Chinese Manufacturing Import Penetration and Firm Performance: Evidence from Belt and Road Initiative Countries

Elvis Korku Avenyo, Danilo Spinola, and Fiona Tregenna

SARChI Industrial Development Working Paper Series

WP 2024-06

July 2024

science & innovation
Department:
Science and Innovation
REPUBLIC OF SOUTH AFRICA

National Research Foundation

SARChI
SARChI Chair:
Industrial Development

UNIVERSITY OF JOHANNESBURG

Chinese manufacturing import penetration and firm performance: Evidence from Belt and Road Initiative countries

DSI/NRF SOUTH AFRICAN RESEARCH CHAIR IN INDUSTRIAL DEVELOPMENT

Elvis Korku Avenyo, Danilo Spinola, and Fiona Tregenna

SARChI Industrial Development Working Paper Series

WP 2024-06

ISBN 978-1-7764501-0-7

July 2024

About the South African Research Chair in Industrial Development (SARChI-ID)

The DSI/NRF South African Research Chair in Industrial Development conducts research, builds capacity and undertakes public and policy engagement in the field of industrial development. Activities focus on research projects; training and supervision of graduate students; hosting postdoctoral fellows and research visitors; and various projects, often in conjunction with partners, such as conferences, workshops, seminars, training courses, and public and policy engagements. SARChI Industrial Development is hosted at the University of Johannesburg, where it operates as a centre located in the College of Business and Economics.

Funding acknowledgement

The South African Research Chairs Initiative (SARChI) was established in 2006 by the then Department of Science and Technology (DST), now known as the Department of Science and Innovation (DSI), and the National Research Foundation (NRF). The Chairs are designed to attract and retain excellence in research and innovation at South African public universities. The funding support of the DSI and the NRF through Grant Number 98627 and Grant Number 110691 for the South African Research Chair in Industrial Development has made this working paper series possible.

Recommended citation

Avenyo, E.K., Spinola, D. and Tregenna, F. Chinese Manufacturing Import Penetration and Firm Performance: Evidence from Belt and Road Initiative Countries. SARChI Industrial Development Working Paper Series WP 2024-06. SARChI Industrial Development, University of Johannesburg.

Disclaimer

The Working Paper series is intended to stimulate policy debate. Working papers express the views of their respective authors and not necessarily those of the South African Research Chair in Industrial Development (SARChI-ID), the University of Johannesburg (UJ), the Department of Science and Innovation (DSI) or the National Research Foundation (NRF).

Working Papers can be downloaded from https://www.uj.ac.za/faculties/college-of-business-and-economics/schools/school-of-management/south-african-research-chair-in-industrial-development/working-paper-series/ in PDF (Adobe Acrobat) format.

Abstract

This paper examines the firm-level effects of Chinese manufacturing import penetration on the performance of manufacturing firms in Belt and Road Initiative (BRI) countries. We construct a dataset of 59 BRI member countries by combining firm-level data from the World Bank's Enterprise Survey with industry-level data from the United Nations Commodity Trade (Comtrade) database from 2011 to 2020. Employing a multi-level modelling approach, our findings reveal that Chinese manufacturing imports exert a considerable adverse effect on productivity growth and employment, and a robust and significant positive effect on the export capabilities of manufacturing firms. The adverse effects on performance are significantly moderated by firms that pursue innovation and engage in foreign licensing. These findings are significant in middle-income countries and small and medium-sized enterprises (SMEs) within BRI countries. Based on these findings, we argue that the importation of manufactured goods from China results in a crowding-out effect on the productive capacities of firms within the Belt and Road Initiative (BRI) countries on the one hand and a catalytic effect on the internationalisation of firms on the other hand. These dual outcomes may underscore China's global value chains (GVCs) position-seeking strategy.

Keywords: Chinese manufacturing import penetration; Multi-level modelling; Firm-level effects; Belt and Road Initiative.

JEL codes: F14, F15, F61, O14, P33

About the Authors

Elvis Korku Avenyo is a Visiting Associate Professor at the South African Research Chair in Industrial Development, University of Johannesburg. E-mail: elvisa@uj.ac.za.

Danilo Spinola is a Senior Lecturer at Birmingham City University College of Accounting, Finance and Economics; Researcher at UNU-Merit, and Senior Research Associate at the South African Research Chair in Industrial Development, University of Johannesburg. E-mail: danilo.spinola@bcu.ac.uk.

Fiona Tregenna is the Chairholder at the South African Research Chair in Industrial Development, University of Johannesburg. E-mail: ftregenna@uj.ac.za.

Acknowledgements

Support for this research was received under the project 'Community of Practice in Industrialisation and Innovation' (grant number 110691), hosted by the DSI/NRF South African Research Chair in Industrial Development (grant number 98627), University of Johannesburg.

Table of Contents

List of Tables

List of Figures

1. Introduction

The dynamics and structure of global industrial production and trade changed with the emergence of China as the 'world's factory'. The tremendous industrial growth experienced by China and its thriving manufacturing sector has rendered 'Made in China' products ubiquitous through (a) exploring the domestic demand of its partners (market-seeking) and (b) offering cheap intermediary goods that can affect the production chain (GVC position seeking) (Gereffi & Frederick, 2010). China's industrial development has also altered and changed the global development discourse due to its unique industrial development strategy and its increasing role in the economic transformation of other countries, particularly in the developing world. Hence, China's industrial transformation has had significant, complex, and multifaceted effects on the international development strategy and agenda.

There is emerging literature on the effects of trade with China on manufacturing firms' performance in labour markets (Acemoglu et al., 2016; Autor et al., 2013, Balsvik et al., 2015) on learning and productivity growth (Bloom et al., 2016; Dollar, 1992; Fu, 2005; Grossman & Helpman, 1991; Qiu & Zhan, 2016; Schiff & Wang, 2006), and on innovation performance of domestic firms (Autor et al., 2013; Bernard et al., 2006; Bloom et al., 2016; Ebenstein et al., 2014). The empirical evidence highlights that domestic manufacturing firms experience adverse effects from import competition, including lower output or employment growth and a higher probability of exiting. Firms can escape low-wage competition by changing production techniques, moving to more capital-intensive products or shifting towards export markets (Bernard et al., 2006; Doan et al., 2016).

The literature mentioned above primarily focuses on manufacturing firms' performance in developed countries, with no direct extrapolation of findings for developing economies (Hou et al., 2021). The effects of Chinese manufacturing imports on the industrial performance of developing countries may differ in two ways; one, the effects may be more dramatic as the industrial structure of developing countries is less developed, and second, firms in developing countries thus have weaker capabilities to innovate and compete with imported manufactured goods from China. Low- and medium-tech manufacturing sectors are the most affected by the increase in imported goods and competition from Chinese manufactured products (Alvarez & Claro, 2009; Iacovone et al., 2013). There is also evidence that increased Chinese manufacturing and textile imports contributed to declining textile manufacturing activities in developing countries (Gampfer & Geishecker, 2019).

A strong trade relationship with China increases access to manufacturing intermediaries and final goods at lower prices. Cheap inputs foster the capacity to export by certain firms, leading to

integration opportunities into the GVCs (Amendolagine et al., 2019). Furthermore, access to intermediate inputs, such as capital goods at cheaper values, leads to machinery upgrading (Habiyaremye & Raymond, 2013), positive learning effects (Fu et al., 2014), and productivity improvement (Bernard et al., 2003; De Hoyos & Iacovone, 2013; Habiyaremye & Raymond, 2013). These two effects can be divided into (1) a market-seeking displacement-competition effect of Chinese imports on domestic firms and the opportunities that those firms might benefit from international trade integration, and (2) a GVC-integration effect.

The available empirical literature focusing on the impact of Chinese import competition has expanded over the years with relevant contributions aimed at understanding this effect on Latin America (Alvarez & Claro, 2009; Gallagher & Porzecanski, 2020; Iacovone et al., 2013; Lall & Weiss, 2005; Paz, 2018), Asia (Doan et al., 2016,), and Africa (Morris & Einhorn, 2008; Torreggiani & Andreoni, 2019). Most of these studies explore the effect of Chinese import competition on performance measures, such as employment and productivity (Kaplinsky & Morris, 2009), the probability of domestic firms exiting the market, labour market indicators (wage premium) and innovation/innovative capabilities (Dang, 2017; Stevens & Kennan, 2006). The evidence emerging from this literature is mixed.[1] The most common view according to the literature, suggests that a rise in manufacturing imports from China has a displacement-competition effect, namely downsizing of manufacturing firms/plants[2] (Edwards & Jenkins, 2013; Torreggiani & Andreoni, 2019), a reduction in employment growth (Alvarez & Claro, 2009; Blyde & Fentanes, 2019; Edwards & Jenkins, 2013; Kaplinsky et al., 2007), and an increase in the probability of firms exiting (Alvarez & Claro, 2009; Edwards & Jenkins, 2015; Kaplinsky et al., 2007). Evidence also indicates that Chinese import competition has had no impact on firms' innovations (Dang, 2017) nor a negative impact (Stevens & Kennan, 2006).

The literature also distinguishes between the impact of trading with China on developed and developing economies (Alvarez & Claro, 2009). The main argument is that South-South trade has different characteristics from North-South trade; the 'Global South' countries typically export labour-intensive products at a low cost, whereas 'Global North' countries have stronger capabilities to export high-value added capital goods (Lall, 2000). These differences are caused by the productivity effects of trade, based on the technology gap theory and the theory of appropriate technology (Fransman, 1984). However, China is a unique economy in the 'Global South' group. According to Alvarez and Claro (2009), Chinese particularity resides in its labour-abundant dominance in world trade flows, significantly affecting small developing economies'

[1] Table 9 in the appendix presents a summary of this literature.

[2] However, Torreggiani and Andreoni (2019) found that the capabilities of domestic firms moderate the negative effects of Chinese manufacturing imports.

production patterns. However, as stated by Rodrik (2006) and Schott (2008), Chinese exports are more sophisticated than suggested by their income level, and their competitive pressures are not the same as those of other countries with the same income per capita.

The evidence concerning the effect of Chinese manufacturing on other countries' manufacturing performance is thus mixed, with a strong focus on the impact of firm-level displacement competition. This paper contributes to this limited but growing literature by examining the 'crowding-out' effect or the 'catalytic' effect of China's industrialisation (import penetration) on the manufacturing performance of firms. Specifically, our empirical analysis explores the net effect of Chinese import penetration on firms' performance (productivity, employment and exports) in Belt and Road Initiative member countries. We combine firm-level data from the World Bank Enterprise Survey with industry-level Chinese import penetration data from UN COMTRADE to conduct a multi-level empirical analysis. Our results suggest a dominance of the GVC-integration effect over the displacement-competition effect, indicating that Chinese import penetration crowds out productivity and employment growth while increasing the export performance of firms in the BRI. However, the negative effect of Chinese manufacturing import penetration on productivity, in particular, is mitigated in firms that introduce innovations and use foreign license technologies.

This paper contributes to the literature in the following ways: first, our analysis includes 59 BRI member countries rather than one country, which has been the most common approach. Second, we contribute methodologically by introducing a multi-level model. The approach allows us to analyse both firm-level and industry-level determinants. Furthermore, we control for possible endogeneity between Chinese manufacturing imports and local manufacturing performance by analysing this relationship at the firm and industry levels. Firm-level analysis, where we control for firm heterogeneities, is found to minimise bias and measurement errors (Hou et al., 2021). This micro-meso level analysis is generally missing in the existing literature. Third, our analysis contributes through novel extensions to the baseline analysis, observing the indirect mechanism and splitting the sample by country income level and firm size.

The remaining sections of the paper are organised as follows: in Section 2, we present a brief review of China's internationalisation strategy in the context of the BRI. Section 3 discusses the data and develops our empirical strategy following the multi-level model literature. In Section 4, we report and discuss our results. Finally, we conclude the paper in Section 5.

2. Chinese internationalisation strategy: GVC-positioning and the Belt and Road Initiative

2.1 Overview

The emergence of China as a 'global factory' and leading world economy has led to a transformation and reorganisation of international production dynamics. China embraced the opportunities created by GVCs, by becoming the main centre of industrial activity in the globalised world (Moore, 2002). The rise of China as a manufacturing powerhouse has placed the country in a central and unprecedented position in the international division of labour, changing the configuration of the global economy. China plays a central role in international trade, foreign direct investment, and aid (Enevoldsen, 2016; Kaplinsky, 2006) but is still an upper-middle-income country.

Its recent prominent global position led the Chinese government to engage in a broad internationalisation strategy by developing South-South cooperation to create a value chain network in which the country occupies a central position. The case of Chinese economic internationalisation can be derived from the eclectic framework of international business (Dunning, 2000). This then observes the motives of a firm's internationalisation in its search for resources, markets, efficiency or strategic assets (Dunning, 2000). While efficiency-seeking is mainly related to developed countries, the focus is on R&D and design-related activities (Fu et al., 2020). One can understand the internationalisation of Chinese firms in the developing world by considering the composition of distinct strategies centred on, among others, **market seeking** and/or **GVC position seeking (**Kaplinski, 2006).

China has been actively increasing its emerging international role in the developing world. As of 2013, that effort accelerated with the implementation of the BRI initiative (Huang, 2016), which entails financing substantial investment projects in partner countries (De Soyres et al., 2019). It is one of the most ambitious projects in history (Tekdal, 2018).

Figure 1: Countries in the BRI.

Source: Own elaboration inspired by Development Reimagined.com (https://developmentreimagined.com/)

According to Han and Webber (2020), by formulating this South-South cooperation strategy, economic interactions with China are viewed as a significant opportunity for structural transformation among BRI member countries. Since the beginning of the BRI strategy in 2013, Chinese firms have made one in three infrastructural investments in Africa (Han & Webber, 2020). A trade relationship with China increases access to manufacturing intermediaries and final goods at lower prices. This could enable firms from BRI member countries the chance to break into the global economy. The literature refers to this as linking to the GVC while linking back to their domestic economies (Andreoni & Tregenna, 2020).

However, the growing trade relations with China have impacted the domestic manufacturing capabilities of developing economies. A **market-seeking displacement-competition effect** plays an important role where domestic manufacturing firms in developing economies are often unable to compete with Chinese imports. This negatively affects their performance, sometimes causing them to leave the market (Alvarez & Claro, 2009; Gallagher & Porzecanski, 2020; Paz, 2018; Iacovone et al., 2013; Doan et al., 2016; Andreoni & Torregianni, 2019). Alternatively, access to cheap inputs enhances the export capabilities of firms that are deeply integrated into global value chains (GVCs). A **GVC-integration effect** generates learning opportunities (De Marchi et al., 2018), upgrading (Sturgeon & Kawakami, 2011; Lee & Gereffi, 2021), and the relaxation of

financial and external constraints (Caggese & Cuñat, 2013; Reddy & Sasidharan, 2021). Furthermore, a strong partnership with China opens new sources of foreign direct investment (FDI), especially in infrastructure (Geda & Meskel, 2009).

Building on the discussion above, we explore the emerging academic literature that focuses on China's market-seeking strategy and its impact on the manufacturing performance of countries, particularly those in the developing world.

2.2 Chinese internationalisation strategy - market-seeking strategy

The Chinese economy opened in 1978, and since then it has been undergoing a constant and fast evolution, impacting its interaction with the rest of the world. Initially, Chinese growth was caused by a large inflow of foreign direct investment (FDI) from Japan and Western economies (Zhang, 2001). In the decades since 1978, China benefited from the emergence of GVCs which transformed the country into the centre of industrial activity in the globalised world (Moore, 2002). The rise of China as the world's centre of manufacturing positioned it at the heart of the international division of labour, significantly altering the configuration of the global economy. This leading role encouraged the Chinese government to pursue an aggressive internationalisation strategy.

Specifically, the market-seeking strategy entailed engaging with a partner to access its domestic market (Dunning, 2000). This approach frequently involves initiatives by firms from one country to penetrate the local market of the partner country, utilising increased trade and foreign direct investment (FDI). FDI is strategically employed to enhance the manufacturing capacity in the host country, capitalising on local market demand. The literature reveals that the market-seeking strategy is mainly geared towards trade dynamics. The expansion of Chinese manufacturing has facilitated the extensive exporting of Chinese products. This strategy serves a dual purpose: (a) tapping into the domestic demand of the partner economy, and (b) providing intermediary goods that influence the production chain (Gereffi & Frederick, 2010).

The literature increasingly focuses on how trade with China impacts the performance of manufacturing firms in developed countries, examining aspects, such as wage disparities, the composition of skilled labour, unemployment, and the enhancement of product quality. Key contributions to this field include studies by Acemoglu et al. (2016), Autor et al. (2013) and Balsvik et al. (2015). Other significant research explores the influence of trade flow on the prospects for learning and productivity growth, as well as the innovation performance of domestic firms. This literature includes foundational studies by Grossman and Helpman (1991) and Dollar (1992), alongside more recent analyses by Bloom et al. (2016), Fu (2005), Qiu and Zhan (2016) and Schiff and Wang (2006). In addition, the impact on domestic firms' innovation has been documented

by scholars, such as Autor et al. (2013), Bernard et al. (2006), Bloom et al. (2016) and Ebenstein et al. (2014). As mentioned by Doan et al. (2016), domestic firms suffer from the shrinkage of import competition in manufacturing plants (employment growth and the probability of exiting). However, they adjust to Chinese competition, changing the output mix toward export markets (Bernard et al., 2006). In this context, developing countries can move away from low-wage competition by adopting new production techniques or shifting towards more capital-intensive products. This strategy aligns with the findings of Andreoni and Torregiani (2019). The key insight is that observations from the literature concerning developed countries may not directly apply to developing economies (Hou et al., 2021). This discrepancy arises primarily because firms in developing countries often lack the capacity and resources to innovate and compete against similar imported products from China.

The literature on the market-seeking (trade) Chinese strategy and its firm-level impact is extensive for developed countries but rather limited for developing countries (Dong, 2017) despite recent important contributions. As mentioned by Hou et al. (2021), there are very few studies on the firm-level impact of bilateral trade, for instance, between Africa-South and Africa-North except for Elu et al. (2010), for instance.

Much of the research on developing countries examines the impact of Chinese competition on local firms, primarily using import penetration as a key explanatory variable. Notable studies across various regions illustrate these effects in Latin America, such as works by Alvarez and Claro (2009), Gallagher and Porzecanski (2020), Paz (2018), Iacovone et al. (2013), and Lall and Weiss (2005), in Asia, research by Doan et al. (2016) and Blásquez-Lidoy et al. (2007), and in Africa, studies by Morris and Einhorn (2008) and Andreoni and Torregianni (2019). These investigations explore several dimensions, including changes in firm size and employment, productivity enhancements (Kaplinsky & Morris, 2009), the risk of domestic firms exiting the market, labour market effects, such as wage premiums, and the impact on innovation and firms' innovative capabilities.

Blásquez-Lidoy et al. (2007) examine the impact of China's growth on trade and FDI flowing into Latin America at the industry level. In contrast, studies in Africa, such as those by Edwards and Jenkins (2013), He (2013), Kaplinsky and Morris (2009) and Amighini and Sanfilippo (2014), focus on the impact of trade on productivity at the sector level. However, firm-level analyses remain rare, highlighting a significant research gap that our paper aims to address. As Hou et al. (2021) noted, sector-level analysis can be overly aggregated, often overlooking specific impacts that are more accurately captured at the firm level. Firm-level analysis also reduces bias and measurement errors by controlling for firm-specific heterogeneities. In addition, empirical

studies quantifying China's effects on its Belt and Road Initiative (BRI) partners are notably scarce, presenting another area our research seeks to contribute to.

3. Methodology

3.1 Description of data and variables

We combine data sources from two different databases, namely firm-level data from the World Bank's Enterprise Survey (WBES) and industry-level data from the United Nations Commodity Trade (Comtrade) Statistics Database.

The WBES is a cross-country firm-level survey conducted by the World Bank in 151 countries which included about 174,000 firms. These surveys use nationally representative samples based on size, location, and industry stratifications. Given that this paper focuses on countries in the Belt and Road Initiative, we employ the most recent WBES data for 59 countries from 2011 to 2020. Our analysis employs all firm-level variables from the WBES across manufacturing subsectors.

We obtained data from the UN Comtrade database on manufacturing exports from China for each country considered. The UN Comtrade database provides trade data for over 200 countries, with detailed import and export data categorised using the Harmonized System (HS) and the Standard International Trade Classification (SITC). The Chinese manufacturing export data is from 1962, with values converted to US dollars and metric units. Given that the WBESs were conducted in specific years for specific countries, we obtained trade data to match the years of the WBES for each country (See Table A.2 in the appendix for a list of countries and years of the WBES).

We merged the firm-level data from the ES and the industry-level manufacturing export data from the UN Comtrade. We then matched the manufacturing sectors classified with the ISIC Rev.3.1 in the WBES to each commodity classified, based on the SITC2 codes in the trade data. For this, we used product concordance tables obtained from the World Integrated Trade Solution (WITS) database. Table 1 presents the descriptive statistics and sources of all firm-level and industry-level variables obtained from the ES and the UN Comtrade databases. Table A3 in the appendix shows the complete definitions of all variables.

Table 1: Descriptive statistics

Variable	count	mean	sd	min	max	Source
Chinese manufacturing import penetration	7,761	4.936	5.336	2.50E-11	21.003	UN Comtrade
Productivity growth (log)	7,761	0.170	1.296	-14.326	18.407	WBES
Employment growth (log)	7,761	0.076	0.368	-3.861	3.730	WBES
Export (%)	2, 234	42.283	29.194	1	99	WBES
Innovation	7,761	0.632	0.482	0	1	WBES

Total sales (last year, log)	7,761	16.456	3.117	0.000	28.839	WBES
Cost of labour (log)	7,761	14.693	2.764	1.099	25.351	WBES
Age (log)	7,761	5.752	1.430	0.000	10.617	WBES
% workers completed high school	7,761	55.534	37.749	0.000	100.000	WBES
Experience of top manager (log)	7,761	2.813	0.668	0.693	4.248	WBES
Foreign licenced technology	7,761	0.847	0 .359	0	1	WBES
Lack of transport	7,761	0.674	0.267	0	1	WBES
Access finance	7,761	0.716	0.252	0	1	WBES
Tax rates	7,761	0.776	0.222	0	1	WBES
Licensing	7,761	0.577	0.294	0	1	WBES
Political instability	7,761	0.725	0.297	0	1	WBES
Corruption	7,761	0.696	0.288	0	1	WBES
Inadequate workforce	7,761	0.695	0.249	0	1	WBES
Size of locality	7,761			1	5	WBES
Industry	7,761			1	17	WBES
Year	7,761			2011	2020	WBES
Country	7,761			1	59	WBES

3.2 Empirical strategy

This paper explores the impact of Chinese manufacturing imports on the performance of manufacturing firms in Belt and Road Initiative (BRI) countries. As detailed in Section 1, the empirical literature recognises a bi-directional causality between firm performance and manufacturing imports. Increased manufacturing imports can enhance productivity by enabling firms to access more advanced capital goods. In addition, higher imports may bolster export performance by allowing firms to procure cheaper intermediate goods, facilitating the production of competitively priced products for international markets. Conversely, a rise in domestic production or productivity can stimulate the entry of local firms, potentially leading to the substitution of foreign manufacturing imports with domestic alternatives.

We employ a multi-level modelling approach for two reasons: first, it allows us to control for firm- and industry-level factors affecting firms' performance; second, it enables us to account for a possible bidirectional relationship between domestic firms' performance and manufacturing imports from China.[3] To do so, we use our Chinese import variable at the industry level, with the dependent variable measures of performance at the firm level, to account for possible bidirectional causality due to the differences in level.

[3] An advantage of a multi-level approach is that it assumes a hierarchical or clustered structure that allows one to capture and control clustering of our sample at different levels (Hox et al., 2017; Hox & Roberts, 2011).

To estimate the effect of Chinese manufacturing imports on the performance of manufacturing firms in BRI countries, our paper utilises a two-level multi-level data structure where firms are nested within industries. Formally:

$$Performance_{ij} = \beta_{0j} + \beta_{1j}X_{ij} + \beta_{2j}X_{qj} + \beta_{3j}X_j + \beta_{4j}X_t + \mu_{ij} + \rho_{qj} \quad (1)$$

$Performance_{ij}$ is a vector measuring the domestic manufacturing firm performance in firm i in country j. We employ labour productivity growth, employment growth and export performance (percentage of total exports) as firm performance variables. X_{ij} is based on the empirical literature, defined as a vector of all firm-level factors that influence the manufacturing performance of firms across countries. X_{qj} represents Chinese manufacturing imports penetration, measured as the total value of Chinese manufacturing imports in industry q in country j divided by the total value of domestic sales in industry q in country j. X_{jt} captures the years of the data used in country j in time t. β_{0j} is assumed to vary across industries while μ_{ij} and ρ_{qj} are the random parts capturing the firm and industry-level error terms, respectively. μ_{ij} is assumed to be normally distributed with zero mean and a constant variance while ρ_{qj} is assumed to be multivariate, normally distributed with a zero mean and independent of μ_{ij}.

To measure the level of correlation within industry and country clusters (Hox & Roberts, 2011; Maas & Hox, 2005), we compute the intra-class correlation as follows:

$$\rho = Corr\,(v^*_{ij}, v^*_{i'j}) = \frac{\gamma^2}{\gamma^2+\theta^2} \quad (2)$$

where ρ captures the correlation between firms within the same industry and country or the proportion of the variance that is explained by the hierarchical or multi-level data structure. θ^2 measures the variance of the random error term τ_j while γ^2 is standard in multi-level analysis, defined as $\frac{\pi^2}{3}$, where π is approximately 3.14159 or 22/7. If ρ>0, it suggests that there is a correlation between firms in the same industry and country and that there is a lack of independence across observations (Maas & Hox, 2005).

4. Results and discussion

We present and analyse estimation results from both ordinary least squares (OLS) and multi-level models to evaluate three key indicators of manufacturing firm performance, namely growth in labour productivity, employment growth, and the percentage of total exports. Section 4.1 details the baseline results, providing an initial assessment and discussion. Subsequently, Section 4.2 explores various extensions to our baseline model, discussing the implications and additional insights these variations offer.

4.1 Effects of Chinese manufacturing import penetration on firm performance: Baseline results

Table 2 presents the baseline results showing the effect of Chinese manufacturing import penetration on firm performance within BRI countries for both OLS and multi-level approaches. The consistency across the results from the OLS model (Columns 1, 2 and 3) and the multi-level approach (Columns 4, 5 and 6) underscores the robustness of our results.[4] Given that our variable of interest, Chinese manufacturing import penetration, is measured across the industry q in country j, we argue that firms are nested within their respective industries. As a result, and for interpretative clarity, we focus on the multi-level analyses across all measures of firm performance.

Column 4 of Table 2 presents the estimation results for labour productivity using a multi-level approach. The findings indicate that Chinese import penetration significantly and negatively impacts productivity growth within firms in the Belt and Road Initiative (BRI) countries. This adverse effect most likely arises from displacement caused by competitive pressures associated with manufacturing imports from China, echoing the observations made by Amighini and Sanfilippo (2014) and Hou et al. (2021). This finding also aligns with the evidence that China's manufacturing exports are increasingly technologically complex compared to its per capita income (Rodrik, 2006; Schott, 2008). The exports consist mainly of final consumption goods, creating a distinct competitive landscape within BRI countries.

Regarding employment growth, the negative coefficient in Column 5 indicates a negative effect of Chinese import penetration on job growth within firms. This suggests that the increased competition from Chinese manufacturing imports leads to workforce reductions or slower hiring rates within BRI countries. This pattern aligns with the displacement effect hypothesis, where domestic firms may struggle to compete with the influx of Chinese goods, and as a result, streamline their operations or exit the market in response to the import competition, leading to labour market adjustments.

In contrast, Column 6 reveals a strong and positive effect of Chinese manufacturing imports on the export performance of firms, supporting the notion that China's GVC-position-seeking strategy effectively enhances BRI countries' export capacities. This reflects a savvy integration into the GVCs, where strategic positioning can be instrumental for economies to capitalise on the new wave of industrialisation (Gereffi, 2018). China's concerted efforts to secure a central role in

[4] Note that the firm samples differ for the regressions with productivity growth and exports as dependent variables, since the export regressions are restricted to firms that export. Since there are likely to be relevant differences in characteristics between exporting firms and non-exporting firms, the results are not directly comparable.

GVC networks, as articulated in its 13th and 14th five-year plans, play into this dynamic. Thus, while import penetration may present challenges for domestic production, it concurrently catalyses firms in BRI countries to avoid domestic market competition by pivoting towards exports and integration into global value chains ('escape competition' hypothesis) as an alternative strategy for firm growth, in line with Melitz (2003).

The other control variables indicate that innovation boosts firm performance through quality products and efficiency both domestically and internationally, echoing the consensus in the literature, emphasising the importance of innovation for firm competitiveness and performance (Fernández-Mesa & Alegre, 2015; Kafouros et al., 2008; Melitz, 2003; Van Beveren & Vandenbussche, 2010). Labour costs are positively correlated with productivity, revealing that higher costs generate higher productivity benefits. Firm size (proxied by lagged total sales) is positively linked to export propensity but harms productivity and employment, implying positive gains only when firms diversify internationally. Older firms and firms with experienced managers show a negative association with employment growth, while older firms are more productive. Financial constraints significantly hinder firms' productivity capabilities while increasing employment growth. Firms that use foreign-licensed technologies which consistently and positively affect productivity and export performance, are most likely generated through improved efficiency and product quality improvements.

In summary, the findings indicate that Chinese manufacturing imports exert a complex effect on the performance of firms within Belt and Road Initiative (BRI) countries. These results have significant policy implications for how firms adapt and remain competitive in an increasingly globalised international market where China plays a dominant role in global manufacturing exports.

Table 2: Effects of Chinese manufacturing import penetration on firm performance – baseline results

	(1)	(2)	(3)	(4)	(5)	(6)
	Ordinary Least Squares (OLS)			Mixed Two-level model with robust SE		
	Productivity	Employment	Export	Productivity	Employment	Export
Chinese manuf. import penetration	-0.024***	-0.001	0.672**	-0.066***	-0.002**	0.186***
	(0.007)	(0.001)	(0.313)	(0.017)	(0.001)	(0.082)
Innovation	0.029**	0.058***	0.264***	0.024*	0.033***	0.117***
	(0.012)	(0.011)	(0.008)	(0.012)	(0.010)	(0.040)
Total sales (log) lagged 3	-0.490***	-0.011**	0.214**	-0.510***	-0.017***	0.651***
	(0.039)	(0.004)	(0.045)	(0.037)	(0.004)	(0.035)
Cost of labour (log)	0.372***	0.019***	0.153	0.367***	0.005	0.415
	(0.039)	(0.006)	(0.769)	(0.038)	(0.005)	(0.717)
Age (log)	0.051***	-0.025***	-0.157	0.048***	-0.028***	-0.162
	(0.013)	(0.003)	(0.649)	(0.013)	(0.004)	(0.585)
% FT Workers High School	0.000	0.000	-0.073**	0.000	0.000	-0.064**
	(0.001)	(0.000)	(0.034)	(0.000)	(0.000)	(0.031)
Top Manager Experience (log)	-0.006	-0.024**	-0.595	0.002	-0.022**	-0.226
	(0.018)	(0.011)	(0.702)	(0.022)	(0.010)	(0.809)
Foreign licensed technology	0.184***	0.031*	0.826***	0.203***	0.018	0.305***
	(0.056)	(0.015)	(1.159)	(0.050)	(0.014)	(0.046)
Transport	0.256**	-0.000	-0.606	0.165*	-0.010	-0.952
	(0.109)	(0.027)	(3.510)	(0.086)	(0.028)	(3.217)
Finance	-0.245**	0.047	0.099	-0.180**	0.066**	0.171
	(0.096)	(0.028)	(2.922)	(0.089)	(0.030)	(2.988)
Tax rates	0.151*	0.063**	0.311	0.116	0.063**	0.814
	(0.080)	(0.029)	(4.289)	(0.082)	(0.027)	(4.507)
Licensing	-0.152	-0.009	-0.861	-0.124	-0.006	-0.868
	(0.090)	(0.020)	(3.936)	(0.084)	(0.017)	(4.367)
Political Instability	0.145***	-0.062	0.841**	0.185***	-0.060*	0.239**
	(0.044)	(0.036)	(0.447)	(0.053)	(0.035)	(0.143)
Corruption	0.039	0.016	-0.316	0.051	0.018	-0.185**
	(0.045)	(0.032)	(4.210)	(0.046)	(0.025)	(0.068)
Inadequate Workforce	-0.092	-0.064**	2.251	-0.097	-0.068***	1.083
	(0.070)	(0.028)	(3.292)	(0.068)	(0.024)	(3.271)
Constant	1.049**	0.464*	35.631	2.992***	0.561***	52.333***
	(0.423)	(0.220)	(23.139)	(0.523)	(0.101)	(9.391)
lns1_1_1 constant				-1.440***	-4.208***	1.924***

				(0.159)	(0.361)	(0.219)
lnsig_e constant				-0.029	-1.039***	3.271***
				(0.038)	(0.049)	(0.026)
Observations	7761	7446	2234	7761	7446	2234

Note: All regressions include all control variables shown in Table 3 including year and country fixed effects. Standard errors in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

4.2 Extensions

This section presents our extended estimation results from the multi-level analyses when introducing interaction terms to explain possible indirect mechanisms and the split sample analyses focusing on productivity only by country income and firm size.

To explore the indirect mechanisms by which Chinese manufacturing import penetration influences firm performance, we have incorporated interaction terms related to foreign technology licensing and innovation in Table 3.[5] Our analyses seek to understand the effect that may occur when domestic products, purported to be of higher quality, replace Chinese imports. In such scenarios, we anticipate either a moderating effect on negative consequences or an amplification of positive outcomes related to Chinese manufacturing products on firm performance, as posited by Paz (2018) and Edward and Jenkins (2013). Moreover, foreign technology licenses are presumed to engender learning effects and broaden market access for firms, potentially countering the detrimental effects of Chinese import penetration on firm performance (Torregiani & Andreoni, 2019).

The results in Table 3 indicate that firms utilising international technology licenses and innovation can better mitigate the negative effect of Chinese import penetration on firm productivity, as shown in Columns 1 and 2. Firms that use foreign-licensed technologies tend to be shielded from a decline in productivity resulting from Chinese manufacturing import competition compared to their counterparts lacking such licenses, suggesting less complex internal capabilities (Laursen et al., 2010). In addition, innovative firms appear to buffer the adverse effects of import penetration, most likely through product differentiation and higher value-added services. These are more resilient against the displacement effects stemming from Chinese competition (Yamashita & Yamaguchi, 2020; Torregiani & Andreoni, 2019). The discussion highlights the critical importance of licensing and innovation in leveraging Chinese manufacturing import competition as a catalyst for adopting new technologies or processes and enhancing their productivity.

[5] In Table 3, we only report our variables of interest given that all controls remain similar to Table 2 in terms of signs and significance.

Innovation and foreign-licensed technologies have no discernible indirect effect on employment and exports. Although the indirect mechanisms are not statistically significant for exports, innovation and licensing appear to enhance the positive influence of Chinese import penetration on the export share, consistent with the findings of Wakelin (1998). Our conclusions agree with others' research, such as Lachenmaier and Wößman (2006) using German data. The effect of Chinese manufacturing import penetration on employment is weak, indicating that while such imports influence productivity and exports, they do not significantly impact job creation or reduction within firms.

Table 3: Effects of Chinese manufacturing import penetration on firm performance with interaction terms

	Mixed two-level model with robust SE					
	(1)	(2)	(3)	(4)	(5)	(6)
	Productivity		Employment		Export	
Chinese manuf. import penetration	-0.109***	-0.076***	-0.003	-0.002**	0.933*	0.169***
	(0.021)	(0.016)	(0.005)	(0.001)	(0.502)	(0.099)
Import penetration*Licence	0.023*		0.001		0.145	
	(0.012)		(0.003)		(0.161)	
Import penetration*Innovation		0.016***		0.000		0.042
		(0.006)		(0.001)		(0.124)
Innovation	0.023*	0.105***	0.037***	0.037**	0.002***	0.796***
	(0.013)	(0.031)	(0.011)	(0.017)	(0.000)	(0.063)
Foreign licensed technology	-0.300***	-0.203***	-0.035**	-0.032**	-4.142***	-3.523***
	(-0.055)	(-0.05)	(-0.015)	(-0.015)	(-1.53)	(-1.041)
Constant	3.412***	1.152**	0.365***	0.473**	16.656	53.126***
	(0.738)	(0.462)	(0.128)	(0.217)	(22.524)	(10.322)
All controls	Yes	Yes	Yes	Yes	Yes	Yes
lns1_1_1 constant	-1.438***	-1.454***	-3.958***	-3.960***	1.934***	1.937***
	(0.158)	(0.161)	(0.308)	(0.309)	(0.187)	(0.186)
lnsig_e constant	-0.030	-0.030	-1.031***	-1.031***	3.266***	3.266***
	(0.037)	(0.038)	(0.045)	(0.045)	(0.025)	(0.025)
Observations	7761	7761	7446	7446	2234	2234

Note: All regressions include all control variables shown in Table 3, including year and country fixed effects. Standard errors in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 4 presents the econometric results showing the effect of Chinese manufacturing import penetration on firm productivity, stratified by low, middle, and high-income country levels. It reveals a particularly stark, significant negative effect on the productivity growth of firms in middle-income countries. This finding suggests that middle-income countries are most vulnerable to Chinese manufacturing imports; this is most likely due to their level of industrial

development, which is neither niche enough to avoid direct competition nor advanced and large enough to leverage economies of scale, hence experiencing heightened productivity losses.

Considering the interaction terms, our results show that interactions between import penetration, licensing and innovation, buffer the negative effect on firms in middle-income countries. The foregoing clarifies our baseline results, suggesting that middle-income countries drive the observed baseline results.

Table 4. Impact of Chinese import penetration on firm productivity across income levels

	Mixed two-level model with robust SE								
	Productivity growth								
	Low			Middle			High		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Chinese manuf. import penetration	-0.021	-0.030	-0.010	-0.086***	-0.151***	-0.098***	-0.011***	-0.003	-0.008*
	(0.017)	(0.027)	(0.020)	(0.021)	(0.026)	(0.019)	(0.003)	(0.007)	(0.005)
Import penetration * Licence		0.005			0.034**			-0.004	
		(0.014)			(0.016)			(0.004)	
Import penetration *Innovation			0.015			0.021***			0.005
			(0.020)			(0.007)			(0.004)
Innovation	0.195***	0.195***	0.172***	0.004	0.203***	0.111**	0.347***	0.347***	0.317***
	(0.059)	(0.059)	(0.064)	(0.022)	(0.022)	(0.046)	(0.038)	(0.039)	(0.035)
Foreign licensed technology	0.073	0.082	0.073	0.214***	0.372***	0.213***	0.113**	0.095*	0.114**
	(0.086)	(0.087)	(0.086)	(0.060)	(0.061)	(0.059)	(0.045)	(0.050)	(0.046)
Constant	1.823***	1.823***	1.352***	3.273***	4.682***	4.966***	0.854**	0.847**	0.851**
	(0.402)	(0.401)	(0.409)	(0.547)	(0.972)	(0.769)	(0.336)	(0.330)	(0.335)
All controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
lns1_1_1 constant	-1.901***	-1.902***	-1.909***	-1.193***	-1.191***	-1.209***	-2.837***	-2.880***	-2.767***
	(0.271)	(0.274)	(0.266)	(0.153)	(0.151)	(0.156)	(0.800)	(0.904)	(0.683)
lnsig_e constant	-0.027	-0.027	-0.027	0.006	0.004	0.005	-0.790***	-0.790***	-0.791***
	(0.068)	(0.068)	(0.067)	(0.043)	(0.042)	(0.043)	(0.106)	(0.106)	(0.106)
Observations	635	635	635	6110	6110	6110	1016	1016	1016

Table 5 presents the results of a detailed investigation into how Chinese manufacturing import penetration affects firms of different sizes, namely small and medium enterprises (SMEs) (<5 and <=99) and large firms (>=100) and the possible indirect mechanisms at play. SMEs are examined in Columns 1, 2 and 3, while large firms are analysed in Columns 4, 5 and 6.

The evidence indicates a substantial negative effect of Chinese import penetration on productivity growth for both SMEs and large firms. This finding extends our previous observations and introduces a nuanced view of the effect of Chinese import penetration. The interaction terms between Chinese import penetration, and licensing and innovation appear to temper the negative effect of Chinese import penetration for SMEs. This suggests that SMEs are somewhat better able to counteract the adverse effects of Chinese imports through innovation and licensing, most likely due to their dynamism. SMEs may adapt and mitigate the competitive challenges posed by Chinese imports through strategic business practices and technology adoption to sustain competitiveness and productivity amidst global trade dynamics.

Table 5: Effect of Chinese import penetration on performance by size of firms

	Mixed two-level model with robust SE					
	Productivity growth					
	(1)	(2)	(3)	(4)	(5)	(6)
	SME (<5 and <=99)			Large (>=100)		
Chinese manuf. import penetration	-0.062***	-0.106***	-0.069***	-0.069***	-0.092**	-0.083***
	(0.019)	(0.027)	(0.019)	(0.015)	(0.040)	(0.025)
Import penetration * Licence		0.023*			0.013	
		(0.014)			(0.019)	
Import penetration*Innovation			0.013**			0.025
			(0.006)			(0.023)
Innovation	0.003***	0.003***	0.263***	0.042***	0.042***	0.250***
	(0.004)	(0.004)	(0.043)	(0.008)	(0.008)	(0.009)
Foreign licensed technology	0.211***	0.315***	0.211***	0.135*	0.188***	0.132*
	(0.048)	(0.053)	(0.048)	(0.072)	(0.064)	(0.071)
Constant	5.445***	5.571***	5.450***	4.063***	4.079***	4.072***
	(0.654)	(0.670)	(0.649)	(1.286)	(1.297)	(1.263)
All controls	Yes	Yes	Yes	Yes	Yes	Yes
lns1_1_1 constant	-1.451***	-1.453***	-1.463***	-1.690***	-1.695***	-1.717***
	(0.175)	(0.175)	(0.179)	(0.301)	(0.301)	(0.309)
lnsig_e constant	-0.030	-0.030	-0.030	-0.105	-0.105	-0.106
	(0.042)	(0.041)	(0.041)	(0.099)	(0.098)	(0.097)
Observations	5828	5828	5828	1933	1933	1933

Note: All regressions include all control variables shown in Table 3, including year and country fixed effects. Standard errors in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

4.3 Robustness check

To check the robustness of our results, we implemented several varied approaches using a different measure of Chinese import penetration to import penetration ratio. We estimated the ordinary least squares (OLS) and the mixed two-level model with robust standard errors (SE) to further check the reliability of our baseline results. Table 6 shows that the import penetration ratio has a consistent and negative effect on productivity and employment and a positive effect on export performance. These results align with our baseline findings and reinforce the earlier findings that an increase in Chinese manufacturing import penetration is associated with decreased productivity and employment growth while enabling firms to better integrate into global markets through exports.

Table 6: Robustness check

	Mixed two-level model with robust SE					
	Ordinary Least Squares (OLS)			Mixed two-level model with robust SE		
	(1)	(2)	(3)	(4)	(5)	(6)
	Productivity	Employment	Export	Productivity	Employment	Export
Chinese import penetration ratio	-0.404***	-0.008	0.139***	-0.646***	-0.034***	0.943***
	(0.121)	(0.029)	(0.076)	(0.133)	(0.009)	(0.048)
Innovation	0.016	0.053***	0.585***	0.107***	0.045***	0.833***
	(0.038)	(0.007)	(0.065)	(0.040)	(0.009)	(0.096)
Total sales (log) lagged 3	-0.501***	-0.010*	1.038	-0.514***	-0.013**	1.592***
	(0.056)	(0.006)	(0.640)	(0.054)	(0.006)	(0.445)
Cost of labour (log)	0.352***	0.022***	0.594	0.358***	0.016***	0.708
	(0.039)	(0.006)	(0.769)	(0.038)	(0.005)	(0.717)
Age (log)	0.087***	-0.031***	-1.853***	0.079***	-0.031***	-1.554***
	(0.016)	(0.005)	(0.585)	(0.015)	(0.005)	(0.536)
% FT Workers High School	0.001*	-0.000**	-0.127***	0.001*	-0.000**	-0.094***
	(0.001)	(0.000)	(0.041)	(0.001)	(0.000)	(0.027)
Top manager experience (log)	-0.023	-0.015	-0.599	-0.020	-0.016*	-1.383*
	(0.033)	(0.008)	(0.806)	(0.032)	(0.008)	(0.820)
Foreign licensed technology	0.121***	0.008	0.402***	0.137***	0.008	0.139***
	(0.037)	(0.007)	(0.041)	(0.032)	(0.008)	(0.030)
Transport	0.192	0.006	-6.096	0.124	0.004	-2.633
	(0.136)	(0.028)	(4.257)	(0.131)	(0.030)	(3.623)
Finance	-0.210**	0.034	-3.951	-0.222**	0.036	-5.007**
	(0.095)	(0.022)	(2.422)	(0.098)	(0.022)	(2.337)
Tax rates	0.309***	0.029	0.121	0.251***	0.029	0.131
	(0.080)	(0.044)	(3.963)	(0.075)	(0.045)	(3.575)
Licensing	-0.114	-0.017	-0.465	-0.106	-0.011	-2.835
	(0.135)	(0.034)	(3.901)	(0.116)	(0.031)	(4.671)
Political instability	0.090	-0.029	10.540***	0.139	-0.028	9.036***
	(0.114)	(0.045)	(2.644)	(0.111)	(0.042)	(3.099)
Corruption	0.153	-0.027	-6.812*	0.166*	-0.027	-6.475**
	(0.103)	(0.036)	(3.375)	(0.097)	(0.039)	(3.216)
Inadequate workforce	-0.193	-0.027	5.480	-0.133	-0.023	1.930

	(0.126)	(0.035)	(3.209)	(0.124)	(0.032)	(3.407)
Constant	3.021***	0.354***	47.074**	3.350***	0.280***	7.957
	(0.500)	(0.098)	(19.343)	(0.516)	(0.107)	(27.733)
lns1_1_1 constant				-1.854***	-4.087***	2.295***
				(0.203)	(0.260)	(0.143)
lnsig_e constant				-0.082*	-1.194***	3.320***
				(0.043)	(0.093)	(0.049)
Observations	3133	3133	3184	3133	3133	3184

Note: All regressions include all control variables shown in Table 3, including year and country fixed effects. Standard errors in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

5. Conclusion

Over recent decades, China has emerged as a pivotal player in global trade. Its formidable manufacturing capacity has significantly reshaped its interactions with the global economy, presenting challenges and opportunities for other developing nations. This paper investigates the impact of Chinese manufacturing imports on the performance of manufacturing firms in countries associated with the Belt and Road Initiative (BRI). We analysed data from 59 BRI countries from 2011 to 2020 and conducted multi-level analyses using firm- and industry-level explanatory variables. Our findings are further enhanced by several methodological extensions, including introducing interaction terms (such as innovation and foreign technology licenses) to explore potential indirect effects and segmented sample analyses differentiated by country income and firm size.

Our analyses reveal that the influx of Chinese manufacturing imports has mixed effects on the performance of manufacturing firms within BRI countries; it negatively affects domestic productivity and employment growth whilst boosting export performance. These findings support the notion that for Belt and Road Initiative (BRI) countries, engaging more deeply with China does not solely lead to the market-seeking displacement-competition effect and the pursuit of more substantial positions within the global value chain (GVC). In addition, our results show that innovation and licensing within firms act as mitigating factors against the negative effect of Chinese manufacturing imports on productivity, fostering a more beneficial integration into the GVC, particularly in middle-income countries and small and medium-sized firms. These suggest that with the right strategies, the adverse aspects of import penetration can be offset, leading to a scenario where both China and its BRI partners can achieve mutual growth and stronger international ties.

Therefore, a crucial policy implication for Belt and Road Initiative (BRI) countries, especially those developing, is capitalising on the opportunities arising from China's strategy to enhance its position within the global value chain (GVC). While integration with China presents a potential

gateway for entering GVCs, this process is neither automatic nor guaranteed to yield benefits without strategic intervention. Central to harnessing these opportunities is the role of mediation through innovation and licensing. Domestic firms must build their capacity to absorb new technologies and technological practices, enabling them to shield themselves from import competition and to learn and advance through international integration. Consequently, industrial policies should aim to facilitate integration with China by bolstering local manufacturing competencies. This approach involves transforming manufacturing inputs from China, importing capital goods for domestic benefit, and fostering a culture of learning and adaptation, enabling seamless integration into global value chains.

This research could be extended in several directions. A limitation of our analysis is that our firm-level dataset is a cross-section. A first possibility is to build panel data that would allow one to observe the dynamic effects of Chinese manufacturing imports on firm performance in BRI countries. Another way of building on this paper would be to examine the role of FDI from China on performance at the firm and sectoral levels. The BRI is a programme focused chiefly on investments (FDI), especially those related to infrastructure, as well as investments from China that influence the productive structure and export pattern of many developing economies in Africa, Asia, and Latin America, especially in specific sectors. Finally, to analyse the composite effects of trade and FDI under the BRI in a more unified framework.

References

Acemoglu, D., Autor, D., Dorn, D., Hanson, G.H., & Price, B. (2016). Import competition and the great US employment sag of the 2000s. *Journal of Labor Economics*, *34*(S1), S141-S198.

Álvarez, R., & Claro, S. (2009). David versus Goliath: The impact of Chinese competition on developing countries. *World Development*, *37*(3), 560-571.

Amendolagine, V., Presbitero, A.F., Rabellotti, R., & Sanfilippo, M. (2019). Local sourcing in developing countries: The role of foreign direct investments and global value chains. *World Development*, *113*, 73-88.

Amighini, A., & Sanfilippo, M. (2014). Impact of South–South FDI and trade on the export upgrading of African economies. *World Development*, *64*, 1-17.

Andreoni, A., & Tregenna, F. (2020). Escaping the middle-income technology trap: A comparative analysis of industrial policies in China, Brazil and South Africa. *Structural Change and Economic Dynamics*, *54*, 324-340.

Autor, D., Dorn, D., & Hanson, G. (2013). The China Syndrome: Local Labor Market Effects of Import Competition in the United States. *American Economic Review*, *103*(6), 2121–68.

Balsvik, R., Jensen, S., & Jensen, K. (2015). Made in China, Sold in Norway: Local Labor Market Effects of an Import Shock. *Journal of Public Economics*, *127*: 137–44.

Bernard, A.B., Eaton, J., Jensen, J.B., & Kortum, S. (2003). Plants and productivity in international trade. *American Economic Review*, *93*(4), 1268-1290.

Bernard, A.B., Jensen, J.B., & Schott, P.K. (2006). Trade costs, firms and productivity. *Journal of Monetary Economics*, *53*(5), 917-937.

Blázquez-Lidoy, J., Rodríguez, J., & Santiso, J. (2006). *Angel or devil? China's trade impact on Latin American emerging markets*. OECD Publishing.

Bloom, N., Draca, M., & Van Reenen, J. (2016). Trade induced technical change? The impact of Chinese imports on innovation, IT and productivity. *The Review of Economic Studies*, *83*(1), 87-117.

Blyde, J.S., & Fentanes, O. (2019). *The heterogeneous impacts of import competition on Mexican manufacturing plants* (No. IDB-WP-01087). IDB Working Paper Series.

Caggese, A., & Cuñat, V. (2013). Financing constraints, firm dynamics, export decisions, and aggregate productivity. *Review of Economic Dynamics*, *16*(1), 177-193.

Dang, D.A. (2017). *The effects of Chinese import penetration on firm innovation: Evidence from the Vietnamese manufacturing sector* (No. 2017/77). WIDER Working Paper.

De Hoyos, R.E., & Iacovone, L. (2013). Economic performance under NAFTA: a firm-level analysis of the trade-productivity linkages. *World Development*, *44*, 180-193.

De Marchi, V., Giuliani, E., & Rabellotti, R. (2018). Do global value chains offer developing countries learning and innovation opportunities? *The European Journal of Development Research*, *30*, 389-407.

De Soyres, F., Mulabdic, A., Murray, S., Rocha, N., & Ruta, M. (2019). How much will the Belt and Road Initiative reduce trade costs? *International Economics*, *159*, 151-164.

Doan, T., Nguyen, S., Tran, T., Vu, H., & Steven. L. (2016). Does Rising Import Competition Harm Local Firm Productivity in Less Advanced Economies? Evidence from Vietnam's Manufacturing Sector. *Journal of International Trade and Economic Development*, *25*(1), 23–46.

Dollar, D. (1992). Outward-oriented developing economies really do grow more rapidly: evidence from 95 LDCs, 1976-1985. *Economic Development and Cultural Change*, *40*(3), 523-544.

Dunning, J.H. (2000). The eclectic paradigm as an envelope for economic and business theories of MNE activity. *International Business Review*, *9*(2), 163-190.

Ebenstein, A., Harrison, A., & McMillan, M. (2014). Why Are American Workers Getting Poorer? China, Trade and Offshoring. *Unpublished Manuscript.*

Edwards, L., & Jenkins, R.O. (2013). *The competitive effects of China on the South African manufacturing sector*. Development Policy Research Unit, University of Cape Town.

Edwards, L., & Jenkins, R. (2015). The Impact of Chinese Import Penetration on the South African Manufacturing Sector. *Journal of Development Studies*, *51*(4), 447–63.

Elu, J.U., Gregory, N., & Price, G.N. (2010). Does China transfer productivity enhancing technology to Sub-Saharan Africa? Evidence from manufacturing firms. *African Development Review, 22* (1), 587–598.

Enevoldsen, P. (2016). Onshore wind energy in Northern European forests: Reviewing the risks. *Renewable and Sustainable Energy Reviews*, *60*, 1251-1262.

Fernández-Mesa, A., & Alegre, J. (2015). Entrepreneurial orientation and export intensity: Examining the interplay of organisational learning and innovation. *International Business Review*, *24*(1), 148-156.

Fransman, M. (1984). Technological capability in the Third World: an overview and introduction to some of the issues raised in this book. *Technological capability in the Third World*, 3-30.

Fu, X. (2005). Exports, technical progress and productivity growth in a transition economy: a non-parametric approach for China. *Applied Economics*, *37*(7), 725-739.

Fu, X., Buckley, P.J., & Fu, X.M. (2020). The growth impact of Chinese direct investment on host developing countries. *International Business Review*, *29*(2), 101658.

Fu, X., Li, J., Xiong, H., & Chesbrough, H. (2014). Open innovation as a response to constraints and risks: evidence from China. *Asian Economic Papers*, *13*(3), 30-58.

Gallagher, K., & Porzecanski, R. (2020). *The dragon in the room*. Stanford University Press.

Gampfer, B., & Geishecker, I. (2019). Chinese competition: intra-industry and intra-firm adaptation. *Review of World Economics*, 155(2), 327-352.

Geda, A., & Meskel, A.G. (2009). Impact of China-Africa Investment Relations: Case Study of Ethiopia.

Gereffi, G. (2018). *Global value chains and development: Redefining the contours of 21st century capitalism*. Cambridge University Press.

Gereffi, G., & Frederick, S. (2010). *The global apparel value chain, trade and the crisis: challenges and opportunities for developing countries*. The World Bank.

Grossman, G.M., & Helpman, E. (1991). Trade, knowledge spillovers, and growth. *European Economic Review*, *35*(2-3), 517-526.

Habiyaremye, A., & Raymond, W. (2013). *Transnational corruption and innovation in transition economies.* UNU-MERIT Working Paper Series Number 050: Maastricht. http://collections.unu.edu/eserv/UNU:81/wp2013-050.pdf

Han, X., & Webber, M. (2020). From Chinese dam building in Africa to the Belt and Road Initiative: Assembling infrastructure projects and their linkages. *Political Geography*, *77*, 102102.

Hou, J., Fu, X., & Mohnen, P. (2021). The impact of China–Africa trade on the productivity of African

firms: evidence from Ghana. *The European Journal of Development Research*, 1-28.

Hox, J.J., Moerbeek, M., & Van de Schoot, R. (2017). *Multi-level analysis: Techniques and applications*. Routledge.

Hox, J., & Roberts, J.K. (Eds.). (2011). *Handbook of advanced multi-level analysis*. Psychology Press.

Huang, Y. (2016). Understanding China's Belt & Road initiative: motivation, framework and assessment. *China Economic Review*, *40*, 314-321.

Iacovone, L., Rauch, F., & Winters, L.A. (2013). Trade as an engine of creative destruction: Mexican experience with Chinese competition. *Journal of International Economics*, *89*(2), 379-392.

Kafouros, M.I., Buckley, P.J., Sharp, J.A., & Wang, C. (2008). The role of internationalisation in explaining innovation performance. *Technovation*, *28*(1-2), 63-74.

Kaplinsky, R. (2006). Revisiting the revisited terms of trade: will China make a difference? *World Development*, *34*(6), 981-995.

Kaplinsky, R., McCormick, D., & Morris, M. (2007). *The Impact of China on Sub-Saharan Africa*. IDS Working Paper 291. http://erepository.uonbi.ac.ke/handle/11295/46023

Kaplinsky, R. & Morris, M. (2009). Chinese FDI in Sub-Saharan Africa: Engaging with Large Dragons. *The European Journal of Development Research*, *21*(4), 551-69.

Lachenmaier, S., & Wößmann, L. (2006). Does innovation cause exports? Evidence from exogenous innovation impulses and obstacles using German micro data. *Oxford Economic Papers*, *58*(2), 317-350.

Lall, S. (2000). The Technological structure and performance of developing country manufactured exports, 1985-98. *Oxford Development Studies*, *28*(3), 337-369.

Lall, S., & Weiss, J. (2005). *The Competitive Threat Posed by the People's Republic of China to Latin America: An Analysis for 1990-2002* (No. 65). ADBI Research Paper Series.

Laursen, K., Leone, M.I., & Torrisi, S. (2010). Technological exploration through licensing: new insights from the licensee's point of view. *Industrial and Corporate Change*, *19*(3), 871-897.

Lee, J., & Gereffi, G. (2021). Innovation, upgrading, and governance in cross-sectoral global value chains: the case of smartphones. *Industrial and Corporate Change*, *30*(1), 215-231.

Maas, C.J., & Hox, J.J. (2005). Sufficient sample sizes for multi-level modelling. *Methodology: European Journal of Research Methods for the Behavioral and Social Sciences*, *1*(3), 86.

Melitz, M.J. (2003). The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity. *Econometrica, 71*(6), 1695–1725.

Moore, T.G. (2002). *China in the world market: Chinese industry and international sources of reform in the post-Mao era*. Cambridge University Press.

Morris, M., & Einhorn, G. (2008). Globalisation, welfare and competitiveness: The impacts of Chinese imports on the South African clothing and textile industry. *Competition & Change*, *12*(4), 355-376.

Paliokaitė, A. (2019). An innovation policy framework for upgrading firm absorptive capacities in the context of catching-up economies. *Journal of Entrepreneurship, Management and Innovation*, *15*(3), 103-130.

Paz, L.S. (2018). The effect of import competition on Brazil's manufacturing labor market in the 2000s: Are imports from China different? *The International Trade Journal*, *32*(1), 76-99.

Qiu, L.D., & Zhan, C. (2016). China's global influence: A survey through the lens of international trade.

Pacific Economic Review, *21*(1), 45-71.

Reddy, K., & Sasidharan, S. (2021). Financial constraints and global value chain participation: Firm-level evidence from India. *The Journal of International Trade and Economic Development*, *30*(5), 739-765.

Rodrik, D. (2006). What's so special about China's exports? *China and World Economy*, *14*(5), 1-19.

Schiff, M., & Wang, Y. (2006). North-South and South-South trade-related technology diffusion: an industry-level analysis of direct and indirect effects. *Canadian Journal of Economics/Revue canadienne d'économique*, *39*(3), 831-844.

Schott, P.K. (2008). The relative sophistication of Chinese exports. *Economic Policy*, *23*(53), 6-49.

Stevens, C., & Kennan, J. (2006). How to identify the trade impact of China on small countries. In R. Kaplinsky (Ed.), *Asian drivers: opportunity and threat*. Special issue of IDS Bulletin.

Sturgeon, T.J., & Kawakami, M. (2011). Global value chains in the electronics industry: characteristics, crisis, and upgrading opportunities for firms from developing countries. *International Journal of Technological Learning, Innovation and Development*, *4*(1-3), 120-147.

Tekdal, V. (2018). China's Belt and Road Initiative: at the crossroads of challenges and ambitions. *The Pacific Review*, *31*(3), 373-390.

Torreggiani, S., & Andreoni, A. (2019). *Dancing with dragons: Chinese import penetration and the performances of manufacturing firms in South Africa,* (No. 2019/63). WIDER Working Paper.

UN Comtrade. United Nations Commodity Trade Statistics Database, http://comtrade.un.org/db/ (accessed August 2022).

Wakelin, K. (1998). Innovation and export behaviour at the firm level. *Research Policy*, *26*(7-8), 829-841.

Yamashita, N., & Yamauchi, I. (2020). Innovation responses of Japanese firms to Chinese import competition. *The World Economy*, *43*(1), 60-80.

Zhang, K.H. (2001). How does foreign direct investment affect economic growth in China? *Economics of Transition*, *9*(3), 679-693.

Appendix

Table A1. Selected literature on the impacts of Chinese import competition in developing economies

Paper	Country	Method	Data	Instruments	Impacts
Dang (2017)	Vietnam	Panel (FE) and (IV) approach Impact of import penetration on firm innovation	Small- & Medium-Scale ES (2011–15)	China global exports (IV for import penetration)	Chinese import penetration has no impact on firm innovation
Paz (2018)	Brazil	Panel Chinese import penetration on Wage premium.	National accounts and trade data Labour market outcomes (industry level) data. Brazilian demographic censuses (2000-2010)	Industry-level real exchange rate (Goldberg, 2004)	Import penetration has ↑ effect on unskilled-labour-intensive industries
Edwards and Jenkins (2015)	South Africa	Chenery-type decomposition/ econometric estimation Chinese trade on production and employment in South African manufacturing	Data (44 manufacturing industries) (1992-2010)		↓ Employment intensity ↑ Productivity within industries Labour-intensive industries badly affected Lower price inflation → curtail production cost increases
Álvarez and Claro (2009)	Chile	Panel data (FE)	Plant-level Chilean data (1990-2000) UNIDO database (Nicita & Olarreaga, 2007)		↓ Employment growth ↓ Plant survival ↑ TFP growth for surviving plants ↑ Skill & capital deepening ↑ Probability of exporting
Hou, Fu and Mohnen (2021)	Ghana	Firm-level and industrial-regional panel (GMM) Trade dataset commodity-level (Comtrade)	Firm-level data manufacturing firms Centre for the study of African economies (CSAE) (1991-2002)	Lagged levels and lagged first-difference of dependent variables	Firm or/and industry-specific, but time-invariant, using fixed effects estimator

Torreggiani and Andreoni (2019)	South Africa	Firm-level IV estimation	Chinese import penetration has a significant impact in reducing the manufacturing capacity of South African firms

Source: own elaboration

Table A2: Data by country

Country	Income group	Year of sign-up to RBI	WBES data year	Country	Income group	Year of signup to RBI	WBES data year
Bangladesh	Lower middle	2019	2013	Montenegro	Upper middle	2017	2019
Belarus	Upper middle	2013	2018	Morocco	Lower middle	2017	2019
Benin	Low	Unknown	2016	Mozambique	Low	2018	2018
Bulgaria	Upper middle	2015	2019	Myanmar	Lower middle	2016	2014
Burundi	Low	2018	2014	Namibia	Upper middle	2018	2014
Cameroon	Lower middle	2015	2016	Nepal	Low	2017	2013
Chad	Low	2018	2018	Niger	Low	Unknown	2017
Croatia	High	2017	2019	Nigeria	Lower middle	2018	2014
Cyprus	High	2019	2019	Pakistan	Lower middle	2013	2013
DRC	Low	2021	2013	Peru	Upper middle	2019	2017
Ecuador	Upper middle	2018	2017	Poland	High	2015	2019
El Salvador	Lower middle	2018	2016	Portugal	High	2018	2019
Ethiopia	Low	2018	2015	Romania	Upper middle	2015	2019
Gambia	Low	2018	2018	Russia	Upper middle	Unknown	2019
Georgia	Lower middle	2016	2019	Rwanda	Low	2018	2019
Ghana	Lower middle	2018	2013	Senegal	Low	2018	2014
Greece	High	2018	2018	Serbia	Upper middle	2015	2019
Hungary	High	2015	2019	Slovenia	High	2017	2019
Italy	High	2019	2019	Sri Lanka	Lower middle	2017	2011
Kazakhstan	Upper middle	2015	2019	Suriname	Upper middle	2018	2018
Kenya	Lower middle	2017	2018	Tajikistan	Low	2018	2019
Latvia	High	2016	2019	Togo	Low	2018	2016
Lebanon	Upper middle	2017	2019	Tunisia	Lower middle	2018	2020
Lesotho	Lower middle	2019	2016	Turkey	Upper middle	2015	2019
Liberia	Low	2019	2017	Uganda	Low	2018	2013
Lithuania	High	2017	2019	Uruguay	High	2018	2017
Luxembourg	High	2019	2020	Uzbekistan	Lower middle	2015	2019
Mali	Low	2019	2016	Zambia	Lower middle	2018	2019
Mauritania	Lower middle	2018	2014	Zimbabwe	Low	2018	2016
Mongolia	Lower middle	2013	2019				

Table A3: Definition of variables

Variables	Definition/Measurement
Chinese manufacturing import penetration (log)	Continuous variable measuring total manufacturing imports from China by industry divided by GDP, in constant prices in US dollars (industry-level).
Capacity utilisation (%)	Continuous variable measuring capacity utilisation of the firm in the last financial year (%).
Productivity growth	Continuous variable measured as the difference between output per worker in the firm in the last fiscal year and three fiscal years ago.
Employment growth	Continuous variable measured as the difference between the log of total employment in the firm in the last fiscal year and 3 fiscal years ago.
Export	Continuous variable measuring total exports as a percentage of a firm's total sales in the last fiscal year (total exports is the sum of direct and indirect exports).
Size of enterprise	Categorical variable measuring size of enterprise measured as: Micro <5; Small >=5 and <=19; Medium >=20 and <=99; Large >=100 employees.
Age (log)	Age of the enterprise (log).
Transport	Continuous variable indicating to what extent lack of transport is an obstacle to the operations of the firm, regional average.
Foreign licensed technology	A dummy variable indicating if the firm uses technology licensed from a foreign company averaged across regions, measures as: 1=Yes; 0=No
Access finance	Continuous variable indicating to what extent lack of finance is an obstacle to the operations of the firm, averaged across regions.
Tax rates	Continuous variable indicating how much tax rates is an obstacle to the operations of the firm, averaged across regions.
Licensing	Continuous variable indicating how much an obstacle business licensing and permits are to the operations of the firm averaged across regions, measured as: 0=No obstacle; 1=Minor obstacle; 2= Moderate obstacle; 3= Major obstacle; 4= Very Severe Obstacle
Corruption	Continuous variable indicating how much of an obstacle corruption is to the operations of the firm averaged across regions.
Labour regulations	Continuous variable indicating how much of an obstacle labour regulations are to the operations of the firm averaged across regions.
Inadequate workforce	Continuous variable indicating how much of an obstacle inadequate workforce is to the operations of the firm averaged across regions.
Experience of top manager (log)	Continuous variable measuring the experience of the firm's top manager in years (log).
% Workers completed high school	Continuous variable measuring the percentage of full-time workers in the firm who completed high school.
Total sales (last year, log)	Continuous variable measuring the firm's total annual sales in the last fiscal year.
Cost of labour (log)	Continuous variable measuring the firm's total annual cost of labour including wages, salaries, bonuses, social security pensions, etc.
Industry	List of 17 manufacturing industries: Chemicals; Electricals; Electronics; Food; Leather; Metals and fabricated metals; Non-metallic mineral products; Paper; Plastics and rubber; Precision instruments; Publishing, printing and recorded media; Recycling; Refined petroleum products; Textiles; Tobacco; Transport machines; Vehicles.
Country	List of 59 countries.
Size of locality	Categorical variable indicating size of locality, measured as: 1 for >1 million; 2 for >250 000 and <=1 million; 3 for >=50 000 and <=250 000; and 4 for <50 000 inhabitants.
Year	Year of WBES survey.

DSI/NRF South African Research Chair in
Industrial Development (SARChI-ID)
JBS Park, Kingsway, Auckland Park,
Johannesburg, South Africa

General enquiries:
Koketso Manyane-Dlangamandla
Email: koketsom@uj.ac.za
Tel: +27 011 559 7454