capable of making repairs. Also, the commercial spinoffs from NASA in various coatings, fasteners, purification systems and imaging are the work of engineers, not scientists. Now mix into the debate national prestige, international cooperation, the excitement of space exploration, and pork-barrel politics, and the shape of the new space station becomes even more uncertain.

Space station funds were crucial to Houston's economic recovery from the oil bust. They contributed to the rapid growth the city enjoyed from 1987 to 1991 and to local economic diversification. JSC now faces a likely reduction in this funding, and we will soon learn the extent of the damage. A resumption of strong growth at one of Houston's other growth poles will be needed to make repairs.

[1] John Caffrey and Herbert H. Isaacs (1971), *Estimating the Impact of a College or University on the Local Economy* (Washington, D.C.: American Council on Education).

Wage and salary employment improved sharply over the first three months of 1993, and seasonally adjusted data reveal that Houston has returned to the peak levels of employment enjoyed in mid-1991. Some combination of skepticism and caution is required in interpreting these data, however. Skepticism is warranted because early data for each of the previous three years showed gains that later vanished after data revisions by the Texas Employment Commission. Analysis also requires caution because of the mix of jobs that make up these apparent gains. Mining, durable manufacturing and other export sectors continue to decline; new jobs are concentrated in retail, services and especially local government. Beige Book responses are consistent with continued slow-to-flat economic conditions in Houston.

RETAIL AND AUTO SALES

Retail sales were generally reported to be running slightly better than 1992, despite heavy rains and flooding that slowed business in March. March auto sales were excellent, up 24 percent over March 1992, but April sales tailed off to lag April 1992 sales by 12 percent. Figures for March are a small part of the annual total for local auto dealers and can be volatile, but April begins the strongest period of the sales year. April, May and June sales are crucial determinants of annual sales volume.

OIL AND GAS PRICES

OPEC continues to maintain production cuts that are holding oil prices $1 higher than a year ago. National gas price futures hit record high levels on the heels of blizzards along the East Coast. For the second consecutive year, late cold weather boosted natural gas prices after the heating season was officially over and storage had already been depleted. Replenishing stored fuel over the summer should keep prices high for several months.

Weather—warm weather, cold weather and Hurricane Andrew—has largely driven gas prices for two years, but many analysts are now forecasting that the increase in natural gas prices will be sustained. Except in the Gulf of Mexico, where drilling is up sharply, higher gas prices have yet to stimulate oil-field activity. The domestic rig count hovers at record low levels. Many producers, burned by similar optimism about gas prices in 1990–91, have adopted a wait-and-see attitude about natural gas prices and increased drilling.

CHEMICALS AND REFINING

Gasoline prices, showing a seasonal climb, have hit the highest levels so far this year. This price increase—normal for the summer driving season—began earlier than usual this year. Refiners' margins have risen over the past few weeks, along with gasoline prices, but the improvement is from extremely low levels seen throughout the early spring. Petrochemical operations continue to show little increase in demand, and prices are flat. Chemical margins are squeezed by rising prices for hydrocarbon inputs. Few construction projects are on the immediate horizon for either chemical producers or refiners.

REAL ESTATE

Inventories of existing homes continued to grow through March, with active listings up 7 percent from last year. Sales were similarly off 7 percent, as many potential buyers are now taking more time to decide, convinced that interest rates are down for awhile. In contrast, new home sales were up 7 percent, according to one report, and optimistic builders pushed March starts up 14 percent from March 1992. March is an important month for starts, as builders try to get product on the ground for spring sales. Strong traffic in model homes early in the year was important in driving these new starts.

Otherwise, Houston real estate has changed little. Rents and occupancy are flat in the apartment market. Office space remains stable and rents flat for most of the market, but downtown continues to see rents and occupancy decline.

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