Robert Inman

Commentary

There is no economic issue more likely to make or break the political career of a large-city mayor than the city's job growth or decline. Understanding why firms locate where they do and why they expand or contract has now become an important part of any mayor's first course in good governance.

The paper by Stuart S. Rosenthal and William C. Strange belongs on the syllabus—it is careful research with an important message. Using a truly extraordinary sample of business locations by census tract for the New York metropolitan area, the paper reaches three conclusions. First, firms are attracted to locations populated by other firms, particularly in their own industry. The authors conjecture that this attraction is caused by a production spillover that economists call agglomeration economies. Second, the observable reach of these agglomeration economies is strongly bounded geographically, probably not much further than one mile from the center of current firm locations. Third, at present levels of employment density—remember, the New York metropolitan area and New York City in particular are already very dense locations—adding a new firm does not appear to have a very strong further effect on local employment; the multiplier effect is modest at best, perhaps no more than 25 to 50 new jobs for every 1,000 additional jobs located at an employment center. These conclusions are valuable, perhaps provocative, and deserve a close look.

I should note at the outset that I am a great admirer of this line of research by Rosenthal and Strange. A companion piece to their study, recently published in the *Review of Economics and Statistics*, was the first to adopt the authors' unique empirical approach to the analysis of business location.[1] In that study, the authors use a national sample of firm locations organized by ZIP code and reach much the same conclusions, but only for six narrow, but still interesting, industry classifications: software, food products, clothing, printing and publishing, fabricated metals, and machinery. This study follows their original methodology, but here the authors examine new firm locations within one metropolitan area, use a finer geographical grid (census tracts are much smaller areas than ZIP codes), and search for effects more broadly: first, for "all industries" and then within the major employment categories of manufacturing; wholesale trade; finance, insurance, and real estate (FIRE); and services. The authors emphasize business services in particular.

The methodology used in both studies is straightforward. New firms will locate in a census tract if they can make a profit, where profits are defined by:

$$(1) \qquad \pi(x,A) = p(A)\cdot Q(x,A) - \sum w(A)\cdot x,$$

where $\pi(x,A)$ are the profits (appropriately discounted) earned by the firm by locating in the census tract with a vector of location attributes A; x is the vector of inputs the firm must buy to produce output Q at that location using a location-specific production function $Q(x,A)$; $p(A)$ is the price the firm can charge for its output Q, where the price also may be

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location-specific; and $w(A)$ is the price the firm must pay for each input, where again, prices may be location-specific. Location attributes A include measures of local demand conditions when the firm produces a locally traded product (for example, restaurants), local supply conditions when the firm hires locally produced inputs (for instance, labor and most importantly land), and finally, any local resources that make the firm more or less productive (such as public infrastructure, harbors, clean rivers).

Also included in A, and central to the Rosenthal-Strange analysis, is the density of other-firm employment at a location. As first stated by Alfred Marshall, having many firms from the same industry close at hand enables each firm to attract and encourage specialty inputs, save on the transit costs of needed natural resources, and perhaps share in the development of industry-specific innovations. As first noted by Jane Jacobs, productive synergies may also exist between proximate firms in different industries. Restaurants thrive near theaters, software firms stimulate innovations by hardware firms, and hospitals encourage medical research and development. The presence of these Marshallian and Jacobian agglomeration economies, proxied here by existing employment in a firm's own and related industries, promises higher total-factor productivity, greater profits, and, all else equal, new firm arrivals at the location. In fact, when deciding where to locate, firms are concerned only with the elements of A. As profit-maximizers, firms adjust their use of inputs to accommodate local prices, local resource availability, and local agglomeration economies. Thus, $x = \chi(A)$; therefore, $\pi(\chi(A), A) = \Pi(A)$. If profits conditional on location attributes are positive, then firms will locate in the census tract; if not, they will stay away. As any New Yorker will say: "It's location, baby!"

Finally, new employment at a location depends upon the number of new firms—"births" (B) in Rosenthal and Strange—and the number of jobs that arrive with these new firms (N). Since new firms only arrive if $\Pi(A) > 0$, predicting B and N entails estimating a pair of regressions of the general form:

$$(2) \qquad B = b(A) \text{ and } N = n(A)$$

across a sample of census tracts, each with different values of A, where B and N represent new establishments and new employment in the tract, respectively. Rosenthal and Strange do so, both here and in their earlier national study, except in this case, the key variables in A are own-industry employment and other-industry employment at the location. In both studies, the authors are careful to allow for the fact that some census tracts—often more than half of those in their sample here—may actually have no new firms or new employment. The authors do not study the effects of location on the loss of firms and jobs, although this too would be a useful exercise.[2]

The "structural" profit relationship in equation 1 helps us understand what might lay beneath Rosenthal and Strange's "reduced form" estimates of equation 2 and in particular the effect of current census-tract employment on the arrival of new establishments and new employment over the next three years. Current employment affects firms' profits in three ways. First, current employment in a census tract might influence the price that new firms charge for their products, $p(A)$. More current employment in an industry means more market competition for locally traded goods and services, causing a fall in product prices and firm profits; this effect discourages new firm entry and new jobs. Second, more current employment in a firm's own industry raises the price of locally supplied specialty inputs (for example, skilled labor), while more current employment in all industries raises the price of local inputs generally (such as unskilled labor and land). Higher factor prices lower firm profits so that again new firm location and employment are discouraged. These two adverse effects of higher current employment are offset by the potential gains in total-factor productivity from Marshallian agglomeration economies with more "own workers" employment and from Jacobian agglomeration economies with more "all workers" employment. Whether the two adverse price effects of more current employment are offset by the positive effects of current employment's agglomeration effects is an empirical issue.[3] Positive coefficients for current employment—the key A variable in this study—in the estimated new establishment and new employment equations suggest that positive agglomeration effects offset adverse price effects; negative coefficients suggest that the negative price effects dominate (Rosenthal and Strange's Tables 2 and 3, respectively).

What do Rosenthal and Strange find? That positive coefficients, and thus agglomeration economies, seem to dominate; and when statistically significant negative coefficients do appear, they usually obtain for "all workers" and not for workers in the firm's narrower own industry. (See the results in the aforementioned Tables 2 and 3 for Model 2). This outcome makes sense. Negative price effects are most likely to arise from high factor prices—most likely the price of land and office space—in this metropolitan area's very dense, high-employment centers. The results for wholesale trade, FIRE, and business services are particularly instructive on the point.

Before we embrace the agglomeration explanation, however, we need to think a bit more critically about exactly what has been estimated in the authors' Tables 2 and 3. The results show a statistically significant positive *correlation*

between old jobs and new jobs in a firm's own industry; but correlations do not signify causation. For example, there may be a very attractive attribute within current (2001) high-employment tracts—for example, a good highway location or harbor, low taxes, or easy public transportation—that leads these tracts to have high new (2002-04) employment as well. If so, we cannot conclude that current employment is *causing* new employment; rather, the *cause* of both is good infrastructure, low taxes, or a natural-resource advantage. If important location attributes are omitted from the Rosenthal-Strange regressions but they cause both old and new employment to be jointly larger (or smaller), then the regression coefficients in Tables 2 and 3 will not be valid measures of causation. The estimated coefficients will be upwardly biased (overly large) estimates of the true causal link from old to new employment. Rosenthal and Strange are aware of this statistical problem. Their solution is to use industry SIC-fixed effects as a proxy variable for omitted location attributes; but unless a firm's SIC code is strongly correlated with omitted attributes, this control will be weak.[4] Still, we cannot rule out a causal connection from existing jobs to new jobs. *When one keeps this qualification in mind, the estimates in Tables 2 and 3 stand as plausible upper bounds for a true causal impact of old jobs on new employment in a tract.*

The study's second conclusion, the one rightly underscored by Rosenthal and Strange, is in many ways the most important one. Whether causation or correlation, the connection between current jobs and new jobs is very local. Almost all of the effect of current jobs on future jobs is exhausted within one mile of the center of the census tract. If the connection is causal and arises from agglomeration economies, then spatially small governments will be sufficient to recognize, and thus fully internalize, all the benefits arising from productive firm-to-firm interdependencies. If the observed connection measures an important omitted public policy—for example, infrastructure, local tax breaks, or better neighborhood services—then again the benefits can easily be internalized by a small local government. Indeed, large but still privately owned and managed industrial parks might be sufficient to do the job. This narrow spatial reach for firm or policy interdependencies means that economic development strategies can be locally designed, and most importantly, *fully* funded from locally raised revenues. Business improvement districts, as small governments designed to internalize firm and policy spatial interdependencies, make good sense in light of the Rosenthal-Strange results. Countywide, citywide, or statewide funding should be limited only to those development policies with significant multicommunity benefits—for example, sharing the fixed costs of large transportation and telecommunication networks. *Beyond that, economic development decision-making and financing should be kept very local.*

Third, and again whether correlation or causation, the second-order—or multiplier—effects estimated here of adding new jobs to any location are very small, perhaps no more than 25 to 50 extra jobs for every 1,000 initial jobs brought into a location.[5] In the New York metropolitan area, retaining or attracting a large employer, such as a financial institution's call center, will add those jobs to the location; but there will be a very modest multiplier effect of at most .05 jobs for every new job created. The reason for this modest effect is surely the current density of employment in the New York area. Most tracts are likely to have sufficient supply capacity to meet the needs of any new employers brought into the tract. More important, if the land area needed to accommodate new employment is scarce, then 1,000 new jobs will simply drive up rents and thereby discourage additional firm location. Remarkably, agglomeration economies seem sufficient to compensate fully for the rent increases imposed by the initial 1,000 jobs—that is, the multiplier is even slightly positive. For economic development proponents and critics too, however, the lesson here is clear: *In the New York metropolitan area, multiplier arguments used to justify economic development policies should be ignored.*[6]

There is a final benefit of Rosenthal and Strange's work for those of us who study urban economies. We have an important new fact against which to calibrate our structural analysis of firm location in dense urban areas. It is impractical to think that we will ever be able to disentangle statistically household utility and firm production functions from the myriad product and factor market interdependencies that define how real urban economies perform. What we can do statistically, however, is identify a set of carefully constructed "reduced form" *facts* that any well-specified structural model of an urban economy must replicate. A failure to "predict" these facts means that the structural model is likely to have been misspecified—that is, something is missing. The authors' work here, and in their companion national study, gives us one such fact—I am willing to elevate it now to the status of a "robust fact"—that our structural models must reproduce. Whatever policy or technology shock that generates firm demand for X new jobs in an urban economy, X, and maybe a bit more of those potential new jobs, must actually locate in the city. In the end, the model's beneficial agglomeration effects must dominate the adverse price effects, but not by too much. Models that cannot match this benchmark are probably not appropriate for the study of economic policies in dense cities. On both the policy and research fronts, the paper by Rosenthal and Strange makes a valuable contribution.

Endnotes

1. Rosenthal and Strange (2003).

2. I cannot resist mentioning my own work with colleagues on the adverse effects of inefficient taxation on job location in four cities, one of which is New York City; see Haughwout et al. (2004).

3. Rosenthal and Strange (2003) provide a cleaner estimate of the effects of agglomeration on firm location. In that study, they attempt through sample design to remove the effects of current employment on $p(A)$ and $w(A)$. First, they examine narrower industry categories producing goods primarily intended for export from the production site to national or world markets; thus, $p(A) = p$, the "world price." Second, they use ZIP code areas as the unit of analysis. Because ZIP code areas are often very large—sometimes as big as a county—it is more likely that there will be an elastic supply of labor and land available to firms. If so, factor prices will be independent of demand shocks from more employment; thus, $w(A) = w$. Assuming that these identification assumptions hold, the only remaining effects of current employment on new firm location are due to positive agglomeration economies.

4. Consider this test: Do all census tracts with many investment bankers have nearly identical public transportation and low income taxes? Do all census tracts with many machine shops have equally easy access to the turnpike? Are all warehousing centers near harbors or centrally located train yards? The answer is surely *no*; thus, omitted attributes will be imperfectly correlated with industry classification. The issue is how imperfectly correlated they will be.

5. This estimate is computed from Rosenthal and Strange's Table 3, Model 2 estimate of the effect of 1(000) additional "all workers" within the one-mile ring of employment in a given SIC code: .0157 new workers in each SIC code in each census tract within one mile of the 1(000) additional workers. There are eighty-one industry SIC codes within the "all industries" category and roughly ten census tracts within a one-mile radius. Thus, the total new jobs will be 12.7 jobs = .0157·(81 SIC industries/tract)·(10 tracts/1-mile radius). In addition to the "all workers" effect, there will be an "own workers" effect. Assume that the 1,000 additional workers are spread evenly across the eighty-one SIC industries—the linearity of the model makes this an inconsequential assumption—and that the "own workers" effect is 1.37 new jobs per 1(000) current SIC jobs, as estimated in Table 3, Model 2 for "all industries." Then the "own workers" effect of the 1(000) current jobs will be an additional 13.7 new jobs within the one-mile radius: 13.7 jobs = 1.37[(1/81)·(1)]·(81 SIC industries/tract)·(10 tracts/1-mile radius). The total new jobs created from 1(000) additional current jobs is therefore 12.7 + 13.7 = 26.4 new jobs. I appreciate the authors' assistance with this calculation. This is only a partial equilibrium effect, however, measuring the impact in the first three years after the "arrival" of 1,000 additional jobs and ignoring any feedback from these 26.4 new jobs back onto the original 2001 economy. I concede the conceptual point but suspect that any additional effects are small. In conversation, the authors are more optimistic; they felt that doubling the 26.4 new jobs to 52.8 new jobs might be a better general equilibrium estimate. Either way, the total effect of adding 1,000 new jobs is modest.

6. For additional evidence that the multiplier effect of new location on own- or other-industry employment may be small, even in less dense counties, see Greenstone and Moretti (2003). The fact that the authors of that study find that land values rise with own-tax-financed subsidies to attract firms suggests that efficiency gains and agglomeration economies are at work. Such a result is consistent with the analysis here, but again it lacks a sizable multiplier.

References

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