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POLICY RESEARCH

The Belt and Road Initiative: Maximizing benefits, managing risks—A computable general equilibrium approach

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ABSTRACT

Using a Global Trade Analysis Project (GTAP) model, and China as the base for analytical comparison, this paper shows that there are significant economic benefits to China and the participating countries along all six Belt and Road Initiative (BRI) economic corridors. However, to maximize these benefits, the social and environmental risks need to be well managed. The analysis shows a clear sequencing in terms of priority corridors. Two corridors have minimal investments and immediate returns, two corridors have significant investments with huge returns, and two corridors have high investments with lower returns. Overall, the paper demonstrates that to ensure the sustainability of any BRI corridor development, there is a need to consider its costs and benefits from the economic, social and environmental perspectives.

Keywords: *BRI; GTAP; sustainable development*

1. Introduction

The Belt and Road Initiative (BRI) is a development strategy and framework proposed by China's President Xi Jinping in late 2013. Combining the Silk Road Economic Belt and the 21st Century Maritime Silk Road, its primary goal is to promote freer flow of economic factors (*e.g.*, capital, goods, services, energy, technology, and people) in Asia-Pacific and beyond. BRI will be a massive, expensive, and complex series of undertakings in dozens of countries over a number of years. BRI aims to connect the vibrant East Asia economic circle at one end to the developed European economic circle at the other, encompassing all countries in between.

The "Belt" is a network of overland road and rail routes, oil and gas pipelines, energy grids, and ITC fiber optic links that stretch from China through Central Asia to ultimately reach Europe. The Belt comprises six economic corridors along the ancient Silk Road. The "Road" is its maritime equivalent, a network of ports and other coastal infrastructure that dot the map from Southeast Asia and South and Southwest Asia to East Africa and the Mediterranean Sea[1]. The "Belt" seeks to enhance land transport routes between China and North and Central Asia, South and

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1. For the purposes of this paper, only the land-based 'Belt' corridors are examined, and the 'Road' marine route that aims to improve sea transport routes to Europe and the Pacific is ignored.

Southwest Asia, and Southeast Asia through six economic corridors. These corridors include: Bangladesh-China-India-Myanmar (BCIM) Corridor, China-Mongolia-Russia (CMR) Corridor, China-Central Asia-West Asia (CAWA) Corridor, China-Indochina Peninsular (ICP) Corridor, China-Pakistan (CP) Corridor, and New Eurasian Land Bridge (NELB).

For generations, the Silk Road has paved the way for trade and spurred economic activities and social exchange in its wake. The ancient transport network has promoted trade and investment, and trade in turn has created the infrastructure for physical economic integration. Witnessed was the development of major international transport corridors through regional economic cooperation that resulted in better resource allocation and additional growth opportunities as more people participate in global production networks and value chains. BRI, through infrastructure connectivity, could potentially bring multiple socioeconomic benefits to rural China as well as to China's neighbors in Central Asia, Southeast Asia, and beyond. For China, BRI represents a new direction of its foreign economic policy. Rather than investing in extractive industries, BRI aims to enhance industrial capacity and boost consumer demand in participating countries, thus encouraging demand for Chinese products.

As of early 2015, the Chinese government is reported to have committed up to USD1 trillion on infrastructure investments, including in the central and western provinces, the gateways to Central Asia (Rolland, 2015). The majority of China's provinces have already announced action plans that feature BRI, in a hope to secure some projects financed by central government funds. Several large-scale infrastructure and energy projects being planned are not entirely new, instead they are based on facilities that have predated BRI. There is no official or consolidated source that reports the progress of BRI. In fact, it is not clear which cooperation schemes are a part or not a part of BRI. For example, in September 2013, China signed agreements with Kyrgyzstan, Tajikistan, and Uzbekistan to build an additional line of the Central Asia-China gas pipeline. This would expand the 3,666-km line running from Turkmenistan/Uzbekistan border to Xinjiang province of China, which has been operational since 2010 (Farchy, 2016). There are strong linkages between BRI and trans-boundary power trade. The power generation, transmission, and distribution networks are spread throughout the region in many small and larger grids. Moreover, there is a large potential for renewable energy within sub-regions that can be shared to connect sustainable energy supply and demand centers. Ultimately, the goal is to create Clean Energy Corridors along the Belt and Road that promotes the development of clean, indigenous, and cost-effective renewable power options.

BRI provides an opportunity to reduce the differences within China and connect China's inland areas to its neighboring sub-regions. It offers an ambitious vision of economic cooperation between and amongst countries. The development of safe and reliable transport corridors to allow for the efficient passage of goods and people is a priority. For example, substandard sections of the Asian Highway network will have to be upgraded, as there is still over 10,000 km along the Asian Highway that do not meet desirable standards. In addition to investments in hard infrastructure, improvements in the soft components are equally important, such as developing harmonized cross-border administrative procedures, consistent vehicle technical standards, unified cross-border transport documents, and strengthened transport safety measures.

The development of transport infrastructure has led to greater cross-border trade and investment, and vice versa. Trade facilitation measures (*e.g.*, cross-border information exchange), such as the World Trade Organization (WTO) Trade Facilitation Agreement, are key to achieving seamless conectivity and unimpeded trade. Trade facilitation makes trade cheaper and faster. Administrative hurdles from cumbersome procedural and documentary requirements can account for up to 75% of the delay of shipments. Each additional day of delay can reduce trade volumes by 1% or up to 7% if the products are agricultural commodities. Trade facilitation also generates new trade and employment. The potential gains from cross-border paperless trade are large, with estimates reaching about USD250 billion in additional export potential for the Asia-Pacific region. However, barriers for trade facilitation along BRI remain, and countries along BRI corridors still face complex trade procedures. For instance, it typically takes 35 days to export fabrics from China to Kyrgyzstan, involving over 20 trade procedures and over 20 actors (ESCAP, 2015).

BRI is in part a reflection of China's emergence as a major economic power, a driver of global economic growth, and a catalyst of regional economic integration. Contemporary China, which holds huge foreign currency reserves, has a vast domestic market and owns a currency that is increasingly used to settle international payments (Reilly, 2016). BRI is backed by financial firepower. China has already launched a USD40-billion Silk Road Fund to support BRI (backed by the China Investment Corporation, China Development Bank, Export-Import Bank of China, and the State Administration of Foreign Exchange). In addition, China has indicated upwards of USD300 billion in infrastructure financing on top of the multilateral pledges to the Asian Infrastructure Investment Bank (AIIB) and the New Development Bank. This does not include the possible leveraging effect on private investors and lenders in terms of infrastructure financing. Financing for development will require investment decisions with due emphasis on rates of return, as well as social and environmental concerns. This will necessarily entail the active participation of partner countries (host country authorities and local private sector entities) in the decision-making process, and not be directed as a state planning exercise. Efforts to foster local financial institution participation in BRI infrastructure projects, through co-financing, counterpart financing, and even direct host country budget support, needs to be explored to promote financial deepening and market development.

In addition to infrastructure development (road and rail routes, oil and gas pipelines, energy grids, and fiber optic links) and trade and investment flows, BRI is anticipated to have significant implications for economic growth, social and environmental impacts, employment generation, and financial cooperation and integration in the Asia-Pacific region and beyond in the coming decades. Essentially, BRI is expected to generate significant network effects as it weaves 60-plus countries into a consolidated logistical, trade, and investment web. The expanded access to capital, industrial intermediaries, technology, and export markets will create new economic opportunities for countries to integrate themselves into global and regional value chains and to diversify domestic economies.

The aim of this paper is twofold. The first objective is to estimate the potential economic benefits across the six BRI economic corridors. The second aim is to develop an understanding of how to prioritize investment between the six BRI economic corridors. The paper uses Global Trade Analysis Project (GTAP) global general equilibrium model to estimate the economic impacts of the six BRI corridors. The GTAP model is a common quantitative tool for analyzing the *ex-ante* impacts of multilateral economic cooperation agreements. The model assumes that economic benefits of BRI are primarily achieved through reduced transport costs, lower import tariffs, and higher productivity as a result of economic diversification and greater energy security. This paper examines the relative benefits and costs between the BRI corridors and ranks the six BRI corridors based on their net economic benefits for China, while highlighting the social and environmental costs. To estimate China's net economic benefits for each corridor, the country's welfare gain for each corridor, derived through the GTAP model, is compared against the required investment that China needs to undertake to develop such corridor. Based on assessments of benefits and costs from the economic, social and environmental perspectives, the paper suggests ways to prioritize and sequence investments along the BRI corridors.

The organization of this paper is as follows: Section 2 provides a brief overview of the six BRI economic corridors; Section 3 presents an analysis the economic benefits of each corridors; Section 4 assesses the potential economic, social, and environmental risks associated with each corridor. Section 5 then suggests ways to maximize the benefits while minimizing the costs associated with each corridor, taking into account the economic, social, and environmental costs and benefits. Finally, Section 6 concludes.

2. An overview of the six BRI economic corridors

Figure 1 presents the six BRI corridors. The brief descriptions of the six corridors are given below:

A. Bangladesh-China-India-Myanmar Corridor (BCIM): In a series of meetings during Premier Li Keqiang's visit to India in May 2013, China and India jointly proposed the building of the BCIM. In December 2013, the BCIM Joint Working Group convened its first meeting in Kunming, conducting in-depth discussions about the development prospects, priority areas, and mechanisms for cooperation. They agreed on co-operation in transportation infrastructure, investment and commercial circulation, and people-to-people connectivity.

B. China-Indochina Peninsula Corridor (ICP): During the Fifth Leaders Meeting on Greater Mekong Sub-Regional Economic Co-operation in December 2014, Premier Li Keqiang put forward three suggestions to broaden with the five countries in the Indochina Peninsula: (1) jointly planning and building an extensive transportation network and industrial co-operation projects; (2) creating a new mode of co-operation for financing; and (3) promoting sustainable and coordinated socio-economic development. The countries along the Mekong River are building multiple connecting international transport links.

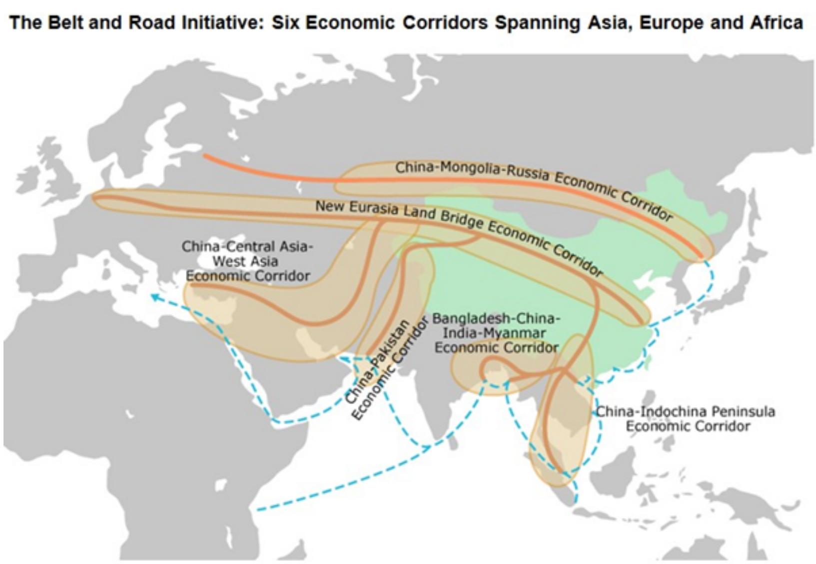


Figure 1. The six Belt and Road Initiative economic corridors

C. China-Central-West Asia Economic Corridor (CAWA): CAWA runs from Xinjiang and exits the country via Alashankou to join the railway networks of Central and West Asia and beyond. CAWA comprises Kazakhstan, Kyrgyzstan, Tajikistan, Uzbekistan, Turkmenistan, Iran, and Turkey. At the third China-Central Asia Co-operation Forum held in Shandong in June 2015, a commitment to “jointly building the Silk Road Economic Belt” was incorporated into a joint declaration signed by China and these five countries, aimed at deepening and expanding mutually beneficial co-operation in such areas as trade, investment, finance, transport, and communication. The Belt initiative shares common ground with existing national strategies such as Kazakhstan’s “Road to Brightness”, Tajikistan’s “Energy, Transport and Food”, and Turkmenistan’s “Strong and Happy Era”.

D. New Eurasian Land Bridge (NELB): This is an international rail line running from Lianyungang in Jiangsu, through Alashankou in Xinjiang, to Rotterdam in Holland. The China section of the line comprises the Lanzhou-Lianyungang and the Lanzhou-Xinjiang railways. The new land bridge passes through Kazakhstan, Russia, Belarus, and Poland, reaching coastal ports in Europe. China already has opened routes linking Chongqing to Duisburg, Germany; Wuhan to Mělník and Pardubice, Czech Republic; Chengdu to Lodz, Poland; and Zhengzhou to Hamburg, Germany. All offer rail-to-rail freight transport with the convenience of “one declaration, one inspection, one cargo release” for cargo.

E. China-Mongolia-Russia Economic Corridor (CMR): Linked by land, these countries have long-established economic ties, frontier trade, and cross-border co-operation. In September 2014, when the three heads of state met at the Shanghai Cooperation Organisation’s (SCO) Dushanbe Summit, they reached agreement on forging tripartite cooperation. They also agreed to coordinate the Belt, the renovation of Russia’s Eurasia Land Bridge, and Mongolia’s Steppe Road. This commitment strengthens rail and highway connectivity and construction, advances customs clearance and transport facilitation, promotes cross-national co-operation in transportation, and establishes the CMR.

F. China-Pakistan Economic Corridor (CP): This concept was first raised by Premier Li Keqiang during his visit to Pakistan in May 2013. The objective was to build an economic corridor running from Kashgar, Xinjiang, to Pakistan’s Gwadar Port. Both governments have mapped out a provisional long-term plan for building highways, railways, oil and natural gas pipelines, and fiber optic networks. According to a joint declaration in Islamabad in April 2015, the two countries will advance key projects such as phase II of the upgrade of the Karakoram Highway, expressways to Gwadar Port and from Karachi to Lahore, a new international airport, the Lahore orange line railway, the Haier-Ruba economic zone, and the China-Pakistan fiber optic network.

The exact routes for BRI have not been announced officially by the Chinese government and the list of participating countries remains fluid. BRI is striking in its sheer scale in terms of investment needed and economic benefits yielded to participating countries. Studies suggested that the BRI could include more than 60 economies with a collective gross domestic product (GDP) of about one-third of world output, 40% of global trade, and a population of over four billion. There is no official indication of the implementation period, but many analysts believe that BRI could take up to 20–30 years to complete.

3. Maximizing benefits from BRI

Realizing potential economic gains offered by BRI would help revive economic growth in the developing Asia-Pacific countries. BRI comes at a time when the region's merchandise trade growth has slowed notably as a result of subdued import demand in developed markets and rising trade protectionism. Amid sluggish trade, economic growth in developing Asia-Pacific region, though steady in recent years, is lower than its historical trend. Part of this slowdown was also driven by slower productivity growth owing to supply-side constraints such as infrastructure and energy shortages. There is thus a need for developing Asia-Pacific to focus relatively more on domestic and regional demand in order to revive its economic growth momentum. Promoting regional demand, of course, will require strengthening intra-regional trade flows. Increased intra-regional trade will require enhanced connectivity through better transport infrastructure and streamlined cross-border regulations. These areas lie at the heart of BRI.

To estimate economic impacts of BRI corridors, this paper uses the GTAP global general equilibrium model. The GTAP model is widely used to analyse the ex-ante impacts of economic cooperation agreements on key economic variables, such as economic growth and international trade. This paper uses the database that reflects economic conditions in the year 2015. See Box 1 for further details of the model.

Conceptually, by promoting freer flow of capital, goods, services, and people, BRI is likely to benefit participating economies through higher investment, trade, and tourism. In the medium term, BRI could enhance a country's productivity as a result of economic diversification, better transport networks, and greater energy security. To reflect these channels, five GTAP parameters are shocked—that is, their baseline values are changed—in all simulation scenarios. These are: (a) tariff rate on bilateral imports amid closer economic cooperation; (b) transaction cost in bilateral trade as a result of better connectivity; (c) factor productivity; (d) efficiency of shipping; and (e) value-added productivity. The latter three parameters reflect higher economy-wide productivity.

A total of three scenarios are presented for each simulation, namely the base-case scenario, the low-case scenario, and the high-case scenario. The difference across these scenarios is in the magnitude of shocks that is being assumed. For example, the base-case scenario assumes a 30% reduction in both import tariffs and cross-border transport cost, while the low-case scenario assumes a 15% reduction in tariffs and a 10% reduction in transport cost. The low-case scenario reflects smaller-than-expected extent of economic cooperation that could be due to factors such as political transitions and geopolitical uncertainty. In contrast, the high-case scenario reflects greater degree of economic cooperation, which could arise when rising trade protectionism in developed markets incentivizes Asia-Pacific countries to work together more actively to benefit from freer trade. All scenarios are run under the GTAP closures where factor endowments, technology, and tax and subsidy rates as treated as exogenous variables.

Figure 2 depicts the distribution of estimated economic gains across all participating economies in each corridor under the base-case scenario. In particular, the four panels show the dollar value of welfare gains by corridor and country, change in real GDP level, and changes in exports of goods and services.

Box 1. The Global Trade Analysis Project (GTAP) model

The GTAP model is a linearized, static, and computable general equilibrium (CGE) model[2]. The model assumes perfect competition in all markets, constant returns to scale in all production and trade activities, profit-maximizing behaviour by firms, and utility-maximizing behaviour by households.

In the GTAP model, each region has a single representative household, known as the regional household. The income of the regional household is generated through factor payments and tax revenues net of subsidies. The regional household allocates expenditure to private household expenditure, government expenditure, and savings according to a Cobb–Douglas per capita utility function. Each component of final demand maintains a constant share of total regional income.

The private household buys commodity bundles to maximize utility, subject to its expenditure constraint. In the GTAP model, the constrained optimizing behaviour of the private household is represented by a constant difference of elasticity expenditure function. The private household spends its income on consumption of both domestic and imported commodities and pays taxes. The consumption bundles are constant elasticity of substitution (CES) aggregates of domestic and imported goods, where the imported goods are also CES aggregates of imports from different regions. Taxes paid by the private household include commodity taxes for domestically produced and imported goods and income tax net of subsidies.

The government spends its income on domestic and imported commodities, and it collects taxes. Taxes consist of commodity taxes on domestically produced and imported commodities. Like the private household's, government consumption is a CES composite of domestically produced and imported goods.

The GTAP model considers the demand for investment in a particular region as savings. In a multi-country setting, the model is closed by assuming that regional savings are homogenous and contribute to a global pool of savings. This global savings is then allocated among regions for investment in response to changes in the expected rates of return in different regions. If all other markets in the multi-regional model are in equilibrium, if all firms earn zero profits, and if all households are on their budget constraint, such a treatment of savings and investment will lead to a situation in which global investment must equal global savings.

In the GTAP model, producers receive payments for selling consumption goods and intermediate inputs both in the domestic market and to the rest of the world. Under the zero-profit assumption employed in the model, these revenues must be precisely exhausted by spending on domestic intermediate inputs, imported intermediate inputs, factor income, and taxes paid to the regional household.

The GTAP model postulates a nested production technology, with the assumption that every industry produces a single output, and constant returns to scale prevail in all markets. Industries have a Leontief production technology to produce their outputs. Industries maximize profits by choosing two broad categories of inputs, namely a composite of factors (value added) and a composite of intermediate inputs. The factor composite is a CES function of labour, capital, land, and natural resources. The intermediate composite is a Leontief function of material inputs, which are in turn a CES composite of domestically produced goods and imports. Imports come from all regions.

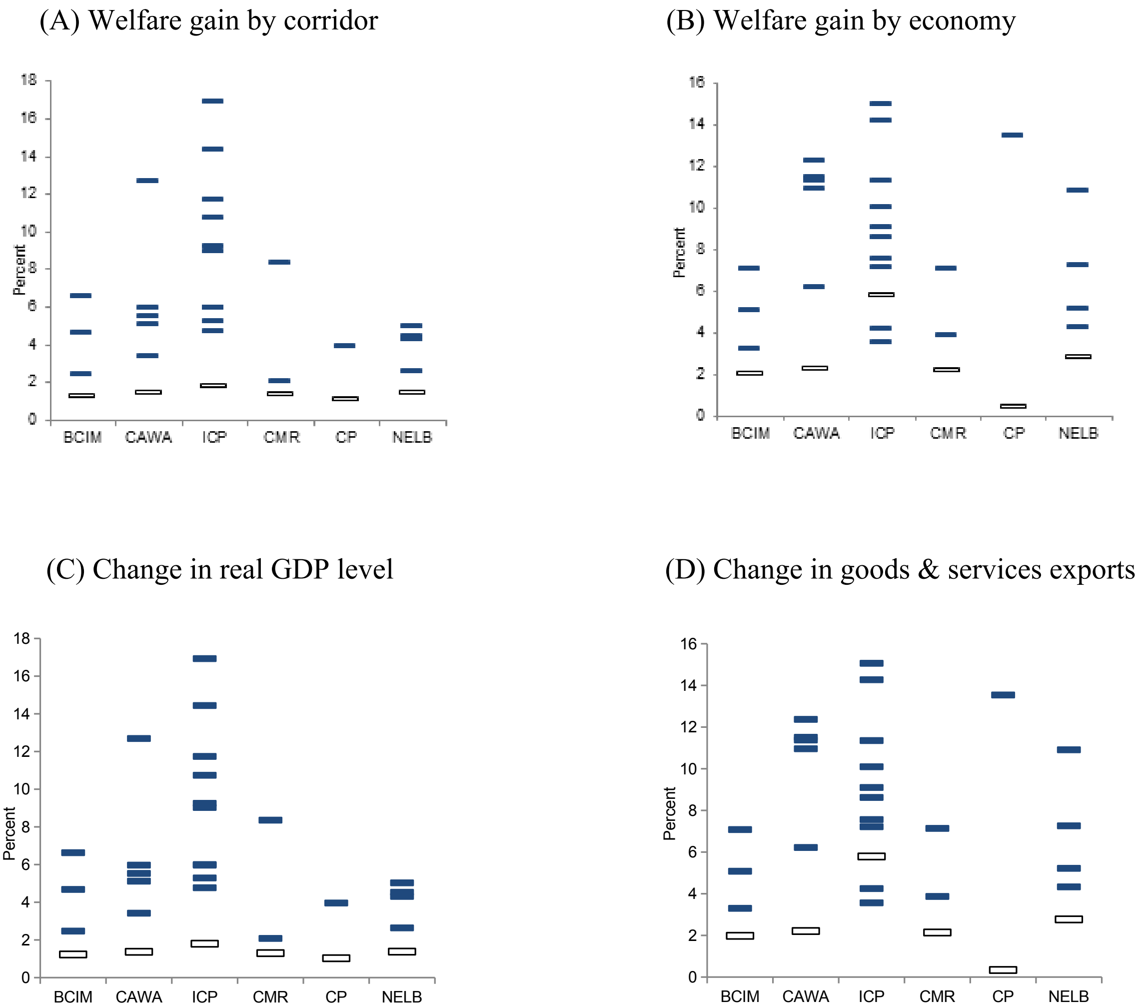
2. For full documentation of the GTAP model and the database, see Hertel (1997).

In Figure 2, the economic gains are sizeable across all BRI corridors. In value terms, the combined welfare gains by all participating economies under ICP are the largest at about USD372 billion, or about 3.5% of the group's total GDP. This is followed by USD216 billion in NELB, USD190 billion in CAWA, USD167 billion in BCIM, USD152 billion in CMR, and USD86 billion in CP. Welfare gains under BCIM, CAWA, CMR, and NELB are equivalent to about 1.5%–2% of their corresponding output levels, and close to 1% for CP.

The size of a country's welfare gains is determined mainly by its economic structure. Among other factors, these include the relative share of agriculture, industry, and services in GDP; share of exports and imports in GDP; composition of export and import baskets; degree of trade restrictiveness; the current level of cross-border transport cost; and productivity level in different economic sectors. In this regard, the simulation results show that ICP tends to yield the highest economic returns, which is somewhat expected, given that most Southeast Asian economies are export-oriented, with close trade links with China. Similarly, estimated economic gains under CAWA and NELB are rather high because BRI would help to reduce the currently high cross-border transport and trade costs in most North and Central Asian economies. Moreover, as the corridor's welfare gains are calculated as combined welfare increases across all participating economies, the corridors that exhibit higher number of large economies, such as BCIM, ICP, and NELB, tend to be those with higher returns.

The simulation results suggest that China's output gains in terms of a percentage increase in real GDP level are estimated to be smaller than those in other participating countries, although its welfare gains in value terms are far greater than others. Across the six corridors, China's real GDP level is expected to increase by 1%–1.8% in the next few years, which is more modest relative to other economies. Among others, the underlying reason is that China's exports to other BRI economies remain small compared to its shipments to major industrial economies. For example, China's exports to 64 BRI economies accounted for only about a quarter of China's total exports in 2015, which was lower than China's export shares to Japan, the Republic of Korea, and the United States combined. As a result, estimated increases in China's exports across BRI corridors are not significant. Nonetheless, given the size of the Chinese economy, China's welfare gains in value terms are much larger than those in other countries, ranging from USD78 billion in CP to USD138 billion in ICP (Figure 2B).

Though the output gains vary greatly across participating economies, the land-locked developing countries (LLDCs) would experience the greatest improvements in terms of percentage increase in real GDP (Figure 2C). In economies which are expected to benefit the most from BRI in each corridor, the estimated increase in output level could amount to 7% in Bangladesh under BCIM, 13% in Kyrgyzstan under CAWA, 17% in Vietnam under ICP, 8% in Mongolia under CMR, 4% in Pakistan under CP, and 5% in Kazakhstan under NELB (Figure 2C). The biggest gains seem to accrue most to land-locked developing countries (*e.g.*, Kyrgyzstan, Mongolia, and Kazakhstan) within each corridor. Meanwhile, among economies which tend to benefit relatively less from BRI (excluding China), estimated output gains are smaller but still sizeable: between 2%–3% across all corridors. Such country groups tend to have larger economies, such as India under BCIM, Turkey under CAWA, Indonesia under ICP, and the Russian Federation under CMR and NELB. This is partly because the simulation assumes smaller productivity gains in larger countries; although an economic corridor may have large impact on certain geographic regions of the country, such impact tends to be smaller when considering the size of the whole economy.



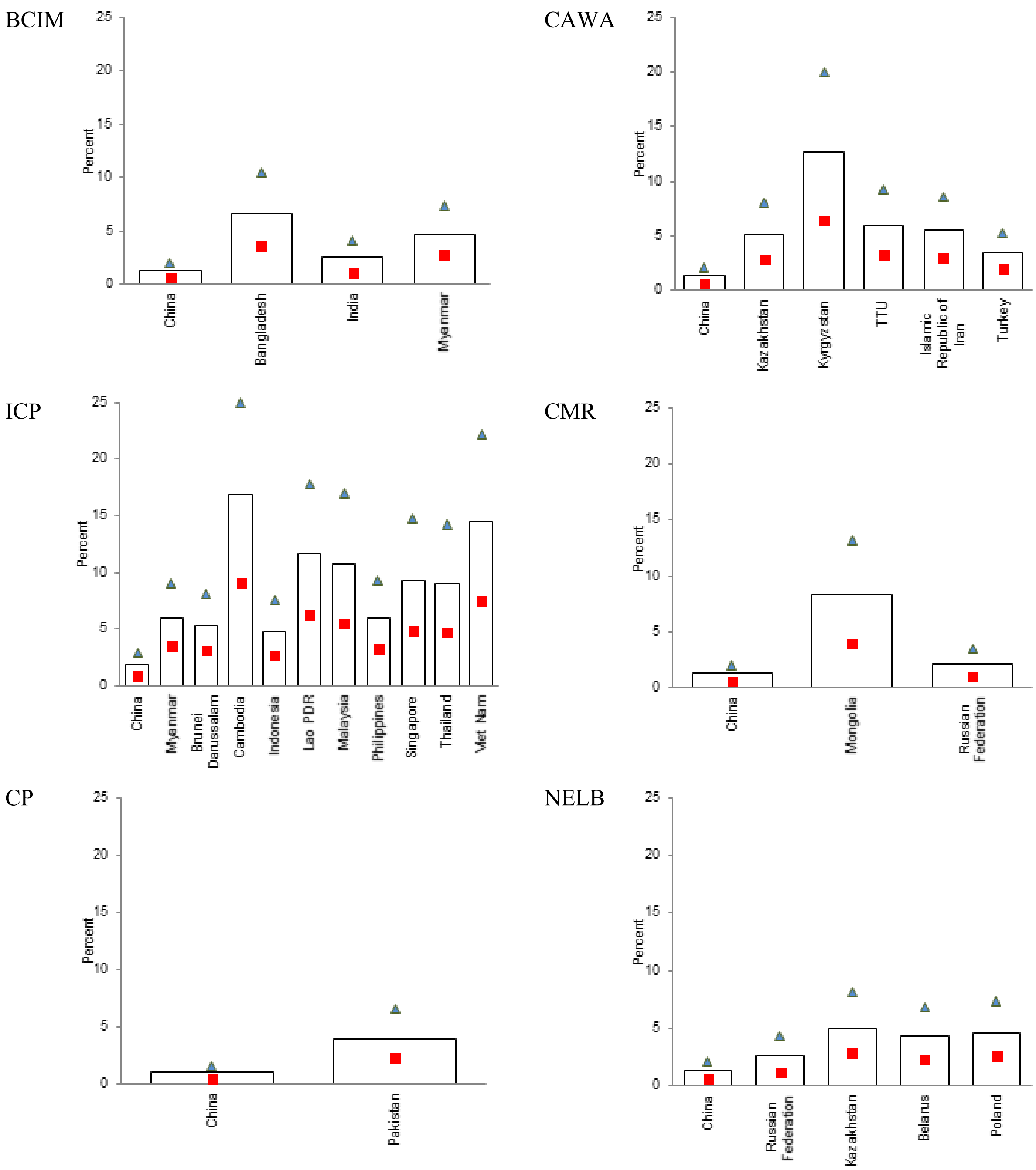
Source: Based on GTAP CGE simulations.

Note: Except in panel (A), unfilled bars represent China while filled bars represent other individual BRI economies.

Figure 2. Estimated economic gains under the base-case scenario

Simulation results also suggest that all countries under the six BRI economic corridors would experience rise in exports, though in varying magnitudes (Figure 2D). The estimated increases in exports of agricultural items are generally larger than those of industrial goods. Among other reasons, this is because agricultural products have typically been subject to more restricted trade measures, while a shorter transport time is more beneficial to perishable products than durable goods. The simulation result shows that such boost to agricultural exports is recorded in poorer economies with large subsistence agriculture, such as Bangladesh, Cambodia, Lao People's Democratic Republic, and Myanmar. Thus, BRI could contribute to rural poverty reduction in these countries. Countries will do well if they can improve their export competitiveness by adopting long-term policies and improving policy coordination with trading partners.

Figure 3 shows the estimated country-level output gains by corridor for the base-case, low-case, and high-case scenarios. The output gains under the low-case scenario are also substantial. While estimated economic gains derived from the CGE simulations are already significant, actual economic benefits tend to be far greater than what these simulations suggest for at least two reasons. First, the medium-term economic benefits of BRI are far beyond improvements in short-term economic variables. For example, for energy-deficit countries, such as those in South and Southwest Asia, access to more efficient and diverse energy sources could help improve health outcomes, and thus labour productivity, by reducing reliance on wood and coal for cooking and heating that have resulted in indoor air pollution and premature deaths. Second, actual economic benefits go beyond participating countries. For example, in addition to China and Pakistan, CP will also benefit several neighbouring landlocked economies via access to sea through Pakistan. These include economies whose full country-level data is not available in the GTAP model, such as the Afghanistan, Tajikistan, Turkmenistan, and Uzbekistan.



Source: Based on GTAP CGE simulations.
Note: TTU refers the group of Tajikistan, Turkmenistan, and Uzbekistan. The bars represent the base-case scenario, triangles for the high-case scenario, and squares for the low-case scenario.
Figure 3. Estimated output gains at the country level across BRI corridors

4. Managing risks of BRI

Despite considerable economic opportunities, BRI also carries economic risks. Two economic risks are notable: debt and inflation. A slight deterioration in trade balance and large foreign loans for infrastructure projects, even if on a concessional basis, could undermine macroeconomic and balance of payments stability in small economies with underdeveloped financial markets and less effective debt management systems. The debt servicing capacity of the recipient countries would depend on the nature of engagement under different projects of the BRI, and the mix of private versus public debt that is raised in the process. Of concern is when the announced investment value under BRI is high relative to the size of the recipient economy. For example, the USD15 billion China-Uzbekistan investment deal signed in late 2013 is roughly equivalent to a quarter of Uzbekistan's GDP. Similarly, the USD37 billion China-Kazakhstan cooperation agreements signed in late 2014 and early 2015, and the USD46 billion China-Pakistan agreement in April 2015, each represent over a fifth of GDP level in Kazakhstan and Pakistan. Moreover, the USD24 billion China-Bangladesh agreement in October 2016 is equivalent to almost 20% of Bangladesh's GDP. External account indicators for some of these economies are relatively weak. In Kazakhstan, the current account deficit amounted to about 6% of GDP in 2016, while external debt stood at over 80% of GDP in 2015. In Pakistan, foreign external reserves are rather small at about four months of imports in early 2017.

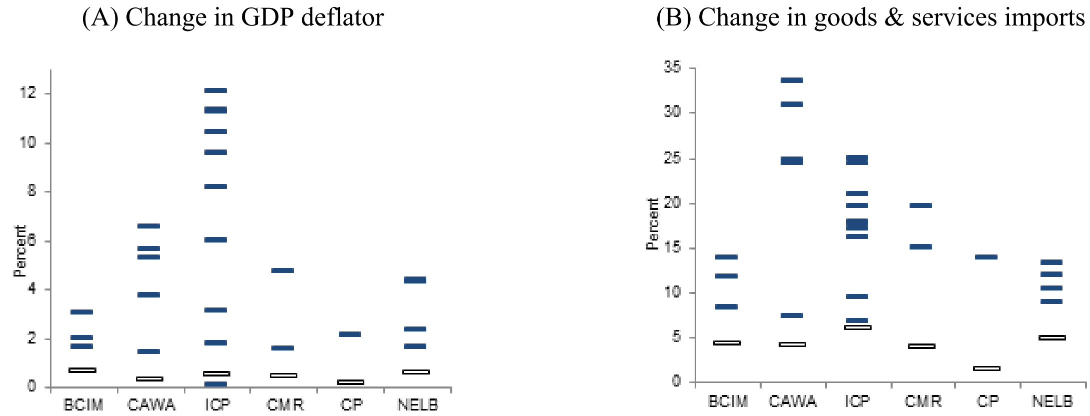
The financing for BRI infrastructure projects will require large capital investments. An estimate by the Chinese government suggests that total investment by China would amount to about USD4 trillion. More broadly, the Asian Development Bank estimated that infrastructure development needs in the Asian part of BRI are about USD820 billion annually in the coming decade. An estimate by McKinsey Global Institute (2016) is much higher at USD1.6 trillion per year on average in the years to 2030.

Domestic governments and financial markets would need to step up efforts in mobilizing the additional required financing. The financing strategy could be a mix of public-private partnerships (PPPs), domestic bond market, and co-financing between multilateral and national institutions. Each of these channels has its own requirements. While PPPs require an enabling policy framework with specialized agencies and mature financial markets, bond financing require harmonized practices in areas such as taxation, foreign exchange regulation, and credit ratings. However, many participating countries in Asia are still beset by narrow fiscal space and shallow financial markets, and do not have sufficient experience and expertise in infrastructure financing through access to local or external bond markets, including for PPP projects. Nevertheless, efforts to raise funds for large-scale infrastructure projects could spur bond market development in the region. More generally, financial integration, along with internationalization of the Renminbi, could accelerate. The process of financial cooperation and integration would lead to demand for more professional services in financial and related sectors. In short, the significant increase in cross-border investment and trade between participating countries would require greater financial cooperation and integration to facilitate capital flows and transactions. At the same time, financial regulation and macro-prudential measures need to be strengthened to hedge against any negative side effects.

The CGE simulation results also suggest that price stability could be an economic risk for some participating economies. While promoting economic growth, BRI tends to push up the overall price levels (Figure 4). In economies where estimated output gains are large, such as Lao People's Democratic Republic, Thailand, and Vietnam, increases in GDP deflator are also estimated to be steeper. However, the magnitude of price increases is expected to be modest across most economies. While

BRI could boost economic activity and could lead to demand-pull inflation, it also enhances a country's supply capacity, which helps maintain economy-wide price pressure. Vigilant monetary policy and targeted price management measures are desirable.

A comparison between Figure 2 and Figure 4 suggests that the estimated increases in imports of goods and services are generally larger than those of exports. This result is expected, as lower transport costs and more relaxed trade restrictions reduce import prices and push up a country's import demand. As a result, the trade balance deteriorates in most economies and poses a risk for the overall balance of payments, which in turn could adversely affect economic growth.



Source: Based on GTAP CGE simulations.
Note: Except in panel (A), unfilled bars represent China while filled bars represent other individual BRI economies.
Figure 4. Estimated change in GDP deflator and imports under the base-case scenario

In addition to financial concerns, BRI also presents social and environmental challenges. On the social front, displacement and marginalization of local communities and indigenous group are possible as results of land grabbing and changing communities. Similarly, workers in industries that will no longer be competitive after opening up of markets could be marginalized. Poor working conditions, especially for migrant workers and construction workers in remote areas, are also a concern. Meanwhile, facilitated cross-border access could lead to greater trafficking of people and illicit goods, with direct implications on social issues, such as rising HIV infections and drug use. More broadly, social unrest and ethnic conflicts could escalate in societies and areas where management of BRI projects is viewed as unfair and lacking a people-centered approach. Finally, despite notable economic benefits, it is not clear whether such gains will be inclusive. For examples, foreign companies and workers could benefit more than their local counterparts, while within-country inequality could rise amid unequal access to infrastructure.

On the environmental front, construction of large-scale infrastructure projects is likely to result in land-use changes and poorer air and water quality. Threats to the protection and restoration of biodiversity and natural resources, with implications on the overall ecosystems, could also rise. These issues are more worrisome if a country's institutional ability to minimize and mitigate adverse environmental impacts, as well as to compensate affected sections of population, is limited.

To cope with social and environmental risks, there is a need to make economic benefits more inclusive. For examples, connecting remote areas with new multi-country transport routes enables rural industrialization and helps narrow the urban-rural development gap within BRI economies. An effort to ensure that local workers benefit from BRI construction projects could support the working poor. Such effort would help address widespread public concerns over the dominance of Chinese interests in recipient economies, which has already led to social protests and weakened investor confidence in several countries. To achieve social buy-in, consultative discussions that include indigenous communities are needed, for example, in deciding transport routes and designing fair compensation schemes. In China, economic gains could be made inclusive by ensuring that smaller companies also benefit from BRI, in which state-owned enterprises have played an instrumental role. On the environmental side, there is the need for upfront comprehensive assessments of environmental safeguards as well as environmental monitoring and reporting for BRI projects in sectors such as extractive and energy industries.

5. Prioritization among BRI economic corridors

Not all BRI economic corridors can be implemented simultaneously primarily due to limited availability of finances. China, therefore, needs to devote more effort and capital on corridors that offer her larger net benefits. By presenting the rankings of BRI corridors based on their economic benefits and costs, while highlighting social and environmental risks, this part of the paper seeks to facilitate the Chinese government in deciding how to prioritize its investment among the BRI corridors. The rankings are from the perspective of China, as China is the common base country in all six corridors.

5.1. Economic benefits and costs

The economic benefit for China is measured as the country's welfare gain that is estimated using the GTAP model. The welfare gain by China is the largest under ICP at USD137.9 billion, followed by USD111.2 billion for NELB, USD104.5 billion for CAWA, USD102.4 billion for BCIM, USD102.1 for CMR, and USD77.5 billion for CP. Table 1 shows the ranking of corridors based on the size of welfare gains.

Table 1. Ranking of economic corridors based on economic benefits and costs for China

BRI corridor	A	B	C	
	Highest economic benefit	**Lowest economic cost**	**Net economic benefit (average of A and B)**	**Ranking of net economic benefit (ranking of column C)**
China-Indochina Peninsula (ICP)	1	4	2.5	1
China-Central Asia-West Asia (CAWA)	3	3	3.0	2
China-Mongolia-Russia (CMR)	5	2	3.5	3
China-Pakistan (CP)	6	1	3.5	3
New Eurasian Land Bridge (NELB)	2	6	4.0	5
Bangladesh-China-India-Myanmar(BCIM)	4	5	4.5	6

Source: Based on GTAP CGE simulations and qualitative assessment.
Note: Lower value means better ranking (higher benefit or lower cost).

The economic cost is measured as the estimated investment that China needs to undertake to develop each economic corridor. Among other factors, the economic cost depends on the length of an economic corridor, number of countries involved, and the current level of infrastructure. The paper argues that the required investment for CP, reportedly at about USD46 billion, is the smallest. Similarly, the next corridor with the least investment requirement is arguably CMR, as the corridor covers only three countries. The third lowest corridor is CAWA, as a large part of the planned railway that leaves the China-Kazakhstan border will join the existing railway network in Central Asia and the Middle East. On the other hand, the investment requirement would be high under ICP given the number of countries involved and the length of the corridor. Investment requirement for NELB could be the largest at over USD230 billion, as the corridor plans to build a 4,350-mile high-speed railway that connects Beijing to Moscow (Luft, 2016).

When comparing the economic benefits with the economic costs, the analysis ranks ICP as the highest net economic benefit corridor. CAWA comes in second, and CMR and CP are tied at third. NELB and BCIM round out the rankings at fifth and sixth in terms of the net economic benefit for China. The analysis highlights ICP and CAWA as priority economic corridors for the development of BRI.

5.2. Social and environmental costs

A social challenge for BRI comes within China itself, where BRI is seen as a grand scheme to reboot the Chinese economy. There is intense interest surrounding BRI from local and provincial governments, state-owned enterprises (SOEs), and Chinese private firms—and the rush to join, expecting quick results. The plans of provincial governments and business strategies of SOEs and Chinese firms reflect expectations of transferring surplus production capacity abroad, anticipating that this in turn will facilitate export of equipment and products from China. Huge contracts in electricity, construction, and pipeline construction are anticipated. China will send out its own capital, technology and management expertise to promote the development and prosperity of its neighbors. BRI holds rich promise for Chinese companies looking to expand abroad. The danger, however, is in over-extending and over-hyping. BRI-supported infrastructure platforms must adhere to concerns about economic rates of return. BRI projects need to generate enough returns on investment (ROI) at minimum to cover the financial operating and maintenance costs. Development driven by natural resource extraction, with minimal social and environment concerns, are intrinsically unsustainable. If Chinese companies stumble into markets unprepared, there will be ramifications for both themselves and the financial institutions that have backed these efforts. Failing to assess risk appropriately may lead to huge wastage and, worse, may have damaging repercussions for China both at home and abroad.

Clearly defining the role of the Chinese state in developing BRI infrastructure is essential. The corollary is to delineate much of the investment decisions to the host countries and to the market. The Government's role should be to coordinate policies, and ensure that rules and regulations are fair and facilitate trade. Efforts must be made to make private enterprises the backbone of BRI. For this to take place, BRI needs careful planning for it to succeed. The key is ensuring sufficient local (host country) participation in the development process of BRI itself. This includes the use of local workers and laborers during the implementation phase.

In determining potential social costs across BRI corridors, this paper considers various dimensions of social development. Among others, these dimensions include issues such as public health conditions, forced migration, human trafficking, social mobility, income and gender inequality, and unequal access to natural resources. Other factors that are taken into account are cross-country cultural differences, number of countries involved in each corridor, and concentration of rural and urban population along the corridors.

Taking these factors into account, this paper argues that ICP seems to exhibit the largest social cost, followed by BCIM, CAWA, NELB, CMR and CP (Table 2). The caveat is that this relative ranking should be viewed as indicative. The official statistics and information on BRI corridors are limited, especially on the social and environmental fronts. An emphasis here is to highlight the need for all relevant stakeholders to also consider the social and environmental dimensions of BRI, and not just its economic dimension.

Table 2. Ranking of economic corridors based on social and environmental costs

BRI corridor	Lowest social cost	Lowest environmental cost
China-Pakistan (CP)	1	1
China-Mongolia-Russia (CMR)	2	2
New Eurasian Land Bridge (NELB)	3	5
China-Central Asia-West Asia (CAWA)	4	4
Bangladesh-China-India-Myanmar (BCIM)	5	3
China-Indochina Peninsula (ICP)	6	6

Source: ESCAP analysis.
Note: Lower value means lower cost and better ranking.

The high social costs in ICP reflect the possibilities that construction of transport networks along the peninsular could lead to displacement of populations in this region where rural populations are still predominant. Experiences from past corridor developments in ICP economies, such as in Lao People's Democratic Republic, also suggest that unequal access to infrastructure contributed to greater income inequality between urban and rural areas (Lord, 2010). Moreover, increased mobility of goods could facilitate illicit trade, while increased mobility of people could hold back the progress in reducing the prevalence of HIV/AIDS as a result of potential increases in sex work along major road routes and trafficking of narcotics. More open borders could also lead to an increase in human trafficking from smaller countries such as Cambodia and Lao People's Democratic Republic to larger economies such as Thailand. Finally, the issues of land grabbing and land tenure insecurity could increase, as land use rights are customary, as opposed to formal structures of ownership, in several ICP economies.

In BCIM, the region which BRI corridor is expected to pass through areas that are home to ethnic minorities, whose identity could be lost amid an influx of internal migrants and workers from abroad. Moreover, these are areas with ongoing conflict and instability, in which conflict could escalate if BRI projects are not seen to be transparent and consultative. Similar to the ICP, the issue of trafficking of people and drug, with its implications on HIV/AIDS, is pertinent. In particular, Myanmar is a significant source of opium, while the Myanmar-India border already has high prevalence of

HIV/AIDS among people who inject drugs. Human trafficking from Myanmar to China is also possible.

In CAWA, a social risk includes marginalization of minority groups, as Central Asia, the Islamic Republic of Iran, and Turkey are home to various ethnic groups with different cultural practices. Meanwhile, given limited female workforce participation in several CAWA economies, economic benefits for female workers and entrepreneurs could be disproportionally low and further undermine gender equality. Finally, social issues such as HIV/AIDS and illicit trade are also relevant here, as Afghanistan is a major producer of opium.

In NELB, railway construction is expected to go through remote areas in Kazakhstan and the Russian Federation with low population densities. Employment conditions may deteriorate in this harsh environment, which affect workers' health and productivity. Migrant workers are also often subjected to exploitative working environments. Trafficking of illegal goods, especially along the borders of China, Kazakhstan, and the Russian Federation, is also a concern.

In CMR, a key social risk is whether economic benefits would be sufficiently inclusive. Examples include whether local workers, such as the abundance of young unemployed persons in Mongolia, would benefit from substantial construction work that CMR is planning. Another example is the extent that sparsely populated rural areas in Mongolia would benefit from enhanced connectivity among large urban cities.

In CP, a social risk is the possible displacement and marginalization of local communities. Migrants from other regions of Pakistan are likely to relocate to areas where construction of BRI projects takes place. The passing of CP transport routes through the already narrow strip of cultivable land in the mountainous western Pakistan would dampen farmland.

Turning to the environmental costs, the main concern is environmental impacts of construction and operation of large-scale transportation projects, such as those related to land-use changes and air pollution. The impact on land-use changes will depend on whether the project under consideration involves new construction or merely rehabilitation and maintenance of existing infrastructure. In addition to the direct environmental impacts, new infrastructure, particularly transport infrastructure, may also cause indirect environmental impacts by facilitating access to areas previously reserved for environmental purposes, such as protected forests. The environmental cost also depends on the volume and frequency of economic activities and types of good traded along the economic corridors.

The environmental costs are thought to be higher in ICP, CAWA, and NELB relative to other corridors. Extensive transport and energy networks are required to connect the southern and western parts of China with these three corridors. Along the routes, the affected areas could also include well-preserved forest lands with serious impact on biodiversity and ecosystems. Among these three corridors, the potential environmental impact is considered less damaging in CAWA as part of the planned railway already exists. Meanwhile, the environmental risk is viewed as relatively low in CMR as the corridor covers fewer population centers, although further expansion of coal mining in Mongolia is environmentally harmful. Meanwhile, CP tends to incur the lowest environmental cost, as the corridor covers only two countries and has shorter transport routes.

5.3. Net total benefits

It is difficult to contrast the economic rankings to the social and environmental ones. The finance theory idiom that higher returns entail higher risks also holds in terms of the six corridors. The corridors with the highest returns also possess the highest social and environmental risks. To maximize returns, the social and environmental risks must be well managed.

When examining the economic benefits and costs for China, the paper argues that the Indochina Peninsula Corridor and the Central Asia West Asia Corridor offer sizeable output gains relative to their investment requirements. The ICP and CAWA have large benefits to China but also generate large output gains for the many BRI participating countries along those corridors. The total benefits are significant, despite the large financial outlays required. However, both ICP and CAWA entail high social and environmental costs. ICP has the highest social and environmental costs, while CAWA has the third largest social and environmental costs (behind ICP and BCIM). Any prioritization of these corridors will require careful planning and social and environmental impact assessments. Social and environmental safeguards will be essential.

Conversely, for the China-Pakistan Corridor and the China-Mongolia-Russia Corridor, the economic benefits are estimated to be smaller but the concomitant investment requirements are also low. Both CP and CMR corridors also have the lowest social and environmental costs. These two corridors represent the “low-hanging fruits” from China’s prioritization perspective. They represent the low-cost–low-returns investment option, with the quickest returns, as much of the infrastructure is already in place along these two corridors.

The two corridors that should be sequenced last are the New European Land Bridge Corridor and the Bangladesh-China-India-Myanmar Corridor. NELB and BCIM display the lowest net economic gains, primarily due to the prohibitively high investment requirements. The two corridors also have significant social and environmental costs. BCIM entails the second highest social costs, while NELB exhibits the second highest environmental costs. Both NELB and BCIM possess high costs (economic, social, and environmental) with lowest returns. These two corridors stand out in their cost structure and the analysis indicates that they should most likely be developed last.

6. Conclusion

Unlike the ancient Silk Road that was developed by her neighbors to pioneer a passage to China, the motivation for BRI comes from China itself. China must therefore garner the cooperation and the demand for BRI from all the participating partner countries. Such will be a major undertaking that cannot be pursued based on a supply-based approach. There is a need to build a clearer sense of demand from BRI partner countries. BRI needs to develop clarity of vision and a shared sense of purpose. In this regard, BRI needs better and sequenced planning. With multiple countries, multiple ministries/agencies within each country, and multiple sectors involved, BRI needs serious organization and planning: planning in terms of internal coordination, and coordination with central government ministries, with local governments and SOEs, and with the private sector. Given its size and scope, it will also require a well-thought-through plan that incorporates how and which BRI corridors will be sequenced and prioritized. This paper attempts to do exactly that, by estimating the potential economic benefits across BRI corridors, while highlighting the social and environmental risks for each corridor during implementation of BRI. The analysis estimates the net economic gains and identifies the priority corridors from China’s perspective. Three messages can be drawn from this paper.

First, the simulation results based on a general equilibrium approach suggest that economic benefits are sizeable across all countries in the six BRI economic corridors. Welfare gains range from USD86 billion in CP to USD372 billion in ICP, or equivalent to 1% and 3.5% of the groups’ output level, respectively. Although China tends to enjoy much larger welfare gains than other participating economies, output levels in countries such as Bangladesh and Vietnam could be lifted by up to 7%–17% over the next few years. The most notable gains accrue to land-locked less developed economies (LLDCs) such as Kyrgyzstan, Tajikistan, and Mongolia within their respective corridors.

Second, BRI carries notable challenges. An economic risk includes possible macroeconomic instability, underpinned by eased access to large foreign loans and demand-push inflation. From a social perspective, displacement of local communities, the influx of Chinese workers, greater trafficking of people and illicit goods, and the uncertainty regarding the distributional impacts of economic gains, are some of the key concerns. On the environmental front, construction of large-scale infrastructure projects is likely to result in land-use changes, poorer air quality, and reduced biodiversity. For BRI to realize the large benefits that accrue to each economic corridor, the social and environment impacts must be well managed. Overall, to ensure the sustainability of any BRI corridor development, there is a need to consider its costs and benefits from the economic, social, and environmental perspectives.

Third and finally, from China's perspectives, corridors that merit priority in terms of corridor development could be CP and CMR. They are the low-hanging fruits requiring the smallest amounts of investments and delivering significant returns. The highest prized investments are ICP and CAWA, as they offer the largest net economic benefits for the many participating economies. However, these two corridors are also the most socially and environmentally sensitive, requiring upfront assessments of social and environmental risks and safeguards. For these two corridors, there is a need for careful policy analysis to maximize economic gains while managing risks. The analysis points to sequencing the BCIM and NELB corridors last. These two corridors represent the highest cost–lowest return options. However, there could be large but unmeasured 'Peace Dividends' from the BCIM corridor, through the integration of China and India.

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