



## **Territorial Economic Impact Index**

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*Measuring the ongoing effects of long-term disruptions to Pacific Island Territories*

**Decision and Infrastructure Sciences Division**

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prepared by

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# Territorial Economic Impact Index

## Executive Summary

### What is the Territorial Economic Impact Index (TEII)?

Large disruptive events, including the COVID-19 pandemic, often result in significant changes in employment, personal income, industry output, and other measures of economic well-being and activity. Depending on the nature of the disruption, economic consequences can be relatively short-lived or they can linger for months or years. Argonne National Laboratory (Argonne), in coordination with the U.S. Department of Interior (DOI) Office of Insular Affairs (OIA), developed the Territory Economic Impact Index (TEII) to track near real-time economic impacts to United States Pacific Island Territories (PITs). While data for U.S. territories is relatively limited (especially for the PITs) compared to states and counties, Argonne leveraged available territorial and national datasets to provide impact index estimates consistent with the approach used for the County Economic Impact Index (CEII), which measures the near real time direct economic impacts of disruptions to U.S. counties.

The goal of the TEII is to identify which PITs may be more adversely affected during medium- to long-term disruptions with near real-time (and readily available) data and track their recovery over time relative to a pre-event baseline. The TEII also provides insight into economic recovery over time. A TEII value of 1 indicates that a territory's economy is in the same position as it was in January 2020, while scores below 1 indicate that it is worse off and scores greater than 1 indicate that it has since grown. It does not account for economic growth that would have happened under normal circumstances that did not occur.

### What Does the TEII Measure?

Like Argonne's [County Economic Impact Index \(CEII\)](#), the TEII measures potential monthly changes in a territory's gross domestic product (GDP)<sup>1</sup> relative to a pre-event baseline based on changes in industry employment. The TEII estimates impacts to U.S. territories located in the Pacific Ocean, including American Samoa (AS), Guam, and the Commonwealth of the Northern Mariana Islands (CNMI). The index shows which territories are potentially more susceptible to large reductions in economic activity compared to normal conditions by accounting for the industrial make-up of each territory's economy and tracking monthly changes in U.S. national employment by industry. Territories with higher concentrations of industries experiencing relatively large increases in unemployment (in the U.S. nationally) can expect larger direct impacts to their local economies, particularly if those industries contribute more to the region's GDP. These estimated employment losses for each territory are then aggregated and adjusted by Guam's quarterly employment change since March 2020 (end of the first quarter of 2020). To account for potential unique economic factors for Pacific territories, the index uses Guam's actual change in employment in the absence of more frequent data releases from AS and CNMI.

### Why Is the TEII Important?

The TEII provides the ability to monitor trends over time of the economic health of United States territories in the Pacific. One way to measure overall economic activity in a region is through its gross domestic product (GDP), or the monetary value of all final goods and services produced in an economy

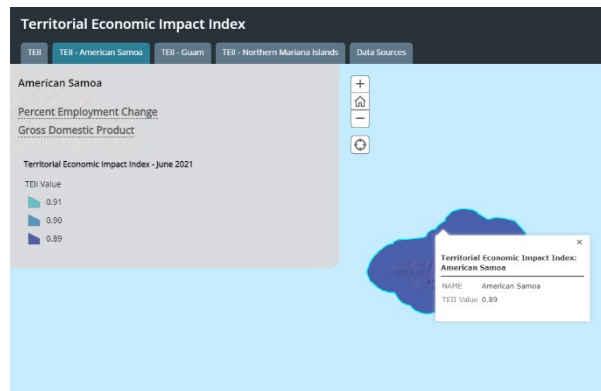
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<sup>1</sup> Or, more accurately, it's gross territorial product.

in a given year, with higher values being associated with more economic activity in a region. GDP is often used as an assessment of an economy's overall size and health, and while certainly not a perfect indicator of overall economic wellbeing or equity, increasing GDP over time generally implies an economy is experiencing more economic activity. Decreases in GDP, on the other hand, may imply that an economy is experiencing more unemployment, lower incomes, and overall less production and spending in the economy. As such, TEII values lower than 1 may imply that more people are unemployed and businesses are producing and earning less than they were prior to COVID-19.

## How Can I Use the TEII?

You can use the [TEII storymap](#) to check on the current or trending economic situation in a specific U.S. Territory. From the tabs at the top, clicking on a territory will give you a pop-up box that provides the Economic Index calculation (EconomicIndex[month]) by month. Darker blue shades indicate less stable economies, while lighter blue shades indicate more stability.



Users can also [download the data](#) to see monthly results since January 2020, as well as to see territorial impacts by industry.

## Introduction

Disruptive events have economic consequences, often resulting in significant changes in employment, personal income, industry output, and other measures of economic well-being and activity. While economists have developed a variety of methods for estimating cascading impacts from economic disruptions, there is a need for near-real-time indicators of local economic conditions by decision makers responsible for managing impacts and consequences during long-term events. Economic data are often published with a significant lag and near-real-time indicators must rely in part on data that is released with some regular frequency, posing a challenge when developing indicators for regions with sparse or infrequent data coverage. Argonne’s County Economic Impact Index (CEII)<sup>2</sup>, which identifies regions whose local economies may be more adversely affected during medium- to long-term disruptions, is one example of a metric developed for such a purpose, relying on detailed national employment and economic accounts data and aggregated local employment data to estimate potential impacts to economic output. To date, no similar indicator exists for the U.S. territories, particularly the island areas located in the Pacific Ocean, as available data for these areas is severely limited relative to the states.

This paper describes Argonne’s Territory Economic Impact Index (TEII). Similar to the CEII described in detail by Smith et al. (2021), the goal of the TEII is to identify which territorial economies may be more adversely affected during medium- to long-term disruptions with near real-time (and readily available) data and track their recovery over time relative to a pre-event baseline. Specifically, the estimates impacts to U.S. territories in the Pacific Ocean, including American Samoa (AS), Guam, and the Commonwealth of the Northern Mariana Islands (CNMI). The index shows which territories are potentially more susceptible to large reductions in economic activity compared to normal conditions by accounting for the industrial make-up of each territory’s economy and tracking monthly changes in U.S. national employment by industry. Territories with economic activities dominated by industries experiencing relatively large increases in unemployment can expect larger direct impacts to their local economies, particularly if the industries are high-value.

Like the CEII, the TEII measures potential monthly changes in a territory’s gross domestic product (GDP)<sup>3</sup> relative to a pre-event baseline. GDP is a measure of the monetary value of all final goods and services produced in an economy in a given year, with higher values being associated with more economic activity in a region. GDP is often used as an assessment of an economy’s overall size and health, and while certainly not a perfect indicator of overall economic wellbeing or equity, increasing GDP over time generally implies an economy is experiencing more economic activity. Decreases in GDP, on the other hand, may imply that an economy is experiencing more unemployment, lower incomes, and overall less production and spending in the economy.

GDP is measured using a few different approaches that evaluate the total contributions of separate components of the economy. These include the expenditure, income, and output approaches.<sup>4</sup> The output, or value-added, approach measures the total value of all final goods and services and services produced in an economy in a given year; in other words, it is the sum total of the value added by each industry at each stage of production. As with the CEII, the TEII is based on this approach.

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<sup>2</sup> Smith, Braeton J., Matthew E. Riddle, Amanda Wagner, Lesley Edgemon, Carmella Burdi, and Iain Hyde, “County Economic Impact Index: Measuring the ongoing economic effects of COVID-19”. Argonne National Laboratory, XXXXXX, 2021.

<sup>3</sup> Stated more precisely, it is gross territorial product.

<sup>4</sup> Please see Smith et al. (2021) for a more thorough discussion of these approaches.

While other measures of economic wellbeing are certainly important (such as those measuring consumer confidence, economic opportunity, equity, etc.), decreases in a region's total value-added imply less overall economic activity, an indicator of potentially challenging economic conditions for the people who live and work there.

## Method

The TEII represents the current (or near-current) level of economic activity in a U.S. territory relative to a pre-event baseline based on industry employment trends. As such, the first step is calculating the baseline economic activity by industry (represented here as value-added) for each territory. While the Bureau of Economic Analysis (BEA) does provide value added data for selected sectors for U.S. territories, it is highly aggregated and not available at the detailed level needed to correspond to changes in industry employment. Thus, value-added for each territory  $t$  and industry  $i$  is calculated for the baseline period as the value-added for the sector  $I$  (or territory as a whole) multiplied by the share of employment in industry  $i$  in the territory<sup>5</sup> in the base period (note, the sum over all industries is the territory's total value-added, or GDP):<sup>6</sup>

$$VA_{t,i,base} = VA_{t,I,base} \frac{Emp_{t,i,base}}{Emp_{t,I,base}}, \forall i \in I$$

The second step is calculating the change in employment in each industry on a rolling basis, as this data is updated more frequently at the U.S. national level. This is calculated as the percentage change in U.S. employment in industry  $i$  and month  $m$  from the pre-event base period (note, the pre-event base period may differ from the base period used to calculate value-added, and is thus designated with a hat<sup>7</sup>):

$$\% \Delta Emp_{US,i,m} = \frac{Emp_{US,i,m} - Emp_{US,i,\widehat{base}}}{Emp_{US,i,\widehat{base}}}$$

By multiplying the above equation by the baseline employment for each industry  $i$  in territory  $t$ , summing over all industries in the territory, and then dividing by total baseline territory employment, this can be used to calculate the total *estimated* percentage change in territorial employment in month  $m$ :

$$\% \Delta EmpEst_{t,m} = \frac{\sum_i (Emp_{t,i,base} \cdot \% \Delta Emp_{US,i,m})}{\sum_i Emp_{t,i,base}}$$

This gives the change in employment in territory  $t$  weighted by changes in U.S. employment by industry. However, applying this calculation may not accurately capture the actual change in territorial employment in month  $m$  since it is based on national employment data and individual territories may experience

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<sup>5</sup> Sectors are comprised of industries.

<sup>6</sup> This equation implies that all employees within an industry represent an equal amount of economic output in a sector and is thus more accurate for labor-intensive industries than for capital-intensive ones.

<sup>7</sup> Detailed value added by industry tables are updated annually by the Bureau of Economic Analysis, with the previous year's data becoming available late in the current year. It is assumed that (proportionally) value added by industry does not vary significantly from year to year. Because the TEII is ultimately represented as a proportion, a slight difference in reference period from the employment data does not pose an issue.

significantly different trends locally. The actual percentage change in employment in territory  $t$  in month  $m$  is:

$$\% \Delta Emp_{t,m} = \frac{Emp_{t,m} - Emp_{t,\widehat{base}}}{Emp_{t,\widehat{base}}}$$

Notably, monthly employment data for the Pacific Island Territories (PITs) is not available. As quarterly employment data is available for Guam from Guam’s Bureau of Labor Statistics, in practice the actual percentage change in employment for the island areas uses Guam’s data for the previous 3-month period. In the absence of monthly data from each territory, Argonne selected Guam in order to calibrate the index to the unique economic characteristics in PITs that may not be present in U.S. states. Quarterly employment data is not available for AS or CNMI.

The adjusted percentage change in employment in territory  $t$  for industry  $i$  is then calculated as the U.S. national percentage change in employment in the industry adjusted by the difference between the actual change in the territory’s overall employment (as approximated by Guam’s overall employment) and the estimated change in territory  $t$ ’s employment:

$$\% \Delta EmpAdj_{t,i,m} = \% \Delta Emp_{US,i,m} + (\% \Delta Emp_{t,m} - \% \Delta EmpEst_{t,m})$$

The difference between Guam’s actual change and territory  $t$ ’s estimated change in employment can be thought of as the “error” between the estimated and actual employment change. It serves as a territory-specific constant applied evenly across all industry-specific changes. The adjusted percentage change in territory employment by industry represents the prospective change in value-added in industry  $i$  in territory  $t$ . The new potential value-added (based on changes in employment) is then calculated as:

$$VA_{t,i,m} = VA_{t,i,base} (1 + \% \Delta EmpAdj_{t,i,m})$$

The monthly TEII is represented by the ratio of the new total value-added for territory  $t$  to its total baseline value-added:

$$TEII_{t,m} = \frac{\sum_i VA_{t,i,m}}{\sum_i VA_{t,i,base}}$$

Larger values of the TEII imply relatively greater overall economic stability or even growth. Values equal to 1 imply that a county’s economic activity is identical to its pre-event baseline, values below 1 indicate that the economy is experiencing less economic activity relative to the baseline, and values over 1 indicate that the economy has greater activity relative to the baseline.

As with any economic indicator, the TEII is not perfect. The sections below detail additional assumptions, notes, and limitations of the approach as well as current data sources and key results.



## Data Sources

**Table 1: Data sources used to calculate the Territory Economic Impact Index**

Index Data	Data Source	Reference Period
Employment (Private) by Industry by Island Area	Census Bureau, County Business Patterns, 2018; Number of Employees by Industry	Annual, 2018
Employment by Industry (Agriculture) by Island Area	U.S. Department of Agriculture, 2017 Census of Agriculture, weighted average of paid labor by number of days employed	Annual, 2018
Current Employment by Industry (excl. Agriculture), US Total	BLS, Current Employment Statistics (CES); Employment and Earnings, Table B-1a: Employees on nonfarm payrolls by industry sector and selected industry detail, seasonally adjusted	Monthly, Jan '20 - Jun '21
Current Employment (Agriculture), US Total	BLS, Labor Force Statistics from the Current Population Survey (CPS), Table A-7: Employed persons by class of worker and part-time status, seasonally adjusted	Monthly, Jan '20 - Jun '21
Current Employment for Guam, Total	Guam Bureau of Labor Statistics, Current Employment Statistics: Employment on Payroll by Ownership and Industry, Total Payroll Employment, Dec 2019 – Mar 2021	Quarterly, Q1 2020 – Q1 2021
Value Added by Industry, American Samoa	Bureau of Economic Analysis, Gross Domestic Product (GDP) for American Samoa, 2019; Table 2.1: Value Added by Industry	Annual, 2019
Value Added by Industry, Guam	Bureau of Economic Analysis, GDP for Guam, 2019; Table 2.1: Value Added by Industry	Annual, 2019
Value Added by Industry, Commonwealth of the Northern Mariana Islands	Bureau of Economic Analysis, GDP for the Commonwealth of the Northern Mariana Islands, 2019; Table 2.1: Value Added by Industry	Annual, 2019

## Additional Notes and Limitations

- The index represents changes in employment in the Pacific Island Territories based on U.S. national trends. While these changes are scaled to changes in individual territory employment, they still may not be representative of actual changes in industry composition at the local level.
- The goal of the TEII is to provide a metric for the U.S. Pacific Island Territories that is roughly comparable to the estimates provided by Argonne’s CEII. Consequently, the approach used to calculate the TEII favors consistency across datasets rather than the use of specialized datasets that pertain to a specific region; it also favors datasets that enable the method to be applied in a similar fashion.
- Estimated employment changes are adjusted by the quarterly change in total payroll employment in Guam since the first quarter (March) of 2020. It is therefore assumed that general employment trends in Guam are more reflective of general trends in AS and CNMI than trends for the rest of the U.S. Actual trends in AS and CNMI may differ from those in Guam; however, more current and frequent employment data for AS and CNMI has not been located.

- The employment adjustment accounts for “error” between estimated changes in overall employment and actual employment (as represented by Guam). For larger errors, the adjustment will be larger.
- The disaggregation of territory value added by industry into more detailed industries assumes that all employees within an industry represent an equal share of that industry’s output, which is a better assumption for labor-intensive industries than for capital-intensive industries.
- Argonne calculated detailed employment data based on data available from the 2018 County Business Patterns (CBP) dataset from the U.S. Census Bureau, which does not include public sector employment. Both the federal and territorial governments make up significant portions of the economies of all three island areas in the index. For Guam, public sector employment is taken from the Guam Bureau of Labor Statistics Current Employment Statistics data. For AS and CNMI, public sector employment is based on their relative contributions to GDP for each territory. This method assumes that all employees have an equal contribution to GDP.
- Employment data for Utilities (NAICS 22) and Arts, Entertainment, and Recreation (NAICS 71) could not be located for AS, and are not included in the index for AS. Employment for sub-industries with missing (or nondisclosed) data was estimated assuming they represent an equal share of the parent industry with available data.
- The changes in employment are calculated using employment levels rather than unemployment or employment rate, which account for changes in the labor force. Due to the increased potential for decreases in the labor force participation rate during prolonged economic disruptions (such as the COVID-19 pandemic), the unemployment rate may not reflect the true magnitude of employment loss. A more ideal measure is the employment per working-age population, however, such data is not readily available at the territory level. Not accounting for population changes may not control for large changes in employment in small population areas such as the island areas and may overstate changes in employment relative to the employment rate (similarly, the unemployment rate may understate actual decreases in employment).
- While the index estimates monthly value-added by territory, it is not intended to represent an estimate of current value-added ahead of those produced by the Bureau of Economic Analysis. The index relies on their most recent value-added by industry release (in this case 2018 data released in 2021).
- The index accounts for nondisclosed and suppressed employment in certain sub-industries for some territories in the Census Bureau’s County Business Patterns (CBP) dataset that have been withheld for purposes of confidentiality. For sub-industries with suppressed data, the index assumes an equal share of employees in the sector work in each sub-industry. See Nondisclosed Data section below for more details.
- These estimates do not directly account for any provisions provided to the U.S. territories to address the impacts of COVID-19.
- The index assumes that “economic impact” is best measured by changes in a territory’s value-added (or, gross territorial product) and that this provides a representation of overall economic well-being.
- The most current index estimates rely on the latest quarterly employment estimates from the Guam Bureau of Labor Statistics Current Employment Statistics (GBLS/CES) dataset, which is published at

a significant lag. This implies that the June index values available in August (for example), which rely on GBLS/CES estimates from Q1 (March), may differ from the June index values released after the GBLS/CES releases its Q2 (June) estimates.

## **Industry Mapping and Aggregation**

The index currently accounts for monthly employment changes in 83 separate industries comprised of industry codes as defined by the North American Industry Classification System (NAICS) codes. The list is comprised of 50 three-digit codes, 21 four-digit codes, 4 two-digit codes, and 5 industry aggregates defined for the purposes of this study, which include separately federal and territorial government. The government codes, named G1 and G2, respectively, account for employment in all sectors associated with government owned establishments; the other 78 industries account for private employment only.

## **Government Employment**

Federal and territorial government make up a significant portion of the economies of all three Pacific Island Territories; however, employment in the public sector is not reported by the 2018 CBP. For Guam, both federal and territorial employment are provided by the Current Employment Statistics from the GBLS. For AS and CNMI, the total private employment reported by the CBP is inflated to represent total employment (including public sector employment) using the public sector's value added to each territory's economy (e.g., if private industries make up 85% of value added, then it is assumed that the reported private sector employment only makes up 85% of total employment while the public sector makes up 15%). Public sector employment is then separated out and multiplied by the share federal and territorial government contribute to each region's GDP to estimate federal and territorial employment in each region.

## **Agricultural and Farm Employment**

The index uses a separate source for employment in the agricultural industry for Guam and AS, as farm employment is only included in the 2018 CBP data for CNMI. Agricultural employment for Guam and AS is calculated as the weighted average of paid agricultural labor by the number of days employed from the 2017 Census of Agriculture from the U.S. Department of Agriculture.

As with the CEII, changes in agricultural employment also rely on a different source from other industries, which are based on changes in the Current Employment Statistics from the BLS. Seasonally adjusted employment for agriculture and related industries is accounted for by data from the Labor Force Statistics from the Current Population Survey and is used to represent the entirety of NAICS 11 in the index, which includes employment in the entire agricultural sector, such as crop farming, logging, and fisheries. A monthly data source that separates current employment in these sectors has not been located.

## **Nondisclosed Data in the CBP Dataset**

Due to confidentiality concerns, the Census withholds employment data for disaggregated industries in regions where specific employers and establishments could potentially be identified in the CBP dataset. In order to consistently map industry changes across all territories, all industry employment (and value added) data was disaggregated to the same level. For each nondisclosed (or missing) subindustry, the baseline employment level for each is assumed to be an equal share with other nondisclosed industries of the remaining unassigned sectoral employment. For example, if a territory has 100 reported employees in NAICS 71, 80 reported employees in NAICS 713, nondisclosed employment for NAICS 711 and 712, then both 711 and 712 are assigned 10 employees each for that territory.

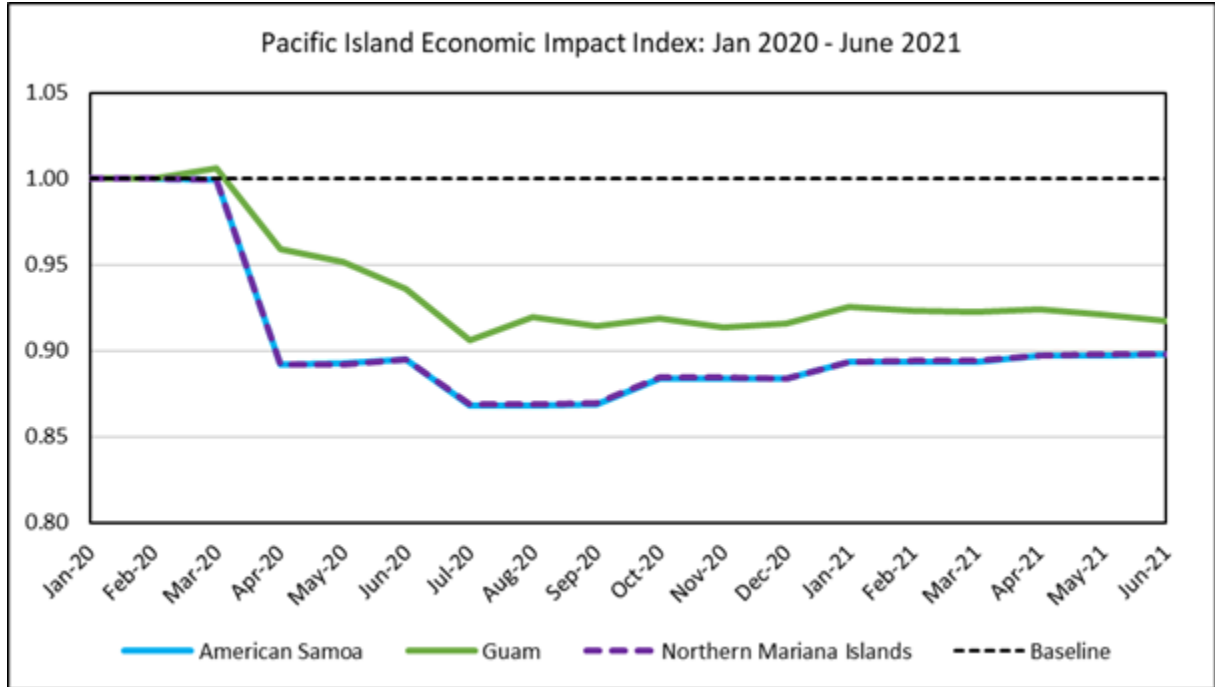
## **Additional Considerations**

There are other, similar, approaches to estimating an index that tracks ongoing impacts to U.S. Pacific Island Territories. Notably, the TEII tracks changes in industry employment using U.S. national data, so it is best suited toward estimating impacts that affect the nation as a whole. More frequent employment data for the U.Ss territories would allow for an index that more accurately captures impacts to the territories specifically. One approach could be to use the quarterly industry employment changes reported by the Current Employment Statistics from the GBLS instead. However, such an approach uses data that is updated less frequently and carries a similar assumption about how changes affecting one region affect others equivalently.

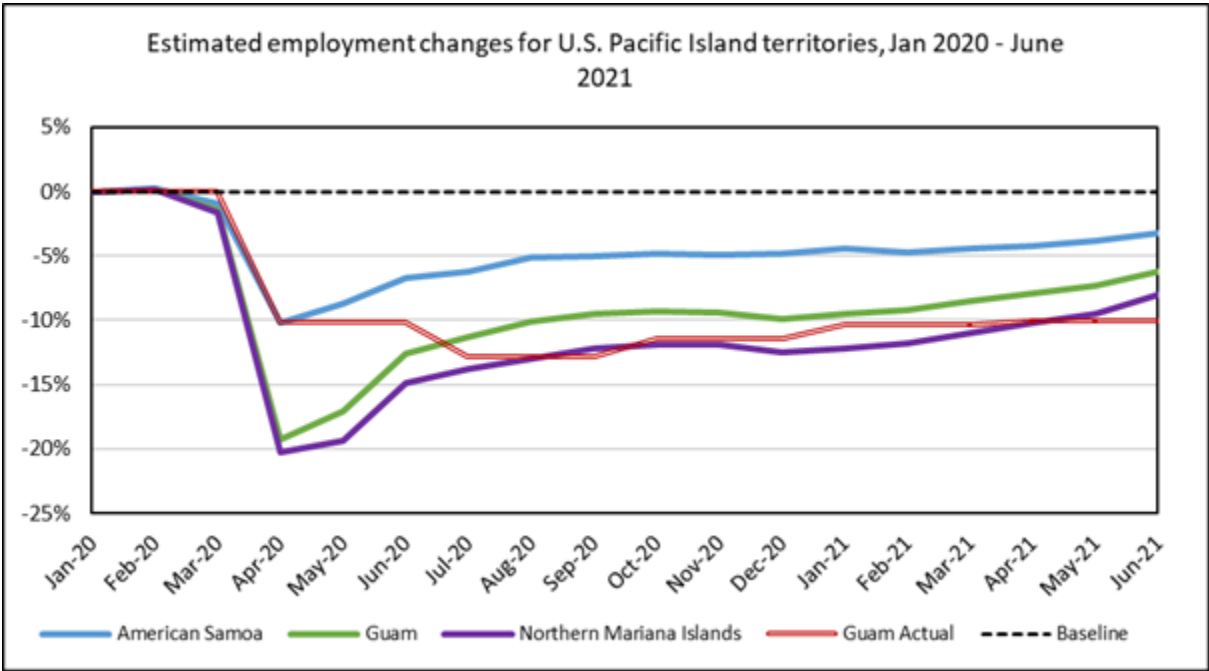
## Key Results

**Table 2: Economic impact from COVID-19 according to the Territory Economic Impact Index for June 2021**

Territory	Est. Value-Added (Jan '20) (\$M)	Est. Value-Added (June '21) (\$M)	TEII
American Samoa	\$644	\$579	0.90
Guam	\$5,885	\$5,397	0.92
Northern Mariana Islands	\$1,344	\$1,207	0.90



**Figure 1: The Economic Impact Index for the Pacific Island Territories, January 2020-June 2021**



**Figure 2: Estimated employment changes for the Pacific Island Territories prior to adjustment, January 2020-June 2021**

## Appendix A: Data Dictionary

The following table describes the data columns provided in the index data file.

**Table 2: Data Definitions**

Sheet	Column Name	Units	Description
	fips	-	Unique FIPS code representing each county
	name	-	Territory name
	naics	-	Industry code according to the North American Industry Classification System
industry	empUS	Proportion	National percentage change in employment by industry by month from the base month (January 2020); calculated from the BLS/CES data
	empEst	Amount	Estimated number of employees by industry based on U.S. national trends
	empAdj	Proportion	Adjusted percentage change in employment by industry by county for [month] from the base month (January 2020); calculated as documented above
	va	Millions USD	Estimated value-added by industry by territory by month



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