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Local Multipliers

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Every time a local economy generates a new job by attracting a new business, additional jobs might also be created, mainly through increased demand for local goods and services. This positive effect on employment is partially offset by general equilibrium effects induced by changes in local wages and prices of local services. In this paper, I estimate the long-term employment multiplier at the local level. Specifically, I quantify the long-term change in the number of jobs in a city's tradable and nontradable sectors generated by an exogenous increase in the number of jobs in the tradable sector, allowing for the endogenous reallocation of factors and adjustment of prices.

I find that for each additional job in manufacturing in a given city, 1.6 jobs are created in the *nontradable sector* in the same city. As the number of workers and the equilibrium wage increase in a city, the demand for local goods and services increases. This effect is significantly larger for skilled jobs, because they command higher earnings. Adding one additional skilled job in the tradable sector generates 2.5 jobs in local goods and services. The corresponding figure for unskilled jobs is one. The multiplier also varies across industries. Industry-specific multipliers indicate that high tech industries have the largest multiplier.

A simple framework suggests that the local multiplier for the *tradable sector* should be smaller than the one for the nontradable sector, and possibly even negative. This is because the increase in labor costs generated by the initial labor demand shock hurts local producers of tradables. This negative effect may be in part offset by agglomeration externalities, if they exist, and an increase in the demand for intermediate inputs, if supply chains are localized. Empirically, I find that adding one additional job in one part of the tradable sector has no significant effect on employment in other parts of the tradable sector.

The magnitude of local multipliers is important for regional economic development policies. State and local governments spend considerable amounts of taxpayer money on incentives to attract new businesses to their jurisdictions. Such location-based incentives are pervasive in manufacturing. However, the efficiency of these policies and their actual effects on employment are not fully understood, because there is little systematic evidence on the effects of successfully attracting a new firm on other parts of the local economy. The estimates in this paper help inform this debate.[1]

Moreover, assuming that the objective of local economic development policies is to maximize local employment, it is important to know where subsidies should be directed. The multiplier is likely to vary across industries and skill groups. There is little existing evidence on which industries and skill groups have the largest multiplier and therefore generate the largest number of additional jobs. My estimates shed some light on this question.

It should be noted, however, that the presence of large multipliers is not, in itself, a market failure and therefore does not necessarily justify government intervention. Local subsidies may be efficiency enhancing in the presence of agglomeration externalities. However, a multiplier larger than one does not necessarily imply the existence of agglomeration economies. For example, the multiplier effect that operates through increases in the product demand for local goods and services is a pecuniary externality and does not constitute a market failure. On the other hand, the finding of a nonnegative employment effect for tradables is consistent with (although not proof of) the existence of agglomeration economies.

The magnitude of local multipliers may also be relevant for the literature on nationwide multipliers. The exact magnitude of multipliers is

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[1] See also Greenstone and Moretti (2004); and Greenstone, Hornbeck, and Moretti (forthcoming).

a crucial element in formulating countercyclical stimulus policies. For example, the Obama administration's ex ante estimates of the effect of the 2009 American Recovery and Reinvestment Plan depended crucially on the magnitude of the multiplier used in the simulations (Romer and Bernstein 2009). Existing estimates of multipliers based on national time-series hinge upon very strong identifying assumptions. My estimates of local multipliers provide bounds for national multipliers.

I. Conceptual Framework

Assume that each city is a competitive economy that uses labor to produce a vector of nationally traded goods, $x_1, x_2, x_3, \ldots, x_K$—whose price is set—and a vector of nontraded goods, $z_1, z_2, \ldots, z_M$—whose price is determined locally. Labor is mobile across sectors within a city so that marginal product and wages are equalized within a city. Local labor supply is upward sloping, and its slope depends on the distribution of residents' tastes for leisure and the degree of labor mobility across cities. Higher geographical mobility implies a higher elasticity of labor supply. In the extreme, perfect mobility would imply an infinitely elastic local supply of labor. Local housing supply is upward sloping, and its slope depends on geography and land use regulations.

Consider the case of a permanent increase in labor demand in tradable industry x_1 in city c. This increase may be due to the successful attraction of a new firm (see for examples the cases documented in Greenstone and Moretti 2004) or an increase in the product demand faced by existing firms. The direct effect of this shock is an increase in employment in industry x_1. But this shock to sector x_1 may also affect local employment in the rest of the tradable sector $x_2, x_3, \ldots, x_K$ and in the nontradable sector. The shock is also likely to have general equilibrium effects on local prices: the wage of *all* workers in the city increases (unless local labor supply is infinitely elastic) and the cost of housing also increases (unless housing supply is infinitely elastic).

Multiplier for the Nontradable Sector.—The city budget constraint increases, both because there are more local jobs and because wages are higher. The increase in the city budget constraint results in an increase in the local demand for nontradables $z_1, z_2, \ldots, z_M$. Employment in industries like restaurants, real estate, cleaning services, legal services, construction, medical services, retail, personal services, etc. grows because the city has more workers and wages are higher. These new jobs are split between existing residents and new residents who move from somewhere else, depending on the degree of geographical mobility. The magnitude of the multiplier effect depends on three factors. First, it depends on consumer preferences for nontradables and the technology in the nontradable sector. More labor intensive technologies result in a larger multiplier. Second, it depends on the type of new jobs in the tradable sector. Skilled jobs should have a larger multiplier than unskilled jobs, because they pay higher earnings and therefore are likely to generate a larger increase in the demand for local services.

Third, there are offsetting general equilibrium effects on wages and prices, which ultimately depend on the elasticities of local labor and housing supply. The citywide increase in labor costs generated by the shock to x_1 causes a decline in the supply of local services.[2] This decline partially—but not fully—undoes the effect of the increase in demand for local services. Effectively, the addition of jobs in x_1 partially crowds out jobs in other industries. If labor supply is locally very elastic, this crowding out is more limited and the increase in labor costs is small, making the multiplier larger.[3]

Multiplier for the Tradable Sector.—The shock to industry x_1 may also affect employment in *tradable* industries $x_2, x_3, \ldots, x_K$ although the direction of the effect is a priori unclear. This effect is governed by three different forces. First, and most important, the citywide increase in labor costs hurts employment in $x_2, x_3, \ldots, x_K$. Because these are tradable industries, the increase in production costs lowers their competitiveness. Unlike the case of nontradable goods,

[2] This decline is further exacerbated by the increase in the cost of land caused by the increase in population.

[3] In the extreme case where local labor supply elasticity is infinite, nominal wages in the city do increase, but only to compensate workers for the higher cost of housing, so that real wages remain constant. In this case, the decline in the supply of nontradables is limited, and the increase in the demand for local services is driven only by the increase in number of workers in the city.

the price of tradable goods is set on the national market and cannot adjust to local economic conditions. In the long run, some of the production in these industries is likely to be shifted to different cities. Second, the increase in production of x_1 may increase the local demand for intermediate goods and services. This effect depends on the geography of the industry supply chain. While many industries are geographically clustered, the magnitude of this effect is likely to be quantitatively limited if the market for x_2, $x_3, \ldots, x_K$ is truly national.[4] Third, if agglomeration economies are important, the increase in production in sector x_1 may result in more local agglomeration (see, for example, Greenstone, Hornbeck, and Moretti forthcoming). [5]

State and local governments spend considerable public resources to finance regional economic development policies. To estimate the economic impact of these policies, state and local governments typically use estimates of local multipliers based on local Input-Output tables. This simple framework shows that Input-Output tables are unlikely to produce meaningful estimates of local multipliers. First, they completely miss the employment effect for nontradables. Second, they miss the job losses in the tradable sector caused by increases in labor costs and any of the jobs gains caused by agglomeration economies.

Relationship with National Multipliers.—The multiplier for the nontradable sector measured locally is an upper bound for the national multiplier. The reason is that due to geographical mobility, labor supply is arguably more elastic at the local level than at the national level. Higher elasticity implies that less crowding out takes place at the local level than at the national level. In the extreme, when labor supply elasticity equals zero, any increase in the number of jobs in a sector comes at the expense of another sector, so the multiplier must equal one. The multiplier for the tradable sector measured locally is a lower bound for the national multiplier. By definition, the market for tradables is national, and much of the additional local demand is likely to benefit other cities. Additionally, the negative effects of higher labor costs are more significant locally than nationally.

[4] Consider, for example, the automotive industry. While some of the car parts used in establishments located in Detroit may be produced in Detroit, most of the parts are likely to come from other states and from abroad.

[5] A shock to the nontradable sector has similar implications. The predictions for employment in the tradable sector are more negative, if an increase in nontradable jobs generates limited agglomeration spillovers for tradable industries.

II. Empirical Estimates

Using data from the 1980, 1990, and 2000 Census of Population, I estimate variants of the following models:

$$(1) \qquad \Delta N_{ct}^{NT} = \alpha + \beta \, \Delta N_{ct}^{T} + \gamma \, d_t + \varepsilon_{ct}$$

$$(2) \qquad \Delta N_{ct}^{T1} = \alpha' + \beta' \, \Delta N_{ct}^{T2} + \gamma' \, d_t + \varepsilon'_{ct}$$

where ΔN_{ct}^{T} and ΔN_{ct}^{NT} are the change over time in the log number of jobs in city c in the tradable and nontradable sector, respectively; ΔN_{ct}^{T1} is the change in the log number of jobs in a randomly selected part of the tradable sector; and ΔN_{ct}^{T2} is the change in the log number of jobs in the rest of the tradable sector. The sample includes two observations per city, corresponding to the periods 1980–1990 and 1990–2000. d_t is an indicator for the second period. Standard errors are clustered at the city level. In practice, ΔN_{ct}^{T} is measured using changes in manufacturing employment, while ΔN_{ct}^{NT} includes all other industries excluding agriculture, mining, government and the military.

To isolate exogenous shifts in the demand for labor in the manufacturing sector, I use as an instrument the weighted average of nationwide employment growth by 77 narrowly defined industries within manufacturing, with weights reflecting the city-specific employment share in those industries at the beginning of the period. For the 1980–1990 period, the instrument is $\sum_j \omega_{jc} \, \Delta N_{jt}^{T}$ where ω_{jc} is the share of manufacturing jobs in industry j in city c in 1980; and ΔN_{jt}^{T} is the nationwide change in employment between 1980 and 1990 in industry j among all manufacturing industries. Consider, for example, two cities that have the same share of manufacturing jobs in 1980, but a different industry mix within manufacturing. If employment in a given industry increases (decreases) nationally, the city where that industry employs a larger share of the labor force experiences a positive (negative) shock to the labor demand in manufacturing.

Table 1—Local Multipliers for Tradables and Nontradables

	Elasticity OLS	Elasticity IV	Additional jobs for each new job
Model 1			
Effect of tradable on nontradable	0.554 (0.036)	0.335 (0.055) [8.2]	1.59 (0.26)
Model 2			
Effect of tradable durable on nontradable	0.283 (0.039)	0.006 (0.138) [3.21, 5.52]	0.73 (1.73)
Effect of tradable nondurable on nontradable	0.290 (0.024)	0.250 (0.072) [8.53, 2.57]	1.89 (0.54)
Model 3			
Effect of tradable on other tradable	0.546 (0.069)	0.176 (0.156) [9.1]	0.26 (0.23)

Notes: Standard errors clustered by city in parentheses. First-stage *p*-values in brackets.

The previous section indicates that an exogenous increase in employment in a tradable industry should result in an increase in local employment in the nontradable sector. The first row in Table 1 shows estimates of β. The OLS and IV elasticities are 0.55 and 0.33, respectively. The latter indicates that a ten percent increase in the number of manufacturing jobs in a city is associated with a 3.3 percent increase in employment in local goods and services. Since there are almost five nontradable jobs for each tradable job, the IV estimate implies that for each additional job in manufacturing in a given city, 1.59 jobs are created in the nontradable sector in the same city (column 3). When I split the manufacturing sector into durable and nondurable goods, I find a significantly larger elasticity for the latter (Model 2). A finer subdivision of the manufacturing sector into more narrowly defined industry groups is also possible.[6] Among the industries for which IV estimates are identified, the high tech sector—here approximated by Machinery and Computing Equipment, Electrical Machinery and Professional Equipment—generates the largest number of additional nontradable jobs: 4.9.

The theoretical framework above indicates that the employment effect on the tradable sector should be quantitatively smaller than the effect on the nontradable sector, and possibly even negative, unless agglomeration spillovers are large or the supply of intermediate inputs is highly localized. To test this prediction, I randomly divide the 77 manufacturing industries in two groups. Using a version of the shift-share instrument that is group-specific, I then estimate β in equation 2. Consistent with the theory, Model 3 in Table 1 indicates that the estimated elasticity appears economically low and not statistically different from zero. Employment increases in parts of the tradable sector seem to have no discernible effect on other parts of the tradable sector.

In columns 1 to 3 of Table 2, the effect of adding skilled manufacturing jobs is allowed to differ from the effect of adding unskilled manufacturing jobs. Here I define skilled workers as those with some college or more, and unskilled workers as those with high school or less. Using a version of the shift-share instrument that is skill-specific, I find that the elasticity is significantly larger for skilled labor. Column 3 indicates that one additional skilled job in the tradable sector generates 2.52 additional jobs in the nontradable sector. The corresponding figure for unskilled jobs is 1.04. While the estimates are not very precise, they are consistent with the fact that skilled jobs pay higher earnings than unskilled jobs and therefore generate more demand for local goods and services.

In columns 4 to 9, I estimate a model of the form $\Delta N_{ct}^{K,NT} = \alpha + \beta^{S}\,\Delta N_{ct}^{S,T} + \beta^{U}\,\Delta N_{ct}^{U,T} + \gamma\,d_t + \varepsilon_{sct}$, where the superscripts S and U denote skilled and unskilled jobs, respectively,

[6] In this case, I use a version of the shift-share instrument that is sector-specific. Identification comes from the fact that there are multiple industries within each industry group. Empirically, IV estimates are not identified for all groups.

TABLE 2—LOCAL MULTIPLIERS, BY SKILL LEVEL

	Dependent variable								
	All nontradable			Nontradable—skilled			Nontradable—unskilled		
Independent variable	Elast. OLS (1)	Elast. IV (2)	Addit. jobs (3)	Elast. OLS (4)	Elast. IV (5)	Addit. jobs (6)	Elast. OLS (7)	Elast. IV (8)	Addit. jobs (9)
Tradable skilled	0.287 (0.037)	0.257 (0.157)	2.52 (1.54)	0.420 (0.044)	0.208 (0.176)	2.03 (1.72)	0.109 (0.039)	0.030 (0.172)	0.296 (1.68)
Tradable unskilled	0.292 (0.033)	0.115 (0.109)	1.04 (0.99)	0.125 (0.042)	−0.010 (0.133)	−0.09 (1.21)	0.510 (0.037)	0.367 (0.117)	3.34 (1.06)

and $K = \{S, U\}$. Columns 6 and 9 indicate that adding a skilled job in the tradable sector generates two skilled jobs and no unskilled job in the nontradable sector, while adding an unskilled job in the tradable sector generates 3.3 unskilled jobs and no skilled job in the nontradable sector. In interpreting these estimates, one should keep in mind the general equilibrium effect on relative wages. An increase in the demand for skilled workers in the tradable sector, for example, will affect relative wages because it raises the wage of skilled workers in both sectors as well as the wage of unskilled workers because of imperfect substitution.

Finally, I estimate separate elasticities for each industry within the nontradable sector. This amounts to re-estimating equation 1 using the industry-specific change in employment as the dependent variable. I find that employment increases in the tradable sector have the largest percent effect on employment in construction, wholesale trade and personal services.

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