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Geographic redistribution of US manufacturing and the role of state development policy

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ABSTRACT

Competition among state and local governments to lure businesses has attracted considerable interest from economists, as well as legislators and policy makers. This paper quantifies the role of plant relocations in the geographic redistribution of manufacturing employment and examines the effectiveness of state development policy. Only a few studies have looked at how manufacturing firms locate their production facilities geographically; they have used either small manufacturing samples or small geographic regions. This paper provides broader evidence of the impact of plant relocations using confidential establishment level data from the US Census Longitudinal Research Database (LRD), covering the full population of manufacturing establishments in the United States over the period from 1972 to 1992. This paper finds a relatively small role for relocation in explaining the disparity of manufacturing employment growth rates across states. Moreover, it finds evidence of very weak effects of incentive programs on plant relocations.

1. Introduction

Many state and local governments have used economic development incentives to influence business relocation, expansion, or start-ups. Over the past three decades, state and local governments have continued to expand their economic development activities with a variety of tax and financial incentive programs, replicating one another's programs. These efforts to foster economic stimulation, once characterized as smokestack chasing, usually involve the provision of various incentive packages to businesses in an attempt to induce them to relocate into or expand within the state. Despite the large amount of attention and resources that policymakers have devoted to these programs, there is little systematic empirical evidence concerning the cost-effectiveness and impact of such business incentives.

While the location decisions of manufacturing firms may have major consequences for the ability of local governments to raise revenue and provide services, there has been relatively little research on whether state and local governments can influence the relocation decisions which firms make. Although some studies such as Carlton (1983) and Gabe and Kraybill (2002) have examined plant locations, firm births, or plant expansions, they do not explicitly consider the relocation decisions of existing firms. Mainly because of the unavailability of data, no empirical research has examined patterns of firms relocating production facilities across locations in the face of legislative changes that affect the business climate. Given that the most common targets of state and local incentives are new branch plants of large firms (much of the popular debate over economic development incentives has focused on highly publicized "firm specific incentives"), empirical evidence concerning the degree of mobility or responsiveness of firms to state development incentives is essential to legislators crafting such incentive programs. I address this need by providing summary measures of the patterns of location changes in US manufacturing industries and by examining the effects of state economic development incentives on the growth of manufacturing plants in the United States over the period from 1972 to 1992.

As an initial step, I summarize the patterns of plant relocations in US manufacturing industries and examine the importance of relocations on the growth of local labor markets. Previous studies using aggregate data sources at the industry level document a clear movement of economic activity from the Rust Belt to Sun Belt states (Blanchard and Katz, 1992; Crandall, 1993; Newman, 1983; Topel, 1986). However, very little is known about the role of manufacturing firms in the geographic redistribution of manufacturing industries across states. Most of these studies—which are based on regional changes in output and employment at the aggregate level rather than on geographic shifts of individual firms' production facilities—do not provide insights into the importance of relocation,

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specifically to what extent the relocation of individual establishments explains geographic shifts of US manufacturing industries.

So far, research on relocation has focused mainly on the urban economic aspects of the decision, using either relatively small samples from the manufacturing sector or small geographic regions. Burns (1977) indicates that vertical movers (relocations from central cities to suburbs) are attracted by lower expenses, while horizontal movers (relocations between cities) are more interested in factors reflecting agglomeration economics. Erickson and Wasylenko (1980) find the availability of a labor force and other agglomeration economic factors to be the main reasons for vertical relocations of firms in Milwaukee and its suburbs. Using privately constructed data from some plants around Cincinnati, New England, and nationally within the Fortune 500 group, Schmenner (1980, 1982) finds that the typical moving of a plant is characterized by managerial considerations and space problems. While these studies provide valuable insights into business relocation, their limited samples can hardly represent US manufacturing plants as a whole, and their methods are subject to the limitations of survey research, such as discussed in Barkley and McNamara (1994).

Compared to previous studies, I provide broader evidence about the patterns of plant relocations and the role of state development incentive programs. I employ confidential data from the US Bureau of the Census, covering the universe of manufacturing establishments present in the US. Using individual plant and firm level data collected in the last five Censuses of Manufactures from the Longitudinal Research Database (LRD), I identify and measure relocations in US manufacturing between 1972 and 1992. In this paper, I focus on a multi-unit firm's plant relocation, the case in which an incumbent firm opens a new plant that produces the same product (i.e. in the same four-digit industry), by shifting its production processes from one location to another.

I also investigate job creation and destruction caused by plant relocations in order to examine the extent to which job flows across geographic units are explained by firms' reallocating jobs between plants. Numerous studies about job reallocations in US manufacturing have documented the fact that labor markets are characterized by large and pervasive job flows among establishments. However, most of these studies have focused on employment at individual plants; therefore, little is known about job flows between firms or the role of firms in job creation and destruction. As an initial study, Schuh and Triest (1999) provided new evidence about the role of firms and corporate reorganization in the determination of job creation and destruction. I quantify the role of plant relocations in the geographic redistribution of manufacturing employment across states in the United States and investigate the ways in which the pattern of relocation differs between growing and declining regions.

To assess the effectiveness of state development policy, I estimate a multinomial logit model for a plant's decision to shut down, relocate, or continue in the same location. I use the listings of economic development programs collected annually by Conway Data, Inc. in the "50 States Legislative Climate Survey" of the Site Selection and Industrial Development (1967–1997), to examine whether incentive programs are successful in retaining the businesses in the state. Although a modest amount of research has focused on economic development incentives, relatively little is known about how firms respond to these incentives. So far, most of these studies have focused on the aggregate employment growth at the regional and industry level. For example, de Bartolome and Spiegel (1997) find that economic development expenditures by the state are related to a significant degree to the growth of manufacturing industries. In a study examining employment growth in 37 industries across metropolitan statistical areas, O'Huallachain and Satterthwaite (1992) find that job growth is positively correlated with the presence of targeted economic development programs, such as enterprise zones and university parks.[1] This paper complements previous studies concerning the effect of state fiscal policies on new plant births by providing insights into the ways in which factors affecting business location decisions influence plant turnover and relocation decisions.

In Section 2, I construct measures of entry, exit, and relocation and summarize empirical findings on plant entry, exit, and relocation. I report the average level of entry, relocation, and exit rate and relative sizes of entrants, relocated plants, and exiting plants across the continental states for each 5-year period between census years. Over a typical 5-year period, I find more than nine percent of closed multi-unit plants are relocated to other states. For every 100 new plants opened in a state over a 5-year period, more than 10 plants turn out to be relocating from other states.

Furthermore, I investigate the impact of plant turnovers and relocations on local labor markets by examining how much of the employment growth in each state can be explained by the four distinctive phases of individual plants, that is birth, growth, death, and relocation. Although net employment gains from plant relocations are higher for growing states, I find large offsetting employment flows caused by plant relocations in both growing and declining states. I find plant relocations within the same firm account for about seven percent of the variation in employment growth rates across states during the sample period. Overall, relocations of individual firms play a relatively small role in explaining geographic redistribution of the manufacturing employment.

In Section 3, I examine the effects of state development policy on geographic redistribution of manufacturing industries. First, I briefly describe the tax and financial incentive programs that I examine in this study. I fit the relocation decisions of existing plants to a standard discrete choice model in order to examine the effectiveness of these state development policies in retaining businesses in state. I also examine the effects of these policies on plant-level employment growth. Overall, I find very weak evidence of the role of tax and financial incentives in explaining the patterns of plant relocations.

2. Patterns of entry, exit, and relocation

Recently available business data from numerous national census bureaus allow researchers to generate a great number of stylized facts on the entries and exits of businesses (see Caves, 1998). As most research has been focused on industry differences, however, knowledge of the geographic distribution of births, growth, and deaths of individual businesses is still quite limited. In this section, I describe how manufacturing firms have relocated their production facilities across geographic areas, directing attention to entry, relocation, and exit patterns in the 48 contiguous states and the District of Columbia. First, I define relocation and discuss possible issues that may occur in identifying relocation. Following Dunne et al. (1988), I construct summary measures of entry, relocation, and exit, as well as their sizes relative to other plants in the state. Previous literature on entry and exit ignores the possibility that plants can be reopened (relocated) after shutting down. I distinguish the entry due to relocation from the entry of *de novo* plants—new plants unrelated to the relocation of incumbent plants—, and exit due to relocation from *permanent* exit—shutting down a plant without relocating the production processes to any other new plant.

[1] See Bartik (1991), Fisher and Peter (1997), and Newman and Sullivan (1988), for a survey of previous research.

2.1. Measuring plant relocation with the census of manufactures data

The plant-level data used in this study are taken from the Census of Manufactures (CM) maintained by the Center for Economic Studies (CES) at the US Bureau of the Census. The CM, which is taken every 5 years, contains data on output and detailed information on the factors of production and costs, such as the levels of capital, labor, energy and materials used as inputs, for individual manufacturing establishments. An important feature of the CM is its plant classification and identification information including firm affiliation, location, product, industry, and various status codes which identify birth, death, and ownership changes. These identifying codes—permanent plant number (PPN) or firm ID—are used in developing the longitudinal linkages of individual plants or firms.

In this study, I use the five CM files (1972, 1977, 1982, 1987 and 1992) on 300,000–400,000 plants to develop measures of relocation for each establishment. Since the CM covers the universe of manufacturing plants in the US, the measurement of entry and exit is likely to be more reliable when full CM files are used. Because the CM is only taken at 5-year intervals, however, it is not possible to observe plants that enter and also exit or relocate between two consecutive census years.[2]

To examine which states have experienced frequent relocations relative to others, I construct summary measures of entry, exit, and relocation. Throughout this paper, entry, relocation, and exit are measured as plant opening or closing—entry into or exit from a state. Entry is defined as the opening of an establishment that was not operating in a location in the previous censuses ($t \leqslant t-5$), but is operating in the current census. Exit is defined as the closing of an establishment that was operating in a location in the previous census ($t-5$), but is not operating in the current (t) and later censuses ($t \geqslant t+5$).[3]

Relocation is defined as a firm's geographic shift of production processes.[4] For example, a firm with a plant in New Jersey opens a new plant in Pennsylvania producing the same product (four-digit industry) as a previously existing plant in New Jersey. This process can occur either when a firm expands into a new geographic market by opening a branch plant or when changes in the economic environment results in the movement of an establishment to a new location. In the first case, the firm will keep the production in the original location, while in the second case, it will probably shut down or contract the original plant. In this study, I focus mainly on the second case, complete relocation of a production process from one location to another. To distinguish relocation, as distinct from simple expansion, I classify a shift of production processes as relocation only when a previously existing plant in the original location shut down before the following census year.[5] In addition, for a new plant to be considered a relocated plant, it should be located in a "new location" away from the "original location" of the plant. In this paper, a new plant is considered to have relocated only when it is moved outside the state.[6] However, since the Census of Manufactures only covers establishments in the US, plants moved outside the country are not identified in the data.[7] I label a previously existing plant in the original location—one that was operated by the same firm *before* the firm shifted production processes—as the *origin* plant and a new plant *after* relocation as the *destination* plant.

2.2. Entry, relocation, and exit statistics across states

Table 1 reports the average rates of entry, relocation, and exit across states between each pair of census years, along with the average sizes of those plants. On average, about 25% of multi-unit plants (41% of all plants) operating in each state in each census year are new plants that were not in production in that state in the previous census year. I find that an average of 12% of plant openings in each state are accounted for by relocations from other states. The average ratios of relocation to entry vary from 0.108 to 0.133 across census years.[8]

To assess the relative importance of origin and destination plants in the labor market, I measure the relative size of origin and destination plants compared to existing plants in the state. For entering plants and destination plants, I examine the average size of entrants and destination plants in new locale relative to existing plants in that locale (*Entrant Relative Size* and *Relocation New Locale Relative Size*), as well as the average size of destination plants (in new locale) relative to other non-relocated entrants (*Relocation New Locale Relative Size compared to Entrants*). A pattern similar to that observed in studies of entry and exit across industries is present. I find that the average size of entrants is less than the average size of incumbents, which is consistent with Dunne et al. (1988), as well as with Cable and Schwalbach (1991). The sixth row of the table indicates that destination plants are 43% of the size of incumbents. Compared to non-relocated entrants, however, destination plants are shown to have larger work forces. On average, destination plants hire 37.5 percent more workers than do *de novo* entrants as seen in the last row of the top half of the table.

The exit variables in the bottom panel of Table 1 reveal a pattern similar to that observed in entry variables. On average, less than 3% of plants operating in a state are relocated to other states in a given census year. Origin plants that are relocated out of state after being shut down account for $7.8 \sim 12.2\%$ of plant closings across states in each census year. The average size of destination

[2] Entry, exit, and relocation rates across adjoining census years may underestimate the actual number of entries, exits, and relocations. For a more complete description of the LRD, see Davis et al. (1996) and McGuckin and Pascoe (1988).

[3] Note that this measure is different from entry and exit measures in industry level study (i.e., in and out of a product market), where definition of entry and exit includes entry and exit of an existing (continuing) establishment by changing the mix of products they produce between two census years as well. Since I am interested in firm's location choice and the impact of plant turnover on the location involved, I focus on entry and exit by plant opening and closing. Since entering plants between $t-5$ and t are not observed in the previous Census ($t-5$), entry is measured at time t (i.e., what percentage of plants in a given state are new plants that have entered during each 5-year time period). Similarly, since exiting plants are not observed at time t, exit is measured at time $t-5$ (i.e., what percentage of plants in a given state exit during each 5-year time period).

[4] An establishment in the CM is given a unique plant identification number (PPN). Since PPN usually changes when a plant changes its location, I track the firm identification number (firm ID), which is assigned to only multi-unit establishments. Using the firm ID, I keep track of locations of all plants that belong to the individual firm. Since single unit plants are not given separate firm ID, it is not possible to identify relocation of single unit plant with currently available LRD.

[5] Most studies in the literature focus on complete relocation (Miller, 1984; Neumark et al., 2005). I also exclude partial relocation of production, in which existing plants in the original location contract their activity but keep operating. This measure of relocation does not capture relocation of employment between two continuing plants (e.g., relocating 30% of workers in plant A to plant B). While such instance of relocation may be an important source of redistribution of production process within a firm, it is not easy to distinguish employment changes due to relocations from those due to simple expansion or contraction. For this reason, I focus on relocation at the extensive margin, which involves opening of new plant and shutdown of existing plant.

[6] While I focus on relocations across states, I separately examine relocations within the state to distinguish relocated plants from de novo entrants or permanent shutdowns. Since the focus of this paper is relocations across states, relocation rates in this paper measure "out-of-state" relocation rates unless specified otherwise.

[7] Those plants would be counted as permanent shutdown in this paper.

[8] Note that there are four different relocation rates measuring relocation. *Relocation Rate New Locale*$_i(t)$ and *Relocation Rate Old Locale*$_i(t-5)$ respectively measure how many plants opened or closed due to relocations among the total number of plants. The other two relocation rates (*Ratio of Relocation to Entry*$_i(t-5)$ or *Ratio of Relocation to Exit*$_i(t)$) measure the fraction of original (or relocated) plants among opening (or closing) plants.

Table 1
Entry, exit, and relocation variables in manufacturing (averages of 49 states)

	All years pooled	72–77	77–82	82–87	87–92
Entry Rate					
all plants	0.408	0.448	0.393	0.383	0.408
multi-unit plants	0.245	0.294	0.214	0.234	0.237
Out-of-State Relocation Rate New Locale					
	0.029	0.032	0.029	0.031	0.026
Ratio of Out-of-State Relocation to Entry					
	0.120	0.108	0.133	0.128	0.109
Entrant Relative Size					
	0.347	0.295	0.320	0.356	0.416
Relocation New Locale Relative Size					
relative to incumbents	0.430	0.385	0.415	0.419	0.500
relative to other entrants	1.375	1.399	1.378	1.228	1.496
Exit Rate					
all plants	0.371	0.357	0.403	0.354	0.368
multi-unit plants	0.264	0.226	0.255	0.293	0.282
Out-of-State Relocation Rate Old Locale					
	0.026	0.029	0.026	0.023	0.026
Ratio of Out-of-State Relocation to Exit					
	0.098	0.122	0.099	0.078	0.095
Exiting plant Relative Size					
	0.364	0.319	0.295	0.411	0.431
Relocation Old Locale Relative Size					
relative tocontinuing plants	0.451	0.467	0.321	0.486	0.529
relative to other exiting plants	1.413	1.648	1.187	1.296	1.527

Note: Only multi-unit plants are included in the analysis except entry and exit rate for all plants.
Entry Rate $= \frac{\text{the number of opening plants in state } i}{\text{the total number of plants in state } i}$,
Relocation Rate New Locale $= \frac{\text{the number of relocated (destination) plants in new locale}}{\text{the total number of plants in state } i}$,
Ratio of Relocation to Entry $= \frac{\text{the number of relocated (destination) plants in new locale}}{\text{the number of opening plants in state } i}$,
Entrant Relative Size $= \frac{\text{average size of entrants}}{\text{average size of continuing plants}}$,
Relocation New Locale Relative Size $= \frac{\text{average size of relocated plants}}{\text{average size of continuing plants [or de novo entrants]}}$.
The statistics for exiting plants are calculated in a similar way.

plants is less than the average size of continuing plants but is greater than that of non-relocated closing plants. In general, origin plants hire less than half the workers hired by average-sized incumbent plants in the same state, but they employ 40% more workers than closed plants that have not been relocated.

In order to explore how patterns of entry, relocation, and exit differ across the United States, I present in Table 2 the average values of entry, exit, and relocation rates over the four time-period observations. An interesting pattern thereby revealed is the similarity between the average entry and exit rates across states. As expected from previous research using the aggregated data, growing states in the South and West have relatively higher entry rates compared to states in the Rust Belt and Midwest. However, the average exit rates are also higher in these states with higher entry rates. This suggests that growing states in the South and West have as many plant closings as openings, while states in the Rust Belt and Midwest have relatively fewer plant closings during the sample period.

This similarity across states is stronger for relocation rates than it is for entry and exit patterns. The simple correlation between the average relocation rates in new locales and the average relocation rates in old locales is 0.816, while the simple correlation between the average entry rates and the average exit rates is 0.473. In general, a state with a higher average relocation rate for new locales (entry) also has a higher average relocation rate for old locales (exit). The simple correlation between the average ratios of relocation to entry and the average ratios of relocation to exit is 0.866. However, the pattern of relocation rates shows a different picture from that of entry and exit rates. Although relocation rates of entrants are lower in declining states in the Rust Belt, Middle Atlantic, and North Central Census divisions, they are not always high in growing states in the South and West. For example, while entry rates are low in North Carolina and South Carolina, a relatively large number of plants have moved to these states. On the other hand, higher entry rates in California, Texas, or Florida do not necessarily imply that these states have attracted many existing plants from other states. In the case of closing plants, exit rates are higher in the Pacific and Mountain Census divisions, but the ratios of relocation to exit are relatively lower, suggesting that these states did not lose many plants to other states. In contrast, while a small fraction of plants have shut down in the Rust Belt, a large fraction of plants shutting down in Indiana and West Virginia have actually relocated to other states.

This pattern is clearly observed in Table 3, which presents a transition matrix of relocation flows across Census divisions, and in which I report the fraction of relocated plants moving from the Origin (row) to the Destination (column). The diagonal of the matrix shows the fraction of relocated plants that stayed within the same Census division while the off diagonal of the matrix represents the fraction of relocation across Census divisions. While New England and the Middle Atlantic suffered from plants losses, with smaller share of plants moving into the area than the share moving out, the South Atlantic, West South Central, and Pacific divisions have attracted a relatively large number of plants from all across the country. In fact, the South Atlantic (in column (5)) shows a slightly higher share than the other off diagonal columns in each row, suggesting that a relatively higher percentage of relocated plants chose the South Atlantic as their new production site. Three other findings are worth mentioning. First, there exist a lot of relocations from one census division to another. Contrary to previous

Table 2
Entry, exit, and relocation rates (means across years, 1972–1992)

Census region	Census division	State	Entry rate	Exit rate	Ratio of relocation to entry	Ratio of relocation to exit
Northeast	New England	Maine	0.209	0.260	0.112	0.060
		New Hampshire	0.245	0.279	0.141	0.094
		Vermont	0.213	0.226	0.144	0.066
		Massachusetts	0.212	0.307	0.079	0.081
		Rhode Island	0.228	0.318	0.059	0.057
		Connecticut	0.206	0.276	0.087	0.099
	Middle Atlantic	New York	0.203	0.340	0.062	0.079
		New Jersey	0.219	0.322	0.105	0.084
		Pennsylvania	0.192	0.254	0.092	0.071
Midwest	East North Central	Ohio	0.190	0.228	0.079	0.087
		Indiana	0.218	0.223	0.115	0.107
		Illinois	0.189	0.254	0.081	0.096
		Michigan	0.212	0.261	0.060	0.083
		Wisconsin	0.198	0.200	0.086	0.065
	West North Central	Minnesota	0.235	0.265	0.076	0.080
		Iowa	0.199	0.194	0.132	0.098
		Missouri	0.210	0.243	0.126	0.121
		North Dakota	0.257	0.249	0.174	0.118
		South Dakota	0.255	0.213	0.097	0.066
		Nebraska	0.189	0.220	0.121	0.140
		Kansas	0.243	0.248	0.121	0.107
South	South Atlantic	Delaware	0.222	0.222	0.197	0.121
		Maryland	0.231	0.282	0.116	0.094
		District of Columbia	0.378	0.446	0.082	0.187
		Virginia	0.231	0.220	0.141	0.090
		West Virginia	0.199	0.245	0.168	0.139
		North Carolina	0.230	0.211	0.129	0.073
		South Carolina	0.216	0.193	0.156	0.077
		Georgia	0.249	0.229	0.128	0.104
		Florida	0.299	0.298	0.111	0.090
	East South Central	Kentucky	0.219	0.201	0.156	0.105
		Tennessee	0.221	0.219	0.132	0.099
		Alabama	0.226	0.218	0.125	0.108
		Mississippi	0.223	0.202	0.163	0.103
	West South Central	Arkansas	0.215	0.207	0.180	0.099
		Louisiana	0.237	0.264	0.115	0.118
		Oklahoma	0.270	0.270	0.113	0.095
		Texas	0.289	0.285	0.096	0.079
West	Mountain	Montana	0.226	0.275	0.132	0.150
		Idaho	0.227	0.264	0.175	0.158
		Wyoming	0.373	0.394	0.189	0.138
		Colorado	0.312	0.320	0.117	0.103
		New Mexico	0.339	0.319	0.132	0.115
		Arizona	0.334	0.297	0.136	0.090
		Utah	0.303	0.275	0.130	0.085
		Nevada	0.430	0.343	0.121	0.082
	Pacific	Washington	0.266	0.282	0.117	0.085
		Oregon	0.233	0.253	0.094	0.101
		California	0.271	0.317	0.059	0.070

Table 3
Transition matrix of relocations for the nine census divisions

		Destination								
	Census division	(1) NE	(2) MA	(3) ENC	(4) WNC	(5) SA	(6) ESC	(7) WSC	(8) MT	(9) PAC
Origin	New England	**24.3**	10.8	13.0	7.9	14.5	8.3	9.4	3.9	8.1
	Middle Atlantic	4.3	**29.4**	14.3	5.4	15.5	6.8	9.4	4.9	10.1
	E. North Central	3.5	9.2	**36.0**	8.3	14.0	6.7	9.9	4.4	7.9
	W. North Central	2.5	8.2	15.0	**31.1**	10.5	6.5	11.8	6.4	8.0
	South Atlantic	2.3	6.9	9.0	9.1	**42.0**	18.0	11.9	12.1	10.6
	E. South Central	2.9	6.9	12.8	5.9	20.1	**23.6**	13.8	4.7	9.4
	W. South Central	2.6	6.8	10.6	5.0	13.3	7.6	**35.4**	5.3	13.4
	Mountain	2.6	8.0	10.1	6.6	14.7	5.9	13.1	**24.1**	15.0
	Pacific	2.4	6.7	11.0	4.6	15.4	6.0	10.5	6.7	**36.8**

Table 4
Components of employment changes due to plant openings and closings

Census division	Employment gains by plant openings (percentage of total gains from plant openings)			Employment losses by plant closings (percentage of total losses from plant closings)		
	New plants (*de novo*)	Relocation within	Relocation in	Permanent shutdowns	Relocation within	Relocation out
New England	67.4%	16.5%	16.2%	82.7%	8.9%	8.8%
Middle Atlantic	68.6%	20.6%	10.9%	80.1%	9.5%	10.3%
E. North Central	69.7%	18.9%	11.4%	76.2%	11.3%	12.5%
W. North Central	68.8%	14.4%	17.3%	72.4%	11.7%	15.9%
South Atlantic	72.1%	12.4%	15.3%	80.4%	7.8%	13.3%
E. South Central	70.7%	7.1%	22.3%	83.7%	6.0%	10.3%
W. South Central	71.9%	10.5%	17.6%	79.7%	7.0%	13.3%
Mountain	68.8%	11.1%	19.6%	78.0%	7.7%	13.8%
Pacific	66.8%	14.9%	18.3%	79.1%	11.4%	9.4%

Notes: Averages of four 5-year periods between a pair of census years are reported (multi-unit plants only). "Relocation Within" includes employment changes from plant movements within the neighborhood of the plant (movement within a state) to distinguish employment changes in *de novo* entrants (or permanent shutdowns) from relocated plants.

finding of Schmenner (1980) and Miller (1984) that manufacturing firms usually move plant operations over short distances within states, I find that more than 50% of relocations occur across state borders.[9] This contrasting finding of relatively frequent out-of-state relocations is the result of the broader coverage of the data used in this study, in terms of its geographic scope. While such limitations may have led previous researchers to understate relocations, the use of the LRD enables this study to overcome such limitations found in previous studies. Second, while I find that some plants relocate over a long distance, relatively higher share of relocations occur within neighboring states. I find that a firm is more likely to keep a large portion of existing jobs in a nearby location by relocating bigger plants over shorter distances while relocating smaller ones over longer distances. Third, although plants tend to relocate from declining states into growing states, there are relatively large offsetting flows from growing states to declining states.

A natural question that arises regarding entry and exit rates across states concerns the impact on employment growth of the entry, relocation and exit of businesses. Although entry and exit rates show a high correlation across states, I find that employment growth rates across states in each census year are positively correlated with entry rates and negatively correlated with exit rates.[10] Overall, states with higher employment rates in manufacturing industries have relatively more plants built on their territory—whether these are *de novo* or relocated plants—than they have plants that shut down or relocate to other states.

2.3. *Quantifying the role of relocations in employment growth*

Overall, plant openings and closings respectively account for approximately half of the employment gains and losses in each state for each 5-year period. If I focus on plant openings and closings for multi-unit firms, I find that jobs created from the openings of multi-unit plants account for 24 percent of total employment gains in each state for each 5-year period. On average, the jobs lost from the closings of multi-unit plants account for 29 percent of total employment losses in each state for each 5-year period. To examine how much of these employment changes are attributable to relocations across states, I break down total employment gains from multi-unit plant openings into employment gains from *de novo* plant births, relocations within a state, and relocations between states. In the same way, I break down total employment losses from multi-unit plant closings into employment losses from permanent deaths without relocation, relocations within a state, and relocations between states.

Table 4 presents the average values of these variables—the percentages of employment gains (losses) from multi-unit plant births (deaths), relocations within states, and relocations between states—over the four 5-year periods for all states within a Census Division. The percentages of employment gains from plant relocations are a bit lower in states with a traditional manufacturing base, such as those in the Middle Atlantic and East North Central divisions. In the East North Central division, new jobs created from relocations across states account for 11.4 percent of employment gains from multi-unit plant openings in each state. In other words, for every 100 jobs created from new multi-unit plants built in a state in the East North Central division, 11.4 jobs on average are imported from other states. The percentage of employment losses from multi-unit plant closings accounted for by plant relocations across states ranges from a low of 8.8 in states in the New England division to a high of 15.9 in the West North Central division. This means that on average 15.9 jobs are exported to other states for every 100 jobs lost from multi-unit plant closings in a state in the West North Central division.

To examine how much the relocation of manufacturing firms explains variations in employment changes across states, I decompose changes in employment for each state into the following:

$$\underbrace{\Delta E}_{\text{Total Employment Changes}} = \underbrace{\left\{|Opening| + |Expansion| - |Contraction| - |Closing|\right\}}_{\text{Changes Within State}} + \underbrace{\left\{|Reloc\_In| - |Reloc\_Out|\right\}}_{\text{Changes Between States}} = \underbrace{\Delta Ew}_{\text{Employment Changes Within State}} + \underbrace{\Delta Eb}_{\text{Employment Changes Between States}}$$

where *Opening* and *Expansion* respectively measure employment gains due to plant openings (excluding out-of-state relocations) and expansions of continuing plants and *Closing* and *Contraction* respectively measure employment losses due to plant closings (excluding out-of-state relocations) and contraction of con-

[9] For example, Miller (1984), in a study using Dun & Bradstreet data, found that only 10 percent of relocated plants relocated to other census divisions between 1969 and 1975. Since these studies used data that fail to distinguish between establishments and firms, it is difficult to identify ownership transfers or relocations from the births and deaths of establishments. Such limitations of the data may lead to understate relocation.

[10] The simple correlation between net entry rates and net employment growth rates is 0.622. For relocation rates, although state employment growth rates are positively correlated with both the out-of-state relocation rates in new locales and the out-of-state relocation rates in old locales, net relocation rates—the former minus the latter—are also positively correlated with state employment growth rates (0.126).

Table 5
The roles of between-state and within-state employment changes in employment growth across states

	$\frac{Cov(\Delta Eb,\Delta E)}{Var(\Delta E)}$ Between-state changes	$\frac{Cov(\Delta Ew,\Delta E)}{Var(\Delta E)}$ Within-state changes
All years (1972–1992)	0.073	0.927
1972–1977	0.048	0.952
1977–1982	0.078	0.922
1982–1987	0.032	0.968
1987–1992	0.044	0.956

Note: Only multi-unit plants included.

tinuing plants. While these four terms reflect changes in employment within states, *Reloc_In* and *Reloc_Out* reflect changes between states due to relocations. *Reloc_In* measures employment gains from plant openings due to relocation into the state and *Reloc_Out* measures employment losses from plant closings due to relocation out of the state.

The following decomposition of the variance of total employment change (ΔE) quantifies the extent to which interstate plant relocations explain the variation of employment growths across states:

$$1 = \frac{Var(\Delta E)}{Var(\Delta E)} = \frac{Cov(\Delta E, \Delta Eb + \Delta Ew)}{Var(\Delta E)}$$
$$= \frac{Cov(\Delta Eb, \Delta E)}{Var(\Delta E)} + \frac{Cov(\Delta Ew, \Delta E)}{Var(\Delta E)}.$$

This decomposition is equivalent to examining the coefficients from independently regressing ΔEb (employment changes between states) and ΔEw (employment changes within a state), respectively, on ΔE (total employment changes). The results of this decomposition, reported in Table 5, provide an answer to the question concerning the importance of inter-state job reallocations within the same firm in accounting for differences in state employment growth; i.e., how many jobs are expected to be imported from other states (via plant relocations) and how many jobs are expected be created within the state, when one more job is created in one state relative to the mean of the other 48 states. On average, plant relocations account for about 7 percent of variations in net employment growth across states. The remaining 93 percent is accounted for by within-state changes such as employment growth within continuing plants, *de novo* plant openings, *permanent* closings without relocation, and intrastate plant relocations.

Overall, the employment shift of multi-unit firms via plant relocations accounts for only a small part of the disparity in employment growth across states. This result is not surprising, considering the fact that there may be little scope for job reallocations within firms, most of which own only one or two plants. Furthermore, the gross employment flows due to plant relocations did not consist primarily of the reallocation of employment from declining to growing states. The finding of large offsetting employment flows caused by plant relocations in both growing and declining states (see Table 3) suggests that manufacturing firms have relocated jobs from declining states to expanding states as well as from expanding states to declining states.

Results in this section must be interpreted with some caution since my estimates of employment changes caused by plant relocations are limited to those of multi-unit firms. Without further analysis of the behavior of single-unit firms, which unfortunately is impossible with the currently available LRD, it may be premature to draw a firm conclusion about the role of manufacturing firms' relocation in employment changes across states. However, single unit plants are more likely to be tied to a location for reasons such as the owner's personal ties to the given geographic area. Furthermore, given that job creation and destruction in multi-unit plants account for about 70% of the job reallocations in manufacturing industries (Davis et al., 1996), the finding of a relatively small role for plant relocations in explaining inter-state employment growth rates should hold even after accounting for the relocations of single unit plants.

3. The role of state development incentives

Since the 1970s, the number of states providing tax incentives to businesses has steadily increased. By 1992, more than 40 states offered tax concessions or credits to businesses for land and capital improvement, equipment and machinery, manufacturers' inventories, goods in transition, investment, and job creation. Over the past two decades, the number of states with financial-incentive programs has also increased. In 1992, more than 40 states offered special subsidized loans for building construction, equipment, machinery, or plant expansion especially in areas of high unemployment (see Fig. 1).

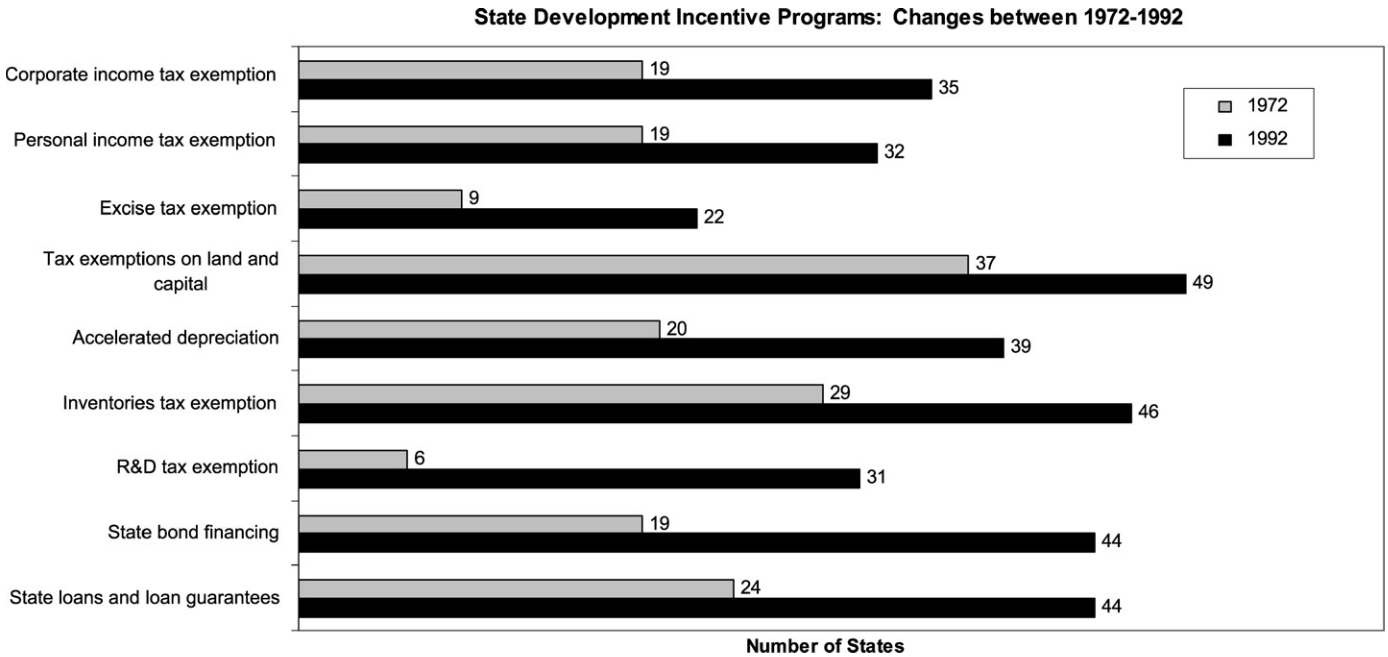
3.1. State development incentives

A critical problem faced by all studies that examine the economic impact of development incentives has been quantifying those incentives in a meaningful way. As used in many of these studies, crude measures of state and local development incentive efforts have been criticized for misrepresenting true development incentives (Fisher and Peter, 1997). One popular method of measuring development incentives is to create an index reflecting the number of state incentive programs provided to businesses (Carlton, 1983; Wasylenko and McGuire, 1985). Lacking measures of the generosity of the incentives offered, however, these studies are subject to the criticism that simple program counting measures may not represent a state or city's commitment to economic development. Moreover, most of these studies do not separately analyze various policy instruments, ignoring the possibility that some policies could have mutually counteractive effects on the economic conditions represented by dependent variables. For example, tax incentives on capital investment may induce firms to pursue labor-saving capital improvements, leading to a decrease in employment. Therefore, by failing to consider such contrary effects of individual policies, research that relies on the index measures may result in findings which are overly generalized and do not provide a detailed picture of the effects of the various policy instruments.

A small number of recent studies have tried to find better summary measures of state development efforts by using state agency spending from the NASDA (National Association of State Development Agency) database (de Bartolome and Spiegel, 1997; Goss, 1994). However, economic development expenditure data from the NASDA also have deficiencies. Most critically, they omit some crucial categories of economic development programs such as loan guarantees and loan subsidies. These loan-related programs, as well as other development credit programs, provide the most generous state incentives available, but are not included in state development agency expenditures since they involve few direct costs to the agencies. Moreover, the NASDA expenditure and salary survey data are only available for years since 1982 and, are not suitable for studies that examine earlier time periods.

In this paper, instead of simply counting the number of programs, I treat each individual incentive program as a dummy variable. Although this approach to measuring development incentives is open to the same criticism concerning counting measures, it allows a separate examination of the effects of individual programs.[11] Using the listings of economic development programs

[11] The indicator variable approach doe not properly measure the cost impact of individual incentives on plants. Fisher and Peter (1997) measures average magnitude



Source: Compiled and reclassified by the author from *Site Selection and Industrial Development*, Conway Data Inc.

Fig. 1. State development incentive programs.

cataloged annually by Conway Data, Inc. in the "50 States Legislative Climate Survey" of the Site Selection and Industrial Development (1967–1997), I identify states that have a certain set of tax or financial incentives during the sample period, over which the change of location is measured.[12] Then, I create an indicator variable for each incentive program, that indicator being equal to 1 if a state has that specific program over the five years covering the beginning of the sample period. In particular, I examine whether a policy was present during the last three years of the previous period and the first two years of the 5-year sample period (e.g., for the sample period between 1982 and 1987, the presence of policy is measured between 1979 and 1984).[13]

By measuring the presence of policy over a 5-year period, I can capture some policies that have been implemented during the 5-year sample period. However, I chose this 5-year window of policy measure to lead the 5-year sample period over which the change of location is measured for the following reasons. First, it takes time for a firm to respond to changes in policy. If the policy is introduced toward the end of the 5-year window, firms may not have enough time to respond to the policy (within the 5-year window of data collection). Although it is very difficult to determine the exact time lag of such a policy, I want to focus on changes in the policy that have occurred in the earlier part of the sample period and may have affected a firm's decision. Second, I can exclude policies that have been implemented in the later part of the sample period to avoid a possible endogeneity issue. Besides the problem of the time lag for a policy to produce results, a state that has lost many plants is more likely to introduce such policies to keep plants. There may exist an endogeneity issue, which may lead to a negative correlation between the policy dummies and the independent variable. Such endogeneity will become more an issue for policies that have been implemented in the later part of the sample period. In the empirical results that follow, I explore the following tax and financial incentives (see NASDA, 1983 for the detail of individual programs).

Corporate income tax exemption. The objective of tax programs is to keep the effective tax rates on businesses low. As with most other tax incentives, the characteristics of such programs vary across states. In 1972, Nevada, Ohio, Texas, and Wyoming did not collect corporate income tax. In 1992, firms located in South Dakota and Washington did not have to pay corporate income tax, in addition to those in Nevada, Texas, and Wyoming. In that year, the state government of Ohio, while collecting corporate income tax, gave a corporate franchise tax or personal income tax credit for a portion of personal property tax paid on new machinery or equipment. In many states, a corporate income tax credit is allowed for new or expanding plants creating new jobs or investing in excess of specified threshold levels.

Personal income tax exemption. Lowering effective personal income tax rates is an important business development tool because many small companies are not incorporated (e.g., sole proprietorships or partnerships) thus, their profits are taxed at the personal income rates of the owners. For noncorporate plants that hired new employees or made capital investments that meet a certain criteria, credit is allowed in a manner similar to that which is given against corporate income tax.[14] Moreover, personal income tax rates affect pre-tax wages, an important determinant of plant location decisions. To the extent that state personal income rates account for differences in pre-tax wages among the states, incentives on personal income tax may affect on plant location decisions. In 1992, seven states did not collect personal income tax.

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of economic development incentives in 24 states with the greatest manufacturing employment. However, my study covers most of the states in the US and it is very challenging to consistently measure the magnitude of individual program across all states over 20-year period.

[12] The District of Columbia is excluded from the analysis in this section since data on tax and financial incentives are unavailable for the sample periods.

[13] Given that the dependent variables represent changes in manufacturing activity, it is natural to examine the effects of innovations in state development policy. However, examining only the effects of changes in policies may be problematic, since it would not capture the impact of policies in force at that time. I also examined the presence of policy in the first two years of the 5-year sample period only but the results did not change much.

[14] For example, a tax credit equal to 5% of qualified capital invested in new production facilities (buildings or equipments) that are used for manufacturing, processing, assembling, or other specified activities in New York in 1982.

Excise tax exemption. In some states, tax credit has been expanded to apply to the excise taxes paid by corporations. In Tennessee, for example, businesses receive an excise tax credit equal to 1% of the purchase, installation and/or repair of qualified industrial machinery, as well as the purchase of telephone and computer related equipment.

Tax exemptions on land and capital. This variable indicates whether a state has introduced one of the following tax incentive programs: (i) Land and capital improvements tax exemption; (ii) Equipment and machinery tax exemption; (iii) Sales and/or use tax on new equipment exemption. By providing tax concessions for the installation of new and reconditioned machinery and equipment, states have long pursued a policy of encouraging the modernization of businesses to maintain and improve productive capability. The sales and/or use tax exemption on machinery and equipment is an incentive usually made available to new and expanding businesses, which use such equipment at a fixed location to manufacture, process, compound, or produce tangible personal property for sale, or for exclusive use in spaceport activities.

Accelerated depreciation. Accelerated depreciation lets businesses write off the costs of their machinery and buildings faster than they actually wear out. In practice, this incentive sharply lowers tax bills for individuals and corporations that can take advantage of tax breaks.

Manufactures' inventories tax exemption. Inventories are subject to property taxes in many states. Inventories on hand during the tax year might include not only finished products awaiting sale but also raw materials and component parts that will eventually become finished products. Since the majority of states include inventories as a component of the ad valorem property tax, the most frequent form of tax relief is an exemption from property taxes, or a separate classification for inventories resulting in a lower rate of property taxation.

Research and development tax exemption. R&D equipment may be classified as manufacturer's machinery and equipment and thus become eligible for tax exemptions. In some states, local governments may classify the tangible personal property of R&D firms as distinct from that of other taxpayers, taxing it at a different rate.

State bond financing. Bond financing permits state and local governments to issue tax-exempt municipal bonds to raise capital for public purposes. Because interest earned by investors is exempt from federal and, in some cases, state income taxes, municipal bonds are marketed by government entities at a rate of interest less than that of taxable corporate bonds. In this study, I examine the role of industrial revenue bonds and general obligation bonds. Industrial bonds are municipal bonds used to finance the construction of manufacturing or commercial facilities for a private user. While business revenues are the only security backing an industrial revenue bond issue, general obligation bonds have the full faith and credit of the government issuing the bond as a pledge of security. In the event of a default in payment of the bond principal and interest by the facility user, the state or local government would have to repay the outstanding principal and interest of the obligation bond from its revenues.

State loans and loan guarantees. Loans permit firms to borrow money directly from the state government or its agents such as economic development corporations and financial authorities. New or small firms without established lines of credit or credit ratings find state loan programs particularly advantageous. An example of a state loans program is the Community Economic Betterment Account (CEBA) program in Iowa, which provides financial assistance of up to 1 million dollars to companies that create new employment opportunities and/or retain existing jobs, and make new capital investment. Guarantees of loans by private or other government lenders are provide by some states to reduce the lenders' risk. Lenders, in turn, are encouraged to make loans that otherwise could not be made or to provide lower interest rates, making the loan feasible for the borrower.

The Conway data contain other economic development policies adopted in many state governments, such as the raw materials for manufacturing tax exemption, the job creation tax incentive exemption, the industrial investment tax incentive, and the inventory tax exemption on goods in transit. I exclude these incentives from the analysis because they were not available for the whole sample period or were used either in virtually every state or in only a few states, providing a poor basis for discrimination.

3.2. Decisions to stay, relocate, or shut down

One objective of the state economic development policy may be characterized as smokestack chasing, encouraging manufactures to relocate in the state, either from other states or from abroad. Early state development efforts focused on bringing new business establishments to the state since new plant openings created the most visible impact on communities by creating jobs and economic activity. Spurred largely by the experience of the Northeast and Midwest in their competition with southern and western states for new plants, many states have become increasingly aware of the importance of businesses already located within their boundaries. As states began to pay attention to the needs and potential of in-state businesses, an increasing number of states expanded their programs to cover in-state businesses, hoping to keep them within the state.

To examine how a state government's efforts to stem the outflow of businesses affect a firm's decision to shut down, relocate, or stay in the state, I employ the standard tool of discrete choice analysis: the multinomial logit. I assume that a firm decides either to shut down a plant permanently, to keep operating in the same state, or to relocate the plant to a new location outside the state. I choose to model the decision as an unordered choice with three alternatives that depend on plant and state characteristics: "Shut down (permanent exit)," "Stay," or "Relocate." The multinomial logit model used in estimation is

$$\Pr(y_{pt}=k) = \frac{\exp(\beta_k' X_{p,t})}{\exp(\beta_{Shut\ Down}' X_{p,t}) + \exp(\beta_{Stay}' X_{p,t}) + \exp(\beta_{Relocate}' X_{p,t})}, \quad (1)$$
$$k = Shut\ Down,\ Stay,\ Relocate,$$

where β_{Stay} is normalized to zero for identification.[15] The term $X_{p,t}$ represents a vector consisting of a set of tax and financial incentive variables pertaining to differences in policy from state to state. The vector also includes various plant characteristics such as total employment of the plant; three indicators specifying whether the plant has operated for at least 10 years, 15 years, or more, respectively; labor productivity; the primary product specialization ratio as a measure of specialization; capital intensity, measured by total capital stock divided by total employment; non-production worker wage shares in total payrolls; and energy expenditure as a share of total shipment. Previous studies by Dunne et al. (1989) and Evans (1987a, 1987b) find that these variables are important determinants of plant survival and growth. To control for location-specific characteristics that may affect the decision to relocate, $X_{p,t}$ also includes the average of employee wages of all manufacturing plants in the same two-digit industry within the county as a measure of labor costs, as well as the average cost of electricity in

[15] The decision to stay includes relocation within the state.

Table 6
Changes in covariate adjusted percentage of permanent shut-downs and relocation (Marginal effect of individual program)

Program	(1)		(2)	
	Shut down	Relocation	Shut down	Relocation
Corp. income taxexemption	−0.66%**	−0.03%**	−0.17%	−0.08%
Personal income taxexemption	0.90%**	−0.08%**	0.40%	−0.02%
Excise tax exemption	0.16%	0.16%	−0.83%*	−0.12%*
Capital (land, equipment &machine)	−1.14%**	−0.31%**	−0.18%	−0.03%
Accelerated depreciation	−0.47%**	−0.16%**	−0.33%**	−0.38%**
Tax exemption oninventories	−0.61%**	−0.17%**	−0.36%	0.04%
Research and development	0.39%	−0.01%	−0.66%	0.01%
Bond financing	−0.19%	0.22%	−0.33%	0.19%
Loan or loan guarantee(for building or equipment)	0.31%	−0.09%	0.24%	0.11%
Pseudo R-square	0.098		0.099	
Other plant and locationcharacteristics	Yes		Yes	
Industry by periodfixed effects	Yes		Yes	
State fixed effects	No		Yes	

Note: Number of observations = 268,367. In the sample, 22.4 percent and 3.3 percent of plants are shut-downs and relocations, respectively.
* Significant at 5% level.
** Significant at 1% level (likelihood-ratio test for whether the coefficients on the policy indicator variables appearing in the multinomial logit estimations are jointly zero). (See Appendix Table 1 for parameter estimates.)

the county, used as a measure of energy costs. Union membership rates and effective corporate tax rates of the state are also included.[16] To adjust for agglomeration effects suggested by recent research on the economics of geography (Krugman, 1991), I control for capital intensity (the average of capital stock per worker), skill intensity (the average of the wage share of non-production workers), and employment density within the county, as well as neighborhood counties within 50 miles of the county where the plant is located.

It is difficult to interpret the coefficients from the multinomial logit model, especially since the marginal effects of the independent variable do not necessarily have the same sign as the coefficients of the model. To measure how much an individual incentive program changes the probability of choosing one of the three alternatives, I create “adjusted” probabilities conditional on plant and state characteristics. Using the “method of recycled predictions,” I vary the policy dummies of interest across the whole data set and calculate the average of the predicted values for each state, in terms of the presence versus absence of a given policy. More specifically, I first estimate a multinomial logit using all plant and state characteristics of interests as independent variables. Then, I pretend that all plants in the data set are located in states that did not have the policy of interest, for example a corporate income tax exemption program. To do so, I go back to the raw data and code as 0 the dummy variable indicating the existence of the policy. Using the parameter estimates from the multinomial estimation, I calculate a predicted value for the probability of the outcome for each individual plant, by multiplying the estimated coefficients by the corresponding individual values for the independent variables. I calculate the means of these predicted values for the probabilities of a plant’s shutting down and of relocating, which are the adjusted percentages for shutting down and relocating (probability set 1, policy not implemented). Next, I pretend that all plants are in states that have a corporate income tax exemption and code the dummy variable for having a corporate income tax exemption as 1. After that, I calculate the means of the predicted probabilities for shutting down and for relocation respectively (probability set 2, policy implemented). I report the difference in those two sets of adjusted probabilities, which is the difference due to the policy change, holding other characteristics constant. I also test whether the coefficients on the incentive programs, corresponding to “Permanent Exit” and “Relocation” decisions, are jointly zero. The likelihood-ratio (LR) statistic is calculated by estimating the restricted (i.e., without the indicator for corporate income tax exemption) and unrestricted multinomial logit estimations.

In Table 6, I present changes in the adjusted probabilities from the multinomial logit estimation, the parameter estimates of which are reported in the Appendix Table 1.[17] This estimation controls for various plant and location characteristics, as well as for two-digit industry and time effects. The specification reported in column (2) also includes state fixed effects to control for unobserved differences across states. In this specification, the effects of individual programs are identified from within-state comparisons of the probabilities with and without the program.

The results in Table 6 suggest that most incentive programs change the probability of a plant’s shutting down or relocating only marginally. While these policies are expected to reduce the probability of shutting down or relocation, there are situations in which these coefficients are positively correlated with the probability. If a state that has experience a massive shut down of existing plants introduces development programs to improve economic conditions, I may observe that an indicator representing a program is associated with an increase in probability of shutting down or relocation. For example, states such as Illinois, Iowa, Massachusetts, and Rhode Island implemented excise tax exemption in early 1980s. An increase in the probability of shutdown and relocation associated with the excise tax exemption during this time period in part reflects a relatively higher percentage of plants shutting down or relocating in those states that implemented such policy. However, once permanent differences across states are controlled for (column (2)), individual states seem to have a lower probability of having plants shut down or relocate when an excise tax exemption is in place.

[16] Variables on union membership rates among wage and salary workers in each state are obtained from Hirsch et al. (2001). Aggregate state effective tax rates on businesses are calculated following the method suggested by Wheaton (1983). I sum up all taxes that businesses are legally liable for and divide the sum by a tax base (e.g., net business income). Since net business income is not available, I use the state personal income as a proxy. The following taxes from the Census of Government (1972∼1992) are collected for each state for each year: state tax revenue (corporation net income tax, property, severance, document and stock transfer), sales and gross receipts tax revenue (insurance and public utilities), and license tax revenue (corporations in general, public utilities, occupations and businesses, n.e.c.).

[17] I also estimated a probit model of the binomial choice of shutting down versus staying in the state (to continue or relocate within the state) and find a similar result to the multinomial logit estimation concerning the effect of the incentives on the probability of shutting down.

Once I control for state fixed effects, I find that most of the incentive programs slightly reduce the probability of a plant shutting down permanently. Personal income tax exemptions and loans or loan guarantee programs are positively correlated with the probability of shutting down or relocation, but the coefficients on these policies are not statistically significant. While the effects of tax and financial incentives on the probability of relocation are quite mixed, the magnitude of the effects seems to be relatively small for most programs. With the exception of accelerated depreciation, most programs do not change the probability of relocation by more than 0.3 percentage points. The LR test statistic suggests that the coefficients on the incentive programs are not significantly different from zero for most programs.

A number of policy makers and researchers have suggested wage differences as a major factor that affects relocation decisions. To find out how big the impact of these incentives are, I compare these reductions in probability to such changes in the predicted value of the probability of a plant's shutting down if the state's average wage for production workers were hypothetically reduced, holding other factors constant. When the average wage of production workers in the same two-digit industry in the county decreases by 10% from the mean value, I find that the predicted probability of shutting down and that of relocation decrease by 0.44 percentage point and 0.09 percentage point, respectively. When the average wage of production workers in the whole manufacturing industry in the county was used instead, a 10% decrease in average wage generated about the same percentage of reduction in the probability of shutting down but greater response in that of relocation (a 0.21 percentage point decrease).[18,19]

This finding of a relatively small magnitude in the response to a decrease in wages stands in contrast to previous research, which found the role of wages to be important in firms' location choices.[20] However, this paper focuses on the effects on the exit margin and the results are not directly comparable to the majority of previous studies focusing on the entry margin (i.e., location choice of new firms or branch plants). In addition, the average wage of production workers is correlated with the skill or labor productivity of the location, which may bias the coefficient representing the wage effect. However, the magnitude of the wage effects did not change much when I included plant-level wage or labor productivity to control for such bias.

While the wage effects on the probability of shutting down did not change much over time, such effects on relocation declined somewhat over time. While a 10 percent wage cut decreased the probability of relocation by 0.19 percentage point between 1972 and 1982, it decreased the same probability by only 0.05 percentage point between 1982 and 1992. While this finding may partially explain the relatively larger role of wages found in previous studies based on earlier time periods, it appears that the importance of "cheap labor" in the manufacturing firms' location decisions has diminished.

Recently, there is a growing concern among policy makers about relocation of manufacturing jobs offshore in search of cheaper labor. Due to the limitation of the data, this study does not address the issue of international relocation. However, the finding of the relatively small role of wages in relocation within the states suggests that higher wages in the US may not be the main factor driving the decline in US manufacturing employment.[21]

The effects of plant-level characteristics on the probability of shutting down are consistent with the finding of previous studies. Overall, older, bigger, more capital intensive, and less specialized, and less-skilled-labor plants have lower probabilities of closing or relocating. While more productive plants are less likely to shut down, they are more likely to be relocated. Higher county-level wages, higher state tax rates, higher capital and skill intensities, as well as higher employment densities in neighborhood counties are associated with higher probabilities of shutting down. Plants in the states with higher union membership rates are less likely to shut down or relocate. On the other hand, once state fixed effects were included, union membership rates in the state did not affect the probability of shutting down or relocating.

3.3. The impact on plant growth

The results in previous sections suggest that the role of relocations is relatively small in explaining the geographic redistribution of manufacturing industries. Moreover, state development policies have only marginally affected the decision to relocate existing plants. Given the finding that more than 90 percent of variation in state employment growth rates is explained by within state changes (i.e., continuing plants' growth, entry, and exit), an evaluation of the effectiveness of a development policy requires a thorough examination of such effects on the growth of businesses in the state as well as on the births and deaths of businesses within the state.[22]

Numerous studies of the growth of firms have focused on the link between growth rates and internal conditions such as the size and age of firms (Dunne et al., 1989, Evans, 1987a, 1987b; Hall, 1987). In this paper, I explore the effects of incentives on employment growth by extending empirical growth models used in previous studies to include additional industry and location growth factors that may affect establishment growth. Following Greenstone (2002), the establishment-level data are fit to the following reduced-form equations:[23]

$$\begin{aligned}\%\Delta S_{pt} &= \frac{S_{pt} - S_{p,t-5}}{(S_{pt} + S_{p,t-5})/2} \\ &= \alpha_s + \beta_1 X_{p,t-5} + \beta_2 IND_{it} \\ &\quad + \sum_k \gamma_k \cdot Incentive(k)_{st,t-5} + \Delta u_{pt}, \end{aligned} \tag{2}$$

where Δu_{pt} is the plant-specific error term. Here p indexes a plant, i indexes an industry, s references a state, and t and $t-5$ respectively index the last and first years of a period between censuses. The dependent variable, $\%\Delta S_{pt}$, is the percentage change

[18] Such response to county-level wages did not change whether state fixed effects were included or not. The changes in the probabilities are proportional to the percentage change in the wage (i.e., 20 percent change in the wage generated about twice as great a reduction in the probabilities of shutting down (−0.91 percentage point) and of relocation (−0.18 percentage point).

[19] When the state-level manufacturing wage was used for the wage measure, the same percentage change in the figure generated a somewhat greater response. In a specification including state fixed effects, 10% change in state-level wage decreased the probabilities of shutting down and relocation by 1.59 and 0.60 percentage point, respectively.

[20] For example, in a study examining the location choice of the Fortune 500 companies' new manufacturing plant, Bartik (1985) found that a 10% increase in wages led to about eight percent decrease in the number of new plants. In a study focusing on a set of industries that ship relatively long distances, Carlton (1983) found that the same percentage decrease in wages led to a three to 16 percent decrease in new plant openings.

[21] According to the Bureau of Labor Statistics (International Comparisons of Hourly Compensation Costs in Manufacturing, 2006), hourly compensation costs for a manufacturing workers in China is about 3% of that in the US. The multinomial logit results suggest that a 97% wage reduction (for example, $10 to $.3 per hour) would decrease the probability of relocation by about 2 percentage points, at most. In a recent study, Harrison and McMillan (2006) find that other factors, such as falling prices of investment goods or consumption goods and import penetration, are primary factors driving the decline in domestic employment of US multinationals.

[22] Holmes (1999) finds a big difference in manufacturing activity between states with and those without right-to-work laws.

[23] This empirical model is based on Greenstone (2002), which examined the impacts of the Clean Air Act amendments on manufacturing activity using the Census of Manufactures.

Table 7
Estimated regression models for plant level percentage change in employment

	(1)		(2)	
	γ	(std. error)	γ	(std. error)
Tax Incentives				
Corp. income tax exemption	0.019**	(0.003)	0.004**	(0.004)
Personal income tax exemption	−0.032**	(0.003)	−0.001**	(0.004)
Excise tax exemption	−0.007**	(0.003)	0.013**	(0.004)
Capital (land, equipment &machine)	0.047**	(0.004)	0.017**	(0.004)
Accelerated depreciation	0.017**	(0.002)	0.006**	(0.004)
Tax exemption on inventories	0.028**	(0.003)	0.030**	(0.004)
Research and development	0.007**	(0.003)	0.014**	(0.004)
Financial Incentive				
Bond financing	0.015**	(0.003)	0.015**	(0.004)
Loan or loan guarantee(for building or equipment)	0.011**	(0.003)	0.016**	(0.004)
R^2	0.072		0.610	
Other plant level variables	Yes		Yes	
Industry by period fixed effects	Yes		Yes	
State fixed effects	No		Yes	

Note: Standard Errors in parentheses. Number of observations = 1,245,565.
** Significant at 1% level.

in plant size, which is measured in employment between t and $t-5$. The measure of percentage change used in dependent variables is an alternative to the traditional method, which takes the difference of the natural logarithms for the year t and $t-5$ levels. This alternative measure of growth ranges from −2.0 (when employment goes from positive in year $t-5$ to zero in t, e.g., *death*) to +2.0 (when employment is zero in $t-5$ and positive in t, e.g., *birth*) and allows the sample to contain observations on "births" and "deaths" and to describe expansion and contraction symmetrically (Davis et al., 1996). The term α_s represents state fixed effects, while IND_{it} indicates industry-specific period effects. State fixed effects capture any differences in the resources across states while industry*time indicators control for unobserved industry-specific economic shocks.

The term $X_{p,t-5}$ is a vector containing plant characteristics, as in the previous section. The term $Incentive(k)_{st,t-5}$ is a dummy variable indicating whether the state government *st* had incentive program k around $t-5$. The parameter γ_k captures the variation in the dependent variables specific to plants located in a state that has the particular program relative to plants in other states. These parameters provide the correlation between individual development programs and the average employment growth of plants that operate in the state.

In Table 7, the results from the estimation of (2) are presented for two different specifications.[24] Both specifications include industry-by-period fixed effects to control for unobserved industry-specific transitory economic shocks, as well as industry differences in the impact of the development incentive programs. The dependent variable is a plant's 5-year growth rate for total employment, which has a mean of 8.6%. Although most incentives were not effective enough to stem the outflow of plants in a given state, they turn out to be effective in causing firms to adjust employment among existing plants. The results in Table 7 suggest that plants have modestly increased total employment when the state government implemented most incentive programs. For example, plants located in states that have incentive programs targeting capital investment increased their total employment about 4.7 percent relative to similar plants in other states over the 5-year period. The coefficients for other incentive programs are much smaller.

In column (1), personal income tax exemptions and excise tax exemptions are negatively correlated with plant employment growth. As briefly explained in the previous section, such negative correlation may occur due to policy lag or endogenous changes in policy. If state governments facing a depressed labor market are more likely to implement these incentives and it takes a while until the policies have an impact, such incentives may be negatively correlated with employment changes in the short run. After controlling for state fixed effects in column (2), personal income tax exemptions are virtually not correlated with plant-level employment growth, and the correlation between excise tax exemption and employment growth rates turns its sign to be positive. For most of the incentive programs, the magnitude of coefficients did not change much or declined once state fixed effects were added in the specification.[25]

On average, a typical incentive program is associated with about 1.3 percent of employment growth over a 5-year period. Although coefficients on these incentive variables are statistically significant, their magnitude seems to be modest given that the plant-level growth is measured over a 5-year period. A comparison to the other coefficients helps assess the relative magnitude of this coefficient. In the specification that includes state fixed effects, I find a 10% decrease in the county-level wage in the two-digit industry is correlated with about the same magnitude of increase in employment (1.3 percent). This change was comparable to the response to a decrease of 12 percentage point in business tax rates (for example, 14% to 2%). However, without a direct measure of the cost impact of these incentives, any quantification of the effectiveness of these incentives should be interpreted with a caution.

3.4. Some caveats

The analyses in the previous section are based on the assumption that a firm's decision on where to relocate to occurs simultaneously with its decision on whether to relocate or shut down. However, such a decision may occur in a sequential manner, with a firm choosing a new location after deciding to shut down an old plant. In a different specification that incorporates such a pos-

[24] The coefficients in Table 7 are correlations between the dependent variable and independent variables and do not necessarily imply a causal relation.

[25] When certain policies were more likely to be present in declining states, the coefficients of such policies would increase once state fixed effects correct the negative bias caused by endogenous policy. While this was the case for the personal income tax exemption, the excise tax exemption, research and development incentives, and loan or loan guarantee programs, the bias may have worked in the opposite direction if policies were more likely to be in effect in growing states. For example, the coefficients for corporate income tax exemptions, capital, and accelerated depreciation declined once state fixed effects were introduced.

sibility, I found similar results to those reported in the previous section.[26]

What may be more important in interpreting the results in this section is that these estimates are not derived from randomized experiments, and therefore, do not necessarily imply causal relations. A possible explanation for the negative correlation between relocation and policy variables is the existence of either policy lag or endogenous changes in policy. If state governments introduce incentives to encourage a depressed labor market, and the policies have a delayed impact, such legislative changes may be negatively correlated with relocation rates in the short run. Given that it is not clear how many years it takes a certain policy to affect a firm's decision to relocate, the results in this paper should be interpreted with caution.

Moreover, some incentives, in particular on capital, may have a negative impact on employment by inducing plants to replace labor with new machinery or equipment, which has become relatively cheaper as a result of the incentives. While much of the discussion of development incentives assumes that all incentives can be expected to stimulate the creation of jobs, recent research finds that incentives may produce the opposite effect (Fisher and Peter, 1997). Incentives affecting factor prices, which in turn lower the price of capital goods, have both a positive effect (by increasing production and employment when costs are lowered, i.e., a scale effect) and a negative effect (by substituting capital for labor, i.e., a substitution effect). A strong substitution effect may reduce the magnitude of the coefficients.

4. Conclusion

I document the patterns of plant entry, exit, and relocation among US manufacturing industries and examine the influence of development incentives given by individual states on plant relocation. By examining the full population of manufacturing establishments present in the national market over the period from 1972 to 1992, I provide new evidence of the role of plant relocations in the process of geographic redistribution of manufacturing industries. I find that growing states have not only a higher fraction of employment gains from plant openings but also a higher fraction of employment losses from plant closings. The higher turnover rates found in growing states suggest that creative destruction, reflected in the high number of turnovers, may play an important role in the growth of a state. This finding highlights the importance of the reallocation process in understanding the disparity of growth rates across states. Such a process has been ignored in previous studies focusing on net employment changes across states.

While plant relocations across states account for 10 percent of the plant turnover in a state, the employment shift via plant relocations accounts for only a small part of the disparity in employment growth across states. Furthermore, the empirical results show that most development incentive programs have only marginally affected decisions concerning the relocation of existing plants. Exploring the effects of incentives on the plant-level growth in a given state, I find that some incentive programs are effective in fostering plant-level employment growth. However, the magnitude of the effects is relatively small, even if they are statistically significant. Overall, the results of this study support previous findings that the use of public funds for tax incentives to attract large industrial plants is not very effective. While the conclusions from those previous studies were not robust in terms of changes in time frame and were subject to criticism due to their limited sample sizes, this study addresses those deficiencies.

[26] I assumed that the decision structure of a firm has the following two stages. In the first stage, a firm decides either to shut down a plant permanently, to keep operating in the same location (no relocation), or to relocate the plant to a new location. In the second stage, conditional on a decision to relocate in the first stage, a firm decides whether to relocate within or outside the state.

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Appendix Table 1
Multinomial logit estimation of shut down, stay, and relocation

	(1)				(2)			
	$\beta_{Shut\ Down}$		$\beta_{Relocate}$		$\beta_{Shut\ Down}$		$\beta_{Relocate}$	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
Corp. income tax exemption	−0.046	(0.014)	−0.020	(0.031)	−0.013	(0.022)	−0.028	(0.048)
Personal income tax exemption	0.063	(0.013)	0.040	(0.030)	0.028	(0.021)	0.001	(0.044)
Excise tax exemption	0.013	(0.014)	0.054	(0.031)	−0.059	(0.024)	−0.052	(0.051)
Capital (land, equipment & machine)	−0.082	(0.020)	−0.119	(0.043)	−0.012	(0.024)	−0.012	(0.051)
Accelerated depreciation	−0.035	(0.012)	−0.059	(0.027)	−0.029	(0.020)	−0.131	(0.043)
Tax exemption on inventories	−0.044	(0.016)	−0.066	(0.033)	−0.024	(0.023)	0.008	(0.047)
Research & development	0.026	(0.014)	0.003	(0.030)	−0.045	(0.022)	−0.008	(0.048)
Bond financing	−0.010	(0.018)	0.069	(0.037)	−0.020	(0.023)	0.059	(0.048)
Loan or loan guarantee (for building or equipment)	0.020	(0.018)	−0.023	(0.038)	0.018	(0.023)	0.039	(0.048)
Age greater than 10 years	−0.227	(0.020)	−0.401	(0.050)	−0.226	(0.020)	−0.400	(0.051)
Age greater than 15 years	−0.308	(0.030)	−0.564	(0.074)	−0.309	(0.030)	−0.565	(0.074)
Age greater than 20 years	−0.317	(0.014)	−0.320	(0.031)	−0.314	(0.014)	−0.320	(0.031)
Size (log total employment)	−0.480	(0.004)	−0.185	(0.009)	−0.478	(0.004)	−0.184	(0.009)
Labor productivity	−0.225	(0.009)	0.083	(0.019)	−0.223	(0.009)	0.083	(0.020)
Product specialization	0.004	(0.000)	0.004	(0.001)	0.004	(0.000)	0.004	(0.001)
Capital intensity	−0.266	(0.006)	−0.196	(0.013)	−0.266	(0.006)	−0.196	(0.013)
Non-production worker wage share	0.185	(0.026)	0.207	(0.057)	0.175	(0.026)	0.193	(0.057)
Energy intensity	0.000	(0.000)	0.000	(0.000)	0.000	(0.000)	0.000	(0.000)
Average hourly wage	0.101	(0.019)	0.063	(0.041)	0.090	(0.019)	0.056	(0.041)
County average wage (2-digit)	0.301	(0.031)	0.351	(0.069)	0.298	(0.032)	0.342	(0.070)
County electricity price	0.024	(0.026)	0.091	(0.057)	−0.036	(0.061)	0.365	(0.128)
Union participation	−0.001	(0.001)	−0.006	(0.002)	0.005	(0.003)	0.003	(0.007)
Business tax rate	0.081	(0.011)	0.010	(0.024)	0.099	(0.025)	0.091	(0.050)
Neighborhood capital intensity	0.062	(0.015)	0.094	(0.031)	0.077	(0.016)	0.095	(0.034)
Neighborhood skill intensity	0.945	(0.083)	0.692	(0.183)	0.223	(0.109)	0.391	(0.236)
Neighborhood employment density (manufacturing)	0.105	(0.006)	0.033	(0.013)	0.131	(0.007)	0.072	(0.016)
State fixed effects	No				Yes			

Note: Parameters for staying are normalized to zero. Both specifications include industry by period fixed effects.

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