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CONNECTING EURASIAN SUPPLY CHAINS

THE IMPACT OF COVID-19 AND THE RUSSIA-UKRAINE WAR ON THE EU-CHINA RAIL LANDBRIDGE

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Abstract

International supply chains are dependent on ease of crossing borders and efficient connectivity in terms of price, speed, and reliability. Communication costs explain why intensification of international supply chains during the last four decades has occurred primarily within regional value chains (RVCs), centered on East Asia, Europe, and North America. Initially responding to demand from automobile and electronics firms to connect their European and Chinese supply chains with shorter and more reliable freight services than maritime shipping, the Eurasian rail Landbridge established in the 2010s was the first major overland link between RVCs. The Eurasian Landbridge was resilient through deteriorating EU-Russia relations after 2014 and the COVID-19 epidemic in 2020-21. However, following the Russian invasion of Ukraine and inclusion of the Russian rail company in western sanctions in February/March 2022, traffic along the main Landbridge routes stalled. This paper analyzes the evolution of the Landbridge as an exercise in choice of connectivity for Eurasian supply chains, the response of supply chain managers to the closure of routes in 2022, and the role of public policy in creating reliable alternatives.

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International supply chains are dependent on ease of crossing borders and efficient connectivity in terms of price, speed, and reliability. The intensification of international supply chains during the last four decades has been easier in some parts of the world than others and so-called global value chains have been primarily regional value chains (RVCs), centered on East Asia, Europe, and North America (Johnson and Noguera, 2017). The RVCs were only linked at the final step of sending finished products to markets in high-income countries, typically by ocean shipping. The Eurasian rail Landbridge established the first major overland link between RVCs, and traffic grew rapidly from 2011 to 2021.

Efficient supply chain management relies on just-in-time delivery and minimization of inventories whether held at production points or in transit. Over long distances, rail is faster than sea transport and has more reliable arrival times, as well as being more environmentally friendly, while maritime freight rates are lower. For European car companies sending components to factories in China and for electronics firms sending computers and printers from China to their European marketing centers, the benefits outweighed the higher costs of rail freight. Nonstop rail services between China and Europe were established in the 2010s to meet this demand. As services and routes expanded, the number of customers increased.

Development of the Landbridge was market-driven. However, it relied on governments to agree on transit rules and on the (state-owned) rail companies to collaborate over schedules and rates. With success, a danger is that a key transit country might use its monopoly power to increase prices. In the case of the Landbridge, the main routes all pass north of the Caspian Sea and transit Russia. China and, to a lesser extent, the EU sought to develop alternative routes to deter hold-up actions along the northern route, although routes across or south of the Caspian Sea had significant disadvantages.

The first section of this paper describes expansion of trade along the Landbridge that linked RVCs in East Asia and in Europe. The Landbridge flourished despite shocks such as deteriorating EU-Russia relations after 2014, shifting EU-China political relations after 2017, and the COVID-19 epidemic in 2020-21. However, the potential for disruption was dramatically and unexpectedly revealed in 2022 when Russia's invasion of Ukraine

was followed by sanctions that made Russian Railways an unacceptable partner to many Landbridge customers. The second and third sections analyze the impact of these shocks and the search for alternative routes after the sanctions.

Establishment and Development of the Landbridge, 2011-21

Between 1500 and 2000, trade between Europe and East Asia was almost entirely by sea. As ships increased in size, costs fell. Although rail track had been laid across Eurasia in the late 19th and early 20th century, rail could not compete with sea transport for freight services between East Asia and Europe.[1] The situation started to change between 2007 and 2010 as German car manufacturers chartered block trains to transport components from Europe to their joint venture factories in northeast China via the TransSiberian railway (TSR) or through Russia and Kazakhstan.[2] A key development, driven by demand from car companies sending components to China and from electronics companies wishing to link their production facilities in China to marketing centers in Europe, was establishment in 2011 of regular train services between Chongqing and Duisburg and between Chengdu and Łódź.[3]

Travel times were reduced as competing termini and freight forwarders and other intermediaries increased efficiency, and as the change of gauge process was simplified at the China-Kazakhstan and Belarus-Poland borders. The Chongqing-Duisburg service became daily in 2016. By 2017, train journeys from Chongqing to Duisburg, which could take longer than ships before 2011, had been cut to around fifteen days, while the same route by river and sea took between 35 and 50 days depending on congestion along the

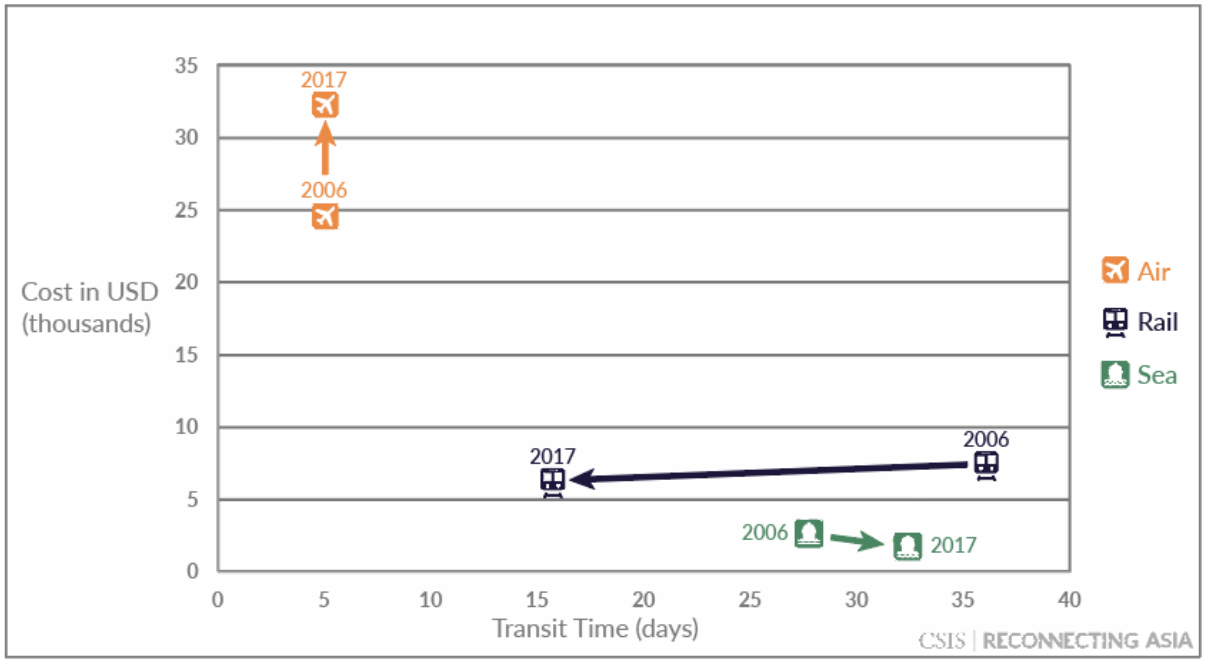
[1] The extensive rail network established in the late Ottoman Empire is in ruins, and today "from Morocco to Iraq not a single train crosses borders"; "Murder of the Orient Express", *The Economist Christmas Specials*, 18 December 2021, 41.

[2] UNECE (2020, 41) provides an example of TransContainer (Russia) and Far East Land Bridge (Austria) arranging transport of BMW automobile parts from Germany to China in September 2010, and reports that at that time three block trains a week, on average, provided door-to-door service from Europe to China in 22–25 days. Similar bespoke services between Lianyungang and Andijan supplied Korean components to the Daewoo/GM factory in Uzbekistan. It is difficult to document all such one-off services.

[3] A trigger for the services from Chengdu and Chongqing was China's 'Go West' policy that had encouraged firms such as Foxconn (assembler of Apple products), HP, Intel, and Acer to establish large factories in the region. The firms' intention had been to export products along the Yangtze River to Shanghai, but the river became congested (Pomfret, 2021a).

Yangtze, weather, piracy, and queues to enter the Suez Canal.[4] Meanwhile, air freight rates increased, and ships moved more slowly to reduce pollution (Figure 1).

Figure 1: Time and Cost of Shipping a 40-foot Container from Shanghai to Hamburg by Air, Rail and Sea, 2006 and 2017.



Source: Hillman (2018), Redrafted from Zhang (2017).
Notes: I am grateful to Jonathan Hillman and Sabrina Zhang for permission to use.

Initially driven by demand from large firms to link their EU and China RVCs, the growth was sustained by a virtuous circle of more services (part container loads, refrigerated containers, multimodal connections) and new routes that stimulated further demand, increased number of trips, and lower costs.

A feature of the 2011-21 Landbridge was the proliferation of routes, responding to different geographical demand or aiming to reduce congestion or other costs. The most popular lines were China-Kazakhstan-Belarus-EU or the Trans-Siberian Railway between Northeast China and Europe, but in both China and in Europe there were many termini. By 2017 over thirty cities in China were offering nonstop freight services to Europe (Figure 2). In Europe the main termini were in Duisburg and Łódź, but cities far from these hubs, such as Madrid or Budapest, initiated direct regular services. To avoid

[4] Sandkamp et al. (2022) highlight the number of piracy incidents affecting ships sailing between China and Europe (200 reported incidents in 2017 with 166 hostages and three deaths), and the costs of rerouting to avoid notable trouble spots (e.g. detours to avoid the Malacca Strait add 1,000 nautical miles to the journey).

bottlenecks, e.g. at the Belarus-Poland border where a change of gauge was necessary, services ran to Baltic ports for transit by sea to Scandinavia.[5]

Figure 2: China Railway Express Service Route Map, May 2017.

Traffic along the rail Landbridge grew rapidly in the decade after 2011. There is no consistent single data source (Bucsky, 2019), in part because it is unclear which routes qualify as Landbridge trade (see Appendix). Numbers reported by the Eurasian Rail Alliance (UTLC) for the mainline through Kazakhstan, Russia and Belarus show rapid growth in container shipments from zero in 2010 to over half a million in 2020 (Table 1). The UTLC numbers understate total freight, because many customers, especially from northeast China, use the TSR. The Chinese data in Table 1 cover all routes, and try to exclude bilateral trade with Kazakhstan, Mongolia or Russia, but it is not always clear where to draw the line, e.g. trains to Russian Baltic ports are mostly Landbridge traffic to Scandinavia or Germany. In sum, both series in Table 1 may understate the extent of Landbridge traffic, but the time-path is consistent (Table 1 and Appendix).

[5] Eastern European countries (especially Czechia, Hungary, Poland, and Slovakia) have been active RVC participants (Pomfret and Sourdin, 2018). Łódź quickly established itself as the Eastern European hub for EU-China rail freight (Jakóbowski et al., 2018). The port of Klaipéda (Lithuania) became a hub for southern Sweden.

Table 1: Volume of Traffic on China-EU-China Container Trains

Year	Number of twenty-foot equivalent containers (TEUs)	Number of Trains to and from China
2011		17
2012		42
2013		80
2014		308
2015	46,000	815
2016	100,500	1,702
2017	175,800.	3,673
2018	280,500	6,376
2019	333,000	8,225
2020	546,900	12,406
2021	692,500	15,000

Sources: **column 1** UTLC website at www.utlc.com; **column 2** Chinese official data cited in *The 2021 Silk Road numbers are there: what do they tell us?* Posted at https://www.railfreight.com/specials/2022/01/14/the-2021-silk-road-numbers-are-here-what-do-they-tell-us/ 14 January 2022. The Appendix discusses data sources.

The creation and improvement of rail services along the Landbridge have been essentially market-driven (Pomfret, 2019a) and based on pre-existing hard infrastructure. Improved rail links, with regular services connecting an increasing number of cities, broadened the range of customers willing to pay more than sea freight for faster more reliable transport but unwilling to pay for air freight.[6] The increased traffic is itself an indicator of success, as the Landbridge has brought financial benefits to those providing and using the services.[7] As a result of state subsidies, some of the benefits

[6] Variability of time may be even more important than average time (Ansón et al. 2020). The more predictable arrival time for a train than for a ship is especially important for trade along global value chains, which rely on just-in-time delivery and for which inventories are anathema.

[7] The national rail companies are state-owned but, led by Deutsche Bahn, they responded to profitable opportunities. The revenues to the rail companies are confidential, but an Asian Development Bank source reported that Kazakhstan earned over one billion dollars in transit fees in 2015 (Pomfret, 2019b, 267), the *Astana Times* reported in October 2019 that transit revenues had been $2 billion over the past year (Yergaliyeva, 2019), and Kazakhstan's 2015-19 Nurly Zhol investment program envisaged transit revenues of $4 billion in 2020. Participation of freight

may be transfers, but subsidies are mainly given to promote new services (Bucsky, 2020).[8] Financial and other benefits are likely to have increased over the decade of the 2010s as the time and price advantages of rail were improving and services increased, while ocean-shipping companies adopted slow-steaming to economize on fuel and reduce pollution.

Promoting Alternatives to the Current Main Lines

The Landbridge is a key element of the Belt in China's Belt and Road Initiative (BRI), although the rail services were established before the first announcement of the Belt in September 2013 and were well-developed by the time the BRI was formally launched in May 2017. The Chinese government has been active in promoting alternatives to the main lines, which all run north of the Caspian Sea. Experimenting with alternative routes aims in part to serve new destinations, but also to avoid the possibility of hold-up by a key transit country.

Immediately after the easing of UN sanctions on Iran in January 2016, President Xi visited Tehran. China-Iran train services were established in the same month. The first train from China reached Tehran in February;.[9] So far, no trains from China have gone beyond Tehran. Although the track exists to Istanbul and the Marmaray Tunnel eliminates the need for transfer by ship across the Bosporus, many parts of the Iran-Türkiye rail journey are slow, including a four-hour ferry across Lake Van in eastern Türkiye.

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forwarders and integration of Landbridge services into the operations of courier services such as DHL, Fedex, and UPS are profit-driven. A model-based World Bank project found large benefits to countries along the Landbridge (Bird et al., 2020).

[8] The subsidies are mostly offered by Chinese provincial or local governments to encourage development of services from their cities. The central government imposed a cap of 30% on subsidies in 2020 (Chu, 2019) and the subsidies are eventually to be discontinued (Pepe, 2021). Given the non-transparency, it is impossible to quantify the impact of terminating subsidies; without subsidies, the number of routes will fall as Chinese termini concentrate in a few hubs, whose services are likely to continue to be profitable.

[9] China subsequently established regular services from Ningxia Autonomous region and from Yiwu to Iran. The route crossed Kazakhstan almost to the Caspian Sea where it followed the rail link trough Turkmenistan to Iran, bypassing Uzbekistan whose transit regulations were too onerous. Following the death of Uzbekistan's President Karimov in September 2016 and his succession by the more outward-looking President Mirziyoyev, China-Iran trains took the more direct route through Uzbekistan. Construction of the Kashi-Andijan link would make this route even shorter.

More attention has been paid to the Middle Corridor that runs through Kazakhstan, crosses the Caspian Sea from Aktau to Baku, and then goes through Georgia either to link with the Turkish railway system or to cross the Black Sea by ship (Azhgaliyeva and Kalyuzhnova eds., 2021). This route had been proposed by the EU in the 1990s as a way to link Central Asia and the Caucasus to Europe, but with little success.[10] Since then, the hard infrastructure has been improved by completion of the Zhezkazgan-Beyneu railroad in 2014, reducing the length of the east-west rail journey across Kazakhstan, and of the Baku-Tblisi-Kars (BTK) railroad, which became operational in November 2017 and provided an overland link from Azerbaijan to Türkiye.[11] The first China-Türkiye train from Xian in November 2019 used the BTK and crossed under the Bosporus by the Marmaray Tunnel before continuing to Prague (Pepe, 2020 29). However, the rail-sea-rail mode change remains an unattractive feature and a Black Sea crossing from Georgia to Romania or onward rail from Istanbul to Europe still had problems.

A strong economic motive for establishing multiple routes between China and Europe is to avoid dependence on a single route. Such dependence could allow a transit country to hold up traffic, extorting bigger transit fees until the returns to service providers are driven down to the breakeven point. With multiple transit countries along a single route, each may try to extract more rents and, absent effective cooperation, the outcome will be a tragedy of the anti-commons.[12] As well as avoiding a tragedy of the anti-commons, multiple options encourage competition along many dimensions. Freight forwarders are aware of substantial differences between routes in terms of efficiency as well as price.[13]

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[10] Under the TRACECA program, the EU promoted a route from Central Asia across the Caspian Sea to Baku and then by rail through Azerbaijan and Georgia to the Black Sea and ship to Europe. Despite support from Azerbaijan and Kazakhstan, the route attracted little China-EU freight due to the inconvenience of transferring freight from train to ship and back to train, twice.

[11] Further infrastructure improvements included opening of a Kazakhstan-Turkmenistan-Iran line in 2013, the Marmaray Tunnel under the Bosporus, and improvements of port and other facilities at Aktau and Turkmenbashi and the new Alyat port in Azerbaijan.

[12] The tragedy of the commons arises when too many people have access to a common resource, e.g. a fishing ground may be over-fished or pastureland over-grazed; too much activity leads eventually to destruction of the resource. The tragedy of the anti-commons arises when too many people can access the rents and, as each participant maximizes their own rents while ignoring the behaviour of the others, excessive rent-seeking eliminates an otherwise profitable business; too little activity is the source of loss (Buchanan and Yoon, 2000).

[13] The empirical evidence (e.g. Barthélémy, 2021; Treb and Arkolakis, 2020) is region-specific and mostly for sea ports and road connections, but it is strong. An example in the present context is the response to congestion and delays due to the change of gauge at the Belarus-Polish border;

External Shock in 2020-21: COVID-19

International trade was negatively impacted by the COVID-19 epidemic, but the impact on different modes of transport varied. In Russia, Central Asia and the Caucasus, air freight essentially stopped and transport by road was disrupted by requirements for drivers to be tested for COVID at border crossing points and other regulations.[14] Sea freight was disrupted by quarantine and other restrictions that stranded ships in the wrong place. Many shippers turned to the rail option, and the rail Landbridge flourished in 2020 and 2021.

In 2020, the COVID-19 pandemic seriously disrupted international maritime trade. Journey time for cargo ready at the East Asian port of departure to delivery at the European port of arrival increased from less than 60 days in 2019 to over 100 days by the end of 2021.[15] Price data presents a similar picture.[16] Unreliability of maritime delivery times was highlighted by closure of the Suez Canal for a week in March 2021 after the *Ever Given* container ship became wedged.[17] Even as lockdowns were eased and factories started up again, containers and ships were out of location as managers dealt with crew safety issues and dockside biosecurity.

Lithuania and Finland, which both use the Russian gauge, have boosted their hub facilities and ports to transfer goods to north German and other Baltic ports.

[14] Air freight and road transport appear to have recovered in 2021. A World Bank study (Arvis et al., 2022) reported EU-China-EU trade in 2021 by value to be €698 billion (67% by sea, 28% by air and 5% by rail) and EU-Central Asia-EU trade in 2021 by value to be €25 billion (9% by air, 27% by road, 60% multimodal, and 3% "other").

[15] The Flexport Ocean Timeliness Indicator measures the journey of a container from the time it is set to leave a factory to the time it is picked up from its destination port. Separate indicators for the world's two largest trade lanes - the Trans-Pacific Eastbound from Asia to North America, and the Far East Westbound from Asia to Europe - are measured in days, with data provided on a weekly basis (available at https://www.flexport.com/research/understanding-the-ocean-timeliness-indicator/).

[16] The Freightos Baltic Index, a weighted average of spot rates for 40-foot containers using real time data from hundreds of logistical providers along twelve global shipping lanes, increased on average by about six times between early 2020 and the third quarter of 2021 (Kamali, 2022). From the Drewry Container Freight Rate Index of all-in costs for a 40-foot container between major port pairs, Isaacson and Rubinton (2022) report increased container shipping costs from Russia or China to the USA of over 150% in 2021.

[17] The *Ever Given*, one of the world's largest container ships with a capacity of over 20,000 TEUs, was impounded as Egypt and the ship's owners negotiated compensation terms and exited the Canal 106 days after entering.

Rail transport was less affected by anti-COVID measures, and acceleration of digitalization and paperless trade may even have improved the efficiency of international rail transport. Manufacturers, distributors, and logistics agents, who had previously relied upon maritime transport between East Asia and Europe, turned to overland freight routes. Although the change in transport mode was initially disruptive for many participants, the overland alternatives often turned out to be easier and more profitable than anticipated as users experienced reliable delivery schedules. In May 2020, at the height of the COVID crisis in Europe, UTLC reported that 52,500 TEUs were shipped on the Landbridge, the highest figure for a single month up to that date. The number of containers shipped between China and EU by rail through Kazakhstan increased from 333,000 in 2019 to 546,000 in 2020 and to almost 700,000 in 2021 (Table 1).

The negative side to the unexpected windfall was increased congestion. Travel times by rail between China and Europe had been reduced to 14-16 days, but in 2021 PRC-EU transit times of more than 30 days were reported. The main reason cited was an increase in demand, while popular border crossing points were unable to deal with the sudden rise in numbers. Congestion decreased in the first weeks of 2022, exacerbated by Chinese New Year celebrations (January 31st - February 6th, 2022) when production in China slows down, and the demand for westbound trains is less than usual.[18] By mid-February, transport time to Poland had been less than 20 days for several weeks. That was just before the war in Ukraine started.

External Shock in 2022: The Russia-Ukraine War

China's promotion of alternative routes to the main lines that run north of the Caspian Sea through Russia could have been precautionary behavior to reduce vulnerability to hold-up transit charges. In fact, when disruption occurred in 2022, it was a result of Russia's invasion of Ukraine and subsequent closing down of routes transiting Russia. Despite the higher cost of alternative China-Europe rail routes they were being quickly developed in 2022, highlighting the importance of the Landbridge for Eurasian supply chains.

[18] Majorie van Leijen, *Transit times New Silk Road back to normal, what's the secret*? Posted 22 February 2022 at https://www.railfreight.com/beltandroad/2022/02/22/transit-times-new-silk-road-back-to-normal-whats-the-secret/

The immediate effect of Russia's invasion of Ukraine was to end Landbridge traffic via Ukraine. Routes through Ukraine had been promoted by Hungary and by Slovakia.[19] Trains from Changsha and other cities went to Kyiv. However, in 2021 only around 2% of China-EU overland trade passed through Ukraine. That trade began to be paused or rerouted in January 2022 as Ukraine-Russia tensions mounted, and it was entirely suspended by the end of February.

The financial and export sanctions imposed by the USA and the EU on Russia on Friday 25 February meant that European companies could face issues with money transactions when doing business in Russia and that trains could not stop in Russian territory. A few days later, both the EU and USA included Russian Railways in their sanctions lists.[20] Customers began abandoning the northern corridor, concerned about the legal implications of working with a sanctioned company and also about potential problems such as insurance coverage being invalidated by "Act of War" clauses.

The actual situation is difficult to assess. The ULTC website continued to report substantial traffic (614,100 TEUs over the first eleven months) and EU companies continued to work with Russian Railways. Arvis et al. (2022, 42) report that rail connections continued to function, subject to additional procedures to check sanctions compliance, and, although international payments to Russian railways could be difficult, freight charges could be paid in China.[21]

Alternatives to transiting Russia were sought immediately. In late February 2022, a train went from China to Istanbul and then the containers went by sea to Trieste.[22] This example highlights that the Middle Corridor typically involves at least two sea crossings:

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[19] Majorie van Leijen, *How Important is Ukraine on the New Silk Road?* Posted on 25 February 2022 at https://www.railfreight.com/specials/2022/02/25/how-important-is-ukraine-on-the-new-silk-road/

[20] Nikos Papatolios *Russian Railways on the Sanctions List of EU and US*, posted 28 February 2022 at https://www.railfreight.com/policy/2022/02/28/no-business-with-russian-railways-say-the-us-and-eu/.

[21] New routes were established after the Russian invasion, e.g. a weekly Xian-Hull (UK) service via Kaliningrad and Mukran (Germany) was announced in February 2022 and service between Jinhua (Zhejiang) and Venlo (Netherlands) via Kazakhstan was initiated on 20 July 2022, both coordinated by German logistics companies (reported at www.railfreight.com). In July 2022, the EU determined that Russia-Kaliningrad trains transiting Lithuania were not subject to sanctions.

[22] Majorie van Leijen, *A Bypass Route to Duisburg: Is this the new normal?* Posted 8 March 2022 at https://www.railfreight.com/beltandroad/2022/03/08/a-bypass-route-to-duisburg-is-this-the-new-normal/ The Istanbul-Trieste segment avoided delays in southeast Europe at non-EU borders and due to rail works in Slovenia.

either crossing the Black Sea from Georgia to enter the EU through Romania or Bulgaria, or crossing the Adriatic to avoid passing through non-EU members in southeast Europe. Changes of transport mode lengthen the journey, reducing the benefits of rail over sea.[23] In March 2022, two Middle Corridor routes in common use ran from Baku either to a Georgian port and by sea to Constanta (Romania) or to Kars and then by rail to Istanbul or Mersin. In the short term, there are issues with coordinating documentation and rules (e.g. what constitutes a hazardous material shipment) among the countries and operators involved; by contrast, such issues had been long resolved on the China-Kazakhstan-Russia-Belarus-Poland route. Prior to Russia's invasion of Ukraine, less than 5% of Landbridge traffic used the Middle Corridor.

Figure 4: Middle Corridor Routes, March 2022

Scaling up faces capacity constraints associated with the Caspian Sea crossing as well as congestion at Constanta port and on parts of the Turkish rail network.[24] The two boats operating between Azerbaijan and Kazakhstan at the start of 2022 had a combined capacity of 250 containers per week, i.e. freight from five or six trains. A third ship with capacity of 350 TEUs was operating in April 2022. With a transit time of 3-4 days per roundtrip, the three vessels could provide five departures per week and a maximum

[23] It should be noted, however, that in northern Europe mixed mode routes have been competitive. For several years some Landbridge freight has gone to Baltic or Finnish ports and then by sea to, say, Germany. The slower travel on the ship segment is compensated by avoiding delays at the congested Belarus-Poland border where a change of gauge is required.

[24] In March 2022, Constanta faced congestion because freight previously intended to pass through Odessa to Ukraine or to Moldova shifted to Constanta. Rail congestion around Ankara is often remarked upon.

capacity of 3,000 TEUs, which is equivalent to 30-40 trains. With the addition of three new ships in September, this capacity doubled to 60-80 trains per week – a substantial increase, but still less than half of the ULTC traffic in 2021 (Table 1).[25]

The invasion has shifted the focus towards developing a sustainable alternative Landbridge. Türkiye is interested in capturing 30% of Landbridge traffic. On 31 March 2022, Georgia, Azerbaijan, Türkiye, and Kazakhstan agreed to create a joint venture that would provide high-quality intermodal transport and logistics services, harmonize cross-border rates, and introduce a unified IT platform to fully automate cargo transport services from China to Türkiye, and the Black Sea ports. The statement emphasized the importance of cooperation between the countries along the route and of investment in infrastructure development to integrate the Trans-Caspian transport corridor into the international transport system. A priority is to accelerate works to increase the capacity of the Baku-Tbilisi-Kars (BTK) rail line.

Interest in alternative Middle Corridor routes has also been stimulated by the outcome of the 2020 Azerbaijan-Armenia war and the prospect of a rail link through Armenia's Zangezur Corridor to link Azerbaijan to its Nakhichevan exclave. Linking Nakhichevan to Türkiye's Kars rail hub would create an all-Turkic route from the Caspian to Istanbul (Eldem, 2022). However, such plans are contested by Armenia and by Iran which fears disruption of its route to Georgia and Russia via Armenia if Armenian sovereignty is sacrificed for the rail lines (Kaleji, 2022).[26]

The EU moves more slowly than China or the Middle Corridor countries, but it too has increased focus on the Middle Corridor. In 2019-20 the EU had announced the intention to bring its Trans-European Transport Network (TEN-T) in line with EU-China links.[27] Revisions of TEN-T regulations announced in April 2022 focused on three pillars.

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[25] PortSEurope *Three more container ships to double the cargo capacity of the Middle Corridor between Aktau and Baku*, posted 19 April 2022 at https://www.portseurope.com/three-more-container-ships-to-double-the-cargo-capacity-of-the-middle-corridor-between-aktau-and-baku/ Doubling of container ships operating between Turkmenistan and Azerbaijan in 2022 from one to two adds new Middle Corridor options.

[26] The substantial transit fees earned by Kazakhstan from the Landbridge have encouraged other countries to establish their place, while also being aware of the costs of being bypassed. The "Turkic" route via Nakhichevan will undermine Georgia's position. If a no-modal-change route via Turkmenistan and Iran to Türkiye could be established, Azerbaijan would lose its key position.

[27] Simon Walton, "TEN-T and New Silk Road Integration – Top priority in 2020." *RailFreight.com*, 27 December 2019 – available at https://www.railfreight.com/beltandroad/2019/12/27/ten-t-and-new-silk-road-integration-top-priority-in-2020/

Pillar number one makes the infrastructure for longer and heavier intermodal trains universal for the whole TEN-T network.[28] Pillar number two requires creation of adequate capacity to ensure a defined number of 740-metre-long trains per hour on every TEN-T line, to elevate the punctuality of freight trains to 90%, and to enable the crossing of an internal EU border within 15 minutes. The third pillar concerns mandatory modernization of existing intermodal terminals and construction of intermodal terminals where capacity is lacking. The revised regulations are to be supported by significant investment. The EU commitment to Central Asia was restated at the EU-Central Asia Connectivity Conference in Samarkand on 17-18 November 2022 attended by the EU High Representative for Foreign Affairs, Josep Borrell, and the foreign ministers of the five Central Asian countries.[29]

In the longer term, currently difficult routes south of the Caspian Sea could be feasible. A route through Uzbekistan and Turkmenistan to Iran could connect to the Turkish rail network or to Iran's ocean ports.[30] At the 1+5 meeting between the presidents of China and the five Central Asian countries in January 2022, the atmosphere was cooperative and Uzbekistan and the Kyrgyz Republic specifically pressed China to move forward on a railway linking Kashi, the furthest west point in China's rail network, to Uzbekistan, and hence providing an alternative east-west route to the Caspian (avoiding both Russia and Kazakhstan). Agreement on the route and financing was announced at the Samarkand summit of the Shanghai Cooperation Organization in September 2022.[31]

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[28] Minimum infrastructure parameters along the entire long distance freight network are set for train length (740m), axle load (22,5t), P400 loading gauge, and electrification and interoperability of signaling systems.

[29] In the previous month, President of the European Council Charles Michel visited Kazakhstan and Uzbekistan. The press statement with President Mirziyoyev of Uzbekistan emphasized: "Creation of sustainable transport corridors has been specified as key factor for increasing mutual trade, including explore options for further development of the Trans-Caspian Multimodal Route. . . The Presidents discussed the importance of expanding port capacities, increasing ferry and rail fleets, harmonizing customs procedures, introducing digital solutions for cargo handling and border crossing." Allocated EU funding for Central Asia is 300 million euros over four years.

[30] US sanctions on Iran may be an obstacle for some potential customers. An Uzbekistan-Afghanistan-Iran route would face security issues transiting Afghanistan.

[31] Richard Pomfret "China's Western Neighbours, and the Future of Eurasian Overland Trade", 26 September 2022 at https://iit.adelaide.edu.au/news/list/2022/09/26/chinas-western-neighbours-and-the-future-of-eurasian-overland-trade.

Another reaction to disruption of the main Landbridge lines has been improvement in maritime-rail routes. Previous comparisons were between China-EU rail times and shipping times of 35-45 days from Shanghai to Rotterdam (the largest ports in China and in the EU), but shippers seeking alternatives to Russian routes in March 2022 used sea from Shenzhen to Mediterranean ports such as Piraeus (20-25 days) and then rail to northern and western European destinations. This option was disrupted by a COVID-19 outbreak in Shenzhen later in March 2022, but it illustrated the potential for innovative routing by freight forwarders.

Conclusions

The rapid evolution of the Landbridge highlighted the importance of appropriate connectivity for international supply chains. The Landbridge remained robust to potential threats of disruption in 2014 and 2020, but the Russia-Ukraine war in 2022 highlighted the dangers of relying on a system with a key chokepoint (i.e. transiting Russia). The rapid response to the war-driven disruption reflected the demand for these services and the potential win-win gains for service providers as well as customers.

If the war is brief and the post-war settlement appropriate, the main lines of the Landbridge could revive.[32] Absent those conditions, how feasible are alternative routes? The market test is clear; the Middle Corridor and services to Iran are already in use, although traffic is far less than that carried on the main Landbridge routes prior to the Russia-Ukraine war. The attractiveness of the alternative routes will be increased if the countries involved can reduce delays by agreeing on customs procedures for trains in transit and prioritizing the through trains, by setting reasonable but not excessive freight rates, and by investing to improve choke points such as change of gauge.

Improved long-distance Eurasian rail services along the Middle Corridor or south of the Caspian Sea could also benefit Central Asian countries seeking to diversify their exports from a narrow range of primary products.[33] So far, the Central Asian countries

[32] Feyrer (2021) estimated that closure of the Suez Canal in 1967 had a significant impact on trade flows, depending on location and value of trade (among the sample countries, Pakistan, India, Kenya and Sri Lanka had the largest trade-weighted increase in distance). The impact of the unanticipated exogenous shock on trade lasted for three years and on GDP five years.

[33] In September 2022, a block train of twenty-four 40-foot containers mainly filled with fertilisers left Uzbekistan for the port of Turkmenbashi, and then across the Caspian Sea to the Azerbaijani port of Alat, by rail to the Georgian port of Batumi, and across the Black Sea to Constanta in Romania; the first train using the Middle Corridor not from or to China - reported by Nikos

have been almost totally absent from international supply chains. Diversifying exports and becoming attractive supply chain partners will require domestic reforms to reduce the costs of doing business in general and of international trade in particular. An encouraging sign is the generational change in leaders from presidents whose outlook was molded in the Soviet era to presidents whose adult lives have been mostly spent in post-Soviet economies (Pomfret, 2021b).

This paper has focused on exogenous shocks, contrasting the impact on the Eurasian rail Landbridge of the COVID shock in 2020-1 and of the Russia-Ukraine war shock in 2022. However, the long-term prospects for rail connections between China and Europe are positive. Electric trains along well-maintained track are a more environmentally friendly mode of international transport than ships or planes.[34] A major demand stimulus in 2023 could be provided by increased exports of electronic vehicles assembled in China;[35] electric cars transported on green rail could further transform Eurasian supply chains. Whatever the stimulus for future expansion, rail transport has proven to be the ideal link between the regional value chains of East Asia and Europe.

Papatolios on 6 September 2022 at https://www.railfreight.com/corridors/2022/09/06/ady-container-transports-uzbek-fertilisers-to-europe-for-the-first-time/

[34] Air freighting a 12,000-kilogram load from Chengdu to inland Western Europe produces about 54 tonnes of carbon dioxide, shipping by maritime and rail routes produces 3.3 tonnes, and rail-freighting across the Landbridge produces 2.8 tonnes (EUCCC, 2020, 17). Regulations to reduce sulphur and other emissions between 2020 and 2050 will add to the cost of maritime freight (Tonchev, 2020).

[35] The demand in Europe for China-made electric vehicles has been increasing rapidly; in the first seven months of 2022 exports were 90% higher than in the same period in 2021. However, all Chinese exports of electric cars travel by sea; lithium is considered a hazardous substance and the Chinese government bans dangerous goods from its railway network. Taking the rising demand and new safety concerns (including increased fire incidents on ships carrying EVs) into account, China may respond to lobbying by car producers and freight forwarders and reconsider allowing EVs to travel on Eurasian trains. See Nikos Papatolios, *Electric Cars on Eurasian Rail? China seems ready to do it,* posted 9 September 2022 at https://www.railfreight.com/policy/2022/09/09/electric-cars-on-eurasian-rail-china-seems-ready-to-do-it/.

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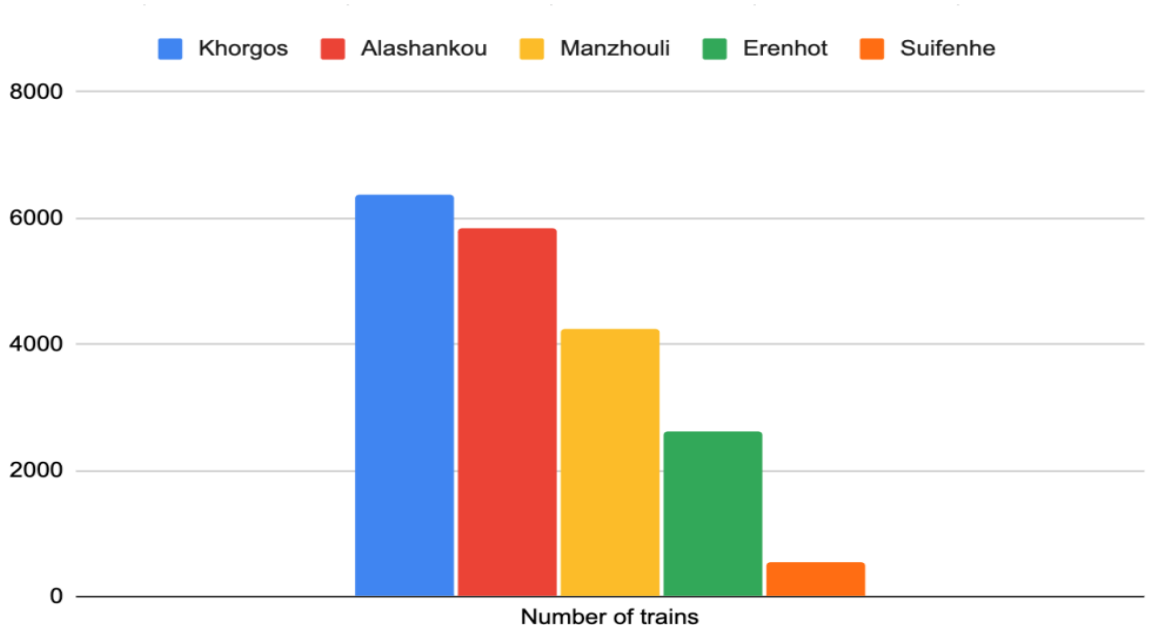
APPENDIX: Measuring Traffic along the Landbridge

There is no consistent single data source (Bucsky, 2019). In part, this is a matter of units: should we count trains or containers? More importantly, it is unclear which routes qualify as Landbridge trade. The Chinese data in Table 1 report number of trains to and from China, but do not distinguish whether they go to the EU.[36] The Chinese data try to exclude bilateral trade with Kazakhstan, Mongolia or Russia, but it is not always clear where to draw the line, e.g. trains to Russian Baltic ports are mostly Landbridge traffic to Scandinavia or Germany.

The number of containers reported on the UTLC website are easily accessed and commonly used. The Eurasian Rail Alliance (UTLC) was founded by Belarus, Kazakhstan, and Russia in 2014 to provide services for container block trains running between China and Europe. This is the main Landbridge route. According to Bucsky (2019, 9), 80% of China–Europe trains used the Kazakhstan corridor, 11% the Mongolian corridor and 9% the northern TSR corridor in 2018. The Chinese data on border crossing points show a different pattern (not precisely consistent with the numbers in Table 1), with around 12,000 trains crossing the Kazakhstan border at Khorgos or Alashankou, 4,500 crossing at Manzhouli or Suifanhe for the Russia-only TSR route, and c.2,500 using the Mongolia-TSR route via Erenhot. In sum, the UTLC data may be missing between a fifth and a third of Landbridge traffic.



Source: Chinese official data cited in *The 2021 Silk Road numbers are there: what do they tell us?* Posted at https://www.railfreight.com/specials/2022/01/14/the-2021-silk-road-numbers-are-here-what-do-they-tell-us/ 14 January 2022

Despite the uncertainty surrounding the numbers, the two series in Table 1 paint a consistent picture. Starting from a low base, traffic along the Landbridge roughly doubled each year between 2011 and 2017. The growth continued over the next five years and was, noticeably, not disrupted in 2020 and 2021 despite the COVID-19 shock.

[36] Numbers are not necessarily balanced in both directions. In 2018, of the 1,442 trains on the most frequent route, between Duisburg and Chongqing, 728 were from the EU and 714 from China.