LEGATUM INSTITUTE

PROSPERITY INDEX

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# United States Prosperity Index

## Measuring prosperity

**2021**

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The Legatum Institute would like to thank the Legatum Foundation for their sponsorship and for making this report possible. Learn more about the Legatum Foundation at www.legatum.org

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# Introduction

Our mission at the Legatum Institute is to build an international movement of people committed to the transformation of society and the creation of pathways from poverty to prosperity.

Prosperity is far more than wealth; it is when all people have the opportunity and freedom to thrive. Prosperity is underpinned by an inclusive society, with a strong social contract that protects the fundamental liberties and security of every individual. It is driven by an open economy that harnesses ideas and talent to create sustainable pathways out of poverty. And it is built by empowered people, who contribute and play their part in creating a society that promotes wellbeing.

The measurement of prosperity is an important task for all leaders, and for those who hold them to account. It is the real test of whether a nation, state, or community is truly fulfilling the potential of its people, in terms of both their productive capacity and their collective wellbeing. Our Indexes deliberately combine the wide range of elements that drive prosperity, in order to help policymakers and influencers focus on the broader implications of institutional, economic, and social policies.

In 2019, we published the inaugural United States Prosperity Index, seeking to explore why the undeniable economic success of the United States was not translating fully into social wellbeing across the 50 states of the Union and Washington D.C. We are very grateful to the 40 U.S. experts, who advised us on how prosperity is generated within the United States and with the selection of the most appropriate datasets on how to measure it. A list of the experts can be found on our website: www.usprosperity.net.

This year's report presents an update on the prosperity of the 50 states and D.C., as well as providing in-depth analysis of prosperity across 1,196 counties in twelve selected states (California, Colorado, Florida, Georgia, Iowa, Kentucky, Minnesota, Montana, Nebraska, New York, Oklahoma, and Texas).

These Indexes have been purposefully designed to be transformational tools that complement each other. The comprehensive set of indicators provides a rich and policy-focused dataset, allowing the potential of all states (and all counties in the selected states) to be identified and understood. This enables much more targeted policy responses that can drive tangible improvements in prosperity. Our ambition is that national, state, and local governments, business leaders, investors, philanthropists, and civil society leaders across the U.S. will use the Index to help set their agendas for growth and development, and that others will use it to hold them to account.

This report constitutes two parts: Part I addresses and explains moving from the definition of prosperity (see accompanying Defining United States prosperity document, which can be found on the usprosperity.net website) to measurement, how indicators have been selected to fit the prosperity framework, and the process of going from these indicators to an overall measure of prosperity. Part II explores the statistical analyses and comparisons that were used to benchmark the 2019 United States Prosperity Index.

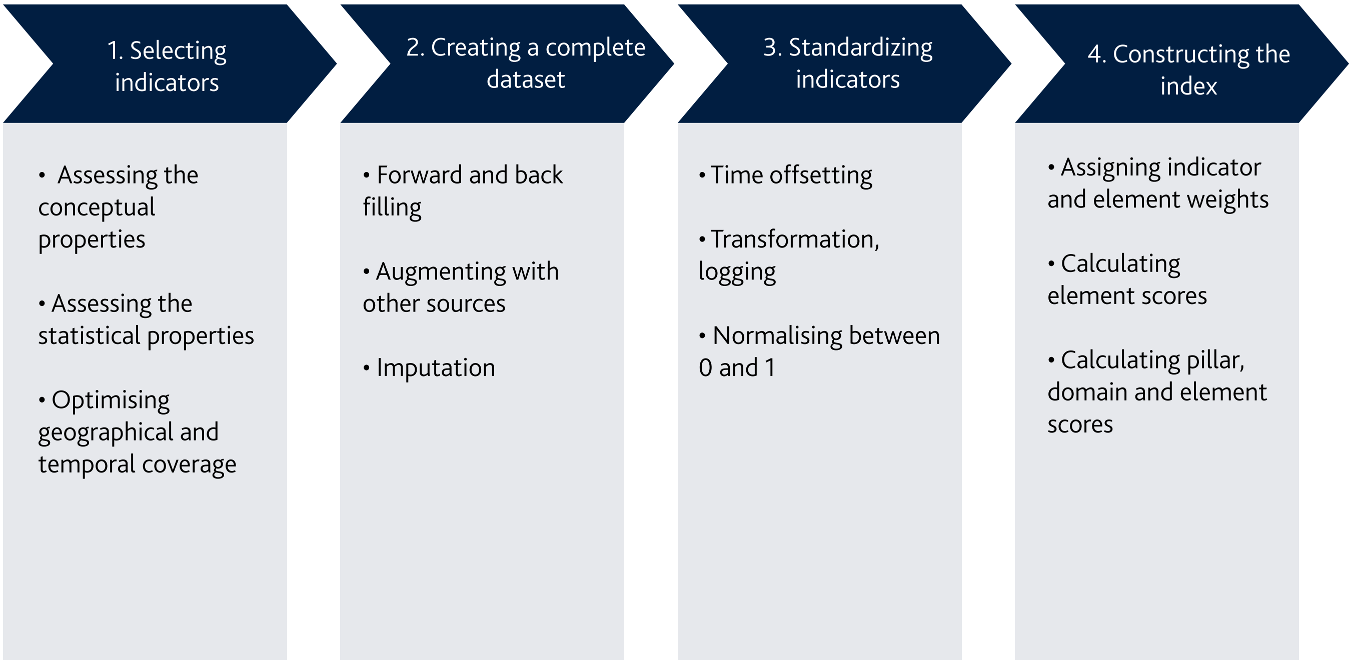
Part I

# Measuring prosperity

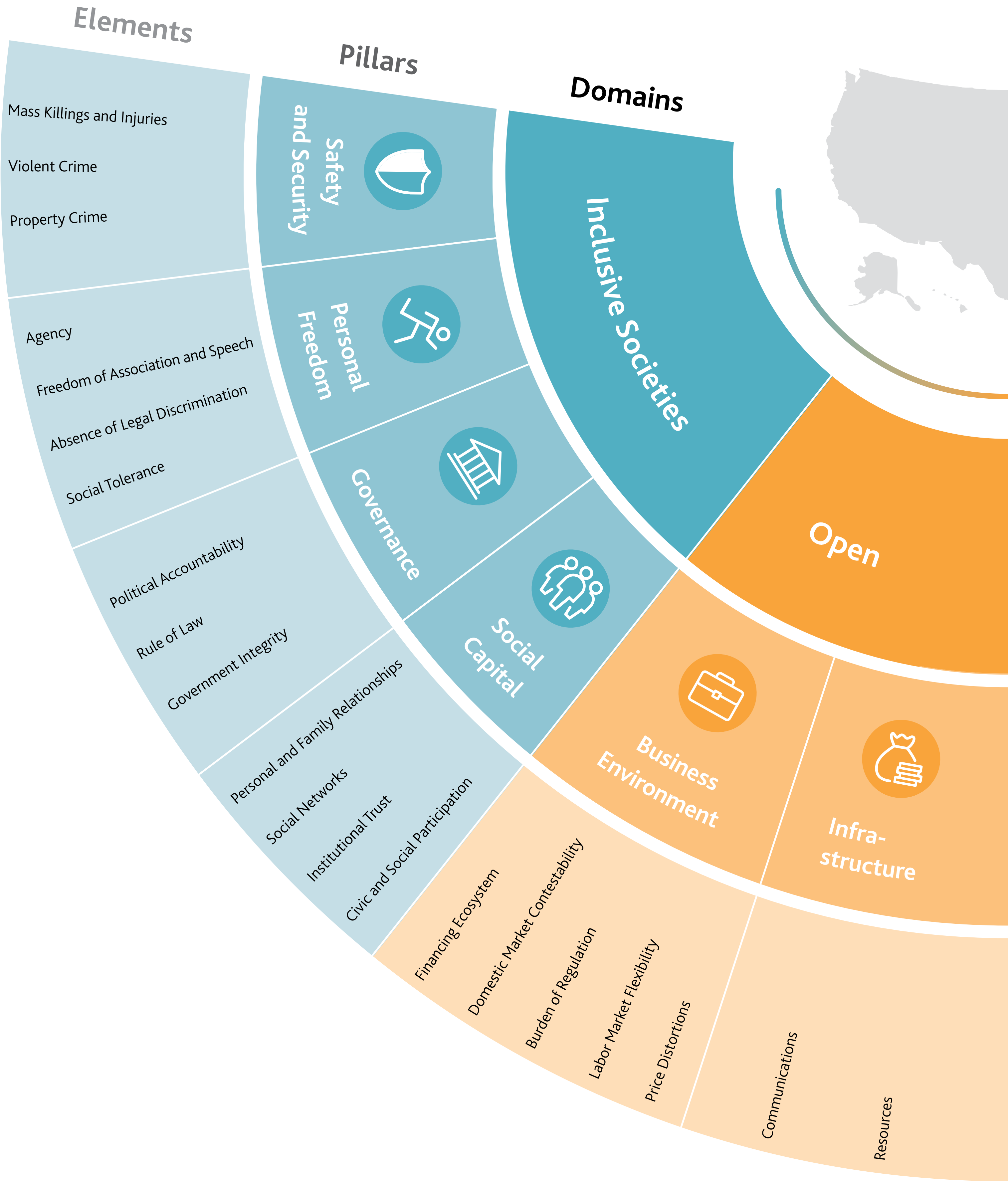
### OVERVIEW

Using our conceptual framework for measuring prosperity across the U.S. comprising 3 domains, 11 pillars, and underpinned by 48 policy-focused elements (see “The building blocks of prosperity” diagram on the following page), we created a measurement system.

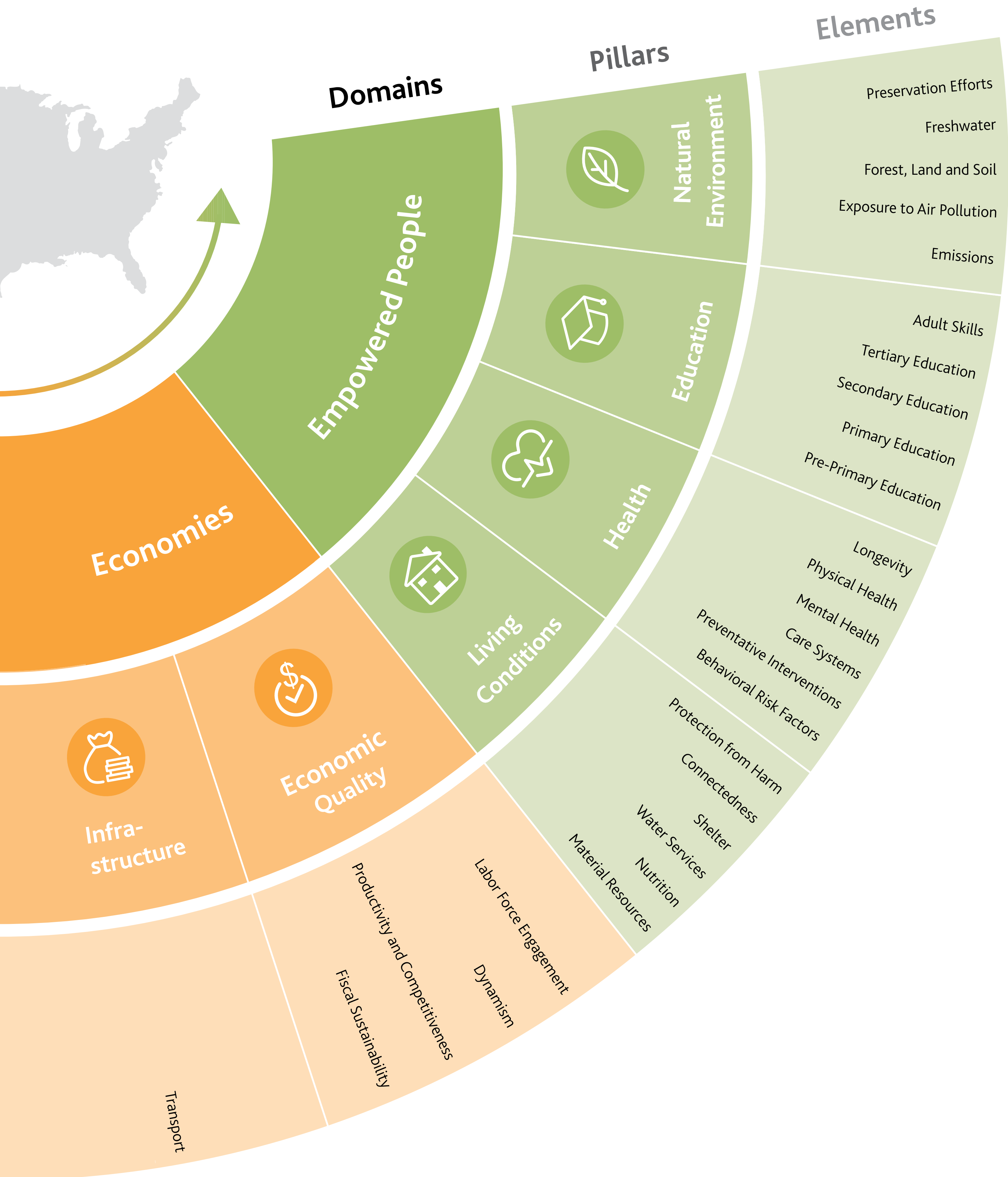
The following section describes the calculation of the Prosperity Index, broadly split into four sections: (1) the selection of indicators underpinning each of the 48 elements; (2) creating a complete dataset; (3) standardising the indicators; (4) constructing the Index through a process of transformation and aggregation. This process is outlined in the diagram below.



# The building blocks of U.S. prosperity



# The domains, pillars and elements of U.S. prosperity



## 1. SELECTING INDICATORS

The goal of selecting and organising indicators underneath the framework defining prosperity has been to enable measurement of prosperity for the 50 states of the Union and Washington D.C., and for the 1,196 counties of the twelve selected states (California, Colorado, Florida, Georgia, Iowa, Kentucky, Minnesota, Montana, Nebraska, New York, Oklahoma, and Texas). We aim to use a set of indicators that (a) collectively act as a good proxy for the elements, and (b) have good geographic and temporal coverage.

The United States Prosperity Index was first constructed for each of the 50 states and D.C., using a suitable set of indicators in 2019. With the advice of our panel of 40 U.S. experts, we developed criteria for selecting indicators — this is outlined below. Over the last two years we have constructed the Index at a county level, for the twelve selected states, to mirror the Index at the state level, which has involved sourcing indicators at a county level where available. We explore later in this section the county indicators that have been used and how they compare with the state level indicators.

**Connection to the element**

The first set of considerations when selecting indicators for each element was how well these indicators, both in isolation and as a collective grouping, create a good interpretation of the element in question. Both conceptual and statistical reasoning were taken into consideration to identify how well a set of indicators act as a proxy for each element.

- **Supported by academic literature**: We choose indicators where there is wide consensus that they capture the underlying meaning of the element and are important to improving prosperity. As well as undertaking our own literature review, our panels of 40 U.S. experts were indispensable in advising on which indicators were best used;
- **Connection to GDP per working age population and Cantril's Ladder**: We choose indicators that are plausibly a causal factor of both wealth and wellbeing. To explore this link, we look at two things: (1) the degree of correlation each indicator has with proxies for economic and social wellbeing, namely GDP per working age population and Cantril's Ladder (see Part II of this report), and (2) the research and academic literature around each indicator, and their connection to wealth and wellbeing. Considering both of these factors, we selected indicators that are seen as plausible drivers of fundamental aspects of prosperity;
- **Objectivity and reliability**: Data quality and availability were binding constraints in selecting indicators for the U.S. Prosperity Index. Indicators with strong conceptual relationships could not be used if they either had bias from their sources, or significant issues in measuring what they were purporting to measure. For example, in "Social Tolerance", two indicators were considered to capture the degree to which societal intolerance results in hate driven activity: 'hate group concentration', and 'hate crime rate'. While hate group concentration has its own measurement issues and potential biases (much as any source does), the inconsistency of hate crime reporting across the U.S. is well documented, and so hate crime rates were not included in the final Index.[1]

**Spatial and temporal coverage**

The second set of considerations in selecting indicators was the geographic and temporal coverage of each indicator:

- **Wide geographic coverage of states and counties**: This consideration is more relevant at the county level, as at the state level most data sources cover all states (with a few notable exceptions such as D.C., see Appendix IV of the Summary of Indicator Details document for a summary of how many states have missing data for specific pillars). At the county level we had to consider whether data was available at a county level, metropolitan/micropolitan statistical area (MSA) level, or other sub-state level (see page 8 for how we used data at a MSA level in the Index).
- **Coverage through time**: We intended to create an Index that demonstrates how prosperity has shifted over time, rather than just the current state. To that end, we prefer indicators that capture change over time. We also prefer indicators that will continue to be measured so that we can use updated data in future editions of the Index.

Using these criteria, we selected 215 indicators, underpinning the 48 elements that provided the best articulation of these building blocks of U.S. prosperity. Before the Index could be calculated from these indicators, the issue of missing data points had to be addressed (see "2. Creating a complete dataset").

**Comparison of state level indicators to county level indicators**

Our intention was to mirror the county level Index on the state level Index, so our preference was to source county level data that match the state level. This was not always possible or appropriate, however, and we have classified the county indicators into four types to show how closely they match the state level indicators.

1. The state indicator is available at county level. An example is the 'complete kitchen and plumbing facilities' indicator.
2. The state indicator is not available at county level but is available at a different sub-state level. An example is the 'adult doctor visits' indicator, which uses data from the Behavioral Risk Factors

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**1**. Pezzella, Frank S., Matthew D. Fetzer, and Tyler Keller. "The Dark Figure of Hate Crime Underreporting." *American Behavioral Scientist*, (January 2019). doi:10.1177/0002764218823844.

Surveillance Survey at the Metropolitan Statistical Area (MSA) level.

3. The state indicator was not available at county or sub-state level, so an alternative county indicator was selected that captures the concept behind the state indicator as closely as possible. An example is the percent of public water sources without health-based violations, which is not available at a county level.

4a. No identical or alternative indicator was found at county level, even though county variation is likely to occur. In this case, state values were applied to each county within the state.

4b. The state level indicator is conceptually relevant to all counties within the state, for example the 'state minimum wage' indicator. In this case, state values were applied to each county within the state.

Figure 1: Type of match of county to state-level indicators

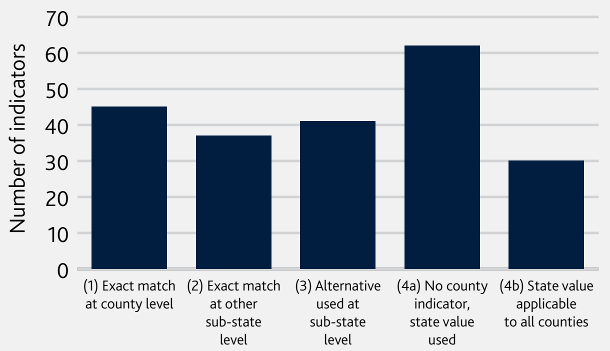


Figure 1 presents a summary of the numbers of indicators at the county level according to the four types above. Of the 215 indicators, 123 are available at sub-state level, and 92 are only available at state level. A full comparison of indicators, at a state and county level, can be found in Appendix II of the Summary of Indicator Details document.

In Part II, we assess the Index as constructed at the state level with that at the county level for the twelve selected states to determine comparability.

## 2. CREATING A COMPLETE DATASET

The U.S. Prosperity Index, as with most composite indexes, faces the problem of incomplete data. Some data points for some years might be missing for some states or counties, some indicators might be missing entirely for some states or counties, and some indicators might be released with time lag. To complete our dataset, we prioritised real data in the following order:

1. Where missing data are detected, we first use the latest known value for that indicator. For example, indicators with missing data in 2015 are assigned the corresponding values of 2014. The values are forward-filled until the next available data point for that indicator;

2. Where data are missing and no prior data are available, which mainly happens with the Index's earlier years, the earliest data available are employed. For example, the Public Religion Research Institute's latest data set for support of same sex marriage only started in 2014. That means the earliest data, from 2014, is used to back-fill all previous years;

3. Where no reliable real data for a specific state or county are accessible from the main source for an indicator, augmentation and imputation are employed on a case-by-case basis.

### Augmenting data with other sources

The preferred approach for dealing with data missing for a state or county for all years is to insert values directly based on other sources for the data. For example, the U.S. Fish and Wildlife Service provide data on Wetlands and Deepwater Habitats, but excluded Alaska and Hawaii in their reporting. The data for Alaska for this indicator was sourced from the Wetlands and Deepwater Habitats Alaska Region, and the Hawaii data from the Hawaii Wetland Resources.[2,3]

### Imputation

*At the state level*

If we could not insert data from an appropriate alternative source, we used linear regressions to impute an indicator based on other independent variables. We used the following independent variables:

- Log(GDP/Working Age Population)
- Regional groupings.[4]

Imputation was used very occasionally in the construction of the state level U.S. Prosperity Index as nearly all data sources provided data for all states, with the District of Columbia being the main exception. Information about the degree of imputation for each state is available, broken down by pillar, in Appendix V.

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**2**. Jonathan Hall, Frayer, Bill Wilen, "Status of Alaska Wetlands," *U.S. Fish & Wildlife Service*: last accessed July 10 2019, https://www.fws.gov/wetlands/documents/Status-of-Alaska-Wetlands.pdf

**3**. "Hawaii Wetland Resources," *U.S. Fish & Wildlife Service*: last accessed July 10 2019, https://www.fws.gov/wetlands/data/Water-Summary-Reports/National-Water-Summary-Wetland-Resources-Hawaii.pdf

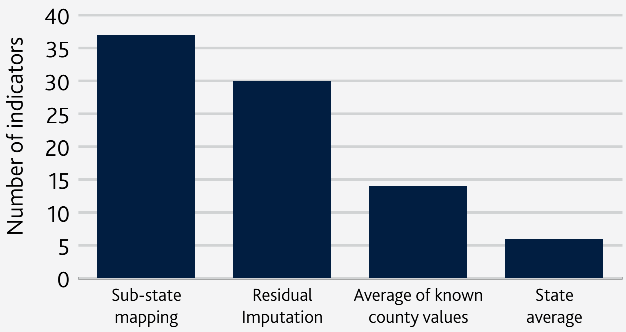
**4**. Following the National Geographic definition.

*At the county level*

Higher levels of missing data were apparent at the county level as opposed to the state level. We dealt with missing data at the county level with the following hierarchy: (1) mapping sub-state data to counties; (2) residual imputation, (3) a fallback option of either the state value or the average of county values.

Some indicators required both sub-state mapping and imputation where the original dataset did not cover all sub-state areas in a state. Figure 2 shows the number of indicators which used each approach. It shows that 37 indicators required mapping from a sub-state level to the county level, and 30 indicators used the residual imputation approach.

Figure 2: County indicators by missing data approach




1. Mapping sub-state data to counties

At the county level, in the cases where data was only available at a geographic level larger than a county, such as at Metropolitan Statistical Area (MSA) level, or a sub-state region defined by a specific source, we assigned the value of the larger sub-state region to all counties contained in that area. We used delineation files from the Census Bureau to assign counties to MSAs.

Examples of sources that only release data at sub-state area level include The Current Population Survey, Civic Engagement Supplement, which only releases data at the MSA level, and The National Survey on Drug Use and Health conducted by the Substance Abuse and Mental Health Services Administration, which is conducted at a more localised level and documents which counties are contained within each sub-state region.

2. Residual imputation

Residual imputation has been applied where state data was available for an indicator and where we had reported data for some but not all counties within the state. Using the reported state value and the known county values enabled us to calculate the missing counties values, as the average of all counties in the state should equal the state value.

The missing values were therefore calculated by taking the residual value of all known county values from the state value and applying this value to all counties where data was missing.

This is calculated as follows:

$$Residual\ Value = \frac{(State\ Val \times State\ Pop) - \sum(County\ Val \times County\ Pop)}{Residual\ Pop}$$

The residual imputation approach was used where the total population of the counties that had missing values was greater than 5% of the population of the state. The residual value was capped at two standard deviations away from the state value.

3. Fallback option

In cases where the residual population was less than 5% of the state's population, or where the state level and county level indicator were different, we either applied the fallback of the state value, or used the average of all known county values.

- We used the state value when the state and county indicators were sufficiently similar and were measuring the same concept, such as the 'adults with no health care coverage' indicator.
- We used the average of all known county values where the indicators at the state and county level were measuring something different, or where the unit of measurement was different, for example the 'public drinking water violations' indicator.

The extent of imputation at a county level within the twelve selected states is shown in Appendix IV of the Summary of Indicator Details document.

## 3. STANDARDISING INDICATORS

Once the set of indicators had been selected and missing data points filled at a state and county level, standardised them so that they can then be aggregated to produce composite scores at the element level, and further aggregated to pillar, domain, and Index level. This section outlines the steps undertaken to standardise indicators.

### Time offsetting

The lags between when data is recorded, published by the source organisation, and subsequently made use of in this Index can vary by a matter of months to years. Very little data is released in the year it was collected. This means we need to consider how to align the time-series of each indicator before they can be aggregated into an Index.

Figure 3a: Indicators offset, state level

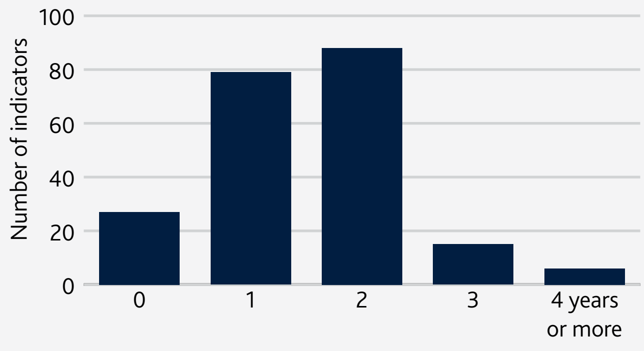
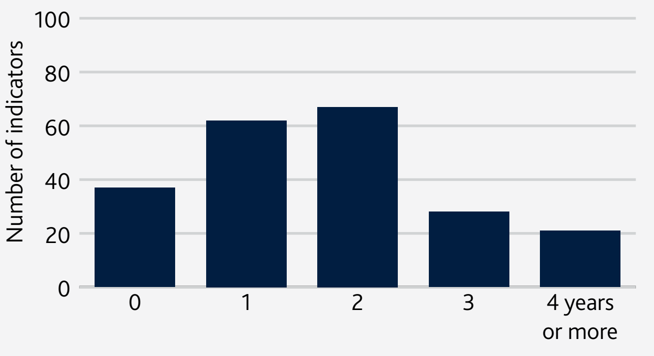



Figure 3b: Indicators offset, county level




We offset the majority of indicators by 0-2 years, based on when they became available. So if, for example, data for an indicator for the year 2018 only became available in 2020, we would assign the data for the year 2018 to the 2020 Index, and the data for 2017 to the 2019 Index score, and so on — thereby offsetting by two years. Practically, this means that we assign data to the Index year in which it becomes available, rather than the year in which it is collected. All but 27 indicators used in the U.S. Prosperity Index at both state and county levels were given an offset of three years or less, as shown in Figures 3a and 3b.

Another option would be to assign the data to the Index year in which it was recorded. However, this would mean that for most indicators, the data in the latest Index year would be exactly the same as the year before (due to the fact that when data is missing in a year, we roll forward a previous year's data). This would have two major disadvantages. The first is that it would create an artificial flat-lining in the last year of the Index. Second, it would mean the most recent year's score would change significantly as reported in the subsequent year's Index, as the data are updated. While there will always be small changes to previous year's scores, we want to minimise this as much as possible.

It is worth noting that this process affects only the presentation of historical values. It does not affect the latest score: both approaches create a prosperity score based on the latest available data.

We considered the benefits and disadvantages of each approach. Our view was that the offsetting approach was preferable, because it was more important to see the historical trend of prosperity, rather than the exact year in which a change occurred. Due to the fact that we note the year in which data was collected, this still means that it is possible to investigate policy changes that stimulate improvements or deteriorations in prosperity.

**Transformation**

Some indicators in the Indexes require transformation for comparisons of an indicator's value across states or counties to be meaningful. In most of these cases, we transform these indicators by converting to a per capita, or per unit area, metric. In cases where the data distribution is skewed or has long tails, we log-normalise the indicator. For example, the rate of terrorism deaths per million population is below 1 in most states in most years. However, in several states in several specific years, much higher rates occurred. Variation of this nature requires normalisation by taking the logarithm of the values, so that different observations can be compared within a narrower data range, and so that extreme variation in a single indicator does not unreasonably affect overall performance. Thirty-nine indicators at the state-level and forty indicators at the county level were log-normalised in this manner.

**Normalisation**

The transformed indicators in the Index are based on many different units of measurement, such as percentages and ordinal scales. These different units need to be normalised for comparisons between indicators to be meaningful. A distance-to-frontier (DTF) approach is used for this task, in which every indicator is normalised to a value between 0 and 1. The DTF approach compares performance in an indicator with the values of the assumed best-case and worst-case for the indicator. In this way, a state or county's relative position can be captured by the DTF score generated. The first step was to define the frontiers — the best and worst cases for each indicator.

*Defining the frontiers*

For indicators which have logical upper and lower bounds, the best and worst cases might be set at, or close to, their highest and lowest possible values. This scenario mainly applied to indicators with ordinal scales as units of measurement. The indicator "free speech in public places", for instance, is limited to values between 0 and 3, thus its frontiers can be defined according to its logical boundaries.

However, where possible, we set the boundaries such that the normalised values (between 0 and 1) contain a relatively consistent standard deviation across indicators. For indicators with clearly defined logical bounds, this often means the DTF does not rely on 'logical bounds'. That is because, in many cases, the upper or lower logical bound is never actually achieved. This is particularly the case with survey variables.

For indicators with values that can vary on a spectrum that is unlimited at one or both ends, best and worst cases are imposed on the basis of the data collected for the Index since 2007. In cases where it is likely that the historical upper bound will be superseded in the future, as with ultra-fast internet access, we left room for improvement, incrementally extending the upper bound.

Where greater values indicate worse outcomes — for instance, in the case of the "unemployment" indicator — we invert the DTFs, such that higher scores always indicate better performance.

In general, we set the same best and worse values at the county level as at the state level, where the indicators were measuring the same concept. For some indicators, there was greater variation at county level than at state level owing to counties being smaller units of aggregation. As a result, in these instances we widened the DTFs for that county indicator, such as for the 'poverty' indicator.

*Excluding outliers*

Another key consideration in applying distance-to-frontiers was to decide whether or not there were outliers that should be excluded when selecting best and worst cases. This was done primarily because selecting frontiers to include outliers would result in some instances of very little differentiation between the majority of areas for that indicator.

We are typically guided by the 5th and 95th percentiles for observed values in excluding outliers. Selecting frontiers based on these percentiles means that each indicator's DTF scores differentiate between states to a similar degree to other indicators, which is crucial when aggregating these scores to create element and pillar scores. We decided to opt for compatibility of DTF scores for aggregation over avoiding penalisation of extremely high or low performers.

For example, age requirements for license over the last decade ranged from 4 to 16 years. However, 95% of the time, a state's age requirements ranged between 4 and 15 years. The boundaries set for this indicator were 0 and 15, based on the 95% upper bound for values.

*Normalising the values*

After we determined the frontiers, the next step was to calculate a DTF score for each indicator, at a state and county level. For a given indicator $i$, if we write $Worst\ Case$ and $Best\ Case$ for the frontiers established for this indicator, and $x_i^j$ for state or county $j$'s raw value in indicator $i$, then the state or county's normalised score is given by the following equation:

$$Normalised\ Score = \frac{x_i^j - Worst\ Case}{Best\ Case - Worst\ Case}$$

Using distance-to-frontier scores allows direct comparison of values across indicators and areas, and also allows tracking and comparison of a state or county's performance across years. Since the upper and lower frontiers are fixed across years, changes in a state or county's year-to-year DTF score reflects its improvement or deterioration in the same indicator, pillar, or overall score in absolute terms.

## 4. CONSTRUCTING THE INDEX

At this stage, there is a set of 215 state and county level indicators, using a comparable scale, organised underneath the definitional framework of prosperity. To create the U.S. Prosperity Index at a state and county level, the indicators are combined and aggregated up to measure each element, pillar, and domain of prosperity, as well as the overall measurement of prosperity.

**Weighting**

As noted earlier, we recognise that not every indicator is equally important to an element, and not every element is equally important to a pillar. Therefore, each indicator is assigned a weight within an element, indicating the level of importance it has in that element. Similarly, each element is assigned a weight that reflects its importance in the overall pillar.

We first weigh indicators within an element. Indicators are assigned one of four weights: 0.5, 1, 1.5, or 2. The default weight for each indicator is 1 and, based on its significance to the element in which it is contained, its weight was adjusted downwards or upwards. An indicator with a weight of 2 is twice as important in affecting the concept its element represents as an indicator with a weight of 1.

Weights were determined by three factors:

- The relevance and significance of the indicator with respect to its element, which is informed by the academic literature, policy debate, and expert opinion;
- The robustness and reliability of the indicator in question, including whether it has any known measurement flaws;
- The significance of the indicator in its relationship with both economic and social wellbeing in the U.S. context.

While it may seem more objective to weight each of our indicators equally, we choose variable weights for our indicators for a number of reasons. First, because we include a wide variety of different indicators, in line with our multidimensional view of prosperity. Second, because some indicators are more important than others in delivering prosperity. In the Economic Quality pillar, for example, within the Productivity and Competitiveness element, labor productivity (factor x2) is twice as important as manufactured export value (factor x1).

After weighting the indicators, we weight elements within each pillar, led by the same three factors above. At the element level we express weights as percentages rather than factors.

Ultimately, our weighting approach — as with any weighting approach — involves a level of judgement and subjectivity. To understand the robustness of our weighting structure, we test the impact of applying equal weights, as well as randomly-assigned weights, to all indicators, and assess the impact on the overall rankings (see page 13). Users of the Index are also able to apply their own indicator and element weights to see how this affects overall rankings at our website (www.usprosperity.net).

**Calculating element scores**

Once the indicators have been normalised and assigned a weight, they can be aggregated to create an element score. As a result of the normalisation step, indicator scores lie between 0 and 1.

In each element, the scores for each indicator are summed together to give an element score.[5] As a formula, an element score $E$ for an element with indicator scores $ind_j$ with respective weights $w_j$ for $j = 1, \dots, n$ is given by:

$$E = 100 * \frac{\sum_{j=1}^{n} w_j * ind_j}{\sum_{j=1}^{n} w_j}$$

This results in an element score between 0 and 100.

**Calculating pillar, domain, and index scores**

Once element scores have been constructed, they are summed to give pillar scores out of 100.[6] As a formula, the pillar score $P$ for a pillar with element scores $E_j$ and weights $\kappa_j$ for $j = 1, \dots, m$ is given by

$$P = \frac{\sum_{j=1}^{m} \kappa_j * E_j}{\sum_{j=1}^{m} \kappa_j}$$

Once pillar scores have been determined, these are aggregated into domain scores by weighting each pillar equally within each domain. We then aggregate domains into index scores by weighting each domain equally, as we consider each of the institutional, economic and social domains equally important to Prosperity.

**Conclusion**

There is a significant amount of detail within the four stages of Index construction: indicator selection, creating a complete data set, standardising indicators, and the calculation of the Index that supports the measurement of prosperity. In being able to set out these details, we hope to formalize the logic that underpins the way the United States Prosperity Index measures prosperity, at a state and county level. This section, not only gives transparency about how prosperity is measured but also provides a blueprint for the technical underpinning of any multidimensional index. Building such an index requires a multitude of discrete technical decisions. Should aggregation happen using weights? Should an arithmetic or geometric mean be used? How should cases of missing data be handled? The discretization of each decision, whilst still seeing the picture of the whole process, enables careful decision making in the technical task of index building.

**5**. Weighted sum, using the weights assigned.

**6**. Weighted sum, using the weights assigned.

## Part II

# Assessing the United States Prosperity Index and its pillars

### INTRODUCTION

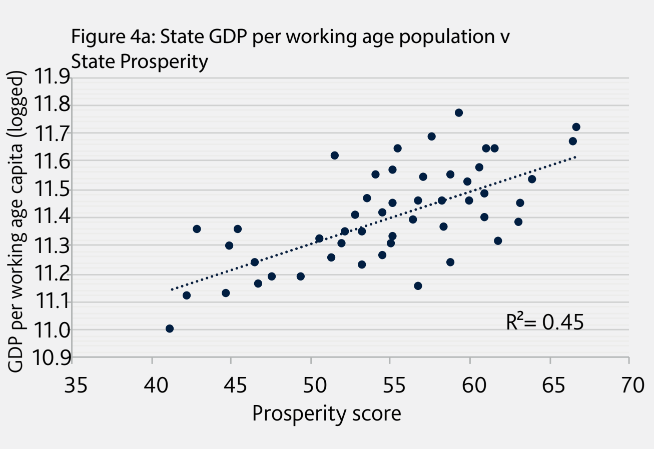
To test the structural integrity of the Index we conducted the following analyses for each pillar. Further summary statistics can be found in Appendix III of the Summary of Indicator Details document.

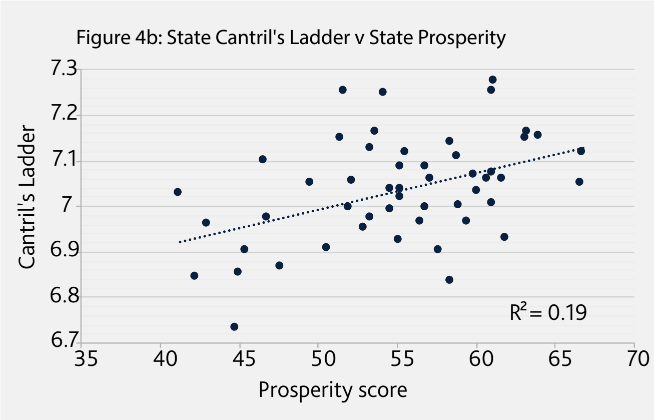
In line with our approach at the global level, the first test we employ is to test the Index scores against common benchmarks for both economic output and social wellbeing.

**Comparison with GDP per Working Age Population and Cantril's Ladder**

*State level comparison:*

For testing scores at the state level, we used two proxies: Log (GDP per Working Age Population) and Cantril's Ladder. This is a way of benchmarking the U.S. Prosperity Index against established measures of both wealth and wellbeing. Figures 4a and 4b shows the relationship:




The relationship between these measures and the state level U.S. Prosperity Index is weaker than the relationship they have with the prosperity of countries, as seen in our analysis on the Global Prosperity Index. This is due to the phenomenon of *range restriction*.[7] Essentially, on a global level, the extremities in country performance on single measures across the world allows for a far greater range of values, and this fosters a stronger statistical relationship. In the U.S., on the other hand, single measurements are on a much narrower scale, and thus fluctuations in scores appear far more dramatic.

To help illustrate this point, the range of scores seen across the 50 states of the U.S. and D.C. is similar to the range of scores between countries whose ranks are 15 apart in the Global Prosperity Index. If we restrict the comparative analysis to only the countries in this range in the global prosperity rankings, the correlation between prosperity and GDP per working age population drops to 0.58, in line with the strength of relationship we see in U.S. Index. While this relationship between GDP per capita and prosperity is as strong between states as it is between countries, the relationship between Cantril's Ladder and prosperity is not as strong between states as it is between countries.

**7**. Goodwin, Laura D., and Nancy L. Leech. "Understanding correlation: Factors that affect the size of r." *The Journal of Experimental Education* 74, no. 3 (2006): 249-266. https://pdfs.semanticscholar.org/b6cf/001cbab0375a96c370585462dd3c163669af.pdf.

*County level comparison:*

We compared GDP per capita at the county level with prosperity scores but did not find an association ($R^2 = 0.05$). At a local level, such as county, the economic output generated within the county is not necessarily shared amongst the residents of that county, which results in some very large per capita estimates for counties with a small population but large economic output (oil producing counties for example). Instead, we used median income as a measure of economic wellbeing of the residents of a county, compared this with prosperity, which elicited an $R^2$ of 0.4. This result is in the same order of magnitude as for the state level index. We were not able to conduct a comparison between social wellbeing and prosperity at the county level because Cantril's Ladder is not available at this level.

## INTERNAL TESTS

In constructing the Index, we wanted to ensure that the selected indicators within each element, as well as the elements within each pillar, had a high degree of internal consistency. To do this, we used Cronbach's alpha, which assesses how closely related a set of items are as a group. We aim to get a Cronbach's alpha above 0.7 as a rule of thumb. This was not always possible for two reasons.

- Firstly, certain indicators had a reverse relationship with wealth and wellbeing, and other indicators. For example, the 'tree canopy cover' indicator, in the Natural Environment pillar, had a negative correlation with Log (GDP/Working Age Population) and Cantril's Ladder, and a number of other indicators in its element. This is because tree cover is reduced by urbanization, whereas urbanization has improved wealth in the U.S.
- Secondly, as is the case shown earlier with the relationship between U.S. prosperity and both GDP per working age capita and Cantril's ladder, there was little variation between states in numerous indicators. While indicators were important from a conceptual and policy standpoint, indicators didn't always follow a straightforward pattern. This adds to, rather than detracts from, the Index, accounting for various factors for which more prosperous states may still lag behind.

In addition, for those pillars and elements that have a Cronbach alpha below 0.7, we discussed their conceptual standing with external experts and found that reasons for their inclusion counterbalanced the statistical findings.

## SENSITIVITY TO CHANGES IN WEIGHTING

Our weighting choice is only one of many possible approaches that would be justifiable on different grounds. In discussions with experts, the issue of sensitivity of composite indexes to different weighting choices was a topic that often came up, but the conceptual importance of an indicator was given as much consideration as its statistical significance as assessed using factor and regression analysis.

In this section, we test the impact on the Index's scores and rankings by changing our weighting approach in two ways: (1) by comparing against an Index generated using equally weighted indicators within each element, and (2) assessing against an Index generated using randomised indicator weightings, derived using Monte Carlo randomisation simulations.

We used an almost identical set of indicators and weighting scheme at the state and county levels, and the results at state and county level closely align. Given this, the weighting sensitivity analysis has been undertaken at the state level only.

**Equal weighting approach**

The first test of the sensitivity of the Index to changes in the choice of weightings is to understand how the rankings of the Index would change if we were to use equal weighting across indicators.

Figure 5 plots, on the vertical axis, state's rankings derived by equally weighting indicators and, on the horizontal axis, state's rankings derived using the current weighting approach. The overall correlation is strong, though many states experience minor changes in their overall prosperity score and ranking.

In five states, the ranking differed by more than ten places: New York (+16 vs. equal weighting), California (+12), Illinois (+12), Pennsylvania (+12), Idaho (-11). The breakdown of the rank change in the remaining states is: No change - 8%, 1 rank - 24%, 2 ranks - 8%, 3 ranks - 16%, 4 ranks - 10%, between 5 and 10 ranks - 25%. Overall, the weights chosen for the indicators do not create a large deviation in ranks when compared to equal weightings.

**Randomised weighting approach**

A second test to understand the sensitivity of the Index to the particular choice of indicator weightings, is to understand how the rankings of the Index vary when indicator weighting choices are randomised. To do so, we used Monte Carlo simulations, generating Index ranks 1,000 times with indicators randomly allocated a weighting of 0.5, 1.0, 1.5, 2.0 each time.

Figure 6 shows the outcome of this simulation for each state. The states have been ordered by their ranks under the current weighting approach (illustrated with a red cross). The range between the 5$^{th}$ and 95$^{th}$ percentile ranks for each state is shown by the vertical bar for each state. This illustrates the volatility of the rank based on the indicator weightings. The median rank is also marked on the line with a horizontal black bar.

The range of ranks is uniformly quite small across all states and D.C., with only one state (California) having a range over 10 or more places, with a range of ten. Furthermore, the median rank is a better comparator after 1,000 simulations, and only four states' median ranks differ by more than three places from their rank in the U.S. Prosperity Index — D.C. (-6 vs. median rank), Michigan (+5), California (-4), and Illinois (-4).

The choice and application of weights constitute our view of the relative importance of indicators in their contribution to prosperity, after considering the statistical analysis and seeking the advice of our panel of experts.

The sensitivity analysis demonstrates that the rankings are relatively stable when they are placed under different weighting scenarios. This implies that the scores and rankings in the Index are affected more by variation in the indicator values than the weights that have been applied.

Whilst equally weighting the indicators, or randomly assigning indicator weights, results in some differences in the state rankings, the specific choice of weighting has been carefully chosen after full consideration of the statistical analysis and lengthy discussions with experts.

Figure 5: Ranking with U.S. Prosperity Index weighting vs equal weighting

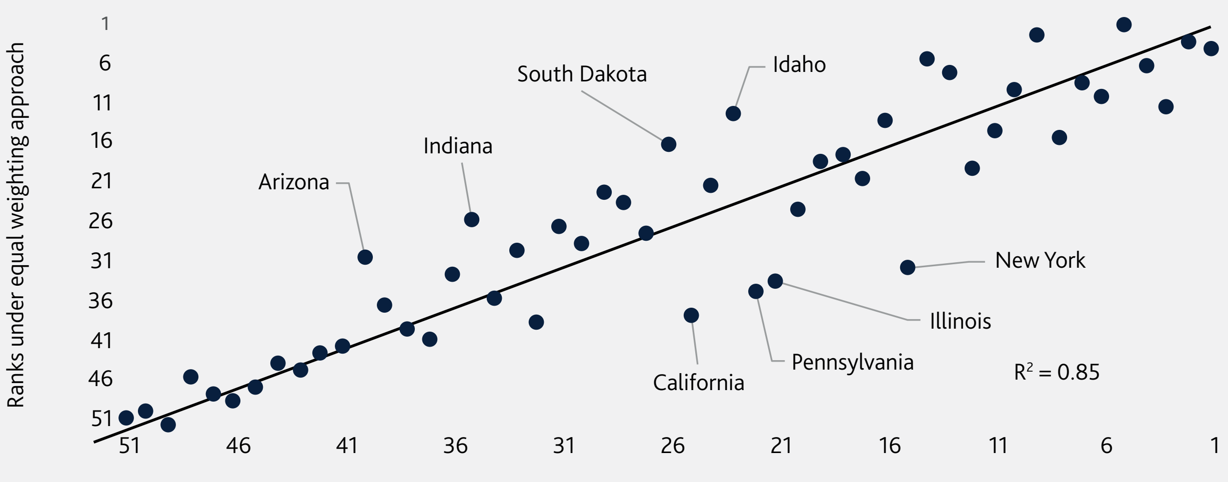
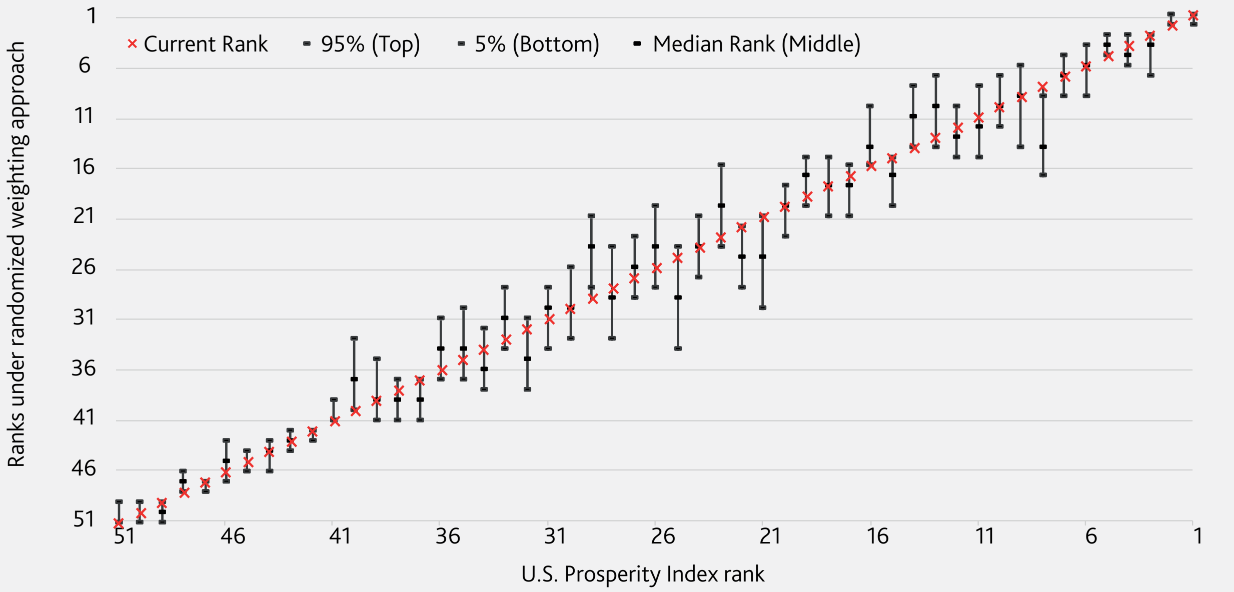



Figure 6: Range of ranks under randomised weighting approach



## Limitations of the Index:

No nationwide index can fully explain the true picture and nuance between areas. Some primary limitations of the U.S. Prosperity Index are the following:

*Data availability:* A key limitation encountered in creating a robust Index for the U.S. was the availability of data. There are certain issues where data is simply not collected across all states or counties, and there is a wealth of data collected that lacks comparability or has significant flaws in either its collection methodology or accuracy.

We hope that in presenting the U.S. Prosperity Index, in addition to explaining prosperity at a sub-national level, it highlights areas in which data collection efforts could be bolstered, particularly at county level.

*The efficacy of the data:* There are always challenges obtaining data that captures the core idea of what we are trying to communicate. That is why, in some cases, we need to use outcome data rather than input data.

### COMPARING THE UNITED STATES PROSPERITY INDEX AT A STATE AND COUNTY LEVEL

We closely based the production of the county level Index on the state level Index. To test the integrity of the county results, we compared the aggregated county level population weighted scores of the twelve selected states from 2011 to 2021 with the state level scores for these states. We find a high degree of consistency between the two sets of results, with an $R^2 = 0.97$ for prosperity, an $R^2 \geq 0.9$ for eight pillars, and $R^2 \geq 0.7$ for all pillars. (For the Governance pillar, the county level Index is made up entirely of state level indicators, so the two match exactly.)

There are differences between the state and county level results for several reasons. Firstly, in using population to aggregate indicators from county to state level we are introducing differences for some indicators. For instance, the 'tree cover canopy' indicator would best be aggregated using the land area of a county, rather than population. For the purposes of this comparison exercise we felt it sufficient to use population weighting, as an approximate weighting measure to assess comparability.

Secondly, there are some differences due to slightly different indicators being used at a county level compared to the state level. For instance, the 'life years lost from air pollution' indicator is used in the state level index, but this is not available at county level, so we have used 'life expectancy loss from air pollution'.

Thirdly, some county indicators use modelling as part of their methodology and as such aggregated county values may not equal state values, one example being the 'obesity' indicator. Finally, differences can be attributed to different DTF bounds being used at a state and county level, as there can be greater variation at county level.

Despite these differences, there is a high degree of correlation between the Index at a state and county level for prosperity as well as for each pillar. See Figures 7a-7k.

Figure 7a: Prosperity for the twelve selected states (years 2011-2021)

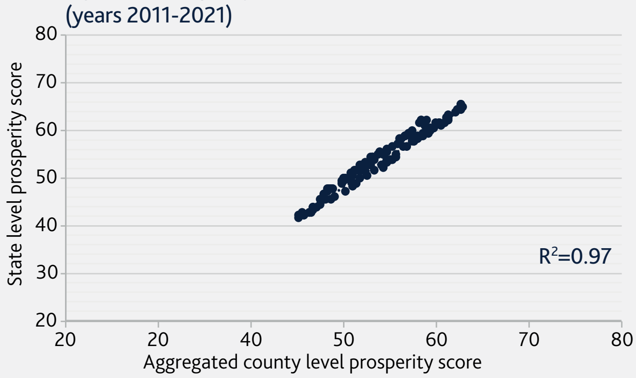



Figure 7b: Safety and Security for the twelve selected states (years 2011-2021)

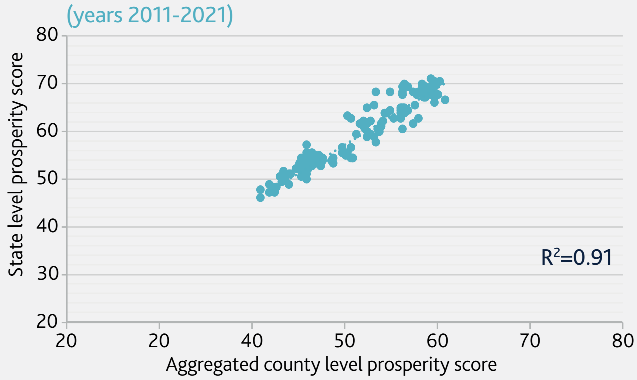


Figure 7c: Personal Freedom for the twelve selected states (years 2011-2021)

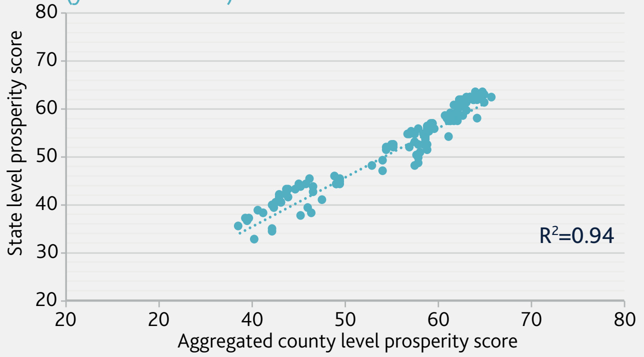



Figure 7d: Social Capital for the twelve selected states (years 2011-2021)


Figure 7e: Business Environment for the twelve selected states (years 2011-2021)

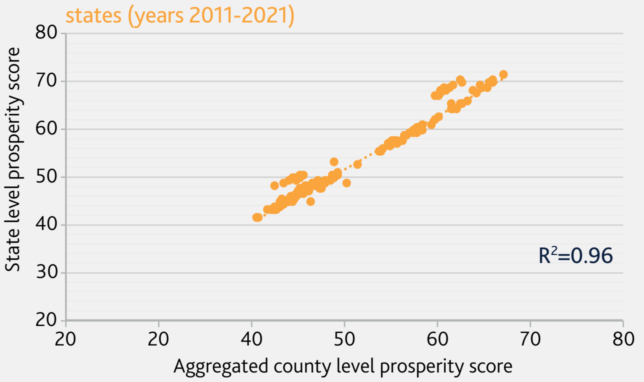



Figure 7f: Infrastructure for the twelve selected states (years 2011-2021)

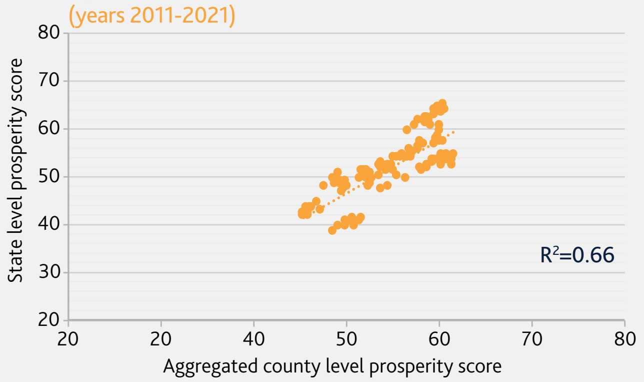



Figure 7g: Economic Quality for the twelve selected states (years 2011-2021)

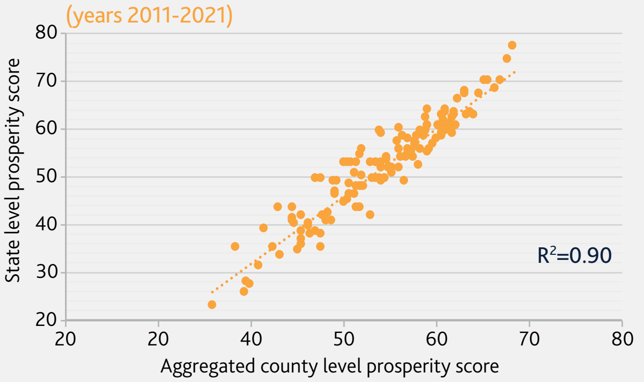



Figure 7h: Living Conditions for the twelve selected states (years 2011-2021)

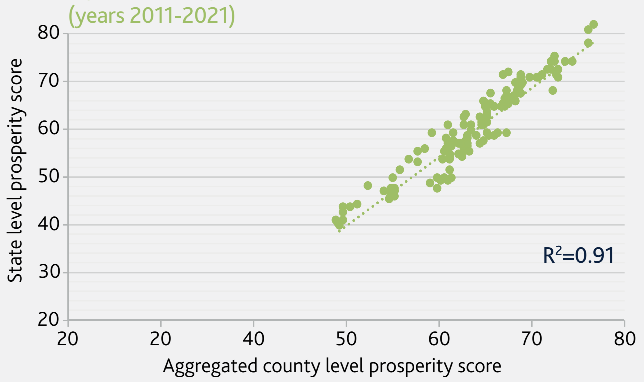



Figure 7i: Health for the twelve selected states (years 2011-2021)

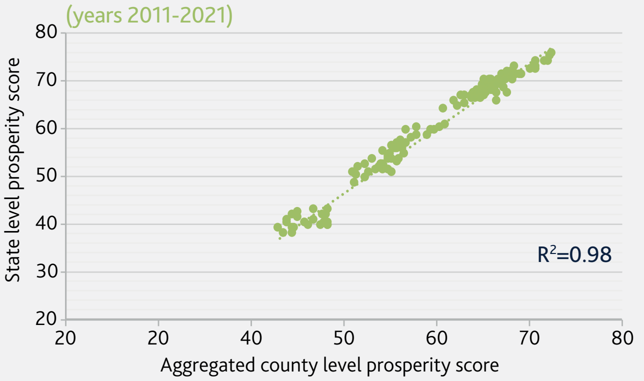
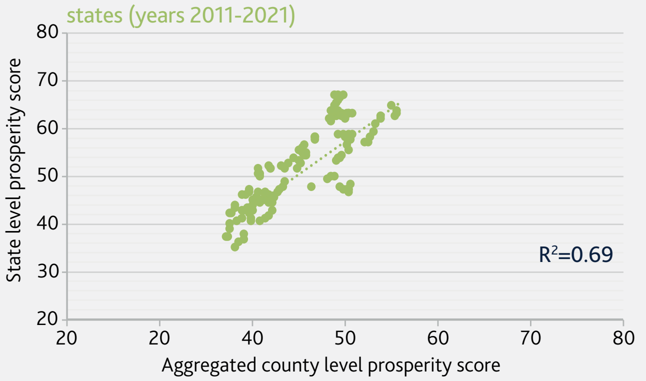



Figure 7j: Education for the twelve selected states (years 2011-2021)

Figure 7k: Natural Environment for the twelve selected states (years 2011-2021)




## COMPARISON OF THE UNITED STATES PROSPERITY INDEX WITH OTHER U.S. INDEXES

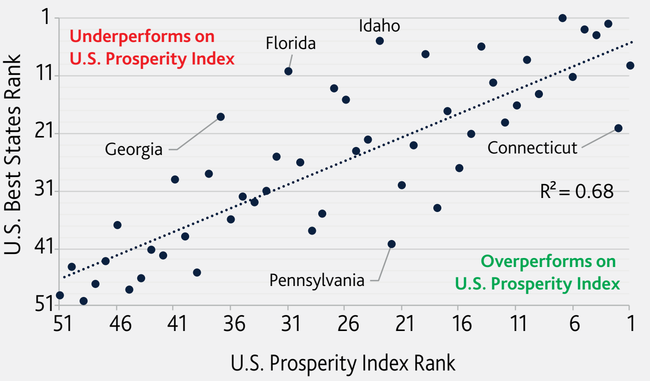
### State level

As part of the stress-testing of the U.S. Prosperity Index, we wanted to compare the Index with two other indexes that examine areas of social or economic wellbeing of each state:

- The Best States Rankings (U.S. News) — Compared against the U.S. Prosperity Index rankings;
- The Social Progress Index (Social Progress Imperative) — Compared against the Inclusive Societies and Empowered People domains of the U.S. Prosperity Index.

We ran simple regressions against both of these indexes to identify the similarities and differences between our Index and other indexes. During this process we looked at how similar the scores are, and what can be learned from examining the outliers in each Index.

Figure 8: U.S. Prosperity Index v U.S. Best States

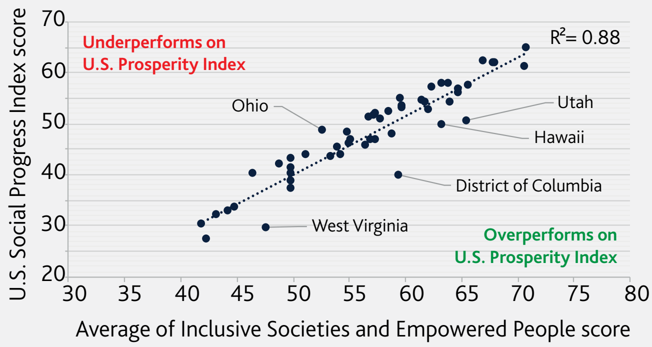



The U.S. Best States Rankings broadly covers topics similar to ours, except for Personal Freedom, Governance, and Social Capital, and it is primarily these exclusions that explain the differences. Despite this, the $R^2$ of 0.68 as shown in Figure 8 suggests the rankings are broadly aligned.

The Social Progress Index (SPI) measures 51 social and environmental indicators, focusing on life outcomes from shelter and nutrition to rights and education. It divides these indicators across three broad dimensions of social progress: Basic Human Needs, Foundations of Wellbeing, and Opportunity. The SPI does not capture the economic aspects of a society, so we have compared the SPI with the combined score for the Inclusive Societies and Empowered People domains of the U.S. Prosperity Index.

There is a strong relationship between the two measures ($R^2$=0.88), due to a high level of overlap between the data sources used in the two indexes (the U.S. Prosperity Index contains 29 indicators used in the Social Progress Index, out of a total of 53 used in their index).

Figure 9: Average of Inclusive Societies and Empowered People v Social Progress Index




Nevertheless, there are differences in both the conceptual framework and organizing structure, leading to the slight differences in scores and rankings (see Figure 9).

### County level

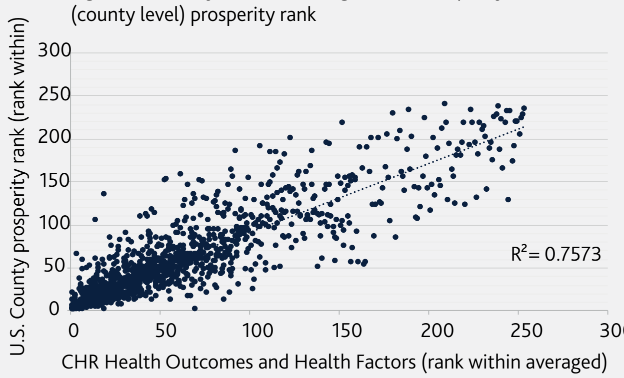
We also wanted to compare the U.S. Prosperity Index at the county level with other indexes that examine the social, institutional, or economic wellbeing of each county. For benchmarking purposes, we examined the 2021 County Health Rankings and compared them against the prosperity rankings of the counties of the twelve selected states in the U.S. Prosperity Index.

The County Health Rankings combine health and a broader set of measures, including access to jobs, quality of education, safety of a neighborhood, availability of affordable housing, proximity to green space, and transportation, as these things shape day-to-day life and create long-term opportunities for good health. Given the County Health Rankings include indicators of social, economic, and environmental determinants of health, as well as health indicators, we compared their rankings with the overall prosperity rankings of the counties within the eight selected states.

The $R^2$ of 0.76 suggests broad alignment between the two Indexes. When comparing the counties in each of the twelve selected states between the two indexes, we see the strongest association in California ($R^2$ = 0.90) and the least association in Nebraska ($R^2$ = 0.33). Differences between the two measures are mainly explained by the indicators used within each. Of the 35 indicators in the County Health

Rankings, there are 13 exact indicator matches in the U.S. Prosperity Index, 10 that are similar, and 12 which do not feature in the U.S. Prosperity Index.

Figure 10: County Health Rankings vs U.S. Prosperity Index (county level) prosperity rank



## ABOUT THE LEGATUM INSTITUTE

The Legatum Institute is a London-based think-tank with a bold vision to create a global movement of people committed to creating the pathways from poverty to prosperity and the transformation of society. We seek to fulfil our mission by raising up leaders of character, restoring an ethical vitality to all sectors of society, and developing the practical solutions and data tools that will help build inclusive and peaceful societies with open economies and empowered people. For more information about the United States Prosperity Index or to speak to one of the Legatum Institute's experts, please email info@li.com.

CREATING THE PATHWAYS FROM POVERTY TO PROSPERITY

## PROSPERITY INDEX

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