Is the Eighth District Catching Up with the Nation?

By Rubén Hernández-Murillo

How can innovation be measured? And how does the Eighth District's level of innovation compare with the rest of the United States? To answer these questions, we analyzed data on patented innovations in the District during the 1990s, including the trends of innovation rates and the share of patent output by technological category. Then we compared these results with the national trends.

As economists have recently found, innovations play an important role in promoting economic activity and growth through *knowledge spillovers*—that is, the diffusion of new ideas and technological improvements. Some studies have also tried to identify the factors determining the rate of innovation. Their findings suggest that *spatial agglomeration*—the concentration of people and firms in cities and urbanized areas—generates positive external effects that facilitate the creation of new ideas.[1]

Traditionally, the economics literature has acknowledged the role of the agglomeration of economic activity, especially for manufacturing: Firms value proximity to customers; they also value proximity to specialized inputs or to other firms. When agglomeration increases the productivity of all firms in a given location, industry clusters arise.[2] Economists Gerald Carlino, Satyajit Chatterjee and Robert Hunt found that densely populated areas in the United States are becoming more important as centers of innovation, rather than as locations for the production of goods. They also found that other local demographic and economic factors, such as the distribution of skilled labor in a region, are important determinants of innovative activity. It is crucial, then, to understand the local demographic and economic conditions of regions to assess their potential for the creation and development of new ideas.

Patent Data

In the American patent system, an innovation has to meet three requirements to qualify for protection by a patent: It has to be novel; it has to be useful; and it has to represent more than a trivial advance over existing knowledge.

The number of patents granted can be used to measure innovation activity—with a caveat: Because all patented innovations are commercialized, it is difficult to assess the economic value of innovations merely by examining patent counts. Economists Bronwyn Hall, Adam Jaffe and Manuel Trajtenberg have recently compiled a rich database on patent citations.[3] Citations can be used to construct measures of knowledge spillovers to assess the value of individual patents. The authors constructed measures of *generality* and *originality*, which illustrate the way knowledge spreads out across innovations. The generality index measures the impact an innovation has over future innovations. An innovation receives a high generality score if a patent receives citations from other innovations in a wide range of technological fields.[4] If a patent receives citations from a narrow set of fields, the score is low. The originality index, on the other hand, indicates how an innovation increases existing knowledge, using citations made to previous patents. If a given patent cites other innovations in a narrow range of technological fields, the originality score is low; if it cites patents in a wider range, the score will be high. The database includes the addresses of innovators, allowing us to trace patents geographically to measure the innovation output of regions.

Patent Activity in the Eighth District

To examine patent activity in the Eighth District, we aggregated patent counts at the county level over the years 1990 to 1999, then compared them with those of the previous decade.[5] (The Eighth District includes all of Arkansas and parts of Illinois, Indiana, Kentucky, Mississippi, Missouri and Tennessee.[6])

Patents in the District represented about 2.3 percent of total patents granted in the United States during the 1980s. In the 1990s, this number fell to 2.1 percent.

When population is taken into account, it is clear that the District lags the rest of the country, as shown in Figure 1 below. Because most patent activity takes place in urban areas, we also examine the patent output in the region's metropolitan statistical areas (MSAs), as shown in Figure 2. As these numbers reveal, compared with the 1980s, the District's metro areas became more innovative during the 1990s, but still fell behind the rest of the country.[7]

Figure 1—Total patents granted per 100,000 people

	8th District	Nation
1980s	72	158
1990s	95	215
% Increase	32	36

Figure 2—Total patents granted per 100,000 people in MSAs

	8th District	Nation
1980s	110	168
1990s	140	231
% Increase	27	37

Figure 3 ranks individual metro areas in the District by the increase in their innovation rates. The highest increase was observed in the Jackson,

Tenn., MSA, where the rate rose from 25.3 to 81.0. The increase in patenting occurred mainly in the mechanical sector. The Fayetteville-Springdale-Rogers, Ark., metro area followed with a rate of 78.1 in the 1990s, up from 43.1 in the 1980s. In this case, the increase in patenting was spread across all categories. The Owensboro, Ky., MSA experienced the largest decline, from 89.5 in the 1980s to 42.6 in the 1990s. Unfortunately, the reason for the decline cannot be easily disentangled because the largest reduction in patenting occurred in the category labeled "others." The Evansville-Henderson metro area, straddling the Indiana-Kentucky border, also had a large decline because of a reduction of about 200 patents in the chemical and drugs and medical industries, which followed the move of the Bristol-Myers Squibb research headquarters to New Jersey in 1990.

Originality of Eighth District Innovations

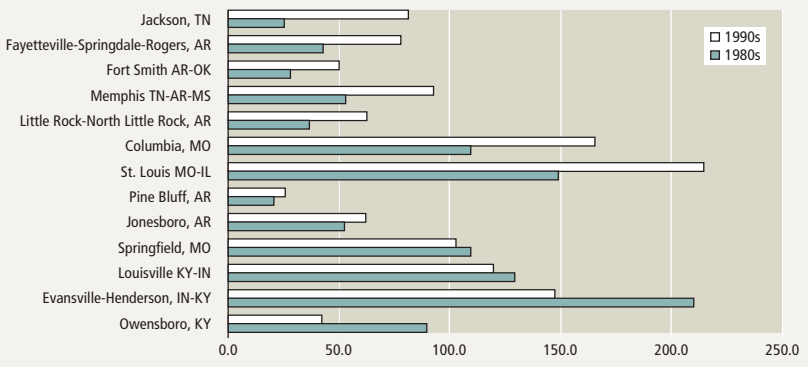
Overall, the average generality score for the Eighth District during the 1980s was 0.33; the score for originality was 0.34. The national average scores were, respectively, 0.38 and 0.35. During the 1990s, the generality score for the District fell to 0.24, indicating that innovations in the region received citations from a narrower set of technological fields. For the entire United States, the generality score during the 1990s averaged 0.29. One must consider, however, that innovations during the 1990s had a shorter span of time to allow for received citations, since the sample ended in 1999. For this reason, the originality score is of greater interest. During the 1990s, the score for the District increased to 0.41, and the national score was 0.42. The percentage increase in the District was slightly higher than the increase in the national average, about six-tenths of a percentage point. If we consider only metro areas, the increase in the District was almost four percentage points higher than the increase in the national average. These results suggest that the District is catching up with the nation in terms of originality of its innovations.

Innovation Activity across Technological Fields

California, Texas and Florida seem to be outperforming other states in terms of technological advances. Studies find, however, that all regions in the country are patenting more innovations than in the past.[8] It is important, therefore, for economic development officials to identify the innovative potential of different regions in such a competitive innovative environment. For example, legislators in Missouri recently announced plans to exploit the state's potential for innovation in the life sciences. Although governments undertake only a fraction of innovation, efforts to enhance research and development in new technologies will no doubt continue to be a major issue in state and local governments' agendas during the coming years.

To identify the innovative potential of the region, it may help to examine how the composition of patent output in the District has evolved across technological fields. It turns out the District has followed the same behavior as the rest of the nation. The share of patents granted in the computers and communications industry almost doubled during the 1990s. This industry represented 2.6 percent of all patents granted in the region in the 1980s. During the 1990s, the share increased to 4.0 percent. Another sector that increased its share in patent output was the drugs and medical industry. The output share of this industry in the District rose from 6.9 percent in the 1980s to 9.0 percent in the 1990s. At the national level, the share of patent output in the computers and communication industry rose from 8.2 percent in the 1980s to 14.8 percent in the 1990s, while the share of innovation output in the drugs and medical industry rose from 7.3 percent to 12.7 percent. The share of patent output for all other categories experienced declines both nationally and in the District.

Figure 3—Innovation Rates in Eighth District Metro Areas



Conclusion

Most regions in the country are patenting more now than in previous years, and the Eighth District is no exception, especially in high-tech sectors. Although the District's innovation output is lagging other areas in the nation, during the 1990s the region experienced a recovery in the originality of its innovations.

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ENDNOTES

1 See Carlino et al. (2001).

2 See LaFountain (2002) and Hanson (2000).

3 See Hall, Jaffe and Trajtenberg (2001).

4 Patent counts are aggregated in Hall, Jaffe and Trajtenberg (2001) into the following categories: chemical, computers and communications, drugs and medical, electrical and electronics, mechanical and others.

5 We matched city names in the inventors address file to a list of places in the Federal Information Processing Standards Publication 55 from the National Institute of Standards and Technology. We used the Metaphone phonetic-matching algorithm developed by Lawrence Philips (1990) to allow for differences in spelling and typographical mistakes in the inventors source file.

6 Although the database includes a field for the state, some of the patents could not be matched to a city name in the District states. These patents were left out of the analysis.

7 This measure is sometimes referred to as the innovation rate.

8 See Ceh (2001).

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