

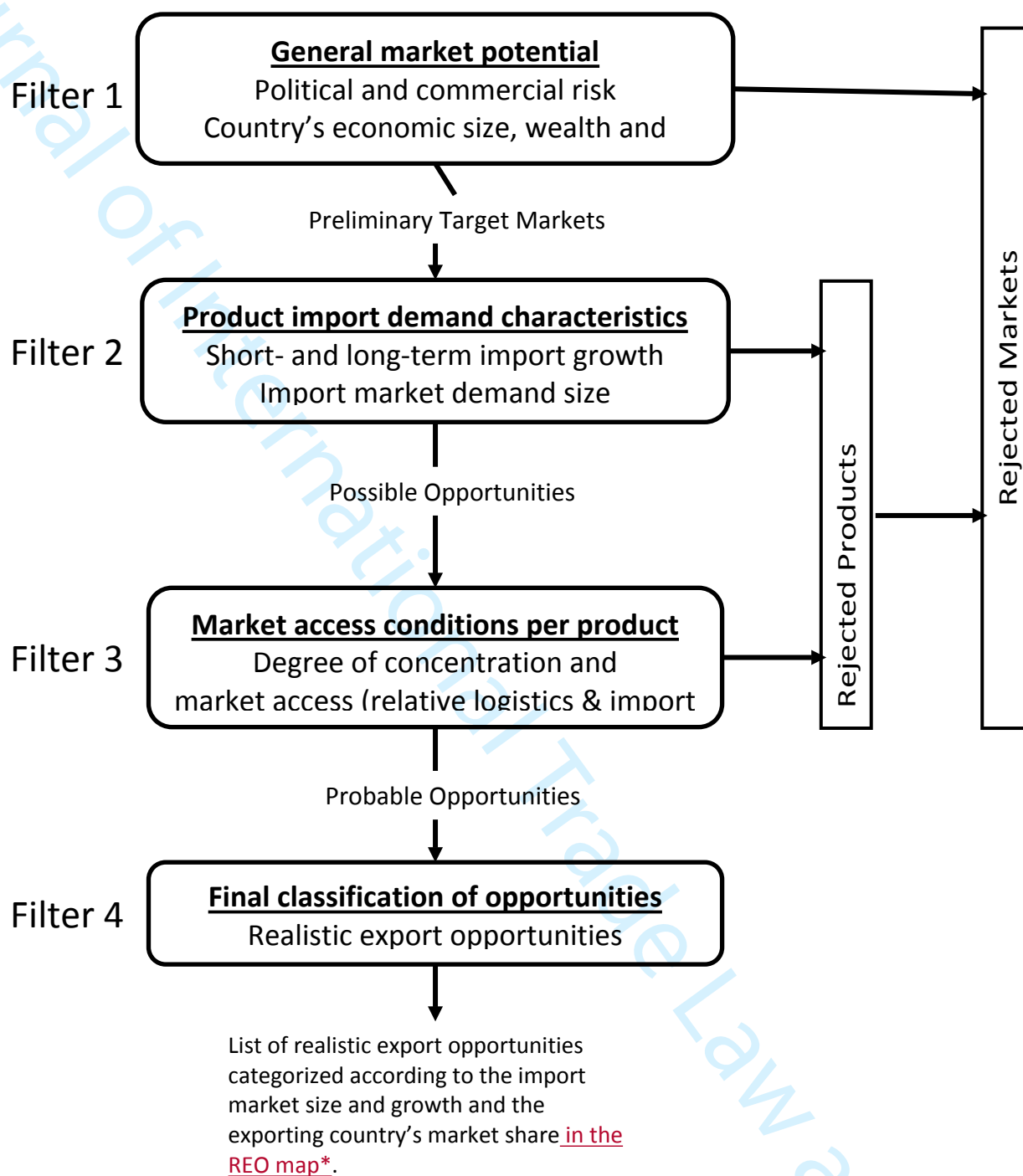


Identifying Export Opportunities for China in the 'Belt and Road Initiative' Group of Countries: A Decision Support Model Approach

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Figure 1. Summary of the basic methodology of the DSM.



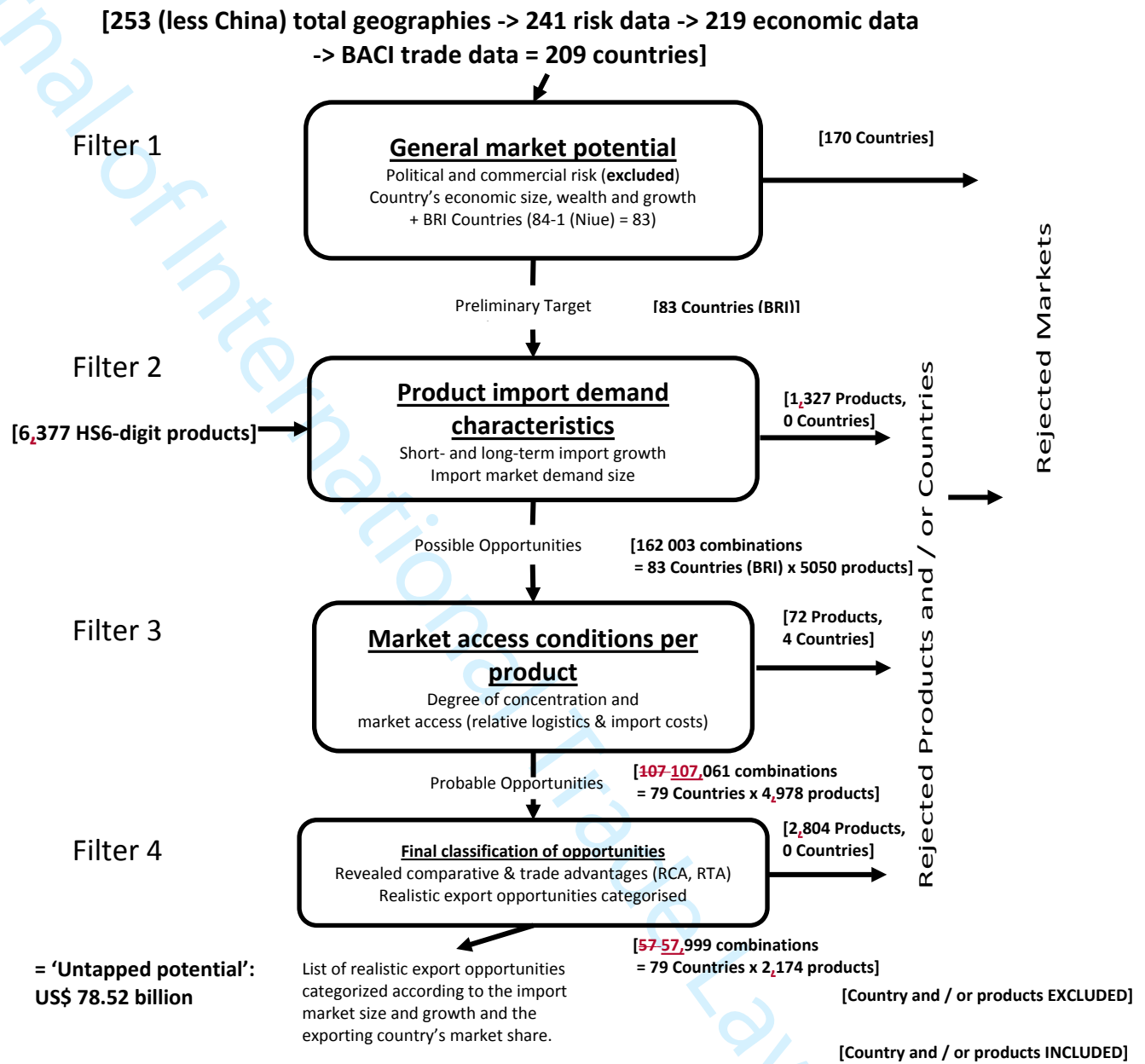
Source: Adapted from Cuyvers et al. 2017. * See more detail in figure 2.

Figure 2. The REO map.

	REALISTIC EXPORT OPPORTUNITIES	Home Market relative market share of Target Market			
		SMALL	INTERMEDIATELY		LARGE
			SMALL	LARGE	
Target Market characteristics (Detailed HS6 product x country)	LARGE	REO1,1	REO2,1	REO3,1	REO4,1
	GROWING (Short & Long term)	REO1,2	REO2,2	REO3,2	REO4,2
	LARGE AND GROWING (Short term)	REO1,3	REO2,3	REO3,3	REO4,3
	LARGE AND GROWING (Long-term)	REO1,4	REO2,4	REO3,4	REO4,4
	LARGE AND GROWING (Short & Long-term)	REO1,5	REO2,5	REO3,5	REO4,5
		OFFENSIVE Exploration	OFFENSIVE Expansion	DEFENSIVE Sustain and Maintain	

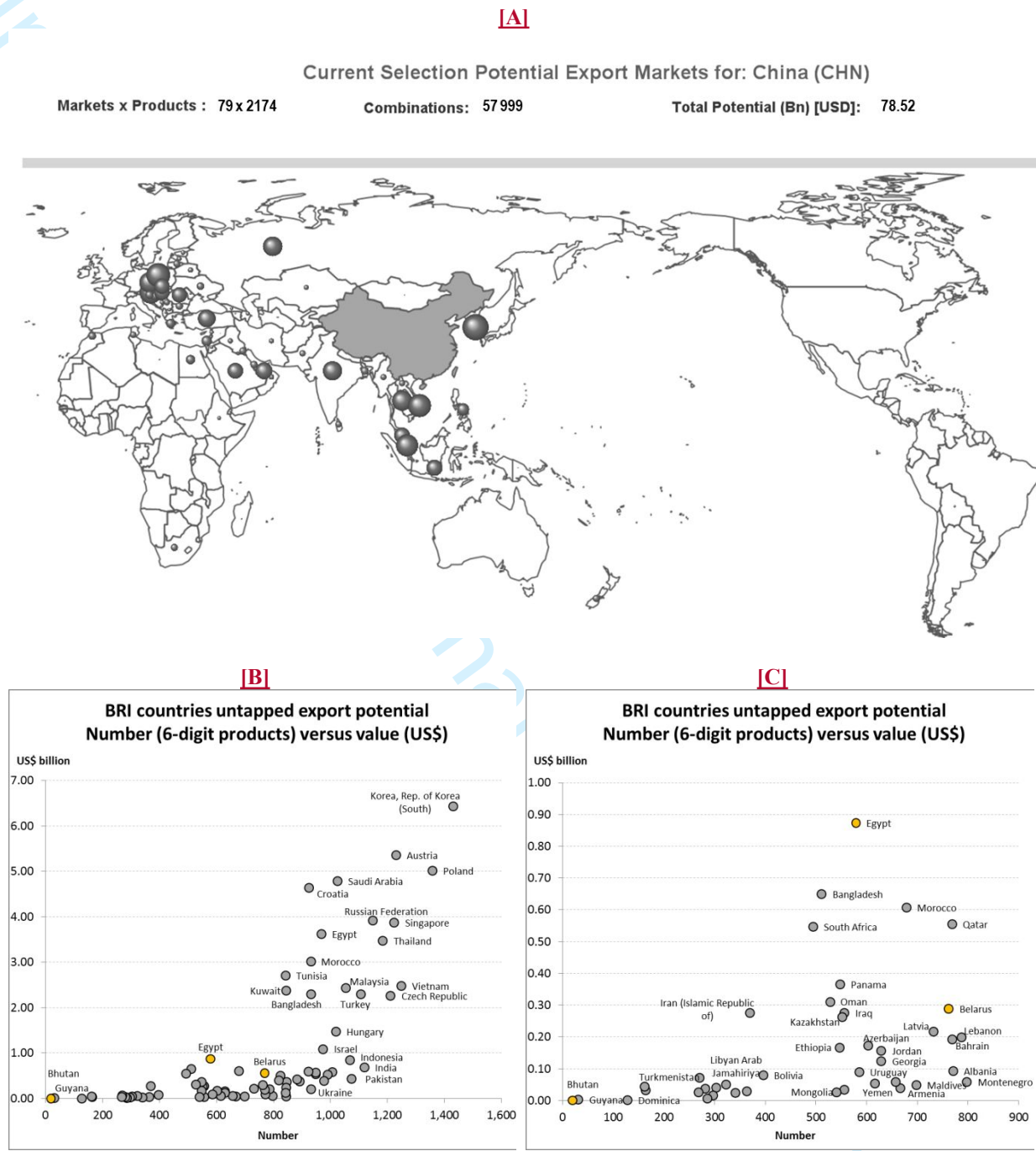
Source: Cameron et al. 2017, based on Cuyvers et al. 1995

Figure 3. Filtering process applied to China for the subset of BRI countries (summarised).



Source: Authors' calculations

Figure 4. Geographical representation of untapped export potential (in US\$ bn) of BRI countries for China.



Source: Authors' calculations

The size of the bubbles reflects total realistic export potential of the target market(s) in US\$ bn. Panel [C] provides more resolution of lower opportunity countries indicated in panel [A], with Egypt, Belarus and Bhutan indicated as points of orientation between the two charts.

Identifying Export Opportunities for China in the ‘Belt and Road Initiative’ Group of Countries: A Decision Support Model Approach

Abstract

Purpose – This paper aims to identify China’s realistic export opportunities among the “Belt and Road Initiative” (BRI) group of countries.

Design/methodology/approach – The methodology used is a Decision Support Model (DSM) which filters data based on country risk; macro-economic country performance; market potential in terms of import growth and import market size; and market access conditions. The high-potential realistic export opportunities (REOs) are revealed.

Findings – 79 of the 84 BRI countries represent 42.5 percent of China’s realistic export opportunities (REOs) globally and 26.9 percent of China’s globally untapped potential value. Interestingly, 17.9 percent of this untapped potential is in the BRI countries Poland, Austria and the Czech Republic, thus providing a potentially important route into the EU.

Originality/value – The paper is the first to use the DSM to identify China’s REOs at HS6-digit level within the BRI group. The findings have important implications for China’s export promotion agencies, industry associations and individual companies.

Research implications – If China wants to develop additional or new markets, focus should be put on the BRI markets outside of the top 20. China should also invest in the development of most BRI economies, to ensure their future growth and increased demand for import of products and services from China.

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3 Practical implications –The shortlist of China’s REOs in the individual BRI countries
4 makes for more efficient planning and prioritising of export development activities. It
5 also highlights the need for policymakers to look beyond international trade and focus
6 on how to also improve the domestic economies of the BRI partners.
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12 Keywords - Export promotion, China, BRI, Realistic export opportunities, Decision
13 support model, DSM, Comparative advantage, international market research.
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20 Paper type – Research paper.

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22 EL codes: F13, F145, F15, F17, O50
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27 **1. Introduction**

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30 The Chinese President Xi Jinping called for the establishment of a new regional cooperation
31 model through the construction of the ‘Silk Road Economic Belt’ during his visit to Kazakhstan
32 in September 2013. While visiting Indonesia in October 2013, he called for the creation of the
33 Asian Infrastructure Investment Bank (AIIB) and the construction of the ‘21st Century
34 Maritime Silk Road’. These two initiatives together are officially named the ‘Belt and Road
35 Initiative’ (BRI).
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44 The BRI aims to enhance trade ties, mutual trust and greater policy coordination among
45 those countries that link China’s ancient land and maritime silk routes to Europe, the Middle
46 East, Africa and the rest of Asia (Johnston, 2019). Among the BRI’s priorities are to rigorously
47 research and identify optimal investment and trade facilitation solutions, eliminate barriers to
48 trade and investment, and create a free trade zone among participating countries.¹ The BRI also
49 aims to strengthen bilateral investment ties and facilitate the formation of cross-country industry
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59 ¹ The BRI has five main pillars for regional cooperation: policy dialogue, infrastructure connectivity, unimpeded
60 trade, financial support and people-to-people exchanges (Huang, 2016).

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3 value chains. To this end, China aims to reduce its own trade barriers, increase internal market
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5 efficiency and strengthen its regional economic integration efforts.
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8 The BRI has provided a stimulus to China's efforts to deepen trade, investment and
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10 infrastructure links with the associated countries. While the BRI could help foster a trade revival
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12 for China, it also affords BRI countries access to China's overseas direct investment, thereby
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14 assisting them in the development and/or upgrading of their infrastructure. Such developments
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16 create important export opportunities for China. However, the BRI countries are very diverse
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18 in terms of their development status, political system, market size, consumption characteristics
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20 and transport infrastructure. As a result, Chinese companies are exposed to a range of
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22 opportunities in different countries. Owing to resource limitations, though, relatively few of
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24 China's potential export opportunities have a good chance of being successfully and sustainably
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26 exploited. Yet a key component of a successful export promotion drive is the ability to identify
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28 the 'most realistic' foreign markets for specific products or groups of products, using
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30 comprehensive and reliable data.
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35 The main purpose of this paper is to reveal China's most realistic export opportunities
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37 (REOs) in the BRI countries using the Decision Support Model (DSM) approach.² This will
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39 add rigour to China's export promotion efforts. There are many models available for choosing
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41 international markets. The Green and Allaway shift-share model, Papadopulous et al.'s trade-
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43 off model, the International Trade Centre's (ITC) multi-criteria method, the gravity model, the
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45 product space network methodology, Canada's Trade Opportunity Matrix and the TRADE-
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47 DSM are but a few (Steenkamp et al., 2012). For this paper, the TRADE-DSM was selected as
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49 it was specifically designed for international market selection purposes and has been widely
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51 used (Cuyvers et al., 2012b). For example, since 1995, the TRADE-DSM has been applied in
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58 ²The individual countries in the BRI can be obtained from the Belt and Road Portal of the Office of the Leading
59 Group for the Belt and Road Initiative hosted by the State Information Center via <https://www.yidaiyilu.gov.cn/>.
60 Date of access: 2018/10/06.

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3 various countries, including Belgium, Thailand, Rwanda, the Czech Republic, Greece, Thailand
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5 and the USA (at state level – Louisiana), in addition to South Africa (Cameron and Viviers
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7 2017; Oluwade 2018; Jansen van Rensburg et al. 2019). It has also received favourable reviews
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9 from the International Trade Centre (ITC 2017) as well as the WTO (see Steenkamp et al. 2016).
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11 There is an extensive body of literature on the DSM methodology and its applications in various
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13 countries (see Cuyvers et al. 1995, 2004; Cuyvers et al. 2012^a; Cameron et al. 2017; Jansen van
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15 Rensburg et al. 2019).

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19 In a nutshell, the DSM is a market selection method that screens large quantities of data
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21 that would be too voluminous to analyse using more conventional techniques. From a specific
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23 home market's perspective (for current purposes, China), the DSM systematically analyses
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25 markets against criteria such as political and commercial risk and macroeconomic stability,
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27 market size, market accessibility and growth prospects. It then creates a list of the most realistic
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29 markets for various product categories.
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33 To our knowledge, this paper reveals the first attempt to use the DSM to identify China's
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35 export opportunities at the country–product (HS³6-digit) level within the BRI group of
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37 countries. The findings therefore have important implications for China's export promotion
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39 agencies, industry associations and individual companies. In the next section we review the
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41 literature on China's BRI and its economic impact. In section 3 we summarise the DSM
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43 methodology and in section 4 we present and discuss the results of the DSM application for
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54 ³The Harmonized Commodity Description and Coding System (HS) is an internationally standardized system of
55 names and numbers used to classify traded products. The HS first came into effect in 1988. It has since been
56 maintained and periodically revised by the World Customs Organization (WCO) (formerly the Customs Co-
57 operation Council), an independent intergovernmental organisation based in Brussels, Belgium, with over 200
58 member countries. The lowest level of internationally consistent codes applied according to the system is the HS
59 6-digit product level; however, individual countries may extend the coding system as required. Some countries,
60 such as the United States of America, apply a 10-digit classification to products.

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3 China, revealing the most realistic export opportunities in the BRI countries. We provide
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5 concluding remarks in section 5.⁴
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8 9 **2. Literature review**

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12 Since China's announcement of the BRI in 2013, a growing body of literature and research
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14 outputs on the BRI has been produced.

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16 A first strand of the literature examines the motivation behind, possible frameworks for
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18 and implications of regional economic integration among the BRI countries. For instance,
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20 Huang (2016) argued that the BRI represents an important attempt by China to sustain its
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22 economic growth momentum by exploring new forms of international economic cooperation
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24 with new partners. China also intends to exert greater influence in the world and contribute to
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26 the evolving global economic architecture. The author argued, however, that it is too early to
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28 assess the impact of the BRI. Cheng (2016) said that the BRI offers great potential for economic
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30 cooperation, but its success depends on many factors beyond China's control. Wang (2016)
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32 argued that the China-led BRI has more of a defensive than an offensive nature and could
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34 present tremendous opportunities for international economic cooperation. Gorbunova and
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36 Komarov (2017), in turn, stressed that the BRI has a clear developmental purpose, focusing on
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38 industrialisation in those countries lacking in infrastructure.
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45 A second strand of the literature analyses the impact of the BRI on China and other BRI
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47 countries. Several papers focus on its trade and FDI effects. For example, Wang et al. (2018)
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49 examined the impact of the BRI on Chinese exports. They asserted that since the Initiative was
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51 launched, the expanded infrastructure and improvements in logistics performance have had a
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53 positive effect on China's exports. Cinar et al. (2016), using a gravity model, examined the
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58 ⁴ Since the analysis that is reported in this paper was conducted, the COVID-19 pandemic wreaked havoc in the
59 international economy. It follows that the results of our analysis overstate reality for a post COVID-19 global
60 trade environment. Taking into account the lacking data and the many uncertainties involved, it is evidently
beyond the scope of the present investigation to attempt to rectify this.

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3 extent to which countries in the former Silk Road regions were either meeting or falling short
4 of their trading potential with China. The results of their study suggest that China's former Silk
5 Road trading partners have yet to fully realise the benefits of China's economic growth, but that
6 the gap may be narrowing. Du and Zhang (2018) showed that China's overseas direct
7 investment has risen significantly in the BRI countries. Zhai (2018) investigated the
8 macroeconomic impact of the BRI, using a global computable general equilibrium model. The
9 author found sizeable welfare and trade benefits for the global economy, even when
10 conservative assumptions were made about the magnitude of the total investment under the
11 Initiative.

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24 The BRI also affects partner countries. For instance, Fardella and Prodi (2017) analysed
25 the impact of the BRI on Europe, with a specific focus on Italy. Their analysis suggests that the
26 development of new railway connections will benefit the northern and central European
27 countries the most, and that Italy needs to coordinate its ports with its railway network to take
28 advantage of the BRI's opportunities. Jabin (2017) reviewed the respective responses of India
29 and Pakistan to the BRI, showing that China's BRI is often simplistically understood to be
30 opposed by India and supported by Pakistan. García-Herrero and Xu (2017) estimated how
31 much trade might be created among BRI countries and found that European Union (EU)
32 member countries, especially those that are landlocked, would benefit considerably. This is also
33 true for Eastern Europe and Central Asia and, to a lesser extent, South-East Asia. Timofeev,
34 Lissovolik and Filippova (2017) examined the possible opportunities and challenges associated
35 with the co-development of the Eurasian Economic Union and the BRI, arguing that the success
36 of Russia–China collaboration in Eurasia would depend crucially on strong dynamics in a future
37 Eurasia–China partnership.

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56 Although the number of countries joining the BRI is increasing and the BRI is generally
57 positively perceived, it has also created concerns globally. Sachdeva (2018) investigated Indian
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3 perceptions of the BRI and found that developments in the broader India–China relationship
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5 have affected Indian perceptions. The Indian government considers the BRI primarily a Chinese
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7 initiative. It is therefore difficult for New Delhi to endorse the China–Pakistan Economic
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9 Corridor (CPEC). Banerjee (2016) argued that the success of the BRI depends on India’s
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11 participation. In addition to geopolitical tensions, there are global concerns about China-
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13 initiated BRI projects which lack regulation and market coordination. [García-García-Herrero](#)
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15 and Xu (2019) conducted a big-data analysis of countries’ perceptions of China’s BRI and
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17 found that all regions, except South Asia, have a positive view of the BRI. However, some
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19 individual countries have a very negative view. [Interestingly, Rahman & Rahman \(2019\) have](#)
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21 [argued that the BRI will create gravity between China and Eurasia through a land corridor and](#)
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23 [to transport and logistics costs minimisation for all the countries involved.](#)
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29 From the literature review it can be concluded that the BRI offers great export potential
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31 for China and constitutes a means of stimulating economic growth and increased wealth for
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33 both China and associated countries. However, gravity model or computable general
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35 equilibrium model estimations of this export potential are at an aggregate level and offer few
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37 policy insights for companies and export promotion agencies. Until this paper was written, no
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39 attempt had been made to identify China’s export opportunities in the BRI countries at a level
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41 of disaggregation that was sufficiently detailed to be useful to individual companies.
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45 **3. The Decision Support Model (DSM) methodology**

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48 A small but expanding body of literature addresses the question of how to identify opportunities
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50 for exporters. Country-level international market selection methods are designed to identify
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52 opportunities for all exporters in a country; they are not confined simply to a few products, as
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54 in firm-level studies. The Decision Support Model (DSM) used in this paper can be classified
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56 as a country-level international market selection method (Steenkamp et al. 2012; Cuyvers et al.
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58 2017; Cameron et al. 2017).
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3 The DSM is derived from international marketing research and is used to identify, for
4 an exporting country (the home market), the realistic export opportunities (REOs) in a target
5 economy (or target economies) or the world at large. It uses macroeconomic performance data
6 and international trade data for those countries where data is available and filters out less-
7 interesting countries and export products. The DSM was originally designed to help export
8 promotion agencies identify promising export opportunities and formulate suitable export
9 promotion strategies (Cuyvers et al. 1995). The method has been applied for countries as diverse
10 as Belgium (Cuyvers et al. 1995; Cuyvers et al. 2012a,b), Thailand (Cuyvers 2004; Cuyvers et
11 al. 2017), South Africa (Pearson et al. 2010), Greece (Kanellopoulos and Skintzi 2016), the
12 Czech Republic (Urban et al. 2014), Namibia (Teweldemedhin and Chiripanura 2015) and the
13 USA (specifically Louisiana) (Oluwade 2018). Furthermore, the TRADE-DSM has also been
14 recognised as an important information source used by companies in their international market
15 selection decisions as well as to develop a multi-phase, big data analytics model for
16 international market selection (Calof and Viviers 2020).

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19 As summarised in Figure 1, the DSM methodology uses filters that sequentially
20 eliminate less realistic/interesting product–country combinations with a view to categorising
21 and prioritising REOs in different positions on a grid, for the country/firm/company for which
22 the analysis is applied.

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(PLACE Figure 1 HERE)

3.1 Filter 1: General market potential

The first filter eliminates countries that pose too high a political and/or commercial risk to the exporting country and indicate inadequate size or economic growth. In this context the definition of Political-political risk means to include any event in the importing country that assumes the nature of a force majeure incident (including wars, revolutions, natural disasters,

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3 currency shortages and unanticipated government actions) (ONDD 2014). Commercial risk is
4 the risk of the importer's financial situation deteriorating to the point that payment for a
5 consignment becomes impossible (ONDD 2014).⁵ The political and/or commercial risk
6 evaluations applied in the modelling supporting this paper makes use of evaluations for all
7 countries as at October 2018 (Credendo, 2018).

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14 Countries that pose a high political and/or commercial risk to the exporting country—
15 according to the country risk ratings of the Belgian public credit insurance agency, Office
16 National du Dueroire (ONDD 2014)—are eliminated from the screening process. This filter
17 also considers the macroeconomic size and growth of the importing country measured by GDP
18 and GDP per capita, and GDP growth and GDP growth per capita, respectively.
19 Macroeconomic data is sourced from the National Accounts Estimates of Main Aggregates of
20 the United Nations Statistics Division (UN, 2017). Countries that do not meet the relevant cut-
21 off values are eliminated from the screening process. ~~(For more detail on the calculation of the~~
22 ~~cut-off values, see Cameron et al. 2017).~~

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36 In order not to reduce the list of countries (and BRI countries) based on political and
37 commercial risk assessments, it was decided in the present paper, not to apply the political and
38 commercial risks filtering procedure, in contrast to previous DSM research. Consequently, only
39 countries are eliminated that show inadequate preliminary potential based on economic size
40 and/or purchasing potential, as well as economic growth performance (using the World Bank's
41 GDP and GDP per capita data respectively up to 2018).⁶ In this context, "inadequate" means
42 that a country's GDP or GDP per capita and economic growth rates are below statistically
43 determined "cut-off" values. For GDP and GDP per capita these cut-off values are determined
44 at the 20th percentile of the values for the countries for which all data necessary to run the DSM

5 ONDD (Office National Du Dueroire) (2014) Rating explanation.
<http://www.delcredereuroire.be/en/country-risks/rating/> Date of access: May 2014.

6 <http://databank.worldbank.org/data/views/variableselection/selectvariables.aspx>

are available, and for GDP and GDP per capita growth rates the cut-off values are determined at the world averages for each year. The application of Filter 1 allows the researcher to further focus in the subsequent filters on the product imports of a smaller list of importing countries. Of the 253 countries in the world (excluding China), macro-economic data were available for only 219 countries. Due to lacking data and after applying Filter 1, 50 countries were not considered for further investigation.

However, as we focus on the BRI group of countries in this paper, we relax Filter 1 for the countries in question as we are interested in their broad market potential, irrespective of their current economic and risk characteristics.

3.2 Filter 2: Product import demand characteristics

The aim of this filter is to identify the product–country combinations with a satisfactory import market size and short- and long-term import market growth rate (relative to global trends for the product).

The international trade data is obtained from the *Base Analytique du Commerce International* (BACI) data set (Gaulier & Zignago 2010), which is a reconciled version of the UN COMTRADE database provided by CEPII (*Centre d'Études Prospectives et d'Informations Internationales*) (CEPII 2017).⁷ The data is reconciled for more than 200 countries and makes use of the 2007 HS revision data (at the 6-digit level, which is the most detailed level comparable on an international basis across all reporting countries⁸). The modelling supporting this paper also makes use of the latest (2016) trade data from the International Trade Centre's Trade Map database for the period 2012–2016.

⁷ CEPII (2017). BACI. Retrieved from

http://www.cepii.fr/CEPII/en/bdd_modele/downhold.asp?id=1#sthash.jCBRqXk.dpuf

⁸ The World Customs Organisation (WCO) requires 6-digit reporting as the maximum detail for international comparative purposes. However, some countries can report up to 10-digit e.g. the United States of America.

Balassa's (1964) revealed comparative advantage (RCA) index is used to define cut-off points for each of the criteria. The degree to which the exporting country is specialised in exporting the product is a deciding factor when determining the import market size and import market growth cut-off points ~~(for more details, see Cameron et al. 2017)~~.

An assessment is made of the potential 1,332,7931,333,002- import figures for the 203209 countries⁹ for which there exist imports data at the HS 6-digit level in the BACI database of CEPII (203209 countries x 63778 HS 6-digit products). In practice 879,198 combinations have actual trade reported on 5,052 products for the period of investigation in the CEPII data set¹⁰. For each product-country combination, *short-term import growth*, *long-term import growth* and *import market size* are calculated. *Short-term import growth* is the most recent available simple annual growth rate in imports. *Long-term growth* is calculated as the weighted compounded annual percentage growth rate of imports over the most recent five years period. Finally, the relative *import market size* is proxied by the ratio of imports of country i for product category j and the total world imports of product category j. Next, "cut-off" values are calculated for short- and long-term import growth, as well as for import market size, using formulas that per product category, consider the degree of specialisation (as proxied by Balassa's RCA) of the home market (exporting country ~~here~~, in this case China). The cut-off points thus calculated are more restrictive, the lower the degree of specialisation of the exporting country in the respective products (Cuyvers, 2004: 259-261; Cuyvers, Steenkamp & Viviers, 2012: 60-64). Of the product-country combinations thus selected, only these are considered for further analysis that are at least growing adequately in the short or long term and/or be of adequate size. The product-country combinations thus identified are the PEOs that subsequently enter filter 3.

⁹ Including China as the home market.

¹⁰ Not all countries trade on exactly all possible HS codes in the given period.

3.3 Filter 3: Product–country market access conditions

A target market selected on the basis of only size and growth is not necessarily easily accessed. Therefore, trade barriers such as the degree of market concentration (Filter 3.1) and trade restrictions (Filter 3.2) are considered, thereby screening the remaining possible export opportunities (Cuyvers et al. 1995, 180; Cuyvers 2004, 261).

3.3.1 Filter 3.1: Target market concentration

A target market whose import supply patterns are highly concentrated is more difficult to enter than a less concentrated market. It might therefore be inefficient for an exporting country to focus on a concentrated target market as the chances of success are likely to be reduced. The Herfindahl-Hirschman Index (HHI) (Hirschman 1964) (adjusted), which excludes the influence (if any) of the ‘home market’, is calculated as a measure of target market concentration. ~~Import market sizes and growth rates determine the market concentration cut-off values (for more details, see Cameron et al. 2017).~~

An HHI of 1 indicates that only one exporting country supplies the importing market and an HHI closer to 0 indicates that many exporting countries are supplying the importing market. Cut-off values for importing market concentration are set heuristically at 0.4, 0.5 and 0.6 respectively, depending on the importing market characteristics (large market, large and short-term or long-term growing market, large and growing market in the short and the long term). At the world level (of the 879,198 combinations), application of Filter 3.1 (in isolation of the rest of the filters) leads to a HHI adjusted sub-set HHI of386,348 product/country combinations (so only 44 percent of the product/country combinations meet the cut-off values).

3.3.2 Filter 3.2: Target market access, relative logistics and import costs

The methodology considers trade cost as a measure of trade barriers, but it also includes (i) tariffs, (ii) international shipping-cost approximations and both domestic and international

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3 transit times, as well as transit country–border cost approximations, and (iii) the domestic cost
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5 to import in the various target markets. Each of these is calculated as an ad valorem equivalent
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7 (percentage) of the value of the goods and added together to arrive at the total ad valorem
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9 equivalent of trade cost per product–country combination MAI_{ij} (for more details, see Cameron
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11 et al. 2017). The zero tariffs in existing FTA’s between China and individual BRI countries are
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13 taken into consideration in the calculation of the ad valorem equivalent of the trade cost per
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15 product-country combinations.
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22 This allows us to construct a relative cost index that not only considers the international
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24 (marine) shipping cost and domestic cost to import (World Bank, 2016) but also other costs
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26 relating to trade time, infrastructure and logistics (allowing for some differentiation between
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28 road freight and marine freight) as part of the filtering process to ensure that the most realistic
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30 opportunities are identified.
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33 The data sources are International Trade Centre’s Market Access Map (MacMap),
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35 online sources such as World Freight Rates¹¹, Searates.com¹², Mediterranean Shipping
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37 Company (MSC)¹³, Maersk, CMA CGM¹⁴, Pacific International Lines¹⁵, the Logistics
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39 Cluster¹⁶ and Google Maps¹⁷, and the World Bank’s Doing Business Report. As MAI_{ij} cut-off
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41 point, Pareto’s “eighty-twenty rule” was applied, such that only the product/country
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43 combinations that passed Filter 2 with a MAI_{ij} of less than or equal to the 80th percentile of
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45 the total *ad valorem* equivalent trade costs are allowed as elements of the set MAI. For China,
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55 ¹¹ See <http://www.worldfreightrates.com/en/freight>

56 ¹² See <https://www.searates.com/>

57 ¹³ See <https://www.msc.com/routefinder>

58 ¹⁴ See <https://www.cma-cgm.com>

59 ¹⁵ See <https://www.pilship.com/en-pil-pacific-international-lines/1.html>

60 ¹⁶ See <http://www.logcluster.org/>

¹⁷ See <https://www.google.co.za/maps>

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3 Filter 3.2 (applied in isolation) leads to a MAI adjusted sub-set of 700,692 product/country
4 combinations (so 80 percent of the world total of 879,198 combinations remains).
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10 11 **3.4 Filter 4: Categorisation of REOs**

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13
14 In the last stage of the analysis, the REOs identified are categorised and prioritised. The filtering
15 process leads to an REO matrix providing a consolidated picture of a market's demand potential
16 as reflected in its imports' size and growth, concentration and accessibility (i.e. in the face of
17 potential trade barriers) (see Figure 2).
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24 **(PLACE Figure 2 HERE)**
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26
27 For the purpose of short-term export promotion activities, an additional criterion that is
28 applied is the exporting country's production capacity for exports, as measured by its RCA and
29 revealed trade advantage (RTA) (Vollrath, 1991). This ensures that only those product-country
30 combinations in which the exporting country has developed a significant level of capacity are
31 selected as export opportunities. Thus, the final categorisation of outcomes is based on the
32 RCA, RTA, and 'home market' and 'target market' product-level trade characteristics (see also
33 Cameron et al. 2017; Jansen van Rensburg et al. 2019).
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43 The value of 'untapped' export potential is categorised according to the home market's
44 (in this case, China's) current export performance in such markets, compared to the
45 performance of the top six competitors in each market (measured in terms of the value of
46 imports from each of these competitors). The 'untapped' potential US dollar export value for a
47 product in a target market is defined as the average import market value of the top six
48 competitors in each market, excluding imports from the home market (if the home market
49 happens to be one of the top six sources of imports for the target market for a given product)
50 (for more details, see Cameron et al. 2017).
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3 This measure therefore provides an indication of the potential ‘additional’ size of
4
5 different export opportunities in relation to one another from the perspective of the home
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7 market, relative to existing exports to the target market. If the share of total imports into a target
8
9 market, from one of the main exporters to that market, exceeds the average market value of the
10
11 same product supplied to the market by the top six competitors, it is possible that the actual
12
13 export value from the home market is higher than this indicative untapped potential export
14
15 value. In this way, we provide a realistic indication (assuming all other factors remain constant)
16
17 of the potential market value that the home market could ‘target’ to obtain, in addition to its
18
19 existing exports to the target market. Using the ‘all else constant’ assumption, it would imply
20
21 that the home market would need to take market share away from the group of other countries
22
23 already supplying this product into the target market in question.
24
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30 *3.4.1 REO matrix*

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32
33 For ease of reference and interpretation, the outcomes are translated into a matrix that depicts
34
35 the characteristics of each REO (combination of a single market x single product), as depicted
36
37 in Figure 2.
38
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40 *3.4.1.1 REOs’ market share characteristics*

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43
44 REO characteristics can inform appropriate, though still broadly defined, export promotion or
45
46 marketing strategies, as follows (Cuyvers et al. 1995; Cuyvers et al. 2012c; Cuyvers et al. 2017;
47
48 Cameron et al., 2017, Jansen van Rensburg et al. 2019):
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51

- 52
53 a) REO1,1 to REO1,5: The home market has a non-existent to low market share and
54
55 an offensive market exploration strategy is appropriate for products in which a
56
57 comparative advantage already exists or can be developed;
58
59
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2
3 b) REO2,1 to REO2,5: The home market has a moderate to large market share and
4 REOs are situated in large and/or growing markets; therefore, an offensive market
5 expansion strategy can be advised; and
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7
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9
10 c) REO3,1 to REO4,5: The home market has already achieved an important relative
11 market share; therefore, a defensive market support/sustain and maintain strategy
12 seems most appropriate.
13
14
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18 *3.4.1.2 REOs' target market characteristics*

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21 The target (or importing) market's characteristics in terms of both size and growth can also be
22 used to inform appropriate strategies, as discussed in Cuyvers et al. (2012c).
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27 **4. Results and discussion: China's REOs**

28 *4.1 REOs in the BRI-associated countries*

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33 Of the 209 countries for which sufficient data was available, only the 84 BRI countries were
34 selected.¹⁸ This number dropped further to 83 due to insufficient data for Niue. Figure 3
35 provides an overview of the process and the outcomes obtained for the subset of BRI countries.
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41 **(PLACE Figure 3 HERE)**

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43
44 At the end of the process, 57,999 product–country combinations remained (covering 79
45 countries and 2,174 products). Market access-related factors in Filter 3 served to exclude
46 Afghanistan, Kyrgyzstan, Tajikistan and Uzbekistan as well as a total of 72 products. If we
47 assume that the BRI will remove logistical constraints, resulting in these countries not passing
48 the DSM filtering process (by relaxing the Filter 3.2 requirement for these four countries), an
49 additional 2,135 opportunities (4 countries x 1,255) with an untapped potential value of US\$
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¹⁸ A list of BRI countries we selected according to the Belt and Road Portal is available from Appendix 1.

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3 182.4 million become accessible to Chinese exporters. While this may seem negligible in the
4
5 larger context, for the individual countries and exporting companies these opportunities may be
6
7 significant. Nevertheless, we decided to exclude these markets from our analysis because they
8
9 are currently relatively inaccessible. Future research can probe the export opportunities for
10
11 China presented by these four markets.
12
13

14
15 The geographical spread and untapped potential in the BRI group, representing a
16
17 significant US\$78.52 billion, are depicted in Figure 4. Interestingly, at first glance, the untapped
18
19 potential seems to be spread quite well within the geographical area of the old ‘silk routes’,
20
21 whereas African countries and distant locations such as New Zealand and Panama offer, in
22
23 relative terms, significantly less potential.
24
25

26
27 **(PLACE Figure 4 HERE)**
28
29

30 Evident from panel [B] in figure 4 is that South Korea presents the largest ‘untapped’
31
32 potential in terms of both monetary value as well as number of 6-digit product codes (8.2
33
34 percent of value and 2.5 percent of number – refer to table 2 for more detail). On the opposite
35
36 side of the scale countries like Bhutan and Guyana appear. More detail within the range of
37
38 countries with a number of opportunities between 0 and 900 can be seen in panel [C] of figure
39
40 4. It is important not to jump to the hasty conclusion that these markets do not offer any
41
42 potential. It could very well be that they have potential, although relatively small – not only
43
44 because of the small size of their economies and thus limited demand, but also because China
45
46 may already be a dominant supplier to such markets. A more detailed analysis would give a
47
48 clearer picture of these potential target markets. However, this is beyond the scope of this paper,
49
50 which is to demonstrate how the DSM approach can provide China’s export promotion agencies
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52 with high-level strategic insights and some of the core facts needed to take informed decisions
53
54 and prioritise markets for development. From previous studies it is clear that although the DSM
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56 results provide well structured and quantitative inputs into the process of concrete strategy
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3 formulation, much more detailed a variety of further information, such as field research,
4 marketing intelligence and to also include geopolitical and diplomatic relations, etc. is required
5 for designing an appropriate export promotion strategy (Cuyvers, et al., 2012).
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10 11 ***4.1.14.2. China's REO matrix for BRI countries***

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15 An analysis of China's worldwide REOs based on the DSM revealed that there are 105,439
16 global opportunities, representing US\$303.34 billion. It is interesting to compare the results for
17 the BRI group, as summarised in Table 1, with these global REOs.
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21
22 **(PLACE Table 1 HERE)**
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24
25 It is evident that the untapped potential value in the BRI group of countries represents
26 25.9 percent of China's global opportunities (i.e. US\$78.52 billion out of US\$303.34 billion)
27 and 55 percent (57,999) of the 105,439 opportunities globally.
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32 Most of the untapped opportunity in the BRI countries is in markets that are relatively
33 small but growing, both in the short and long term (49.1 percent – see Table 1). Yet this group
34 of markets represents the smallest share of untapped imports globally (20.9 percent). Within
35 this set, 16 percent of the value of untapped potential is associated with opportunities where
36 China already supplies some of the imports (19.7 percent of the opportunities) but has only an
37 intermediately small share, while 15.6 percent of the value is associated with opportunities
38 where China is already the dominant supplier (41.1 percent of the opportunities).
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48 In terms of policy implications, the group of REOs in cell REO2,2, for example, may
49 be prioritised for an offensive expansion strategy (see section 3.4.1).
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52 53 54 ***4.1.24.3. China's REO results for the top 20 BRI countries***

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57 In terms of both untapped potential and number of REOs for China, South Korea ranks first.
58 Total exports from China relative to the untapped potential (column [D] in Table 2) reflect a
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3 ratio of 734.8 percent, indicating that China already exports more than seven times the
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5 remaining untapped potential in South Korea.
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8 **(PLACE Table 2 HERE)**
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10
11 In terms of untapped potential, South Korea is followed by Poland, Vietnam, Austria
12
13 and Singapore, while China's existing exports are lower than the untapped potential in Austria
14
15 and Romania only. Therefore, while the top 20 countries present around 82 percent of the
16
17 untapped potential in value terms, China is already a large supplier of most of the imports into
18
19 these markets. The BRI has tended to be overlooked by the European Commission, which has
20
21 resulted in some of the smaller EU countries forging bilateral trade ties with China. It is striking
22
23 that, when taken together, the results show that 17.9 percent of the value of China's export
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25 potential in the BRI countries is associated with Poland, Austria and the Czech Republic
26
27 (although in number of REOs these represent only 5.9 percent of China's REOs), thus indicating
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29 a potentially important eastern European gateway for China.
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34 Furthermore, most opportunities (63.4 percent) are associated with BRI countries
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36 outside of the top 20, but these represent only 18 percent of the associated untapped potential
37
38 value. Hence, when it comes to spending resources on the extensive margin (i.e. developing
39
40 additional or new markets), it would be sensible for China to focus on the BRI markets outside
41
42 of the top 20, i.e. the smaller but growing markets. China's top 20 HS 4-digit product
43
44 opportunities are listed in Table 3. ~~As can be seen many of these opportunities belong to HS84~~
45
46 ~~(nuclear reactors, boilers, machinery and mechanical appliances; parts thereof) and HS85~~
47
48 ~~(electrical machinery and equipment and parts thereof; sound recorders and reproducers;~~
49
50 ~~television image and sound recorders and reproducers, parts and accessories of such articles).~~
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55 **(PLACE Table 3 HERE)**
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3 As can be seen many of these opportunities belong to HS84 (nuclear reactors, boilers,
4 machinery and mechanical appliances; parts thereof) and HS85 (electrical machinery and
5 equipment and parts thereof; sound recorders and reproducers; television image and sound
6 recorders and reproducers, parts and accessories of such articles).

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11
12 In terms of groups of products, HS8517 (Apparatus for carrier-current line
13 systems/digital line systems) represents the single largest potential in value terms at 7.4 percent
14 of the total potential but only 0.4 percent of the number of products. From a volume of
15 opportunities perspective HS5407 (Woven fabrics (excl. of 5407.10-5407.30), cont. <85% by
16 wt. of synthetic filaments) represent the largest number at 665 (not shown in table 3).

23 24 25 **5. Implications**

26 27 28 ***5.1 — Implications for theory and theory development***

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30
31 Gravity model or computable general equilibrium model estimations of a country's export
32 potential are at an aggregate level and offer few policy insights for companies and export
33 promotion agencies. In contrast, the DSM results are a list of detailed product-country
34 combinations, that allow both government export promotion agencies and/or exporters to
35 follow these realistic export opportunities involved. However, while the DSM approach can
36 provide crucial information for China's export promotion activities, real-world logistics may
37 need to be better understood before specific recommendations can be made. This is clearly
38 illustrated by four key BRI countries (Afghanistan, Kyrgyzstan, Tajikistan and Uzbekistan)
39 that, using the DSM, were eliminated on the basis of market access challenges and current
40 logistics assumptions since the routing of most goods to these markets is via sea rather than
41 road and rail – the latter transport modes being exactly what the BRI aims to unlock.

42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 ***5.2 — Implications for business and management practice***

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3 Our analysis shows that the BRI consists mainly of emerging and developing economies, with
4
5 70 of the 8219 countries being classified as such, according to the International Monetary Fund.
6
7 Of these 70 countries, 11 are further classified by the United Nations as least-developed
8
9 countries. Therefore, only 12 of the BRI countries can be considered to be ‘advanced’
10
11 economies.
12
13

14
15 China should aim to facilitate the upliftment of the emerging and developing economies
16
17 within the BRI. To yield mutually beneficial economic outcomes, China would also need to
18
19 consider investing in growth- and wealth-creating activities in these economies to ensure their
20
21 future growth and increased demand for Chinese (and other countries’) export products and
22
23 services. Therefore, more than simply logistics connectivity will be required to connect the
24
25 current major demand centres.
26
27

28 29 **5.3 — Implications for readers**

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31
32 Comparing all of China’s REOs in the world with the untapped potential associated with its
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34 REOs in the BRI countries only, we found:
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39 • Of the total of 84 BRI countries, Niue was eliminated due to information
40
41 deficiencies, while another four BRI countries (Afghanistan, Kyrgyzstan,
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43 Tajikistan and Uzbekistan) were eliminated due to market access challenges.
44
45
- 46
47 • The remaining 79 BRI countries represent 42.5 percent of all 186 potential target
48
49 markets globally and 26.9 percent of China’s globally untapped potential in US
50
51 dollar value terms.
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57
58 ¹⁹ While there are 84 countries associated with the BRI, the IMF has data and classifications for only 82. Since
59
60 2011 Syria has been excluded due to the ongoing conflict in the country. Niue is not included either due to a lack
of data.

- Most markets (more than 85 percent) are considered emerging and developing economies, which signals (in relative terms) constrained future potential as significant demand centres for Chinese exports.
- However, 17.9 percent of the untapped potential value is associated with the BRI countries of Poland, Austria and the Czech Republic, providing China with a potentially important eastern European route into the EU.
- Although a necessary condition, increased logistics will not, in isolation, necessarily lead to the creation of sufficient future demand centres in the BRI countries which will significantly boost Chinese trade with such countries – unless Chinese policymakers and economic planners also consider effective ways of enhancing domestic economic growth and wealth creation in these countries.

6. Conclusions and some policy implications

Chinese companies and export promotion agencies may find it difficult to identify export markets that have potential in terms of demand, growth and sustainability. While China's announcement of the Belt and Road Initiative (BRI) heralded great export opportunities for China's business sector, no specific attempts appear to have been made to identify realistic export opportunities among the BRI countries at the detailed product level.

We have demonstrated how the Decision Support Model (DSM) approach can be applied to identify China's realistic export opportunities (REOs) in the BRI countries. Importantly, the results show that one quarter of China's untapped REOs in the world are in the BRI region, with South Korea, Poland and Vietnam ranking as the top three markets. A relatively large share of the total untapped value associated with the identified REOs is attributed to relatively small but growing markets for which China either has an intermediately

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2
3 small market share or a very large market share. The product categories ‘Machinery and
4
5 electrical products (HS chapter 84 and 85)’ enjoy a particularly strong comparative advantage.
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8 It is important to consider the details of specific product–country combinations as
9
10 different approaches may be required for such alternative combinations. In this regard, the DSM
11
12 methodology provides structured and well-researched guidelines to assist export promotion
13
14 specialists and policymakers in their strategic planning. For example, since 17.9 percent of the
15
16 untapped potential is associated with Poland, Austria and the Czech Republic, such markets
17
18 could be useful entry points for China into the greater EU region. Because of the relatively
19
20 small size of the economies of many of the BRI countries, regional ‘hubs’ of similar REOs
21
22 could be investigated to aggregate for scale. In addition, offensive expansion opportunities
23
24 should be unpacked in more detail so that the deployment of resources is more focused and
25
26 makes sense from an export and investment promotion perspective. Furthermore, a pre-emptive
27
28 analysis of mature markets, where Chinese exports already dominate, may be warranted.
29
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31
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33 Clearly, the opportunities associated with the relatively small but growing markets need
34
35 to be prioritised and leveraged by way of an offensive expansion strategy. However, also
36
37 evident from the analysis is that most of the countries associated with the BRI are emerging and
38
39 developing economies which will not be able to absorb large volumes of Chinese exports unless
40
41 the BRI implements a deliberate policy of enhancing countries’ domestic economies and
42
43 income levels. This would help to boost demand and countries’ ability to pay for exports from
44
45 the rest of the world, including China.
46
47
48

49 Our findings, while demonstrating how to build strong, fact-based foundations for
50
51 company export strategies and government-driven export promotion policies, also highlight the
52
53 need for policymakers to look beyond international trade and focus on how to also improve the
54
55 domestic economies of the partners in the BRI. This will induce higher levels of wealth and
56
57 growth, which in turn will stimulate increased trade potential for China. The possible
58
59
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mechanisms to realise this goal of increased and more diversified domestic growth might include targeted bilateral investment, development assistance (aid) and trade agreements between China and individual BRI countries (or regional agreements with groups of countries). However, care needs to be taken when sorting out the mechanics of such initiatives or agreements, as there is already a perception that China is aiming to ‘exploit’ and ‘re-colonise’ these countries.

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Journal of International Trade Law and Policy

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3 **Appendix 1. The BRI group of countries and reasons for some countries' exclusion from**
4 **the analysis.**
5

6
7 While the island of Niue is listed as being part of the BRI group of countries (according to the
8 Belt and Road Portal of the Office of the Leading Group for the Belt and Road Initiative, which
9 is hosted by the State Information Center), the island did not have the required economic and
10 international trade data for modelling purposes. Furthermore, for Filter 1, only the sub-filter for
11 economic size and growth was applied, while political and commercial risk elements were
12 ignored for the BRI analysis. However, the treatment of Filter 1 in the BRI analysis did not
13 exclude any of the BRI countries specifically. Table 4 lists the BRI countries that were excluded
14 from the rest of the analysis based on the sub-filters of Filter 3.2 (market access) of the DSM
15 methodology.
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(PLACE Table 4 HERE)

Table 1. China's REO matrix for BRI countries (summarised).

Map of Realistic Export Opportunities (REOs) Number [% of total] Untapped potential Billions (Bn) United States Dollar (USD) [% of total]		Relative market share of Home Market (China) into Target Market(s)				Row Totals
		Small (1) <5% (x1)	Intermediate Small (2) 5-25% (x2)	Intermediate Large (3) 25-50% (x3)	Large (4) >50% (x4)	
Target market x product demand characteristics	Large (1)	1,1 138 [0.2%] 1.00 Bn [1.3%]	2,1 363 [0.6%] 2.69 Bn [3.4%]	3,1 329 [0.6%] 2.97 Bn [3.8%]	4,1 1 122 [1.9%] 6.21 Bn [7.9%]	x,1 1 952 [3.4%] 12.87 Bn [16.4%]
	Growing (2) (Short & Long term)	1,2 7 717 [13.3%] 6.42 Bn [8.2%]	2,2 11 407 [19.7%] 12.58 Bn [16.0%]	3,2 8 045 [13.9%] 7.25 Bn [9.2%]	4,2 23 844 [41.1%] 12.26 Bn [15.6%]	x,2 51 013 [88.0%] 38.51 Bn [49.1%]
	Large and growing (3) (Short term)	1,3 38 [0.1%] 0.37 Bn [0.5%]	2,3 83 [0.1%] 0.65 Bn [0.8%]	3,3 70 [0.1%] 0.47 Bn [0.6%]	4,3 196 [0.3%] 0.95 Bn [1.2%]	x,3 387 [0.7%] 2.44 Bn [3.1%]
	Large and growing (4) (Long term)	1,4 98 [0.2%] 0.67 Bn [0.9%]	2,4 195 [0.3%] 1.12 Bn [1.4%]	3,4 166 [0.3%] 1.13 Bn [1.4%]	4,4 729 [1.3%] 2.86 Bn [3.6%]	x,4 1 188 [2.0%] 5.79 Bn [7.4%]
	Large and growing (5) (Short & Long term)	1,5 418 [0.7%] 2.83 Bn [3.6%]	2,5 583 [1.0%] 4.78 Bn [6.1%]	3,5 487 [0.8%] 4.02 Bn [5.1%]	4,5 1 971 [3.4%] 7.28 Bn [9.3%]	x,5 3 459 [6.0%] 18.90 Bn [24.1%]
	Column Totals	1,y 8 409 [14.5%] 11.30 Bn [14.4%]	2,y 12 631 [21.8%] 21.82 Bn [27.8%]	3,y 9 097 [15.7%] 15.84 Bn [20.2%]	4,y 27 862 [48.0%] 29.56 Bn [37.6%]	x,y 57 999 [100.0%] 78.52 Bn [100.0%]

Source: Authors' calculations

Table 2. China's REO results for the top 20 BRI countries.

	Country	Number	[A]* Total realistic export potential target market(s) US\$ bn	[B] Total exports from CHN to target market(s) US\$ bn	[C] Total exports from CHN/target market(s) total imports %	[D] Total exports from CHN/realistic export potential %	[E] Relative contribution to total realistic export potential value %	[F] Cumulative contribution to total realistic export potential value %	[G] Relative contribution to total realistic export potential number %	[H] Cumulative contribution to total realistic export potential number %
1	Korea, Rep. of Korea (South)	1,431	6.43	47.23	51.6	734.8	8.2%	8.2%	2.5%	2.5%
2	Poland	1,230	5.35	12.94	24.2	241.7	6.8%	15.0%	2.1%	4.6%
3	Vietnam	1,358	5.02	33.79	51.5	673.7	6.4%	21.4%	2.3%	6.9%
4	Austria	1,024	4.78	4.37	11.5	91.2	6.1%	27.5%	1.8%	8.7%
5	Singapore	925	4.63	15.83	32.4	341.7	5.9%	33.4%	1.6%	10.3%
6	Czech Republic	1,148	3.91	8.68	22.9	221.7	5.0%	38.4%	2.0%	12.3%
7	Thailand	1,224	3.87	21.49	44.8	555.4	4.9%	43.3%	2.1%	14.4%
8	Russian Federation	968	3.62	18.16	39.1	501.8	4.6%	47.9%	1.7%	16.0%
9	India	1,184	3.47	28.09	52.8	808.8	4.4%	52.3%	2.0%	18.1%
10	Turkey	931	3.01	10.84	33.1	359.8	3.8%	56.2%	1.6%	19.7%
11	United Arab Emirates	843	2.70	13.54	39.8	500.9	3.4%	59.6%	1.5%	21.1%
12	Indonesia	1,249	2.48	15.53	48.3	626.2	3.2%	62.8%	2.2%	23.3%
13	Malaysia	1,053	2.43	14.09	45.0	579.1	3.1%	65.9%	1.8%	25.1%
14	Saudi Arabia	844	2.37	8.24	32.4	347.3	3.0%	68.9%	1.5%	26.6%
15	Hungary	1,107	2.30	2.43	12.5	105.9	2.9%	71.8%	1.9%	28.5%
16	Slovakia	932	2.29	2.89	15.6	126.3	2.9%	74.7%	1.6%	30.1%
17	Romania	1,211	2.26	1.95	10.7	86.5	2.9%	77.6%	2.1%	32.2%
18	Philippines	1,020	1.47	14.96	60.9	1 016.4	1.9%	79.5%	1.8%	33.9%
19	Israel	974	1.09	2.78	25.6	255.3	1.4%	80.9%	1.7%	35.6%
20	Egypt	579	0.87	2.58	29.9	295.3	1.1%	82.0%	1.0%	36.6%
21	Rest	36,764	14.15	54.59	35.8	385.8	18.0%	100.0%	63.4%	100.0%
	Total	57,999	78.52	334.99	37.6	426.6	100.0%		100.0%	

Source: Authors' calculations

* Results sorted in descending order based on column [A]. Outcomes based on modelled data from CEPII and other sources for 2017 and 2018.

Table 3. China's REO results for the top 20 BRI-associated products

HS 4 group		HS4 description	Number	[A]* Total realistic export potential target market(s) US\$ bn	[B] Total exports from CHN to target market(s) US\$ bn	[C] Total exports from CHN/target market(s) total imports %	[D] Total exports from CHN/realistic export potential %	[E] Relative contribution to total realistic export potential value %	[F] Cumulative contribution to total realistic export potential value %	[G] Relative contribution to total realistic export potential Number	[H] Cumulative contribution to total realistic export potential number %
1	HS8517	Apparatus for carrier-current line systems/digital line systems	238	5.77	35.91	46.8	621.9	7.4%	7.4%	0.4%	0.4%
2	HS8471	Analogue/hybrid auto. data processing machines	276	2.30	11.26	40.3	490.2	2.9%	10.3%	0.5%	0.9%
3	HS8473	Parts and accessories (excl. covers, carrying cases and the like)	143	1.92	8.06	37.4	420.1	2.4%	12.7%	0.2%	1.1%
4	HS8481	Check (non-return) valves for pipes/boiler shells/tanks/vats, etc.	127	1.61	2.99	18.5	184.9	2.1%	14.8%	0.2%	1.4%
5	HS8901	Cruise ships, excursion boats and sim. vessels princ. designed for passengers	24	1.41	2.87	22.6	202.9	1.8%	16.6%	0.0%	1.4%
6	HS8529	Aerials and reflectors of all kinds suit. for use solely/princ. with television	65	1.27	6.33	41.7	498.9	1.6%	18.2%	0.1%	1.5%
7	HS8443	Flexographic printing mach.	213	1.20	3.07	26.7	255.2	1.5%	19.7%	0.4%	1.9%
8	HS7210	Flat-rolled prods. of iron/non-alloy steel, of a width of 600mm/more, clad/ ...	196	1.14	3.91	33.9	344.4	1.4%	21.2%	0.3%	2.2%
9	HS8528	Reception app. for television, whether or not incorp. radio-broadcast receivers	272	1.05	5.18	42.4	492.0	1.3%	22.5%	0.5%	2.7%
10	HS3926	Articles of apparel and clothing access (incl. gloves, mittens and mitts)...	161	1.05	2.32	21.7	220.6	1.3%	23.9%	0.3%	3.0%
11	HS8541	Diodes (excl. photosensitive/light emitting diodes)	110	1.04	6.41	48.2	614.0	1.3%	25.2%	0.2%	3.1%
12	HS7308	Bridges and bridge-sections of iron/steel	175	1.03	3.11	28.1	301.2	1.3%	26.5%	0.3%	3.4%
13	HS8544	Co-axial cable and oth. co-axial elec. conductors	160	1.00	3.21	29.0	320.2	1.3%	27.8%	0.3%	3.7%
14	HS8534	Printed circuits	40	0.96	3.62	35.5	376.1	1.2%	29.0%	0.1%	3.8%
15	HS7326	Articles of iron/steel wire	92	0.96	1.71	17.9	178.2	1.2%	30.2%	0.2%	4.0%
16	HS8708	Brakes and servo-brakes and parts thereof (excl. mounted brake linings) for the ...	111	0.90	1.46	17.5	161.9	1.1%	31.4%	0.2%	4.1%
17	HS8504	Ballasts for discharge lamps/tubes	236	0.89	4.22	36.0	471.4	1.1%	32.5%	0.4%	4.6%
18	HS8415	Air-conditioning machines (excl. of 8415.10-8415.81), incorp. a refrigeration...	157	0.81	3.38	37.8	420.0	1.0%	33.5%	0.3%	4.8%
19	HS7207	Semi-finished prods. of iron/non-alloy steel, cont. by wt. <0.25% of carbon ...	60	0.80	2.25	30.5	281.4	1.0%	34.6%	0.1%	4.9%
20	HS8536	Apparatus for protecting electrical circuits (excl. of 8536.10 and 8536.20)	193	0.79	1.45	19.3	183.9	1.0%	35.6%	0.3%	5.3%
		Rest	54,950	50.59	222.26	38.6	439.3	64.4%	100.0%	94.7%	100.0%
	Total		57,999	78.52	334.99	37.6	426.6	100.0%		100.0%	

Source: Authors' calculations

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* Results sorted in descending order based on column [A]

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Table 4. BRI group of countries and reasons for some countries' exclusion.

No.	Country	Least-developed countries (based on the UN*)	(A)dvanced and (E)merging and developing economies (based on the IMF**)	Excluded due to data constraints	Excluded due to Filter 3.2 (market access and logistics)
1	Afghanistan	X	E		X
2	Albania		E		
3	Antigua and Barbuda		E		
4	Armenia		E		
5	Austria		A		
6	Azerbaijan		E		
7	Bahrain		E		
8	Bangladesh	X	E		
9	Belarus		E		
10	Bhutan	X	E		
11	Bolivia		E		
12	Bosnia and Herzegovina		E		
13	Brunei Darussalam		E		
14	Bulgaria		E		
15	Cambodia	X	E		
16	Croatia		E		
17	Czech Republic		A		
18	Dominica		E		
19	East Timor (Timor-Leste)	X	E		
20	Egypt		E		
21	Estonia		A		
22	Ethiopia	X	E		
23	Georgia		E		
24	Greece		A		
25	Guyana		E		
26	Hungary		E		
27	India		E		
28	Indonesia		E		
29	Iran		E		
30	Iraq		E		
31	Israel		A		
32	Jordan		E		
33	Kazakhstan		E		
34	Republic of Korea		A		
35	Kuwait		E		
36	Kyrgyz Republic (Kyrgyzstan)		E		X
37	Lao People's Democratic Republic	X	E		
38	Latvia		A		
39	Lebanon		E		
40	Libya		E		
41	Lithuania		A		
42	Macedonia		E		
43	Madagascar		E		
44	Malaysia		E		
45	Maldives		E		
46	Moldova		E		
47	Mongolia		E		
48	Montenegro		E		
49	Morocco		E		
50	Myanmar	X	E		
51	Nepal	X	E		
52	New Zealand		A		
53	Niue		N/A	X	
54	Palestine		N/A		
55	Oman		E		

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3	56	Pakistan		E	
4	57	Panama		E	
5	58	Papua New Guinea		E	
6	59	Philippines		E	
7	60	Poland		E	
8	61	Qatar		E	
9	62	Romania		E	
10	63	Russia		E	
11	64	Saudi Arabia		E	
12	65	Senegal	X	E	
13	66	Serbia		E	
14	67	Singapore		A	
15	68	Slovak Republic (Slovakia)		A	
16	69	Slovenia		A	
17	70	South Africa		E	
18	71	Sri Lanka		E	
19	72	Syria		E	
20	73	Tajikistan		E	X
21	74	Thailand		E	
22	75	Trinidad and Tobago		E	
23	76	Tunisia		E	
24	77	Turkey		E	
25	78	Turkmenistan		E	
26	79	Ukraine		E	
27	80	United Arab Emirates		E	
28	81	Uruguay		E	
29	82	Uzbekistan		E	X
30	83	Vietnam		E	
31	84	Yemen	X	E	

Source: Compiled by authors

* According to the United Nations Department of Economic and Social Affairs, least-developed countries (LDCs) are low-income countries faced with severe structural impediments to sustainable development. They are highly vulnerable to economic and environmental shocks and have low levels of human assets.¹

** The IMF's World Economic Outlook classifies² countries as advanced, emerging or developing, depending on:

(1) the per capita income level;

(2) the extent of export diversification, implying that oil-exporting countries that have a high per capita GDP would not make the advanced classification because around 70 percent of their exports are oil; and

(3) the degree of integration into the global financial system.

¹See <https://www.un.org/development/desa/dpad/least-developed-country-category.html> for more information.

²See <https://www.imf.org/external/pubs/ft/weo/2018/02/weodata/groups.htm> for more information.