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FDI Announcements: A Potential Signal of the Benefits
of Cluster Development

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Aging of the Indiana Workforce

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Aging of the Indiana Workforce

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The number of unemployed workers per job opening is dropping steadily as the U.S. economy continues to rebound from the Great Recession. In June 2015, there were 1.6 people looking for work for every job available—lower than the pre-recession December 2007 ratio of 1.8.¹

This positive economic trend may have some troubling implications for businesses. A 2015 survey revealed that one in three employers reported difficulty in filling open positions within the past year.² Factor in dropping labor participation rates (see **Figure 1**) and baby boomers nearing retirement, and one begins to understand the warnings of impending labor shortages.

Here we take a closer look at stable employment in Indiana and our development of an aging-out indicator to investigate whether there may be future labor shortages, and identify which industries and regions are the most vulnerable.

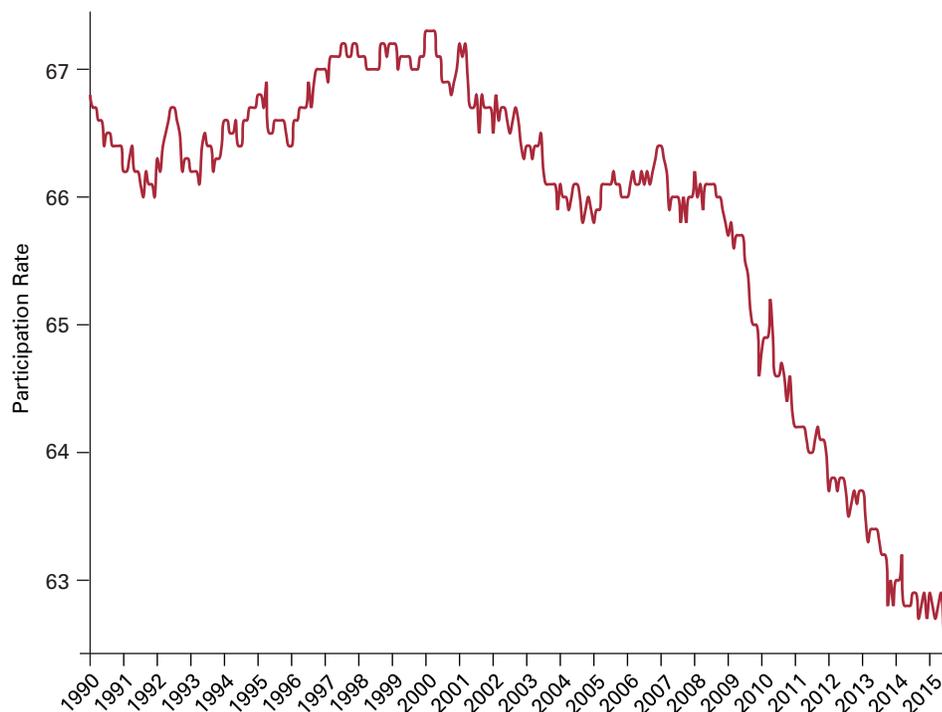
Methodology

Ideally, this analysis would use longitudinal data containing age, occupation, industry and county information on all individuals employed in Indiana to gain a comprehensive look at occupation, industry and regional shifts in labor force ages.

The unavailability of these data on an annual basis necessitated the use of national Quarterly Workforce Indicator (QWI) data, which measures the longitudinal work history—including age range, industry of employment and county—of individuals over time, as reported by their employers through the unemployment insurance system.

QWI data are compiled by the U.S. Census Bureau from

FIGURE 1: U.S. Labor Force Participation Rate, 16 Years and Older



Source: Current Population Survey, U.S. Bureau of Labor Statistics and the U.S. Census Bureau

Longitudinal Employer-Household Dynamics (LEHD) microdata, Unemployment Insurance (UI) earnings data, Quarterly Census of Employment and Wages (QCEW), Business Dynamics Statistics (BDS), the 2000 Census, Social Security administrative records, and individual federal tax returns.

QWI counts of stable employment were used at the North American Industry Classification Systems (NAICS) subsector level (three-digits) for two time periods: 2001-2003 and 2011-2013. Stable employment is defined as an individual being employed with the same employer for at least three consecutive quarters. The quarterly stable employment counts were aggregated to the economic growth region (EGR) level, and were then averaged by year to arrive at annual estimates.

Industry and EGR combinations with less than an average of 10 stable employees per year were suppressed

in order to avoid magnifying small shifts in employee ages over time. An aging-out score was determined for all non-suppressed industry and EGR combinations by calculating the ratio of the average industry proportion of stable employees 45 years or older during the 2011-2013 time period vs. the 2001-2003 time period. We will refer to these time periods as 2013 and 2003, for convenience.

$$AgeOut_{ij} = \left(\frac{\sum_{t=2011}^{t=2013} Emp45_t}{\sum_{t=2011}^{t=2013} TotEmp_t} \right) \times \left(\frac{\sum_{t=2001}^{t=2003} TotEmp_t}{\sum_{t=2001}^{t=2003} Emp45_t} \right)$$

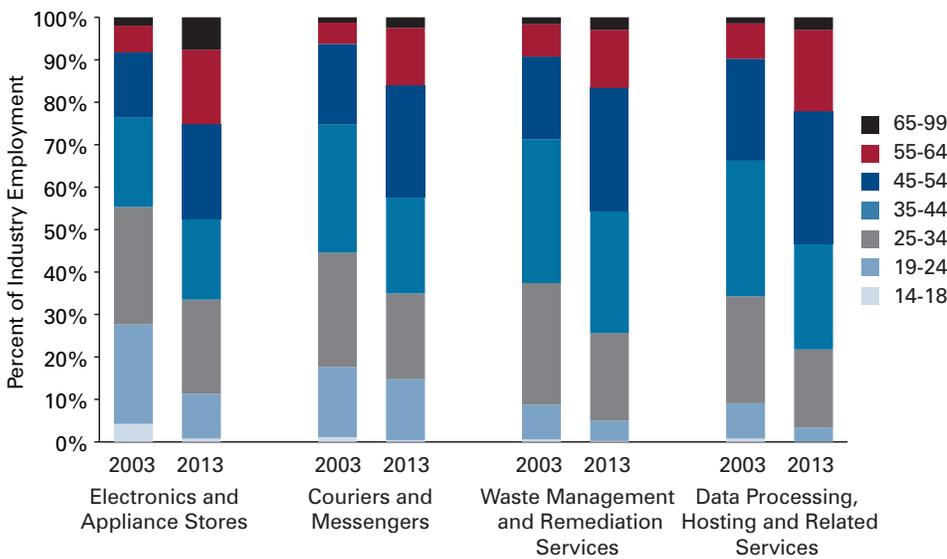
Emp45_t = Annual average of stable employees ages 45 years or more in year *t*, industry *i* and EGR *j*

TotEmp_t = Total annual average of all stable employees in year *t*, industry *i* and EGR *j*

Statewide Results

Statewide, 89 of the 98 (non-suppressed) industries posted aging-out ratios greater than 1. This indicates that ever-growing proportions of employees are 45 years old or more.

FIGURE 2: Age Distributions of Industries with the Highest Aging-Out Scores in Indiana



Source: IBRC, using Longitudinal Employer-Household Dynamics data from the U.S. Census Bureau

What does the aging-out score mean?

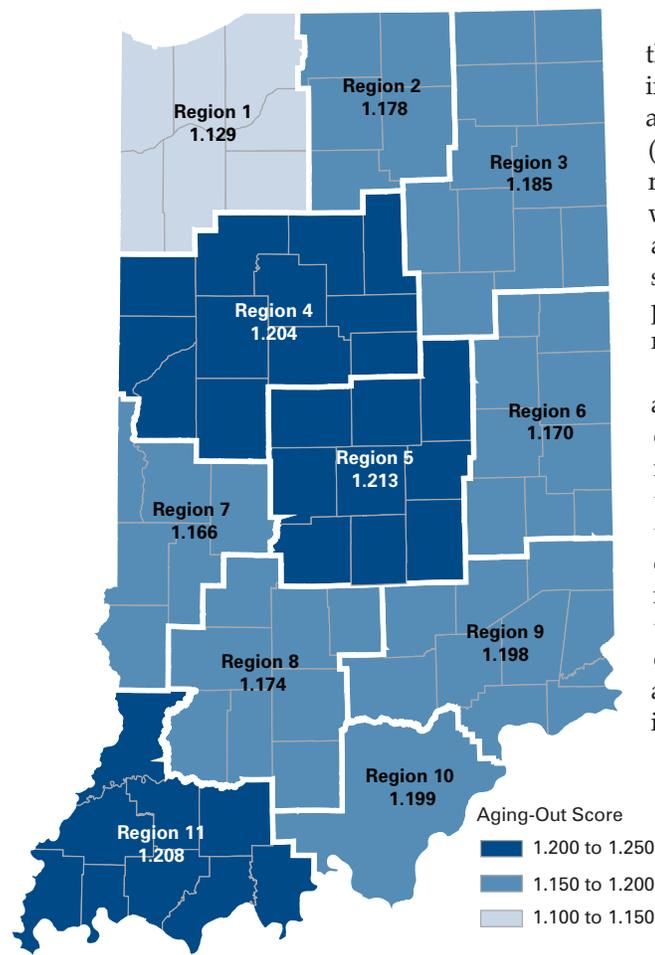
The aging-out score is a ratio that compares the share of employees ages 45 or older within a particular industry or region over a 10-year period: 2003 vs. 2013.

> 1 A score greater than 1 indicates a greater percent of employees are 45 years or older in 2013 than 10 years prior.

= 1 A score equal to 1 means the same percentage of employees are ages 45 or older in 2013 than 10 years prior.

< 1 A score less than 1 indicates a smaller share of employees are 45 years or older in 2013 than 10 years prior.

FIGURE 3: Aging-Out Scores for Indiana's Economic Growth Regions



Source: IBRC, using Longitudinal Employer-Household Dynamics data from the U.S. Census Bureau

The industries with the highest aging-out indicators are electronics and appliance stores (2.02), couriers and messengers (1.68), waste management and remediation services (1.59) and data processing, hosting and related services (1.58).

Figure 2 displays the average age distribution of these industries. It is important to note that industries with the highest aging-out scores do not necessarily encompass the highest percentage of employees ages 45 and older, nor does it indicate the industries with the greatest share of employees close to retirement. Instead, the aging-out score measures the change in the proportion of employees 45

years and older between the two time periods.

The industries with the lowest statewide aging-out scores are leather and allied product manufacturing (0.90), administration of human resource programs (0.90), oil and gas extraction (0.92), and private households (0.94).

Economic Growth Region Results

The workforce in Indiana has aged in every economic growth region. Region 5, which includes Indianapolis, has the highest aging-out score across all industries, while Region 1, near Chicago, has the lowest aging-out score (see **Figure 3**).

The majority of aging-out scores for Indiana EGRs and industry combinations fall within the 1.0 to 2.0 range and most industries have similar aging-out scores across regions. Some notable exceptions include:

- Forestry and logging in Region 8 (8.75)
- Beverage and tobacco manufacturing in Region 3 (4.31)
- Performing arts, spectator sports and related industries in Region 9 (2.99)

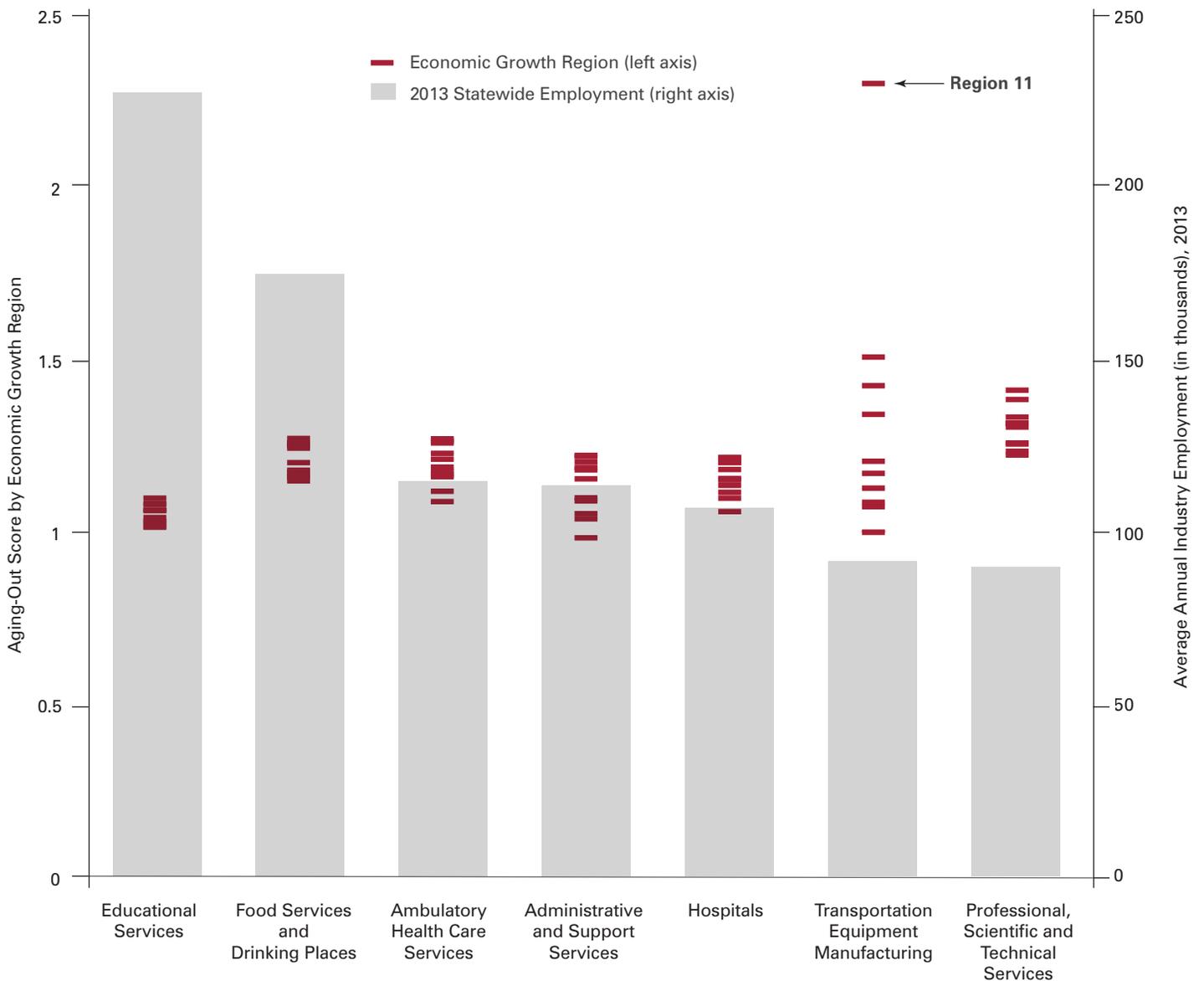
- Air transportation in Region 11 (2.764)
- Motion picture and sound recording in Region 7 (0.00)

Motion picture and sound recording in Region 7 (0.00) was the lowest scoring industry and region combination, indicating an unusual trend of reverse aging. Even with stable employment counts exceeding 45 each year, there were no recorded employees ages 45 or older during the 2013 time period.

The two highest regional aging-out scores from forestry and logging and beverage and tobacco manufacturing should be tempered by the specifics of the particular region and industry combinations, which reveal that both of these aging-out values were close to the suppression threshold due to low annual employment. These high aging-out values constitute only a small portion of the total employment within the overall regions and industries.

Focusing on Indiana's largest industries reveals more stable aging trends. Of the seven industries employing the largest number of employees, all but one of the industry and region combinations have aging-out scores of less than two (see **Figure 4**). Results such as these indicate no impending labor shortages for Indiana's major industries. However, the transportation equipment manufacturing industry in Region 11 may need to focus on hiring younger

FIGURE 4: Aging-Out of Indiana's Industries with the Largest Employment



Source: IBRC, using Longitudinal Employer-Household Dynamics data from the U.S. Census Bureau

“Of the seven industries employing the largest number of employees, all but one of the industry and region combinations have aging-out scores of less than two. Results such as these indicate no impending labor shortages for Indiana’s major industries.”

employees, as its aging-out score is 2.303 and its employment in that region has grown 50 percent between 2003 and 2013.

For a full table of the aging-out scores, annual average of stable employees, and whether the number of stable employees remained consistent between the two time periods, please refer to the appendix at www.ibrc.indiana.edu/ibr/2015/fall/appendix.html.

Recommendations

Similar to the national trend, Indiana’s labor force is aging in all regions and nearly every industry. While the aging is more pronounced for certain industries and regions, none of the highest aging values are in dominant industries in the Indiana economy, and overall, the aging-out scores do not indicate dramatic trends over the 10-year period from the early 2000s to the early 2010s.

Nevertheless, these slow and steady aging trends will require action in order to avoid future labor shortages. Education, training and apprenticeship programs will play an important role in mitigating or eliminating workforce gaps and preparing the future labor force of Indiana. Industry research to ensure programs such as these properly equip individuals with the necessary skills is vital. Additionally, these programs must remain flexible in

order to adapt to emerging industries and technological advancements. Creation of effective education, training and other programs will make Indiana more competitive to attract young talent in the state. However, in order to retain such talent, Indiana’s economy must offer competitive jobs in desirable fields with advancement opportunities.□

Notes

1. U.S. Bureau of Labor Statistics, “Job Openings and Labor Turnover Survey Highlights: June 2015,” August 12, 2015, www.bls.gov/jlt/jlt_labstatgraphs_june2015.pdf.
2. Manpower Group, “10th Annual Talent Shortage Survey,” www.manpowergroup.us/campaigns/talent-shortage-2015/.

FDI Announcements: A Potential Signal of the Benefits of Cluster Development

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Clusters—which are a co-location of firms that may share supply chains, modes of transportation or similar talent requirements—provide a network of economic relationships in a region that can create a competitive advantage for related firms (like software firms congregating in Silicon Valley). Industry clusters, it is said, facilitate the exchange of supplies, personnel and information between related firms in a region.¹ Cluster growth, therefore, may be important for the economic well-being of the region as a whole.

These clusters of industries that are growing in a region are aptly named “growth clusters.”² In earlier issues of the *Indiana Business Review*, we have also written about the role of cluster-based development.³

Clusters grow because those industries in a particular region have a competitive advantage. Differing forces may be at play in that growth. They can grow “metabolically,” that is, expand using the resources, labor and know-how in the region, as well as technology from outside the region—combined with increasing demand for the cluster’s goods and services outside the region. Clusters can also grow “magnetically,” that is, a region can attract firms to take advantage of that region’s competitive advantage in resources, supply networks or human talent. An example of magnetic growth is attracting foreign direct investment (FDI).

Michael Porter suggests that clusters may attract FDI by providing easy access to resources,

technologies and markets, though other scholars are quick to point out that clusters and FDI can be interdependent phenomena. Clusters may also have an influence on the foreign companies that are doing the investing in the region.⁴ The impact of cluster-related FDI on the wider economy also renders the relationship between clusters and investment particularly important. Does FDI stimulate clustering activity and generate positive spillover effects into the wider economy? Some researchers have found that productivity spillovers from FDI actually occur only in pre-existing clusters, suggesting that the relationship between clusters and FDI is complex and worth exploring in greater detail.⁵

In this article, we will explore the role that growth clusters may have in attracting FDI, i.e., magnetic cluster growth, in Indiana. We used industry cluster definitions from the U.S. Cluster Mapping Project and employment by industry data from QCEW-complete employment estimates, which the Indiana Business Research Center (IBRC) provides on the Hoosiers by the Numbers website. A proprietary data set, fDiMarkets, is the source for announced or “intended” FDI flows. All of these data are at the county level.

In contrast to other FDI data sources, fDiMarkets data are comprised of press releases from firms and economic development agencies that announce an intended greenfield investment or an expansion of existing facilities. Merger and acquisitions (M&A) are not included. For the purposes of our inquiry, intended greenfield investments signal a company’s

intention to locate a new facility (or expand an older one), with the emphasis on new. Our contention is that greenfield investment intentions are a stronger signal than M&A activity for the sake of measuring a region’s magnetism. M&A flows of FDI change the owner on the masthead, but the effects are not as apparent.

There are contrasting views on this. A foreign firm buying an existing operation may be motivated by the firm wanting to get a piece of a cluster’s competitive benefits in a region. The Brookings Institution released a report in the summer of 2014 noting the advantages of M&As in terms of job growth, beneficial spillover effects and regional vitality, and provided some anecdotal evidence.⁶ The report also cites several articles related to FDI and productivity growth. That said, according to one article, finding robust empirical evidence to support positive spillovers is more difficult than finding theoretical reasons spillovers may occur.⁷ Perhaps the better case for why greenfield FDI is a better magnetism indicator than M&A investment is that few economic development officials devote a majority of their time soliciting foreign firms to buy out local companies.

Results

For the first of several empirical analyses, we used a statistical procedure that estimates the probability that the presence of a growth cluster attracts greenfield FDI.⁸ The results of the statistical analysis do not point to a strong relationship between the presence of clusters and attracting FDI. The first statistical model shows that the

presence of a traded growth cluster (having an employment concentration greater than the national average) alone increases the likelihood of FDI flows into the county by about 39 percent. That said, the presence of a growth cluster does not appear to explain much of the variation of FDI flows. The decision of making an FDI investment or not that can be explained by the simple model—pseudo R^2 for statistical buffs—is only 0.005. In other words, only 0.5 percent of the variation in the FDI decision can be explained by the presence of a traded growth cluster in the region. (The full table with results from all models can be found in the appendix at the end of this article.)

The simple statistical model addresses only a simple, binary, “on-off” world. That is, either there is a growth cluster or not and either there was FDI or not. If scale, or the size of the growth cluster, is taken into account, more of the variation in the FDI decision can be explained. The second statistical model shows that it is not so much the presence of a cluster that matters, but rather that the scale of the growth cluster (measured by employment) explains more of the variation in the FDI decision. The model indicates that a 1 percent increase in the average employment share of a given growth cluster would nearly double the likelihood of attracting foreign investment.⁹

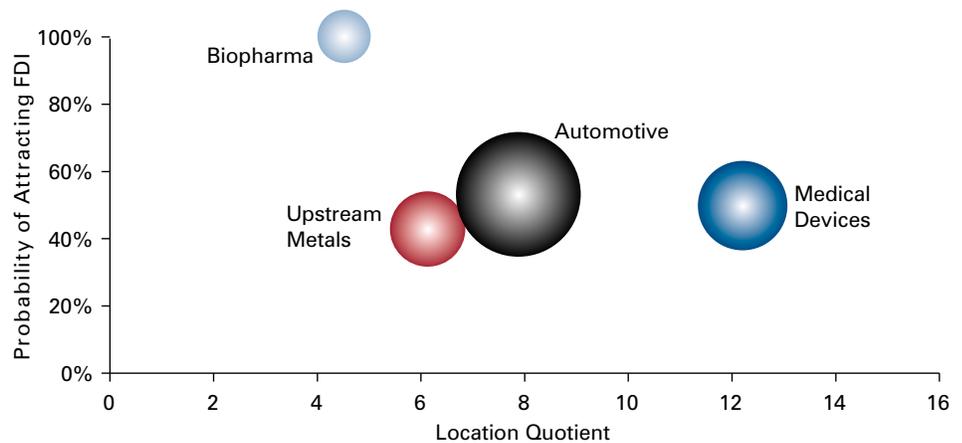
The first two models were generic, industrially speaking. In other words, all growth clusters and the industries that comprise these growth clusters were treated the same. All of the cluster employment and all of the FDI were aggregated together. In two additional models, we examined the role that the specific industry and cluster may play in attracting FDI. We looked at several clusters of particularly high employment concentration in the state: automotive, biopharmaceuticals, upstream metals, recreational vehicles (RV) and

TABLE 1: Cluster Presence and FDI Inflows by Industry, 2007 to 2013

Cluster	Number of Counties Not Attracting FDI	Number of Counties Attracting FDI	Total Number of Indiana Counties
Automotive	9	28	37
Local Health Services	22	17	39
Upstream Metals	15	16	31
Medical Devices	6	6	12
Biopharmaceuticals	7	2	9
Recreational Vehicles (RVs)	14	0	14

Source: IBRC, using fDi Markets data

FIGURE 1: Predicted Probability of FDI in Four Growth Clusters by Average Location Quotient, 2007 to 2013



Note: Bubble size indicates average cluster employment.
Source: Indiana Business Research Center

medical devices.¹⁰ It turns out that the RV cluster (centered around Elkhart) had no RV-related FDI (see **Table 1**).

This may be attributed to the gutting of the RV industry during the Great Recession, as our data covers the period from 2007-2013. Perhaps during these years, RV manufacturing was not considered an attractive industry for foreign direct investment. The RV industry, as a result, did not warrant further statistical analysis. Additionally, in order to focus on traded clusters (i.e., those that sell to other regions), we omitted the local health services cluster from the analysis as well.

Figure 1 shows the relationship between the industry growth cluster’s average location quotient and the probability of attracting FDI for the four remaining key industries from

2007 to 2013. Bubble size indicates the average level of employment in that growth cluster over this time period. Though the medical devices growth cluster has the largest LQ (as indicated by its position to the far right on the graph), the biopharmaceutical industry has the greatest probability of attracting FDI, as 100 percent of the biopharma growth clusters attracted FDI; the automotive industry comes next, with a 53 percent probability of attracting FDI, followed by medical devices (50 percent) and upstream metals (43 percent).

The third statistical model was motivated by the hypothesis that FDI attraction may be affected by the industry, that is, the specific industry’s likelihood of attracting FDI. This model shows that there

TABLE 2: Net Effects of Cluster on the Likelihood of Attracting FDI, 2007 to 2013

Industry Sector	Likelihood of Attracting FDI
Automotive	431%
Biopharmaceuticals	No Effect
Medical Devices	No Effect
Upstream Metals	177%

Source: Indiana Business Research Center

TABLE 3: FDI Attracted by Growth Cluster Regions for Selected Industry Clusters, 2007 to 2013

Cluster	Total Number of Regions	Growth Clusters			Weak Clusters
		Total Number of Regions	Number of Regions Attracting FDI	Dollar Share of FDI (Percent)	Number of Regions Attracting FDI
Automotive	37	34	26	96%	2
Biopharmaceuticals	9	6	2	100%	0
Medical Devices	12	8	4	85%	2
Upstream Metals	31	28	14	95%	2

Note: Weak clusters are those with employment concentration less than the United States. Growth clusters are those with high employment concentration (high LQs).

Source: Indiana Business Research Center

are clear differences by industry. Growth clusters in the automotive sector attracted FDI to an Indiana region (such as Honda opening a new factory in Indiana), while the upstream metal sector also attracted FDI. The odds of these industries attracting FDI are well over 100 percent in our model, with a growth cluster in the automotive industry being 431 percent more likely to attract FDI than a growth cluster in any other industry. A growth cluster in the upstream metal industry is 177 percent more likely to attract FDI than a growth cluster in any other industry (see **Table 2**). The biopharmaceuticals and medical devices industries did not have any statistically confirmed effects on the odds of attracting FDI.

Our fourth model of selected industrial sectors looks at the effect of growth cluster strength, using the interaction between a cluster's location quotient—that is, the relative concentration of employment in a cluster—and the presence of a growth cluster in the region. The model suggests that the presence of

upstream metal manufacturing will indeed attract FDI to a region, as will the presence of a biopharmaceutical growth cluster. The latter result fits with the fact that two regions with growth clusters in biopharma attracted all of the biopharma FDI. No weak biopharma cluster regions attracted FDI, as **Table 3** shows. **Table 3** also signals why the industry results in Model 4 may not be particularly strong for industries other than biopharma. Namely, weak cluster regions also attracted FDI. That said, as column five in **Table 3** indicates, the share of the dollar value of those FDI flows into weak cluster regions were not high. (One minus the percentage in column five equals the percentage of investment dollars flowing into weak cluster regions.)

Conclusion

For Indiana, the evidence suggests that the presence of growth clusters plays, at best, a marginal role in attracting greenfield FDI. Higher average employment concentrations are a better predictor of FDI flows. The degree to which clusters attract

FDI—growth via magnetism—appears to be limited in a generic industry sense, but appears to be sensitive to the type of industries that make up the cluster, e.g., the automotive industry. It is important to consider not just the presence of growing clusters that may attract additional outside investment, but the cluster's size and industry composition that may influence magnetic growth. The analysis was limited to Indiana, and as a result can't be generalized to the nation as a whole. However, these findings provide possible questions for additional research on cluster growth on a national scale. □

Notes

1. M. Porter, "Clusters and the New Economics of Competition," *Harvard Business Review*, November-December 1998, <https://hbr.org/1998/11/clusters-and-the-new-economics-of-competition>.
2. It is important to differentiate the notion of cluster definitions, which are groupings of industries that have been set forth by Porter and the U.S. Cluster Mapping Project, and the presence of a cluster in a region, which is based upon the relative concentration of employment for a particular grouping, or cluster of, industries.
3. T. Slaper and G. Ortuzar, "Industry Clusters and Economic Development," *Indiana Business Review*, Spring 2015, www.ibrc.indiana.edu/ibr/2015/spring/article2.html.
4. P. Gugler and S. Brunner, "FDI Effects on National Competitiveness: A Cluster Approach," *International Advances in Economic Research* 13 (2007): 268-284.
5. L. De Propris and N. Driffield, "The Importance of Clusters for Spillovers from Foreign Direct Investment and Technology Sourcing," *Cambridge Journal of Economics* 30, no. 2 (2006), <http://cje.oxfordjournals.org/content/30/2/277>.
6. D. Saha, K. Fikri and N. Marchio, "FDI in U.S. Metro Areas: The Geography of Jobs in Foreign-Owned Establishments," June 2014, <http://www.brookings.edu/~media/research/files/reports/2014/06/20-fdi-us-metro-areas/metrofdi.pdf>.
7. H. Gorg and D. Greenaway, "Much Ado about Nothing? Do Domestic Firms Really Benefit from Foreign Direct Investment?" (working paper, Institute for the Study of Labor, November 2003), http://papers.ssrn.com/sol3/papers.cfm?abstract_id=475044.
8. We performed a logit regression to determine the probability of clusters attracting FDI. The logit modeling method produces a result that can be interpreted as the likelihood of one condition leading to another, making it suitable for modeling the effect that clusters

have on attracting foreign investment. The presence of a traded cluster—i.e., those industries that generally make for and sell to consumers outside the region—is determined by a location quotient (LQ). An LQ measures the concentration of employment by comparing the percent of employment in a given region in Indiana to national averages. Therefore, the presence of a cluster in an Indiana county is indicated by a higher percentage of workers employed in that industry than is typical across the U.S. as a whole. FDI is measured as a binary variable: counties that have received foreign direct investment are contrasted with those that have not received any, regardless of the differences in actual dollar amounts invested in each county.

9. Controlling for the average employment for each cluster from 2007 to 2013, the impact of the cluster presence variable is reduced dramatically and loses its statistical

significance in Model 2. In turn, the effect of cluster employment on FDI is highly significant.

10. The upstream metal cluster includes pipe, tube and rolled steel manufacturing, forging and secondary smelting industries. The official term for the recreational vehicle cluster is “trailers, motor homes and appliances,” and is overwhelmingly dominated by RV manufacturing in Indiana (hence the lay terminology).

Appendix

Model 1 shows the mean difference of the odds ratio between growth and non-growth (weak) clusters in terms of attracting FDI. Models 2 through 4 show that, after controlling for the average

employment and specific industry clusters (and whether they are growth clusters), the presence of a growth cluster alone loses explanatory power in attracting FDI. The highly significant and large positive (negative) effect from the presence of biopharmaceutical growth clusters (and the sector in general) in Model 4 reflects the fact that all FDI in the biopharmaceutical sector went to its growth clusters. In other words, being a non-growth (or weak) biopharmaceutical cluster does not attract FDI at all.

TABLE 4: Effects of Growth Clusters on the Likelihood of Attracting FDI

	Model 1	Model 2	Model 3	Model 4
Location Quotient (LQ)	0.328** (0.15)	0.011 (0.16)	-0.166 (0.17)	-0.145 (0.17)
Shift-Share Industry	0.123 (0.16)	0.226 (0.18)	0.239 (0.18)	0.246 (0.18)
Average Employment		0.681*** (0.07)	0.658*** (0.07)	0.657*** (0.07)
Automotive Industry			1.669*** (0.40)	1.685 (1.26)
Automotive × LQ				-0.026 (1.33)
Biopharmaceutical Industry			-0.753 (0.78)	-12.747*** (0.62)
Biopharmaceutical × LQ				12.256*** (1.08)
Medical Devices Industry			0.716 (0.62)	1.176 (0.99)
Medical Devices × LQ				-0.736 (1.24)
Upstream Metal Industry			1.020** (0.38)	1.892* (1.00)
Upstream Metal × LQ				-0.966 (1.08)
Constant	-1.016*** (0.12)	-4.965*** (0.43)	-4.858*** (0.44)	-4.868*** (0.44)
Observations	863	863	863	863
Pseudo-R ²	0.005	0.118	0.142	0.144

Note: The dependent variable is a binary indicator for FDI. The independent variable of interest is also a binary indicator for being a growth cluster or not. The model is estimated using logit models for traded industrial clusters only. The selected industrial clusters in Model 3 include automotive, biopharmaceuticals, upstream metal and medical devices. Local health services and RV clusters are excluded from the model because the former is not traded and the latter has no FDI. The interaction term between the biopharmaceutical sector and the growth cluster is also excluded in Model 4 because clusters that have FDI are all growth clusters within the sector. Standard errors are in parentheses. Significance level: * 10%, ** 5% and *** 1%.

Source: Indiana Business Research Center