APPENDIX A
ECONOMIC IMPACT ANALYSIS

EXECUTIVE SUMMARY

The economic impact of rail transportation to Kentucky in 2021 were estimated using Regional Input-Output Modeling System (RIMS II) multipliers from the Bureau of Economic Analysis (BEA) with input data and assumptions on:

- Freight movements, based on data derived from the STB 2021 Waybill Sample data of shipments originating in Kentucky as described in Chapter 2, Section 2.2.2 of the Kentucky State Rail Plan;
- Values of commodity shipments extracted from the Federal Highway Administration's (FHWA's) Freight Analysis Framework (FAF) data base for rail shipments originating in Kentucky in 2021, converted to a value (2021 dollars) per ton; and
- Rail transportation operations.

Impacts of the rail industry in Kentucky considered in this analysis stem from organizations providing freight and passenger transport services, as well as industries using rail freight services to trade goods (i.e., shippers of goods or commodities).

Impacts were estimated and present by activity (service provision and rail users), type (direct, indirect, induced, and total), and measure (employment, income, and value added) for 2021 to provide an extensive review of how rail operations in Kentucky impacts the State's economy. The table below provides a summary of the economic impacts which include the follow:

- **Output**: In terms of total revenue, the rail-related industries generated an estimated $37.4 billion in output, of which, $37.3 billion is contributable to freight rail operations and services.
- **Employment**: The economic impact of rail supported over 51,000 jobs directly in the provision of rail transportation (both freight and passenger). If including other trickle-down impacts, rail-related operations supported almost 130,000 jobs.
- **Employment Income**: In total, the rail-related industries supported $7.7 billion in earnings for the almost 130,000 employees. These earnings include employee compensation and proprietary incomes. Specifically, employee compensation includes wages or

Source: Kentucky Transportation Cabinet

salary payments, employee benefits, and employer paid payroll taxes. Meanwhile, proprietary incomes consists of payments received by self-employment individuals and unincorporated business owners.

- **Value Added**: The combined value-added impact of rail-related activity amount to nearly $17.3 billion, which is approximately 7.3 percent of Kentucky's Gross Domestic Product (GDP) in 2021.[1]

Table A-1. Economic Impacts for Rail Transportation in Kentucky

Impact Metric	Transportation Services		Transportation Users	Total Service		Total
	Freight	Passenger		Freight	Passenger	
Output ($M)						
Direct	$1,173.7 M	$42.3 M	$20,264.8 M	$21,438.5 M	$42.3 M	$21,480.8 M
TOTAL	**$2,111.1 M**	**$76.1 M**	**$35,224.0 M**	**$37,335.1 M**	**$76.1 M**	**$37,411.2 M**
Employment (Jobs)						
Direct	2,159	70	49,119	51,279	70	51,349
TOTAL	**7,091**	**248**	**122,615**	**129,706**	**248**	**129,953**
Employment Income ($M)						
Direct	$210.6 M	$7.6 M	$3,539.8 M	$3,750.4 M	$7.6 M	$3,758.0 M
TOTAL	**$458.1 M**	**$16.5 M**	**$7,255.7 M**	**$7,713.8 M**	**$16.5 M**	**$7,730.3 M**
Value Added ($M)						
Direct	$609.3 M	$22.0 M	$292.5 M	$901.8 M	$22.0 M	$923.7 M
TOTAL	**$1,073.0 M**	**$38.7 M**	**$16,157.3 M**	**$17,230.3 M**	**$38.7 M**	**$17,269.0 M**

Note: All monetary values are in 2021 dollars

Source: Kentucky Transportation Cabinet

1. Based on a GDP of $237,928.9 million for Kentucky in 2021. Data extracted from: U.S. Bureau of Economic Analysis, Gross Domestic Product: All Industry Total in Kentucky [KYNGSP], retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/KYNGSP, March 1, 2024.

A.1. INTRODUCTION

Economic impacts for the rail transportation industry in Kentucky assessed in this analysis stems from (1) railroads providing freight and passenger rail services, and (2) industries using such services to trade or transport goods (i.e., the shippers of good or commodities).

This Appendix outlines the methodology of quantification of these impacts together with input data and results. The methodology represents an input-output approach that captures and quantifies the flow of goods and services (expenditures) between various industries in the economy arising from technical requirements of one industry for inputs provided by another industry. These inter-industry requirements for input supplies and labor create rounds of expenditures and impacts that – when added throughout the economy – exceed the initial expenditure.

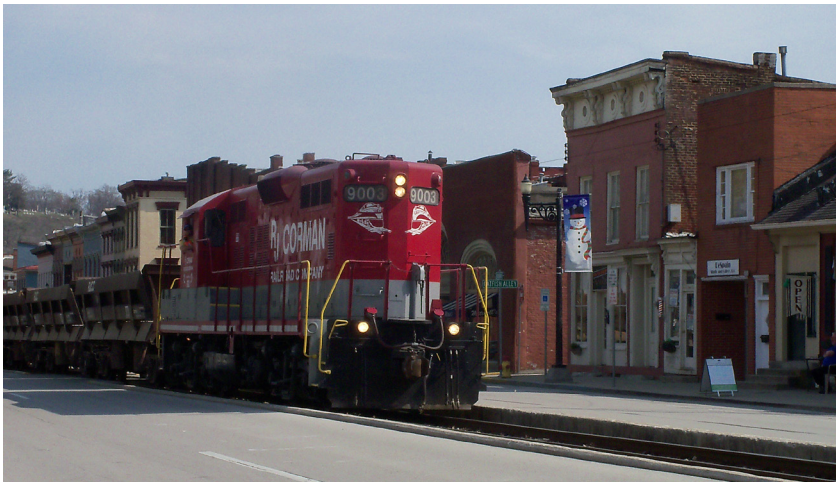
The analysis is implemented on the basis of STB 2021 Waybill Sample data of shipments originating in Kentucky and using Regional Input-Output Modeling System (RIMS II) multipliers from the Bureau of Economic Analysis (BEA) referred to as RIMS II multipliers. The remainder of this document is organized as follows:

- **Section A.2, Methodology, Data Sources, and Assumptions:** Introduces the conceptual framework used in the Benefit-Cost Analysis (BCA).
- **Section A.3, Results:** Provides an overview of RIISE, including a brief description of existing conditions and proposed alternatives; a summary of cost estimates and schedule; and a description of the types of effects that RIISE is expected to generate.
- **Section A.4, Summary of Impacts:** Discusses the general assumptions used in the estimation of project costs and benefits.

A.2. METHODOLOGY, DATA SOURCES, AND ASSUMPTIONS

A.2.1. Key Concepts and Modeling Tools

Economic impact analysis (or assessment) is a type of conceptual analysis that identifies and quantifies the economic activity that is generated or can be attributed and linked to an investment project, government policies, events, etc. being evaluated. These projects, policies, or events have some underlying change in the stream of expenditures in an economy and lead to a change in the demand for goods and services. This has implications on the number of jobs and other measures of economic activity in the local, regional, and national economy.



Source: Kentucky Transportation Cabinet

Traditionally, economic impact analysis involves the estimation of

three distinct types of economic activity, commonly referred to as "direct impacts", "indirect impacts", and "induced impacts" that are attributable to an initial stream of incremental capital of operating expenditures. These are defined as follows:

- **Direct impacts** refer to the initial economic effects occurring as the result of capital of operating expenditures directly related to the project, policy, or event being evaluated. Direct spending results in the employment of workers, business output, and sales of locally produced goods or services.
- **Indirect impacts** refer to the "spin-off" economic activities that result from purchases of production inputs, goods and services, by businesses that are impacted by the initial expenditures. The spending by the supplier firms on their labor, production inputs, goods and services that they require creates output of other firms further down the production chain, bringing about additional business output, employment, and earnings. The sum of these effects across the supply chain is the indirect impact.
- **Induced impacts** represent the increase in business output, employment, and earnings over and above the direct and indirect impacts, generated by re-spending of employment income derived from the direct and indirect employment. Induced impacts are thus changes in economic activity that are the result of personal (household) spending for goods and services by employees comprising the direct and indirect impacts.
- **Total economic impact** is the sum of the direct, indirect, and induced impacts for the activity being evaluated.

Each of the direct, indirect, and induced impacts defined is estimated in terms of the various measures of economic activity that include the following:

- **Output:** Is the total gross value of all business revenue. Output represents the total sum of all economic activity that has taken place in connection with it. This is the broadest measure of economic activity.
- **Employment:** The number of incremental jobs created as a result of all expenditures related to the activities evaluated.[2]
- **Salaries and Wages:** Is the additional salaries and wages that would be paid to above employees.
- **Value Added:** The value added represents the unduplicated measure of the total value of economic activity. This is also sometimes referred to as the gross domestic product (GDP), the "value added" to the economy, or the value of output minus value of purchased goods and services used in the production process.

Indirect and induced impacts are often referred to as "multiplier effects," since they increase the overall economic impacts of the original expenditure that initiated the rounds of spending and effects described above.

2. In economic impact analysis, employment impacts are typically estimated in terms of job-years which expresses the number of jobs created multiplied by the length of time, in years, that they would last for. Example, 1 job-year is 1 job created for 1 year. For simplicity, as the analysis is conducted for a single year, we will refer to job-years as jobs.

The above analysis is made operational via an input-output methodology that captures and quantifies the flow of goods and services between various industries in an economy arising from technical requirements of one industry for inputs produced by another industry (supply-purchase relationships).

Aggregate measures of the requirements of one industry from all other industries (per $1 of output) represent indirect multipliers. Own industry requirements for labor and operational profile (wages and salaries paid, use of production inputs) represent direct multipliers. Indirect multipliers can be used to estimate indirect impacts; direct multipliers can be used to estimate direct effects (or its missing components, e.g. employment from given expenditure amount). Induced impacts are estimated based on profile of consumer expenditures on goods and services.

Source: Kentucky Transportation Cabinet

Economic impacts of transportation are direct by both transportation services and the choice of rail transportation made by users of these services themselves. That is, Kentucky rail-related economic impacts are categorized into service product and user impacts. Rail transportation services would be curtailed in the absence of rail activity (elimination of goods or passenger movements). Transportation user focuses on the impacts pertaining to industries using freight rail to transport goods. The nature of these impacts is briefly discussed below:

- **Transportation Service Providers:** Impacts associated with the provision of rail transportation include a wide range of primarily model transport activity, but also may include other support and administrative operations. In particular, it reflects freight and passenger railroad operations.
- **Transportation Users (Freight Users):** Impacts associated with shippers of freight and the industries that supply goods and services to them. Specifically, this reflects the impacts associated with shippers using freight rail for goods movement, except for the rail industry itself.

  Rail users have several options available to transport freight and can substitute this service with other modes, such as truck or barge, if rail services were unavailable. However, the choice to use rail service to ship freight indicates cost and/or logistical advantages in a competitive marketplace. Loss of rail service could negatively affect its current users. In this sense, rail contributes to the vitality of the state economy and supports jobs and economic activity of its users involved in the production of goods shipped.

  This analysis focuses on the impacts to shippers as captured by outbound freight that originated within Kentucky. Although receivers may also benefit by being able to obtain their orders by rail at a lower cost, including many production inputs and supplies, this impact is

difficult to quantify without a risk of over-stating the impact. For example, the receivers of production supplies may then themselves ship final goods they produce by rail as well. The economic activity and contribution to the state economy corresponding to the production of those final goods will be accounted for under outbound freight. Including impact due to being able to obtain production supplies by rail as well carries a high risk of double counting as those supplies may be used to produce the goods already captured under the outbound freight.

The above analysis is implemented and estimated using RIMS II multiplier from the BEA. RIMS II multipliers are widely used in economic impact modeling to forecast the effect of a given change in the economy's activity on the local, regional, and national economy.

The activity is specified in terms of incremental expenditures related to the activity, such as revenue of the industry that receives orders of its goods and services, or number of workers that will be required to complete the order. The multipliers are then applied for each of the metrics discussed above to obtain direct, indicted, and induced impacts, all in terms of business output, jobs, employment income, and value-added. The approach is based on classic input-output modeling principles. This analysis used the state-wide multipliers for Kentucky for a combination of summary-level aggregation of industries. The multipliers are based on 2021 regional data and 2012 Benchmark Input-Output table for the nation.

Estimation of economic impacts with RIMS II multipliers involved the following key steps:

- **Step 1:** Identify the streams of revenues directly related to the activity being analyzed (i.e., freight shippers' sales by commodity) and classify them into industrial sectors.
- **Step 2:** Identify BEA RIMS II industries that most closely correspond to the industrial sectors of revenues listed in Step 1, based on the type and nature of commodities involved.
- **Step 3:** Develop impact mode, compile multipliers by identified industries, match with streams of revenues, code all direct, indirect, and induced impacts.
- **Step 4:** Run model simulations and analyze results.

The specific data and methodological assumptions used develop the streams of expenditures generating economic impacts are discussed in the next section.

A.2.2. Data and Input Assumptions

RAIL SERVICE PROVISION

Estimation of economic impacts of passenger rail services in Kentucky is based on information on direct industry employment. Amtrak's 2016 fact sheet outlining its contribution to Kentucky's economy indicated that Amtrak supported 70 jobs in Kentucky at the time.[3]

Meanwhile, the economic impacts of freight rail services were estimated based on railroad revenues provided in the STB 2021 Waybill Sample data for each record together with other shipment details, such as weight, number of carloads, and commodity classification.

3. Amtrak, Kentucky. Amtrak's Contributions to Kentucky, 2016.

To align this analysis with the scope of impacts to transportation users, the focus is on impacts due to outbound and interstate shipping and corresponding railroad revenues. It is recognized that some of this revenue would likely accrue to destination states, rather than Kentucky. However, railroad revenues in Kentucky, and thus economic impacts, may also accrue via services provided to inbound and through shipments. Overall, given the tonnage of inbound and through shipments, economic impacts based on railroad revenues from outbound and intrastate shipping are likely to represent a conservative estimate of impacts.

FREIGHT MOVEMENTS

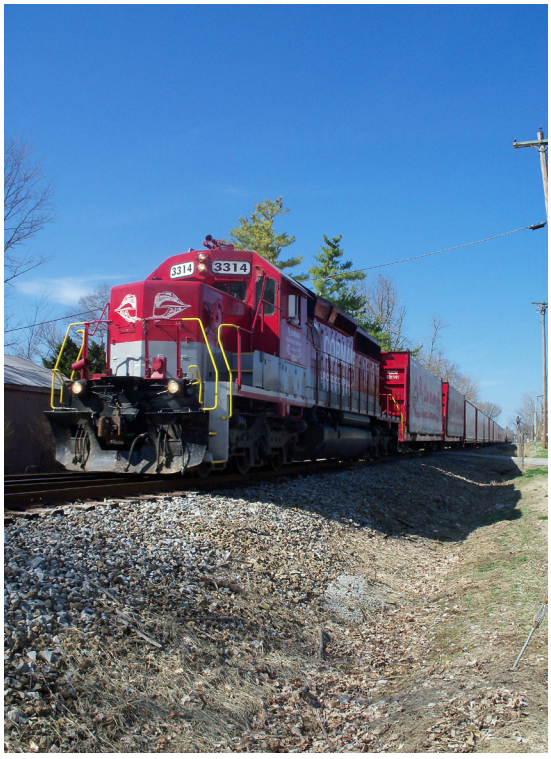
The STB 2021 Waybill Sample data of rail shipments originating in Kentucky described in Chapter 2, Section 2.2.2 provided the volume of shipments of goods originating in Kentucky. Meanwhile, FAF was leveraged to extract values of shipments by rail in millions of 2021 dollars that originate in Kentucky. The total shipment values were converted to average commodity value, by commodity, in terms of value per ton in 2021 dollars. These were then matched to commodity categories in the STB 2021 Waybill Sample data.

Multiplying the tonnage of shipments from the Waybill data by the average value of goods provided the total value of commodities shipped from a Kentucky origin. As mentioned in the previous section, this is interpreted as shippers' revenue, or the value of production, supported (facilitated or made more competitive) by the presence of rail transportation. The employment and income related to these shipments are interpreted as the economic impacts related to rail.

It is noted that, in practice, many shipments may represent movement of goods from warehousing and distribution centers, rather than manufacturing establishments. In particular, the analysis of 2017 Commodity Flow Survey data reveals that, by value, 39.2 percent of shipments are shipped by manufacturing industries, and about 54.9 percent are shipped by wholesale trade and warehousing and storage industries.[4] Based on this analysis, 54.9 percent of all commodity shipments by value were assigned to wholesale trade and the remaining share were assigned to the BEA RIMS II input-output industry that best matched the particular commodity group.

Table A-2 presents the results of this analysis.

The volume of goods shipped from Kentucky origins amounts to over 24.2 million tons, with a total value of $39.5 billion. Of this value, almost $21.8 billion is assumed to represent shipments by wholesale trade, while the remaining $17.8 billion represents various relevant industries presented in **Table A-2**.



Source: Kentucky Transportation Cabinet

4. Calculated based on United States 2017 Economic Census: Transportation, Table A7a.

The table also indicates that the top 3 shipments, in terms of tonnage, were coal (48.8 percent of total tonnage), following by chemicals or allied products (14.9 percent of total tonnage), and transportation equipment (11.5 percent of total tonnage). Meanwhile, in terms of value, the top 3 shipments were transportation equipment ($10.3 billion), natural gas ($5.3 billion), and petroleum or coal products ($3.4 billion).

Table A-2. Freight Shipments Assessed in the Economic Impact Analysis

Commodity Group	Outbound and Intrastate Volumes (thousand tons)	Commodity Value ($/ton)	Shipment Value ($ Millions)	Value to Allocated to Wholesale Trade ($ Millions)	Value to Allocated to RIMS II I-O Industries ($ Millions)	RIMS II Industry Assigned (Other Than Wholesale)	Industry Code
Coal	11,824	$52.80	$624.3	$343.0	$281.3	Petroleum and coal products manufacturing	24
Chemicals or Allied Products	3,613	$1,129.54	$4,081.3	$2,242.2	$1,839.1	Chemical manufacturing	25
Farm Products	803	$242.68	$194.8	$107.0	$87.8	Farms	1
Food or Kindred Products	439	$1,681.50	$738.1	$405.5	$332.6	Food and beverage and tobacco product manufacturing	19
Primary Metal Products	681	$1,379.31	$939.0	$515.9	$423.1	Primary metal manufacturing	10
Misc Mixed Shipments	481	$2,789.64	$1,340.7	$736.6	$604.1	Miscellaneous manufacturing	18
Petroleum or Coal Products	660	$3,364.78	$2,221.9	$1,220.7	$1,001.2	Petroleum and coal products manufacturing	24
Transportation Equipment	2,793	$10,253.61	$28,634.5	$15,731.4	$12,903.1	Other transportation equipment manufacturing	16
Pulp, Paper or Allied Products	287	$538.00	$154.5	$84.9	$69.6	Paper manufacturing	22
Nonmetallic Minerals	1,090	$246.65	$268.9	$147.7	$121.2	Nonmetallic mineral product manufacturing	9
Clay, Concrete, Glass or Stone	761	$3.09	$2.4	$1.3	$1.1	Nonmetallic mineral product manufacturing	9
Logs, Lumber, Wood Prod.	144	$396.73	$56.9	$31.3	$25.7	Wood product manufacturing	8

Waste or Scrap Materials Not Identified by Producing Industry	639	$354.47	$226.5	$124.4	$102.0	Not included in assessment	0
Metallic Ores	1	$954.44	$0.9	$0.5	$0.4	Mining (except oil and gas)	4
Petroleum Prod, Natural Gas	9	$5,302.81	$47.1	$25.9	$21.2	Petroleum and coal products manufacturing	24
TOTAL	**24,224**		**$39,531.6**	**$21,718.1**	**$17,813.4**		

Note: All monetary values are in 2021 dollars

A.3. RESULTS

A.3.1. Rail Transportation Service Impacts

Table A-3 below presents the impacts of rail transportation services provision in Kentucky in 2021. The rail transportation services industry in Kentucky supported over 2,200 jobs, which comprised of almost 70 passenger rail related jobs and over 2,100 freight rail related jobs. The indirect and induced effects in other related industries, due to spending on rail operations, supported an additional 5,100 jobs (2,600 indirect jobs and 2,500 induced jobs) throughout the State. Combined, in 2021 an estimated over 7,300 number of jobs related in some way to the provision of freight and passenger rail services.

Other industry impacts included:

- $2.2 billion in output
- $474.6 million in employment income
- $1.1 billion in value added

Table A-3. Economic Impact of Rail Transportation Service, 2021

Category of Impact	Output ($ Million)	Employment (Jobs)	Employment Income ($ Million)	Value Added ($ Million
Freight Shippers				
Direct	$1,173.7 M	2,159	$210.6 M	$609.3 M
Indirect	$555.4 M	2,498	$140.4 M	$253.5 M
Induced	$382.0 M	2,433	$107.2 M	$210.2 M
TOTAL	**$2,111.1 M**	**7,091**	**$458.1 M**	**$1,073.0 M**
Passenger Rail Operations				
Direct	$42.3 M	70	$7.6 M	$22.0 M
Indirect	$20.0 M	90	$5.1 M	$9.1 M
Induced	$13.8 M	88	$3.9 M	$7.6 M
TOTAL	**$76.1 M**	**248**	**$16.5 M**	**$38.7 M**

All Rail Transportation Service				
Direct	$1,216.0 M	2,229	$218.2 M	$631.2 M
Indirect	$575.4 M	2,588	$145.4 M	$262.7 M
Induced	$395.8 M	2,521	$111.0 M	$217.8 M
TOTAL	$2,187.2 M	7,338	$474.6 M	$1,111.7 M

Note: All monetary values are in 2021 dollars.

The findings shown in **Table A-3** indicate that the predominate share of rail transportation service impacts are attributable to the freight rail industry in Kentucky. This is due to comparatively smaller passenger rail service within Kentucky.

A.3.2. Rail Transportation User Impacts

Table A-4 presents the impacts of rail transportation users in Kentucky in 2021. Through their economic activities, rail users directly supported over 49,100 jobs, and a total of over 122,600 number of jobs overall. Other industry impacts included:

- $35.2 billion in output
- $7.3 billion in employment income
- $16.2 billion in value added

Similar to the results for rail transportation service, the predominate share of impacts from rail transportation users are attributable to the freight rail industry in Kentucky.

Table A-4. Economic Impact of Rail Transportation Users, 2021

Category of Impact	Output ($ Million)	Employment (Jobs)	Employment Income ($ Million)	Value Added ($ Million
Direct	$20,264.8 M	49,119	$3,539.8 M	$292.5 M
Indirect	$8,910.4 M	34,958	$2,018.2 M	$12,534.1 M
Induced	$6,048.8 M	38,538	$1,697.7 M	$3,330.7 M
TOTAL	$35,224.0 M	122,615	$7,255.7 M	$16,157.3 M

Note: All monetary values are in 2021 dollars.

A.4. SUMMARY OF IMPACTS

A.4.1. Total Rail Activity Impacts

Table A-5 provides a summary of the total rail-related impacts in Kentucky in 2021. Accounting for both rail transportation users and rail transportation services, the rail industry supported almost 130,000 jobs and $7.7 billion in employment income in Kentucky. Moreover, the rail-related impacts generated $37.4 billion in output and $17.3 billion in value-added.

Table A-5. Total Rail Transportation Impacts, 2021

Category of Impact	Output ($ Million)	Employment (Jobs)	Employment Income ($ Million)	Value Added ($ Million
Direct	$21,480.8 M	51,349	$3,758.0 M	$923.7 M
Indirect	$9,485.8 M	37,546	$2,163.7 M	$12,796.8 M
Induced	$6,444.6 M	41,059	$1,808.7 M	$3,548.5 M
TOTAL	**$37,411.2 M**	**129,953**	**$7,730.3 M**	**$17,269.0 M**

Note: All monetary values are in 2021 dollars.

A.4.2. Impacts as Percentage of Total Economy

To present the economic contribution of the rail industry in Kentucky, the estimated impacts were compared with the corresponding economic statistics for the entire State. The comparison of the data points is presented in **Table A-6**. The results indicate that the rail industry in Kentucky accounted for about 7.3 percent to 9.6 percent of the State's economy, depending on the reference measure.[5]

Table A-6. Kentucky and Rail-Related Economic Measures, 2021

Measure of Economic Activity	Overall State Level	Rail Industry Related Activity	Share of Rail Related Activity
Employment	1,617,040	129,953	8.0%
Employment Income	$80,502.1 M	$7,730.3 M	9.6%
Value Added	$237,928.9 M	$17,269.0 M	7.3%

Note: All monetary values are in 2021 dollars.

Source: Kentucky Transportation Cabinet

5. Employment and employment income for Kentucky in 2021 were obtained from the U.S. Census Bureau's QuickFacts for Kentucky. Meanwhile, the value added / GDP from Kentucky in 2021 were obtained from the U.S. Bureau of Economic Analysis, Gross Domestic Product: All Industry Total in Kentucky [KYNGSP], retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/KYNGSP, March 1, 2024.