Office of Industries
Working Paper ID-094

Disentangling the Knot: Identifying U.S. and Global Exposure to Xinjiang Cotton

October 2022

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Abstract

On June 21, 2022, the Uyghur Forced Labor Protection Act (UFLPA) went into effect. Among other goals, the UFLPA seeks to prevent all products with content (in whole or in part) made using forced labor in Xinjiang Uyghur Autonomous Region (Xinjiang) from entering the United States. Xinjiang generates one of the largest cotton harvests in the world. Looking at the years leading up to the implementation of the UFLPA, this paper examines the Xinjiang cotton industry and estimates where Xinjiang cotton went after harvest, including the extent to which it ultimately was shipped to the United States in the form of downstream consumer goods. First, we describe a shift that has taken place within China's cotton production toward greater output in the Xinjiang region. This shift has been accompanied by growing findings of human rights abuses centered there, prompting a U.S. and international response. After establishing this context, we use a supply chain analysis to estimate the extent to which Xinjiang cotton enters different countries' markets for cotton yarn, cotton fabric, and cotton consumer goods. Using this information, we calculate estimates of the value of U.S. imports derived from Xinjiang-origin cotton. Based on these estimates, we find that U.S. imports derived from Xinjiang-origin cotton have declined as part of a shift away from China. However, many other countries also import large quantities of intermediate cotton products such as yarn and fabric from China, and these third-country exports to the United States likely remain a significant channel by which Xinjiang-origin cotton enters U.S. markets.

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Office of Industries
U.S. International Trade Commission (USITC)
May 2022

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The authors would like to thank Joanna Bonarriva, Eric Heath, John Fry, Sarah Oliver, Brian Soiset, Graham Soley, and Heather Wickramarachi for their review and comments and Trina Chambers for her production support.

Introduction and Summary

China is one of the largest global producers of cotton and the largest exporter of cotton consumer goods, a category that includes apparel and "made-up" textile products such as linens.[1] Over the last decade, a substantial majority of China's cotton production became consolidated within one province, the Xinjiang Uyghur Autonomous Region (Xinjiang). This consolidation has coincided with concerns raised by many trading partner governments and industries that the Chinese government is engaging in human rights abuses. These are centered in Xinjiang, particularly with respect to the government's treatment of certain ethnic minority groups, especially the Uyghurs. Among these abuses, the use of forced labor has been identified as pervasive in Xinjiang cotton production.[2]

The U.S. government has responded to these concerns by taking steps that include reducing U.S. market exposure to cotton and other products originating in Xinjiang. Effective June 21, 2022, the Uyghur Forced Labor Prevention Act (UFLPA) banned all U.S. imports made (in whole or in part) in Xinjiang.[3] This statutory change follows other U.S. government actions to prevent certain imports and other transactions connected to Xinjiang, including several U.S. Customs and Border Protection (CBP) Withhold Release Orders (WROs) on cotton and cotton-containing products starting in 2019.[4] The U.S. government efforts to eliminate imports of Xinjiang-origin cotton will likely require a rapid and major shift in the U.S. industry's cotton-containing product supply chain, as China is its largest supplier of many downstream cotton-containing goods.[5] As detailed within this paper, such a change in sourcing is likely already underway as we estimate U.S. imports derived from Xinjiang cotton have been declining since 2018.

This paper begins by describing a shift that has taken place within China's cotton production toward greater output in the Xinjiang region, associated human rights abuses centered there, and the U.S. and international response. After establishing this context, we use a supply chain analysis to estimate the concentration of Xinjiang cotton within different global supply chains followed by a presentation of our estimates of the value of U.S. imports derived from Xinjiang-origin cotton (figure 1 contains the summary of these estimates; a full description of our estimation methodology is in Appendix 2). Our

[1] Made-up textile products include non-apparel fabric items such as linens, blankets, curtains, and flags. EC, "Manufacture of Made-up Textile Articles, Except Apparel," accessed March 4, 2022.
[2] China is not the only country with labor issues identified in its cotton production. For example, the U.S. Department of Labor (DOL) identified 17 countries using forced and/or child labor to produce cotton in 2020, including China and India (another of the world's largest cotton producers). DOL, ILAB, "Against Their Will," accessed March 4, 2022; DOL, ILAB, "List of Goods Produced by Child Labor or Forced Labor (2020)," June 23, 2021.
[3] Uyghur Forced Labor Prevention Act of 2021 (UFLPA), Pub. L. No. 117-78, 135 Stat. 1525.
[4] CBP, Withhold Release Orders and Findings List, accessed March 8, 2022. For more information on WROs, see "China's Cotton Industry" below.
[5] The term "cotton-containing products" is used in this paper to refer to yarn, fabric, and cotton consumer products that are identified as being primarily of cotton in the Harmonized System (HS). For purposes of this analysis, cotton yarn includes yarn and sewing thread included within HS chapter 52 (cotton). Cotton fabric includes woven, knitted, or crocheted fabrics identified as being "of cotton" within HS chapters 52 and 60 (knitted or crocheted fabrics). Cotton consumer products include apparel and made-up textile goods identified as being "of cotton" within HS chapters 61 and 62 (two categories of apparel and clothing accessories) and 63 (a chapter that includes other made-up textile articles). See Appendix 1 table 1 for more detail of which HS codes were included in this analysis.

estimation methodology draws on a similar analytical approach to that used in the U.S. International Trade Commission's (USITC) February 2021 report, *Seafood Obtained via Illegal, Unreported, and Unregulated Fishing* ("*IUU Fishing*") and the connected staff working paper *Shedding Light on the Dark Side of Trade: Strategies for Analyzing the Extent and Impact of Illicit Imports* by Berry et al (2022).[6]

Source: Authors' estimates; images from Unsplash (Marina Ermakova; Mel Poole; Greg Rosenke).

Global Cotton Production

Cotton is a widely grown crop, produced in over 75 countries. Despite its widespread cultivation, the majority of cotton production is concentrated in just three countries that accounted for about 63 percent of global production by quantity between crop marketing years (MYs) 2016/17 and 2020/21.[7]

[6] USITC, *IUU Fishing*, February 2021; Berry et al., *Shedding Light on the Dark Side of Trade*, March 2022.
[7] A crop marketing year or marketing year is the twelve-month period, usually coinciding with the planting and marketing cycle of the crop, for which various agricultural data are collected. Marketing years can vary by crop and country. For most countries including China, the United States, and India, USDA uses a cotton marketing year of August to July (e.g., 2016/17 refers to August 2016 to July 2017 for these data). USDA, FAS, PS&D Online, Data Availability: Cotton, accessed June 14, 2022.

These are India (almost 24 percent of global production during MY 2016/17-20/21), China (about 23 percent), and the United States (16 percent).[8]

Cotton is a row crop that can be harvested by machine or by hand and has a number of end-uses. According to a 2016 estimate from a report published by the World Bank, about 71 percent of global cotton was hand-picked and 29 percent mechanically harvested.[9] According to the report, this ratio has been relatively stable since at least the turn of the millennium. In the majority of producing countries, cotton harvesting is heavily or wholly hand-picked, with predominately mechanized harvesting occurring in fewer than ten countries including the United States. However, some countries, including China, use a mix of both harvesting practices (see "The Xinjiang Cotton Industry" below). Once harvested, seed cotton is ginned to separate the lint (fibers) from the seeds (a type of oilseed) and to remove any waste.[10] It is estimated that the majority of cotton fiber is used in apparel (about 64 percent). The remainder goes to home furnishing (28 percent) and industrial uses (8 percent).[11]

China's Cotton Industry

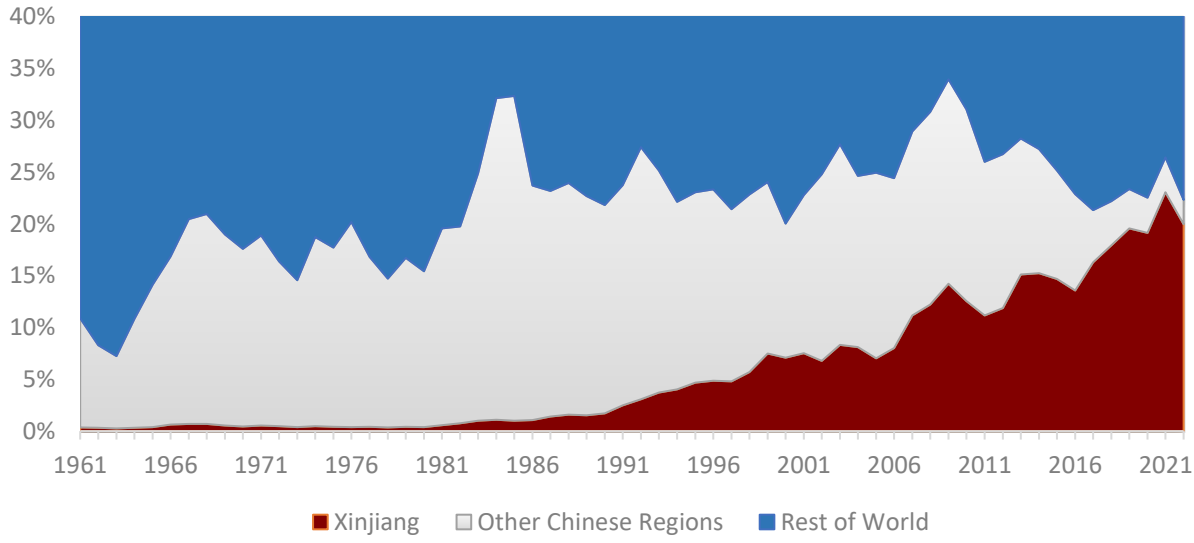
China's cotton output has increased substantially over the past 60 years, and in MY 2020/21 China was the largest cotton producing country in the world with 26.4 percent of global output (figure 2). China's total cotton supply (the amount of cotton available in the country) increased over this period due to this general increase in production as well as significantly larger imports and stock holdings.[12] Notably, China's cotton exports were minimal during most of the past six decades, rarely exceeding 1 percent of total supply.[13] This growth in China's cotton supply has coincided with China becoming the largest global producer in the cotton yarn, fabric, and consumer goods supply chain.[14]

China's cotton production has shifted and has become highly concentrated in Xinjiang. This trend began in the 1990s and accelerated in the 2010s because of factors including the region's high cotton yields and government policies and programs incentivizing the concentration of production in Xinjiang. In 2010, 43.0 percent of Chinese cotton was grown in Xinjiang.[15] At that time, in addition to Xinjiang, 12 provinces in the Yellow River basin and the Yangtze River basin were important cotton producers.[16] However, over the course of the next decade, production in these areas declined while production in

[8] Rounding out the top five producers are Brazil (9 percent) and Pakistan (6 percent). All other producers each accounted for less than 3 percent of global production and the vast majority for less than one percent. Production share based on quantity for 2016/17–20/21. USDA, FAS, PS&D Online: Cotton: Production, accessed March 14, 2022.
[9] Swinkels, Romanova, and Kochkin, *Assessing the Social Impacts of Cotton Harvest Mechanization*, May 2016, 12.
[10] Cotton that has been harvested but not yet ginned is referred to as seed cotton.
[11] Industrial uses for cotton include book binding, cotton pads and padding (used alone or in items such as diapers and sanitary products), bandages, and cords in tires. Voora, Larrea, and Bermudez, *Global Market Report: Cotton*, June 2020, 1; Gray, "What Industrial Uses Are There for Cotton?" January 18, 2015.
[12] USDA, FAS, PS&D Online: Cotton: China, accessed January 24, 2022. USDA has cautioned that obtaining reliable statistics on cotton production in China is challenging. See e.g., USDA, FAS, *China: Cotton Annual (2014)*, April 1, 2014, 2.
[13] USDA, FAS, PS&D Online: Cotton: China, accessed January 24, 2022.
[14] Lehr, *Addressing Forced Labor*, July 2020, 4; Ma, "Apparel Industry in China," May 21, 2021; Fibre2Fashion, "Two Major Risks to China's Economic Recovery," September 2021.
[15] Government of China, NBS, CEIC database, AFF Production Data, accessed February 4, 2022.
[16] Zhang, *The Cotton Sector in China*, August 2011, 6, 23.

Xinjiang continued to increase. By 2012, Xinjiang accounted for half of all Chinese cotton production for the first time. In 2020, approximately 87.3 percent of China's cotton production occurred in Xinjiang and in 2021 it reached 89.5 percent.[17]

Figure 2 Xinjiang and China's share of global cotton output, MY 1960/61–2021/22, percentage



Source: Government of China, NBS, CEIC database, AFF Production Data, accessed February 4, 2022; USDA, FAS, PS&D Online, accessed February 9, 2022.
Note: Years displayed on the x-axis are the final year of the MY pair (e.g., 2021 = 2020/21).

This concentration of production in Xinjiang has been largely driven by a lack of alternative crop options and government programs in that region. Unlike in Xinjiang, producers near the Yellow and Yangtze rivers can grow a number of crops, many of which are less labor intensive and have higher returns than cotton. Some of these crops (e.g., grains) are also supported by government programs. By contrast, China's government support for cotton production has concentrated on producers in Xinjiang over time. In 2011, the Chinese government introduced a formal price support program for cotton to encourage domestic cotton production throughout the country. However, such programs were modified over time and since MY 2014/15 have been targeted at producers in Xinjiang.[18] Other government programs have

[17] Government of China, NBS, CEIC database, AFF Production Data, accessed February 4, 2022.
[18] Cotton price programs have all sought to guarantee a certain level of returns to farmers. Since 2014, such support has taken the form of payments to producers if the market prices fall below target prices. The Chinese government sets target prices which are calculated to cover production costs plus a certain amount of profit. USDA, FAS, *China: Cotton Annual (2012)*, May 3, 2012, 2-3; USDA, FAS, *China: Cotton Annual (2013)*, April 2, 2013, 1, 3-4; Dim Sums, "Subsidies Keep Xinjiang Cotton Farms Afloat," November 1, 2020; MacDonald, Gale, and Hansen, *Cotton Policy in China*, March 2015, 7–13; USDA, FAS, *China: Cotton Annual (2016)*, April 1, 2016, 2–3; USDA, FAS, *China: Cotton Annual (2017)*, April 1, 2017, 2–3; Dim Sums, "China Cotton Clumped in Northwest," January 6, 2019.

also directly and indirectly facilitated cotton production in Xinjiang. Such support is likely to continue, as China's 14th five-year plan for Xinjiang reportedly includes government support for cotton production.[19]

The Xinjiang cotton industry is both productive and intertwined with the Chinese government

Cotton production is concentrated in southern Xinjiang. Reportedly, southern Xinjiang produces a higher quality cotton including long-staple cotton valued in export markets for its use in items such as linens and luxury clothing.[20] Cotton from northern Xinjiang is said to be largely for the domestic market due, in part, to climate conditions in the area favoring early-maturing cotton over long-staple cotton.[21] Xinjiang, among the northernmost cotton growing regions, has generally cooler temperatures which creates a relatively narrow growing season and can impact cotton yields as well as the variety of cotton planted.[22] The greater prevalence of machine harvesting in northern Xinjiang compared to southern Xinjiang (see below) may also contribute to these quality differences. Research has found that, in Xinjiang, machine harvesting cotton lowers the length and strength of fibers compared to hand-harvested cotton.[23]

Cotton production in Xinjiang is characterized by the highest yields in China. Yields in Xinjiang were about 69 percent higher than in other Chinese regions during 2010-17.[24] A number of factors contribute to this including Xinjiang's dry climate, which brings a lower risk of pest and disease, and the ability to plant dwarf cultivars with early maturity.[25] In addition, while irrigation is not universally available

[19] For example, cotton producers in Xinjiang benefit from transportation subsidies to facilitate shipping cotton to eastern China where the textile industry is concentrated. There are reportedly indications that Xinjiang Production and Construction Corps (XPCC), which has extensive cotton production in Xinjiang, may have access to subsidies and credit from state owned banks that may assist in cotton production (e.g., purchasing machinery and obtaining land). Other cotton traders and mills may also have access to subsidized loans through state-owned banks. Dim Sums, "Sprawling 5 Year Plan for Xinjiang," June 12, 2021; MacDonald, Gale, and Hansen, *Cotton Policy in China*, March 2015, 7–9; Dim Sums, "Subsidies Keep Xinjiang Cotton Farms Afloat," November 1, 2020.
[20] Cotton is assessed by several measures including the length of the fiber (staple length). Cotton fiber length impacts its end use. For example, short staple cotton is used in apparel including jeans. See e.g., Cotton Incorporated, *The Classification of Cotton,* 2018, 10; USDA, ERS, "Cotton Sector at a Glance," accessed June 14, 2022; Home Grown Cotton, The Differences Between Short and Long Staple Cotton, June 8, 2018.
[21] Murphy et al., *Laundering Cotton*, November 2021, 13; Niu et al., "Spatial Layout of Cotton Seed Production," August 2021, 3–4.
[22] In Xinjiang, cotton is generally planted in April or May and harvested in September or October. In the United States cotton, which is primarily grown in southern states, is planted between March and June (and harvested between August and November). India has cotton planting occurring through six months of the year (as early as late April in the north and as late September in the south). USDA, FAS, *China Cotton*, May 19, 2020, 1; USDA, ERS, "Cotton Sector at a Glance," accessed June 14, 2022; USDA, FAS, *Cotton and Products Annual: India*, March 24, 2022, 12; Tian et al., *Xinjiang Cotton Production*, 2, 5–6, accessed June 14, 2022; Niu et al., "Spatial Layout of Cotton Seed Production," August 2021, 2. Encyclopedia Britannica, "Climate of Xinjiang," accessed June 14, 2022.
[23] Tian et al., "How to Reduce Cotton Fiber Damage in the Xinjiang China," December 15, 2017, 803–11.
[24] In 2017, for example, yields in Xinjiang were 1,975 kg/ha versus 1,135 kg/ha elsewhere in China. In 2020/21 Xinjiang yields (2,046 kg/ha) were close to 8 percent higher than the national average (of which Xinjiang cotton is the largest share, suggesting even higher yields than in the rest of China). USDA, FAS, *China: 2017/18 Cotton Production Outlook*, August 11, 2017; USDA, FAS, *China Cotton*, May 19, 2020, 1, 3; USDA, FAS, *Cotton Annual: China (2022)*, April 6, 2022, 5.
[25] USDA, FAS, *China: Cotton Annual (2012)*, May 3, 2012, 4; Tian et al., *Xinjiang Cotton Production*, 1–5, accessed June 14, 2022.

throughout the region, it is widely used and the Chinese government is trying to increase its prevalence.[26] However, limited water resources are a factor constraining the ability to substantially increase production in the region.[27]

Xinjiang's cotton industry is also characterized by large-scale production, especially by the Xinjiang Production and Construction Corps (XPCC). Farms growing cotton in the province are large, especially compared to the average Chinese farm.[28] This is connected to the important role the XPCC plays in the cotton industry. The XPCC is a state-owned enterprise that has also been described as "a unique quasigovernmental paramilitary organization."[29] Founded in 1954, it has agricultural and industrial interests (such as its operation of cotton farms) but also has other functions such as overseeing its own cities, police, and army reserves.[30] According to the U.S government and other sources, the XPCC or its affiliates also maintain prisons and labor camps.[31] While its exact production levels are unknown, the XPCC is likely the largest cotton producer in China.[32] The XPCC's cotton farms are larger and have higher levels of mechanized harvesting compared to non-XPCC owned farms.[33] In addition to cotton production, the XPCC is also involved in ginning and some additional downstream manufacturing (see "Overview of the Global Cotton-Containing Products Supply Chain" below).[34]

There is a debate over the extent of manual labor vs. machine harvesting (mechanization) used in the Xinjiang cotton harvest. Reportedly, the lack of local labor is a longstanding challenge for producers in Xinjiang, which has traditionally seen an influx of 100,000 seasonal laborers in September brought in from other parts of China for the cotton harvest.[35] Chinese government policies have reportedly sought to increase the use of mechanized harvest in Xinjiang.[36] Mechanization estimates are contentious because of their relation to the use of forced labor in the Xinjiang cotton industry that the U.S. government and others have identified (see section below). Higher use of manual labor in the cotton harvest is seen as increasing the potential scope of forced labor that may be used in the sector.

Research indicates regular, albeit declining, use of manual labor in the Xinjiang cotton harvest, especially in the southern part of the province. In recent years, some estimates have put harvest mechanization as low as 20 percent in the export-oriented southern Xinjiang cotton fields meaning 80 percent of cotton is

[26] Dim Sums, "Sprawling 5 Year Plan for Xinjiang," June 12, 2021; USDA, FAS, *China: 2017/18 Cotton Production Outlook*, August 11, 2017; Zhang, *The Cotton Sector in China*, August 2011, 23.
[27] USDA, FAS, *Cotton Annual: China (2022)*, April 6, 2022, 2.
[28] MacDonald, Gale, and Hansen, *Cotton Policy in China*, March 2015, 3, 21; Li, Wang, and Lu, "Land Tenure and Cotton Farmers' Land Improvement," 2022, 2-3.
[29] Lehr, *Addressing Forced Labor*, July 2020, 5.
[30] Bao, *The XPCC: An Insider's Perspective*, January 2018, 3, 5–6, 11–12.
[31] See e.g., State et al., "Risks and Considerations," July 13, 2021, 9, 25; Lehr, *Addressing Forced Labor*, July 2020, 5; Turkel, Forced Labor, Mass Internment, and Social Control in Xinjiang, Congressional-Executive Commission on China hearing testimony, October 17, 2019
[32] See e.g., Patton, "Top China Cotton Producer Resists Reforms," February 20, 2015; Dou, "Sanctions on China's Top Cotton Supplier," accessed February 28, 2022; Lehr, *Addressing Forced Labor*, July 2020, 6; Brew et al., "U.S. Bans Imports from China," December 3, 2020; Zhang, *The Cotton Sector in China*, August 2011, 23.
[33] USDA, FAS, *China: Cotton Annual (2019)*, April 11, 2019, 4–5; USDA, FAS, *China: Cotton Annual (2017)*, April 1, 2017, 7.
[34] Lehr, *Addressing Forced Labor*, July 2020, 4–8.
[35] Dim Sums, "Subsidies Keep Xinjiang Cotton Farms Afloat," November 1, 2020.
[36] Dim Sums, "Sprawling 5 Year Plan for Xinjiang," June 12, 2021; MacDonald, Gale, and Hansen, Cotton Policy in China, March 2015, 7-8.

estimated to be manually harvested by hand.[37] A number of estimates of overall mechanization in Xinjiang's cotton harvest, including one from a Chinese government source, range from roughly 30 to 45 percent around 2019.[38] At the high end, certain Chinese sources have been reported to use estimates of 70 percent and above with some reportedly implying 90 percent of the cotton harvest is mechanized, thereby indicating limited use of manual labor.[39] However, a number of other sources report or indicate that such high rates of mechanized harvesting are only found in northern Xinjiang.[40] Regardless of the actual rate, it appears that mechanization rates have continued to increase in Xinjiang.[41] In 2020, mechanization rates reportedly increased because the COVID-19 pandemic reduced the amount of internal migrant labor available for the cotton harvest.[42] Mechanization rates reportedly have continued to rise into 2022, in part because of higher production costs including for labor.[43]

Human rights abuses in Xinjiang have been identified, including forced labor in the cotton industry

The U.S. government, along with a number of other governments, academics, and NGOs have determined that the government of China has been committing serious violations of human rights against Muslim ethnic minority groups including the Uyghurs centered in, but not exclusive to, Xinjiang (see Box 1).[44] They widely identify such behavior occurring since at least 2017, although they note indications that it may have begun earlier. A wide range of human rights abuses have been cited by the U.S. government and others.[45] For example, in 2021, a U.S. multi-agency government report stated that these crimes against humanity include "imprisonment, torture, rape, forced sterilization, and

[37] Murphy et al., *Laundering Cotton*, November 2021, 12–13; Lehr, *Addressing Forced Labor*, July 2020, 6.
[38] USDA, FAS, *China: Cotton Annual (2019)*, April 11, 2019, 4–5; Murphy et al., *Laundering Cotton*, November 2021, 10; Government of China, MARA, *Cotton Machine Picking Rate Is Increasing*, October 16, 2019.
[39] In 2022, The Xinjiang Agricultural and Rural Affairs Department reportedly announced a regional mechanized rate of 80 percent. USDA, FAS, *Cotton Annual: China (2022)*, April 6, 2022, 5; Murphy et al., *Laundering Cotton*, November 2021, 12–13; Liu and Fan, "Mechanization Rate in Xinjiang Farms Beyond Imagination," June 11, 2021; Mao and Zhou, "Mechanization of Xinjiang's Cotton Sector Approaches 90%," April 2, 2021.
[40] Murphy et al., *Laundering Cotton*, November 2021, 6, 10, 12–13; Lehr, *Addressing Forced Labor*, July 2020, 6; Xinhua News Agency, "Xinjiang's Cotton Production," October 20, 2020; Xinhua News, "Cotton Farmer Increases Production Through Mechanization," November 2, 2021.
[41] USDA, FAS, *China: Cotton Annual (2017)*, April 1, 2017, 4–5.
[42] Dim Sums, "Subsidies Keep Xinjiang Cotton Farms Afloat," November 1, 2020.
[43] USDA, FAS, *Cotton Annual: China (2022)*, April 6, 2022, 5.
[44] See e.g., State et al., "Risks and Considerations," July 13, 2021; Pompeo, "Determination of the Secretary of State on Atrocities in Xinjiang, January 19, 2021; Government of Canada, "Canadian Sanctions Related to People's Republic of China," November 16, 2021; UK, House of Commons, Foreign Affairs Committee, *Never Again*, July 8, 2021; Xu et al., *Uyghurs for Sale*, March 1, 2020; Human Rights Watch, "Break Their Lineage, Break Their Roots," April 19, 2021; United Nations Office of the High Commissioner, *OHCHR Assessment of Human Rights Concerns in the Xinjiang*, August 31, 2022..
[45] A number of resources provide detailed information on the government of China's human rights abuses against Uyghur and other ethnic minorities in Xinjiang and also against such individuals who have been transferred to other parts of the country. Xu et al., *Uyghurs for Sale*, March 1, 2020; UK, House of Commons, Foreign Affairs Committee, *Never Again*, July 8, 2021; DOL, ILAB, "Against Their Will," accessed March 4, 2022; Lehr, *Addressing Forced Labor*, July 2020; Human Rights Watch, "Break Their Lineage, Break Their Roots," April 19, 2021.

persecution, including through forced labor and the imposition of draconian restrictions on freedom of religion or belief, freedom of expression, and freedom of movement." It also states that the Chinese government was continuing to "carry out genocide and crimes against humanity against Uyghurs and members of other ethnic and religious minority groups" in Xinjiang.[46] Moreover, the report states that since at least March 2017, the Chinese government "unjustly imprisoned more than one million Uyghurs, ethnic Kazakhs, ethnic Kyrgyz, and members of other ethnic and Muslim minority groups for indefinite periods in internment camps."[47]

Box 1 Who are the Uyghurs?

Uyghurs are members of a group with a distinct ethnic identity who primarily dwell in Xinjiang. They speak a Turkic language and, as a group, are identified as Sunni Muslims. The majority of Uyghurs—about 10 million people—live in China although some live in other central Asian countries (about 300,000 in total). The Chinese government divides non-Han Chinese citizens into 55 official ethnic minority groups. It lists the Uyghurs as the fourth largest official ethnic minority group in China. According to Chinese official statistics, Uyghurs accounted for about 0.8 percent of China's total population in 2010. (The Han, who in 2010 accounted for almost 92 percent of the population, are China's ethnic majority.) China's government established Xinjiang as an official autonomous region for the Uyghurs in 1955. Other Turkic Muslim ethnic minority groups also live in Xinjiang.[48]

There are a number of human rights abuses, including the use of forced labor, identified in the cotton supply chain largely originating in Xinjiang. For example, the U.S. Department of Labor has found that forced labor and child labor are used in Chinese cotton production as well as in production of other goods including yarn, fabric, and garments.[49] Lehr (2020) notes the risk of forced labor being used in both cotton production and ginning run by the XPCC and possibly by others.[50] The XPCC has obtained land from local farmers, often Uyghurs. In some quarters this has been presented as beneficial, however there have also been allegations of coercive land transfers.[51] Moreover, Murphy et al. (2021) found that members of ethnic minorities in Xinjiang without land are more vulnerable to forced labor.[52] According to a U.S. multi-agency government report, Chinese companies are incentivized to open factories near internment camps and use people detained in the camps as labor who are paid little to nothing. "In April 2019, Xinjiang authorities began rolling out a plan to attract textile and garment companies" to Xinjiang near the internment camps.[53] Murphy et al. (2021) also provides in-depth information on the use of forced labor in the Xinjiang cotton and fabric industries, including from hundreds of worker testimonials,

[46] State et al., "Risks and Considerations," July 13, 2021, 2.
[47] State et al., "Risks and Considerations," July 13, 2021, 3.
[48] Government of China, Information Office of the State Council, "National Minorities Policy" September 1999; Solis, "Chinese Ethnic Groups" accessed January 24, 2022; Encyclopedia Britannica, "Uyghur (People)," accessed January 24, 2022.
[49] DOL, ILAB, "Against Their Will," accessed March 4, 2022; DOL, ILAB, "List of Goods Produced by Child Labor or Forced Labor (2020)," June 23, 2021.
[50] Lehr, *Addressing Forced Labor*, July 2020, 5–6.
[51] Bao, *The XPCC: An Insider's Perspective*, January 2018, 7–8; Murphy et al., *Laundering Cotton*, November 2021, 11–12.
[52] Murphy et al., Laundering Cotton, November 2021, 6, 11–12, 14.
[53] State et al, "Risks and Considerations," July 13, 2021, 7.

as well as case studies on Chinese companies involved in the cotton-containing supply chain and their use of forced labor.[54]

Many of these human rights violations occur under Chinese government programs purportedly aimed at things like ‘‘poverty alleviation’’ or “counter-terrorism,” although the Chinese government and others in China deny any such violations are occurring.[55] Protests and terrorist incidents (including bombings by Islamic Uyghurs militants) have occurred in Xinjiang in the past three decades.[56] These are attributed to a longstanding combination of ethnic and economic tensions between the Uyghurs and the Han (China’s majority ethnic group).[57] In May 2014, the Chinese government launched the “Strike Hard against Violent Terrorism Campaign.” The U.S. government and others found that this campaign and other security laws have been used to monitor Uyghurs and other Turkic Muslims. Human Rights Watch has also outlined the campaign’s association with the aforementioned uptick in human rights violations.[58] On August 31, 2022, the United Nations Office of the High Commissioner issued a report which states that “{s}erious human rights violations have been committed in {Xinjiang} in the context of the Government’s application of counter-terrorism and counter-‘extremism’ strategies.”[59] The Chinese government and entities in China, including the press, have objected to these characterizations and continue to argue that no human rights violations, including forced labor, are occurring in Xinjiang.[60]

In response, the U.S. government and others have taken actions, including steps to reduce imports of goods linked to Xinjiang

In objection to human rights abuses in Xinjiang, the U.S. government has taken numerous actions against Chinese individuals, entities, and trade (see figure 3 for a timeline outlining several of these actions). Some actions have been targeted directly at the use of forced labor in the cotton-containing

[54] Murphy et al., *Laundering Cotton*, November 2021. For information on the supply chain see the “Overview of the Global Cotton-Containing Products Supply Chain” section below.
[55] Uyghur Forced Labor Prevention Act of 2021 (UFLPA), Pub. L. No. 117-78, 135 Stat. 1525; UK House of Commons, Foreign Affairs Committee, *Never Again*, July 8, 2021, 4.
[56] See e.g., Tanner and Bellacqua, *China’s Response to Terrorism*, June 2016, 17–18; Winderm, “China’s Terror Problem Worsens,” May 6, 2014; Encyclopedia Britannica, “Uyghur (People),” accessed January 24, 2022.
[57] Tanner and Bellacqua, *China’s Response to Terrorism*, June 2016, i–ii, 14-16; Encyclopedia Britannica, “Uyghur (People),” accessed January 24, 2022
[58] The Human Rights Watch finds that “{t}he Chinese government’s oppression of Turkic Muslims is not a new phenomenon, but in recent years has reached unprecedented levels.” Human Rights Watch, *“*Break Their Lineage, Break Their Roots*,”* April 19, 2021; Human Rights Watch, *China’s Algorithms of Repression*, May 2019; State et al., “Xinjiang Supply Chain Business Advisory,” July 13, 2021, 4; Tanner and Bellacqua, *China’s Response to Terrorism*, June 2016, i–iii.
[59] United Nations Office of the High Commissioner, *OHCHR Assessment of Human Rights Concerns in the Xinjiang*, August 31, 2022.
[60] See e.g., Government of China, MOFCOM, “Foreign Ministry Spokesperson’s Statement on US’ Signing of the So-Called Uyghur Forced Labor Prevention Act,” December 24, 2021; Murphy et al., *Laundering Cotton*, November 2021, Annex A; Agence France-Presse, “China Hits Out at Norway State Fund,” March 9, 2022; Kuo and Rauhala, “China Slams U.N. ‘Farce’ on Xinjiang as Uyghur Exiles Praise Report,” accessed September 7, 2022.

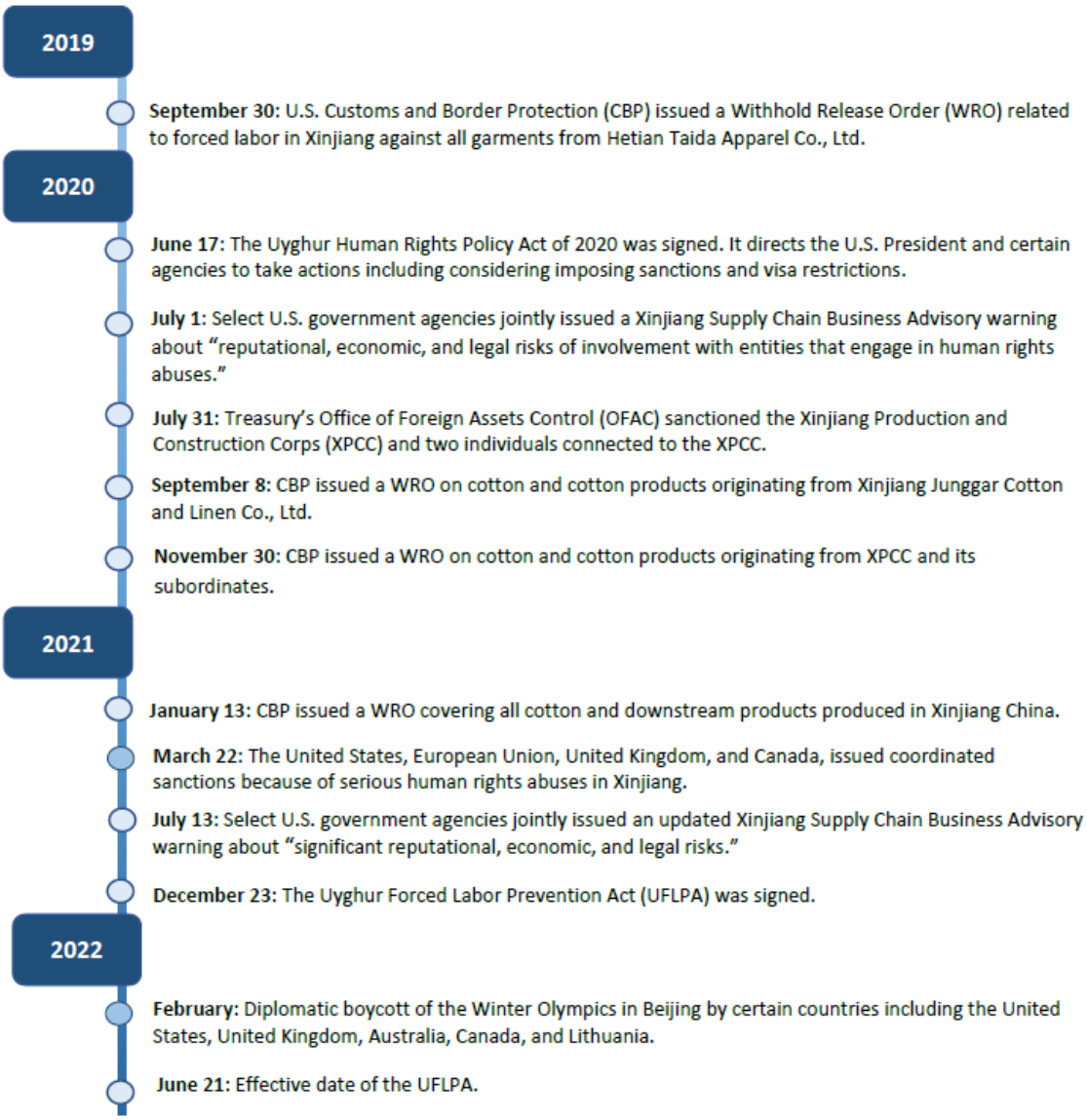
supply chain. U.S. government actions have included a range of measures culminating most recently in the Uyghur Forced Labor Prevention Act (UFLPA).[61] These actions include:

- CBP issuing several Withhold Release Orders (WROs) pertaining to Xinjiang on select Chinese entities and products, including cotton and cotton containing products. According to CBP, a WRO allows it "to detain the products in question at all U.S. ports of entry until/unless importers can prove the absence of forced labor in their product's supply chain." The first of these was on September 30, 2019, covering products from Hetian Taida Apparel Co., Ltd, a Chinese garment producer. They also include the November 30, 2020 WRO covering cotton and cotton products originating from the XPCC and the January 13, 2021 WRO on certain products originating in Xinjiang including all cotton and cotton products.[62]
- The U.S. Department of Treasury (Treasury) Office of Foreign Assets Control (OFAC) placing at least eight Chinese officials and two entities including the XPCC, on its List of Specially Designated Nationals and Blocked Persons (SDN List) in connection to the situation in Xinjiang (as of July 2021). As a result, these individuals and entities are subject to sanctions including those that essentially block their access to certain assets and their ability to generally do business with U.S. persons.[63]
- The U.S. Department of Commerce's (Commerce) Bureau of Industry and Security placing a number of Chinese entities on their Entity List.[64] Those on the list are subject to specific additional license requirements for export, reexport and/or transfer (in-country) of specified items.[65] In its July 2021 additions, Commerce stated that the Chinese entities were added to the Entity List for enabling the Chinese government's "campaign of repression, mass detention, and high-technology surveillance against Uyghurs, Kazakhs, and members of other Muslim minority groups in the Xinjiang."[66]
- The UFLPA, which Congress passed with overwhelming majorities in December 2021 and fully entered into force on June 21, 2022. Among other requirements, the UFLPA establishes a rebuttable presumption for CBP that all imports produced or manufactured wholly or in part in Xinjiang used forced labor and are thus not entitled to entry to the United States. To rebut this presumption, the law requires among other things that importers provide proof that no forced labor was used in the imported goods produced wholly or in part in Xinjiang. The UFLPA also imposes sanctions on select "foreign individuals responsible for forced labor in the region."

[61] Uyghur Forced Labor Prevention Act of 2021 (UFLPA), Pub. L. No. 117-78, 135 Stat. 1525.
[62] CBP, Withhold Release Orders and Findings List, accessed June 6, 2022.
[63] Assets that are in the United States, transiting the United States or in the possession or control of U.S. persons are blocked. State et al., "Risks and Considerations," July 13, 2021, 10-11, 18-19; Treasury, OFAC, Specially Designated Nationals and Blocked Persons List (SDN) Human Readable Lists, updated June 6, 2022; Treasury, "Treasury Sanctions Chinese Entity and Officials," July 31, 2020. OFAC has also placed over 60 Chinese entities on its Non-SDN Chinese Military-Industrial Complex Companies List (NS-CMIC List). Entities on the NS-CMIC list are subject to investment restrictions. Treasury, OFAC, NS-CMIC List, updated December 16, 2021; Treasury, OFAC, Sanctions List Search, accessed June 9, 2022.
[64] The Entity List "identifies entities reasonably believed to be involved, or to pose a significant risk of being or becoming involved, in activities contrary to the national security or foreign policy interests of the United States." State et al., "Risks and Considerations," July 13, 2021, 6; Commerce, "Commerce Department Adds 34 Entities to the Entity List," July 9, 2021; Commerce, "Entity List," accessed March 10, 2022.
[65] Commerce, BIS, "Entity List," accessed June 9, 2022.
[66] Commerce, "Commerce Department Adds 34 Entities to the Entity List," July 9, 2021.

UFLPA further directs the Forced Labor Enforcement Task Force to develop additional strategies to support the ban on importation of goods made with forced labor from China including Xinjiang, and cotton is explicitly referenced as being a high-priority sector for enforcement under this strategy.[67]

Figure 3 Timeline of Select U.S. Government Actions in Response to the Government of China's Human Rights Abuses Centered in Xinjiang



Sources: CBP, Withhold Release Orders and Findings List, accessed March 8, 2022; Uyghur Human Rights Policy Act of 2020, Pub. L. No. 116–145, 134 Stat. 648; State, Treasury, Commerce, and DHS, "Risks and Considerations," July 1, 2020; State et al., "Risks and Considerations," July

[67] Per the UFLPA, the Forced Labor Enforcement Task Force strategy is directed to cover "forced labor in the People's Republic of China, including from the Xinjiang Uyghur Autonomous Region or made by Uyghurs, Kazakhs, Kyrgyz, Tibetans, or members of other persecuted groups in any other part of the People's Republic of China." Uyghur Forced Labor Prevention Act of 2021 (UFLPA), Pub. L. No. 117-78 secs. 2-3, 135 Stat. 1525; 1526-1529; Ji and He, "US' Xinjiang Law Puts Chinese Businesses in Crosshairs," January 20, 2022.

13, 2021; Treasury, "Treasury Sanctions Chinese Entity and Officials," July 31, 2020; Rauhala, "U.S., E.U., Canada and Britain Announce Sanctions," March 22, 2021; Treasury, "Treasury Sanctions Chinese Government Officials," March 22, 2021; Uyghur Forced Labor Prevention Act of 2021 (UFLPA), Pub. L. No. 117-78, 135 Stat. 1525; White House, Press Briefing December 6, 2021; Euronews, "Winter Olympics" January 14, 2022; Bloomberg, "These Are the Countries Joining the Diplomatic Boycott," December 9, 2021.

A number of foreign governments have also taken measures and spoken out against China in objection to China's human rights abuses against the Uyghurs and other minority groups in Xinjiang. These include the governments of Canada, the United Kingdom (UK), the European Union (EU) and several of its member states, and Norway.[68] Some of these actions have been coordinated among multiple countries including the United States. For example, on January 12, 2021, Canada and the UK issued coordinated sanctions on China because of evidence of human rights violations involving Uyghurs and other ethnic minorities in Xinjiang.[69] These include in Canada a "prohibition of imports of goods produced wholly or in part by forced labour," and, in the UK, "export controls as they apply to Xinjiang… to prevent the exports of goods that may contribute to human rights abuses in the region." As noted on the timeline, on March 22, 2021, coordinated sanctions were also issued by the United States, EU, UK, and Canada because of serious human rights abuses in Xinjiang.[70]

Overview of the Global Cotton-containing Products Supply Chain

The cotton-containing products supply chain is generally complex, involving many stages of production and materials. Cotton consumer goods analyzed in this paper cover both apparel and made-up textile products. While there is a pure cotton supply chain, the industry norm is that after ginning, most cotton lint enters into a supply chain which includes a wide range of fibers (e.g., polyester and other synthetic fibers) that can be blended with cotton.[71] A simplified supply chain involves five major processing stages (figure 4). Each stage of the supply chain can involve products crossing borders, although this is rare between the first two stages since cotton is normally ginned near supplying farms.[72] For downstream production there are often intermediaries involved between major processing steps. For example, product manufacturers may have subcontractors doing certain processes or suppliers for certain

[68] See e.g., State et al., "Risks and Considerations," July 13, 2021, Annex 7; Government of Canada, "Canadian Sanctions Related to People's Republic of China," November 16, 2021; Government of Canada, "Special Economic Measures (People's Republic of China)," March 23, 2021; European Parliament, Resolution on Forced Labour and the Situation of the Uyghurs, December 17, 2020; Agence France-Presse, "China Hits Out at Norway State Fund," March 9, 2022; Reuters, "Dutch Parliament," February 25, 2021; Hsiao and Soula, "Waiting for EU," August 10, 2021; Mullen, "Explainer: Xinjiang Timeline," October 9, 2021.
[69] Government of Canada, "Canada Announces New Measures to Address Human Rights," January 12, 2021; Government of UK, "UK Government Announces Business Measures Over Xinjiang," January 12, 2021.
[70] See e.g., Treasury, "Treasury Sanctions Chinese Government Officials," March 22, 2021; Government of Canada, "Canada Joins International Partners in Imposing New Sanctions," March 22, 2021; Rauhala, "U.S., E.U., Canada and Britain Announce Sanctions on China," March 22, 2021.
[71] See e.g., Textile School, "Blended Fabrics," March 17, 2018; Sustainable Fashion, "Cotton Blends," accessed July 15, 2022.
[72] Cotton ginning is the process by which the cotton's lint (fiber), seed as well as any waste are separated. After processing, ginners normally further clean and bale (which is more efficient to transport) cotton lint for sale.

pieces.[73] This use of intermediaries contributes to the complexity of the cotton-containing fabric and consumer goods supply chain which in turn increases the difficulty of tracing cotton to the area of origin.

Within China, companies are involved on a large scale at all stages of the cotton-containing supply chain, although different activities are clustered in different regions. As established above, China's cotton production is concentrated in Xinjiang. Ginning is also primarily based in Xinjiang since this initial processing usually occurs near farms shortly after it is harvested. Lehr (2020) reports that there are approximately 170 cotton gins operated by the XPCC.[74] China's yarn spinning capacity (of cotton and non-cotton yarns) was estimated at about 110 million spindles accounting for half of global capacity in 2018.[75] Xinjiang production of yarn accounts for an estimated 5.9 percent of China's total in 2018, of which 30 percent is estimated to be produced by the XPCC.[76] The majority of China's fabric and apparel production is concentrated in the east of the country, especially the coastal regions including Guangdong, Zhejiang, and Jiangsu.[77] China had an estimated 24,000 firms involved in fabric and clothing production as of 2019.[78] The Chinese government has been seeking to increase the amount of downstream manufacturing (including yarn spinning) occurring in Xinjiang where there is limited fabric and apparel production. This continues to part of government plans to improve the region's economy, in part, by creating more manufacturing jobs.[79]

Figure 4 Simplified cotton-containing fabric and consumer goods supply chain

Sources: Compiled by authors based on Berry et al., *Shedding Light on the Dark Side of Trade*, March 2022, 40; images from Unsplash (Marina Ermakova; Mel Poole; Greg Rosenke) and DepositPhotos.

[73] See e.g., Environmental Justice Foundation, Burden, and Tesco (Firm), *Somebody Knows Where Your Cotton Comes From*, 2009, 6; Donaldson, "Cambodia Faces Alarming Threat of Garment Sector Subcontracting," May 30, 2017; Totty, "How Brands Can Anticipate Unauthorized Subcontracting," September 2, 2020.
[74] Lehr, *Addressing Forced Labor*, July 2020, 7.
[75] USDA reported estimation from the Textile Industry Association, a Chinese association. USDA, FAS, *Cotton Annual: China (2022)*, April 6, 2022, 6.
[76] Lehr, *Addressing Forced Labor*, July 2020, 4–7.
[77] The Chinese government has a cotton transportation subsidies program which aims to facilitate connecting Xinjiang cotton with the approximately 2,000 miles away fabric and apparel industry. Dim Sums, "Subsidies Keep Xinjiang Cotton Farms Afloat," November 1, 2020; USDA, FAS, *Cotton Annual: China (2022)*, April 6, 2022, 3; *RagTrader*, "China's Factories," August 10, 2018; Zhu and Pickles, "Bring In, Go Up, Go West, Go Out," 2014; Dim Sums, "China Cotton Clumped in Northwest," January 6, 2019.
[78] Ma, "Fortune 500 China Leading Textile and Clothing Manufacturers 2021," August 9, 2021.
[79] Dim Sums, "Sprawling 5 Year Plan for Xinjiang," June 12, 2021; Patton, "Xinjiang Cotton at Crossroads," January 12, 2016; Textile Excellence, "Xinjiang Spinning Status Quo," July 12, 2017; Textile Excellence, "China Will Invest," September 30, 2016.

Estimating the Extent of Xinjiang Cotton within Global and U.S. Supply Chains

As described above, the UFLPA and similar U.S. actions were designed to reduce U.S. imports of Xinjiang cotton and downstream cotton-containing products. Xinjiang is the largest source of cotton supply to China, which in turn is the largest U.S. trading partner for cotton-containing goods. In addition, China exports certain cotton-containing intermediate goods—most notably cotton fabric—to other countries, which produce apparel and other cotton consumer goods for export to the United States. To trace the scale of existing U.S. and global market exposure to Xinjiang-origin cotton that passed through these supply chains in the years prior to the 2022 implementation of the UFLPA, we used two types of estimates:

1. **Xinjiang content of cotton-containing goods**: Our first set of estimates are measures of Xinjiang cotton as a share of all cotton used within a country's production and exports of (1) cotton yarn, (2) cotton fabric, and (3) cotton consumer goods (these percentage estimates are also referred to as the "Xinjiang content" of these goods).[80] For each of these three estimates, Xinjiang content is based on the relative quantities of upstream intermediate cotton good inputs derived from Xinjiang- and non-Xinjiang sources. (These estimates are primarily presented within the section "How Xinjiang-origin cotton enters global supply chains.")

   This analysis uses quantities for each country's production and imports of cotton, cotton yarn, and cotton fabric; however, production data for cotton yarn and fabric were not widely available across countries. Therefore, we estimated production data for these intermediate goods using trade-adjusted derivations of available cotton supply within each country. Unless otherwise stated, our estimated quantities are expressed as cotton fiber equivalents. A cotton fiber equivalent refers to the quantity of cotton fiber used to produce the good based on conversion factors that incorporate blending with other materials (e.g., synthetic yarn) and waste of materials along the supply chain.[81] These adjustments were necessary to maintain comparability across different data sources used within the supply chain analysis, as material blending and waste loss are relatively substantial within the supply chain.[82]

2. **U.S. imports derived from Xinjiang-origin cotton:** The second set of estimates are measures of the value of U.S. imports derived from Xinjiang-origin cotton. For purposes of quantifying the scale of these imports that cover a broad range of cotton-containing goods, the Xinjiang content

[80] For purposes of this paper, the term "country" does not imply political independence but refers to any territory for which authorities report separate social or economic statistics.
[81] For example, if there is a statement that a country produces 10,000 mt of cotton fabric and 20 percent of that is derived from Xinjiang-origin cotton, this should be interpreted to mean that 10,000 mt of cotton was needed to produce those products (considering blending and waste) and that 20 percent of that cotton originated in Xinjiang. Conversion factors were provided by an industry source. See the "Estimation Methodology" section below for more details.
[82] BCI, "Measuring Cotton Consumption," October 2020.

of trading partners' production of those goods are multiplied by the value of U.S. imports.[83] (These estimates are primarily presented within the section "How Xinjiang-origin cotton enters the United States.")

We describe the methodology used to generate these estimates in greater detail in Appendix 2. In effect, these estimates are representations of the various concentrations of imported and domestic inputs at each step of the supply chain for each country, based on publicly available trade and production data. Without use of specific firms' sourcing information, estimates expressed on a percentage basis are not directly applicable to any particular shipment or firm along the supply chain. Instead, such estimates should be interpreted as broad depictions of risk of exposure that firms and consumers have to Xinjiang-origin cotton within each stage of the global supply chain for cotton-containing products.

In addition, the basis of our estimates is whether or not the cotton fiber originated in Xinjiang. We did not attempt to estimate the extent to which Xinjiang-origin or any other cotton was harvested using forced labor. Similarly, our estimates are based solely on the origin of cotton harvest. Therefore, Xinjiang's production of cotton yarn, fabric, or cotton consumer goods that use cotton harvested outside of Xinjiang (from China or elsewhere) are not counted within the estimates.

How Xinjiang-origin Cotton Enters Global Supply Chains

As discussed above, China is one of the largest cotton growing countries in the world with production highly concentrated in Xinjiang.[84] China accounted for 26.4 percent of global output in MY 2020/21. In 2020, approximately 87.3 percent of China's cotton production occurred in Xinjiang.[85] This means that Xinjiang was the source of approximately 23.1 percent of global cotton output in 2020/21.[86] For many countries, China is also the largest source of cotton-containing products, particularly cotton fabric and cotton consumer goods like apparel and made-up textiles.

[83] Our estimates were designed to measure cotton that was harvested in Xinjiang as a share of all cotton included within U.S. imports of a defined group of cotton-containing goods, expressed in terms of the value of those imports. It is important to note that the estimates are not the raw material value of Xinjiang-origin cotton within downstream goods. Because there are other material and non-material costs as well as mark-ups along the supply chain included within U.S. imports of downstream cotton-containing goods, the raw material value of cotton within U.S. imports is likely to be far less than the aggregate value of U.S. imports that contain Xinjiang-origin cotton. Nor do these estimated values represent the total value of all U.S. imports that may contain any trace quantities of Xinjiang-origin material (which would likely be quite a bit higher than these estimates).
[84] For the subsequent analysis in this paper, cotton harvesting and ginning are combined within a single first stage of the supply chain (collectively referred to as "cotton production") which reflects the likelihood that harvesting and ginning occur in the same country. The output of this first stage of production is raw, carded, or combed cotton, sometimes referred to as cotton lint or cotton fiber (and generally referred to in this paper simply as "cotton").
[85] Government of China, NBS, CEIC database, AFF Production Data, accessed February 4, 2022.
[86] China's cotton harvest occurs in the later part of the year, and therefore reported production in Xinjiang and China for 2020 refers to harvest that likely occurred within MY 2020/21 (August 2020 to July 2021 for China). BCI, "Better Cotton in China," accessed March 29, 2022; USDA, FAS, PS&D: Data Availability, accessed March 29, 2022.

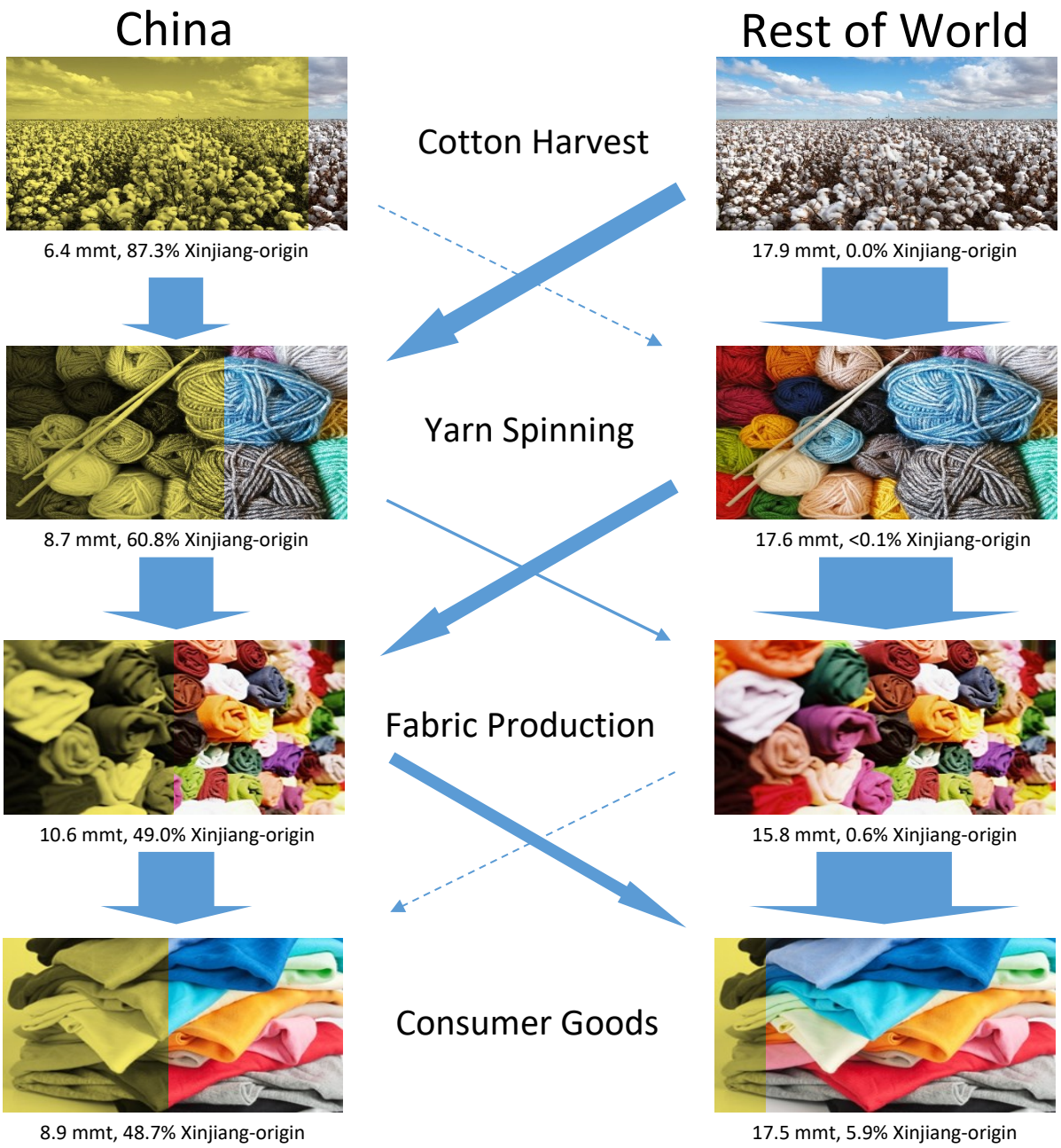
As depicted in figure 5 based on our estimates, Xinjiang-origin cotton likely remains primarily within China until the cotton fabric stage of the supply chain. China's substantial net exports of cotton fabric indicates that other countries' production of downstream cotton consumer goods may contain Xinjiang-origin cotton. However, China's substantial net imports of cotton and cotton yarn from other countries likely dilutes the Xinjiang content of its downstream production and exports. This section uses our estimates to explore the global supply chains that are likely to be most exposed to this large quantity of Xinjiang-origin cotton based on countries' direct imports from China or imports from sources that use Chinese cotton-containing intermediate products (i.e., cotton yarn and cotton fabric).

Xinjiang-origin cotton has not been directly exported in substantial quantities

Despite the substantial size of the Chinese cotton harvest relative to other global producers, this cotton is generally not exported except in very small quantities. China exported only approximately 2,000 metric tons (mt) of cotton in MY 2020/21, representing less than 0.1 percent of the 10.6 million metric tons (mmt) of global exports of this commodity in that year.[87] China's exports of cotton to the United States totaled just over 6 mt in 2021.[88] It is therefore unlikely that there is any substantial global or U.S. exposure to Xinjiang-origin cotton from China's minimal direct exports of cotton. Instead, China is a net importer of cotton, with imports often accounting for a sizable supplement to domestic supply. China's imports accounted for 32.2 percent of its total domestic use of cotton in MY 2020/21.[89]

[87] USDA, FAS, PS&D Online, accessed February 9, 2022.
[88] S&P Global, IHS Markit, Global Trade Atlas database, accessed March 24, 2022.
[89] USDA, FAS, PS&D Online, accessed February 9, 2022.

Figure 5 Estimated production quantities and shares of Xinjiang-origin cotton within the global cotton-containing products supply chain, 2021



Source: Authors' estimates; USDA, FAS, PS&D Online, accessed February 9, 2022; S&P Global, IHS Markit, Global Trade Atlas database, accessed March 24, 2022; Government of China, NBS, CEIC database, AFF Production Data, accessed February 4, 2022.
Note: Production quantities are expressed in cotton fiber equivalents based on conversion factors that incorporate blending with other materials (e.g., synthetic yarn) and waste of materials along the supply chain. Yellow highlighting and "Xinjiang-origin" percentage figures represent the quantity of Xinjiang-origin cotton as a share of total cotton used within each production activity.

Xinjiang-origin cotton yarn enters global supply chains in limited quantities, but China is primarily a net importer of cotton yarn

Because Xinjiang-origin cotton is not directly exported in commercially substantial quantities, the first entry into global markets occurs within the yarn stage. In this analysis, the cotton fiber equivalent of China's cotton yarn production in 2021 is estimated to be 8.7 mmt. Based on the mix of available inputs that exist within China's overall cotton market, an estimated 60.8 percent of the cotton used in China's cotton yarn spinning in 2021 originated in Xinjiang, while 39.2 percent came from other sources (including cotton from other regions in China and imports from foreign sources) (see box 2).[90] China supplements its domestic production of cotton yarn with substantial yarn imports, with the cotton fiber equivalent quantity of China's cotton yarn imports totaling 2.1 mmt in 2021 (42.0 percent of global imports).[91]

Box 2 The Opposing Effects of Two Major Operating Assumptions

As described in greater detail within Appendix 2 below, our estimation approach relied upon publicly available information and, as a result, several operating assumptions. Two major assumptions necessary for the estimation and supply chain analysis have factual limitations, leading to opposing overstating and understating effects on the estimates.

One operating assumption is that cotton is used entirely in the production of cotton yarn. Use of this assumption was necessary to incorporate the globally available total domestic cotton use data from the U.S. Department of Agriculture's Production, Supply and Distribution (PS&D) database.[92] These data were considered equivalent to each country's cotton fiber equivalent production of cotton yarn. There are other uses for cotton besides cotton yarn; however, there was no clear way to systematically allocate each country's cotton use between cotton yarn and other uses. Therefore, this operating assumption likely overstates by varying degrees the extent of cotton yarn production in each country and, more explicitly, the extent of Xinjiang content within China's production of yarn.

Another assumption—covering the composition of China's cotton stocks—likely has the opposite effect. As described in Appendix 2, the share of Xinjiang content within China's cotton yarn production is calculated as the quantity of Xinjiang cotton production divided by the quantity of China's sum of all domestic cotton production (Xinjiang and non- Xinjiang) and imports of cotton. In reality, a third source of supply exists within the Chinese market: stocks (also known as reserves) of cotton harvested

[90] As described in greater detail within the "Estimation Methodology" section below, this analysis uses the operating assumption that cotton production occurs in the first year in a crop marketing year pair (e.g., 2020 in MY 2020/21), and that the trade and downstream use of such products occurs within the second year in a crop marketing year pair (e.g., 2021 in MY 2020/21). Therefore, annual trade data for 2021 and estimates of 2021 production of yarn and downstream products are linked in the supply chain analysis with cotton production reported by USDA for MY 2020/21 and China's region-specific cotton production for 2020.
[91] Trade data within the analyses of the supply chains for cotton yarn, cotton fabric, and cotton consumer goods use S&P Global's Global Trade Atlas. Cotton yarn trade data presented in this section do not include a small quantity of cotton yarn used for resale. S&P Global, IHS Markit, Global Trade Atlas database, accessed March 24, 2022. See Appendix 1 table 1 for details of which HS codes are included in each category.
[92] USDA, FAS, PS&D Online, accessed February 9, 2022.

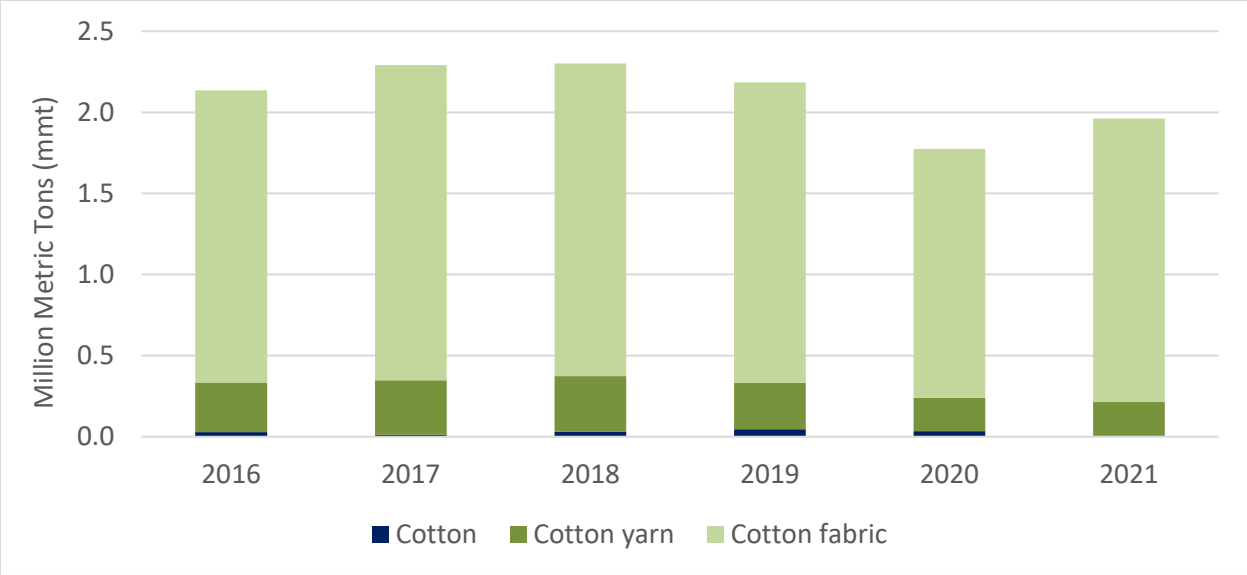
domestically or imported in previous years.[93] In recent years, China's stock purchases are thought to have consisted of disproportionate quantities of foreign-origin cotton (i.e., imports), while stock sales have largely focused on offloading domestic cotton purchased in the earlier part of the 2010s.[94] Therefore, the majority of China's consumption of cotton from stocks is likely of China-origin cotton (including large amounts of Xinjiang-origin cotton). As such, our omission of these stocks from Xinjiang content calculations likely has an understating effect on the extent of Xinjiang-origin cotton within China's production of yarn.

While we identify these two operating assumptions as having different likely effects on our calculations, they should not be viewed as completely offsetting one another. It is not possible for us to assess the degree to which either assumption has led to over- or underestimates of the extent of Xinjiang content within China's production or downstream imports.

China's cotton yarn exports are more substantial than its cotton exports (figure 6) but still only represent small fractions of either China's cotton yarn production or total global cotton yarn exports. In 2021, the cotton fiber equivalent quantity of China's cotton yarn exports totaled 0.2 mmt, equating to approximately 4.2 percent of global cotton yarn exports (5.0 mmt). China's exports of cotton yarn accounted for an estimated 2.4 percent of China's cotton yarn production, suggesting that China's cotton yarn industry has a greater domestic orientation than large cotton yarn industries in other countries.[95] China's largest cotton yarn exports were to Bangladesh, Vietnam, Hong Kong, and Russia.[96] However, with the exception of Hong Kong, China was not the top supplier of cotton yarn to any of these larger importers.

[93] While data for China's stocks are available within the PS&D database (the foundation of our upstream cotton production and trade estimates), the stock data are not broken out by source (e.g., domestic production or imports). USDA, FAS, PS&D Online, accessed February 9, 2022.
[94] USDA, FAS, *Cotton: World Markets and Trade*, June 2022; Johnson et al., "The World and United States Cotton Outlook," February 25, 2022; Graham Soley, interview with USITC staff, July 13, 2022. Consistent with this trend, the China Cotton Association has recently reported that textile enterprises' cotton sourcing is 80-90 percent Xinjiang-origin, far higher than the 60.8 percent we estimate for 2021 cotton yarn production. See e.g., China Cotton Association, "Textile Production Has Recovered Slightly" June 16, 2022.
[95] The five largest exporters of cotton yarn were India (estimated to have 25.5 percent of cotton yarn production exported in 2021), Vietnam (68.0 percent), Uzbekistan (81.4 percent), Pakistan (17.7 percent), and the United States (67.6 percent). S&P Global, IHS Markit, Global Trade Atlas database, accessed March 24, 2022.
[96] Hong Kong is a Special Administrative Region of China; however, China's trade statistics do not include Hong Kong.

Figure 6 China's exports of cotton and cotton-containing intermediate products, 2016-21, cotton fiber equivalents in million metric tons



Source: Authors' estimates; USDA, FAS, PS&D Online, accessed February 9, 2022; S&P Global, IHS Markit, Global Trade Atlas database, accessed March 24, 2022.
Note: Export quantities are expressed in cotton fiber equivalents based on conversion factors that incorporate blending with other materials (e.g., synthetic yarn) and waste of materials along the supply chain. See Appendix 2 below for more details.

Xinjiang-origin cotton enters global markets through China's exports of cotton fabric

A large majority of China's cotton yarn production is used by domestic textile mills to produce fabric. As stated above, Chinese textile mills also import large quantities of cotton yarn from foreign sources, further diluting the Xinjiang content within China's cotton fabric production. In 2021, Xinjiang-origin cotton accounted for an estimated 49.0 percent of the 10.6 mmt of cotton used within China's production of cotton fabric.

China's cotton fabric exports are substantial and, based on our estimates, likely represent the second-largest channel through which Xinjiang-origin cotton enters global supply chains. In 2021, the cotton fiber equivalent of China's exports of cotton fabric to the world totaled 1.7 mmt. China's exports of cotton fabric were shipped primarily to trading partners elsewhere in Asia with major cotton consumer good producing industries, particularly Bangladesh, Vietnam, Hong Kong, Cambodia, and the Philippines. China is also a major supplier of cotton fabric to West African countries, particularly Nigeria.

Most cotton fabric production outside of China does not rely on Xinjiang-origin cotton because of China's limited exports of upstream cotton and cotton yarn. The extent of Xinjiang-origin cotton within non-Chinese cotton fabric production globally is estimated to be very small (0.6 percent in 2021).

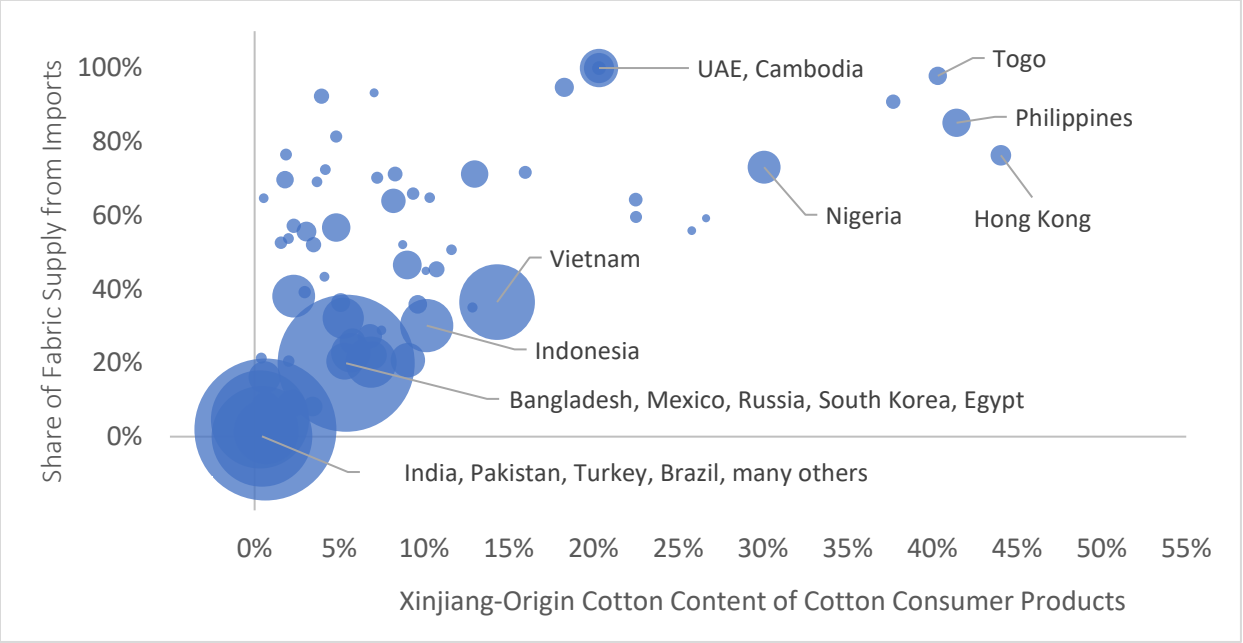
China's exports of cotton consumer goods represent the largest global exposure to Xinjiang-origin cotton

We estimate that the total quantity of cotton used within China's production of cotton consumer goods (apparel and made-up textiles) from all sources was 8.9 mmt in 2021, or approximately one-third of cotton used globally. Because China is the largest source of cotton consumer goods in the world, the level of global exposure to Xinjiang-origin cotton through China's exports of these products is likely substantial. The Xinjiang content within China's production of cotton consumer goods is likely similar to that of its cotton fabric production. This is the case because China relies overwhelmingly on domestic cotton fabric supply to produce cotton consumer goods. It imports relatively small quantities of cotton fabric, estimated to be less than 0.5 percent of its cotton fabric supply in 2021. Xinjiang-origin cotton included within China's production of cotton consumer goods is estimated to be 48.7 percent of all cotton within these products in 2021.

Several other sources of cotton consumer goods also pose exposure risks to Xinjiang-origin cotton

Although China's direct exports of cotton consumer goods represent the largest and most obvious source of exposure to Xinjiang-origin cotton, global importers are also exposed through purchases of cotton consumer goods from non-Chinese sources. This occurs because non-Chinese countries generally mix domestically produced cotton fabric with their imports from other sources, including China, when making cotton consumer goods. The average extent of Xinjiang-origin cotton within global non-Chinese cotton consumer goods is estimated to have been just 5.9 percent in 2021. However, the share of Xinjiang-origin cotton entering global supply chains through cotton consumer goods produced outside of China differs substantially between countries. This is due to differences in their mix of fabric input sources (figure 7). Generally, countries with larger reliance on imported fabric to make cotton consumer goods were more likely to rely on Chinese—and therefore Xinjiang-origin—cotton content.

Figure 7 Xinjiang-origin cotton content in cotton consumer goods production vs. share of cotton fabric supply from imports, by non-Chinese country, 2021



Source: Authors' estimates; USDA, FAS, PS&D Online, accessed February 9, 2022; S&P Global, IHS Markit, Global Trade Atlas database, accessed March 24, 2022; Government of China, NBS, CEIC database, AFF Production Data, accessed February 4, 2022.
Note: Size of points on the map demonstrate visually the total quantity of cotton fiber used in cotton consumer goods production.

- **Import-reliant countries:** In particular, countries like Cambodia, Nigeria, and the Philippines, which do not have a substantial domestic supply of cotton fabric, imported large quantities of Chinese fabric. Therefore, we estimate that import-reliant countries had fairly high shares (from 20 percent to over 40 percent) of Xinjiang-origin cotton content within their production of cotton consumer goods in 2021.
- **Domestic source-reliant countries:** By contrast, several countries with substantial domestic cotton production and downstream industries—like India, Pakistan, Turkey, and Brazil—imported only small quantities of cotton-containing intermediate products from China. Therefore, we estimate that domestic source-reliant countries had a very small share (less than one percent) of Xinjiang-origin cotton content within their production of cotton consumer goods in 2021.
- **Mixed source countries:** A third group of large cotton consumer goods producing countries—like Bangladesh, Vietnam, and Indonesia—rely on a mix of foreign and domestic sources of cotton fabric. Therefore, we estimate that mixed source countries had a share of Xinjiang-origin cotton in their cotton consumer goods production that was closer to the non-Chinese global average (5.9 percent) in 2021.

How Xinjiang-origin Cotton Enters the United States

The United States is one of the largest import markets for cotton-containing goods in the world. China is both the largest source of these imports and the largest user of Xinjiang-origin cotton within its

production. However, as described above, U.S. imports from other countries also likely contain Xinjiang-origin cotton. This section presents estimates covering the extent to which the United States is exposed to Xinjiang-origin cotton through its supply chains, and the specific channels through which it likely enters.

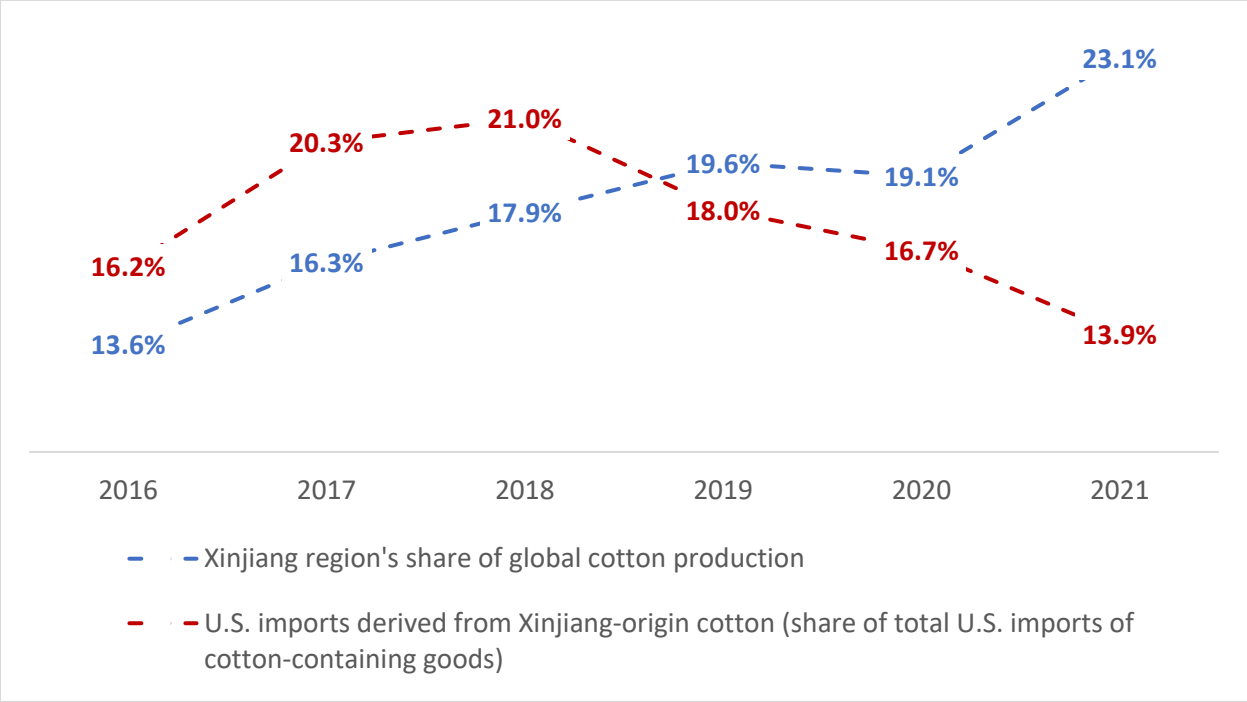
In 2021, the United States imported approximately $44.9 billion of cotton-containing products from all suppliers, of which we estimate $6.2 billion (13.9 percent) was of products derived from Xinjiang-origin cotton.[97] Based on our estimates, cotton consumer goods accounted for over 99 percent of U.S. imports derived from Xinjiang-origin cotton. This reflects the fact that U.S. imports of finished apparel and made-up textile products far outweigh U.S. imports of any raw or intermediate cotton products. The United States imported $43.7 billion worth of cotton consumer goods in 2021, with China being the largest source of these products. By contrast, U.S. imports of cotton fabric and cotton yarn were far lower at $956.3 million and $196.6 million, respectively.[98] As described above, most countries other than China had relatively low estimated Xinjiang-origin cotton within their production of these intermediate goods, and China itself was a relatively small supplier of these products to the United States.[99] As a result, the estimated value of U.S. imports derived from Xinjiang-origin cotton is relatively low for cotton fabric ($49.8 million) and cotton yarn ($5.3 million).[100]

U.S. imports derived from Xinjiang-origin cotton have been declining in line with a shift away from direct imports of Chinese cotton consumer goods

Although we estimate that a large value of U.S. imports of cotton-containing products was derived from Xinjiang-origin cotton in 2021, such imports are declining and are low compared to the Xinjiang region's share of global cotton production. Based on these estimates, approximately 13.9 percent of the value of U.S. imports of cotton-containing products contained Xinjiang-origin cotton in 2021. This is the lowest share in recent years and reflects a steady decrease from the period high 21.0 percent ($9.1 billion) in 2018, a peak level that was reached after several years of growth. This decline occurred despite Xinjiang accounting for a growing share of global cotton production (it increased from 13.6 percent in 2016 to 23.1 percent in 2021) (figure 8). These divergent trends suggest that Xinjiang-origin cotton is being gradually diverted into supply chains that do not serve the U.S. market, including potentially to the Chinese domestic market.

[97] Trade data within the analysis of U.S. imports of cotton-containing products use IHS Markit's Global Trade Atlas. S&P Global, IHS Markit, Global Trade Atlas database, accessed March 24, 2022.
[98] Unlike the cotton yarn export data described within the supply chain analysis above, estimates of the value of U.S. imports of cotton yarn (and overall estimates of U.S. imports of cotton-containing products) include cotton yarn for resale. While cotton yarn for resale accounts for a small share of the global trade of cotton yarn, it accounts for the majority of U.S. imports of cotton yarn.
[99] China accounted for less than 10 percent of U.S. imports of cotton yarn and cotton fabric in 2021.
[100] Estimates of Xinjiang-origin cotton within U.S. imports of cotton were not produced within the broader estimation methodology applied within this paper due to China's low exports of these goods. In 2021, U.S. imports of raw, carded, or combed cotton from China totaled $26,213, and since Xinjiang accounted for 87.3 percent of China's cotton production in MY 2020/21, it is reasonable to assume that the value of direct U.S. imports of these goods was lower than $25,000.

Figure 8 Xinjiang-origin cotton as a share of global cotton production and U.S. imports of cotton-containing products



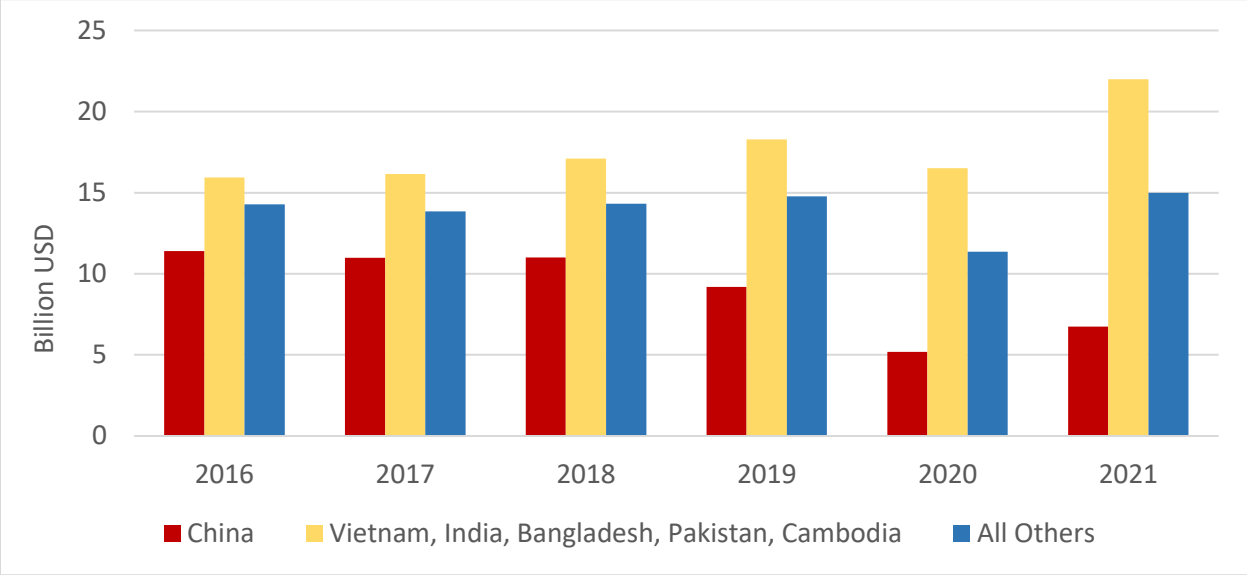
Source: Authors' estimates; USDA, FAS, PS&D Online, accessed February 9, 2022; Government of China, NBS, CEIC database, AFF Production Data, accessed February 4, 2022.

A number of notable factors contributed to the decline in U.S. imports of Xinjiang-origin cotton and, more specifically, the decline in direct imports of these goods from China. Declining U.S. imports of cotton-containing goods from China has occurred as sourcing has diversified to other countries. Although U.S. imports from China have long been the largest bilateral trade flow of cotton consumer goods in the world, U.S. imports of cotton consumer goods from top non-Chinese sources—particularly Vietnam, India, Bangladesh, Pakistan, and Cambodia—have substantially increased while imports of cotton consumer goods from China have declined overall between 2016 and 2021 (figure 9). This trend occurred beginning in 2019, the year that marks the beginning of U.S. government actions aimed at eliminating imports of cotton produced using forced labor in Xinjiang. The decline in U.S. imports from China also coincided with section 301 tariffs imposed in 2018, the COVID-19 pandemic, greater Chinese consumer demand for apparel and similar items, and private sector-led efforts to reduce exposure to Xinjiang cotton.[101] In 2021, while U.S. imports of cotton consumer goods from China slightly recovered

[101] The degree to which brands and other private sector entities are shifting away from Xinjiang cotton is uncertain. In recent years, industry statements expressing concern with human rights violations in Xinjiang have been met with substantial Chinese consumer backlash. Reportedly, the risk of losing access to the large Chinese market has prompted several firms to offer conciliatory statements on Xinjiang. Teodoro and Rodriguez, "Textile and Garment Supply Chains in Times of COVID-19," May 29, 2020; Flannery, "Covid-19 Spread in China Hits Nike," January 3, 2022; STR, "Section 301 Tariffs on China" accessed May 20, 2022; Copley and Rack, "Investors Press Companies with Xinjiang Ties to Clean Up Supply Chains," April 12, 2021; Reuters, "China Branch of Cotton Trade Body Finds No Forced Labour in Xinjiang," March 26, 2021; Rascouet, Hipwell, and Pham, "China Is Forcing Fashion to Mute Itself Over Dirty Cotton," October 14, 2021; Goodman, Wang, and Paton, "Global Brands Find It Hard to Untangle Themselves from Xinjiang Cotton," April 6, 2021.

compared to 2020, they remained considerably below historical levels whereas imports of these products from other countries strongly recovered and reached new peak levels.

Figure 9 U.S. imports of cotton consumer goods from China and other major sources, 2016-21, value in billion USD



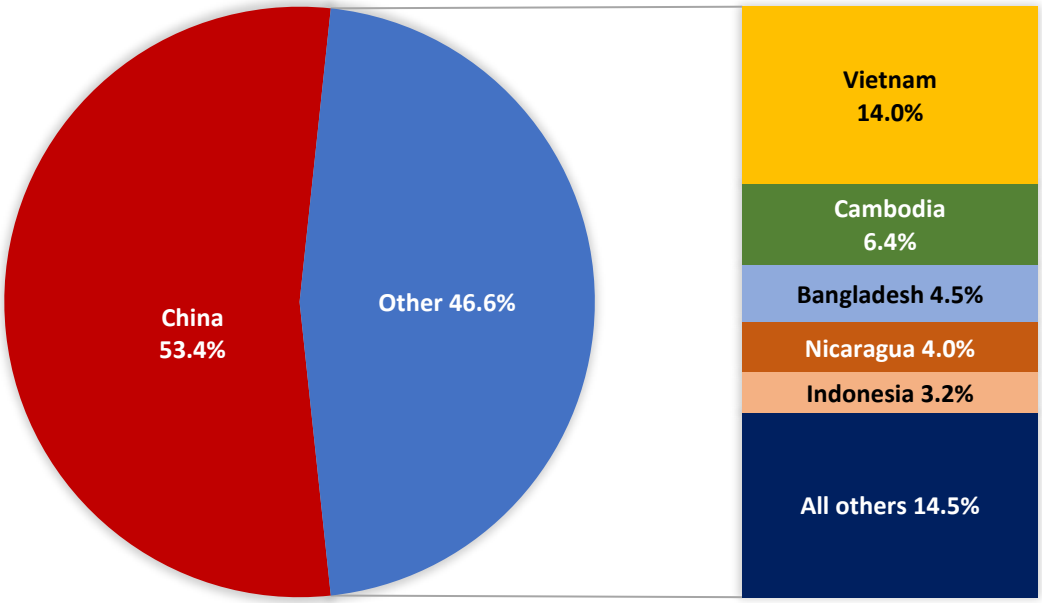
Source: S&P Global, IHS Markit, Global Trade Atlas database, accessed April 11, 2022.
Note: Major U.S. trading partners included within the "All Others" category include Indonesia, Mexico, Honduras, Nicaragua, Guatemala, El Salvador, Turkey, and Sri Lanka.

U.S. imports of Xinjiang-origin cotton from third-country sources have been increasing

Even while overall U.S. imports derived from Xinjiang-origin cotton fell by 27.5 percent, we estimate that the value of such imports from non-Chinese sources increased by 27.4 percent from 2016 to 2021 leading to a partial offset of the declining Xinjiang content within U.S. imports. We also estimate that almost half of U.S. imports derived from Xinjiang-origin cotton that year came from non-Chinese countries that incorporated Chinese cotton fabric into their production of cotton consumer products (figure 10). Most of this was from four large Asian producers of cotton consumer goods— Vietnam, Cambodia, Bangladesh, and Indonesia. However, Nicaragua was the fourth largest third-country source of these imports.[102] Most U.S. imports of cotton-containing products from these five countries were not derived from Xinjiang-origin cotton (see appendix 1 table 2 showing estimated U.S. imports derived from Xinjiang-origin cotton by partner). Nonetheless, these estimates suggest that the U.S. market may remain exposed to Xinjiang-origin cotton due to the sourcing of cotton-containing intermediate products by third-country producers, even as direct imports of these goods from China decline.

[102] Nicaragua is a party to the Central America-Dominican Republic Free Trade Agreement (CAFTA-DR) which, like most U.S. free trade agreements (FTAs), has specific rules of origin in place limiting FTA privileges for U.S. imports of textile and apparel products derived from fabric originating in countries not party to that agreement. However, any U.S. imports of goods from Nicaragua that did not claim CAFTA-DR privileges would not be subject to those same requirements. USTR, *CAFTA-DR Facts*, July 2007.

Figure 10 Estimated trade partner shares of total U.S. imports derived from Xinjiang-origin cotton within cotton-containing products, 2021



Source: Authors' estimates.

Key Takeaways and Future Research

As Xinjiang has become an increasingly substantial supplier of the world's cotton, many observers have expressed concern about the human rights and labor practices occurring within that region (see "China's Cotton Industry"). While findings of human rights and labor violations are centered on ethnic minority groups from Xinjiang, they are not limited to the region. The U.S. government has taken actions seeking to limit imports related to these violations, most notably the UFLPLA which was implemented in 2022. Within that context, this paper took stock of the growth and characteristics of the Xinjiang cotton industry and then attempted to map the ways in which that fiber was being processed downstream through globally traded cotton yarn, fabric, and consumer goods.

What we found was that most Xinjiang fiber does not enter global markets until it is exported as cotton fabric or cotton consumer goods. China's exports of these goods likely incorporate cotton from many non-Chinese sources as well, diluting the Xinjiang content of these products. As U.S. imports of cotton-derived goods from China have declined in recent years, so has U.S. market exposure to Xinjiang-origin cotton through these direct import channels. However, the diversion of U.S. imports away from China has been accompanied by increased U.S. imports from third countries that use Chinese-origin fabric. While China remains the most prominent and largest source of U.S. imports derived from Xinjiang-origin cotton, we estimated that almost half of such imports were from other countries in 2021.

There are a number of ways that the estimation methodology developed for this paper may be expanded or adjusted. Due to our use of publicly available data for this estimate and its relatively simple structure, this supply chain analysis is replicable for future projects that seek to gauge changes in these estimates over time. Producing estimates reflective of changes after the implementation of the UFLPA may be particularly interesting. There are also ways to fine tune or try other approaches to the estimation methodology by making changes in several of the key operating assumptions used in this paper. In particular, two major operating assumptions related to use of Chinese government stocks and the total passthrough of cotton fiber into yarn/fabric channels (used for calculating production) likely have opposing effects on the estimates (see box 2 above). Resolving those issues in a future analysis would improve the accuracy of the estimates.

Future research may also expand the scope of the analysis. For example, our estimates were centered on whether cotton was harvested in Xinjiang based on the U.S. government's findings and actions related to that region. However, the Xinjiang cotton harvest is only one part of the cotton-containing product supply chain. The UFLPA covers downstream production in Xinjiang and, as noted above, some observers have asserted that forced labor occurs in downstream manufacturing in other parts of China as well. Another potential expansion is to included labor violations within the cotton harvest in other countries. As noted above, the U.S. Department of Labor has identified forced and/or child labor in cotton production in 16 other countries besides China.[103]

[103] DOL, ILAB, "List of Goods Produced by Child Labor or Forced Labor (2020)," June 23, 2021.

Appendix 1: Tables

Table 1 Harmonized system codes used in each category

Harmonized system code	Category
5201	Raw, carded, or combed cotton
5203	Raw, carded, or combed cotton
5204	Cotton yarn
5205	Cotton yarn
5206	Cotton yarn
5207	Cotton yarn
5208	Cotton fabric
5209	Cotton fabric
5210	Cotton fabric
5211	Cotton fabric
5212	Cotton fabric
5801.21	Cotton fabric
5801.22	Cotton fabric
5801.23	Cotton fabric
5801.24	Cotton fabric
5801.25	Cotton fabric
5801.26	Cotton fabric
5801.27	Cotton fabric
5802.11	Cotton fabric
5802.19	Cotton fabric
5803.10	Cotton fabric
5806.31	Cotton fabric
5810.91	Cotton fabric
6001.21	Cotton fabric
6001.91	Cotton fabric
6002.42	Cotton fabric
6002.92	Cotton fabric
6003.20	Cotton fabric
6005.21	Cotton fabric
6005.22	Cotton fabric
6005.23	Cotton fabric
6005.24	Cotton fabric
6006.21	Cotton fabric
6006.22	Cotton fabric
6006.23	Cotton fabric
6006.24	Cotton fabric
6101.20	Cotton consumer goods
6102.20	Cotton consumer goods
6103.22	Cotton consumer goods
6103.32	Cotton consumer goods
6103.42	Cotton consumer goods
6104.12	Cotton consumer goods
6104.22	Cotton consumer goods
6104.32	Cotton consumer goods
6104.42	Cotton consumer goods
6104.52	Cotton consumer goods
6104.62	Cotton consumer goods

Harmonized system code	Category
6105.10	Cotton consumer goods
6106.10	Cotton consumer goods
6107.11	Cotton consumer goods
6107.21	Cotton consumer goods
6107.91	Cotton consumer goods
6108.21	Cotton consumer goods
6108.31	Cotton consumer goods
6108.91	Cotton consumer goods
6109.10	Cotton consumer goods
6110.20	Cotton consumer goods
6111.20	Cotton consumer goods
6112.11	Cotton consumer goods
6114.20	Cotton consumer goods
6115.92	Cotton consumer goods
6115.95	Cotton consumer goods
6116.92	Cotton consumer goods
6201.12	Cotton consumer goods
6201.92	Cotton consumer goods
6202.12	Cotton consumer goods
6202.92	Cotton consumer goods
6203.22	Cotton consumer goods
6203.32	Cotton consumer goods
6203.42	Cotton consumer goods
6204.12	Cotton consumer goods
6204.22	Cotton consumer goods
6204.42	Cotton consumer goods
6204.52	Cotton consumer goods
6204.62	Cotton consumer goods
6205.20	Cotton consumer goods
6206.30	Cotton consumer goods
6207.11	Cotton consumer goods
6207.21	Cotton consumer goods
6207.91	Cotton consumer goods
6208.21	Cotton consumer goods
6208.91	Cotton consumer goods
6209.20	Cotton consumer goods
6211.32	Cotton consumer goods
6211.42	Cotton consumer goods
6213.20	Cotton consumer goods
6301.30	Cotton consumer goods
6302.31	Cotton consumer goods
6302.51	Cotton consumer goods
6302.60	Cotton consumer goods
6302.91	Cotton consumer goods
6303.11	Cotton consumer goods
6303.91	Cotton consumer goods
6304.92	Cotton consumer goods
6305.20	Cotton consumer goods
6306.11	Cotton consumer goods
6306.21	Cotton consumer goods
6306.41	Cotton consumer goods

Harmonized system code	Category
6306.91	Cotton consumer goods

Source: Authors.
Note: HS 5207, which consists of cotton yarn for resale, was included within U.S. import presentations in this paper but was not included within the global supply chain analysis.

Table 2 Value of U.S. imports of cotton-containing products and estimated value of U.S. imports derived from Xinjiang-origin cotton ("Xinjiang-origin imports"), by partner, 2021

Partner	Total value of imports (million $)	Value of Xinjiang-origin imports (million $)	Xinjiang-origin share of total value (%)	Change in value of Xinjiang-origin imports, 2016-21 (million $)
China	6,839.7	3,334.9	48.8	-1,265.8
Vietnam	6,116.0	874.8	14.3	219.1
India	6,035.1	36.6	0.6	29.0
Bangladesh	5,215.4	281.9	5.4	35.0
Pakistan	3,180.2	13.6	0.4	12.9
Indonesia	2,000.1	199.3	10.0	87.9
Cambodia	1,970.6	400.6	20.3	56.6
Mexico	1,751.2	116.1	6.6	55.6
Honduras	1,384.6	7.2	0.5	2.7
Nicaragua	1,353.9	247.5	18.3	88.7
Guatemala	958.5	55.3	5.8	1.1
El Salvador	856.3	43.3	5.1	2.6
Turkey	777.4	2.4	0.3	0.5
Sri Lanka	713.0	92.6	13.0	-37.3
Italy	594.4	27.3	4.6	11.2
Peru	561.0	12.2	2.2	6.1
Egypt	502.0	26.5	5.3	10.6
Haiti	469.0	106.2	22.6	26.5
Dominican Republic	343.4	5.3	1.5	-0.6
Portugal	329.8	1.9	0.6	1.2
Thailand	296.9	20.1	6.8	5.3
Jordan	295.9	60.2	20.3	12.0
Philippines	230.6	95.6	41.4	-17.2
South Korea	216.4	5.9	2.7	-1.7
Kenya	178.2	40.1	22.5	-5.3
Ethiopia	166.9	5.7	3.4	5.6
Malaysia	158.3	12.7	8.0	-14.5
Madagascar	148.7	23.8	16.0	17.7
Colombia	118.8	10.7	9.0	1.9
Canada	115.8	10.2	8.8	3.4
Japan	112.3	5.6	5.0	1.9
Burma	91.1	8.2	9.0	7.5
Lesotho	83.5	1.7	2.0	-0.7
Macao	66.3	13.5	20.3	12.4
Morocco	62.6	5.1	8.2	3.3
Mauritius	58.2	1.2	2.1	-7.8
France	56.5	0.9	1.6	0.4
Hong Kong	43.1	19.0	44.0	-6.9
Bahrain	39.0	1.1	2.8	-3.1
United Kingdom	37.6	1.6	4.1	-0.9

Partner	Total value of imports (million $)	Value of Xinjiang-origin imports (million $)	Xinjiang-origin share of total value (%)	Change in value of Xinjiang-origin imports, 2016-21 (million $)
Tunisia	36.1	0.6	1.8	0.1
Romania	36.0	0.7	1.8	-0.1
Germany	32.4	0.7	2.2	0.5
Tanzania	29.6	2.8	9.6	1.4
Israel	26.3	2.3	8.6	-0.3
Taiwan	23.2	2.1	9.1	0.5
Spain	20.5	0.9	4.5	0.4
Bulgaria	18.0	0.3	1.5	0.1
Poland	12.0	0.4	3.0	0.1
All others	125.3	8.8	7.1	0.6
Total	44,888.3	6,247.9	13.9	-640.0

Source: Authors' estimates; S&P Global, IHS Markit, Global Trade Atlas database, accessed April 11, 2022.
Note: Only partners with U.S. imports exceeding $10 million in 2021 are shown in this table. All other partners are included within the "all others" aggregate.

Appendix 2: Estimation Methodology

In this paper, we estimate the Xinjiang-origin cotton fiber share (i.e., "Xinjiang content") of all countries' production and trade of cotton-containing products. In order to produce these estimates, we create a simplified representation of the global cotton-containing products supply chain based on publicly available cotton production and trade information. The objective of this analysis is to develop consistently applied, updateable, and quantifiable measures of the scale of Xinjiang cotton within U.S. imports from various partner countries.

The approach used here draws from prior analysis developed at the USITC, particularly the USITC's February 2021 report, *IUU Fishing*, which produced estimates of the extent of illegal, unreported, and unregulated (IUU) fishing used to supply U.S. seafood imports.[104] A 2022 USITC working paper by Berry et al. detailed how similar approaches could be used for other sectors with pervasive illicit production practices.[105] Berry et al. described how one of the more challenging aspects of *IUU Fishing*—estimating the actual extent of illicit production occurring within source countries—could be simplified in the context of cotton if the scope of illicit activity being measured was simply the Chinese production of cotton within Xinjiang given the scope of human rights and forced labor abuses identified in that region. This scoping idea forms the foundation behind the analysis in this paper.

This methodology uses a related approach to Murphy et al. (2021), which used multiple frameworks to examine how Xinjiang cotton enters global supply chains.[106] Murphy et al. (2021) used public trade data to demonstrate the destinations of Chinese exports for upstream cotton products and followed that up with detailed examination of how specific international intermediary manufacturers sourced cotton from Xinjiang and then channeled that product into global supply chains. This paper extends the use of public trade data in a different way, using it along with global cotton production data to estimate Xinjiang content throughout the global supply chain.

Step 1: Creation of a Production and Trade Database

The supply chain analysis used in this paper relies on compilations of trade and production data for cotton as well as two major categories of cotton-containing products—cotton yarn (including blends and cotton sewing thread but excluding cotton for resale) and cotton fabric (combining woven and knitted fabrics into a single category)—for all countries. Trade data was collected from U.S. Department of Agriculture's (USDA's) Production, Supply and Distribution (PS&D) database for cotton exports and

[104] USITC, *IUU Fishing*, February 2021.
[105] Berry et al., *Shedding Light on the Dark Side of Trade*, March 2022.
[106] Murphy et al., *Laundering Cotton*, November 2021.

imports and from S&P Global's Global Trade Atlas for cotton-containing products.[107] Global production data for cotton was collected from the PS&D database.[108]

Similar global-level production databases for cotton-containing products were unavailable. A few countries provide their own national-level cotton yarn and fabric production data, but it was difficult to make useful comparisons between the data given the inconsistent definitions used and differing levels of reliability among the data sets. Therefore, production quantities were derived using estimates of each country's supply of upstream cotton inputs. Cotton-containing products are blended with other materials (e.g., synthetic fibers such as polyester and natural fibers including wool and linen) and experience some loss of fiber in processing. As a result, production estimates for all cotton-containing products were converted to cotton-fiber equivalent measures. In other words, these production estimates are expressed as the quantity of cotton fiber used along the supply chain in generating those goods.

Step 1.1: Estimating the Quantity of Domestic Cotton Yarn Production for all Countries

Cotton yarn production for each country is considered equal to that country's total domestic use of cotton gathered from the PS&D database.[109] (No conversion is necessary to express domestic use of cotton on a cotton-fiber equivalent basis.) This analysis requires an operating assumption that cotton is used entirely in the production of cotton yarn. Therefore, this method likely overstates by varying degrees the extent of cotton yarn production in each country, given that there are other uses of cotton besides yarn production (see box 2).[110] That said, most sources describing the use of cotton fiber focus primarily or exclusively on its use within cotton fabric derived from yarn.[111] As described above within the Global Cotton Production section, one source estimated that 64 percent of cotton was used in

[107] Global trade data for cotton-containing products were collected and compiled within a database covering all cotton-derived products within HS chapter headings 52, 58, and 60. Reporting countries' import data were used to capture bilateral trade flows, unless a reporter appeared to have substantially underreported its imports (e.g., Honduras) or if a reporter did not have trade data within the Global Trade Atlas database (e.g., Vietnam). In these cases, other countries' reported exports to these under-/non-reported importers were used as "mirror data" for these missing reporters' import data. Where reported quantities (including both primary and secondary quantities) were not expressed on a weight basis and were instead expressed only in terms of square meters (e.g., for fabric trade reported by China), quantities were converted into kilograms (kg) using the annual average HS 6-digit ratio of kg to square meters for all reported data expressed in both quantities. S&P Global, IHS Markit, Global Trade Atlas database, accessed March 24, 2022.

[108] USDA, FAS, PS&D Online, accessed February 9, 2022.

[109] USDA, FAS, PS&D Online, accessed February 9, 2022. PS&D data for domestic consumption of cotton are based on a crop marketing year system overlapping between two years (e.g., MY 2020/21). In order to include these data within a supply chain analysis that integrates other types of data available on a calendar year basis, the yarn production estimate derived from these data is allocated to the second of the two years (e.g., 2021) based on an assumption that the harvest primarily occurs within the first year (e.g., 2020) and the downstream industrial use and trade primarily occurs within the second year.

[110] In later steps, this overstatement has the effect of amplifying Chinese-origin cotton yarn content (and associated Xinjiang content) within China's cotton fabric production operations, while also understating the Chinese-origin cotton yarn content within other countries' cotton fabric production.

[111] Barnhardt Purified Cotton, "Uses of Cotton," October 29, 2019; McKee, "What Are Some Common Uses of Cotton?," November 8, 2018; MasterClass, "What Is Cotton?," August 12, 2021.

apparel manufacturing, while another 28 percent was used in home furnishings (a category that includes made up goods).

Step 1.2: Estimating the Quantity of Domestic Cotton Fabric Production for all Countries

Cotton fabric production for each country is considered equal to that country's domestic use of cotton yarn. Domestic use of cotton yarn is calculated as domestic production of cotton yarn (from step 1.1 above) plus imports minus exports of cotton yarn.[112] Imports and exports of cotton yarn are converted to a cotton-fiber equivalent basis using product-specific conversion factors that consider blending and waste during the yarn spinning process.[113]

Step 2: Estimating the Xinjiang Content as a Share of each Country's Production of Cotton and Cotton-containing Products

As detailed in Berry et al. (2022) and *IUU Fishing*, supply chain analysis for illicit products can use a default assumption that commodity-type products are mixed regardless of their other attributes, with little or no segregation of illicit product from non-illicit product. Using this assumption within the context of the cotton supply chain, national level industries that use raw cotton and other cotton-derived inputs will, in the aggregate, either not have the interest (particularly far upstream) or the visibility (particularly far downstream) necessary to separate Xinjiang-origin cotton content from cotton originating from other places for different kinds of buyers and uses.[114]

Each of the measures described below is an estimate of Xinjiang content as a share of each country's national level production of cotton and cotton-containing products. For each product-country-year combination, the share of Xinjiang content within exports is proportional to that of production. In other words, if Xinjiang content accounts for 20 percent of a given country's production of a cotton-containing product category in a given year, 20 percent of its exports of that product in that year will also be Xinjiang content. In this way, Xinjiang content is assumed to extend proportionally into every supply

[112] Exports and imports of cotton yarn are based on cotton yarn not for retail use (HS 5205 and 5206).
[113] Conversion factors were provided to authors by an industry source.
[114] Given the recent international effort to reduce imports of products containing Xinjiang-origin content, there will likely be more effort by firms and national level industries to limit their sourcing of products from Xinjiang, which may lead to the need for a different set of assumptions for these countries in any future analysis. However, in this analysis that focuses primarily on trade in cotton products that occurred prior to these new rules coming into effect, the proportional assumption used here likely makes more sense. Mixing of cotton from multiple sources is common throughout the cotton-containing product supply chain, even where deliberate efforts are made to use sustainably sourced cotton. For example, while BCI has sought to trace sustainably certified cotton within downstream cotton containing goods, mixing certified cotton with uncertified cotton fiber while still using the Better Cotton label is allowed and common. Rascouet, Hipwell, and Pham, "China is Forcing Fashion to Mute Itself Over Dirty Cotton," October 14, 2021.

chain that incorporates raw cotton, cotton yarn, cotton fabric, or cotton consumer goods from China—including U.S. imports of these products.

Step 2.1: Measuring Xinjiang Content as a Share of China's Cotton Production

By definition, there is only one country in the world that produces Xinjiang origin raw cotton, which is China. The share of Xinjiang content within China's cotton production is, for each harvest year, the harvest of cotton in Xinjiang divided by the harvest of cotton in China as a whole. These national and regional data are from China's National Bureau of Statistics (NBS).[115]

For all other countries, the share of Xinjiang content within cotton production is zero.

Step 2.2: Estimating the Xinjiang Content of each Country's Cotton Yarn Production

For China, the share of Xinjiang content within cotton yarn production is calculated as the quantity of Xinjiang's cotton production[116] divided by the quantity of China's combined sources of cotton supply (i.e., China's cotton production and imports).[117]

For all other countries, the share of Xinjiang content within cotton yarn production is set at zero. As described above, China's exports of cotton are minimal, and the share of any commercially significant yarn producing country's imports of cotton originating in Xinjiang relative to its overall sources of supply is expected to be insignificant.

[115] Government of China, NBS, CEIC database, AFF Production Data, accessed February 4, 2022.
[116] The quantity of the Xinjiang cotton harvest, for these purposes, is measured as Xinjiang content as a share of China's cotton production (derived from step 2.1 above) multiplied by China's cotton production derived from the PS&D database. The purpose of this calculation is to express a proportion derived from NBS data using quantities from the PS&D database for the sake of consistency with all other countries in this report. NBS data collected on a calendar year basis are matched with the first year within the crop marketing year pair of the PS&D cotton production data, as most of China's cotton harvest occurs in the second half of the year. USDA, FAS, *Cotton Annual: China (2021)*, December 1, 2021.
[117] Both China's cotton production and imports are gathered from the PS&D database. In addition to annual production and imports, China also has stocks (reserves) of cotton from previous years that it uses to supply the market. These stocks are not included within this calculation, because the PS&D data does not provide us with a clear basis to estimate the share of sales from stocks that are originally from import sources, Xinjiang, or elsewhere in China. Omitting stocks from this calculation would lead to non-Xinjiang sources being overemphasized if reserves consist of disproportionate amounts of Xinjiang-origin cotton relative to annual sources of available supply; the effect would be the opposite if reserves consist of disproportionate amounts of non-Xinjiang-origin cotton. These implications are examined more fully in box 2 above.

Step 2.3: Estimating the Xinjiang Content of each Country's Cotton Fabric Production

The Xinjiang content of a non-Chinese country's fabric production is measured as the share of Xinjiang content in China's cotton yarn production (step 2.2) multiplied by the country's cotton yarn imports from China, which is then divided by the quantity of the country's combined sources of cotton yarn supply (i.e., domestic cotton yarn production (step 1.1) and imports of cotton yarn).[118]

The Xinjiang content of China's fabric production is measured as the share of Xinjiang content in China's cotton yarn production (step 2.2) multiplied by China's production of cotton yarn (step 1.1), which is then divided by the quantity of China's combined sources of cotton yarn supply (i.e., China's cotton yarn production and imports of cotton yarn).[119]

Step 2.4: Estimating the Xinjiang Content of each Country's Cotton Consumer Goods Production

The Xinjiang content of a country's cotton consumer goods production is based on that country's supply of cotton fabric that can be used to produce such consumer goods, which includes domestic cotton fabric production and imports of cotton fabric. For each country:

- The quantity of Xinjiang-origin cotton fabric production is calculated using the estimate from step 2.3 multiplied by the country's total cotton fabric production (step 1.2).
- The quantity of Xinjiang-origin cotton fabric imports is based on of the country's import sources, which each has its own Xinjiang and non-Xinjiang content within its fabric production (also derived from step 2.3). Using the average of all of these proportions (weighted by the quantity of imports from each source), a country's cotton fabric imports are divided between Xinjiang and non-Xinjiang product.[120]
- The quantities of Xinjiang-origin cotton fabric from production and imports are summed, which represents the country's available supply of Xinjiang-origin cotton fabric. This sum is then divided by the quantity of the country's combined sources of cotton fabric supply (i.e., total production and imports of cotton fabric) to estimate the share of Xinjiang content within cotton consumer goods production.

[118] Trade in cotton yarn is derived from multiple HS subheadings under HS chapter 52. See Appendix 1 table 1 for details of which HS codes are included in the cotton yarn category.
[119] Because China reports imports substantial quantities of various products from itself, these quantities are removed from this calculation.
[120] Trade in cotton fabric is derived from multiple HS subheadings under HS chapters 52, 58, and 60. See Appendix 1 table 1 for details of which HS codes are included in the cotton fabric category. Imports of cotton fabric are converted to a cotton-fiber equivalent basis using product-specific conversion factors that consider blending and waste during the yarn spinning and fabric trimming processes. Conversion factors were provided to authors by an industry source.

Step 3: Estimating U.S. Imports Derived from Xinjiang-origin Cotton

As described above in the introduction to step 2, Xinjiang content is assumed to extend proportionally into every supply chain that incorporates cotton and cotton-containing products from China. This includes U.S. imports of cotton yarn, cotton fabric, and cotton consumer goods from all trading partners. The cotton fiber within U.S. imports of these products from a given trading partner is assumed to include a percentage of Xinjiang-origin cotton equal to the Xinjiang content within that partner's production of that product. This percentage is multiplied directly by the value of those imports.[121] This means that the value of U.S. imports derived from Xinjiang-origin cotton within downstream goods is based entirely on the origin of the cotton within those products, even if they are blended with other materials.

[121] U.S. import data was collected from S&P Global, IHS Markit, Global Trade Atlas Database, accessed March 29, 2022.

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