Economic Contributions of West Virginia's Forest Products Industry Over Time: A Look at 2006, 2010, 2015, and 2017 Data

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Abstract

West Virginia's forest products industry (FPI) has long been viewed as an important industry to the state. However, there is a lack of recent data regarding the economic contribution of the industry to the state's economy. The housing market collapse of the mid-2000s, subsequent recession, continued increasing global competition, natural gas boom, and other macroeconomic trends have affected the FPI in the state. The continuing evolution of the state economy necessitates a reexamination of the role the FPI plays in the state. Thus, this article examines the historical contribution of the FPI to West Virginia's economy using 2006, 2010, 2015, and 2017 data. Both the direct and total economic contributions of the industry substantially declined from 2006 to 2010. The largest declines were experienced in the secondary solid-wood products and wood furniture sectors. Between 2010 and 2015, the industry's direct and total contributions rose for all measures evaluated. Between 2015 and 2017, all measures of direct and total contributions of the industry also increased but at a much slower pace and remained lower than 2006 levels. The inability of the FPI in the state to return to 2006 levels of direct contributions suggests that long-term industry trends such as the continued offshoring of value-added forest products sectors and increased industry automation are still putting negative pressure on direct industry growth. Additionally, the industry is facing new challenges such as uncertainty about the future availability of the foreign markets and competition for resources from emerging industries.

The hardwood forests of West Virginia have been a vital resource to the state throughout its history and have played a fundamental role in its economic development. West Virginia is the third most heavily forested state in the United States with 12 million acres of forestland making up 78 percent of the state's total land area. In 2017, over 181 million ft^3 of timber was harvested from the state (Morin 2018). This plentiful natural resource serves as a strong foundation for a substantial forest products industry (FPI). From industrial shipping pallets and paper products to household cabinetry and hardwood flooring, products derived from West Virginia hardwoods play a vital role in the broader state economy. As large-diameter timber stands within the state have been steadily increasing since 1975, West Virginia's forest products sectors are primed for further economic activity in the state (Morin 2018).

West Virginia's FPI has long been viewed as an important industry to the state. It is one of the top wood-producing states in the nation, producing more than 700 million board feet of lumber, 770 million square feet of oriented strand board and 800 million square feet of veneer annually (West Virginia Department of Commerce 2017). The wood products manufacturing sector is the fifth top manufacturing sector in the state, providing an output of US$381.3 million, which represented approximately 5 percent of the state's total manufacturing output in 2017 (National Association of Manufacturers 2019). Although the average weekly wage rate in the state's FPI is slightly lower than the state's average ($648 vs. $730; WorkForce West Virginia 2019), it

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is the only natural resource industry that provides jobs in all of West Virginia's 55 counties. Compared with other natural-resource-based industries in the state, the FPI plays a much larger role in the state economy than agriculture, fishing, or hunting. Agriculture contributes about $1 billion to the state economy (National Crop Insurance Services 2016) while hunting and fishing each have a $500 million total economic impact (Moran 2015, American Sportfishing Association 2019), compared with FPI's $2.2 billion economic contribution in 2017.

Over the previous decade, assessments of the economic contribution of forestry-related industries across the country have become increasingly prevalent. The information gained from these analyses is often used to advocate for the industry and as a resource for policymakers, industry decision makers, and others. Forest economists in the US South have taken the lead in the assessment of the economic contribution of forest products industries with several region-wide studies (e.g., Hodges et al. 2011, Dahal et al. 2013, Brandeis and Hodges 2015). In recent years, additional efforts have been made to standardize the methods and approaches used in economic analyses of forest product industries, particularly in the methods used with regard to the economic modeling system Impact Analysis for Planning (IMPLAN; Watson et al. 2007, Henderson et al. 2017, Joshi et al. 2017, Parajuli et al. 2018). Pelkki and Sherman (2020) applied this standardized methodology in conducting the most recent analysis in forestry's economic contribution in the United States. Specifically, they looked at all 50 states (and the District of Columbia) and ranked them according to forestry's absolute contributions as well as a percentage of the state's total economy.

As other states with substantive forestry industries regularly perform such research, West Virginia has not kept pace with this trend. In fact, since 2009, analyses have been conducted on a nearly annual basis for two of the states that border West Virginia: Virginia and Kentucky (e.g., Rephann 2017, Stringer et al. 2018). In contrast, the last examination of the contribution of West Virginia's FPI was released in 2005. It was estimated that, in 2005, the industry supported nearly 30,000 jobs and $4 billion in output annually (Childs 2005). Many states have comparable figures for recent years, but West Virginia does not have any up-to-date quantitative measure of what portion of the state economy is supported by its forestry industry.

Certainly, much has changed since 2005. The US housing market collapse of 2006 and the economic recession that followed had severe implications for the US FPI. Mill closures and job losses were witnessed across the country, including in West Virginia. A 2011 study of the northern US FPI estimated that, between 2006 and 2010, total employment in the three major sectors of the forest-related industry fell by approximately 28 percent, or 194,000 jobs (Woodall et al. 2011). The same study found that employment in West Virginia's wood-product manufacturing sector as a percentage of overall manufacturing employment fell by nearly 8 percent over that same time. A corresponding study examining the US South found that the region's three primary forestry sectors lost 110,000 jobs between 2005 and 2009 (Hodges et al. 2011). Somewhat narrower in focus, an examination of eastern US hardwood lumber production estimated that by 2009, domestic hardwood lumber consumption declined by 43 percent from peak levels just 10 years prior (Luppold and Bumgardner 2016). The effects of the housing market collapse have also overshadowed longer term trends in the US FPI, such as the continued offshoring of wood furniture manufacturing that began in earnest in the early 2000s. Simultaneously, lower domestic demand for hardwood lumber has resulted in an increasing reliance on exports of wood products to foreign markets (Luppold and Bumgardner 2016). In more recent years, the boom in Marcellus shale drilling in the hardwood regions of the United States that began in 2007 has also affected forest sector employment. For example, Grushecky and Wang (2013) found a decrease in logging jobs in the top four counties in West Virginia involved in Marcellus shale drilling between 2009 and 2012.

Clearly, the FPI in the United States has undergone significant changes over the past two decades. The housing market collapse, subsequent recession, continued increasing global competition, natural gas boom, and other macroeconomic trends call for a reexamination of the role the FPI plays in the West Virginia economy. Traditionally, industries vital to the state have witnessed high levels of volatility in recent years, which has prompted increasing calls for economic diversification throughout the state. The continuing evolution of the state economy necessitates a reexamination of the role the FPI plays in the state. Thus, this article examines the historical contribution of the FPI in West Virginia. This historical analysis will give much needed information that has been missing since the last major state report released in 2005 and will illustrate how the industry economic contribution has changed over time. Analyzing the industry's contribution over time is helpful in understanding important industry trends (Dahal et al. 2013). Years in the analysis have been chosen to illustrate the effects of the US housing collapse and subsequent recession. These results, paired with the results from the most current data, will illustrate the historical performance of the state's FPI and whether it has returned to prerecession levels of economic activity. Overall, the results of such an examination will provide much needed information to policymakers, forest industry stakeholders, private forest landowners, and others to address the critical economic issues being faced by the industry (Dahal et al. 2013). Making this information available can only serve to benefit the industry and the health of the broader state economy.

Methodology

Economic contribution analysis and IMPLAN

We used the IMPLAN economic modeling software for all economic contribution analysis performed. Through the construction of unique input–output economic models, IMPLAN allows for estimation of the impact or contribution of potential, foregone, or existing economic activities in a user-defined region. The strength of the IMPLAN software lies in the ability of the user to customize the model construction as they see fit. Model customization is done through IMPLAN data set selection, the modeling approach with which the regional purchasing coefficients are constructed, and the customization of the Social Accounting Matrix (SAM) that underlies the input–output model. The SAM is an input–output matrix that represents the market (interindustry) relationships that exist in an economy as well as the nonmarket (institutional) relationships that are present (Cheney 2018a). The inclusion of institutions allows

IMPLAN to not only account for the economic activity caused by interindustry activity, but also that caused by institutional (e.g., household or governmental) spending. Once the custom model is built in IMPLAN, the user then defines the industry of study. Users can choose any number of 536 individual IMPLAN sectors with which to define their industry. Each IMPLAN sector corresponds with one or more North American Industrial Classification System (NAICS) sectors (Cheney 2018b). When defining the industry to be analyzed, the user may aggregate sectors in order to build the industry because they understand it exists in their region. IMPLAN is then able to model the combined economic effects of the industry as well as the effects of the individual component sectors.

When using IMPLAN to conduct economic contribution analysis, steps must be taken to differentiate the analysis from that of an economic impact analysis. Using economic impact analysis methods to estimate economic contribution will result in an overestimation of the economic reality through the double-counting of portions of the industry's contributions (Henderson et al. 2017). There are two generally accepted methods for accomplishing an economic contribution analysis, but this study implements the matrix-inversion method of discounting IMPLAN activity inputs. Detailed in Parajuli et al. (2018) and Henderson and Evans (2017), this method (referred to as Method 2) is external to the IMPLAN software itself and involves downwardly adjusting sector activity inputs (entered as industry sales) before the IMPLAN software models the effects of the activities. We accomplished adjustments to the IMPLAN inputs through obtaining the IMPLAN SAM output multipliers associated with the sectors of interest in order to create a miniature Leontief Inverse, $(I - A)^{-1}$, where I is an identity matrix, and A is the input–output coefficients matrix. By inverting this, we arrive at $(I - A)$, which is then multiplied by the estimated existing industry output to arrive at the downwardly adjusted inputs for the sectors. This downward adjustment of IMPLAN inputs ensured that the resulting total effects of the sectors of interest did not exceed that which was currently estimated to have existed (Henderson and Evans 2017, Parajuli et al. 2018). This method also, however, requires the reported IMPLAN results to be adjusted by replacing the direct effects with original input values (Parajuli et al. 2018).

IMPLAN reports results of economic contribution analyses in a number of economic measures by direct, indirect, and induced effects. In terms of economic contribution analyses, direct effects are those contributions that are made through the primary industry of study's operations in order to meet final demand for its output. Indirect effects are those contributions that arise through interindustry activity that occurs as secondary industries respond to the demand for inputs by the primary industry's operations. Induced effects are those contributions that arise from the spending of personal income by the employees and proprietors of businesses within the primary and secondary industries. The sum of these effects, therefore, makes up the total contribution, or the gross change in a region's economy that can be attributed to the primary industry of study. The relationship between the primary industry's direct effects and its total effects can be illustrated through a SAM multiplier value, which is calculated by dividing the total effects of an industry by its direct effects. Type SAM multipliers are a representation of the magnitude of the ''ripple effects'' that are created through the broader economy by the direct industry activity. They take into account the direct, indirect, and induced effects of an industry's operations. IMPLAN reports direct, indirect, and induced effects for the following measures of industry-specific economic activity:

- Employment: The number of full and part time jobs.
- Employee compensation: The total payroll cost of wage and salary to the employer.
- Output: The value of industry production, or industry sales.
- Value added: The difference between an industry's output and the cost of its intermediate inputs. This consists of employee compensation, proprietor income, indirect business taxes, and other property type income.

It must be noted that when using Output as a measure of economic activity, it double-counts because the Output of an industry requires Output from other industries. Output overstates the amount of additional or new activity because it counts products used as intermediate inputs more than once (US Department of Agriculture Natural Resources Conservation Service 2014). Thus, although this is an essential measure to study and understand the interrelationships of the industries that underlie the overall economy, it may not be a good stand-alone indicator of the overall contribution of an industry or sector (Clouse 2019).

Analyses

We obtained IMPLAN Pro version 3.1 software and state-level data sets for West Virginia for the years 2006, 2010, 2015, and 2017. The 2006 and 2010 data sets had been updated by IMPLAN to reflect the 536-sector sectoring, which was implemented in 2013. These updated data sets produced results that were directly comparable with those derived from the 2015 and 2017 data sets. These updated data sets also allowed for IMPLAN models to be built through the trade-flows approach.

The institutions of state and local governments were made endogenous to the model because any tax revenues received by state or local governments are to be spent within the regional (state) economy. The West Virginia FPI was defined as seven individual major forest products sectors: (1) forestry; (2) logging; (3) primary solid-wood products; (4) secondary solid-wood products; (5) wood furniture; (6) pulp, paper, and paperboard; and (7) secondary paperboard and other paper products (Table 1). These sectors were created in IMPLAN through the aggregation of 31 individual IMPLAN sectors and applied consistently to all analyses. For some analyses, the regions of study did not experience activity in all 31 FPI sectors. In these instances, although the sectors were technically included in defining the FPI, they were in effect not included in the analyses. In selecting these sectors, we gave consideration to the recommendations found in Joshi et al. (2017).

We included IMPLAN sectors 19, 47, 372, and 376 in the analyses as partial sectors. For sectors 19, 372, and 376, we used NAICS data to decrease input values in order to only account for the portion of the sectors that are forestry-related. IMPLAN sector 19 is listed as ''Support activities for agriculture and forestry'' and has eight six-digit NAICS codes associated with it. Through the use of Bureau of Labor Statistics employment data associated with those NAICS codes for the state for each year, a percentage value was calculated by which to decrease input values for sector

Table 1.—Forest products industry (FPI) major sectors included in Impact Analysis for Planning (IMPLAN). Model sector abbreviations and IMPLAN sector numbers are in parentheses.

FPI model sectors	IMPLAN sectors[a]
1. Forestry (F)	(15) Forestry, forest products, and timber tract prod.; (19*) Support activities for forestry
2. Logging (L)	(16) Commercial logging
3. Primary solid-wood products (PSWP)	(47*) Electric power generation—Biomass; (134) Sawmills; (135) Wood preservation; (136) Veneer and plywood mfg.; (138) Reconstituted wood product mfg.
4. Secondary solid-wood products (SSWP)	(137) Engineered wood member and truss mfg.; (139) Wood windows and doors mfg.; (140) Cut stock, resawing lumber, and planing; (141) Other millwork, including flooring; (142) Wood container and pallet mfg.; (143) Manufactured home (mobile home) mfg.; (144) All other miscellaneous wood product mfg.
5. Wood furniture (WF)	(368) Wood kitchen cabinet and countertop mfg.; (369) Upholstered household furniture mfg.; (370) Nonupholstered wood household furniture mfg.; (372*) Institutional wood furniture mfg.; (373) Wood office furniture mfg.; (374) Custom architectural woodwork and millwork mfg.; (376*) Showcase, partition, shelving, and locker mfg.
6. Pulp, paper, and paperboard (PPP)	(146) Pulp mills; (147) Paper mills; (148) Paperboard mills.
7. Secondary paperboard and other paper products (SPOP)	(149) Paperboard container mfg.; (150) Paper bag and coated and treated paper mfg.; (151) Stationary product mfg.; (152) Sanitary paper product mfg.; (153) All other converted paper product mfg.

[a] * = partial sector inclusion.

19 so as to only account for the portion of the sector that is forestry-related. IMPLAN sector 19 corresponds with NAICS code 115 (''Agriculture and forestry support activities''), which contains three lower, more detailed NAICS codes. Only one of the codes (1153) is forestry-related: ''Support activities for forestry.'' The percentages of statewide employment that corresponded to NAIC 1153 were 65, 58, 63, and 68 percent for 2006, 2010, 2015, and 2017, respectively. Sector 19 was therefore downwardly adjusted using these percentages. For Sectors 372 and 376, a similar approach was taken by using NAICS data to find the proportion of employment in sectors that were considered wood-based and nonwood-based. However, there was no employment in the nonwood-based sectors; therefore, Sectors 372 and 376 are treated, essentially, as full sectors. Similarly, US Energy Information Agency data was used to discount Sector 47 values to only account for the biomass-generated electric power that was produced through wood biomass. However, in the only year for which there was reported economic activity in the sector (2006), the Energy Information Agency reported no electrical generation produced with woody biomass. Therefore, sector activity could not be attributed to the FPI and the sector was not included in any of the analyses.

For the years 2006, 2010, 2015, and 2017, the economic contributions of the seven major individual forest products sectors were measured, as well as the combined contribution of the industry as a whole. All dollar values were adjusted for inflation to 2017 constant US dollars using the appropriate output and gross domestic product inflator values derived from IMPLAN. Industry contributions were reported in terms of output, employment, employee compensation, and value added.

Results

The West Virginia FPI

The economic contributions of the West Virginia FPI as a whole are presented in Table 2. The changes in contribution of the industry as a whole over the years evaluated illustrate, firstly, the immense decreases in the overall industry's contributions from 2006 to 2010. Between these years, the direct contributions of the industry declined by no less than 35 percent for all measures. The decline in West Virginia FPI direct contributions in terms of employment equated to 5,337 lost jobs, or 0.6 percent of the total state employment in 2006. West Virginia FPI direct value added saw an even more dramatic decrease of 41.9 percent from 2006 to 2010, which equated to a loss of $376 million, or 0.5 percent of 2006 gross state product. Total contributions also declined for all measures but at a much lower rate. However, compared with the state, the FPI experienced more decline in terms of value added and employment, which indicates that it was more severely affected by the recession during this period. The total contribution of the FPI to the state total values changed from 1.9 to 1.3 percent for value added and from 2.3 to 1.8 percent for employment. This decline in the percentage of FPI contribution is also illustrated by the increase in state value added and employment with a simultaneous decrease in both measures for the FPI. Although losses were also experienced in indirect contributions of the industry, some of those losses were offset by gains in induced contribution. By every measure, induced contributions increased from 2006 to 2010. This is reflected in the growth of the associated multipliers for all measures. The growth in induced contributions implies that, although the industry witnessed considerable losses over these years, the proprietors and employees of firms within the FPI and those firms affected by FPI economic activity spent more of their income within the state. A growth in induced contribution for many industries is an indication of a generally more vibrant state economy, but the fact that the growth in induced contributions is at a higher rate than indirect contributions during this period points to the domestic spending of FPI (and sectors doing business with the FPI) employees and proprietors.

Between 2010 and 2015, the West Virginia FPI started to experience considerable improvement. Industry output saw the greatest relative increases between these years in terms of both direct (19%) and total contributions (23%), reaching

Table 2.—The economic contribution of the West Virginia forest products industry (FPI) and associated Social Accounting Matrix (SAM) multipliers for 2006, 2010, 2015, and 2017. Dollar amounts reported in 2017 US dollars.

Contribution type	2006	2010	2015	2017
Direct				
Output ($MM)	2,800.0	1,788.8	2,122.8	2,218.7
Employment	15,018	9,681	10,175	10,198
Value added ($MM)	897.8	521.8	554.6	750.5
Employee compensation ($MM)	621.5	395.1	389.3	404.5
Indirect				
Output ($MM)	862.4	660.4	824.8	856.9
Employment	5,632	5,059	6,074	5,025
Value added ($MM)	361.4	307.9	371.1	460.0
Employee compensation ($MM)	192.9	164.9	204.7	197.6
Induced				
Output ($MM)	411.8	427.4	562.1	638.2
Employment	3,030	3,547	4,797	5,447
Value added ($MM)	231.5	257.4	331.5	382.0
Employee compensation ($MM)	106.3	128.9	173.3	203.1
Total				
Output ($MM)	3,654.5	2,644.0	3,241.9	3,406.8
Employment	20,745	16,608	19,029	19,219
Value added ($MM)	1,330.1	999.9	1,166.2	1,429.9
Employee compensation ($MM)	836.7	640.9	716.0	764.4
Type SAM multipliers				
Output	1.31	1.48	1.53	1.54
Employment	1.38	1.72	1.87	1.88
Value added	1.48	1.92	2.10	1.91
Employee compensation	1.35	1.62	1.84	1.89
Statewide gross regional product	70,852.9	77,155.0	74,810.6	78,481.4
% total FPI	1.9	1.3	1.6	1.8
Statewide employment	912,431	900,480	912,826	894,439
% total FPI	2.3	1.8	2.0	2.1

$2.1 billion and $3.2 billion, respectively. The number of jobs in the state supported by FPI activity grew by 2,400 over these years to reach a total of 19,029 in 2015, with 10,175 of those jobs being directly within the industry. The industry's direct contribution in terms of employment and state value added (gross state product) remained at 1.1 percent and 0.7 percent, respectively, suggesting that the industry growth over these years was on par with that of the state economy. However, in terms of total contributions made to the broader state economy over these years, the industry's share of state totals did increase from 1.8 to 2.1 percent for employment and from 1.3 to 1.6 percent for value added. This increase in the share of the FPI's contribution to the state indicates that it is performing better than the state during this period, which is illustrated by the decrease in statewide value added and employment with an increase in both for the FPI. Much of the growth in the overall industry took place in terms of indirect and induced contributions. The growth in industry indirect and induced contributions points to the industry's operation having become more highly connected with the broader economy. In the case of indirect contributions, this would mean that the FPI sourced more of its inputs from West Virginia businesses. In the case of induced contributions, it implies that industry workers and proprietors spent more of their income within the state. It could be the case that growing diversity in the broader West Virginia economy has been one of the factors contributing to this growth. Corresponding growth in SAM multipliers for the industry over these years continued, although slower when compared with increases from 2006 to 2010.

From 2015 to 2017, the FPI in West Virginia experienced continued improvement, although with limited increases in direct contribution levels in terms of output, employment, and employee compensation. The industry's direct contributions of value added grew substantially over this period, increasing by 35.3 percent. This resulted in industry direct value added accounting for 1.0 percent of the gross state product in 2017, up from 0.7 percent in 2015. The FPI's contribution in terms of total value added to the state total also grew from 1.6 to 1.8 percent. This indicates the FPI experienced larger growth in terms of value added during this period compared with the state. In terms of total employment, the contribution of the FPI to the state total employment increased from 2.0 to 2.1 percent, indicating that the industry was performing better than the state during this period. State employment experienced a decrease during this period while FPI jobs increased. Multiplier values continued to grow in 2017 but at a lower rate compared with the previous period. In 2017 the West Virginia FPI directly contributed $2.2 billion in output, 10,198 jobs, and $750.5 million to the gross state product. These results show that the West Virginia FPI experienced considerable change from 2006 to 2017. The industry did show improvements from 2010 to 2015 and continued to grow, albeit at a slower pace, from 2015 to 2017; however, the resulting 2017 direct contributions are still well below 2006 levels and total contributions increased only in terms of value added from 2006 to 2017.

The major forest products sectors

The historical performance of the individual sectors of West Virginia's FPI was also evaluated. The direct, indirect, induced, and total contributions of the different sectors of the West Virginia FPI in terms of output, employment, value added, and employee compensation over time are presented in Tables 3 through 9.

Primary solid-wood products.—In 2006, the primary solid-wood products sector was the largest FPI sector in West Virginia in terms of direct and total contributions of output and value added. This sector experienced substantial losses in direct and total contributions from 2006 to 2010 but less severe than those of the overall industry. Direct value added had the largest decrease (41%) followed by direct output (29%). It should be noted that this larger decrease in value added compared with output could be attributed to the duplicative nature of output as a measure of economic activity. Just like the overall industry, this sector started to see improvements from 2010 to 2015. This sector saw significant growth in contributions from 2010 to 2015 in both direct and total contributions in all measures. However, from 2015 to 2017, the direct contributions declined slightly

Table 3.—The economic contribution of the West Virginia primary solid-wood products sector: 2006, 2010, 2015, and 2017. Dollar amounts reported in 2017 US dollars.

Contribution type	2006	2010	2015	2017
Direct				
Output ($MM)	1,037.8	747.9	910.0	878.9
Employment	4,252	2,990	3,006	2,836
Value added ($MM)	285.6	166.9	181.4	171.3
Employee compensation ($MM)	209.3	140.2	130.9	132.3
Indirect				
Output ($MM)	479.7	365.2	459.9	494.2
Employment	3,357	2,905	3,645	2,776
Value added ($MM)	207.3	174.1	212.0	285.7
Employee compensation ($MM)	103.7	89.8	114.7	106.4
Induced				
Output ($MM)	175.2	189.3	253.8	263.2
Employment	1,296	1,577	2,173	2,257
Value added ($MM)	98.8	114.3	150.1	158.2
Employee compensation ($MM)	45.7	57.6	78.8	84.6
Total				
Output ($MM)	1,597.0	1,239.2	1,545.9	1,561.2
Employment	8,493	7,202	8,542	7,598
Value added ($MM)	566.5	441.8	529.1	601.3
Employee compensation ($MM)	340.1	276.2	313.4	311.9

for all measures. In terms of total contribution, output and value added continued to increase, much like the industry as a whole; however, employment decreased by 11 percent or about 944 jobs. In terms of the sector's size relative to the total FPI, the sector remained the industry's largest contributor of direct and total output, employment, and value added. In 2017, the sector's total output was $1.56 billion, or 46 percent of the FPI's total output, and total value added was $601.3 million, or 42 percent of the FPI's total value added. Total employment made up just under 40 percent of the FPI's total employment, or 7,598 jobs.

Table 4.—The economic contribution of the West Virginia secondary solid-wood products sector: 2006, 2010, 2015, and 2017. Dollar amounts reported in 2017 US dollars.

Contribution type	2006	2010	2015	2017
Direct				
Output ($MM)	853.1	436.1	548.1	512.7
Employment	4,792	2,721	2,747	2,613
Value added ($MM)	292.3	140.2	169.8	152.8
Employee compensation ($MM)	213.6	120.5	120.9	120.3
Indirect				
Output ($MM)	290.2	177.4	227.6	231.9
Employment	1,763	1,181	1,459	1,299
Value added ($MM)	116.9	78.6	97.1	111.6
Employee compensation ($MM)	68.2	45.5	56.1	55.6
Induced				
Output ($MM)	146.7	125.9	170.1	169.0
Employment	1,075	1,040	1,448	1,438
Value added ($MM)	82.3	75.6	100.1	100.9
Employee compensation ($MM)	37.5	37.6	52.1	53.5
Total				
Output ($MM)	1,274.5	734.5	939.1	907.0
Employment	7,544	4,912	5,621	5,316
Value added ($MM)	486.2	292.9	364.8	363.4
Employee compensation ($MM)	315.9	202.4	227.8	228.1

Table 5.—The economic contribution of the West Virginia wood furniture products sector: 2006, 2010, 2015, and 2017. Dollar amounts reported in 2017 US dollars.

Contribution type	2006	2010	2015	2017
Direct				
Output ($MM)	271.1	134.4	166.2	186.3
Employment	2,224	1,302	1,408	1,527
Value added ($MM)	112.0	59.5	48.1	49.5
Employee compensation ($MM)	90.1	54.5	55.5	66.2
Indirect				
Output ($MM)	59.0	37.1	51.6	62.5
Employment	371	257	336	394
Value added ($MM)	25.5	17.8	23.5	30.4
Employee compensation ($MM)	14.5	9.9	13.4	16.4
Induced				
Output ($MM)	53.2	48.0	62.2	70.9
Employment	387	394	525	599
Value added ($MM)	29.7	28.7	36.4	42.1
Employee compensation ($MM)	13.5	14.2	18.8	22.2
Total				
Output ($MM)	383.2	219.5	279.8	319.7
Employment	2,982	1,953	2,270	2,519
Value added ($MM)	167.2	106.0	107.9	122.0
Employee compensation ($MM)	118.0	78.5	87.6	104.7

Secondary solid-wood products.—Many of the largest losses within the West Virginia FPI between 2006 and 2010 took place in the secondary solid-wood products sector. Direct contribution in terms of value added had the largest percentage decrease from 2006 to 2010 totaling $152.1 million, or 52 percent of 2006 levels. Similarly, direct output fell by 48.9 percent and direct employment fell by 43.2 percent. The losses in this sector were the largest in absolute terms between these years by all measures of direct and total contribution. The loss in value-added wood-product manufacturing likely affected the broader state FPI

Table 6.—The economic contribution of the West Virginia logging sector: 2006, 2010, 2015, and 2017. Dollar amounts reported in 2017 US dollars.

Contribution type	2006	2010	2015	2017
Direct				
Output ($MM)	248.7	143.1	145.3	354.3
Employment	2,419	1,493	1,940	1,919
Value added ($MM)	126.9	81.1	80.7	312.2
Employee compensation ($MM)	49.7	32.2	39.1	36.3
Indirect				
Output ($MM)	50.0	40.7	35.5	19.3
Employment	647	1,161	947	453
Value added ($MM)	21.7	21.2	16.7	10.8
Employee compensation ($MM)	9.3	9.4	7.3	5.5
Induced				
Output ($MM)	60.9	65.8	74.8	138.1
Employment	454	548	636	1,173
Value added ($MM)	34.5	39.6	44.0	82.3
Employee compensation ($MM)	16.0	19.8	22.8	43.3
Total				
Output ($MM)	358.8	249.3	255.4	511.5
Employment	3,173	3,200	3,521	3,544
Value added ($MM)	182.7	141.7	141.2	405.2
Employee compensation ($MM)	74.8	61.3	69.1	85.1

Table 7.—The economic contribution of the West Virginia forestry sector: 2006, 2010, 2015, and 2017. Dollar amounts reported in 2017 US dollars.

Contribution type	2006	2010	2015	2017
Direct				
Output ($MM)	30.2	25.2	24.8	26.4
Employment	551	534	497	792
Value added ($MM)	19.3	17.2	17.5	22.7
Employee compensation ($MM)	8.3	6.6	4.5	17.6
Indirect				
Output ($MM)	2.9	2.7	2.5	1.8
Employment	29	32	24	19
Value added ($MM)	1.4	1.5	1.2	1.0
Employee compensation ($MM)	0.5	0.7	0.6	0.5
Induced				
Output ($MM)	8.8	9.3	9.7	20.9
Employment	64	77	83	176
Value added ($MM)	4.9	5.6	5.7	12.3
Employee compensation ($MM)	2.2	2.8	3.0	6.4
Total				
Output ($MM)	41.4	36.6	36.7	48.7
Employment	636	628	596	977
Value added ($MM)	25.3	23.9	24.2	35.8
Employee compensation ($MM)	10.9	9.9	8.0	24.4

through the loss of the sector's demands for inputs from the logging and primary solid-wood products sectors. This loss of intersector activity also affected the broader state economy. The decreases in the sector's total contributions to the economy resulted in the loss of 2,631 jobs (34.9%), $540 million in output (42.4%), and $193.4 million in value added (39.8%). Despite these heavy losses, secondary solid-wood products continued to be an important sector to the industry in 2010 and ranked as the second largest sector in terms of direct and total contributions in all measures behind the primary solid-wood products sector. Like the primary solid-wood products sector, this sector experienced growth from 2010 to 2015, both in direct and total contributions, for

Table 8.—The economic contribution of the West Virginia pulp, paper, and paperboard sector: 2006, 2010, 2015, and 2017. Dollar amounts reported in 2017 US dollars.

Contribution type	2006	2010	2015	2017
Direct				
Output ($MM)	229.0	209.5	193.7	150.7
Employment	337	300	260	232
Value added ($MM)	33.3	36.1	30.2	21.4
Employee compensation ($MM)	24.8	22.7	19.5	15.8
Indirect				
Output ($MM)	66.4	86.4	91.2	79.5
Employment	332	514	527	410
Value added ($MM)	25.9	39.0	40.1	40.5
Employee compensation ($MM)	13.8	20.8	21.6	19.1
Induced				
Output ($MM)	20.3	37.0	44.2	39.2
Employment	152	310	381	339
Value added ($MM)	11.6	22.4	26.3	23.7
Employee compensation ($MM)	5.4	11.4	13.9	12.8
Total				
Output ($MM)	314.8	332.7	328.3	269.2
Employment	753	1,124	1,167	980
Value added ($MM)	66.0	97.4	96.5	85.6
Employee compensation ($MM)	40.4	54.9	55.0	47.7

Table 9.—The economic contribution of the West Virginia secondary paperboard and other paper products sector: 2006, 2010, 2015, and 2017. Dollar amounts reported in 2017 US dollars.

Contribution type	2006	2010	2015	2017
Direct				
Output ($MM)	130.2	92.7	134.8	109.3
Employment	443	339	315	281
Value added ($MM)	28.4	20.7	26.8	20.5
Employee compensation ($MM)	25.7	18.4	18.9	16.0
Indirect				
Output ($MM)	14.9	15.7	26.1	23.4
Employment	77	91	155	139
Value added ($MM)	6.7	8.1	13.0	12.5
Employee compensation ($MM)	3.8	4.5	7.3	6.8
Induced				
Output ($MM)	14.4	16.6	24.9	22.1
Employment	105	137	213	190
Value added ($MM)	8.0	10.0	14.7	13.3
Employee compensation ($MM)	3.7	5.0	7.7	7.1
Total				
Output ($MM)	159.3	125.0	185.7	154.8
Employment	625	568	683	609
Value added ($MM)	43.2	38.8	54.4	46.3
Employee compensation ($MM)	33.1	27.9	33.9	30.0

every measure. By 2015, secondary solid-wood products direct output and value added grew by 25.7 and 21.1 percent from 2010 levels, respectively. The higher growth rate observed in output compared with value added suggests that input costs are rising faster than value added and those input costs are being passed on in output sales. This is due to nature of output to ''double-count'' an economic activity as mentioned previously. Thus, caution must be taken when using output as a measure of economic activity. However, direct employment only grew by 1 percent. The sector's recovery did not continue through 2017, however, because it experienced across-the-board decreases in all measures of direct and total contributions between 2015 and 2017. In 2017, the sector was the second largest contributor (both in direct and total) of output and employment and third largest contributor of value added, behind the primary solid-wood products and logging sectors.

Both the primary the secondary solid-wood products sector declined between 2006 and 2017, but the secondary solid-wood products sector showed a substantially larger decline in all measures in both direct and total contributions. For example, the secondary solid-wood products sector experienced a 39 45, 48, and 43 percent decline in direct output, employment, value added, and employee compensation, respectively. The primary solid-wood products sector, on the other hand, declined by 15, 33, 40, and 37 percent in direct output, employment, value added, and employee compensation, respectively. With regard to total contribution, the solid-wood products sector declined by close to 30 percent in all measures while the primary solid-wood products sector only declined by 15 percent and even gained 6 percent in value added. Wood is still being harvested in the state, but there have been considerable declines in both annual harvest removals of live trees and annual harvest removals of growing stock from 2006 to 2017 (Widmann and Cook 2008, Morin 2018). Annual harvest removals of live trees dropped by 31 percent and

annual removals of growing stock dropped 34 percent. The declines observed both in the primary solid-wood products sector and the secondary solid-wood products sector may be attributed to declining harvest in the state. In addition, industrial roundwood production (which includes saw logs, veneer, pulpwood, posts, mine timbers, and other miscellaneous products) in the state also declined by 11 percent between 2007 and 2012 (Morin et al. 2016).

Wood furniture.—The wood furniture sector witnessed the second biggest percentage losses in direct and total contributions among all sectors between 2006 and 2010 for every measure except output, in which it experienced the largest loss. Between 2006 and 2010, the wood furniture and secondary solid-wood products sectors were the only sectors to lose larger percentages of all their direct contributions than the industry as a whole. Although the wood furniture sector experienced smaller losses in absolute terms, the sector's losses of total contributions to the broader state economy were still substantial, with 1,028 jobs being lost (34.5%) alongside a $163.7 million decrease in output (42.7%) and $61.2 million decrease in value added (36.6%). From 2010 to 2015, the sector witnessed badly needed increases in direct output and employment, increasing 23.6 and 8.1 percent, respectively. Despite a continued reduction in direct value added of 19.2 percent, or $11.4 million, from 2010 to 2015, the sector's total contribution rose for all measures. The increases in the sector's total contributions were generally on par with those of the industry, but below those of the industry in terms of value added. This resulted in the sector not substantially growing its share of overall industry total contribution over this period. Between 2015 and 2017, the wood furniture sector was the only major FPI sector to experience increases in both direct and total contributions in all measures. The largest improvement was in direct output, which increased by 12.1 percent from 2015 levels. Total output increased by an even larger percentage, gaining 14.2 percent from 2015 levels.

Logging.—The logging sector also experienced significant decreases in direct contribution from 2006 to 2010. In terms of direct output and employment, the percentage losses were greater than that of the industry as a whole. However, in terms of total contribution, output and value added declined while employment increased slightly, adding about 27 jobs, or a 0.9 percent increase. This suggests that the logging sector's demand for inputs was supporting a much larger amount of employment in other sectors of the economy. From 2010 to 2015, this sector showed a slight improvement in direct and total output, increasing 1.6 and 2.4 percent, respectively.

Direct and total employment experienced much greater growth, increasing by 29.9 percent, or 447 jobs (19.1% of West Virginia FPI total employment), and 10 percent, or 321 jobs (10% of West Virginia FPI total employment), respectively. Direct and total value added did not increase, but only declined by just under 1 percent from 2010 levels. From 2015 to 2017, the logging sector experienced larger increases in direct contributions of output and value added, despite a slight decrease in employment. The largest growth took place in the sector's direct contribution of value added, which rose by $231.5 million, or nearly three times its 2015 value of $81.1 million.

Direct output also grew significantly, increasing by 143.9 percent from 2015 levels. Total contribution improved considerably for all measures, with output and value added exhibiting the largest growth again. Employment only grew by just under 1 percent. The immense growth in logging sector value added between these years is likely attributable to a combination of factors. The growth is not also seen in employee compensation; therefore, it is likely partially due to more efficient logging operations by owner-operators in mechanized logging operations. A contributing factor may also be an increase in logging for clearing timber for gas pipeline right-of-ways between these years as a result of the boom on Marcellus shale gas drilling, which, if the timber is nonmerchantable, results in an increase in proprietor income but not in the costs associated with traditional logging operations. In general, there was also an 11 percent increase in timber harvest during this period (Morin 2016, 2018).

Forestry.—In 2006, the forestry sector was the smallest industry sector by every measure except for employment. Despite decreases in direct and total contributions for all measures between 2006 and 2010, the forestry sector fared much better than the industry overall. The particularly muted decrease in employment resulted in the sector accounting for 5.5 percent of the industry's overall direct employment in 2010, compared with 3.7 percent in 2006. Between 2010 and 2015, direct and total employment fell by 7 and 5 percent, respectively. Direct output continued to decrease during this period, but total output showed a slight improvement, increasing by just under 1 percent. Direct and total value added grew by just under 2 percent. This sector performed much better between 2015 and 2017. Direct contributions increased for all measures with the greatest growth observed in employment, which increased by 59.3 percent. Similarly, total contributions also increased for all measures with employment increasing by 63.9 percent. Just like the logging sector, the recovery of this sector between 2015 and 2017 may be attributed to an increase in harvest activity in the state during this period, either from timber harvest in forest lands or clearing of right-of-ways for Marcellus shale drilling. Annual harvest removals of live trees and growing stock trees both increased by 11 and 9 percent, respectively, between 2015 and 2017 (Morin 2016, 2018).

Pulp, paper, and paperboard.—Despite losses in direct contributions of output and jobs, direct value added increased from 2006 to 2010. The pulp, paper, and paperboard sector was the only industry sector in which total contributions increased in all measures between 2006 and 2010. The largest gains were observed in total employment and value added, increasing by 49.2 and 47.6 percent, respectively.

Total output only increased by 5.7 percent, or about $17.9 million. Between 2010 and 2015 the sector saw continued decreases in direct contributions of output and employment. However, unlike the changes between 2006 and 2010, direct value added also decreased by 16.2 percent. In terms of total contributions, only employment showed an improvement, gaining 43 jobs from 2010 levels. Between 2015 and 2017, this sector experienced declines in both direct and total contributions for all measures. In fact, the most substantial percentage decreases in direct contributions of any FPI sector took place in the pulp, paper, and paperboard sector. A decrease of 29 employees working in the sector led to it being ranked last in terms of direct employment for 2017.

Secondary paperboard and other paper products.—Similar to the pulp, paper, and paperboard sector, the secondary paperboard and other paper products sector also

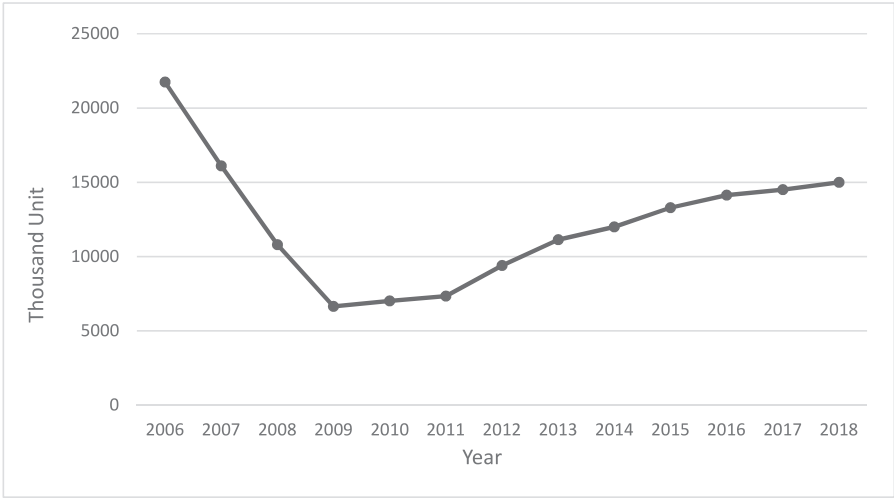

Figure 1.—Total new privately owned housing units started in the United States from 2006 to 2018 (Source: US Census Bureau 2019).

experienced decreases in direct contributions of output and employment from 2006 to 2010. However, in addition to direct output and employment, this sector also experienced a decline of $7.7 million in value added, or about 27 percent from 2006 levels. Total contributions also decreased from 2006 to 2010 for all measures with the largest reduction coming from output. Total output decreased by 21.6 percent from 2006 levels. For the period 2010 to 2015, this sector showed improvement in both direct and total contributions except in direct employment, which fell by 7.1 percent. The largest percentage gain of any direct contribution took place in the sector's direct output, which rose by a substantial 45.4 percent from 2010 to 2015. Like the pulp, paper, and paperboard sector, this sector saw double-digit percentage decreases for all measures of direct and total contributions. Despite a favorable trend between 2010 and 2015, this sector suffered during the period of 2015 to 2017. Direct and total contributions declined in all measures evaluated during this period. The largest reduction in direct contribution was in value added, decreasing by 23.6 percent from 2015 levels. With respect to total contribution, output had the largest decrease at 16.7 percent.

Discussion and Conclusions

The West Virginia FPI has undergone significant changes since the last assessment of the industry's economic contribution in 2005. Continuing pressures of global competition, increasing automation, and the immense repercussions of the recession of the mid-to-late 2000s similarly affected many industries in the state. The period 2006 to 2010 illustrates a significant decline in the West Virginia FPI's economic contributions to the state's economy and is consistent with the performance of the US housing market, which suffered massive decline beginning in 2006 that eventually led to a severe recession in 2008. In fact, there was a sharp decline in new privately owned housing starts in the United States beginning in 2006 (Dahal et al. 2015) Moreover, Keegan et al. (2011) reported that the period 2009 to 2011 exhibited the worst homebuilding and wood products markets since the Great Depression. The FPI in other regions of the country was also severely affected by the collapse of the housing market and economic recession that followed. Woodall et al. (2011) found that the FPI of the northern region of the United States experienced employment decline of approximately 28 percent between 2005 and 2010. Similarly, Hodges et al. (2011) found that FPI employment in the southern United States decreased by 25 percent from 2005 to 2010. The total economic impacts of Ohio's forest-based industries also declined between 2001 and 2011 (Coronado et al. 2015). In Mississippi, the FPI also severely declined after 2006 (Dahal et al. 2013). Out west, sales of wood and paper products dropped by 31 percent and employment in the forest industry declined by 71,000 workers between 2005 and 2009 (Keegan et al. 2011). These clearly indicate how the FPI in general is closely tied to trends in the housing market, and the West Virginia FPI is no different.

The West Virginia FPI started to experience considerable improvement for the period 2010 to 2015, with both direct and total contributions increasing for all measures. This trend is again consistent with the performance of the US housing market during this period, where recovery started picking up after the housing market collapse beginning in 2006. For example, total new privately owned housing units began increasing from 2010 to 2015 (Fig. 1). This trend continued from 2015 through 2018 but at a much slower pace. The same can be observed for West Virginia's FPI during this period. From 2015 to 2017, the FPI in West Virginia experienced continued improvement, although with limited increases in direct contribution levels in terms of output and employment. However, it has fared better than neighboring state Kentucky. During this time, Kentucky experienced a slight decrease in direct output and employment (Stringer et al. 2018). Multiplier values continued to increase in 2017 but remained lower when compared with those reported for Michigan. The associated multipliers for the overall Michigan FPI for employment and output were 2.52 and 1.77, respectively (Leefers 2017). Kentucky also reported a higher employment multiplier of 2.27 but a more comparable output multiplier of 1.59 (Stringer et al. 2018). Ohio's FPI multipliers were also higher for all measures. According to Coronado et al. (2015), Ohio had FPI multipliers of 2.25 for employment, 2.13 for value added, and 1.60 for output. The lower multiplier values for West

Virginia compared with neighboring states are generally indicative of a less diverse, more rural economy. In addition, geographically, West Virginia is a much smaller state. Regions with a small geographic extent will have lower multipliers compared with larger regions because of larger leakage (Klemperer 2003). Between 2015 and 2017, the industry's share of the state's employment and gross state product increased, indicating the industry outperformed the overall state economy over those years. The jobs, revenue, and employee compensation that the industry provides are crucial to the state and its residents. In 2017, the FPI was found to be a significant industry in the state's economy, directly contributing 1.1 percent of all employment and 1.0 percent of gross state product. Furthermore, FPI activity supported 2.2 percent of all employment and 1.8 percent of gross state product in the broader state economy through its total contributions.

Despite the improving trend in the West Virginia FPI, the overall changes in the economic contributions of the state's FPI from 2006 to 2017 reflect an industry that largely failed to return to the levels of total contributions the industry provided to the state in 2006. Certainly, in terms of total sales and jobs, the industry supported less in the state economy in 2017 than it did in 2006. However, in terms of total valued added, or contribution to gross state product, the industry did show improvement over 2006 levels. Though, closer examination of the data has shown that these gains arose as a result of increases in induced contributions and, to a lesser extent, indirect contributions that were spurred by the industry but took place in the broader economy. This growth in nondirect industry contributions relative to direct contributions was reflected by growth in multiplier values and was a common thread found across the years, sectors, and measures of contribution analyzed. This trend illustrates that although direct industry economic activity declined, the interindustry activity and spending of personal income by workers and proprietors that arose as a result of the industry's operations increased within the state. In addition, the increase in induced contributions can also be an effect of a stronger and more vibrant economy as well as increased domestic spending, especially during the recovery period. This increase in household spending could be driven by increase in personal income in the state. West Virginia experienced about 1.1 percent average annual growth in real per capita income and in 2017 per capita personal income in the state stood at 75 percent of the national average (Bureau of Business and Economic Research 2019). The added activity in the broader economy is, of course, beneficial to the state, but it is important not to lose sight of the fact that the underlying direct contributions of the FPI in 2017 were still well below those experienced in 2006.

The failure of the industry to return to 2006 levels of economic contribution is partially reflective of the fact that the demand for products used in housing construction was overinflated in 2006, which came to a halt with the collapse of the housing market. However, it also suggests that longer term pressures on the industry continue to negatively affect industry economic contribution. The offshoring of value-added hardwood industries, paired with the continued increase in automation, have continued to produce disruptions for the eastern US hardwood industry over the past two decades (Luppold and Bumgardner 2016). In addition to these longer term trends, new challenges have emerged, such as the uncertainty many forest products firms face about future access to the foreign markets upon which they have been increasingly dependent. Additionally, state-specific challenges, such as poor human capital outcomes and competition for resources from emerging industries like those related to the Marcellus shale natural-gas boom, are also likely cause for lack of growth in the industry's direct economic contributions to the state. The Marcellus shale natural-gas boom has certainly influenced FPI development over the past decade, with much of the state's economic development resources aimed at developing natural gas exploration and downstream activity. Shifting environmental regulatory requirements that support natural gas extraction and plentiful supplies of natural gas from Marcellus shale have expanded demand from the utilities sector, causing continued growth in the oil and natural gas industry (Lego et al. 2014). In addition, the natural gas industry has made considerable investments in the state to pay for well drilling, mineral royalties, and pipeline infrastructure, among other investment costs totaling $40 billion between 2010 and 2016, which provided a significant boost to the state's economy (Bowen 2018). The construction of the Appalachian Underground Gas Storage Hub is also a top economic priority for the state's governor, financed by a combination of private investment and a $1.9 billion loan from the Department of Energy (Patterson 2019). Although this has generally been viewed as part of the state's effort to offset the long-term decline in coal production, it has also likely stunted the development of the state's FPI. For example, higher wages in the oil and gas industry have created labor competition for the FPI, particularly in the logging sector. Timber resource conditions and labor may also be contributing factors. Pelkki and Sherman (2020) found total economic contributions of forest industry in the United States to be correlated to timber removals and rural population. As mentioned earlier, timber harvest removals in West Virginia fell by as much as 34 percent between 2006 and 2017, although annual net growing stock have increased (Widmann and Cook 2008, Morin 2018). West Virginia's population also fell by 0.50 percent during this time period (US Census Bureau 2020), which can affect the available workforce. In fact, the state's civilian labor force fell by 3 percent during the same time period. However, the growth of the industry's nondirect support of the broader state economy, relative to the size of the industry itself, is something that should be leveraged. This growth, which is represented by the industry's increasing multiplier values, should be viewed as an opportunity because any growth in the industry would not only benefit FPI businesses and their workers, but would also benefit the broader state economy. Larger multiplier values for the industry mean that it has become more integrated and dependent on the state economy (Coronado et al. 2015). The multiplier values that were found for the industry reflect a potential economic advantage over other industries such as tourism and outdoor recreation. The ability of the FPI to not only coexist with these industries but to complement them is a key advantage of the industry.

With regard to the performance of the individual FPI sectors in West Virginia, the trend in economic contributions for the most part follows that of the overall FPI industry. The primary solid-wood products sector remained the largest component of the FPI industry over the period evaluated in terms of direct output. Although this sector experienced immense decreases in direct contributions

between 2006 and 2017, it was found to be somewhat more resilient and, as of 2017, had the largest total contributions of any sector by all measures analyzed. The industry's transition away from the more value-added sectors of the industry and into primary solid-wood products may be illustrative of the industry becoming more reliant on exporting its forest resources to be used in value-added processes outside of the state. West Virginia has a history of exporting its natural resources outside of the state for further processing, and the relative health of the logging and primary solid-wood products sectors when compared with the value-added sectors is indicative of this. In an attempt to develop a more diverse FPI in the future, efforts should be made by economic development authorities and industry proponents to attract and grow the value-added sectors of the industry, connect FPI firms along the value-chain, and improve transportation infrastructure within the state. These efforts would not only grow FPI direct contributions but would reverberate throughout the broader economy as economic leakages are contained within the state.

The two sectors most closely tied to the housing market, the secondary solid-wood products and wood furniture sectors (Dahal et al. 2013), experienced the largest relative decreases in direct contributions from 2006 to 2010. Despite a partial recovery in the sectors from 2010 to 2015, by 2017 the largest percentage decreases in direct contribution from 2006 levels were found in these sectors. The secondary solid-wood products sector showed recovery between 2010 and 2015, but it did not continue through 2017. This could be partly due to a 2.5 percent decrease in housing starts, as measured by new private housing units authorized by building permits, in West Virginia between 2015 and 2017 (US Census Bureau 2020). The losses in the state's secondary solid-wood product sector have immense consequences for the industry as a whole. The inability of the sector to regain its footing in recent years is even more troubling. As this sector continues to struggle, the primary solid-wood products manufacturers and other FPI sectors are becoming increasingly dependent on business with secondary wood product manufacturers outside of the state, which results in further loss in overall economic contribution to the state. With regard to the wood furniture sector, it should be noted that, preceding the housing market collapse of the mid-2000s, this sector had already been in decline since the late 1990s (Luppold and Bumgardner 2016, Howard et al. 2017).

Therefore, those losses in the sector prior to 2006 were not captured by this analysis. Losses in the broader wood furniture sector were largely attributed to the decline in housing construction and the longer term trend of offshoring wood processing (Woodall et al. 2011). The wood furniture industry in the United States did start to stabilize in 2012 and has shown continued growth into 2016, growing 2.9 percent annually in production (Howard et al. 2017). The performance of West Virginia's wood furniture sector is consistent with this trend because the sector started to improve for the period 2010 to 2015 except for direct value added. It continued to show improvement for the period 2015 to 2017 with both direct and total economic contributions increasing for all measures. In order for the state to realize the full economic potential of its forest resources, an effort must be made to cultivate and grow new and existing activity within the secondary solid-wood products and wood furniture sectors. These sectors not only produce large numbers of relatively high-paying jobs compared with other FPI sectors (e.g., the secondary solid-wood products sector's employee compensation in 2017 is 63% to 91% higher compared with logging, forestry, pulp and paper, and secondary paperboard and other paper products sectors; the wood furniture sector is 20% to 76% percent higher compared with these sectors), but they also provide in-state demand for the state's primary forest resources. The pulp and paper–related sectors, which have traditionally not been a feature of the industry in the state, although small, were reflective of the industry as a whole between 2006 and 2017.

These sectors experienced substantial decreases in direct contributions during the period evaluated and mixed changes in total economic contributions. The primary pulp, paper, and paperboard sector, however, fared somewhat better than the more value-added sector of secondary paperboard and other paper products. The decline in employment, particularly for the period 2015 to 2017, in these sectors maybe reflective of increasingly automated sectors requiring a smaller but more highly skilled workforce. Brandeis and Hodges (2015) also observed a decreasing trend in the pulp and paper sector in the southern states. The falling demand for paper and print as electronic communications continue to grow is likely to continue disrupting these sectors; however, increases in demand for paperboard shipping containers could potentially offset some of these decreases.

Both the forestry and logging sectors have shown signs of recovery for the period 2015 to 2017. In fact, these two sectors showed the largest improvement during this period except for employment for the logging sector. While logging sector output and value added have made significant gains since 2006, employment suffered substantial losses. It has been shown that a potential cause of the downturn in logging employment in the state may be the emergence of the natural gas industry's demands for labor due to Marcellus shale exploration (Grushecky and Wang 2013). Another cause may come in the form of increasing worker compensation costs, which have put downward pressure on logging employment (Casto 2018). The state legislature recently passed a bill that would remove the surcharge on all West Virginia businesses effective December 31, 2018. According to the director of the West Virginia Division of Forestry, this landmark legislation should result in more affordable workers' compensation rates, providing insurance coverage to an FPI that has been virtually denied insurance for years (Casto 2018). This move by the state should help the logging industry recover. The state is also facing an aging workforce coupled with a deficit of new younger workers to fill the void, which likely is contributing to the failure of logging employment to return to historical levels. The general increase in the number of mechanized logging operations, as well as the economic downturn's effect of ''weeding out'' less efficient hand-felling logging operations, are also likely contributing factors. To address these issues, the state should not only focus on traditional skill development but on recruitment efforts aimed at the younger workforce. Recruitment efforts may benefit from emphasizing the technological advances in the sector to potential workers who may have a distorted view of the industry as it exists today. Continuing investment in technology is important to make logging more attractive to the younger workforce. As family-owned logging operations struggle to ''pass down''

their businesses to younger generations, investments in outreach and education must be made by industry leaders in conjunction with educational and workforce development officials to showcase how industry technology has developed in recent decades.

To grow West Virginia's FPI, concerted efforts must be made by the state's policymakers, economic development authorities, industry advocates, and entrepreneurs. As mentioned earlier, efforts should be centered on the value-added sectors of the industry, particularly the secondary solid-wood products and wood furniture sectors. The losses of these sectors in the state not only affect firms and workers of these particular sectors but are felt throughout the industry through the loss of potential intrastate activity among the individual forest products sectors. The increasing reliance of the industry on exporting the state's forest resources for value-added processing outside of the state is a major leakage of potential economic activity. Investments made to induce growth in the value-added wood-product manufacturing sectors of the industry would produce a greater return through spurring broader industry-wide activity. Specifically, investment in research and development in wood processing technologies, as well as training current and potential FPI workers for those new technologies, should absolutely be a part of a concerted effort to not only grow the FPI in the state but develop it. State policy officials and some forest products companies have started to invest in efforts to grow the FPI in the state. For example, the current governor of the state has proposed a ''Timber Industry Plan'' to encourage growth of the timber industry and to attract sawmills, processing plants, and furniture manufacturers to the state (Marks 2017). Part of the plan includes creating a worker's compensation insurance risk pool for loggers to reduce their premiums; pursuing investments on biomass energy plants; finishing Corridor H to provide easier access to east coast markets and ports; helping companies market their products for export and to domestic costumers; promoting additional forestry training courses at community colleges; connecting logging operations to existing industry to recycle their excess heat production to run lower cost dry kilns so that more timber can be processed locally; and pushing for a federal subsidy that supports hardwood manufacturing. Some forest products companies are also making investments in upgrading their facilities. These proposed policy actions by the current government and continued investments by existing forest products companies will strengthen the role of the FPI as an economic driver in the state. Continued research into the economic contribution of the state's FPI is also needed in order to track industry performance over time to address key economic issues faced by the FPI industry as a whole and its component sectors.

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