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# A Framework for Measuring County Economic Resilience

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## A Framework for Measuring County Economic Resilience

### An Application to West Virginia

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# A Framework for Measuring County Economic Resilience

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**Abstract**

The study provides a framework to develop economic resilience index for West Virginia counties based on the premise that county economic resilience depends on its physical and human resources, structure and diversity of its economic base (employment and income diversity), entrepreneurial activity and business dynamics and scale and proximity (spatial issues). Using 17 indicators along four of the six proposed dimensions, a preliminary economic resilience index has been created for West Virginia counties between for the years 2000 and 2005. Geospatial maps are also developed to explore the evolution of the geographical patterns of economic resilience across time. The effectiveness of the index is further affirmed in correlation analyses where the contribution of economic resilience to unemployment reduction and employment growth is highly significant. These preliminary results are encouraging and appear to be pointing in a useful direction. The discussion in this study can serve as a starting point for building a broad-based, standardized, and consistent definition and measure of economic resilience.

Keywords: Regional economic development, Economic structure, Resilience
JEL Classification: R11

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# 1 Introduction

Globalization, rapid technological change, deep recessions, and man-made and natural disasters have generated interest in regional economic resilience as an important field of study. The economic impact of these exogenous shocks and the recovery mechanisms differ from region to region. Lack of economic diversification is one of the major weaknesses that limits the ability of a region to absorb an external shock. In rural West Virginia, an over-dependence on the coal and steel industry has shattered the economies of many counties in the South and Northern panhandle of the state.

McDowell County is a good example of a county that is struggling to recover from economic and natural disasters. Once a leading producer of coal in the US, it is hard hit by change in technology in coal production, decline in industry demand (starting in the 1950s), and flooding (2001-2002). In the 1950s the county population was close to 100,000 (West Virginia Health Statistics Center, 2002) and in 1980, 68.9% of its industrial earnings and 48% of it employment were dependent on coal[1]. With technological changes in the coal industry everything started to fall apart. The use of new mining technologies, competition and demand decline from the steel industry resulted in the restructuring of the mining industry and a decrease in the mining labor force. Its population decreased to an estimated 25,000 in 2005. In a quarter of a century (1980-2005) alone, it lost more than 50% of its population and 63.5% of its employment. McDowell County was not able to absorb the external shock and bounce back to transform and diversify its economy and is lagging behind in almost every measure of economic activity. McDowell is an example of many rural counties whose economic resilience and the survival of the community are challenged by economic downturns and disasters. Local stakeholders stand to benefit from a better understanding of the impact of external shocks on their local areas that help them improve response strategies that will minimize adverse effects while at the same time building a more resilient economy and community.

[1]Most of the population, employment, and earnings data used in the McDowell county example are from the Bureau of Economic Analysis (BEA).

The literature in this subarea of regional economics is at still in its infancy. However, the closely related issue of the relationship between economic instability and diversification has been the subject of many studies. In theory, economic diversity results in a more stable economy (Akpadock, 1996; Jackson, 1984). The broader concept of community resilience is also getting much more attention due to the threat of and concerns for man-made and natural disasters. Economic resilience is one dimension of this broader concept of community and regional resilience.

The main objective of this study is to develop a county economic resilience index for measuring the ability of local economies to withstand external shocks and bounce back. It can serve as a standalone measure of economic resilience in relation to economic downturn or it can be used more generally as one measure of community or regional resilience. It is one aspect of the community resilience that includes both social and natural capital of the community. The index highlights and identifies which geographical areas are best positioned to cope with economic downturns and those that are at risk. The index also gives a measurement that reflects the multidimensionality of economic resilience. It provides a framework for identifying the areas of greatest strength and weakness, with a focus on the physical and human resources, structure and diversity of the economic base (employment and income diversity), entrepreneurial activity and business dynamics and scale and proximity (spatial issues). The study is also expected to contribute to our understanding of the geography of economic resilience and its implication for rural economic development. A geospatial map is used to assess the spatial distribution of economic resilience over time.

The index created in this study is not without limitations. Average county-level data masks many important details that could highlight the differences in economic resilience within a county. The lack of a consistent county level database limits the ability to create a broad based index. The variables included to create the index may not provide a complete picture of economic resilience of West Virginia counties. However, the index can serve as a foundation for discussion for understanding economic resilience and standardizing its measurement. It will also provide a benchmark for comparing the strengths and weaknesses of West Virginia counties.

# 2 Defining Economic Resilience

Detailed descriptions and definitions of the resilience concept used in different disciplines are given by Mayunga (2007); Norris et al. (2008); Rose (2009). Despite the many definitions, it appears that there is some consensus among researchers and practitioners on common attributes of resilience. Regional or community resilience is defined "as the ability of a region to anticipate, prepare for, respond to and recover from a disturbance" (Foster, 2007; Mayunga, 2007) while Peacock (2009) defines it "as the ability of a community to absorb, deflect or resist disaster impacts, bounce back after being impacted, and learn from experience and modify its behavior and structure to adapt to future threats".

Economic resilience to disasters is defined as the inherent and adaptive responses to hazards that enable individuals and communities to avoid some potential losses (Rose, 2004). Rose describes static economic resilience as the ability or capacity of a system to absorb or cushion against damage or loss and dynamic resilience as the ability of a system to recover from a severe shock. Following the literature, in this study economic resilience is defined as the ability to absorb shock and bounce back. In this study, bouncing back is defined as returning to the economic status before the external shock. While there is some discussion surrounding the desirability of returning to previous economic status rather than some new normal, and potentially better economic status, setting the target for the index at complete return establishes a foundational point of reference that is useful for interregional comparison. The index will provide a base line where local authorities and policy makers can gauge their region. It will serve to identify the key factors underlying economic resilience at county level.

# 3 Literature

Economic resilience is a highly complex construct which is affected by several factors. Disaster and economic downturns are the two main factors that test the resiliency of a region. There are several frameworks which focus on economic resilience (Briguglio et al., 2009; Rose, 2007; EDAW and

AECOM, 2009; Arnold et al., 2009). Although these conceptual frameworks have advanced our understanding, in the case of the US, they have not led to an index that could have a practical application at the local level.

Several approaches are used to measure the economic resilience of a region. Computational general equilibrium (CGE) modeling (Rose and Liao, 2005), case studies (Foster, 2007), discriminant analysis (Chapple and Lester, 2007), and an entropy index of industrial diversification (Horne et al., 1999) are some of the approaches that have been used to study regional economic resilience in the US. Horne et al. (1999) equate economic resilience to industrial diversification and assumed that greater diversity of the industrial base leads to more resilient economies. This implies that a county with a diversified industrial base is more resilient than an industrial concentrated one. This seems intuitive but warrants some caution. A region with a diversified economy might lack strong capabilities to bounce back after shock (Lanza et al., 2010), perhaps because it fails to incorporate the role of human and physical capital in economic resilience.

Resilience measures the capacity of the community impacted by an external shock to adjust and recover quickly. The stronger the social, economic, and environmental capital, the more resources community has from which to draw for recovery. Small rural communities may not have the necessary resources to deal with major disasters or economic downturns, but they may have a very strong sense of community. How much strong social capital can compensate the lack of resources and help communities to recover is an issue by itself worth investigating. The presence or absence of existence of separate small communities (ethnic, race, economic) within a larger jurisdiction was found to be important in community resilience in areas of Mississippi and Louisiana affected by Katrina (Li et al., 2014). The scale of the economy and the proximity of the region to major urban, transportation, and communication centers could also play a role in fostering economic resilience.

# 4 Methodology

The County Economic Resilience Index (CERI) builds on past research and analysis that used economic resilience indicators as one dimension in community resilience and/ or social vulnerability index (Cutter et al., 2003, 2008, 2009; Peacock, 2009; EDAW and AECOM, 2009). The approach is based on the assumption that economic resilience is a complex phenomenon which cannot be explained by one single attribute but multiple attributes of a region can be combined to create a single, composite index value. Figure 1 and Table 1 shows the proposed framework. The County Economic Resilience Index (CERI) proposed in this study has six dimensions: industrial diversity, entrepreneurial activity and business dynamics, human and social capital, scale and proximity, and physical capital (infrastructure).

Figure 1: Proposed Framework for County Economic Resilience Index (CERI)


## 4.1 Industrial Diversity

Regional economic resilience to large extent depends on the industrial base of its underlying economy. A highly concentrated economic base can give a competitive advantage due to specialization and can be a major source of economic growth. It can also expose the region to external shocks due to over-dependence on particular activities. This can lead to localized job losses if global trends result in outsourcing or demand change. A balance

between diversification and specialization is needed in order to stay competitive but also minimize the exposure to external shocks. To construct a measure of industrial diversity, an index is developed by aggregating industrial employment into ten sectors[2]. The computation of the index is based on data from the Bureau of Labor Statistics (BLS), Quarterly Census of Employment and Wages. Following Attaran and Zwick (1989) and Nissan and Carter (2006) an Entropy Index ($E$) of industrial diversity is created as follows:

$$E = \sum_{i=0}^{n} P_i \times log \frac{1}{P_i} \tag{1}$$

Where $n$ is the number of sectors and $P_i$ is the percentage of employment in each sector from total private employment. The greater the value $E$ the more diversified will be the industrial base.

## 4.2 Income Diversity (INCD)

In social sciences, income diversity often is related to the measures of income distribution that try to show income inequality and its effect to economic development. This is a very important measure of the overall wellbeing of the community. But for economic resilience, sources of income are equally important. The measure used in this study will capture the source of income and the distribution of the income in the region. The objective here is to assess the role of income diversity in absorbing shocks and bouncing back. First an entropy index of income sources using the same formula as in the industrial diversity index will be created by summing up the different sources of income as percentages of per capita income. This index will be added to the Gini coefficient of income inequality to form the index of income diversity. The indicators used to measure the sources of income diversity are:

1. Percentage of wage and salaries (labor income) from total per capita income

[2]The super sectors are natural resource s and mining, construction, manufacturing, trade, transportation, and utilities, information, financial services, professional and business services, leisure and hospitality, and other services.

2. Percentage of investment income from total per capita income
3. Percentage of self employment income from total per capita income
4. Percentage of transfer payment income from total per capita income

$$INCD = \sum_{i=0}^{n} P_i \times log\frac{1}{P_i} + Gini \tag{2}$$

Where $P_i$ is the percentages of the different sources of income from per capita income and *Gini* is the Gini coefficient of income inequality.

## 4.3 Entrepreneurial Activity and Business Dynamics

This dimension captures the extent of self-employment, the number of patents, and establishment churn as a proxy measure of the entrepreneurial activity and business dynamics. A region that scores high in this dimension possesses the flexibility and attitude that might allow its economy to adjust rapidly to changing economic conditions.

1. Self Employment: % of Number of nonfarm proprietors from total employment
2. Establishment churn: It is defined as the total establishment Births, Deaths, Expansions, and contractions, relative to the total number of firms in county j.

$$Establishment\ Churn_j = \frac{Births + Deaths + Expansion + Constraction}{Deaths + Expansions + Constraction + Constants} \tag{3}$$

Where *Births* is the establishment births in year $t$, *Deaths* is establishment deaths in year $t$, *Expansion* is establishment expansions in year $t$, *Contraction* is establishment contractions in year $t$, and *Constants* is

establishment constants in year *t*. Establishment Births, Deaths, Expansions, Contractions, and Constants are determined by the change in establishment employment between the initial and subsequent years.

3. Number of patents: the number of patents in a county is used as a proxy for a measure of innovation.

## 4.4 Scale and Proximity

Local economies do not exist in isolation. They affect and are affected by the economic activities in the region. In West Virginia, this is more apparent in the Eastern and Northern panhandle. Counties in the Eastern panhandle benefit from the proximity and agglomeration of the Washington DC metro area. On the other hand, the economies in the Northern panhandle are part of the Rust Belt and are related to the Pittsburgh metro area. The downturn of the manufacturing sector in the region is one of the reasons that affected the economies of the counties in the Northern panhandle of the state.

The scale and proximity dimension captures the agglomeration effects associated with larger economies. It identifies the level of interconnectivity between neighboring urban economies and reflects the importance of size to economic resilience. Higher levels of integration provide additional opportunities to business and the workforce, while more self contained or isolated economies are dependent upon local opportunities. There are three indicators within this domain:

1. Establishment or business density is the number of businesses for 1000 employee
2. Population Density reflects the scale of the local economy and is measured as population per square mile
3. Average distance and time of work to commute captures both the opportunities and willingness of local people to access employment opportunities beyond the city boundaries.

## 4.5 Human Capital

Higher levels of human capital in a community are expected to increase resiliency by enhancing innovative and productive activities. Human capital also helps regions develop the ability to anticipate, cope, adapt, and recover from disasters and downturns. Educational attainment is the commonly used measure of human capital (reference here would be good). The percentage of creative class employment relative to over employment is used as proxy to the quality and creativity of the work force. The variables used in this dimension are:

1. Education for persons 25 and over with bachelor's degree or higher
2. Education of persons 25 and over with some college level or an associate's degree
3. Percentage of creative class employment relative to over employment

## 4.6 Physical Capital

The strength of economic activity in a region depends on the physical infrastructure in the region. These regional assets facilitate communication and transportation that are vital in sustaining a competitive advantage. These include physical assets and other advantages from location. Physical capital refers to the built environment of buildings roads and bridges; and utilities. The three indicators that are used as proxies to physical capital are:

1. Housing stock
2. Road and highway density
3. Access to health care providers

## 4.7 The Composite Index

Several approaches are available to create the composite index of County Economic Resilience. One approach is to use a three step process.

1. Convert raw data of each indicator to a ratio by dividing the county level data by the West Virginia state level average
2. Standardize all indicators using $\frac{x_i - x_{Min}}{x_{Max} - x_{Min}}$ to a measure between 0-1
3. Create sub-indices by summing the standardized indicators
4. Give weight ($W$) to each sub-indices or dimension ($D$)
5. Sum the weighted averages for each county $j$

$$CERI_j = \sum_{i=0}^{n} W_i \times D_i$$

The second approach is to use principal component analysis (PCA). In this approach all the individual indicators will be included in the PCA and the components with eigenvalues greater than one will be summed together to form the composite index.

# 5 Data Sources

The County Economic Resilience Index is created using data which is publicly available from official government statistical agencies. The Bureau of Economic Analysis (BEA), US Census Bureau, Bureau of Labor Statistics (BLS), and West Virginia Work Labor Market Information are some of the data sources used to create the database for the study. One of the major problems was finding consistent time series data for all indicators. Some of the census variables are available only on decennial bases. In such cases, the closest census year data is used. For example, for all cases during the period of 1995-2005, the decennial Census of 2000 is used and for cases of 1985-1995, the decennial Census of 1990 is used.

# 6 Preliminary Results of the County Economic Resilience Index (CERI)

The composite CERI contains four dimensions: industrial diversity, human capital, entrepreneurial activity and business dynamics, and scale and proximity. Each of the dimensions is a sub-index by itself and is created from multiple variables. The preliminary CERI for 2000 and 2005 are created from 17 variables. Industrial diversity is constructed as index of employment rate in 10 sectors; human capital consists of percentage of population with college degrees, some college degrees, and creative class; entrepreneurial activity and business dynamics includes establishment Churn and percentage of self employment; and scale and proximity is formed from population density and establishment density.

A four step approach: converting the county raw data to a relative measure by dividing the county level data by the West Virginia state level average; standardizing using $\frac{x_i - x_{Min}}{x_{Max} - x_{Min}}$ to a measure between 0-1; creating sub-indices of the four dimensions by summing the standardized indicators; and finally summing the dimensions to create CERI. Equal weight is given to each variable in the sub-indices and each dimension in the composite index.

Table 2 presents the CERI by quartile for West Virginia counties. The counties in each quartile are listed from the highest to the lowest. Figure 1 also provides the spatial distribution of the quartiles in 2000 and 2005. CERI is highly correlated with the degree of urbanization of the counties. The correlation between the CERI 2000 and 2005 with the Index of Relative Rurality (IRR)[3] is $-0.65$ and $-0.61$ respectively. This makes sense because as the level of urbanization increases, counties are expected to be stronger economically.

[3]The Index of Relative Rurality (IRR) is created by Brigitte Waldorf, professor with the Department of Agricultural Economics at Purdue University. It is used to determine a county's degree of rurality based on four dimensions of rurality: population, population density, extent of urbanized area, and the distance to the nearest metro area. The index is based on a scale from 0 to 1, with 0 being the most urban place and 1 being the most rural place. According to this index rural counties are defined as counties with the 0.4 or greater in the index (Waldorf, 2006).

Figure 2: West Virginia CERI Map by Quartile

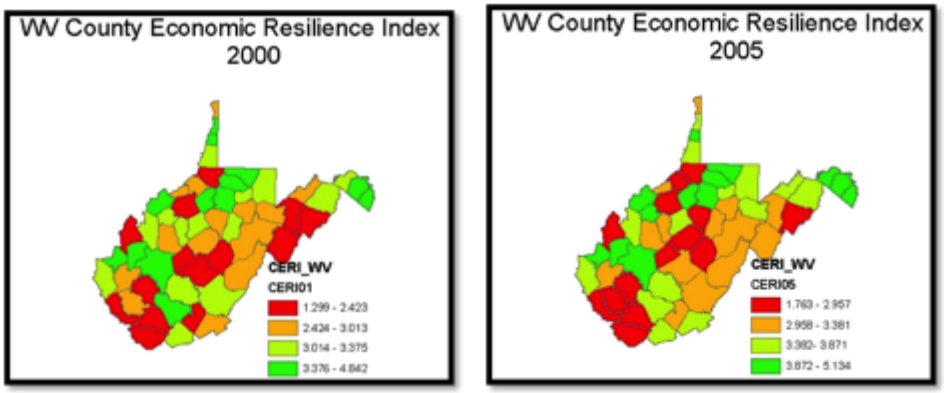


Figure 3: West Virginia CERI Map by Standard Deviation

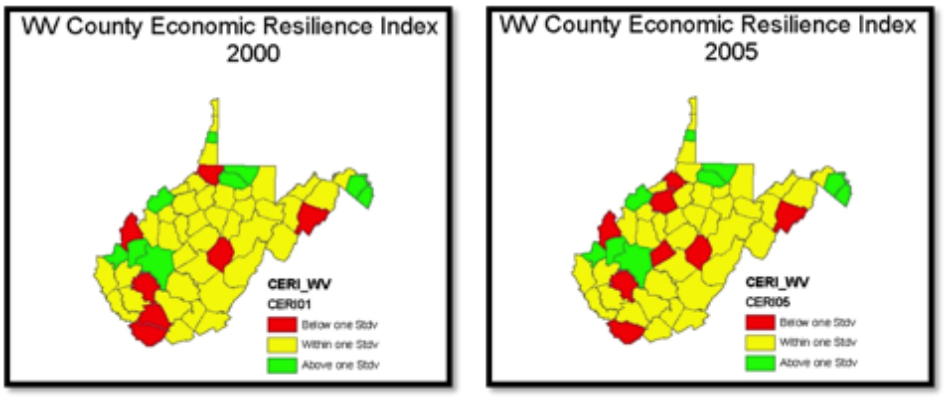

Table 1: Dimensions of County Economic Resilience Index and their Potential Indicators

| Dimensions | Potential Indicators | Potential Impact on CERAI |
|---|---|---|
| Employment and Industrial Diversity | Sectoral mix of employment | The higher the diversity of the industrial base the more resilient the economy |
| Income Diversity | Labor income<br>Investment income<br>Business income<br>Transfer payments<br>Income Inequality | Diversity of income sources helps to absorb external shock |
| Human Capital | Educational attainment<br>Age distribution<br>Health<br>Mobility of labor force<br>Creative class | Increases knowledge and skill to understand community risks; increases ability to develop and implement risk reduction strategy |
| Physical Capital/Infrastructure (Assets) | Housing stock<br>Industrial building stock<br>Road and highway density<br>Railroads and Airports<br>Water and water treatment plants<br>Communication and information infrastructure (radio, phone, newspaper, broadband, etc.)<br>Energy supply infrastructure<br>Access to health care providers (in general)<br>Retirement homes | Facilitates communication and transportation; reflects the importance of strategic infrastructure in sustaining a competitive advantage. |
| Entrepreneurial activity and business dynamics | Percentage of self-employment<br>Establishment Churn, Patents | |
| Scale and proximity | Population size and density,<br>Establishment density,<br>Average distance and time of work commute | Enhances local capital stocks; capturing the agglomeration effects |

Table 2: CERI by Quartile

| 1st Quartile 2000 | | 1st Quartile 2005 | | 2nd Quartile 2000 | | 2nd Quartile 2005 | |
|---|---|---|---|---|---|---|---|
| COUNTY | Index | COUNTY | Index | COUNTY | Index | COUNTY | Index |
| MONONGALIA | 4.84 | MONONGALIA | 5.13 | WAYNE | 3.32 | MONROE | 3.78 |
| PUTNAM | 4.53 | JEFFERSON | 5.09 | JACKSON | 3.29 | BROOKE | 3.70 |
| CABELL | 4.50 | CABELL | 4.68 | WIRT | 3.28 | JACKSON | 3.65 |
| JEFFERSON | 4.48 | PUTNAM | 4.68 | UPSHUR | 3.26 | FAYETTE | 3.64 |
| KANAWHA | 4.39 | BERKELEY | 4.64 | FAYETTE | 3.16 | WAYNE | 3.61 |
| OHIO | 4.29 | KANAWHA | 4.54 | CALHOUN | 3.15 | GILMER | 3.61 |
| WOOD | 4.09 | OHIO | 4.43 | PRESTON | 3.12 | HAMPSHIRE | 3.60 |
| BERKELEY | 4.03 | WOOD | 4.36 | HAMPSHIRE | 3.09 | MARSHALL | 3.6 |
| MARION | 3.79 | MARION | 4.30 | MORGAN | 3.08 | MERCER | 3.59 |
| RALEIGH | 3.74 | WIRT | 4.06 | MARSHALL | 3.07 | MINERAL | 3.50 |
| HARRISON | 3.63 | DODDRIDGE | 3.99 | TAYLOR | 3.05 | TUCKER | 3.44 |
| DODDRIDGE | 3.54 | HARRISON | 3.99 | GILMER | 3.03 | PRESTON | 3.41 |
| BROOKE | 3.44 | MORGAN | 3.89 | GREENBRIER | 3.02 | TAYLOR | 3.40 |
| MERCER | 3.38 | RALEIGH | 3.87 | MINERAL | 3.01 | UPSHUR | 3.38 |
| 3rd Quartile 2000 | | 3rd Quartile 2005 | | 4th Quartile 2000 | | 4th Quartile 2005 | |
| COUNTY | Index | COUNTY | Index | COUNTY | Index | COUNTY | Index |
| LINCOLN | 2.96 | HANCOCK | 3.33 | NICHOLAS | 2.42 | LOGAN | 2.96 |
| POCAHONTAS | 2.95 | PENDLETON | 3.33 | GRANT | 2.40 | LEWIS | 2.96 |
| RANDOLPH | 2.92 | ROANE | 3.30 | RITCHIE | 2.35 | BRAXTON | 2.93 |
| HANCOCK | 2.90 | GREENBRIER | 3.28 | PENDLETON | 2.35 | WETZEL | 2.83 |
| PLEASANTS | 2.85 | BARBOUR | 3.21 | CLAY | 2.35 | WYOMING | 2.72 |
| BARBOUR | 2.84 | POCAHONTAS | 3.2 0 | SUMMERS | 2.34 | MINGO | 2.69 |
| LOGAN | 2.84 | LINCOLN | 3.16 | MINGO | 2.31 | RITCHIE | 2.60 |
| MONROE | 2.82 | SUMMERS | 3.13 | WYOMING | 2.16 | MASON | 2.53 |
| TYLER | 2.76 | GRANT | 3.1 | MASON | 2.13 | CLAY | 2.36 |
| BRAXTON | 2.73 | RANDOLPH | 3.09 | WETZEL | 2.11 | WEBSTER | 2.29 |
| LEWIS | 2.65 | CALHOUN | 3.08 | WEBSTER | 2.01 | TYLER | 2.15 |
| ROANE | 2.62 | PLEASANTS | 2.97 | HARDY | 1.79 | MCDOWELL | 1.97 |
| TUCKER | 2.47 | NICHOLAS | 2.96 | MCDOWELL | 1.74 | HARDY | 1.84 |
| | | | | BOONE | 1.3 | BOONE | 1.76 |

Figure 3 and table 3 present the spatial distribution of CERI based on the deviation of the index from the mean. It highlights which counties are in the top and bottom of the list. There are eight counties that score one standard deviation above the state mean of 3.03 and seven counties below it (Table 3). The rest 40 counties are within one standard deviation of the mean. According to this preliminary index, the counties that scored high are part of a metro area with a major city, close to interstate highway, and high in human capital.

Table 3: West Virginia CERI by Standard Deviation

| COUNTY | $AVCERI_{00} + Stdv$ | COUNTY | $AVCERI_{05} + Stdv$ |
|---|---|---|---|
| MONONGALIA | 4.84 | MONONGALIA | 5.13 |
| PUTNAM | 4.53 | JEFFERSON | 5.09 |
| CABELL | 4.50 | CABELL | 4.68 |
| JEFFERSON | 4.48 | PUTNAM | 4.68 |
| KANAWHA | 4.39 | BERKELEY | 4.64 |
| OHIO | 4.29 | KANAWHA | 4.54 |
| WOOD | 4.09 | OHIO | 4.43 |
| BERKELEY | 4.03 | WOOD | 4.36 |
| MARION | 3.79 | MARION | 4.3 |
| | | | |
| COUNTY | $AVCERI_{00} - Stdv$ | COUNTY | $AVCERI_{05} - Stdv$ |
| WYOMING | 2.16 | RITCHIE | 2.6 |
| MASON | 2.13 | MASON | 2.53 |
| WETZEL | 2.11 | CLAY | 2.36 |
| WEBSTER | 2.01 | WEBSTER | 2.29 |
| HARDY | 1.79 | TYLER | 2.15 |
| MCDOWELL | 1.74 | MCDOWELL | 1.97 |
| BOONE | 1.30 | HARDY | 1.84 |
| | | BOONE | 1.76 |

Jefferson and Marion are the two counties considered rural (according to IRR) that scored one standard deviation above the mean in the index in 2000 and 2005 (Table 3). Jefferson County is part of the Washington D.C. metropolitan area and it is hard to consider it rural. Marion County is center of the Fairmont Micropolitan Statistical Area and is adjacent to the Morgantown Metropolitan region. In both cases the economy of the counties has benefited from its proximity to major urban centers. However, this

is not true in the case of the counties that scored low. Some of the counties included in this group are physically adjacent to metro areas and their economies are not benefiting from any spillover effect from its geographic proximity to urban centers. Even though, a detailed study is needed to understand what is going in these counties, one possible explanation could be the level of accessibility or connectivity with the urban centers.

We test the performance of the index in relation to the unemployment rate of 2002. The correlation of CERI of 2000 with the unemployment rate in 2002 was $-0.48$ and was highly significant at the one percent level. This indicates that counties that scored high in the index on average have low unemployment rate in the recession of 2001-2002. Is this an indication of absorbing the economic shocks and dislocations of the previous decades?

# 7 Conclusion

The differential performance of U.S. regions in face of the most recent economic downturn signifies the necessity of understanding the composition and determinants of economic resilience. By adopting a working definition of economic resilience as the ability to absorb shock and bounce back, this study proposed a framework to create a county level index of economic resilience. Our main objective at this stage is to initiate a discussion that can contribute to the conceptualization and validation of a consistent measure of county economic resilience in the U.S. context.

Drawing on previous literature that concentrates on social vulnerability and disaster resilience, this paper first identifies the research gap in defining and measuring economic resilience and addresses this gap by formulating new concepts and measures that suit the U.S. situation. Next, by choosing 17 indicators along four of the six proposed dimensions, a preliminary economic resilience index has been created and implanted for West Virginia counties between the years 2000 and 2005. Geospatial maps are also developed to explore the evolution of the geographical patterns of economic resilience across time. The index is found to be consistent with the ARC classification of economic status, i.e. competitive, transitional, and distressed, for West Virginia counties. The majority of the counties

that scored low in the economic resilience index are classified as distressed by ARC. The effectiveness of the index is further affirmed in subsequent correlation analyses where the contribution of economic resilience to unemployment reduction and employment growth is highly significant.

These preliminary results are encouraging and appear to be pointing in a useful direction. The discussion in this study can serve as a starting point for building a broad-based, standardized, and consistent definition and measure of economic.

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Table 4: CERI Ranking for 2000 and 2005

| COUNTY | $CERI_{00}$ | $Rank_{00}$ | COUNTY | $CERI_{05}$ | $Rank_{05}$ |
|---|---|---|---|---|---|
| MONONGALIA | 4.84 | 1 | MONONGALIA | 5.13 | 1 |
| PUTNAM | 4.53 | 2 | JEFFERSON | 5.09 | 2 |
| CABELL | 4.50 | 3 | CABELL | 4.68 | 3 |
| JEFFERSON | 4.48 | 4 | PUTNAM | 4.68 | 4 |
| KANAWHA | 4.39 | 5 | BERKELEY | 4.64 | 5 |
| OHIO | 4.29 | 6 | KANAWHA | 4.54 | 6 |
| WOOD | 4.09 | 7 | OHIO | 4.43 | 7 |
| BERKELEY | 4.03 | 8 | WOOD | 4.36 | 8 |
| MARION | 3.79 | 9 | MARION | 4.30 | 9 |
| RALEIGH | 3.74 | 10 | WIRT | 4.06 | 10 |
| HARRISON | 3.63 | 11 | DODDRIDGE | 3.99 | 11 |
| DODDRIDGE | 3.54 | 12 | HARRISON | 3.99 | 12 |
| BROOKE | 3.44 | 13 | MORGAN | 3.89 | 13 |
| MERCER | 3.38 | 14 | RALEIGH | 3.87 | 14 |
| WAYNE | 3.32 | 15 | MONROE | 3.78 | 15 |
| JACKSON | 3.29 | 16 | BROOKE | 3.70 | 16 |
| WIRT | 3.28 | 17 | JACKSON | 3.65 | 17 |
| UPSHUR | 3.26 | 18 | FAYETTE | 3.64 | 18 |
| FAYETTE | 3.16 | 19 | WAYNE | 3.61 | 19 |
| CALHOUN | 3.15 | 20 | GILMER | 3.61 | 20 |
| PRESTON | 3.12 | 21 | HAMPSHIRE | 3.60 | 21 |
| HAMPSHIRE | 3.09 | 22 | MARSHALL | 3.60 | 22 |
| MORGAN | 3.08 | 23 | MERCER | 3.59 | 23 |
| MARSHALL | 3.07 | 24 | MINERAL | 3.50 | 24 |
| TAYLOR | 3.05 | 25 | TUCKER | 3.44 | 25 |
| GILMER | 3.03 | 26 | PRESTON | 3.41 | 26 |
| GREENBRIER | 3.02 | 27 | TAYLOR | 3.40 | 27 |
| MINERAL | 3.01 | 28 | UPSHUR | 3.38 | 28 |
| LINCOLN | 2.96 | 29 | HANCOCK | 3.33 | 29 |
| POCAHONTAS | 2.95 | 30 | PENDLETON | 3.33 | 30 |
| RANDOLPH | 2.92 | 31 | ROANE | 3.30 | 31 |
| HANCOCK | 2.90 | 32 | GREENBRIER | 3.28 | 32 |
| PLEASANTS | 2.85 | 33 | BARBOUR | 3.21 | 33 |
| BARBOUR | 2.84 | 34 | POCAHONTAS | 3.20 | 34 |
| LOGAN | 2.84 | 35 | LINCOLN | 3.16 | 35 |
| MONROE | 2.82 | 36 | SUMMERS | 3.13 | 36 |
| TYLER | 2.76 | 37 | GRANT | 3.10 | 37 |
| BRAXTON | 2.73 | 38 | RANDOLPH | 3.09 | 38 |
| LEWIS | 2.65 | 39 | CALHOUN | 3.08 | 39 |
| ROANE | 2.62 | 40 | PLEASANTS | 2.97 | 40 |
| TUCKER | 2.47 | 41 | NICHOLAS | 2.96 | 41 |
| NICHOLAS | 2.42 | 42 | LOGAN | 2.96 | 42 |
| GRANT | 2.40 | 43 | LEWIS | 2.96 | 43 |
| RITCHIE | 2.35 | 44 | BRAXTON | 2.93 | 44 |
| PENDLETON | 2.35 | 45 | WETZEL | 2.83 | 45 |
| CLAY | 2.35 | 46 | WYOMING | 2.72 | 46 |
| SUMMERS | 2.34 | 47 | MINGO | 2.69 | 47 |
| MINGO | 2.31 | 48 | RITCHIE | 2.60 | 48 |
| WYOMING | 2.16 | 49 | MASON | 2.53 | 49 |
| MASON | 2.13 | 50 | CLAY | 2.36 | 50 |
| WETZEL | 2.11 | 51 | WEBSTER | 2.29 | 51 |
| WEBSTER | 2.01 | 52 | TYLER | 2.15 | 52 |
| HARDY | 1.79 | 53 | MCDOWELL | 1.97 | 53 |
| MCDOWELL | 1.74 | 54 | HARDY | 1.84 | 54 |
| BOONE | 1.30 | 55 | BOONE | 1.76 | 55 |