Trade and American Jobs

The Impact of Trade on U.S. and State-Level Employment: 2022 Update

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Trade Partnership Worldwide LLC

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Executive Summary

Policymakers continue to face a host of challenges, including getting the economy through the pandemic, and creating and sustaining good jobs for millions of American workers. Trade policies and programs are tools in accomplishing this task.

To support hiring dependent on trade, it is important to understand first how important trade is to economies and jobs under "normal" circumstances. This report reviews the data of these benefits for U.S. workers *before* the global pandemic took hold. By looking at this relationship prior to the pandemic, one can better appreciate what was lost and see the importance of adopting trade-enhancing policies that will help American workers, small businesses, farmers, and families get back on their feet through the pandemic and beyond. But looking at 2019 also enables us to see how recent trade-restrictive policies have changed the makeup of U.S. employment – sometimes for the better; sometimes, not.

Based on the latest available data for this assessment (2019) and taking into account both the gains and the losses (i.e., a net estimate), we find that trade supported over 41 million U.S. jobs in 2019. One in every five U.S. jobs was linked to exports and imports of goods and services. Two times as many jobs were supported by trade in 2019 as in 1992 – before the accelerated wave of trade liberalization that began with the implementation of the North American Free Trade Agreement (NAFTA) in 1994 – when our earlier research found that trade supported 14.5 million net jobs, or one in every ten U.S. jobs.

- U.S. trade – both exports and imports – has grown over the past two decades, caused in part by trade liberalizing international agreements as well as increasing demand, purchasing power, and growth outside the U.S. This led to the growth of the number of U.S. jobs tied to trade. Indeed, trade-dependent U.S. jobs grew four times as fast as U.S. jobs generally.

- Every U.S. state realized positive net employment directly attributable to trade in 2019.

- Trade had a positive net impact on U.S. jobs in both the services-providing and good-producing sectors.

- Trade enables millions of workers to earn middle class wages. It also supports employment of union workers and minorities.

I. Introduction

Americans continue to face a host of challenges. Chief among them is finding a way past the coronavirus pandemic that has upended everyone's lives and inflicted so much damage on the U.S. and global economies. Hundreds of thousands have lost their lives; millions lost their jobs. Also important is getting the U.S. economy and labor market back on track. Putting people back to work – particularly those who are most vulnerable during extended periods of unemployment – is fundamental to moving forward.

As policymakers consider ways to accomplish this goal, it is useful to consider carefully the contribution international trade makes to U.S. employment. In addition, it is helpful to understand not only who benefits from trade but also who loses, and whether the net impact is positive or negative.

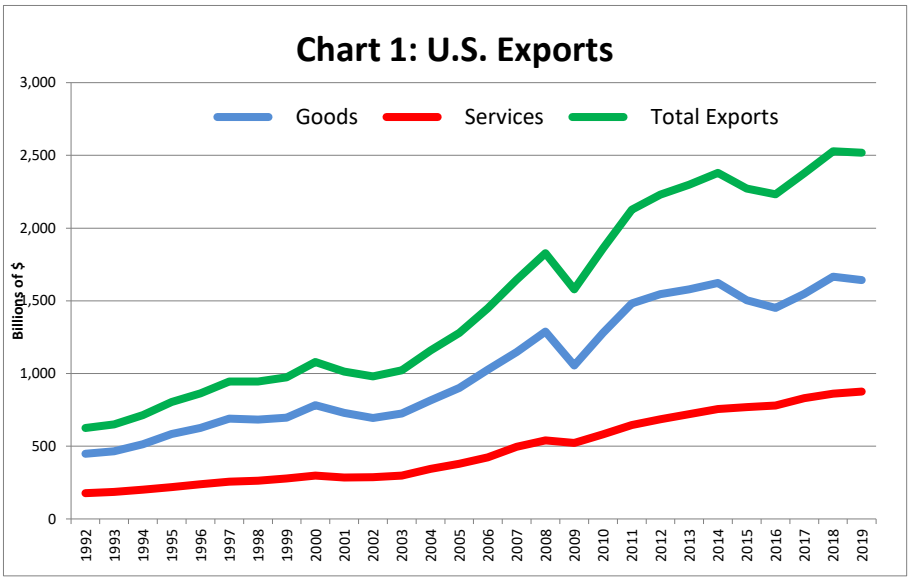
The 2022 Trade and American Jobs report updates a series of path-breaking studies, first issued by Business Roundtable in 2007, that offer a thorough examination of the impacts of trade on U.S. jobs.[1] As in prior studies, this updated report examines the impacts, positive and negative, of both exports *and* imports of goods and services on U.S. employment based on the latest available data (2019). It confirms that trade has a net positive impact on American jobs. In past years, we have looked closely at jobs tied to trade with key trading partners. In this updated, however, we take a closer look at the workers who hold those jobs tied to trade. We find that trade dependent jobs offer millions of workers middle class wages. Workers represented by unions depend on trade for their jobs. Finally, millions of minorities are employed in trade-dependent jobs.

[1] Laura M. Baughman and Joseph Francois, *Trade and American Jobs: The Impact of Trade on U.S. and State-Level Employment*, prepared for the Business Roundtable, February 2007; *Trade and American Jobs: The Impact of Trade on U.S. and State-Level Employment, An Update*, prepared for the Business Roundtable, July, 2010; *How the U.S. Economy Benefits from International Trade and Investment* (2013), prepared for the Business Roundtable; *Trade and American Jobs: The Impact of Trade on U.S. and State-Level Employment, 2014 Update*, prepared for the Business Roundtable, October 2014, *Trade and American Jobs: The Impact of Trade on U.S. and State-Level Employment, 2016 Update*, prepared for the Business Roundtable, January 2016; *Trade and American Jobs: The Impact of Trade on U.S. and State-Level Employment, 2018 Update*, prepared for the Business Roundtable, March 2018; *Trade and American Jobs: The Impact of Trade on U.S. and State-Level Employment, 2019 Update*, prepared for the Business Roundtable, February 2019, and *Trade and American Jobs: The Impact of Trade on U.S. and State-Level Employment, 2020 Update*, prepared for the Business Roundtable, October 2020.

II. The Importance of Trade to the United States

The pandemic has demonstrated the importance of trade to the global economy, from enabling the manufacturing and distribution of medical supplies and vaccines, to ensuring consumers have access to products as consumption patterns shift significantly between services and goods.

Prior to the pandemic, in 2019, trade was also a vital part of the U.S. economy,[2] even though trends in exports and imports show the negative impacts of a series of "trade wars" that accelerated during the year.[3] U.S. exports of goods and services declined by $9.1 billion (-0.4 percent) from 2018-2019, reflecting a $22.5 billion drop in goods exports (-1.4 percent). Chief among the goods exports experiencing the largest declines by total value were petroleum and coal products and gasses, aerospace products and parts; ferrous (steel) and nonferrous (excluding aluminum) products; industrial machinery, basic chemicals, oilseeds and grains and motor vehicle parts.



Notably U.S. services exports, unaffected by the trade disputes, increased by $13 billion. Large increases were experienced by computer services (software, cloud computing and data storage, e.g.), and professional and management consulting services (e.g., legal, accounting and management consulting).

Source: Bureau of Economic Analysis, U.S. Department of Commerce, as detailed in Appendix Table A1.

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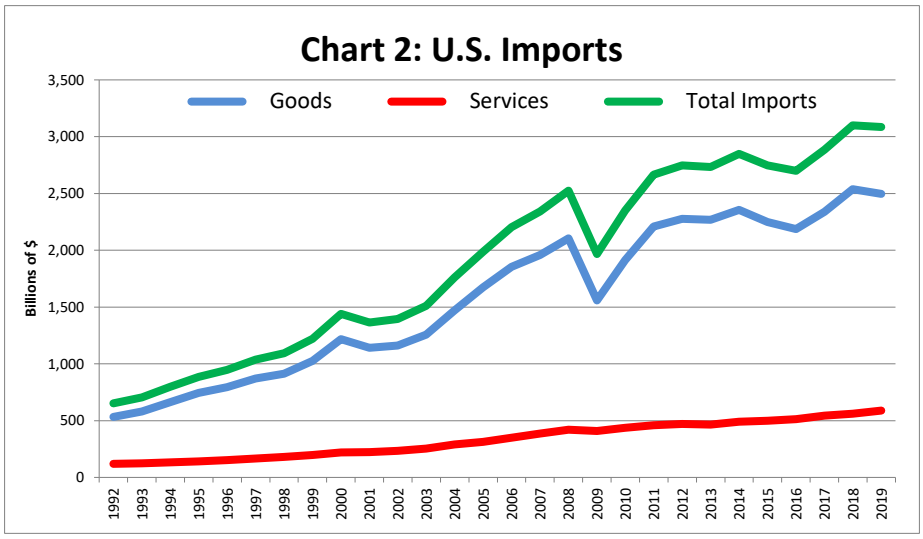
[2] We focus in this update on 2019, even though trade data for 2020 are available, because the data we need for the employment analysis that follows was only available at the time of this writing for 2019.

[3] President Trump imposed tariffs on imports of solar cells/modules, large residential washers and steel and aluminum in early 2018; Lists 1 and 2 of goods imported from China in the summer of 2018, List 3 products from China in the spring of 2019 and List 4A products from China and selected products from the European Union in the fall 2019. Trading partners affected by the steel/aluminum tariffs and China retaliated against U.S. exports. See Congressional Research Service, "Trump Administration Tariff Actions: Frequently Asked Questions," R45529, Updated December 15, 2020, https://fas.org/sgp/crs/row/R45529.pdf.

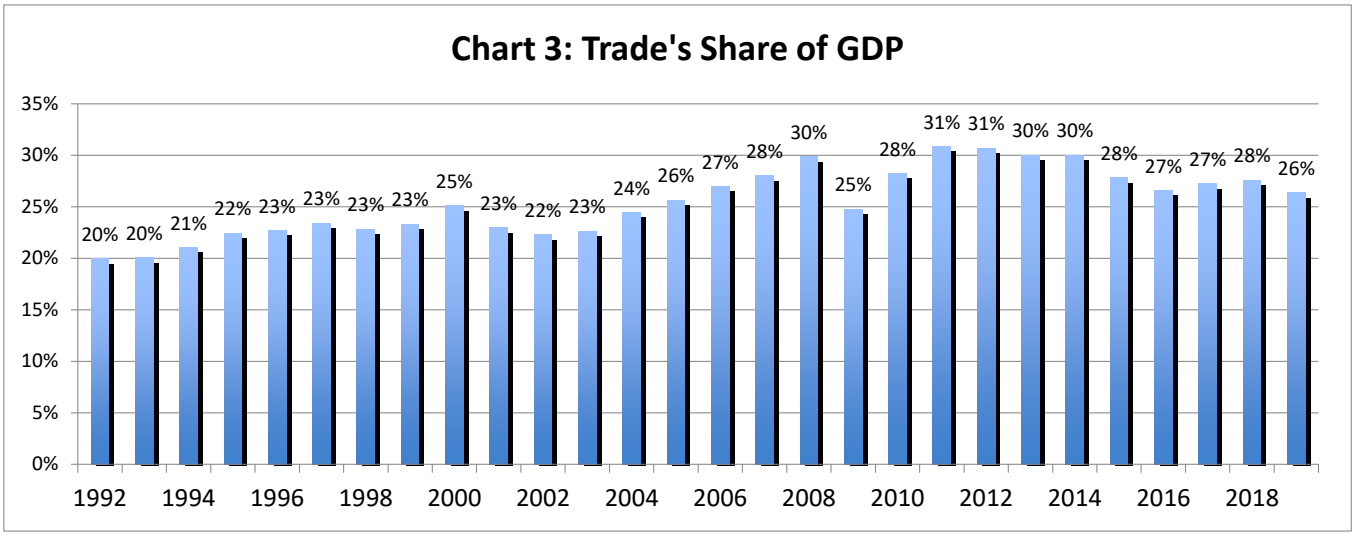
Trade-war induced declines in goods imports also drove a decline in imports in 2019. Overall, goods and services imports declined nearly $14 billion (-0.4 percent). U.S. imports of goods dropped by $40 billion from 2018-2019 (-1.6%). Categories of imports hardest hit (by total value) included oil and gas, communications equipment, semiconductors and other electronic components, petroleum and coal products, iron and steel, basic chemicals, motor vehicle parts, and computer equipment.



Source: Bureau of Economic Analysis, U.S. Department of Commerce, as detailed in Appendix A, Table A2.

Services imports, also unaffected by the trade wars, increased by $2.6 billion. Large gains were recorded for imports of travel services (U.S. travelers going abroad) and certain R&D services.

Trade has always been an important part of the U.S. economy, as our past reports have demonstrated. However, that importance declined measurably in 2019, again likely to the disruption caused by the various tariffs imposed by the United States and many of its trading partners. Trade (exports plus imports) as a share of GDP dropped from 27.6% in 2018 (and an average of about 27% from 2015-2018) to 26.4% in 2019.



Source: Derived from Bureau of Economic Analysis, U.S. Department of Commerce, as detailed in Appendix A, Table A3.

Studies have also demonstrated the correlation between growth in trade and growth of economies. They find that trade is a factor in driving economic growth.[4] Countries with higher rates of GDP growth also have higher rates of growth in trade as a share of output. Economic growth is supported by trade when competition with foreign firms spurs domestic firms to innovate and become more productive. It is supported when firms seek to operate on a large scale (to supply not only domestic customers but foreign as well) so they are able to lower their costs per unit produced, for example. This latter point is particularly true of small businesses, who can significantly grow sales by reaching customers globally. So, a resumption of growth in U.S. trade should have a positive impact on growth of the U.S. economy generally.

[4] For a summary see Esteban Ortiz-Ospina, "Does Trade Cause Growth?," October 22, 2018, https://ourworldindata.org/trade-and-econ-growth.

III. Trade and American Jobs

Concerns about the impact of trade on U.S. jobs remain widespread in America. It is generally accepted that exports have a positive impact on U.S. jobs. However, many worry that imports have a negative impact on U.S. jobs. A large number believe that trade has caused significant disruption in concentrated segments of the U.S. workforce – that, for example, the beneficiaries of trade are generally college-educated workers in so-called "white collar" jobs, but that workers without a college degree or holding "blue collar" jobs have been left behind by trade growth. If trade is to contribute to job growth for all segments of the U.S. working population, it is useful to understand how trade impacts each.

A proper assessment of the impacts of trade on U.S. jobs should use an approach that captures the full range of the many ways in which those impacts are experienced by farmers, manufacturers, services providers, workers and consumers. This study uses such an approach, which is detailed in Appendix B. Briefly stated, it explores the direct and indirect effects of exports, the direct and indirect effects of imports, and the effects of additional trade-induced spending on U.S. output and consumption and, consequently, jobs. It reflects the differences in price, quantity and quality between imported goods and U.S.-produced goods. It also captures the jobs directly and indirectly related to the process of importing goods and services into the United States (e.g., jobs associated with transporting imports from the ports to warehouses, jobs at the warehouses, or retail jobs that sell the imported goods if they are finished consumer products). Finally, our methodology also considers the positive and negative effects of trade on jobs, and results reported are therefore "net" job impacts.

More than 41 million net jobs depend on trade.

This study first estimates the net impacts of trade (exports and imports of goods and services) on jobs by sector. We then drill down on those jobs to explore the characteristics of each. We look at such measures as education, wages, unionization, and race.

Briefly, the findings of this analysis are as follows:

- In 2019, an estimated 41.5 million net jobs were tied to trade.
- These jobs represented 20.3% of total employment, or one in five jobs.

- Between 1992 and 2019, trade-dependent jobs increased by 186% (from a net of 14.5 million[5] to 41.5 million).

- Nearly two times as many jobs were supported by trade in 2019 (20.3 percent) as in 1992 (10.4 percent) – before the accelerated wave of trade liberalization that began with the implementation of NAFTA in 1994.[7]

Table 1
Net Number of U.S. Jobs Related to Trade,* 2019
(Thousands)

Total	**+41,456.7**
Good-producing sectors	**+1,628.2**
Agriculture, forestry, fishing	-405.5
Mining and energy	-66.3[6]
Construction	+2,347.0
Manufacturing	-247.0
Services-producing sectors	**+39,828.5**
Wholesale and retail trade	+5,247.7
Financial activities (including insurance)	+2,351.5
Transportation and utilities	+1,121.5
Communications and information	+2,317.8
Business and professional services	+8,785.7
Education and health services	+6,069.1
Leisure and hospitality; other personal services	+8,260.5
Public administration (government)	+5,674.7
Share of Total U.S. Employment	**20.3%**

* "Trade" = exports plus imports of goods and services.
Source: Authors' estimates.

- Trade has a net positive impact on U.S. jobs in both the services-providing and good-producing sectors.

- Overall it also has a net positive impact on workers with at best a high school education, those earning middle class wages, unionized workers and minority job holders.

Table 1 reports the net number of U.S. jobs, by major sector, that exist because of U.S. 2019 exports and imports of goods and services. In 2019, over 41 million U.S. workers owed their jobs to trade. These jobs represent one in every five jobs in the United States in 2019.

The negative estimated job effects for agriculture, forestry and fishing and for manufacturing reflect two dynamics, one unique to 2019. First, our modeling scenario (described in detail in Appendix B) seeks to quantify the impacts of 2019 trade on U.S. output and employment taking into account the ways in which sectors interact with each other and with the global economy. Directly, exports support U.S. jobs; imports both support and cost U.S.jobs. Indirectly, trade both supports and costs

[5] Baughman and Francois (2007), *op cit*.

[6] The U.S. energy sector presents a special case with respect to the impacts of trade on jobs. Despite significant increases in domestic crude oil production, the United States still imports 3.3% of its daily consumption of petroleum (see https://www.eia.gov/tools/faqs/faq.php?id=32&t=6). Therefore, our modeling scenario (the impact of the absence of trade – exports and imports of petroleum, as described in Appendix A) means that the United States would need to produce *all* of its petroleum, including crude oil, requirements domestically. This would require U.S. petroleum producers to draw resources (including labor) from other sectors of the economy (an additional 437,000 workers).

[7] Baughman and Francois (2007), *op cit*., Table 6, p. 12.

still other jobs in other sectors. Thus, net negative estimate for the trade-related in manufacturing reflects (in part) the impacts of imports on U.S. output and employment. But the job effects of 2019 trade also reflect a new development in that year: the impacts of the various "trade wars" that escalated in 2019 and reduced not only U.S. imports (which would benefit some U.S. manufacturing jobs and hurt others) but also retaliation by U.S. trading partners that impacted U.S. exporters, particularly of agricultural goods and also of manufactured goods. The negative jobs impacts reported in Table 1 for agriculture are largely (but not completely) driven by this second feature of 2019.

Most trade-related jobs are in sectors also hard-hit by the pandemic.

As noted above, the biggest impacts of trade are the ways in which it increases spending across the U.S. economy. But most analysts seeking to assess the impacts of trade on U.S. jobs stop with the direct and indirect impacts of exports and imports. In doing so, they miss the largest source of job-creating activity that comes from trade: the extra spending power companies, workers and consumers have in their bank accounts, spending power that generates still more job-supporting economic activity. Additional spending power comes from, for example, wages of direct and indirect workers in export-related jobs, from wages of direct and indirect workers in import-related jobs, and from consumers who take advantage of lower prices for goods and services resulting from imports, which in turn supports still more economic activity that supports even more jobs. The extra income is spent on other goods and services that are not traded internationally – like dinners out, pre-school or day care for one's child, or a home renovation project. Thus, Table 1 reports large trade-related jobs in sectors like "Construction" and "Leisure and hospitality services." The estimates in Table 1 reflect the increased spending that goes on throughout the economy as a result of higher incomes and lower costs due to trade. The methodology in the report captures all these effects.[8]

It is worth noting that the bulk of the jobs associated with U.S. trade are in these other sectors not commonly thought to benefit from trade. And it is these sectors that have been hardest hit from the pandemic-triggered shut down in the U.S. economy that began in

[8] Our methodology does not capture the number of jobs supported by foreign investments in the United States, and therefore our results *likely understate* the number of U.S. jobs tied to the international economy. We do capture the jobs at U.S. subsidiaries of foreign firms that are linked to trade (exports and/or imports). We do not capture jobs at foreign companies not engaged directly or indirectly in foreign trade.

earnest in March 2020. Thus, as the economy normalizes, trade rebounds, and these sectors return to pre-pandemic levels of activity, trade-induced consumer spending will be more important than ever to supporting those operations and the ability to keep workers employed.

Characteristics of Trade-Related Employment

In this study of the job impacts of trade on net U.S. jobs, we used the modeling to disaggregate the number of trade-related jobs by educational attainment. Assessments of additional characteristics of trade-related jobs were made by examining the characteristics of jobs generally in each sector for 2019 and drawing conclusions about trade-related employment from the national data assuming that the makeup of trade-related employment mirrors the national picture.

Table 2
Net Number of U.S. Jobs Related to Trade, 2019
(Thousands)

	High School or Less	More than High School	Total
Total	**+3,525.6**	**+37,931.1**	**+41,456.7**
Good-producing sectors	**+52.5**	**+1,575.6**	**+1,628.28**
Agriculture, forestry, fishing	-30.1	-375.4	-405.5
Mining and energy	-4.6	-61.7	-66.3[9]
Construction	+102.4	+2,244.6	+2,347.0
Manufacturing	-15.1	-231.9	-247.0
Services-producing sectors	**+3,473.1**	**+36,355.5**	**+39,828.5**
Wholesale and retail trade	+245.5	+5,002.2	+5,247.7
Financial activities (including insurance)	+139.4	+2,212.1	+2,351.5
Transportation and utilities	+122.4	+999.1	+1,121.5
Communications and information	+264.6	+2,053.1	+2,317.8
Business and professional services	+967.7	+7,817.9	+8,785.7
Education and health services	+649.1	+5,420.0	+6,069.1
Leisure and hospitality; other personal services	+365.1	+7,895.2	+8,260.5
Public administration (government)	+719.0	4,955.7	+5,674.7
Share of Total U.S. Employment	**7.1%**	**24.6%**	**20.3%**

Source: Authors' estimates.

Education

We estimate that trade has a net positive impact not only on workers with a college degree (or some college), but also those with at best a high school diploma. Table 2 shows that, taking into account job gains as well as losses, 3.5 million workers with at best a high school degree have jobs thanks to trade – 7.1% of all workers with at best a high school degree. Most of these workers are in services sectors, including business and professional services firms and education and health services providers. As noted above, these are jobs that benefit from trade indirectly, and

[9] The U.S. energy sector presents a special case with respect to the impacts of trade on jobs. Despite significant increases in domestic crude oil production, the United States still imports 3.3% of its daily consumption of petroleum (see https://www.eia.gov/tools/faqs/faq.php?id=32&t=6). Therefore, our modeling scenario (the impact of the absence of trade – exports and imports of petroleum, as described in Appendix A) means that the United States would need to produce *all* of its petroleum, including crude oil, requirements domestically. This would require U.S. petroleum producers to draw resources (including labor) from other sectors of the economy (an additional 437,000 workers).

they account for most of the trade-related jobs we found. While policymakers focus heavily on those who lose jobs to trade – and they should focus on them – our research suggests that the picture is much larger. Policies that would expand trade (exports and imports of goods and services) would have overall a net positive impact on workers with at best a high school education because it would support jobs in sectors that indirectly are tied to that trade.

More than 28 million trade-related jobs provide middle class incomes.

Income

While there is no official definition of what constitutes a "middle class" income level, Pew Research Center suggests that a range for 2018 is about $48,500 to $145,500 (two-thirds to double the median U.S. household income).[10] By this measure, we estimate that more than 28 million trade-related jobs provide Americans with middle class incomes.[11]

Union Membership

Trade provides employment to workers who are members of, or are represented by, unions. According to the Bureau of Labor Statistics, union representation – and trade-related employment – can be found in every sector of the U.S. economy.[12] If the representation and membership rates of trade-related jobs mirror the national averages for comparable sectors, then 3.6 million workers represented by unions (and nearly 4.3 million who are members of unions) have jobs that exist because of trade.

For some sectors that gain the most from trade, rates of unionization that are several times larger than that for manufacturing sector workers. In 2019, 13.6% of construction workers were represented by unions; utilities, 24.0%; transportation and warehousing, 17.6%,

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[10] Jesse Bennett, Richard Fry and Rakesh Kochhar, , "Are you in the American middle class? Find out with our income calculator," Pew Research Center, July 23, 2020, https://www.pewresearch.org/fact-tank/2020/07/23/are-you-in-the-american-middle-class/.

[11] The Bureau of Labor Statistics reports mean annual wages by sector in 2019 for all workers, trade related and non-trade related. See Bureau of Labor Statistics, Occupational Employment Statistics, National Industry-Specific and by Ownership data series, May 2019 survey, https://www.bls.gov/oes/current/oessrci.htm#11. . Totaling the trade-related jobs (both positive and negative) in Table 1 that are provided in sectors that meet the Pew definition of "middle class," as shown in Appendix Table A4, yields this total.

[12] Bureau of Labor Statistics, https://www.bls.gov/webapps/legacy/cpslutab3.htm, data extracted on: February 10, 2021 (12:13:27 PM).

and public administration, 37.2%, compared to 9.4% in manufacturing.

Race

More than 15 million trade-related jobs are held by minorities.

Trade-related jobs are also important sources of employment for minorities. Based on data on the shares of U.S. employment held by Blacks and African Americans, Asians and Hispanic/Latino workers reported by the Bureau of Labor Statistics for non-agriculture sectors, trade-related jobs provide employment to minorities in every sector of the economy.[13] In most sectors, minorities hold at least one-third of those jobs; in some instances, the shares are even larger. Again, if the shares for trade-related jobs mirror the national sector averages, then more than 15 million trade-related jobs are held by minorities.

13 Bureau of Labor Statistics, Labor Force Statistics from the Current Population Survey, 2019 Annual Averages, Household Data, Tables from Employment and Earnings, https://www.bls.gov/cps/cps_aa2019.htm.

State-Level Trade-Related Employment

As demonstrated by a breakdown of the national employment estimates by state (see Table 4), every U.S. state realizes a net positive impact from trade. Not surprisingly, the largest states benefit the most.

See Appendix B for an explanation of our methodology for breaking down trade-related employment by state. As noted there, these estimates report the state-level jobs linked to *national* exports and imports.

Table 4
Net Number of U.S. Jobs Related to Total Trade, by State, 2019
(Thousands)

Alabama	+530.1	Montana	+135.6
Alaska	+92.7	Nebraska	+255.6
Arizona	+832.1	Nevada	+417.5
Arkansas	+313.1	New Hampshire	+182.2
California	+5,082.6	New Jersey	+1,204.7
Colorado	+820.2	New Mexico	+227.2
Connecticut	+480.1	New York	+2,778.5
Delaware	+128.3	North Carolina	+1,248.5
District of Columbia	+211.3	North Dakota	+107.2
Florida	+2,770.2	Ohio	+1,401.2
Georgia	+1,328.1	Oklahoma	+436.3
Hawaii	+204.6	Oregon	+506.1
Idaho	+203.5	Pennsylvania	+1,596.2
Illinois	+1,632.0	Rhode Island	+137.3
Indiana	+749.0	South Carolina	+580.1
Iowa	+379.4	South Dakota	+114.4
Kansas	+364.6	Tennessee	+836.7
Kentucky	+483.7	Texas	+3,622.5
Louisiana	+555.3	Utah	+432.8
Maine	+170.3	Vermont	+86.8
Maryland	+824.5	Virginia	+1,141.0
Massachusetts	+1,046.2	Washington	+931.1
Michigan	+1,118.9	West Virginia	+173.8
Minnesota	+748.1	Wisconsin	+691.4
Mississippi	+310.2	Wyoming	+77.4
Missouri	+755.7	TOTAL	+41,456.7

Source: Authors' estimates.

IV Conclusion

Our analysis demonstrates that trade supports American jobs and the U.S. economy. As the U.S. economy has become more open and both exports and imports have grown, so too have U.S. jobs dependent on trade.

The effects of the pandemic have presented us with new challenges, and expanded trade can help to meet them. Supporting trade-related employment will enable policymakers to meet goals of expanding the middle class, and providing good jobs to minorities, union members and workers in every part of the country.

Thus, policymakers and others seeking to create new jobs for unemployed Americans should focus on harnessing the opportunities afforded by trade policies, negotiations and programs that increase America's participation in the international marketplace. Trade in 2019 supported over 41 million American jobs and strengthened U.S. economic competitiveness and purchasing power for American families. In the present and beyond, trade can support millions more American jobs and position the U.S. economy for a sustained recovery and enhance U.S. competitiveness.

Appendix A

Trade Data

Table A1
U.S. Exports to the World, 1992-2019
(Billions)

	Goods Exports	Services Exports	Total Exports
1992	$448.2	$177.3	$625.5
1993	465.1	185.9	651.0
1994	512.6	200.4	713.0
1995	584.7	219.2	803.9
1996	625.1	239.5	864.6
1997	689.2	256.1	945.3
1998	682.1	262.8	944.9
1999	695.8	278.0	973.8
2000	781.9	298.0	1,079.9
2001	729.1	284.0	1,013.1
2002	693.1	288.1	981.2
2003	724.8	297.7	1,022.5
2004	814.9	344.5	1,159.4
2005	901.1	378.5	1,279.6
2006	1,026.0	423.1	1,449.1
2007	1,148.2	495.7	1,643.9
2008	1,287.4	540.8	1,828.2
2009	1,056.0	522.5	1,578.5
2010	1,278.5	582.0	1,860.5
2011	1,482.5	644.7	2,127.2
2012	1,545.8	684.8	2,230.6
2013	1,578.5	719.5	2,297.9
2014	1,621.9	757.1	2,378.9
2015	1,503.3	768.7	2,272.0
2016	1,451.5	780.9	2,232.4
2017	1,547.2	833.8	2,381.0
2018	1,665.7	861.7	2,527.4
2019	1,643.2	876.3	2,519.5

Source: U.S. Department of Commerce, Bureau of Economic Analysis, using "Census basis" trade data for goods.

Table A2
U.S. Imports from the World, 1992-2019
(Billions)

	Goods Imports	Services Imports	Total Imports
1992	$532.7	$119.6	$652.3
1993	580.7	123.8	704.4
1994	663.3	133.1	796.3
1995	743.5	141.4	884.9
1996	795.3	152.6	947.8
1997	869.7	165.9	1,035.6
1998	911.9	180.7	1,092.6
1999	1,024.6	196.7	1,221.4
2000	1,218.0	220.9	1,438.9
2001	1,141.0	222.0	1,363.0
2002	1,161.4	233.5	1,394.8
2003	1,257.1	252.3	1,509.5
2004	1,469.7	290.6	1,760.3
2005	1,673.5	312.2	1,985.7
2006	1,853.9	349.3	2,203.2
2007	1,957.0	385.5	2,342.4
2008	2,103.6	420.7	2,524.3
2009	1,559.6	407.5	1,967.2
2010	1,913.9	436.5	2,350.3
2011	2,208.0	458.2	2,666.1
2012	2,276.3	469.6	2,745.9
2013	2,268.0	465.7	2,733.7
2014	2,356.4	491.1	2,847.4
2015	2,248.8	498.2	2,747.0
2016	2,186.8	512.6	2,699.4
2017	2,339.4	547.2	2,886.8
2018	2,537.7	563.9	3,101.7
2019	2,497.5	591.1	3,088.7

Source: U.S. Department of Commerce, Bureau of Economic Analysis, using "Census basis" data for goods.

Table A3
"Openness" of U.S. Economy, 1992-2019
(Billions and Percent)

	Total U.S. Trade*	Total Trade's Share of U.S.GDP
1992	$1,300.9	20.0%
1993	1,374.8	20.0
1994	1,534.3	21.1
1995	1,715.4	22.5
1996	1,831.6	22.7
1997	2,009.6	23.4
1998	2,068.7	22.8
1999	2,245.4	23.3
2000	2,573.3	25.1
2001	2,430.4	23.0
2002	2,435.7	22.3
2003	2,592.3	22.6
2004	2,986.9	24.4
2005	3,343.1	25.6
2006	3,726.8	27.0
2007	4,054.5	28.0
2008	4,411.5	29.9
2009	3,584.7	24.8
2010	4,246.8	28.2
2011	4,811.4	30.8
2012	4,987.0	30.7
2013	5,053.4	30.0
2014	5,264.8	30.0
2015	5,063.6	27.8
2016	4,970.5	26.6
2017	5,307.5	27.2
2018	5,663.2	27.6
2019	5,635.7	26.4

* "Total Trade" is goods and services exports plus goods and services imports, using "balance of payments" basis data to coincide with GDP data.
Source: U.S. Department of Commerce, Bureau of the Census, National Income and Product Accounts tables.

Appendix B

Methodology

We applied a multi-sector multi-country computable general equilibrium (CGE) model of the U.S. economy to estimate the impacts of trade on U.S. employment. CGE models use regional and national input-output, employment and trade data to link industries in a value-added chain from primary goods to intermediate processing to the final assembly of goods and services for consumption. Inter-sectoral linkages may be direct, like the input of steel in the production of transport equipment, or indirect, via intermediate use in other sectors (e.g., energy used to make steel that is used in turn in the transport equipment sector). Our CGE model captures these linkages by incorporating firms' use of direct and intermediate inputs. The most important aspects of the model can be summarized as follows: (i) it covers all world trade and production; and (ii) it includes intermediate linkages between sectors within each country.

The Model

The specific model used was the Global Trade Analysis Project (GTAP) model, with the most recent GTAP database, GTAP v10.1, released December 2020. The structure of the v10 database is outlined by Aguiar et al (2019). The model and its associated data are developed and maintained by a network of researchers and policymakers coordinated by the Center for Global Trade Analysis at the Department of Agricultural Economics at Purdue University. Guidance and base-level support for the model and associated activities are provided by the GTAP Consortium, which includes members from government agencies (e.g., the U.S. Department of Commerce, U.S. Department of Agriculture, U.S. Environmental Protection Agency, and U.S. International Trade Commission, European Commission), international institutions (e.g., the Asian Development Bank, Organization for Economic Cooperation and Development, the World Bank, United Nations and the World Trade Organization), the private sector and academia. Dr. Francois is a member of the Consortium.

The model assumes that capital stocks are fixed at a national level. Firms are assumed to be competitive, and employ capital and labor to produce goods and services subject to constant returns to scale.[14] Products from different regions are assumed to be imperfect substitutes in accordance with the so-called "Armington" assumption. Armington elasticities are taken directly from the GTAP v. 10 database, as are substitution elasticities

[14] Compared to dynamic CGE models and models with alternative market structures, the present assumption of constant returns to scale with a fixed capital stock is closest in approach to older studies based on pure input-output modeling of trade and employment linkages. In the present context, it can be viewed as generating a lower-bound estimate of effects relative to alternative CGE modeling structures.

for value added.[15]

We are interested in the impact of trade on the U.S. and state economies given the U.S. wage structures in 2019 (i.e., given the prevailing wage structure of the labor force in a given year, how many jobs in the U.S. economy and in each state's economy were linked either directly or indirectly to trade?). As such, the model employs a labor market closure (equilibrium conditions) where wages are fixed at prevailing levels, and employment levels are forced to adjust. This provides a model-generated estimate of the U.S. jobs supported, at current wage levels, by the 2019 level of trade.

Data

The model incorporates data from a number of sources. Data on production and trade are based on input-output, final demand, and trade data from the GTAP database (see Aguiar, Narayanan & McDougall 2019). These data provide important information on cross-border linkages in industrial production, related to trade in parts and components. For the 2019 simulation, social accounting data are drawn directly from the most recent version of the GTAP dataset, version 10.1 (released December 2020). Trade data (both exports and imports) exclude re-exports.[16] This dataset is benchmarked to 2014 and includes detailed national input-output, trade, and final demand structures for 140 countries across 56 sectors (see Table A-1). We have updated the trade and national accounts data to 2019.

The basic social accounting and trade data are supplemented with data on tariffs and non-tariff barriers from the World Trade Organization's integrated database and from the UNCTAD/World Bank WITS dataset. All tariff information has been concorded to GTAP model sectors within the version 10.1 database.[17]

The GTAP model sectors were concorded to state-level employment data from the Commerce Department's Bureau of Economic Analysis (BEA). This allowed us to map nationwide effects to individual states. It is important to emphasize that we distribute the employment impacts of trade at the national level to employment at the state level. We are therefore reporting state-level employment related to trade nationally; we are *not* reporting the state level employment impacts of state-level trade. BEA does not disclose state-level employment data for certain sectors for confidentiality reasons. For some of these sectors, we were able to use Moody's Analytics state-level employment estimates to estimate the missing national employment to undisclosed sectors in these states. However,

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[15] Technically we work with what is known as a "non-nested" version of the trade demand equation in the GTAP model. As such, in this case the model also corresponds analytically to a recent type of model known as an Eaton-Kortum model. See Bekkers et al (2018) for further technical discussion and derivations.

[16] See https://www.gtap.agecon.purdue.edu/databases/contribute/reexports.asp.

[17] The GTAP database includes relatively more detail in sectors, particularly in agricultural, primary production, and processed foods than we can use here when mapping model results by sector to state employment data by sector. State employment data for most of these sectors are not available.

because we mixed employment data from two sources (BEA and Moody's), the sum of the employment effects for the states may not add perfectly to the total for the United States.

For this update of the study, we mapped GTAP employment data (in five occupational categories) to BEA data on employment by occupation and by educational attainment. The mapping to occupation by educational attainment allows us to further break down employment impacts by a combination of these occupational categories and educational attainment levels. Our aggregation of sectors reflects the availability of data on educational attainment and occupation, and as such for the purposes of the modeling exercise, our aggregation of the GTAP database includes 14 sectors. The model sectors are shown in Table B-1.

Table B1
Model Sectors

Agriculture, forestry and fishing	Information services
Mining and extraction	Financial and insurance services
Construction	Business and professional services
Manufacturing-durables	Education and health services
Manufacturing-nondurables	Leisure and hospitality services
Trade and distribution	Public services
Transportation and utilities	

Model-based Simulations

The simulation conducted with the GTAP model involved imposing changes in U.S. trade, in this instance a hypothetical elimination of all U.S. exports and imports of goods and services by imposing prohibitive duties against goods trade with the United States across the board, and prohibitive trade costs against services trade with the United States.[18]

Our results tell us how much U.S. and state output and employment would decline were the United States to cease exporting and importing goods and services, tracing changes at the border as they work through the U.S. economy. The net negative (or positive, in some cases) impacts on output and jobs from an absence of trade serve as a proxy for the opposite: the net positive (or negative) impacts on U.S. output and employment *because* of trade. We report the results from this second perspective in this paper.

[18] We have modeled an extreme shock to the economy to show the extent to which sectors of the economy are tied to trade. We are not suggesting that a prohibitive tariff is a policy option that has been proposed by anyone. It is useful to understand the job impact of complete elimination of both exports and imports, in order to quantify the opposite scenario: the job impact of actual U.S. trade in the experiment years.

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