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ECONOMIC IMPACTS OF AN INFRASTRUCTURE BILL ON THE WOOD PRODUCTS VALUE CHAIN

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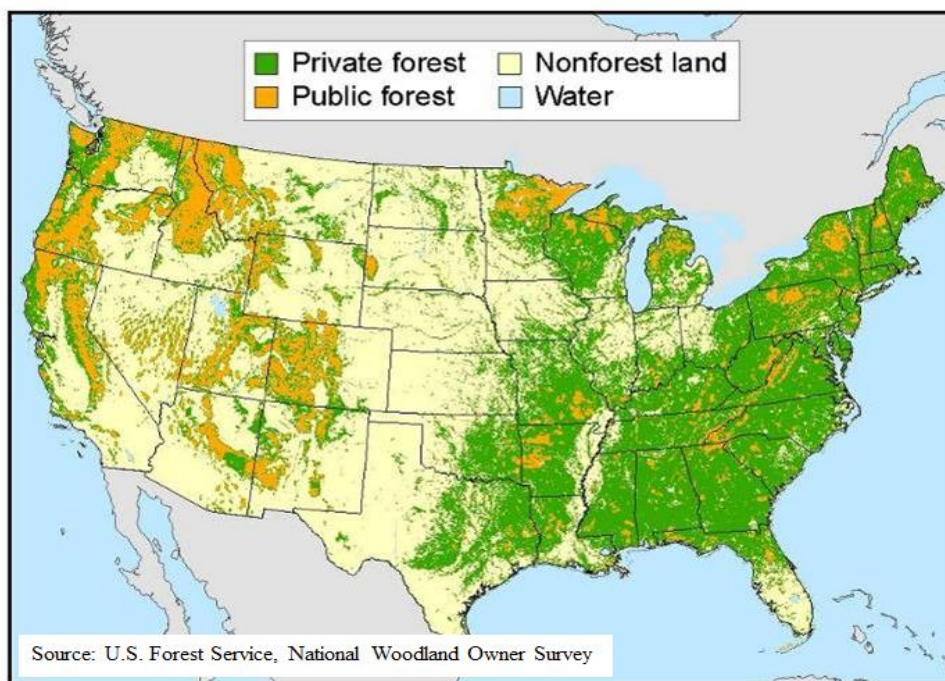
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Executive Summary

The Forest Landowners Association (“FLA”) retained FTI Consulting, Inc. (“FTI”) to assess how a \$1 trillion infrastructure bill could affect the wood products value chain (“WPVC”). For this analysis, we defined the WPVC as consisting of four subsectors defined by the North American Industrial Classification System (“NAICS”):¹ (1) forestry and logging (NAICS 113), (2) wood product manufacturers (NAICS 321), (3) paper product manufacturers (NAICS 322), and (4) printing activities (NAICS 323). Wood products support many types of infrastructure including, but not limited to, paper for design and engineering, furniture for site operations and back office support, pallets for transport, boxes for delivery of materials, lumber for framing, and wood forms for road and bridge construction.

FLA represents America’s family forest landowners. These 10 million families own and manage 60 percent of timberlands in the U.S. (as illustrated in Figure ES- 1), which provide 91 percent the timber used in producing paper, pallets, crates, and other packages, lumber such as 2x4s, and other wood products. Forestry and logging are among the primary economic drivers in many rural communities, particularly in the Southeast U.S.

Figure ES- 1: National Woodland Owner Survey



The WPVC is a significant contributor to the U.S. economy. In 2015, the WPVC sustained 1.46 million jobs and added \$141 billion to the U.S. GDP in direct impacts. The economic activity of the WPVC also supported supply chain jobs and employee earnings and spending that, when coupled with the direct impacts, resulted in an economy-wide impact of 4.19 million jobs, \$406 billion in additional GDP, and other metrics shown in Figure ES-2 below.

¹ “North American Industrial Classification System,” *U.S. Census*, <<https://www.census.gov/eos/www/naics/>>

Figure ES- 2: Current contribution of the existing WPVC to the U.S. economy (2017 \$)

IMPACT OF WPVC	JOBS	SALES OUTPUT	GDP	LABOR INCOME
DIRECT	1.46 million	\$384 billion	\$141 billion	\$82 billion
ECONOMY-WIDE <small>(INCLUDING INDIRECT AND INDUCED)</small>	4.19 million	\$1.12 trillion	\$406 billion	\$319 billion

The Trump administration and leading senators have separately called for \$1 trillion in new infrastructure spending, sourced from both public and private capital, over the next decade. This analysis assumes that a bill passes in 2018, with new expenditures beginning in 2019 and totaling \$1 trillion from 2019 through 2028.

Forest landowners will benefit significantly from a federal infrastructure bill because of the depth to which the WPVC extends. For example, construction firms will need wood to build infrastructure, engineering and design firms will need paper, and the families that work for them will have more money to spend on houses, furniture, and paper products. The WPVC, its suppliers, and their employees will pay more taxes, boosting the budgets of schools, public hospitals, and government offices.

As shown in Figure ES- 3 below, we estimated the impact of proposed federal infrastructure spending on the WPVC by dividing the \$1 trillion across infrastructure spending categories (e.g., roads and bridges, water and sewage, rail and bus systems, and schools), the timing of expenditures, and the share of the allocations for each state. Inputs into this process included historical spending; other legislation, such as the American Reinvestment and Recovery Act (“ARRA”); and other legislative proposals, including a separate \$1 trillion infrastructure spending plan introduced by Senators Patrick Leahy (D-VT), Bernie Sanders (I-VT), and Chuck Schumer (D-NY).

Figure ES- 3: Economic impact of a \$1 trillion infrastructure investment on the WPVC (2017 \$)

TIMING OF IMPACT	JOBS	SALES OUTPUT	GDP	LABOR INCOME
TEN-YEAR SUM	14,000 (on average)	\$37.7 billion	\$11.8 billion	\$8.4 billion
PEAK IMPACT (2020)	38,400 jobs	\$10.4 billion	\$3.2 billion	\$2.3 billion
AVERAGE IMPACT	1.0%	0.9%	0.9%	1.0%

The top row of Figure ES- 3 shows the cumulative impact of a \$1 trillion infrastructure investment on the WPVC from 2019 to 2028, including the average annual impact on employment and the aggregate totals for sales output, labor income, and GDP. As shown in the second row, expenditures will peak in 2020, or 18 to 24 months into the program – the same timeline experienced under ARRA. The last row exhibits the average annual impact of a federal infrastructure bill, which shows that the impact on the WPVC is roughly 1 percent larger with the infrastructure bill than without.

All four subsectors of the WPVC will benefit from increasing infrastructure investments, though these impacts will vary. Figure ES- 4 below shows that wood products will experience the largest impact for all categories, likely because this subsector produces the lumber and wood products needed for construction. Forestry and logging will likely also experience a high average annual impact on jobs and GDP through the provision of raw materials. Finally, while smaller in annual terms, the

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paper and printing subsectors will nevertheless experience a positive impact from federal infrastructure spending for all metrics shown below.

Figure ES- 4: Economic impact of \$1 trillion infrastructure investment on the WPVC from 2019 to 2028 (2017 \$)

SECTOR	JOB ADDITIONS (AVERAGE)	JOB GROWTH	GDP (Cumulative)	GDP (Average)
Forestry and Logging	1,600	1.2%	\$1.1 billion	1.2%
Wood Products	7,000	1.6%	\$4.8 billion	1.5%
Paper Products	2,400	0.6%	\$3.5 billion	0.6%
Printing Activities	3,000	0.6%	\$2.3 billion	0.6%
WPVC TOTAL	14,000	1.0%	\$11.8 billion	0.8%

In addition to analyzing the proposal's impact on the four WPVC subsectors, we also examined its regional impact on five states with a significant presence in the WPVC: (1) Alabama, (2) Arkansas, (3) Georgia, (4) Oregon, and (5) Wisconsin. Figure ES- 5 shows the cumulative impact of a major infrastructure investment in these five states over the 10-year study period.

Figure ES- 5: Economic annual impact of a \$1 trillion infrastructure investment on the WPVC in five example states (2017 \$)

STATE	AVERAGE JOBS (2019 – 2028)	SALES OUTPUT (2019 – 2028)	GDP (2019 – 2028)	LABOR INCOME (2019 – 2028)
ALABAMA	500	\$1.5 billion	\$320 million	\$320 million
ARKANSAS	400	\$1.2 billion	\$250 million	\$200 million
GEORGIA	600	\$2.2 billion	\$520 million	\$430 million
OREGON	600	\$1.8 billion	\$430 million	\$440 million
WISCONSIN	900	\$2.4 billion	\$460 million	\$460 million
U.S. TOTAL	14,000	\$37.7 billion	\$11.8 billion	\$8.4 billion

As shown above, all five states would gain hundreds of new WPVC industry jobs in the, over a billion dollars in additional sales output, and hundreds of millions of dollars in new labor income and GDP. We expect Wisconsin to experience the highest impact from federal infrastructure spending—as shown by its high sales output, average jobs, and labor income figures—due to its strong state paper and printing industries.

All five states also have a significant amount of private timberland. As shown in Figure ES- 6 below, over 90 percent of the forestlands in the Southeast (i.e., Alabama and Georgia) are private; Arkansas's forestlands are 83 percent private, above the national average of 74 percent; Wisconsin's forestlands are 72 percent private, close to the national average; and Oregon, which has a significant amount of public lands compared to the other four states, still has 9.4 million acres of forestlands—or approximately 40 percent—under private ownership. Consequently, families owning timberlands in these states, along with

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the economies surrounding these timberlands, would benefit significantly from a \$1 trillion federal infrastructure program as well.

Figure ES- 6: Private and public forestlands in five focus states and nationally²

FORESTLANDS (MILLIONS OF ACRES)	ALABAMA	ARKANSAS	GEORGIA	OREGON	WISCONSIN	U.S. NATIONAL
Private Forestlands	21.4	15.3	22.2	9.4	11.8	337.7
Public Forestlands	1.4	3.2	2.0	14.3	4.7	120.1
Percent private	94%	83%	92%	40%	72%	74%
Total Forestlands	22.8	18.5	24.2	23.7	16.5	457.8

While this study examines the impact of the \$1 trillion in expenditures, it does not consider the additional, ancillary benefits that an infrastructure bill would likely deliver, including economic productivity or the fiscal costs of funding an infrastructure program.

Introduction

"I will be asking Congress to approve legislation that produces a \$1 trillion investment in the infrastructure of the United States – financed through both public and private capital – creating millions of new jobs."

-President Donald J. Trump, address to Congress, February 28, 2017³

One of the frequent themes of the Trump campaign and his presidency has been a stated desire to invest in the renewal of American infrastructure. Minutes after winning the 2016 presidential election, the first issue President-Elect Trump mentioned in his victory speech was infrastructure: "We are going to fix our inner cities and rebuild our highways, bridges, tunnels, airports, schools, and hospitals."⁴

Shortly after President Trump assumed office in January 2017, Senators Patrick Leahy (D-VT), Bernie Sanders (I-VT), and Chuck Schumer (D-NY) introduced a \$1 trillion infrastructure plan of their own, including \$200 billion for highways, \$110 billion for water and sewers, \$75 billion for school edifices, and hundreds of billions more for other infrastructure-related priorities.⁵ Describing the Leahy-Sanders-Schumer proposal, Joan Lowy of the *Associated Press* wrote that the "Senate Democrats offered a plan...challenging President Trump to join them on an issue where they hope to find common ground."⁶ Senator

² "Jobs & Economic Growth," *National Alliance of Forest Owners*, May 12, 2016, <https://nafoalliance.org/images/documents/task-groups/communications/Forest2Market_Economic_Impact_of_Privately-Owned_Forests_April_2016.pdf>

³ Quoted in "Full text: Trump's address to Congress," *Politico*, February 28, 2017, <<http://www.politico.com/story/2017/02/donald-trump-congress-speech-transcript-235526>>

⁴ Quoted in "Transcript: Donald Trump's Victory Speech," *New York Times*, November 9, 2016, <<https://www.nytimes.com/2016/11/10/us/politics/trump-speech-transcript.html>>

⁵ "Leahy, Sanders, and Other Leading Senate Democrats Unveil \$1 Trillion Infrastructure Plan," *U.S. Senate*, January 24, 2017, <<https://www.leahy.senate.gov/press/leahy-sanders-and-other-leading-senate-democrats-unveil-1-trillion-infrastructure-plan>>

⁶ Joan Lowy, "Senate Dems Have \$1T Infrastructure Plan," *Associated Press*, January 24, 2017, <<https://www.usnews.com/news/business/articles/2017-01-24/senate-democrats-to-propose-1-trillion-infrastructure-plan>>

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Sherrrod Brown (D-OH), in support of the Leahy-Sanders-Schumer plan, stated that, “[t]his blueprint would hold the President accountable for keeping that promise, and we stand ready to work with him to make it a reality.”⁷

As of January 2018, political analysts expect President Trump to unveil an infrastructure plan in advance of his State of the Union address on January 30, 2018.⁸ President Trump’s plan could total up to \$1 trillion through a combination of federal spending and private investment. If a \$1 trillion federal infrastructure bill were to pass in 2018, it would become the largest piece of federal infrastructure legislation since the ARRA in 2009, which Congress passed a few months subsequent to the financial crisis of 2008.

According to the Congressional Budget Office (“CBO”), outlays under the ARRA totaled \$836 billion over ten years.⁹ Of that total, \$173 billion underwrote tax cuts, \$617 billion went to relief for state governments or federal departments, and only \$46 billion went directly to the U.S. Department of Transportation. Including infrastructure-related spending tasked to other departments, such as transmission line upgrades financed by the U.S. Department of Energy, the total infrastructure investment under the ARRA totaled \$159 billion, only 16 percent of the \$1 trillion investment currently proposed by the Trump administration and Senate.

This report focuses on the potential economic impact of a \$1 trillion federal infrastructure bill on the forestry, logging, wood products, paper products, and printing industries. The report discusses the methodology used to determine the total economic impact, as well as the data sources and assumptions applied to estimate the spending allocation and timing of a potential infrastructure bill.

Wood Products Value Chain (WPVC)

For the purposes of this study, we concentrate on the potential impact of a \$1 trillion federal infrastructure bill on the WPVC. In this study, we define the WPVC as any economic activity substantially involving either the production of raw wood, lumber, final wood products, paper, and printing.

Based on formal definitions from the U.S. Census and NAICS, our analysis focuses on the following four subsectors of the WPVC:

- (1) **Forestry and Logging**, which involves growing and harvesting timber on a long cycle (i.e., ten years or more).¹⁰
- (2) **Wood Products**, which involves manufacturing wood products, such as lumber, veneers, flooring, trusses, and buildings.¹¹
- (3) **Paper Products**, which involves making pulp, paper, or converted paper products.¹²
- (4) **Printing Activities**, which involves printing products—such as newspapers, books, labels, business cards, stationery, forms, and other materials—and performing support activities, such as data imaging and bookbinding.¹³

⁷ “Leahy, Sanders, and Other Leading Senate Democrats Unveil \$1 Trillion Infrastructure Plan,” U.S. Senate, January 24, 2017, <<https://www.leahy.senate.gov/press/leahy-sanders-and-other-leading-senate-democrats-unveil-1-trillion-infrastructure-plan>>

⁸ Mark Niquette, “Trump to Release Infrastructure Plan in January, Official Says,” *Bloomberg*, December 7, 2017, <<https://www.bloomberg.com/news/articles/2017-12-07/trump-is-said-to-ready-infrastructure-plan-for-january-release>>

⁹ “Estimated Impact of the American Recovery and Reinvestment Act on Employment and Economic Output in 2014,” *Congressional Budget Office*, February 2015, <<https://www.cbo.gov/sites/default/files/114th-congress-2015-2016/reports/49958-ARRA.pdf>>

¹⁰ “NAICS 113,” *U.S. Census Bureau*, <<https://www.census.gov/cgi-bin/sssd/naics/naicsrch?code=113&search=2017%20NAICS%20Search>>

¹¹ “NAICS 321,” *U.S. Census Bureau*, <<https://www.census.gov/cgi-bin/sssd/naics/naicsrch?code=321&search=2017%20NAICS%20Search>>

¹² “NAICS 322,” *U.S. Census Bureau*, <<https://www.census.gov/cgi-bin/sssd/naics/naicsrch?code=322&search=2017%20NAICS%20Search>>

¹³ “NAICS 323,” *U.S. Census Bureau*, <<https://www.census.gov/cgi-bin/sssd/naics/naicsrch?code=323&search=2017%20NAICS%20Search>>

Figure 1 below illustrates how these four WPVC subsectors interact with each other, households, and other major industries:

Figure 1: Major components of the WPVC and its supply chain internally and to households and other industries¹⁴



As shown above, forestry and logging is the first step in the WPVC, followed by the creation of wood and paper products. Paper products can go directly to consumers and industry, or be transformed in a final step through printing activities.

Current State of the Industry

The WPVC, starting with forestry and logging and moving through its supply chain to wood products, paper, and printed materials, has suffered a prolonged downturn and slow recovery since the real estate bubble and financial crisis of 2008. One of the largest buyers of wood in the U.S. is the construction industry – an industry gravely affected by the housing market’s collapse, which indirectly affected the WPVC. For example, total housing starts (the beginning of new housing construction) peaked at a rate of 2.273 million per month in January 2006, before falling 79 percent to 478,000 per month by April 2009, the lowest monthly numbers since the late 1950s.¹⁵ Currently, monthly housing starts range between 1.1 million and 1.2 million annualized, numbers last seen in the 1990s.

Many of the reasons to be optimistic about the prospects of the WPVC relate to standard housing sector metrics. For example, the interest rate on a typical thirty-year, fixed-rate mortgage remains near historical lows, currently hovering near 4 percent, which is lower than the 5-6 percent rate common in the 2000s and the 7-9 percent rate which was typical during the 1990s.¹⁶ Demographic shifts are beginning benefit to the housing sector as well, as the millennial generation enters its peak

¹⁴ Images courtesy of *Wikimedia*

¹⁵ “Housing Starts: Total: New Privately Owned Housing Units Started,” *Federal Reserve Economic Data*, <<https://fred.stlouisfed.org/series/HOUST#0>>

¹⁶ “30-Year Fixed Rate Mortgage Average in the United States,” *Federal Reserve Economic Data*, <<https://fred.stlouisfed.org/series/MORTGAGE30US>>

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home-buying and child-rearing years.¹⁷ This generation began moving out of cities and into suburbs on a net basis in 2015, providing further stimulus for the housing sector and construction industry. Notably, the improving economy and growing needs for space helped spur this transition.¹⁸

The WPVC could benefit from additional uplift if the proposed \$1 trillion federal infrastructure bill were to become law. There are two main ways in which an infrastructure bill would boost WPVC sales output and the price of wood products, further boosting revenue: (1) indirect contributions and (2) induced contributions. First, “indirect” contributions occur when other firms need wood products as an input to projects. For example, a construction company might require wood products for scaffolds or concrete molds for upgrading an infrastructure node or building a new one. Such spending indirectly benefits the WPVC. Second, “induced” contributions occur on a macroeconomic level; stronger U.S. labor markets and a more robust American economy would create new jobs and higher wages and disposable incomes, which consumers are able to spend according to their preferences, such as home renovations. Consequently, the additional spending induced by the economic benefits of the infrastructure bill can be expected to further benefit the WPVC. Using economic impact modeling, we can better understand the direct, indirect, and induced effects which, combined, show the total economic impact of this proposed legislation.

Current Impact of the WPVC on the U.S. Economy

To conduct our economic impact analysis, we used IMPLAN, which considers the direct operations of industries, indirect impacts on their supply chain, and induced impacts from the wages paid to their employees. Using IMPLAN, we derived the current impact of the WPVC on the U.S. economy in terms of employment (Figure 2), sales output (Figure 3), GDP (Figure 4), and labor income (Figure 5), including a multiplier effect resulting from each dollar of spending.¹⁹

First, Figure 2 below shows the impact of the WPVC on current U.S. employment, in terms of direct, indirect, and induced employment, as well as an economy-wide multiplier. Notably, the WPVC employs 1.46 million workers, the majority of which are employed in the printing subsector.

Figure 2: Impact of the WPVC on U.S. employment (thousands)

SECTOR	DIRECT	INDIRECT	INDUCED	TOTAL	MULTIPLIER
Forestry and Logging	136	74	130	340	2.5
Wood Products	429	480	365	1,275	3.0
Paper Products	373	492	265	1,130	3.0
Printing Activities	522	473	450	1,445	2.8
WPVC TOTAL	1,460	1,519	1,210	4,190	2.9

¹⁷ Shelly Goldberg, “Trump’s Building Promises Energize Lumber Prices,” *Bloomberg View*, April 7, 2017, <<https://www.bloomberg.com/view/articles/2017-04-07/trump-s-building-promises-energize-lumber-prices>>

¹⁸ Dowell Myers, “Peak Millennials: Three Reinforcing Cycles That Amplify the Rise and Fall of Urban Concentration by Millennials,” *Housing Policy Debate*, April 25, 2016, <http://popdynamics.usc.edu/pdf/2016_Myers_Peak-Millennials.pdf>

¹⁹ In IMPLAN, the “multiplier” is the total economic activity associated with initial, direct activity when accounting for indirect and induced effects.

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Accounting for indirect and induced jobs from the industry boosts the employment number to 4.19 million. Direct WPVC employment is 0.8 percent of U.S. employment, and total employment from WPVC activities is 2.2 percent of U.S. employment, making one in every forty-five jobs in the U.S. in the purview of the WPVC. For comparison, 4.19 million jobs is equivalent to the size of the labor force in the five boroughs of New York,²⁰ and almost equal to the size of the population of Oregon,²¹ which we examine later in this report.

Next, Figure 3 quantifies the impact of the WPVC on current U.S. sales output, which has a direct effect of \$384 billion.

Figure 3: Impact of the WPVC on U.S. sales output (2017 \$ billions)

SECTOR	DIRECT	INDIRECT	INDUCED	TOTAL	MULTIPLIER
Forestry and Logging	\$16	\$9	\$15	\$40	2.5
Wood Products	\$97	\$110	\$81	\$289	3.0
Paper Products	\$183	\$237	\$127	\$547	3.0
Printing Activities	\$88	\$80	\$76	\$244	2.8
WPVC TOTAL	\$384	\$436	\$299	\$1,120	2.9

Moreover, by including the WPVC's indirect and induced impact on labor and suppliers, such as machinery manufacturers and petroleum refineries for process fuel, the WPVC's total U.S. sales output impact totals \$1.1 trillion, equivalent to approximately 3.4 percent of the entire U.S. economy. The paper products segment accounts for slightly more than half of the impact, while wood products and printing activities account for approximately 20 percent each. Forestry and logging comprises the smallest component, though its total impact on U.S. sales output is still \$40 billion.

Figure 4 shows the contribution of the WPVC to the U.S. economy in terms of net new economic activity as measured by GDP. GDP, unlike sales output, subtracts intermediate inputs from the production of an industry. This classification serves to avoid any double counting of intermediate products bought then resold by multiple industries.

²⁰ "Table 1 – Civilian labor force and unemployment by state and selected area, seasonally adjusted," *Bureau of Labor Statistics*, <<https://www.bls.gov/news.release/laus.t01.htm>>

²¹ "Annual Estimates of the Resident Population for the United States, Regions, States, and Puerto Rico: April 1, 2010 to July 1, 2017," *U.S. Census Bureau*, <<https://www.census.gov/data/datasets/2017/demo/popest/nation-total.html>>

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Figure 4: Impact of the WPVC on U.S. gross domestic product (2017 \$ billions)

SECTOR	DIRECT	INDIRECT	INDUCED	TOTAL	MULTIPLIER
Forestry and Logging	\$9	\$5	\$8	\$22	2.5
Wood Products	\$27	\$31	\$23	\$80	3.0
Paper Products	\$60	\$78	\$41	\$179	3.0
Printing Activities	\$45	\$41	\$39	\$125	2.8
WPVC TOTAL	\$141	\$155	\$111	\$407	2.9

The WPVC currently contributes \$406 billion to U.S. GDP, around 2.3 percent of the \$18 trillion U.S. economy,²² with paper products activities representing the largest contribution, followed by printing, wood products, and forestry and logging.

Finally, Figure 5 below shows the current impact of the WPVC on U.S. labor income, which, in IMPLAN, includes any payment made to households, such as wages, salaries, the value of in-kind benefits such as insurance, and proprietors' income. The impact on labor income in IMPLAN is the impact on familial checking accounts and wallets, which influences their ability to consume.

Figure 5: Impact of the WPVC on U.S. labor income (2017 \$ billions)

SECTOR	DIRECT	INDIRECT	INDUCED	TOTAL	MULTIPLIER
Forestry and Logging	\$4	\$2	\$4	\$10	2.5
Wood Products	\$20	\$23	\$17	\$60	3.0
Paper Products	\$32	\$42	\$23	\$97	3.0
Printing Activities	\$26	\$24	\$22	\$72	2.8
WPVC TOTAL	\$82	\$91	\$66	\$239	2.9

As shown above, the paper products subsector has the largest effect on current U.S. labor income, totaling \$97 billion. As with the other subsectors, the impact of the paper and wood products subsectors are similar in scale, whereas the forestry and logging subsector has the smallest impact on current labor income. In aggregate, the four WPVC subsectors contribute \$239 billion in labor income.

Assumptions and Inputs

Estimating the economic impact of a federal infrastructure bill requires one overarching assumption regarding the size of the bill, followed by a series of supporting assumptions. This report presumes the bill increases infrastructure investments by \$1

²² "United States GDP," *Trading Economics*, <<http://www.tradingeconomics.com/united-states/gdp>>

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trillion over ten years, indicative of a bill passed in 2018. This magnitude is consistent with President Trump’s public statements and with the Senate’s January 2017 proposal. The remaining assumptions involve dividing the \$1 trillion along three dimensions by: (1) infrastructure spending category, (2) year over the 10-year timeframe,²³ and (3) state, to determine state impacts.

Types of Infrastructure Spending Categories

Choosing the correct set of infrastructure spending categories across which to distribute the \$1 trillion into is critical for properly understanding the impact these investments may have on the WPVC. For example, if a sizable proportion of the investment were spent on upgrades to the electrical power grid, such as replacing substations or upgrading transmission lines, then the industries involved in creating metallic or electrical products would receive most of the investment impact, instead of the WPVC. By contrast, if hospitals and public housing were to receive a sizable proportion of the investment, the WPVC would experience increased benefits from more wood demand, and it would be important to factor this into our analysis.

To determine the mixture of infrastructure types, we examined past infrastructure spending and programs, current infrastructure needs, and existing proposals to estimate the potential distribution of the \$1 trillion investment. These included:

- The infrastructure-related portions of ARRA;
- *Failure to Act: Closing the Infrastructure Investment Gap for America’s Economic Future*, a report by the American Society of Civil Engineers (“ASCE”) on infrastructure funding shortfalls in the U. S.;²⁴
- *Catching Up: Greater Focus Needed to Achieve a More Competitive Infrastructure*, a report by the National Association of Manufacturers (“NAM”) on current infrastructure spending and needs;²⁵
- Data from the CBO on “Public Spending on Transportation and Water Infrastructure, 1956 to 2014;”²⁶ and,
- The Leahy-Sanders-Schumer Senate proposal.²⁷

We then categorized the historical or proposed spending based on the types of infrastructure outlined in the Leahy-Sanders-Schumer proposal. Figure 6 below shows our final assumptions based on this distribution:

²³ Ten years is the typical CBO budgeting window.

²⁴ “Failure to Act: Closing the Infrastructure Investment Gap for America’s Economic Future,” *American Society of Civil Engineers*, 2016, <<http://www.infrastructurereportcard.org/wp-content/uploads/2016/10/ASCE-Failure-to-Act-2016-FINAL.pdf>>

²⁵ “Catching Up: Greater Focus Needed to Achieve a More Competitive Infrastructure,” *National Association of Manufacturers*, September 2014, <<http://www.nam.org/Issues/Infrastructure/Surface-Infrastructure/Infrastructure-Full-Report-2014.pdf>>

²⁶ “Public Spending on Transportation and Water Infrastructure, 1956 to 2014,” *Congressional Budget Office*, March 2, 2015, <<https://www.cbo.gov/publication/49910>>

²⁷ “Leahy, Sanders, and Other Leading Senate Democrats Unveil \$1 Trillion Infrastructure Plan,” *U.S. Senate*, January 24, 2017, <<https://www.leahy.senate.gov/press/leahy-sanders-and-other-leading-senate-democrats-unveil-1-trillion-infrastructure-plan>>

Figure 6: Infrastructure spending type examples and proposals

INFRASTRUCTURE TYPE	ARRA	ASCE	NAM	CBO ²⁸	Senate	Average	Modeled
Roads and Bridges	19%	53%	49%	40%	42% ²⁹	40%	40.0%
Water and Sewer	6%	5%	24%	33%	11%	16%	15.0%
Rail and Bus System	11%	1% ³⁰	11%	16%	18%	12%	12.5%
America's Schools	35% ³¹	18%	0%	0%	7%	12%	12.5%
Ports, Airports, and Waterways	5%	8%	10%	11%	7%	8%	10.0%
Energy Infrastructure	13%	9%	6%	0%	10%	8%	5.0%
Expand Broadband	5%	0%	0%	0%	2%	1%	1.0%
Public Lands and Indian Country	2%	5%	0%	0%	2%	2%	1.0%
VA Hospitals and Care Facilities	1%	0%	0%	0%	0%	0%	1.5%
Army National Guard Centers	4%	0%	0%	0%	0%	1%	1.5%
TOTAL	100%	100%	100%	100%	100%	100%	100.0%

As shown above, the distribution of funds between infrastructure types in our model closely mirrors the average of previous programs, proposals, and spending. Slight differences between our model and the average reflect statements from the Trump administration on their goals and priorities regarding ports, airports, and waterways; energy infrastructure; and veterans' affairs. For example, we increased the proportion of investment funds allotted to ports, airports, and waterways given the Trump administration's stated interest in improving airport facilities.³² We also lowered the amount of investment funds allotted to energy infrastructure, based on the Trump administration's efforts to reduce federal regulation of the energy industry, particularly for natural gas, coal, and petroleum projects.³³ Finally, we increased the proportion of investment funds for the U.S. Department of Veterans Affairs and the National Guard, each a stated focus for the Trump administration,³⁴ and in light of the Committee on Veterans' Affairs Asset and Infrastructure Review Act of 2017, which currently remains pending.³⁵

Timing of Infrastructure Expenditures

Another important consideration in our model is the timing of infrastructure investment. For example, President Obama praised the potential for infrastructure spending under ARRA, but he eventually admitted this was unrealistic: "There's no

²⁸ This includes the narrowest definition of "infrastructure" as only transportation-related projects or water utilities.

²⁹ Leahy, Sanders, and Schumer included a category for "Vital Infrastructure Projects," which we assume are similar to "Roads and Bridges."

³⁰ ASCE included a category for "surface transportation," which likely also includes bus and transit projects.

³¹ This may include some funds not explicitly earmarked for upgrading school buildings but also covering operating budget shortfalls during the financial crisis of 2008.

³² Please see, for instance, Dana Varinsky, "Donald Trump called LaGuardia Airport 'third world' – here's the design that will transform it," *Business Insider*, September 27, 2016, <<http://www.businessinsider.com/trump-laguardia-airport-redesign-2016-9>>

³³ Please see, for instance, John W. Miller, "Donald Trump Promises Deregulation of Energy Production," *Wall Street Journal*, September 22, 2016, <<https://www.wsj.com/articles/donald-trump-promises-deregulation-of-energy-production-1474566335>>

³⁴ Please see, for instance, Dave Boyer, "Trump signs VA accountability act into law, promises better care for veterans," *The Washington Times*, June, 23, 2017, <<https://www.washingtontimes.com/news/2017/jun/23/donald-trump-signs-va-accountability-act-law-promi/>>

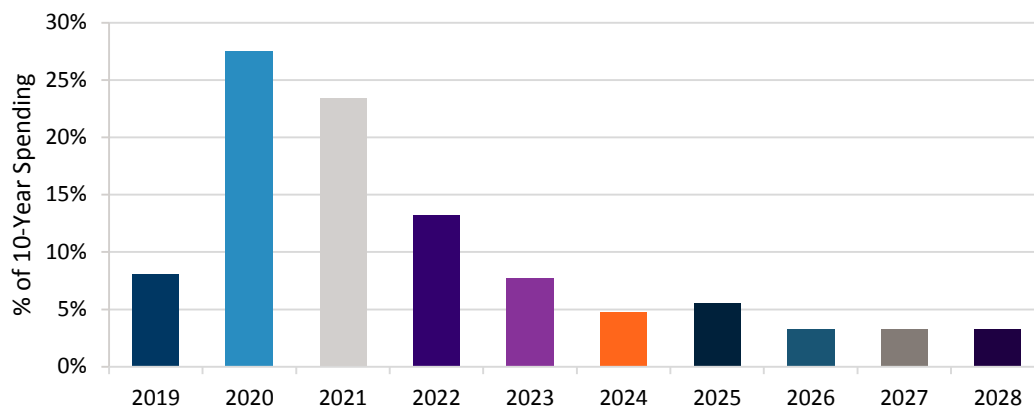
³⁵ <https://veterans.house.gov/assetreview/>

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such thing as shovel-ready projects.”³⁶ Thus, we use the actual rate of spending under the ARRA legislation, a recent and comparable proxy, as guidance for our analysis here.

Developing infrastructure from start to finish—including conceptualization, engineering and design, permitting and siting, stakeholder engagement, acquiring right-of-way, and construction—is an extremely time-consuming process. Moreover, the \$1 trillion plan would be subject to these constraints at both state and local levels. To account for these regulatory and developmental hurdles, we use the ARRA’s actual rate of spending over time for our 10-year study period. Based on this spending rate, Figure 7 below shows the level of annual spending under the proposed bill based on the ARRA rate and our assumed 10-year period:

Figure 7: Assumed infrastructure spending and timing by year³⁷



Beginning in 2019, which is our assumed start year for the \$1 trillion infrastructure bill spending, the ARRA spends 8 percent of its infrastructure dollars during its first year of implementation, followed by over 20 percent each in its second and third years respectively, before declining thereafter. Expenditures in 2025 increase slightly year-on-year, because of planned maintenance for projects completed in 2020.

Allocating Expenditures by State

To allocate expenditures by state, we examined the following five sources: (1) the distribution of infrastructure-related ARRA spending by state,³⁸ (2) U.S. Department of Education spending on school construction and upgrades under ARRA,³⁹ (3) U.S. Department of Transportation annual apportionments under the Highway Trust Fund,⁴⁰ (4) GDP by state,⁴¹ and (5) total population by state.⁴² Because each of these five metrics provided very similar distribution proportions across states, we chose to distribute the \$1 trillion in infrastructure spending between states based on an average of these five factors.

³⁶ Quoted in Michael D. Shear, “Obama Lesson: ‘Shovel Ready’ Not So Ready,” *New York Times*, October 15, 2010, <<https://thecaucus.blogs.nytimes.com/2010/10/15/obama-lesson-shovel-ready-not-so-ready/>>

³⁷ “Estimated Impact of the American Recovery and Reinvestment Act on Employment and Economic Output in 2014,” *Congressional Budget Office*, February 2015, <<https://www.cbo.gov/sites/default/files/114th-congress-2015-2016/reports/49958-ARRA.pdf>>

³⁸ Will Straw, “Interactive Map: Recovery Beyond the Beltway,” *Center for American Progress*, January 23, 2009, <http://cdn.americanprogress.org/wp-content/uploads/issues/2009/01/xml/stimulus_data.xls>

³⁹ “U.S. Department of Education American Recovery and Reinvestment Act Report: Summary of Programs and State-by-State Data,” *U.S. Department of Education*, November 2, 2009, <<https://www2.ed.gov/policy/gen/leg/recovery/spending/arra-program-summary.pdf>>

⁴⁰ “FY 2015 Federal Aid Highway Program Apportionments,” *U.S. Department of Transportation*, August 14, 2015, <https://www.fhwa.dot.gov/legregs/directives/notices/n4510788/n4510788_t1.cfm>

⁴¹ “GDP by State,” *Bureau of Economic Analysis*, <<https://www.bea.gov/regional/>>

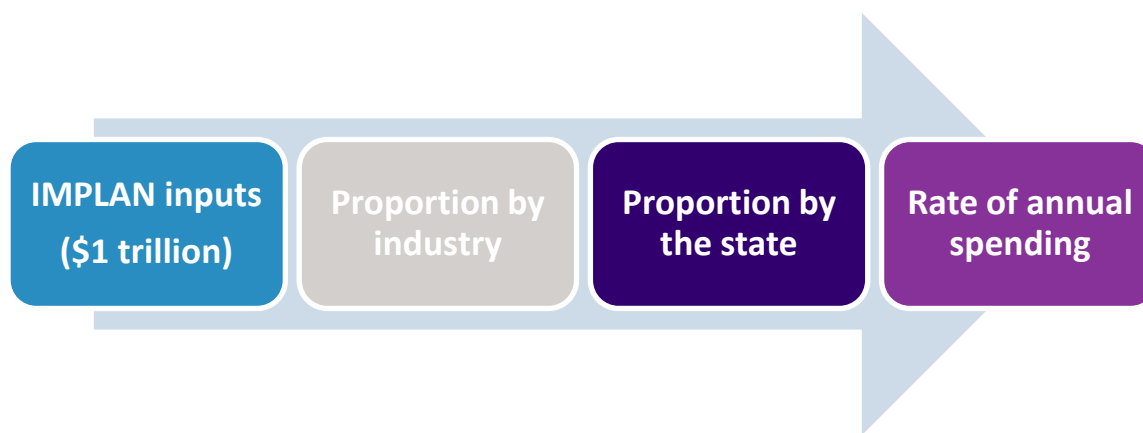
⁴² “State Population Totals Tables: 2010-2016,” *U.S. Census Bureau*, <<https://www.census.gov/data/tables/2016/demo/popest/counties-total.html>>

IMPLAN Methodology and Assumptions

We determined the economic impacts of the proposed infrastructure bill by using the IMPLAN model, which is an input-output (“IO”) modeling system that tracks the movements of expenditures throughout an economy, looking at linkages between industries within a supply chain, to measure the cumulative effects of spending in terms of jobs, output, labor income, and GDP. IMPLAN datasets represent all industries within a regional economy—rather than extrapolating from national averages—and incorporate data collected by federal agencies.⁴³ More detail on IMPLAN can be found in Appendix A.

Each dollar of the \$1 trillion eventually had an industry, state, and year of expenditures. Using the information above, we divided the \$1 trillion into IMPLAN variables as shown in Figure 8 below:

Figure 8: Apportionment of the \$1 trillion of infrastructure spending into IMPLAN variables



IMPLAN calculates economic activity in three categories: (1) direct impacts, (2) indirect impacts, and (3) induced impacts, explained below. The direct impact includes the initial \$1 trillion infrastructure investment, while the indirect and induced include the additional impact generated by this initial spending:

- (1) **DIRECT:** Direct impacts are the economic activity associated with immediate expenditures. In this scenario, for a \$1 trillion infrastructure bill, this includes construction labor and material inputs.
- (2) **INDIRECT:** Indirect impacts are the economic activities resulting from the direct industries spending a portion of their revenues on goods and services provided by their supply chain. For instance, construction firms and primary metal manufacturers each need fuel and electricity to run vehicles and equipment, which indirectly stimulate the petroleum refining industry, power generation, mining and extraction, or renewable energy.
- (3) **INDUCED:** Induced impacts encompass the economic activity resulting from employee spending. The industries under the induced category tend to be consumer-facing and include real estate, healthcare, and retail.

In performing an IMPLAN simulation, local purchase percentages (“LPPs”), also known as regional purchase coefficients (“RPCs”), are important input factors. An LPP or RPC describes the ratio of domestic purchases to imports for any good or

⁴³ IMPLAN dataset includes data from the U.S. Bureau of Labor Statistics “Covered Employment and Wages” (CEW) program; U.S. Bureau of Economic Analysis (BEA) “Regional Economic Information System” (REA) program; U.S. BEA Benchmark IO Accounts of the U.S.; BEA output estimates; BLS Consumer Expenditure Survey (CXS); U.S. Census Bureau’s “County Business Patterns” (CBP) program; U.S. Census Bureau’s “Decennial Census and Population Surveys;” U.S. Census Bureau “Censuses and Surveys;” and the U.S. Department of Agriculture (USDA) “Agricultural Census.”

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service. For this simulation, we assume that the default LPPs and RPCs in the IMPLAN model are sensible; however, if the proposed infrastructure bill were to include a “Buy American” provision,⁴⁴ the results of our analysis would be greater.

IMPLAN does not distinguish between private or public investments, such as upgrading a highway and paying back the improvement costs by collecting tolls (private) or improving water and sewage (public). The Trump administration has stated its intentions to use tax credits and other incentives to induce private capital investment. According to *The Hill*, “[t]he proposal would offer \$137 billion in federal tax credits to private investors, which the blueprint says would unleash up to \$1 trillion worth of infrastructure investment over ten years.”⁴⁵ In IMPLAN, however, the funding source of the investment is irrelevant, as the model focuses only on the total amount spent (i.e., the \$1 trillion goal).

Additionally, we did not model any “pay for” measures in the federal budget, such as raising taxes or cutting other spending priorities, to finance the public share of the \$1 trillion. Such measures would likely have long-term, adverse effects on the overall economy, in contrast to the relatively short-term benefits of the \$1 trillion infrastructure investment. Moreover, neither the Trump administration nor Senate has articulated a specific plan for offsetting the public portion of the costs of the bill. Thus, our model considers only the positive, cumulative effect of the infrastructure spending.

Despite this shortcoming, the infrastructure bill may pay for itself in the long term. According to the ASCE, standard infrastructure costs the average U.S. family around \$3,400 each year in higher transportation costs, such as time delays or needless fuel consumption, and increased vehicular maintenance and repair costs resulting from road damage.⁴⁶ This figure also includes businesses passing their higher costs along to consumers and increased distribution costs or further unreliability from utilities. The \$3,400 per household amounts to \$4.28 trillion over ten years across 125.8 million U.S. households,⁴⁷ or more than four times the proposed \$1 trillion infrastructure investment. While it is unlikely that the proposed infrastructure bill would completely eliminate these costs, increased infrastructure will likely reduce the overall fiscal burden. For example, if the \$1 trillion infrastructure plan is targeted enough to defray approximately 25 percent of these social costs in the first ten years (or the decade or two thereafter), then it would break even financially in terms of societal benefit.

Economic Impact Results

This section describes the results and economic impact of \$1 trillion of infrastructure spending over ten years. It includes results along several dimensions for the following categories:

- **Overall scope:** the WPVC in the U.S. and in key states.
- **WPVC:** overall and by its four subsectors, including forestry and logging, wood products, paper products, and printing activities.
- **Geography:** the total U.S. or five example states (i.e., Alabama, Arkansas, Georgia, Oregon, and Wisconsin).
- **Impact types:** direct, indirect, and induced results.
- **Timing:** from 2019 through 2028 with the peak year in 2020 (i.e., 27.5 percent of overall expenditures).

⁴⁴ Jeremy Diamond, “Trump pushes ‘Buy American, Hire American’ policy in Wisconsin,” *CNN*, April 18, 2017, <<http://www.cnn.com/2017/04/17/politics/trump-wisconsin-buy-american/>>

⁴⁵ Melanie Zanona, “Five things to know about Trump’s infrastructure plan,” *The Hill*, November 20, 2016, <<http://thehill.com/policy/transportation/306847-five-things-to-know-about-trumps-infrastructure-plan>>

⁴⁶ Please see n. 24

⁴⁷ “Total Households,” *Federal Reserve Economic Data*, January 9, 2017, <<https://fred.stlouisfed.org/series/TTLHH>>

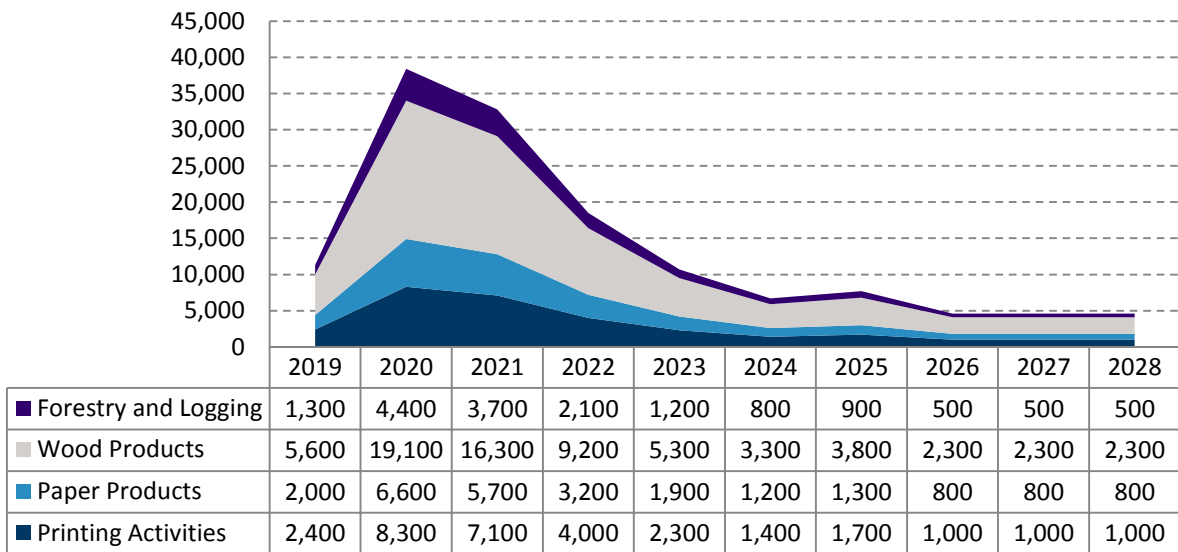
- **Economic metric:** employment, sales output, labor income, and GDP.

United States

Economic Metrics

Figure 9 below shows the economic impact of the \$1 trillion infrastructure investment on annual employment for each of the four WPVC subsectors over the 10-year study period. The values show total jobs in each category per year.

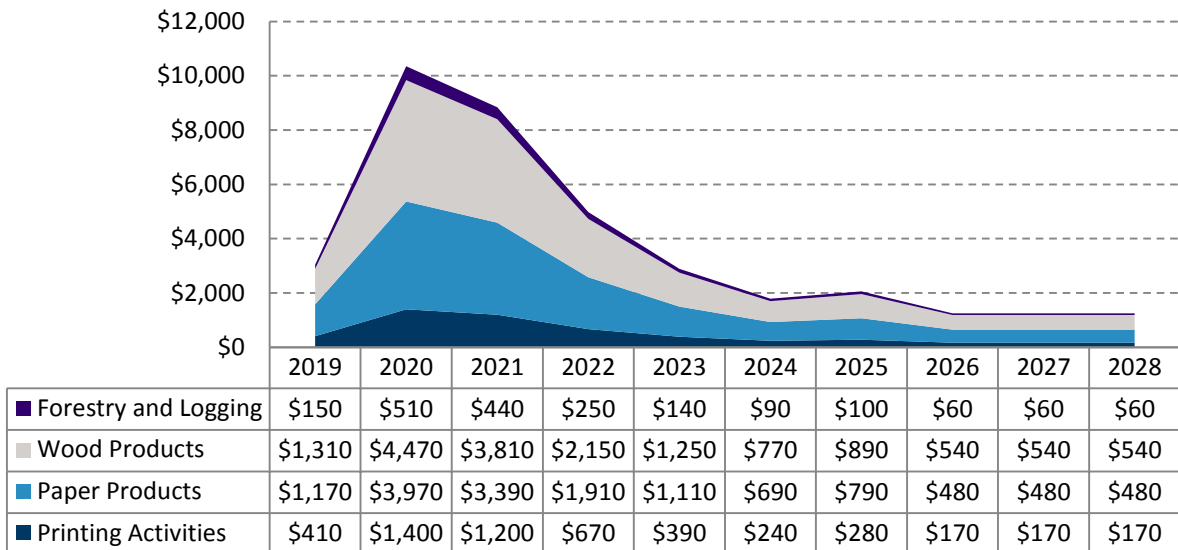
Figure 9: Employment increase from \$1 trillion infrastructure investment in the WPVC (units) from 2019-2028



Assuming an infrastructure measure passes in 2018 and dollars begin to flow in 2019, then, based on the historical record (as evidenced by the ARRA), the economic impact of the investment plan can be expected to ramp up quickly in 2020 and 2021. The wood products subsector experiences the largest impact, with job creation peaking at nearly 20,000 additional jobs in 2020, though the three other subsectors all experience job growth in the thousands. The majority of the \$1 trillion investment is expended between 2020 and 2022, which results in decreasing investment levels through the later 2020s, with the exception of slight increases in spending to maintain the new infrastructure upgrades from earlier years.

Figure 10 below presents the economic impact of the \$1 trillion infrastructure investment on annual sales output for each of the four WPVC subsectors over the 10-year study period.

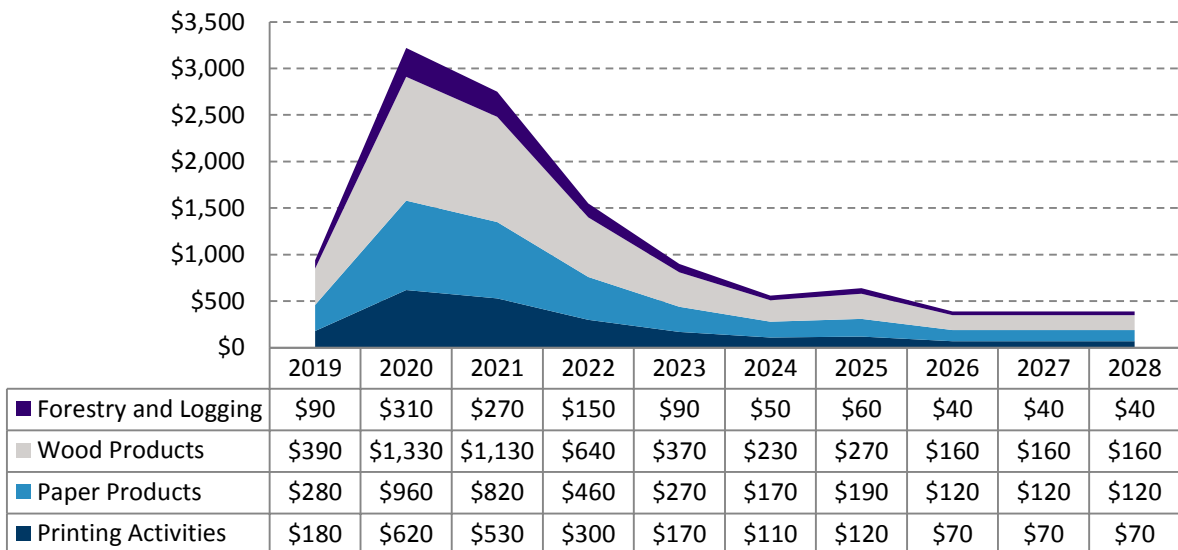
Figure 10: Sales output from \$1 trillion infrastructure investment in the WPVC (2017 \$ millions) from 2019 – 2028



The wood products and paper products subsectors each experience increases in sales output of approximately \$4 billion during the 2020 peak year. These higher sales and output figures initially flow to owners and proprietors, including forest landowners, but then continue through the overall economy as these industries source additional labor inputs, materials, and capital equipment to perform the new production necessary to meet their higher sales orders.

Figure 11 below shows the net new economic activity attributable to the WPVC under the \$1 trillion infrastructure program on an annual basis for each WPVC subsector.

Figure 11: GDP from \$1 trillion infrastructure investment in the WPVC (2017 \$ millions) from 2019 – 2028

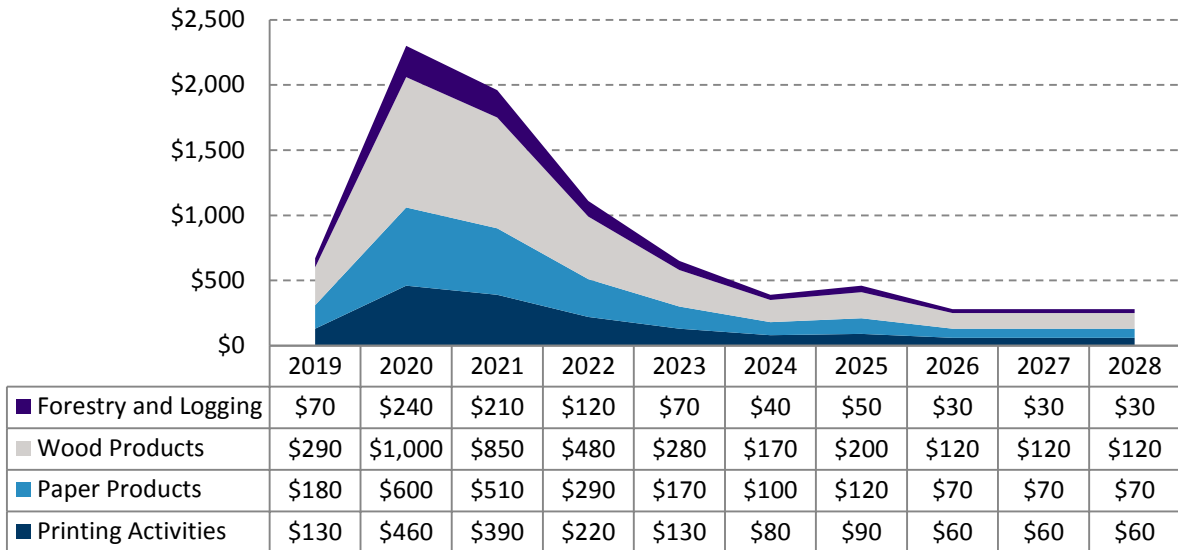


The four WPVC subsectors add value to the U.S. economy by providing raw wood materials and assembling them into intermediate products for other industries and final products for households. Wood products contribute over \$1.3 billion to

U.S. GDP at its peak in 2020, with paper products close behind at \$960 million. Again, most of the GDP impact is concentrated between 2019 and 2021.

Figure 12 below shows the annual impact on labor income for each subsector, again, reaching its peak in 2020.

Figure 12: Labor income from \$1 trillion infrastructure investment in the WPVC (2017 \$ millions) from 2019 – 2028



Notably, the distribution of impacts between subsectors is slightly different here for labor income than for employment and sales output. This difference arises from each subsector’s different labor input needs, labor productivity, and wages. Paper products, for instance, has a comparatively large impact on sales output, but less impact in employment and labor income.

Impact Types

The following four figures show the impact of the \$1 trillion infrastructure bill on employment (Figure 13), sales output (Figure 14), GDP (Figure 15), and labor income (Figure 16) for the four WPVC categories and by type of impact (i.e., direct, indirect, and induced).

The indirect, induced, and total columns in Figure 13 below show the average impact of the proposed bill on employment from 2019 to 2028 by impact category. For example, the 14,000 jobs in the WPVC “Total” row in the figure below indicates that, on an average annual basis, there would be an estimated 14,000 additional jobs to support families in the sector from 2019-2028 if the infrastructure bill were implemented compared to if it were not.

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Figure 13: Average jobs from \$1 trillion infrastructure investment on the WPVC (units) by category⁴⁸

SECTOR	INDIRECT (2019 – 2028)	INDUCED (2019 – 2028)	TOTAL (2019 – 2028)	AVERAGE IMPACT (ANNUAL)
Forestry and Logging	1,400	200	1,600	1.3%
Wood Products	6,200	700	6,900	1.7%
Paper Products	1,400	1,100	2,500	0.6%
Printing Activities	1,400	1,600	3,000	0.6%
WPVC TOTAL	10,400	3,600	14,000	1.0%

The “average impact” column illustrates the average annual impact of the proposed bill on employment in percentage terms. We define the average annual impact as the percent increase in the number of workers employed by the WPVC beyond its current absolute contribution to employment numbers as a result of infrastructure investments. As shown in Figure 2 in the Introduction, the WPVC currently provides 1.46 million jobs. Based on our analysis, the proposed infrastructure bill would yield an additional 14,000 jobs in an average year, equivalent to approximately one new job for every hundred existing jobs (or the 1.0% in the bottom-right of Figure 13).

According to IMPLAN’s definitions, only the construction industry and local governments operating mass transit systems experience direct impacts from infrastructure spending. Therefore, all impacts in the WPVC are either indirect (e.g., demand for lumber and wood to construct scaffolds or temporary sidewalks and tunnels for pedestrian access) or induced (e.g., the wood, paper, and printed products purchased by households).

Figure 14 below shows the cumulative impact of the \$1 trillion of investments on the WPVC over ten years, yielding a total impact on sales output for the proposed infrastructure bill of \$37.6 billion.

Figure 14: Sales output from \$1 trillion infrastructure investment on the WPVC (2017 \$ millions) by category

SECTOR	INDIRECT (2019 – 2028)	INDUCED (2019 – 2028)	TOTAL (2019 – 2028)	AVERAGE IMPACT (ANNUAL)
Forestry and Logging	\$1,600	\$300	\$1,900	1.3%
Wood Products	\$14,600	\$1,600	\$16,200	1.9%
Paper Products	\$7,800	\$6,600	\$14,400	0.7%
Printing Activities	\$2,400	\$2,700	\$5,100	0.6%
WPVC TOTAL	\$26,400	\$11,200	\$37,600	0.9%

⁴⁸ Only the construction industry and local governments operating mass transit systems have direct impacts according to the definitions in IMPLAN; hence, all impacts in the WPVC are either indirect (such as lumber suppliers for construction companies) or induced (such as flooring purchases by households)

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Forestry and logging and wood products experience the highest annual average impact on sales output (i.e., 1.3 percent and 1.9 percent, respectively), at least double that of the paper products and printing activities subsectors (i.e., 0.7 percent and 0.9 percent, respectively). The disparity between cumulative indirect and induced impacts is significantly larger for the forestry and logging and wood products subsectors than it is for paper products and printing activities; in fact, the printing activities subsector experiences a larger induced impact than direct impact. This is because the forestry and logging and wood products subsectors receive more of a stimulus from the industries directly impacted by the proposed bill (e.g., construction), rather than overall economic activity resulting from employee spending.

Figure 15 below shows the total GDP impact of the proposed infrastructure bill by WPVC category and impact type. Overall, our analysis indicates that the \$1 trillion infrastructure bill will produce an estimated \$11.8 billion GDP impact for the U.S. economy.

Figure 15: GDP from \$1 trillion infrastructure investment on the WPVC (2017 \$ millions) by category

SECTOR	INDIRECT (2019 – 2028)	INDUCED (2019 – 2028)	TOTAL (2019 – 2028)	AVERAGE IMPACT (ANNUAL)
Forestry and Logging	\$1,000	\$200	\$1,200	1.4%
Wood Products	\$4,300	\$500	\$4,800	1.9%
Paper Products	\$1,900	\$1,600	\$3,500	0.7%
Printing Activities	\$1,100	\$1,200	\$2,300	0.6%
WPVC TOTAL	\$8,300	\$3,500	\$11,800	0.9%

As is the case with respect to the other metrics, the wood products subsector experiences the highest total GDP and average annual GDP impact from the bill, with its impact concentrated in the indirect category. In addition, the forestry and logging and wood products subsectors experience the largest impacts relative to their underlying industries, as demonstrated by the average annual impact column. This is because, as shown in Figure 4 in the Introduction, these industries are the smaller; the total GDP impacts of the current forestry and logging (\$22 billion) and wood products (\$80 billion) subsectors are smaller than the total GDP impacts of the paper products (\$179 billion) and printing activities (\$125 billion) subsectors. In contrast, the paper products subsector, which has the second highest total GDP impact, experiences less than half the annual average GDP impact as the wood products industry.

Figure 16 below shows the total impact of the proposed bill on labor income for each WPVC category and by impact type. Notably, the \$1 trillion infrastructure investment would yield \$8.4 billion in total labor income for the WPVC industry over the 10-year study horizon.

Figure 16: Labor income from \$1 trillion infrastructure investment on the WPVC (2017 \$ millions) by category

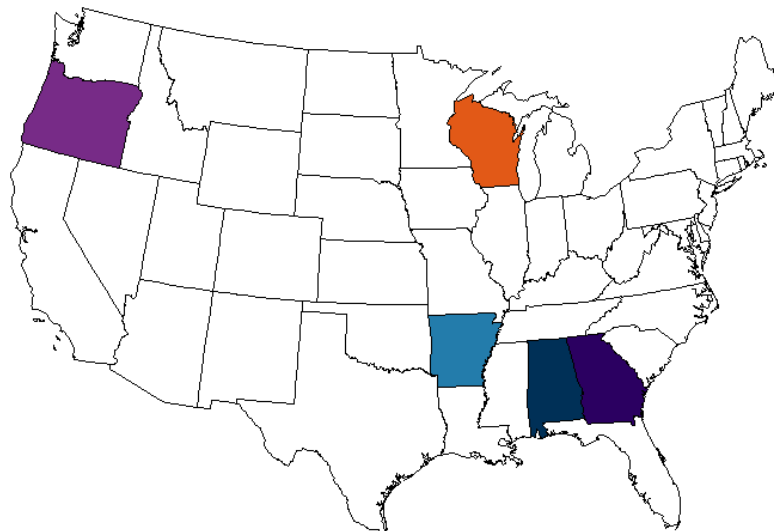
SECTOR	INDIRECT (2019 – 2028)	INDUCED (2019 – 2028)	TOTAL (2019 – 2028)	AVERAGE IMPACT (ANNUAL)
Forestry and Logging	\$800	\$100	\$900	1.4%
Wood Products	\$3,300	\$400	\$3,700	1.9%
Paper Products	\$1,200	\$1,000	\$2,200	0.7%
Printing Activities	\$800	\$900	\$1,700	0.6%
WPVC TOTAL	\$6,100	\$2,400	\$8,500	1.0%

As shown above, the wood products subsector experiences the largest impact on labor income (i.e., \$3.7 billion) in both absolute (i.e., total impact) and relative (i.e., average annual impact) terms. In contrast, the forestry and logging subsector experiences the lowest total labor income impact, but double the average annual impact of the paper products and printing activities subsectors.

Five Example States

This section elucidates the state-level impacts of the \$1 trillion infrastructure investment for the five states shown below in Figure 17: (1) Alabama, (2) Arkansas, (3) Georgia, (4) Oregon, and (5) Wisconsin.

Figure 17: The five example states with regional economic impacts



These five states comprise approximately 18 percent of the WPVC industry in the U.S., as measured by total direct employment of the industry, further demonstrated by the subsector employment numbers shown in Figure 18 below.

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Figure 18: Current employment by state and subsector in the WPVC (units)⁴⁹

SECTOR	ALABAMA	ARKANSAS	GEORGIA	OREGON	WISCONSIN
Forestry and Logging	7,900	2,400	8,600	9,900	4,600
Wood Products	15,900	9,900	18,400	23,600	19,300
Paper Products	11,100	9,500	19,000	4,500	30,700
Printing Activities	4,500	4,500	15,700	6,500	31,300
WPVC TOTAL	39,400	26,300	61,700	44,500	85,900
% of state	1.5%	1.6%	1.1%	1.9%	2.4%

Wisconsin has the most WPVC jobs of the five states, though these jobs are more concentrated in the paper and printing activities subsectors compared to the subsector distribution of other states. For example, Georgia, which has the second highest number of WPVC jobs, maintains almost as many paper products jobs as it does wood products jobs. WPVC jobs also comprise the highest percentage of state jobs for Wisconsin with 2.4 percent of its total jobs being in the WPVC. Conversely, WPVC jobs comprise the lowest percentage of jobs in Georgia. Finally, while Arkansas has the lowest WPVC employment, it also has the smallest economy of the five states. Even so, Arkansas maintains the median percentage of state jobs.

WPVC in Alabama

Current Industry

While employment in the WPVC has declined since 2000, mostly within the manufacturing subsectors, it has risen since 2010 and employed 39,400 workers in 2015, as shown below in Figure 19.

Figure 19: WPVC Employment in Alabama

EMPLOYMENT (UNITS)	2000	2005	2010	2015
Forestry and Logging	8,800	8,100	6,700	7,900
Wood Products	26,800	21,900	13,500	15,900
Paper Products	18,100	14,400	12,600	11,100
Printing Activities	9,800	6,200	4,600	4,500
WPVC TOTAL	63,500	50,600	37,400	39,400

As shown in Figure 20 below, the WPVC industry's contribution to Alabama's GDP has not declined as rapidly as its employment contribution over this period. This is likely due to technological improvements and productivity increases within

⁴⁹ All regional economic data from "Regional Economic Accounts," *Bureau of Economic Analysis*, <<https://www.bea.gov/regional/>>

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the manufacturing sectors. The WPVC contributes 2.1 percent—or \$4.27 billion in 2015—to Alabama’s \$205.6 billion GDP,⁵⁰ mostly within paper products subsector, which is particularly strong.

Figure 20: WPVC GDP Contribution in Alabama

GDP (2017 \$ BILLIONS)	2000	2005	2010	2015
Forestry and Logging	\$0.12	\$0.16	\$0.15	\$0.16
Wood Products	\$1.00	\$1.00	\$0.96	\$1.05
Paper Products	\$3.62	\$3.62	\$3.12	\$2.78
Printing Activities	\$0.37	\$0.37	\$0.20	\$0.28
WPVC TOTAL	\$5.11	\$5.15	\$4.43	\$4.27

Private and public timberland amount to 22.8 million acres or 67.9 percent of Alabama’s land area. This is equivalent to 23 times the land area of Baldwin County, the largest county in the state, with its county seat in Bay Minette. Figure 21 below shows the ownership distribution of forestlands in the state, with almost 94 percent privately owned, the highest of all five states.

Figure 21: Distribution of Forestlands in Alabama

FORESTLANDS ⁵¹	ACRES	SQUARE MILES	PERCENT
Private Forestlands	21.4 million	33,400	93.8%
Public Forestlands	1.4 million	2,200	6.2%
Total Forestlands	22.8 million	35,600	100.0%

Economic Impacts in Alabama

The following figures—together, Figure 22—illustrate the economic impact of the proposed \$1 trillion infrastructure bill on Alabama in three ways: (1) the total impact from 2019 through 2028; (2) the economic impact in the peak year of 2020; and (3) the average annual impact. Key takeaways include:

- The proposed bill would have a cumulative impact of an additional \$1.5 billion in sales output, \$320 million in state GDP, and \$320 million in labor income from 2019 through 2028.
- WPVC industry employment peaks in 2020 with 1,300 jobs, most of which in the wood products subsector.
- Annual average employment would increase 1.3 percent across the WPVC, with even higher gains (i.e., 1.9 percent) in the wood products subsector.

⁵⁰ <https://www.bea.gov/regional/bearfacts/pdf.cfm?fips=01000&areatype=STATE&geotype=3>

⁵¹ “Jobs & Economic Growth,” *National Alliance of Forest Owners*, May 12, 2016, <https://nafoalliance.org/images/documents/task-groups/communications/Forest2Market_Economic_Impact_of_Privately-Owned_Forests_April_2016.pdf>

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- WPVC sales output and labor income would experience similar growth at 1.1 and 1.2 percent, respectively.

Figure 22: Economic Impact of Infrastructure Spending in Alabama

TOTAL IMPACT (2019 – 2028)	AVERAGE EMPLOYMENT (UNITS)	SALES OUTPUT (2017 \$ MILLIONS)	GDP (2017 \$ MILLIONS)	LABOR INCOME (2017 \$ MILLIONS)
Forestry and Logging	100	\$100	\$60	\$70
Wood Products	300	\$780	\$150	\$160
Paper Products	100	\$590	\$100	\$80
Printing Activities	<50	\$40	\$10	\$10
WPVC TOTAL	500	\$1,510	\$320	\$320

PEAK IMPACT (2020)	PEAK EMPLOYMENT (UNITS)	SALES OUTPUT (2017 \$ MILLIONS)	GDP (2017 \$ MILLIONS)	LABOR INCOME (2017 \$ MILLIONS)
Forestry and Logging	300	\$30	\$20	\$20
Wood Products	700	\$210	\$40	\$40
Paper Products	200	\$160	\$30	\$20
Printing Activities	100	\$10	\$0	\$0
WPVC TOTAL	1,300	\$410	\$90	\$80

AVERAGE IMPACT (ANNUAL)	EMPLOYMENT (PERCENT)	SALES OUTPUT (PERCENT)	GDP (PERCENT)	LABOR INCOME (PERCENT)
Forestry and Logging	1.3%	1.4%	1.0%	1.4%
Wood Products	1.9%	1.8%	1.4%	1.8%
Paper Products	0.9%	0.7%	0.4%	0.7%
Printing Activities	1.1%	0.6%	0.3%	0.6%
WPVC TOTAL	1.3%	1.1%	0.7%	1.2%

WPVC in Arkansas

Current Industry

WPVC employment has declined since 2000. As of 2015, the industry employed 26,300 workers in the state in 2015, as shown in Figure 23 below.

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Figure 23: WPVC Employment in Arkansas

EMPLOYMENT (UNITS)	2000	2005	2010	2015
Forestry and Logging	6,700	5,900	4,200	2,400
Wood Products	16,800	14,500	12,200	9,900
Paper Products	14,500	12,000	10,500	9,500
Printing Activities	5,600	5,000	4,500	4,500
WPVC TOTAL	43,600	37,400	31,400	26,300

As in Alabama, the WPVC industry's contribution to Arkansas's GDP has not declined as rapidly as its employment contribution over this period, as shown in Figure 24 below. This is likely due to technological improvements and productivity increases within the manufacturing sectors. The WPVC contributes 2.5 percent—or \$2.97 billion in 2015—of Arkansas's \$121.4 billion GDP,⁵² mostly within paper products subsector, which is especially strong.

Figure 24: WPVC GDP Contribution in Arkansas

GDP (2017 \$ BILLIONS)	2000	2005	2010	2015
Forestry and Logging	\$0.12	\$0.16	\$0.17	\$0.16
Wood Products	\$0.66	\$0.66	\$0.73	\$0.77
Paper Products	\$1.89	\$1.89	\$2.11	\$1.73
Printing Activities	\$0.24	\$0.24	\$0.29	\$0.31
WPVC TOTAL	\$2.91	\$2.95	\$3.30	\$2.97

Private and public forestland amount to 18.5 million acres or 54.5 percent of Arkansas land area. This is equivalent to 28 times the area of Union County, the largest county in the state, with its seat in El Dorado. Figure 25 below shows the ownership distribution of forestlands in the state, with almost 83 percent privately owned.

⁵² <https://www.bea.gov/regional/bearfacts/pdf.cfm?fips=05000&areatype=STATE&geotype=3>

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Figure 25: Distribution of Forestlands in Arkansas

FORESTLANDS ⁵³	ACRES	SQUARE MILES	PERCENT
Private Forestlands	15.3 million	23,900	82.7%
Public Forestlands	3.2 million	5,000	17.3%
Total Forestlands	18.5 million	28,900	100.0%

Economic Impacts in Arkansas

The following figures—together, Figure 26—illustrate the economic impact of the proposed \$1 trillion infrastructure bill on Arkansas in three ways: (1) the total impact from 2019 through 2028; (2) the economic impact in the peak year of 2020; and (3) the average annual impact. Key takeaways include:

- The proposed bill would have a cumulative impact of an additional \$1.18 billion in sales output, \$250 million in state GDP, and \$200 million in labor income from 2019 through 2028.
- WPVC industry employment peaks at 1,000 jobs in 2020, mostly within the wood products subsector.
- Annual average employment would increase of 1.1 percent across the WPVC, with significantly higher gains (4.2 percent) in the forestry and logging subsector.
- Labor income shows the highest average annual growth at 1.2 percent, mostly due to growth in the wood products sector.

Figure 26: Economic Impact of Infrastructure Spending in Arkansas

TOTAL IMPACT (2019 – 2028)	AVERAGE EMPLOYMENT (UNITS)	SALES OUTPUT (2017 \$ MILLIONS)	GDP (2017 \$ MILLIONS)	LABOR INCOME (2017 \$ MILLIONS)
Forestry and Logging	100	\$60	\$30	\$40
Wood Products	200	\$620	\$140	\$100
Paper Products	100	\$460	\$70	\$50
Printing Activities	<50	\$40	\$10	\$10
WPVC TOTAL	400	\$1,180	\$250	\$200

⁵³ “Jobs & Economic Growth,” *National Alliance of Forest Owners*, May 12, 2016, <https://nafoalliance.org/images/documents/task-groups/communications/Forest2Market_Economic_Impact_of_Privately-Owned_Forests_April_2016.pdf>

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PEAK IMPACT (2020)	PEAK EMPLOYMENT (UNITS)	SALES OUTPUT (2017 \$ MILLIONS)	GDP (2017 \$ MILLIONS)	LABOR INCOME (2017 \$ MILLIONS)
Forestry and Logging	200	\$20	\$10	\$10
Wood Products	500	\$170	\$40	\$30
Paper Products	200	\$130	\$20	\$10
Printing Activities	100	\$10	\$0	\$0
WPVC TOTAL	1,000	\$330	\$70	\$50

AVERAGE IMPACT (ANNUAL)	EMPLOYMENT (PERCENT)	SALES OUTPUT (PERCENT)	GDP (PERCENT)	LABOR INCOME (PERCENT)
Forestry and Logging	4.2%	1.4%	2.0%	1.4%
Wood Products	2.0%	2.0%	1.8%	2.0%
Paper Products	1.1%	0.7%	0.4%	0.7%
Printing Activities	1.1%	0.6%	0.3%	0.6%
WPVC TOTAL	1.1%	1.1%	0.7%	1.2%

WPVC in Georgia

Current Industry

While employment in the WPVC has declined since 2000, mostly within the manufacturing subsectors, it has risen since 2010 and employed 61,700 workers in 2015, as shown in Figure 27 below.

Figure 27: WPVC Employment in Georgia

EMPLOYMENT (UNITS)	2000	2005	2010	2015
Forestry and Logging	8,700	8,800	7,600	8,600
Wood Products	31,200	26,900	15,800	18,400
Paper Products	29,100	23,700	19,300	19,000
Printing Activities	26,600	21,400	16,500	15,700
WPVC TOTAL	95,600	80,800	59,200	61,700

As shown in Figure 28 below, the WPVC's contribution to Georgia's GDP has not declined as rapidly as its employment contribution over this period. This is likely due to technological improvements and productivity increases within the

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manufacturing sectors. The WPVC contributes 1.4 percent—or \$7.61 billion in 2015—of Georgia’s \$531.3 billion GDP,⁵⁴ mostly within its paper products subsector.

Figure 28: WPVC GDP Contribution in Georgia

GDP (2017 \$ BILLIONS)	2000	2005	2010	2015
Forestry and Logging	\$0.17	\$0.20	\$0.25	\$0.27
Wood Products	\$1.51	\$1.51	\$1.20	\$1.50
Paper Products	\$5.35	\$5.35	\$3.78	\$4.41
Printing Activities	\$1.62	\$1.62	\$1.56	\$1.43
WPVC TOTAL	\$8.65	\$8.68	\$6.79	\$7.61

Private and public forestland amount to 24.2 million acres or 63.6 percent of Georgia’s land area. This is the equivalent of 35 times the land area covered by Ware County, the largest in the state, with its county seat in Waycross. Figure 29 below shows the ownership distribution of forestlands in the state, with almost 92 percent privately owned.

Figure 29: Distribution of Forestlands in Georgia

FORESTLANDS ⁵⁵	ACRES	SQUARE MILES	PERCENT
Private Forestlands	22.2 million	34,700	91.8%
Public Forestlands	2.0 million	3,100	8.2%
Total Forestlands	24.2 million	37,800	100.0%

Economic Impacts in Georgia

The following figures—together, Figure 30—illustrate the economic impact of the proposed \$1 trillion infrastructure bill on Georgia in three ways: (1) the total impact from 2019 through 2028; (2) the economic impact in the peak year of 2020; and (3) the average annual impact. Key takeaways include:

- The proposed bill would have a cumulative impact of an additional \$2.17 billion in sales output, \$520 million in state GDP, and \$430 million in labor income from 2019 through 2028.
- WPVC employment peaks in 2020 with 1,800 jobs, half of which are in the wood products subsector.
- Annual average employment increase of 1.1 percent across the WPVC industry, with the highest gains in the wood products subsector.

⁵⁴ <https://www.bea.gov/regional/bearfacts/pdf.cfm?fips=13000&areatype=STATE&geotype=3>

⁵⁵ “Jobs & Economic Growth,” *National Alliance of Forest Owners*, May 12, 2016, <https://nafoalliance.org/images/documents/task-groups/communications/Forest2Market_Economic_Impact_of_Privately-Owned_Forests_April_2016.pdf>

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- WPVC sales output and labor income would each grow by 1.0 percent.

Figure 30: Economic Impact of Infrastructure Spending in Georgia

TOTAL IMPACT (2019 – 2028)	AVERAGE EMPLOYMENT (UNITS)	SALES OUTPUT (2017 \$ MILLIONS)	GDP (2017 \$ MILLIONS)	LABOR INCOME (2017 \$ MILLIONS)
Forestry and Logging	100	\$100	\$50	\$60
Wood Products	300	\$1,010	\$250	\$190
Paper Products	100	\$890	\$160	\$130
Printing Activities	100	\$170	\$60	\$50
WPVC TOTAL	600	\$2,170	\$520	\$430

PEAK IMPACT (2020)	PEAK EMPLOYMENT (UNITS)	SALES OUTPUT (2017 \$ MILLIONS)	GDP (2017 \$ MILLIONS)	LABOR INCOME (2017 \$ MILLIONS)
Forestry and Logging	300	\$30	\$10	\$20
Wood Products	900	\$280	\$70	\$50
Paper Products	300	\$240	\$40	\$40
Printing Activities	300	\$50	\$20	\$10
WPVC TOTAL	1,800	\$600	\$140	\$120

AVERAGE IMPACT (ANNUAL)	EMPLOYMENT (PERCENT)	SALES OUTPUT (PERCENT)	GDP (PERCENT)	LABOR INCOME (PERCENT)
Forestry and Logging	1.2%	1.3%	1.5%	1.4%
Wood Products	1.6%	2.0%	1.7%	1.9%
Paper Products	0.5%	0.7%	0.4%	0.7%
Printing Activities	0.6%	0.6%	0.4%	0.6%
WPVC TOTAL	1.1%	1.0%	0.6%	1.0%

WPVC in Oregon

Current Industry

While employment in the WPVC has declined since 2000, mostly within the manufacturing subsectors, it has risen since 2010 and now employs 44,500 workers, as shown below in Figure 31.

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Figure 31: WPVC Employment in Oregon

EMPLOYMENT (UNITS)	2000	2005	2010	2015
Forestry and Logging	11,500	11,300	7,900	9,900
Wood Products	37,400	34,000	21,200	23,600
Paper Products	7,800	6,600	5,000	4,500
Printing Activities	10,500	8,200	6,700	6,500
WPVC TOTAL	67,200	60,100	40,800	44,500

The GDP contribution of the WPVC to Oregon has not declined as rapidly as its employment contribution, as shown in Figure 32 below. This is likely due to technological improvements and productivity increases within the manufacturing sectors. The WPVC contributes 1.6 percent—or \$3.54 billion in 2015—of Oregon’s \$228.9 billion GDP,⁵⁶ mostly within its large wood products industry.

Figure 32: WPVC GDP Contribution in Oregon

GDP (2017 \$ BILLIONS)	2000	2005	2010	2015
Forestry and Logging	\$0.35	\$0.44	\$0.37	\$0.43
Wood Products	\$1.89	\$1.89	\$1.53	\$1.75
Paper Products	\$1.45	\$1.45	\$1.17	\$0.85
Printing Activities	\$0.52	\$0.52	\$0.46	\$0.51
WPVC TOTAL	\$4.21	\$4.30	\$3.53	\$3.54

Private and public timberland amount to 23.7 million acres or 37.6 percent of Oregon’s land area. This is the equivalent of covering Harney, Malheur, Lake, Klamath, and Douglas Counties, five of its largest counties. Figure 33 below shows the ownership distribution of forestlands in the state, with approximately 60 percent publicly owned, in stark contrast to the other four states.

⁵⁶ <https://www.bea.gov/regional/bearfacts/pdf.cfm?fips=41000&areatype=STATE&geotype=3>

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Figure 33: Distribution of Forestlands in Oregon

FORESTLANDS ⁵⁷	ACRES	SQUARE MILES	PERCENT
Private Forestlands	9.4 million	14,700	39.7%
Public Forestlands	14.3 million	22,300	60.3%
Total Forestlands	23.7 million	37,000	100.0%

Economic Impacts in Oregon

The following figures—together, Figure 34—illustrate the economic impact of the proposed \$1 trillion infrastructure bill on Oregon in three ways: (1) the total impact from 2019 through 2028; (2) the economic impact in the peak year of 2020; and (3) the average annual impact. Key takeaways include:

- The proposed bill would have a cumulative impact of an additional \$1.76 billion in sales output, \$430 million in state GDP, and \$440 million in labor income from 2019 through 2028.
- WPVC industry employment peaks in 2020 with 1,800, the majority of which are in the wood products subsector.
- Annual average employment increase of 1.3 percent across the WPVC, with highest gains from the wood products subsector.
- WPVC sales output and labor income would each grow by 1.5 percent.

Figure 34: Economic Impact of Infrastructure Spending in Oregon

TOTAL IMPACT (2019 – 2028)	AVERAGE EMPLOYMENT (UNITS)	SALES OUTPUT (2017 \$ MILLIONS)	GDP (2017 \$ MILLIONS)	LABOR INCOME (2017 \$ MILLIONS)
Forestry and Logging	100	\$150	\$90	\$110
Wood Products	400	\$1,340	\$290	\$280
Paper Products	<50	\$210	\$30	\$30
Printing Activities	<50	\$60	\$20	\$20
WPVC TOTAL	600	\$1,760	\$430	\$440

⁵⁷ "Jobs & Economic Growth," *National Alliance of Forest Owners*, May 12, 2016, <https://nafoalliance.org/images/documents/task-groups/communications/Forest2Market_Economic_Impact_of_Privately-Owned_Forests_April_2016.pdf>

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PEAK IMPACT (2020)	PEAK EMPLOYMENT (UNITS)	SALES OUTPUT (2017 \$ MILLIONS)	GDP (2017 \$ MILLIONS)	LABOR INCOME (2017 \$ MILLIONS)
Forestry and Logging	400	\$40	\$20	\$30
Wood Products	1,200	\$370	\$80	\$80
Paper Products	100	\$60	\$10	\$10
Printing Activities	100	\$20	\$10	\$10
WPVC TOTAL	1,800	\$490	\$120	\$130

AVERAGE IMPACT (ANNUAL)	EMPLOYMENT (PERCENT)	SALES OUTPUT (PERCENT)	GDP (PERCENT)	LABOR INCOME (PERCENT)
Forestry and Logging	1.0%	1.4%	1.5%	1.4%
Wood Products	1.7%	1.9%	1.6%	1.9%
Paper Products	1.1%	0.7%	0.3%	0.7%
Printing Activities	0.8%	0.6%	0.4%	0.6%
WPVC TOTAL	1.3%	1.5%	0.9%	1.5%

WPVC in Wisconsin

Current Industry

While employment in the WPVC has declined since 2000, mostly within the manufacturing subsectors, it has risen since 2010 and employed 85,900 workers in 2015, as shown in Figure 35 below.

Figure 35: WPVC Employment in Wisconsin

EMPLOYMENT (UNITS)	2000	2005	2010	2015
Forestry and Logging	4,900	5,300	3,600	4,600
Wood Products	29,700	28,800	18,400	19,300
Paper Products	49,800	37,500	32,200	30,700
Printing Activities	40,400	34,400	30,000	31,300
WPVC TOTAL	124,800	106,000	84,200	85,900

The WPVC's contribution to Wisconsin's GDP has not declined as rapidly as its employment contribution over this period, as shown in Figure 36 below. This is likely due to technological improvements and productivity increases within the

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manufacturing sectors. The WPVC contributes 2.8 percent—or \$8.87 billion in 2015—of Wisconsin’s \$313.1 billion GDP,⁵⁸ mostly within its large paper products industry.

Figure 36: WPVC GDP Contribution in Wisconsin

GDP (2017 \$ BILLIONS)	2000	2005	2010	2015
Forestry and Logging	\$0.09	\$0.12	\$0.11	\$0.15
Wood Products	\$1.24	\$1.24	\$1.08	\$1.04
Paper Products	\$8.01	\$8.01	\$4.82	\$4.60
Printing Activities	\$2.06	\$2.06	\$2.74	\$3.08
WPVC TOTAL	\$11.40	\$11.43	\$8.75	\$8.87

Private and public forestland amounts to 16.5 million acres or 39.2 percent of Wisconsin’s total land area. This is the equivalent to Marathon County seventeen times over, the largest in the state, with its county seat in Wausau. Figure 37 below shows the ownership distribution of forestlands in the state, with almost 72 percent privately owned.

Figure 37: Distribution of Forestlands in Wisconsin

FORESTLANDS ⁵⁹	ACRES	SQUARE MILES	PERCENT
Private Forestlands	11.8 million	18,400	71.6%
Public Forestlands	4.7 million	7,300	28.4%
Total Forestlands	16.5 million	25,700	100.0%

Economic Impacts in Wisconsin

The following figures—together, Figure 38—illustrate the economic impact of the proposed \$1 trillion infrastructure bill on Wisconsin in three ways: (1) the total impact from 2019 through 2028; (2) the economic impact in the peak year of 2020; and (3) the average annual impact. Key takeaways include:

- The proposed bill would have a cumulative impact of an additional \$2.38 billion in sales output, \$460 million in state GDP, and \$460 million in labor income from 2019 through 2028.
- WPVC industry employment peaks in 2020 with 2,200 jobs, most of which are in the wood products subsector.
- Annual average employment would increase of 0.9 percent across the WPVC, with the highest gains in the forestry and logging and wood products industries.

⁵⁸ <https://www.bea.gov/regional/bearfacts/pdf.cfm?fips=55000&areatype=STATE&geotype=3>

⁵⁹ “Jobs & Economic Growth,” *National Alliance of Forest Owners*, May 12, 2016, <https://nafoalliance.org/images/documents/task-groups/communications/Forest2Market_Economic_Impact_of_Privately-Owned_Forests_April_2016.pdf>

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- WPVC sales output and labor income would experience similar growth of 0.8 and 0.9 percent, respectively.

Figure 38: Economic Impact of Infrastructure Spending in Wisconsin

TOTAL IMPACT (2019 – 2028)	AVERAGE EMPLOYMENT (UNITS)	SALES OUTPUT (2017 \$ MILLIONS)	GDP (2017 \$ MILLIONS)	LABOR INCOME (2017 \$ MILLIONS)
Forestry and Logging	100	\$60	\$20	\$20
Wood Products	400	\$830	\$180	\$180
Paper Products	200	\$1,170	\$150	\$160
Printing Activities	200	\$320	\$110	\$100
WPVC TOTAL	900	\$2,380	\$460	\$460

PEAK IMPACT (2020)	PEAK EMPLOYMENT (UNITS)	SALES OUTPUT (2017 \$ MILLIONS)	GDP (2017 \$ MILLIONS)	LABOR INCOME (2017 \$ MILLIONS)
Forestry and Logging	200	\$20	\$10	\$10
Wood Products	1,000	\$230	\$50	\$50
Paper Products	500	\$320	\$40	\$40
Printing Activities	500	\$90	\$30	\$30
WPVC TOTAL	2,200	\$660	\$130	\$130

AVERAGE IMPACT (ANNUAL)	EMPLOYMENT (PERCENT)	SALES OUTPUT (PERCENT)	GDP (PERCENT)	LABOR INCOME (PERCENT)
Forestry and Logging	2.2%	1.4%	1.2%	1.5%
Wood Products	2.1%	2.1%	1.8%	2.0%
Paper Products	0.7%	0.6%	0.3%	0.6%
Printing Activities	0.6%	0.6%	0.4%	0.6%
WPVC TOTAL	0.9%	0.8%	0.5%	0.9%

Appendix A: Description of IMPLAN Model

IMPLAN, produced by MIG, Inc.,⁶⁰ is a software program containing an IO model of the U.S. or regional economies. Our version of the software here includes the U.S., as well as Alabama, Arkansas, Georgia, Oregon, and Wisconsin. IMPLAN sees wide application throughout economic impact analysis and policy research.⁶¹

IMPLAN works by constructing a series of multipliers throughout the economy where an initial, “direct” activity stimulates a supply chain and related industry. A classic example involves automotive manufacturing in the Midwest or Southeast, where an automobile assembly plant has a complex supply chain of parts suppliers feeding into it from throughout the region, the U.S., and even the rest of the world in a long and complex production process.

The suppliers needed to construct a final automobile—parts, materials suppliers of glass, rubber, leather, electronics, legal, and accounting—are “indirect” impacts in the IMPLAN model. The direct and indirect industries pay wages and salaries to their employees, which support the living expenses of households. These include the standard accoutrements of daily life in any family budget, such as housing and groceries. IMPLAN calls the impact of consumer spending the “induced” effect, which it also includes inside of its modeling and the overall impact results.

The core of IMPLAN is in IO model, otherwise known as a Leontief model. Named for Wassily Leontief, a Nobel Laureate for this and other research,⁶² an IO model imagines the economy as a series of transactions between buyers and sellers. Every transaction must have both sides to exist. Most transactions are between industries (the supply chain) though there are also transactions between businesses and households (through either consumption or wages).

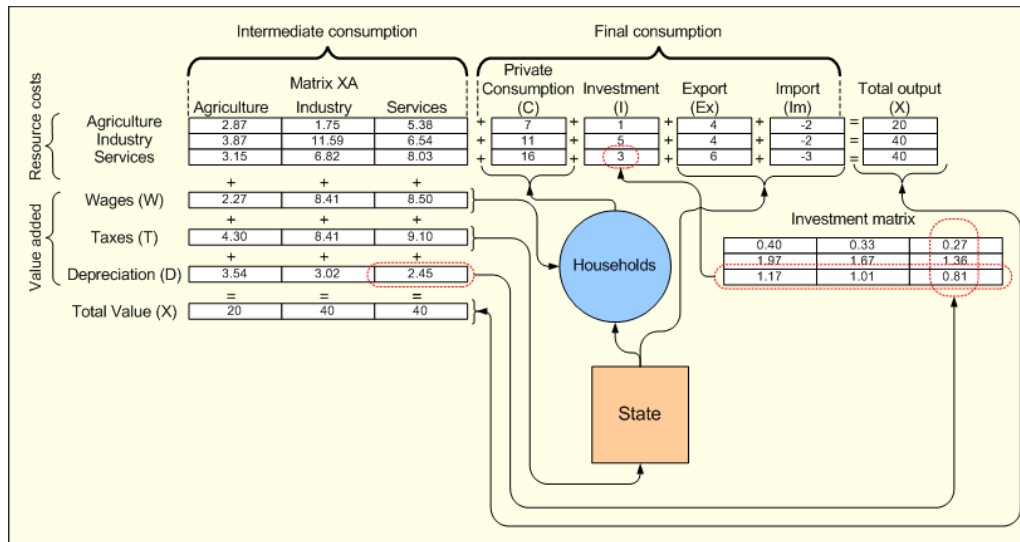
Leontief built a matrix, with inputs and outputs from each industry and households on each axis, to show the volume of the transactions between every sector to one another and allow for the computation of changes to the existing structure. The matrix then shows how initial spending flows through into other industries.

⁶⁰ <<http://implan.com/>>

⁶¹ <<http://www.ci.richmond.ca.us/DocumentCenter/Home/View/6474>>

⁶² <<http://www.econlib.org/library/Enc/bios/Leontief.html>>

Figure 39: Structure of an example input-output model with three industries⁶³



⁶³ <<http://dankozub.com/simulation/>>



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