4. The Innovation Index

4.1 What Is Innovation and Why Index It?

According to the United States Department of Commerce, innovation is "the design, invention, development and/or implementation of new or altered products, services, processes, systems, organizational structures, or business models for the purpose of creating new value for customers and financial returns for the firm" (DOC 2008, i). Other entities offer similar definitions, including the Federal Reserve (2007), which defines innovation as "taking something established and introducing a new idea, method or device that creates a new dimension of performance" and adding value.

For the purposes of this research and report, innovation is defined similarly, but more broadly.

Innovation puts ideas into action with the result of increasing firms' compensation and profits.[15] Innovation can result in the introduction of new or better goods and services and is manifest in adopting new technologies and processes that increase productivity or lower costs. Adopting a new technology makes production more efficient. Adopting new business models and organizational structures improve how firms meet consumer needs, process information or make decisions. As a result, innovation reduces costs and increases profitability. Innovation can be incremental (e.g., reducing breakage during shipping) or radical (e.g., using computers for business applications). On a more macro-level, innovation is evident in an economy that is adaptable and that can readily move resources from lower value-added activities to higher value-added activities.[16]

The body of innovation literature has focused largely on patent activity (Audretsch and Feldman 2006; Barkley et al. 2006; Jaffe et al. 1993) and occupational groupings (Henderson and Abraham 2004; Koo 2005b). Researchers tend to operationalize innovation in terms of an element of the definition of innovation or some proxy, but fall short of capturing innovation's primary goal—economic growth.

Efforts to compare innovative activities at a county-level unit of analysis have occurred sporadically in recent years. Most efforts have focused on a state or country level of analysis due to greater data availability. The most comprehensive county-level analysis is from Lee (2006) who examined select counties in the southern United States in a series of descriptive models.

The index in this report is not typical for two reasons. First, the index includes both inputs and outputs together as a composite indicator of innovation capacity and output potential. Second, it places greater emphasis on increased economic productivity. The combination of multiple variables into a composite index gives local and regional development practitioners a single, high-level snapshot to evaluate innovative capacity, innovation outcomes and economic progress. This approach is similar to the annual European Innovation Scorecard (ETCI 2005, Pro Inno Europe 2006). Second, whereas most other innovation indices

[15] The vast majority of value added is comprised of compensation and profits. In economics, value added refers to the returns to the factors of production—primarily labor and capital—that increase the value of a product and corresponds to the incomes received by labor and the owners of capital.

[16] The definition of innovation for this study is focused on economic outcomes. Innovation can also occur in the social sphere. In such a case, innovation would result in improved social outcomes and a higher quality of life.

are developed on an annual basis, the index developed here spans an entire decade. The advantage of a long-term index approach is that the impact on the overall score of short-term variations resulting from exogenous factors, such as natural disasters, is minimized. The index is also less subject to political manipulation that divides regions into winners and losers based on short-term changes in ranks and scores. The disadvantage of this approach is that counties that have made systematic changes during the middle of the study period may be under-represented with regard to their innovative potential and capacity in the final results.

This index is intended to serve as a tool for regional economic development practitioners. It should be understood, however, that each region of the country will have a different mix of qualities that can boost its overall innovation score. No two counties or regions will be exactly alike and there is no single path toward an innovative and growing economy. Interpretation of this index should be done with caution as the collection of multiple data points into a single composite estimate may obscure important information that could help explain a particular region's underlying innovative capacity and performance.

The following section describes the variables selected for the broad portfolio of innovation-related activities that comprise the "Portfolio Innovation Index." Then, there is a brief discussion of an empirical approach that attempts to link innovation outcomes—namely economic growth—with innovation inputs. The research team's efforts suggest that the portfolio and empirical approaches are modestly correlated. This statistical relationship suggests a broad portfolio can and does capture much of the effect sought through an empirical approach that identifies the independent variables, e.g., human capital, that have the strongest explanatory power on the dependent variable, namely the growth of gross domestic product per worker. The advantage of the portfolio approach is that the relative importance of any one factor is diminished by a wide array of other factors that may influence innovation, whereas the empirical index concentrates innovation scores on far fewer variables.

4.2 Portfolio Innovation Index

The Portfolio Innovation Index (PII) builds on past research and analysis that used higher-order geographic units of analysis such as states and countries (ETCI 2005; Pro Inno Europe 2006; Porter and Stern 1999; Atkinson and Correa 2007). The approach is based on the assumption that innovative capacity, or inputs, can be combined with outputs to create a single, composite index value.

The process of developing the portfolio of variables to index began by identifying possible indicators used in previous analyses (Barkley et al. 2006; Drabenstott and Henderson 2006; ETCI 2005; Pro Inno Europe 2006; Lee 2006; Atkinson and Correa 2007). Several additional variables were identified as theoretically important and investigated for possible inclusion. The final list of variables was restricted to those for which county-level data were available, or that could be developed on the county level with relatively little imputation.

The remaining variables were then classified as either an input to innovative activity or a result or output of innovation. Each variable was classified into one of the following four categories: human capital, economic dynamics, productivity and employment, and economic well-being. Each of the four preceding categories has its own sub-index and is discussed in greater detail below.

A fifth category, state context, seeks to capture data that are theoretically important but available only at the state level. The state context category, which is not discussed in depth below, is composed of science and engineering graduates from state institutions per 1,000 residents of the state and research and development spending per capita.[17] In the future, the state context could expand in scope to mimic several of the state-level indicators reported by Atkinson and Correa (2007), for example, the export of high-tech goods and foreign direct investment flows. The state context category is given relatively scant attention because it is not used for the PII calculation and because the context indicator becomes diluted if a region crosses state boundaries—that is, the index calculation aggregates across all applicable states. In addition, the state context category is not highlighted because the focus of this study is to develop county-level indicators so that users are able to define their geographic unit of analysis based on distinct economic boundaries that, frequently, are not confined by state lines.

As noted above, the innovation index is a tool for regional economic development practitioners to identify the knowledge-based and innovation-based strengths and weaknesses of a regional economy. Many of the measures used for the index gauge the foundational elements that are currently in place in the region for future, innovation-driven economic growth. Some of the measures gauge the degree to which the region is attractive to new talent and firms that may also enhance the regional economy, but those same measures of attractiveness are also measures for retaining current talent and firms. Certain characteristics, in other words, work like gravity, keeping objects on the ground and pulling objects to the ground. It is hoped, therefore, that the innovation index is not primarily used to try to attract outside firms, resources and talent, but primarily used to identify indigenous sources of innovation and ways to fortify those sources. Encouraging home-grown entrepreneurs with personal commitments to the region, for example, is preferred to attracting talent with minimal personal investment in the region.

4.2.1 Inputs

Inputs are those factors, influences or conditions that promote innovation and create knowledge. Inputs are combined into two categories: human capital and economic dynamics.

4.2.1.1 Human Capital Sub-Index

Variables included in the human capital sub-index suggest the extent to which a county's population and labor force are able to engage in innovative activities. Counties with high levels of human capital are those with enhanced knowledge that can be measured by high educational attainment, growth in younger age brackets of the workforce (signifying attractiveness to younger generations of workers), and a sizeable number of innovation-related occupations and jobs relative to the overall labor force.

Education

Educational attainment measures the skills and knowledge that contribute to a population's capacity to innovate. The research team was particularly interested in individuals in the labor force with tertiary degrees. Thus, educational attainment was divided into two categories: (1) some college or an associate's degree and (2) bachelor's degree or higher. The distinction is made to capture the relative importance of a knowledge differential, together with regional distinctions in the types of degrees earned. In many states, educational funding mechanisms favor four-year universities whereas elsewhere state policy tends to favor two-year community colleges and vocational schools (Kolesnikova and Shimek 2008; Rouse 1998).

[17] Please refer to Appendix C for more information on the state context indicator.

An important educational differential is also present within states and counties where higher concentrations of bachelor's degrees tend to surround metropolitan areas, whereas associate degree concentrations tend to be elevated in more rural counties where fewer residents have the resources or ability to travel to distant four-year institutions (Dougherty 1994). Community colleges and vocational schools are more widely dispersed and proximate to rural residents. They also tend to provide education at a lower cost, with easier access, and tend to offer more flexible course schedules, such as evening or weekend courses (Dougherty 1994; Rouse 1998; Kolesnikova and Shimek 2008). Community colleges are also more likely to cater to a region's economic development needs than larger universities (Rosenfeld and Sheaff 2002).

Population Growth Rate

A growing population is desirable. But growth in the number of newborns or retirees does little to suggest whether those persons most likely to engage in innovative activities are present in the community. For this reason, population growth rates are confined in this study to ages 25 to 44. The lower bound ensures transient college students typically aged 18 to 21 become less of a factor in influencing the overall rate of growth, whereas the upper bound signifies a point at which a professional's geographic location would likely remain more stable. The 25-to-44 age bracket is likely to be less risk averse and more entrepreneurial. Moreover, population growth in this age bracket suggests the possibility that new residents are likely to augment the innovative and entrepreneurial characteristics of the base community.

Occupational Mix

Richard Florida (2004; 2005) developed the notion of the "Creative Class," a social concept that describes a region's population by identifying the types of occupations in the workforce. According to Florida, areas with large creative class populations have a more socially tolerant populace and experience greater economic growth. Ultimately Florida concludes that the creative class drives economic expansion in the United States. The creative class is based on occupational data from the decennial census. While Florida's concept is bolstered by research, more recent critiques call into question the validity and reliability of his argument (see Donegan et al. 2008). In fact, the research team's empirical analysis suggests that when combined with other important factors that describe growth in economic productivity, higher proportions of creative class occupations bear a negative relationship.[18]

Like Florida, the research team hypothesized that there is a certain occupational mix that favors innovative behaviors. Rather than relying on Florida's intuitive definitions of the desirable occupational mixes, the research team substituted six technology-based knowledge occupation clusters that were based on statistical analysis.[19] These clusters are similar in composition to those used by Henderson and Abraham (2004), who sought to explain the agglomeration effect of knowledge occupations at the county-level. They defined knowledge occupations as managerial, professional, and technical. Henderson and Abraham's (2004) model found that higher concentrations of knowledge occupations could be explained by the presence of college graduates and colleges, and in areas surrounded by high-knowledge occupations.

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[18] This analysis is not shown. Originally the creative class was used as an "innovation occupations" proxy, prior to the inclusion of O*NET-based occupation cluster data.

[19] Our cluster is highly correlated with creative class (ϱ=0.67). IT and mathematics, statistics, data and accounting are highly correlated with the creative class variable with coefficients greater than 0.7. The natural sciences and environmental management component exhibited the lowest correlation of the component clusters with the creative class (ϱ= 0.02).

The six technology-based knowledge occupation clusters, as described in Chapter 3, include (1) information technology, (2) engineering, (3) health care and medical science practitioners and scientists, (4) mathematics, statistics, data and accounting, (5) natural sciences and environmental management, and (6) postsecondary education and knowledge creation. Occupations in these clusters each hold Occupational Information Network (O*NET) scores of three or higher.[20] O*NET's seven-point Likert-like scale accounts for the degree to which knowledge is required to satisfactorily perform the duties of the occupation. The use of scores of three or higher removes low-scoring occupations. Following the theories of Florida, in conjunction with the occupation cluster analysis reported in Chapter 3 of this report, these six technology-based clusters were also hypothesized to have a higher probability of developing new and innovative ideas, products and processes that drive economic growth. Collectively these clusters comprise 8 percent of national employment.

High-Technology Employment

In addition to knowledge occupations, there are other occupations linked to high-technology firms and activities that either retain opportunities for the home-grown, skilled and specialized labor force or attract similar workers that are complementary to technology-based knowledge occupations. According to Kolko (1999), high-tech firm employment and growth is overwhelmingly found in urban centers, producing a rural-urban technology gap. High-tech employment uses industry-level data. The high-tech sector is defined by Moody's as comprised of such industries as telecommunications, Internet providers, computer manufacturing, and scientific laboratories, to name a few.

Together, the high-tech industry employment and technology-based knowledge occupational data provide a reasonable understanding of the extent to which a county's occupational and industry mix provide either the existing capacity to generate innovative products and processes or the ability to augment local innovative capacity by attracting new firms and new talent.

4.2.1.2 Economic Dynamics Sub-Index

The economic dynamics sub-index measures local business conditions and resources available to entrepreneurs and businesses. Targeted resources such as research and development funds are input flows that encourage innovation close to home, or that, if not present, can limit innovative activity.

R&D Investment

Inputs to innovation can come in the form of fund or knowledge transfers that may originate outside a region but benefit firms and individuals inside a region.

Investments targeted to a region provide capital to aid the economic dynamics of a region. In particular, direct research and development (R&D) investments in a given county are indicative of overall levels of research being conducted. While research itself may not always result in a marketable innovation, it is a vital precursor. R&D expenditures are thus an indicator of innovation—even if the funds go toward unsuccessful products. It is generally understood, however, that those spending more will have the greatest innovative results or outcomes. R&D also has a well-documented spillover effect where R&D can provide crucial knowledge and resources for third-party firms to further innovate (Audretsch and Feldman 2006).

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[20] The methodology is based on the approach advocated by Feser (2003) and Koo (2005b).

Unfortunately, private R&D data is coded in a manner based on the location of company headquarters and not the research sites. Thus, the data may not reveal the true location of the R&D activity. Be that as it may, the R&D concept was operationalized in this study for each county by dividing total R&D expenditures by total worker compensation. In this way, the volume of R&D expenditures is adjusted for the level of productive activity in the county (as opposed to high personal income values that may be due to a large presence of retirees) and, to some degree, the local cost of living or doing business.

Venture Capital Investment

Venture capital (VC) funds are used to launch new ideas or expand innovative companies. In the United States, VC may be responsible for up to 14 percent of all innovative output activity (Kortum and Lerner 2000). Rin and Penas (2007) note that VC investment firms are highly selective with their investments to maximize the probability of high returns. The return on VC, and possibly the importance of VC, is diminished somewhat by the fact that the VC investments are typically management-intensive. Looking for VC funding may consume a considerable level of effort by the seeking firm's management, just as VC firms exert considerable effort seeking suitable projects to invest in (Timmons and Bygrave 1986).

Broadband Density

Several state-level studies have attempted to capture the effect of adding broadband capacity to a region's infrastructure. These studies suggest that broadband capacity has an overwhelmingly positive impact on economic performance (Lehr et al. 2005, 2005b; Crandall et al. 2007). Broadband provides high-speed Internet connections to businesses and consumers. Thus, high-speed Internet access ensures that businesses and individuals can access and share new ideas from virtually any location. An increase in broadband density would indicate an improvement in capacity over time.

Unfortunately, broadband density or penetration is not directly tracked at the county level by the Federal Communications Commission (FCC). The FCC does collect data on the number of broadband providers, not users or broadband lines, at a ZIP code level. The number of broadband lines is available only at the more aggregated state level of analysis. To create a measure—that is, a broadband density proxy at the county level—broadband penetration was estimated by using population densities of both counties and ZIP codes to transform the FCC ZIP code data into county-level data. In other words, the number of broadband holding companies per ZIP code were assigned to a county using weighted averages of populations and ZIP code population centroids.[21]

This measure of broadband penetration does not state how many individuals in a region have access to broadband. Broadband density could be driven by two starkly different factors. Either (1) the increased number of providers is related to total employment and demand for access or (2) the number of providers is

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[21] One of the limitations of these data is the assumption that postal service ZIP code data from the FCC was directly comparable to ZIP code tabulation areas (ZCTAs) available from the U.S. Census Bureau. This assumption was necessary in order to weight the ZIP code data accordingly to develop a county-level dataset. To assess the reliability of this measure, the county-level density data were aggregated to a state level which showed a weak correlation (r=0.3) with the actual number of broadband lines per capita among states. The correlation was marginally stronger (r=0.4) with the actual number of lines irrespective of a state's population. Perhaps a greater limitation is that service providers can be, or more likely are, frequently double-counted because a service provider may service multiple ZIP codes within the same county.

a function of geographic size. The number of broadband providers tends to increase with employment and decrease with land area.

The extent to which a county has broadband access differs conceptually from the rate at which counties opt to add broadband access. A county that had high density and a slow rate of change was likely an early adopter of the technology whereas a county with a low density and a low rate of change never really engaged in full adoption of broadband technology. But, of particular interest are the counties with low initial densities that exhibit high rates of change in adding broadband access. These are the counties that presumably recognized the importance of access and sought to add it between 2000 and 2007.[22]

Given the limitations of the data, but acknowledging the theoretical importance of the concept, the index uses two broadband indicators. The first is a measure of current density, that is, density in 2007, and the second is the rate of density change from 2000, the first year of available data.

Churn

Competition is crucial to innovation. Market structures can influence the degree to which innovation is even possible (Jadlow 1981). Specifically, markets with high rates of firm entry have been linked to increased levels of innovation (Geroski 1995). Conversely, the rate at which businesses shut their doors or reduce their workforce indicates a decrease in economic deadwood. Together the growth and contractions along with births and deaths produce the notion of economic churn, which serves as an indicator of the extent to which innovative and efficient companies replace outdated firms unable to modernize techniques and processes. Churn has been linked to positive employment growth (Spletzer 2000) and is not subject to agglomeration effects that often distinguish urban and rural economic structures (Plummer and Head 2008).

The average churn variable is defined as the total establishment births and deaths, and expansions and contractions, relative to the total number of firms in county *j* for all years available, 1999 through 2004. More specifically,

$$average\ churn_j = \frac{\sum_{t_0}^{t_n}(Births + Deaths + Expansions + Contractions)_t}{\sum_{t_0}^{t_n}(Deaths + Expansions + Contractions + Constant)_t}$$

where *constant* is the number of establishments that neither expanded or contracted in year *t*.

Business Sizes

While churn measures the creative destruction in a region, it provides relatively little information about the structural composition of a region. Small firms, it is thought, are highly adaptable and can easily change their processes to incorporate new ideas. In recent years, high merger rates between small and large firms have coincided with increased technological influence of small firms. Some evidence, however, suggests these acquisitions may not be significant sources of innovation for large firms (Acs and Audretsch 1990; CHI Research 2004).

[22] Broadband density is measured using the same data in two ways: the average number of broadband service providers available per county and the change in average number of broadband service providers available per county.

Theoretically, a higher proportion of large businesses would positively contribute to innovation through the increased availability of funds for research and development, as well as the resources to directly employ scientists rather than hire out research services. Available data, however, do not identify whether, or the degree to which, an establishment is engaged in innovation activities. It may be that one *establishment* has a large, low-skilled operation while innovative activities for the same firm occur at a different location.

Moreover, using data on large establishments, defined as establishments with 500 or more employees,[23] may be of limited utility for explaining innovative capacities in rural counties with small economies. Not many large establishments exist in rural counties. This could explain the reason that the large establishment variable did not yield statistically significant results in the empirical model. Just the same, because the variable has some theoretical merit, the number of large establishments per 10,000 workers remains in the portfolio index.

4.2.2 Outputs

Outputs are the direct outcomes and economic improvements that result from inputs. Typically outputs are lagged where possible to reflect a cause-and-effect element or presented as a decade-long rate of change to capture the degree to which improvements were realized. Outputs are divided into two categories or sub-indices: productivity and employment, and economic well-being.

4.2.2.1 Productivity and Employment Sub-Index

The productivity and employment sub-index describes economic growth, regional desirability, or direct outcomes of innovative activity. Variables in this index suggest the extent to which local and regional economies are moving up the value chain and attracting workers seeking particular jobs.

High-Tech Employment Share Growth

Just as the share of high-tech employment in a county was an important input, the extent to which that share is increasing relative to total employment is an important performance measure. Firms requiring a highly skilled and specialized workforce are drawn to innovative areas. In a similar way, this measure also registers the degree to which home-grown, high-tech firms have expanded their presence. Growth in the share of high-tech employment suggests the increasing presence of innovative activity and signifies that high-tech firms are growing in the county or region both in relative as well as absolute terms.

Job Growth-to-Population Growth Ratio

Even as high-tech employment increases, other sectors may decline or grow. High employment growth relative to population growth suggests jobs are being created faster than people are moving to a region. Even though the ratio measures the change in level between jobs and population and, therefore, can't be used to compare rates of growth, it can rank order counties or regions in terms of employment performance. A high ratio between these two variables indicates strong employment growth. The ratio for the United States is 0.73, meaning that ratios above this value would imply job creation performance above the national average. (On a national level, it would be unusual for employment growth to exceed population growth.) This ratio can vary dramatically county to county. A negative value signifies that population is growing while employment is

[23] The definition (size) of a large establishment follows Barkley et al. 2006.

declining or vice versa. In cases for which population is declining while employment is increasing, the absolute value of the ratio is used as that would be considered favorable employment performance.

Patent Activity

New patented technologies provide an indicator of individuals' and firms' abilities to develop new technologies and remain competitive. The number of patents produced is a commonly used output measure for innovative activities, but the data can mislead. Patent data are coded to distinguish between the residence of the filer and the recorded location of the employer (if the applicant is not a private inventor), but the recorded location of the employer may or may not correspond to the location of the work that produced the patent, especially if the employer is a large, diversified company with many locations. In addition, the available patent data do not cover the universe of all patent types (Barkley et al. 2006). Patent data are recoded from the raw data provided by the U.S. Patent Office and awards patents to any county from which one of the filers reported as their location. This means that for any single patent with more than one filer, a patent may be counted multiple times if filers are located in different counties. As far as the type of patent, only utility patents are considered. Utility patents are items intended to serve a function, in contrast to design patents, which are nonfunctional in nature and include such things as new computer fonts (USPTO 2008). Patents can also be an inaccurate indicator of innovation outcomes, particularly in areas where a single firm overwhelms the total patent count, such as Eli Lilly in Indianapolis (White 2008).

Gross Domestic Product

The final component of the productivity and employment sub-index is the single most important measure of productivity available—gross domestic product (GDP). The index incorporates both the level of a county's current-dollar GDP per worker today, and also growth in the value over the past decade. A high rate of growth signifies substantial improvement from 1997 to 2006.

4.2.2.2 Economic Well-Being Sub-Index

Innovative economies improve economic well-being because residents earn more and have a higher standard of living. Decreasing poverty rates, increasing employment, in-migration of new residents and improvements in personal income signal a more desirable location to live and point to an increase in economic well-being.

Net Migration

Migration measures the extent to which a county or region is broadly appealing and excludes other elements of population dynamics such as fertility rates. While people may migrate into a region for a host of reasons, from employment opportunities to environmental amenities, migration out of a region almost certainly signals declining economic conditions and the inability to keep the innovative talent that will spawn economic growth in the future.

Compensation

Compensation data convey how much workers make based on their place of work. Likewise, proprietors' income is also based on place of work. Compensation and proprietor's income, therefore, probably provide a strong relationship between the activities of innovation and the rewards of innovation based on the location of innovation.

As an alternative to measuring remuneration based on place of work, per capita personal income (PCPI) measure incomes by place of residence. Because PCPI includes other forms of income in addition to wages, salaries and fringe benefits, it is a more comprehensive measure of well-being. That said, the linkage between where innovation occurs (county of work) and the financial rewards of innovation (county of residence) is less direct.

4.2.3 Calculating the Sub-Indices

Each sub-index (X_s) for human capital, economic dynamics, productivity and employment, and economic well-being is calculated by summing weighted ratios that divide the county-level metric by the U.S.-level metric:

$$X_{sj} = 100 * \left[\sum_{i=1}^{n} \alpha_i \left(\frac{x_{ij}}{x_{iU}}\right) \dots \alpha_n \left(\frac{x_{nj}}{x_{nU}}\right)\right] \qquad \text{(Equation 1)}$$

where x_{ij} denotes data for county *j* for innovation factor (or variable) *i* , where x_{iU} denotes the U.S. average for innovation factor *i* and where α_i is the weighting for factor *i* for the particular sub-index *s*. Equation 1 provides a general sense of how each X_s is calculated.[24] In instances where the factor could have a negative range (e.g., growth variables), the entire range was shifted upward by adding the absolute value of the minimum value in the range. This shift prevents any single variable from subtracting points from the overall index as a result of its negative range and maintains necessary rank order of continuous variables.

Additional adjustments may also be warranted. If the ratio of the county value to the U.S. value exceeds two standard deviations above or below the U.S. mean, the value of that datum for that particular county is constrained to within two standard deviations. This procedure limits the amount of influence any single variable can have in the overall index. Even with this constraint on extreme outliers, this procedure was insufficient to modify the extremes of three variables with broad ranges, namely patents, venture capital and R&D. As a result, before calculating the standard deviation for constraining extreme values for these three variables, extreme outliers[25] were removed prior to calculating the standard deviations used for the 2σ constrained data range.

Strictly speaking, innovation factors were not weighted equally as some factors were broken down into two measures in a sub-index. That said, each concept was weighted equally.[26] A concept is defined here as an umbrella under which a factor may be measured in multiple ways. For instance, GDP per worker is a concept and the concept is included as a level that measures a county's relative performance today as well as a rate of change to suggest the extent to which an economy has grown over the last decade. Together the measures are one concept and each receives half of the concept's overall weight. The weighting of a concept within a sub-index is dependent on the number of concepts included in each sub-index (four to five).

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[24] See full algorithm and discussion in Appendix C.

[25] Extreme outliers are here defined to be greater than four standard deviations, as calculated from the complete dataset. The extreme outliers, therefore, were not used to calculate the standard deviation for the 2σ constrained data.

[26] This is the same approach utilized in the European Innovation studies due largely to disagreement on the precise weighting metrics and an inability to derive anything on a more empirical basis. See the Empirical Innovation Index (EII) section for further discussion of the research team's attempts to move beyond the simple weighting scheme.

A similar weighting approach is used in several other innovation indexes (Atkinson and Correa 2007; Pro Inno Europe 2006). An alternative approach would be a weighting scheme based on which factors (or variables) have the greatest explanatory power for the changes in innovation. The alternative approach is early in its genesis. For one reason, the approach requires that researchers declare their dependent variable, that is, declare their single measure for changes in innovation (see Empirical Index discussion in Section 4.3; Porter and Stern 1999).

4.2.4 Calculating the Portfolio Index

The Portfolio Innovation Index (PII) combines the four sub-indices presented above. Each component is weighted relatively equally. Economic well-being has a less direct relationship to innovation activities, and receives one-third the weight of the other three sub-indices. In addition, the index values for economic well-being across counties also tend to be higher than the other sub-indices, largely because there is less dispersion in measures such as poverty rate and average unemployment than there is among measures such as high-tech employment or R&D expenditures among counties.

The final calculation for the portfolio index is as follows:

$$PII_j = \sum_{s=1}^{4} A_s X_{sj} \qquad \text{(Equation 2)}$$

where PII_j is the portfolio index for county *j*, A_s is the weight for the sub-index *s* component of the portfolio index and X_{sj} is a given sub-index value for county *j*.[27]

See Table 14 for a presentation of all the indices used for the PII and summary statistics for each component.

Table 14: Summary Statistics for Innovation Indices and Data Series

Index	Variable	Variable Label	Percent of Sub-Index	U.S. Value	All Counties				
					Mean	Median	Std	Min	Max
Overall	Portfolio Index			100.0	80.5	79.0	9.2	60.3	127.4
	Human Capital Sub-Index			100.0	77.8	75.0	16.1	50.1	146.0
	Economic Dynamics Sub-Index			100.0	78.4	76.8	11.2	51.7	132.2
	Productivity and Employment Sub-Index			100.0	79.7	79.1	9.8	47.8	128.7
	Economic Well-Being Sub-Index			100.0	97.1	96.7	7.3	70.6	126.2

[27] j is introduced to the X_i variable to reflect that in addition to calculating a sub-index for each county, there are also multiple indexes for each county.

Index	Variable	Variable Label	Percent of Sub-Index	U.S. Value	All Counties				
					Mean	Median	Std	Min	Max
Human Capital Sub-Index	Mid-Aged Population Growth Rate, 1997 to 2006	popgroma	20%	-0.2%	-0.7%	-0.7%	2.1%	-22.2%	9.4%
	Percent of Population Ages 25-64 with Some College or an Associate's Degree, 2000	Perassoc	20%	29.5%	29.1%	29.1%	6.2%	11.3%	47.2%
	Percent of Population Ages 25-64 with a Bachelor's Degree, 2000	Perbach	20%	26.5%	18.0%	16.2%	8.2%	4.9%	64.0%
	Average High-Tech Employment Share, 1997 to 2006	avghtshare	20%	4.8%	2.9%	2.3%	2.5%	0.1%	51.2%
	Technology-Based Knowledge Occupations Share, 2007	KOC	20%	1.0	0.6	0.6	0.3	0.1	3.9
Economic Dynamics Sub-Index	Average Venture Capital Investment per $10,000 GDP, 2000 to 2006	avgVCGDP	20%	35.2	4.2	0.0	25.2	0.0	648.5
	Average Private Research & Development per $1,000 Compensation, 1997 to 2006	avgRDpCOMP	20%	2.3	3.0	0.0	28.2	0.0	1081.7
	Broadband Density, 2007	Bb_lya	10%	10.6	7.7	7.5	2.6	0.0	19.0
	Change in Broadband Density, 2000 to 2007	bbd	10%	16%	21%	21%	6%	0%	88%

Index	Variable	Variable Label	Percent of Sub-Index	U.S. Value	All Counties				
					Mean	Median	Std	Min	Max
	Average Establishment Churn, 1999 to 2004	avgchurn	20%	0.80	0.74	0.74	0.06	0.42	0.96
	Average Small Establishments per 10,000 Workers, 1997 to 2006	smestpw	10%	364	412	400	101	36	1,176
	Average Large Establishments per 10,000 Workers, 1997 to 2006	lgestpw	10%	1.07	0.67	0.58	0.70	0.0	7.27
Productivity & Employment Sub-Index	Job Growth to Population Growth Ratio, 1997 to 2006	jobpop	25%	0.7	1.0	0.5	30.4	-909.0	1200.3
	Change in High-Tech Employment Share, 1997 to 2006	HTESd	25%	-0.7%	0.0%	-0.2%	4.0%	-21.7%	33.1%
	Average Annual Rate of Change in GDP ($ Current) per Worker, 1997 to 2006	GDPWcod	12.5%	3.6%	3.4%	3.4%	1.9%	-25.2%	13.9%
	Gross Domestic Product ($ Current) per Worker, 2006	cuGDPW	12.5%	73,989	58,976	57,119	20,831	3,314	622,632
	Average Patents per 1,000 Workers, 1997 to 2006	avgPatpw	25%	18.8	4.0	1.8	7.3	0.0	101.2

Index	Variable	Variable Label	Percent of Sub-Index	U.S. Value	All Counties				
					Mean	Median	Std	Min	Max
Economic Well-Being Sub-Index	Average Poverty Rate, 2003 to 2005, inverse	avgpovR	20%	12.8%	14.1%	13.2%	5.5%	3.0%	41.2%
	Average Unemployment Rate, 2005 to 2007, inverse	avgunempR	20%	4.8%	5.1%	4.8%	1.7%	1.7%	20.6%
	Average Net Internal Migration Rate, 2000 to 2006	netmigR	20%	0.0%	0.0%	-0.1%	1.1%	-11.1%	7.3%
	Change in Per Capita Personal Income, 1997 to 2006	PCPId	20%	4.1%	3.8%	3.7%	1.1%	-1.7%	15.7%
	Change in Wage and Salary Compensation per Worker, 1997 to 2006	wspWd	10%	3.8%	3.5%	3.5%	0.8%	-4.8%	9.8%
	Change in Proprietors Income per Proprietor, 1997 to 2006	propincd	10%	3.0%	0.7%	0.5%	3.8%	-18.1%	20.0%

Source: Indiana Business Research Center

4.2.5 What Does the Portfolio Innovation Index Mean?

Interpreting the PII is not as simple as an initial glance may suggest. The PII rates a county's performance relative to the United States on a continuous scale. Comparisons between counties are similarly relative to the U.S. average. Additionally, the PII composite index has no simple definition as there is no single dependent variable. Rather, the PII is a collection of measures baked into one at-a-glance number, not unlike the leading economic index of the Conference Board[28] (except the PII components have a more equal weighting). As a "portfolio," the index is an aggregation of many disparate parts that may or may not move in tandem with each other.

The PII is an aggregation of underlying sub-indices for innovation inputs and outputs. Traditionally these two components—inputs and outputs—would not be combined into a single figure. The higher scoring counties will tend to exhibit high levels of inputs and outputs, whereas the lowest-scoring counties will have low levels

[28] See www.conference-board.org/economics/indicators.cfm.

of inputs and outputs. The murky analytical area is for counties that may have a high overall score but only due to a relative advantage in either inputs or outputs, but not both concepts simultaneously.

Overall, there are 100 counties (out of 3,111 counties) that have high output results (defined as greater than 100, the U.S. average) in both economic well-being and productivity and employment. Of those counties, only 40 also have high inputs (>100) in human capital and economic dynamics (see Table 15). These 40 counties are, in essence, the innovation leaders where high inputs are linked to high outputs.

For the remaining 60 counties with high outputs, 31 have high levels of inputs in at least one category, as well as relatively high levels in the other (85<x<100). The remaining 29 counties are more challenging to interpret as their outputs are high but neither input component is high. For these counties, their high output levels could be related to other input factors not included in the index (e.g. natural resource extraction). Conversely, the counties with high levels of inputs but marginal outputs may signify a delayed or lagged effect in realizing the economic benefits from improved human capital and economic dynamism. Testing such a relationship was beyond the scope of this study, but the notion merits further research.

There is no perfect combination of factors that define an innovative region, but an innovative county could be expected to perform at or better than the nation in at least one category. A total of 1,165 counties (37 percent) score greater than 100 in at least one input or output sub-index. Many of those (774 counties) are bolstered by the economic well-being sub-index. The other 1,946 counties (63 percent) do not have any sub-index value greater than the national average, thereby showing how a relatively few large population, high-output counties pull up the national average.

Figure 10 presents mean scores from three of the groupings presented in Table 15. The high-input/high-output grouping is, on average, as good as it gets for counties, whereas the low-input/low-output is the average of the counties that did not ever score higher than 100 on any single sub-index. As Figure 10 indicates, the averages vary substantially between these groups in both input categories, with the greatest disparity in human capital.

Table 15 and Figure 10 present alternate approaches to describing the input-output leaders. As illustrated in Figure 10, the economic well-being sub-index tends to measure highly for all types of counties.

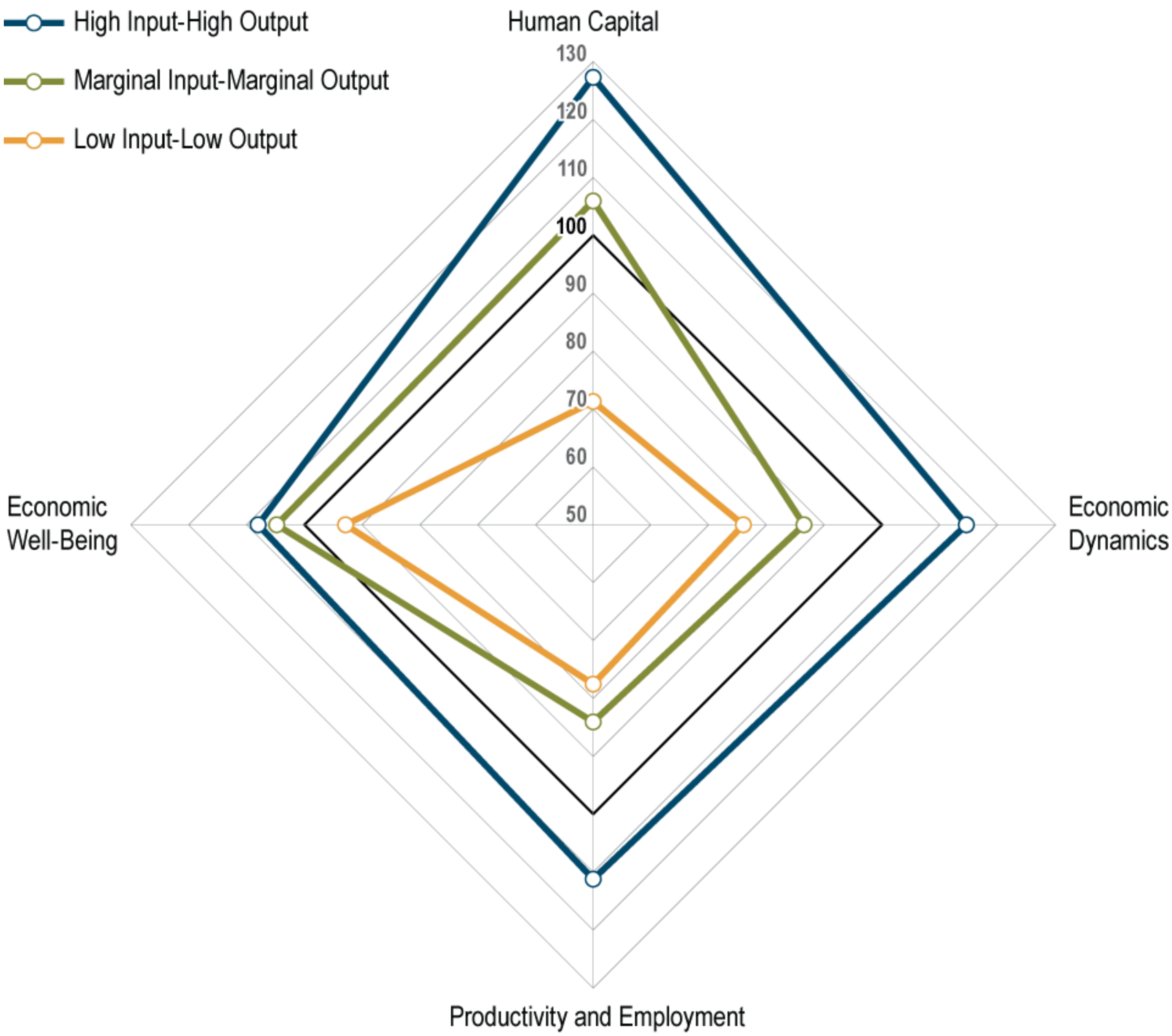
Table 15: Innovation Categorization Based on Performance in Input and Output Sub-Indices

No. of Input Sub-Indices over 100	No. of Output Sub-Indices over 100	Mean Portfolio Index	No. of Counties	Innovation Category
2	2	116.7	40	High-Input/High-Output
2	1	107.6	45	High-Input/Marginal-Output
2	0	102.9	12	High-Input/Low-Output
1	2	104.0	31	Marginal-Input/High-Output
1	1	93.4	137	Marginal-Input/Marginal-Output
1	0	90.1	97	Marginal-Input/Low-Output
0	2	93.3	29	Low-Input/High-Output
0	1	81.2	774	Low-Input/Marginal-Output

No. of Input Sub-Indices over 100	No. of Output Sub-Indices over 100	Mean Portfolio Index	No. of Counties	Innovation Category
0	0	76.7	1,941	Low-Input/Low-Output

Note: Counties do not sum to 3,111 as five counties were omitted due to null values.
Source: Indiana Business Research Center

Figure 10: Sub-Index Dimensions of the Portfolio Innovation Index



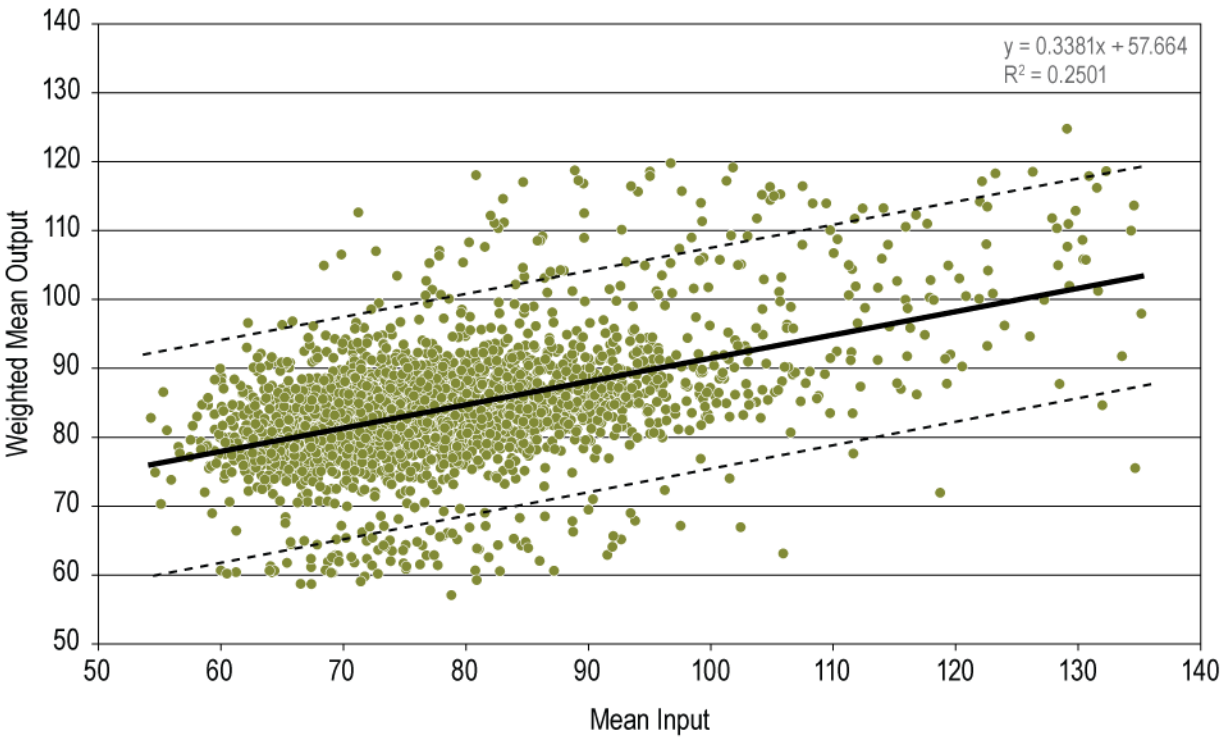
Note: United States = 100
Source: Indiana Business Research Center

4.2.6 The Relationship between Innovation Inputs and Outputs

The measures for inputs and outputs in the portfolio index are theoretically linked, as discussed in the introduction to this section of the report. The manner by which the concept of innovation was operationalized shows that there is a clear relation between the results of innovation and factors that describe innovation capacity and activity.[29] The fact that the variables that measure innovation inputs and outputs tend to move together offers statistical support for joining the two concepts into a single composite index.

Figure 11 highlights the range of capacity and performance. The graph also shows that some counties may have relatively high innovative capacity or inputs coupled with low innovation output, at least for the time frame for which there are data. Conversely, high output measures can be realized with low input capacity, suggesting that there are unexplained exogenous factors influencing performance.

Figure 11: Weighted Average Input/Output (proportional)



Source: Indiana Business Research Center

4.2.7 Spatial Considerations

Spatially, high-innovation counties tend to be proximate to metropolitan areas (see Figure 12). For instance, some of the greatest concentrations of high PII are clustered in the New England states, Silicon Valley, the District of Columbia, St. Paul-Minneapolis, and along the central corridor of Colorado. The highest innovation scores are not, however, always confined to the central portions of major cities. Take, for instance, Kansas City, Mo., where the composite indicator is marginal, but in suburban Johnson County, Kan., the composite indicator is among the highest in the country.

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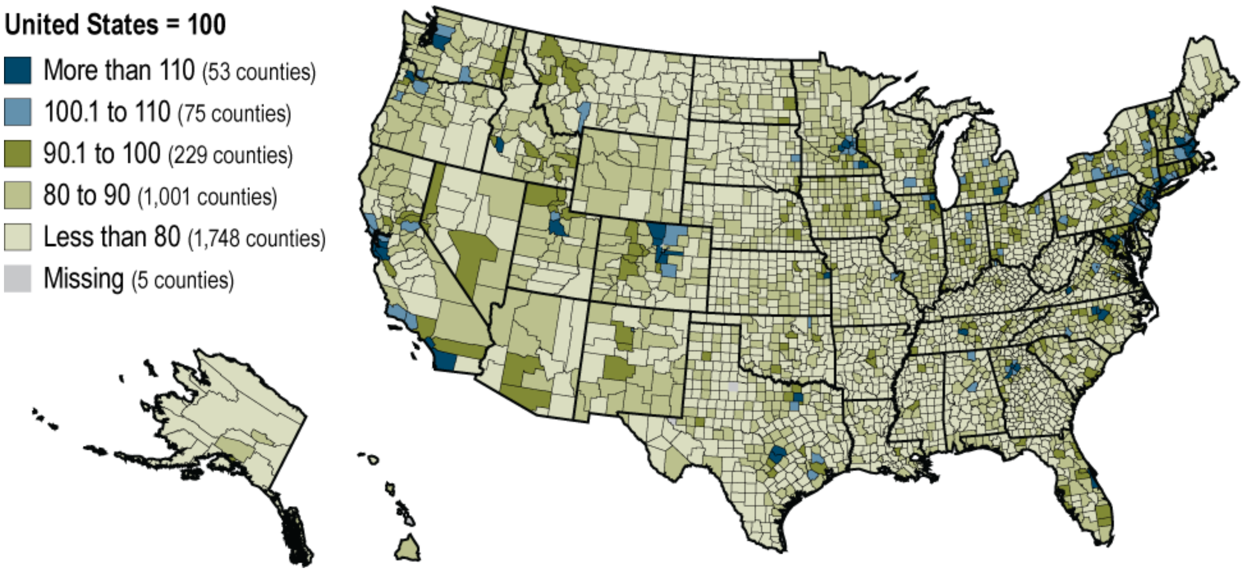
[29] The research team, however, cannot be certain about the direction of causality based on this approach.

Figure 12: County-Level Portfolio Index for the United States



Note: A missing value for any one data series results in a missing value for a sub-index, which results in a missing value for the PII.
Source: Indiana Business Research Center

4.2.8 Can Rural Regions Be Innovative?

The idea that innovation occurs only in large metropolitan areas is spurious. While rural regions may lack certain agglomerative effects for innovation capacity, the ability of a rural area to become an innovation leader should not be dismissed.

There are a number of rural counties (defined as 0.4 or greater on the Index of Relative Rurality[30]) that score above average in the portfolio index and also score above average in three or four of the sub-indices. Each of these rural counties has specific traits that lead to its strong performance, but no two counties have identical traits.

Here are a few examples:

- **Midland County, Mich.**, located 40 miles northwest of Flint, Mich., is an example of a rural county that fares quite well within the PII. Three sub-indices were greater than the U.S. average including two inputs and one output. Only economic well-being was below the U.S. average, and not by much. So what characteristics describe this rural county's relatively high performance in the PII? There are a few things that clearly set this county aside from other more rural areas, including large research and development expenditures by Dow Chemical, above average educational attainment, and high broadband density and growth. But the entire story is not positive. The county's GDP per worker is lower than the U.S. average, as is GDP-per-worker growth, migration, per capita personal income growth, and tech-based knowledge occupation share. The key to Midland's higher innovation score is that the strong positives outweigh the

[30] The IRR was briefly discussed in Chapter 3. It is comprised, by county, using four measures: population, population density, extent of urbanized area, and distance to the nearest metropolitan area. For more information, please see Section 3.2.2 of the prior report: www.statsamerica.org/innovation/report_role_of_regional_clusters_2007.html.

relative negatives. For instance, Midland's reported relative R&D expenditures are among the highest in the county.

- **Dodge County, Minn.**, directly west of Olmsted County, home to the Mayo Clinic, portrays a slightly different picture. Dodge County is located in the Rochester MSA due to commuter flow patterns into that city. Dodge County scores above the U.S. average in one sub-index input category and both sub-index output categories. Despite an absence of both R&D and venture capital investment in the county, the variables that set Dodge apart from the rest of the country include combinations of growth in the mid-aged populations, high growth in per capita personal income, low unemployment, and a low poverty rate.
- **Gallatin County, Mont.**, home of Montana State University in Bozeman, benefits from the presence of a major university. The two input categories are high, as is one output category. The presence of highly educated individuals, as well as R&D and VC investments, explains the above-average input sub-indices.
- **Los Alamos County, N.M.**, is home to Los Alamos National Laboratory where the Manhattan Project research was conducted. Except for the economic dynamics category, the county performs well in all other indices. In the other input measures, particularly educational attainment, the county performs very well. Los Alamos has the nation's greatest concentration of bachelor's or higher degrees in its population. This model to promote innovation, however, would be difficult, if not impossible, for other counties to replicate.
- **Steuben County, N.Y.**, has the Corning Glass Museum as its claim to fame. Corning, a glass and ceramic manufacturer, contributes significantly to Steuben's high output indices by providing a substantial amount of private R&D to the county on the order of $4.1 billion between 1998 and 2006. The county performs marginally well in the human capital area, but above average in every other sub-index.
- **Tioga County, N.Y.**, is located in the Binghamton MSA due to its commuter patterns. The county is home to Biolife Solutions, a large biosciences research firm. Tioga is an example of a county that performed above average in only one output sub-index and one input sub-index. In terms of economic dynamics, the county performs poorly with a low degree of establishment churn and low broadband density. However, the county performs very well in terms of human capital with a high location quotient for technology-based knowledge occupations.

While the precise sources of innovation in several of these counties would prove difficult to replicate elsewhere, such as the case of Los Alamos County, others could more easily be modeled. For instance, Steuben and Tioga counties mostly benefit from the presence of firms investing in major R&D ventures. These firms attract a certain type of worker capable of performing specified tasks, which in turn leads to increases in desired innovative outputs and improvements in the quality of life in the areas. Neither of these two counties performed above average in every sub-index, but still performed well overall on the PII.

4.3 Empirically Based Innovation Index

The Portfolio Innovation Index discussed above weights each incorporated measure relatively equally. To assess the validity of this broad approach, the research team also derived an empirically based Innovation Index (EII). The EII departs from previous attempts to index innovative activities by identifying those specific factors with the greatest influence on economic growth, while controlling for some non-innovation factors. Interpreting this index is simpler than the portfolio approach because there is only one output measure—economic growth.[31]

The empirical scheme was developed with weights based on a descriptive cross-sectional regression model using the variables that most influence growth in GDP per worker.[32] The inputs, or independent variables, considered in this index are weighted according to their statistical relationship to the main measure of economic output. Instead of using the weights based on the beta coefficients from the regression model, the research team re-weighted the statistically significant and positive independent variables so that the weights, or coefficients, of the set of indicators summed to one. As a result, this empirical index diverges from a purely theoretical or empirical approach because factors that, theoretically, should contribute to innovation but showed a negative relationship to innovation were removed from the index.

Further discussion of the regression models and data used is available in Appendix C.

4.3.1 Comparing EII and PII

The empirical index uses the same equations presented for calculating PII's sub-indices, although only a single iteration is necessary due to the limited number of positively significant variables: mid-age population growth, two measures of educational attainment, growth in high-tech employment, average small establishments per 10,000 workers, average VC investment per GDP dollar and change in broadband density.

Estimates for the empirical index are positively correlated with the portfolio index (r=0.46) indicating a somewhat modest relationship between the two approaches. The indices, however, represent distinctively different approaches to measuring innovation performance. The PII takes a broad, multi-metric approach to gauge performance. The EII, however, posits that the rate of economic growth is partially determined by innovation and that the rate of economic growth is the most direct measure to gauge innovation performance.

4.4 Conclusion

Developing an innovation index relies on a relatively small pool of literature regarding indices and their applications in the social sciences. The data and method pursued by the research team for designing and building an innovation index attempted to appeal to two audiences: academic and policy-related researchers as well as economic development practitioners in the field.

This index is, to the research team's knowledge, the first attempt to create a comprehensive innovation measure at the county-level unit of analysis in the United States, and the measure is admittedly not perfect. The Europeans have noted that their own effort to create national measures for innovation has been fraught with difficulties. For example, using indices can result in a loss of variability and explanatory power through the grouping of data. It also implies that more data are always better. Finally, using all available data ignores

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[31] Y=GDP-per-worker growth from 1997 to 2006

[32] Ideally a time-series regression model would be utilized; however, several key variables had only limited time frames available that were not conducive to this approach. The research team did run a time series analysis including as many of the independent variables as possible, but the results were weaker than the simple descriptive model that could incorporate a broader array of variables.

multicollinearity between variables and that some data are redundant (Hollanders and van Cruysen 2008). The Portfolio Innovation Index shares several of these flaws.

In order to address the issue of potentially spurious grouping of data and the loss of variability, a web-enabled database and tool was created as a part of this research project. The database and tool will allow a user to see the effects a particular measure (or data series) has on a county or region's overall index. Of potentially greater concern may be the degree to which concepts or measures are related conceptually and statistically. The research team minimized correlations between factors of the PII by carefully selecting data series, calculations and measures.

Imperfections aside, this index presents a state-of-the-art measure of county and regional innovation performance and capacity. This index can serve as a valuable tool for policymakers and practitioners to quickly evaluate innovative capacity and potential. As with all indices, however, the overall estimate is not as important as the sum of its parts. Economic development practitioners not only get a quick snapshot of how their region is doing in terms of innovation with the portfolio index, but they also have the ability to drill down into the highly granular data to gain a better understanding about their region's strengths and weaknesses.

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4.6 Data Sources

The Innovation Index used data from both official government statistical agencies and several private, proprietary sources.

The research and database team accessed the following websites between May and August 2008. In all cases, the latest year available (lya) of each data series was used. In the majority of cases, 2006 was the latest year available. The initial year for a majority of the economic statistics on employment and output was 1997, the first year of the major revision in industrial classification, i.e., the NAICS. For data series that did not begin in 1997, the series extended as far back as possible. In several cases—notably educational attainment and migration—the data were anchored in 2000, the year of the last decennial Census.

Economic Modeling Specialists Inc. (EMSI), Spring 2008 Release v. 2, www.economicmodeling.com, (data series: EMSI Complete Employment).

Used for:

Number of Technology-Based Knowledge Occupation Employment, **Technology-Based Knowledge Occupation Cluster**, Human Capital Sub-Index

Total Employment (EMSI Definition), **Technology-Based Knowledge Occupation Cluster**, Human Capital Sub-Index

Federal Communications Commission, Local Telephone Competition and Broadband Deployment, www.fcc.gov/wcb/iatd/comp.html, (data series: ZIP Codes by Number of High-Speed Service Providers).

Used for:

Broadband Weighting Factor, **Broadband Density and Penetration**, Economic Dynamics Sub-Index

Innovation Economy 360, Decision Data Resources, www.ie360.net, (data series: Venture Capital Investment).

Used for:

Total Venture Capital, **Average Venture Capital**, Economic Dynamics Sub-Index

Innovation Economy 360, Decision Data Resources, www.ie360.net, (data series: Private Research and Development).

Used for:
Total Research & Development Funds, **Average Private R&D**, Economic Dynamics Sub-Index

Innovation Economy 360, Decision Data Resources, www.ie360.net, (data series: Patents).

Used for:
Total Patents, **Average Patents per 1,000 Workers**, Productivity & Employment Sub-Index

Moody's economy.com, www.economy.com/databuffet/pro/beta/ , (data series: FEZTECA, High tech industries employment in thousands, seasonally adjusted).

Used for:
High Tech Employment, **High-Tech Employment Share**, Human Capital Sub-Index

High Tech Employment, **Change in Share of High-Tech Employment**, Productivity & Employment Sub-Index

Moody's economy.com, www.economy.com/databuffet/pro/beta/, (data series: FETA, Total non-farm employment in thousands, seasonally adjusted).

Used for:
Moody's Estimated Total Employment, **High-Tech Employment Share**, Human Capital Sub-Index

Moody's Estimated Total Employment, **Change in Share of High-Tech Employment**, Productivity & Employment Sub-Index

Moody's economy.com, www.economy.com/databuffet/pro/beta/, (data series: RGDPA, Total Gross Product, in millions).

Used for:
Current-Dollar County GDP, **Average Venture Capital**, Economic Dynamics Sub-Index

Current-Dollar County GDP, **Change in Gross Domestic Product per Worker**, Productivity & Employment Sub-Index

Current-Dollar County GDP, **Gross Domestic Product per Worker**, Productivity & Employment Sub-Index

National Science Foundation, IPEDS Completions Survey, webcaspar.nsf.gov, (data series: Degrees/Awards Conferred [NSF population of institutions]).

Used for:
Number of Sciences and Engineering Graduates – Bachelor's and Advanced Degrees, **S&E Graduations from State Institutions**, State Context Sub-Index

National Science Foundation, Division of Science Resources Statistics, www.nsf.gov/statistics/nsf08318/, National Patterns of R&D Resources, (data series: U.S. R&D Expenditures by state, sector, and source of funds).

Used for:
Research and Development Expenditures by University and Private Firms, **R&D Spending per Capita**, State Context Sub-Index

U.S. Bureau of Economic Analysis, Regional Economic Accounts, Compensation by Industry, www.bea.gov/regional/reis/default.cfm?catable=CA06.

Used for:
Total Worker Compensation, **Average Private R & D**, Economic Dynamics Sub-Index

BEA Wage and Salary Earnings, **Compensation – Annual Wage and Salary Earnings per Worker,** Economic Well-Being Sub-Index

U.S. Bureau of Economic Analysis, Regional Economic Accounts – Total Wages, Wage Employment, Average Wage Per Job, www.bea.gov/regional/reis/default.cfm?catable=CA34&section=2.

Used for:
BEA Wage and Salary Employees, **Compensation – Annual Wage and Salary Earnings per Worker,** Economic Well-Being Sub-Index

U.S. Bureau of Economic Analysis, Regional Economic Accounts, Personal Income and Detailed Earnings by Industry, www.bea.gov/regional/reis/default.cfm?catable=CA05N&series=NAICS.

Used for:
BEA Nonfarm Proprietors Income, **Compensation – Proprietor's Income per Proprietor**, Economic Well-Being Sub-Index

BEA Personal Income, **Per Capita Personal Income Growth**, Economic Well-Being Sub-Index

BEA Population Estimate, **Per Capita Personal Income Growth**, Economic Well-Being Sub-Index

U.S. Bureau of Economic Analysis, Regional Economic Accounts, Total Employment by Industry, www.bea.gov/regional/reis/default.cfm?catable=CA25.

Used for:
BEA Total Employment, **Gross Domestic Product per Worker**, Productivity and Employment Sub-Index

BEA Total Employment, **Change in Gross Domestic Product per Worker**, Productivity and Employment Sub-Index

BEA Total Employment, **Average Small Establishments per 10,000 Workers**, Economic Dynamics Sub-Index

BEA Total Employment, **Average Large Establishments per 10,000 Workers**, Economic Dynamics Sub-Index

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