Expect A Favorable Outlook For Tie Demand In Spite Of Various Challenges

The Semiconductor Chip Shortage Is Playing A Role

By Petr Ledvina

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In the first half of this year the economy made impressive strides, with a Q2 estimated annualized growth rate of 6.6 percent.

With the improved economy, the railroads reported good financial results despite facing challenges. In line with the economy and also with the hardwood sawmill industry, some rails face labor shortages. Others deal with weather-related events. And still others are dealing with a shortage of container storage in the Chicago area.

Nevertheless, revenue ton-miles improved significantly (see Business Trends).

From railroad reports and conference calls, it was clear that cargo volume was up compared to 2020, with more than 50 percent of the segments also surpassing 2019 levels (AAR reports, RTA calculations). However, the coal and motor vehicle segments were the worst performers. For coal, the drag was caused by cheap natural gas and lagging industrial production, which is still down by 3.5 percent from the first half of 2019 as measured by the Industrial Production Index (FRED).

One of the common themes from these conference calls was the motor vehicle segment. In the first half of 2019, the average car volume was 16.3K per week, while in 2021 it was 13.2K, even though the demand for new cars is high. As reported, this is due to chip shortages experienced by car manufacturers. While this segment was only 3.2 percent of all carload traffic in the first half of 2019, it was measurably less in the first half of 2021, constituting only 2.6 percent of all carload traffic (AAR reports, RTA calculations). This caused a disproportionate cut in railroads' profitability, since this segment is among the more profitable.

So, how did the chip shortage come to be? To answer this question, it is important to understand how chips are made and also how the market for chips operates. The semiconductor chip has two main components: a wafer and several layers of silicon dioxide and metal. The base of every chip is the wafer, produced in a semiconductor fabrication plant sometimes called a "foundry" or a "fab." Then, through a complicated technological process, the silicon dioxide and metal layers are placed on top of this wafer, creating the finished chip. Some chip makers have their own foundries and some do not. Independent foundries also supply wafers to a variety of chip makers.

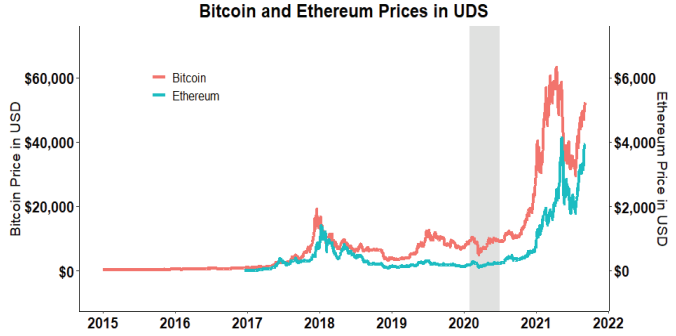
When the COVID-19 pandemic hit, there was a major shift in demand. Many people started to work from home, and schools transitioned online. This increased demand for computers, web cameras, cell phones and other electronic equipment resulted in elevated demand for various chips, especially the central processing units (CPU) and graphical processing units (GPU). Meanwhile, the auto industry was canceling orders for their chips, anticipating a prolonged period of lower demand for cars. The independent fabs responded by shifting some production capacity to more profitable high-end wafers for items like the 5G network and cell phone chips, CPUs and GPUs for computers, and data storage chips (Reuters, "Semiconductor shortage and the U.S. auto industry," June 22, 2021). Unfortunately, fabs producing wafers for car chips cannot produce high-end wafers for CPUs and GPUs and vice versa.

At the same time, central banks embarked on yet another round of quantitative-easing endeavors, reigniting inflation fears. This caused an increased interest in cryptocurrency or, rather, crypto mining activity (Figure 1). The mining process/algorithm of the cryptocurrencies such as Bitcoin and Ethereum utilizes many GPUs and other chips (NPR Marketplace Tech, "Cryptocurrency miners snap up so many computer chips that mining has become a market," May 13, 2021). Simultaneously, some of the money from the generous government pandemic stimulus checks substantially increased demand for computer gaming, requiring more GPUs and other chips (NVIDIA quarterly reports).

Just as the softwood sawmills were not ready for dramatically increased demand for new houses and remodeling projects during second quarter 2020, the car companies were also not ready when orders started to pour in from the dealerships. Car manufacturers sent their orders to the chipmakers. The companies that owned fabs were able to respond, while those that did not placed orders with the independent fabs. But these fabs could not easily fulfill their orders, because they needed to fill prior orders for the high-end chip wafer and also because restarting the fabs takes time. The inadequate supply of wafers from the independent fabs started to become apparent at the end of 2020. (https://arstechnica.com/cars/2021/02/a-silicon-chip-shortage-is-causing-automakers-to-idle-their-factories/).

According to the Semiconductor Industry Association, the worldwide capacity utili-

Figure 1



Source: https://www.coindesk.com/price/

zation rate was about 85 percent in 2019, while in 2020, it was about 92 percent, with little if any extra capacity left. As a result, chips got more expensive. But for the car manufacturers and chipmakers, this was not the only problem.

So, what else happened? After sifting through several quarterly reports and listening to earnings calls and company news reports, it became clear that the shortage in auto chips could be attributed to the Texas winter storm in February this year and other mishaps. This involved several major car chipmakers, including Infineon, NXP Semiconductors and Renesas Electronics, which supply about 30 percent of chips worldwide.

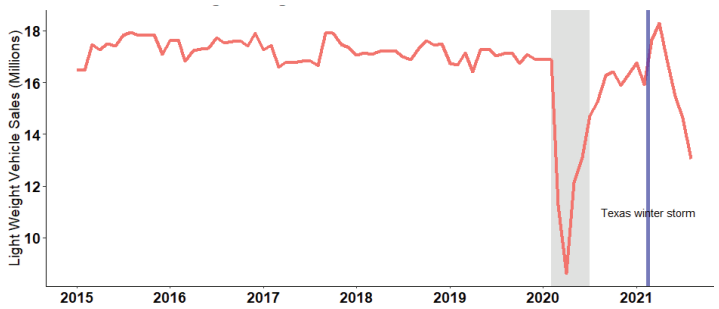
NXP Semiconductors, a Dutch semiconductor manufacturer, is estimated to have about 10 percent market share. NXP produces about 30 percent of its car chip wafers at two facilities in Austin, Texas. Before the storm, NXP facilities were running 24/7. Because of the storm, both facilities were fully out of commission from Feb. 15 to March 11. The fabs resumed initial operations, and NXT reported on March 11 that it was "making solid progress on our recovery plan designed to return the wafer fabs to pre-storm production levels" (NXP Semiconductors website, "NXP Resumes Operations at Austin, Texas Facilities Following Weather-Related Shutdown and Provides Revenue Update").

Infineon, a German company with a fab in Austin, was affected as well, though the outage did not last as long. By mid-March, the company reported that "we expect to reach pre-shutdown output levels in June 2021" (Infineon website, "Infineon increases production in Austin, Texas, and provides update on customer impact; pre-shutdown output level expected in June 2021," March 19, 2021). The COVID Delta variant also halted production at Infineon's site in Melaka, Malaysia.

Meanwhile, the Renesas Electronics car chip fab in Japan was affected by a fire in March, and full production capacity was expected to be restored in June, adding still more pressure to the drastic car chip shortage.

Unquestionably, the major culprit causing car chip shortages was the Texas power grid that failed during the February storm. Since the capacity of independent fabs was already stretched, immediate replacements for wafers could not be found and new car sales plummeted (Figure 2). ➤

Figure 2



Source: U.S. Bureau of Economic Analysis, retrieved from FRED.

The impact of weather on railroads did not stop with declines in car transport. In addition to snowstorms, wildfires are currently raging across British Columbia. The scorched area due to these fires is twice as large as in the United States. This destruction has had a direct effect on Canadian railroads because fire damaged tracks near Lytton on June 30. Fire also damaged a bridge on the main east-west line carrying an average traffic of 25 trains per day (Vancouverun.com; CN and CP earnings calls). Traffic on the line had to stop completely for two weeks at the end of June, causing congestion at the port in Vancouver. In addition, a directive from the Canadian authorities now requires a decrease in train speed when the temperature rises above 33C (91.4F) in areas prone to wildfires.

The headwind posed by the car chip shortages should continue at least through the rest of this year, causing a negative impact on the railroads' profitability. However, other segments should perform well, including coal. The pickup in the global economy and trade tensions between Australia and China should provide export opportunities. In addition, as the U.S. economy picks up more speed, the demand for electricity in the United States should rise by 2.7 percent. Also, because the price of natural gas increased substantially compared to 2020 and 2019, coal production should increase by 13 percent this year and only decline marginally in 2022 (EIA short term forecast, August 2021).

Meanwhile, the housing market shows signs of normalization, as measured by the Monthly Supply of Houses, improving to 6.2 months from the 2020 lows of 3.5 months, mainly driven by decline in new house sales. For comparison, the Q4 2019 average was 5.4 months (FRED, see Business Trends).

Housing starts and consumer spending should remain strong for the rest of the year, providing retailers receive their orders. The outlook for 2022 suggests still robust consumer spending and housing starts (S&P June forecast). So, the revenue ton-miles for the railroads should also improve.

This should result in an upbeat forecast for tie demand for this year and the next compared to 2020 (Table 1). However, the COVID pandemic still poses a threat to the world economy, and most consumer support by the federal government has already expired. How the consumer fares in this environment should become clearer in the last quarter of this year and with it the outlook for inflation. ➤

Table 1 - New Wood Crossties (in thousands)

Year	Real GDP	Class 1 Purchases	Small Market Purchases	Total Purchases	Pct
2018	2.9%	15,489	5,872	21,361	-8.4%
2019	2.3%	14,471	4,105	18,575	-13.0%
2020	-3.4%	15,309	3,175	18,483	-0.5%
2021	6.7%	14,433	4,386	18,820	1.8%
2022	3.7%	14,527	4,713	19,241	2.2%

Table 2

	Crossties Laid In Replacement Or in Addition - 2020			AAR Checks and Comparison				Rail Laid In Replacement Or In Addition - 2020		
District & Railroad	New Wood Ties	New Ties (Other than Wood)	Second-Hand Ties (All Types)	Tons of Rail Laid Per Mile	Crossties Per Mile	Avg. Spend Per Ton of Rail	Avg. Spend Per Tie*	New Rail Laid (Tons)	Relay Rail Laid (Tons)	Avg. Weight Rail (lbs/yd)
Eastern District										
CSX Transportation	2,923,277	22,441	0	4.5	104.2	$4,160.0	$121.0	109,954	17,624	135.9
Grand Trunk Corp. (CN)	712,838	4,957	61	2.6	78.0	$6,238.5	$147.9	17,149	7,184	134.8
Norfolk Southern	1,718,904	5,020	85,195	3.5	63.9	$4,635.1	$142.9	89,011	11,057	136.0
Total Eastern Dist.	**5,355,019**	**32,418**	**85,256**	**3.8**	**83.5**	**$4,549.4**	**131.8**	**216,114**	**35,865**	**135.9**
Western District										
BNSF	2,619,838	78,368	0	3.3	67.7	$5,534.9	$133.5	130,508	120	135.8
KCS	345,762	0	0	3.4	86.3	$3,225.6	$125.0	9,869	3,582	133.3
Soo Line Corp. (CP)	325,484	0	0	2.3	68.9	$6,776.6	$180.6	10,345	729	135.5
UP	4,509,988	161,454	0	3.0	107.0	$8,779.3	$124.6	129,874	1,409	135.7
Total Western Dist.	**7,801,072**	**239,822**	**0**	**3.1**	**87.1**	**$6,961.5**	**129.9**	**280,596**	**5,840**	**135.7**
Total U.S.	**13,156,091**	**272,240**	**85,256**	**3.4**	**85.5**	**$5,823.9**	**130.7**	**496,710**	**41,705**	**135.8**

Source: Association of American Railroads (AAR). The average weight of rail installed for CP's Soo Line Corp is an AAR estimate using data from the other railroads and CPSL spending data.

Table 3 - Railway Tie Association Annual Survey
Estimated Crosstie Requirements • Class I Railroads 2021-2023 Inclusive

Authorized Crossties for 2021

	Total Track	New Wood Crossties		Wood Relay	New Non-Wood Crossties			Switch Ties (Units)		Bridge Timbers
District and Railroad	Mileage	Hardwood	Softwood	Crossties	Concrete	Steel	Other	Wood	Other	Units
Eastern U.S.	39,500	4,850,000	0	110,000	0	0	0	230,000	0	60,000
Western U.S.	99,123	6,100,000	300,000	8,500	305,000	5,000	2,000	280,000	500	70,000
Canada	32,500	3,350,000	0	4,000	74,000	100	19,000	73,000	0	14,000
TOTAL	**171,123**	**14,300,000**	**300,000**	**122,500**	**379,000**	**5,100**	**21,000**	**583,000**	**500**	**144,000**

Authorized Crossties for 2022

	Total Track	New Wood Crossties		Wood Relay	New Non-Wood Crossties			Switch Ties (Units)		Bridge Timbers
Eastern U.S.	39,500	5,000,000	0	60,000	0	0	0	225,500	0	60,000
Western U.S.	99,123	5,950,000	500,000	8,500	305,000	5,000	2,000	280,000	500	70,000
Canada	32,500	3,200,000	0	5,000	78,000	1,000	35,000	70,000	0	15,000
TOTAL	**171,123**	**14,150,000**	**500,000**	**73,500**	**383,000**	**6,000**	**37,000**	**575,500**	**500**	**145,000**

Authorized Crossties for 2023

	Total Track	New Wood Crossties		Wood Relay	New Non-Wood Crossties			Switch Ties (Units)		Bridge Timbers
Eastern U.S.	39,500	5,000,000	0	60,000	0	0	0	225,500	0	60,000
Western U.S.	99,123	5,950,000	500,000	8,500	305,000	5,000	2,000	280,000	500	70,000
Canada	32,500	3,150,000	0	5,000	78,000	1,000	50,000	70,000	0	15,000
TOTAL	**171,123**	**14,100,000**	**500,000**	**73,500**	**383,000**	**6,000**	**52,000**	**575,500**	**500**	**145,000**

Table 4 - Short Line Survey Summary 2021

Tie Categories	2020 Usage	2021 Projected	2022 Projected	2023 Projected
New 6" and 7" Ties	3,149,100	3,136,330	2,993,782	3,043,823
Relay 6" and 7" Ties	8,742	7,709	7,033	5,680
Grand Total All Wood Ties	**3,157,842**	**3,144,039**	**3,000,815**	**3,049,503**
Switch Ties	30,448	38,466	35,927	37,391
Bridge Timbers	13,536	18,575	18,861	18,872
Concrete Ties	0	0	0	0
Steel Ties	0	2,168	4,336	1,323
Composite/Plastic Ties	0	0	0	0

	2021	2020	2019	2018	2017	2016	2015	2014	2013	2012	2011	2010	2009	2008	2007	2006	2005
Track Miles Reporting	**17,561**	**19,735**	**28,080**	**21,908**	**26,900**	**23,232**	**20,620**	**24,964**	**25,391**	**18,217**	**21,116**	**26,696**	**15,116**	**14,966**	**28,516**	**19,924**	**17,663**
Total Track Miles	**47,500**	**47,500**	**47,500**	**47,500**	**47,500**	**47,500**	**47,500**	**47,500**	**47,500**	**47,500**	**47,500**	**46,823**	**46,823**	**46,823**	**46,018**	**46,018**	**43,990**
% Reporting	36.97%	41.55%	59.12%	46.12%	56.63%	48.91%	43.41%	52.56%	53.45%	38.4%	44.5%	57.0%	32%	32%	62%	43%	40%
Total Roads Reported	**151**	**185**	**234**	**188**	**223**	**206**	**176**	**197**	**192**	**157**	**185**	**191**	**117**	**116**	**139**	**130**	**115**
Total Short Lines	**603**	603	603	603	558	558	558	558	572	572	572	572	572	306	455	633	633
% Reporting	25.04%	30.68%	38.81%	31.18%	39.96%	36.92%	31.54%	35.30%	33.57%	27.4%	32.3%	33.4%	20.5%	38%	31%	21%	18%