FDI and human capital development: a tale of two Southeast Asian economies

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FDI and human capital development: a tale of two Southeast Asian economies

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Abstract

Middle-income economies must prioritise human capital development to ensure long-term sustainable growth and economic upgrading. While foreign direct investment (FDI) is believed to aid this endeavour, its impact on technical vocational education and training (TVET) remains understudied. This research explores the influence of FDI by multinational enterprises (MNEs) at various stages of global value chains (GVCs) on TVET graduate numbers in Vietnam and Indonesia from 2006 to 2016. Our findings reveal that greenfield FDI plays a role in shaping TVET supply, with heterogeneous effects across different GVC segments and subnational regions. Specifically, FDI in logistics, sales and marketing, and support and servicing are associated with an increase in the supply of TVET graduates in the region, whereas FDI in headquarters and production may lead to a decline in technical skills. To address these dynamics, public policies should prioritise flexible education systems capable of adapting to MNEs' evolving skill demands. By doing so, these economies can elevate local human capital levels and avoid the stagnation often associated with middle-income traps. This research underscores the importance of aligning policy with the needs of a rapidly changing global economy to foster sustainable development.

Keywords Foreign direct investment · Multinational enterprises · Human capital · Global value chains · Emerging markets · Theory of FDI · Panel data analysis

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Introduction

Many countries that are undergoing an economic take-off phase, largely due to inflows of foreign direct investment (FDI), eventually experience a slow-down of economic growth rates and often become stuck in the middle-income trap (Altenburg & Lütkenhorst, 2015; Lee, 2012). These middle-income economies face the challenge of improving their human capital base to ensure long-term competitiveness and growth (Sala-i-Martin et al., 2007). The process by which a territory's initial endowment of human capital is converted into a source of competitive advantage for its firms and industries is known as *human capital development*, and it can occur via multiple channels, including formal education or training (Gereffi et al., 2011). Multinational enterprises (MNEs), through their FDI activities, have acquired a prominent role in contributing to human capital development in the host economies (Blomström & Kokko, 2002; Miyamoto, 2003). By providing attractive employment opportunities, MNEs may have an effect on educational choices (Blomström & Kokko, 2002; Checchi et al., 2007; Miyamoto, 2003). Increasing FDI may change relative wages

in the host location, thus modifying people's incentives to acquire education or training (Slaughter, 2004). For the host economy, increasing foreign firms' presence could potentially either contribute to increases in the human capital base (Iammarino & McCann, 2013) or hamper the skill formation process (Atkin, 2016; Ibarra-Olivo, 2021). The question of which FDI-induced labour market effect dominates over the other is the issue that we address in this paper.

Most of the evidence regarding the host labour market effects of FDI focuses on changes arising from MNEs' skill-biased demand for labour in terms of wages (e.g., Aitken et al., 1996; Doms & Jensen, 1998; Feenstra & Hanson, 1997; Taylor & Driffield, 2005; Te Velde & Morrissey, 2004). Moreover, the empirical work assessing the effects of FDI on direct measures of human capital—e.g., educational attainment or enrolment—is relatively scarcer and shows mixed results, while mainly focusing on the effects on formal general education (Asali et al., 2016; Atkin, 2016; Checchi et al., 2007; Egger et al., 2010; Ibarra-Olivo, 2021; Mughal & Vechiu, 2010). In the context of middle-income economies, however, formal vocational training has been perceived as a crucial component of human capital development, as this type of education helps young and adult workers develop the skills they need for employment (UNESCO-UNEVOC, 2021),[1] as well as preparing them to deal with technological change (Albizu et al., 2017). Despite considerable efforts to strengthen *technical vocational education and training* (TVET) institutional frameworks in many middle-income economies (Pavlova, 2014), TVET is still a neglected or insufficiently developed educational subsystem (Wiemann & Fuchs, 2018; Wrana et al., 2019). With the exception of a few qualitative studies showing evidence of MNE collaboration with local actors and institutions to upgrade host-location TVET subsystems (Fuchs et al., 2016; Kleibert, 2015; Manning et al., 2012; Wrana & Revilla Diez, 2016; Wrana et al., 2019), little is known about how inward FDI affects human capital development in the vocational and technical orientation of education.

In a globalising world economy, it has been recognised that the only sustained sources of competitive advantage are localised resources and capabilities (Humphrey & Schmitz, 2002; Maskell & Malmberg, 1999). Middle-income economies typically concentrate in the low to medium value-adding activities of global value chains (GVCs) (Mudambi, 2007), and they often tend to have an imbalance between vocational training and general education, which renders their educational systems less effective while hampering graduates' ability to develop the skills required for employment in global industries (Fernandez-Stark et al., 2012). At the same time, MNEs strive to continually leverage and create highly specialised capabilities based on resources existing in specific locations (Mudambi et al., 2018). A deeper understanding of the mechanisms through which FDI may affect the human capital development process requires going beyond FDI data by extending the analysis to the functional position of FDI projects across GVC activities, as well as the local and national educational settings in which they are embedded (Ramirez & Rainbird, 2010). This paper aims to explore whether inward FDI in different GVC functions generates broader impacts and contributes to human capital development by raising the supply of TVET graduates in host regions.

Southeast Asia has become an important destination for FDI in the global economy. Indonesia and Vietnam are among the largest economies in the region. They constitute middle-income countries whose economic progress has advanced, to a great extent, hand in hand with FDI inflows. According to fDi Markets, a database developed by fDi Intelligence (a division of Financial Times Ltd.), the two countries have a very similar distribution of FDI across value chain functions, as the vast majority of greenfield FDI jobs are created in production activities—around 86% of accumulated FDI jobs in each country during the 2006–2016 period. Notwithstanding, new FDI jobs in other service-based activities—such as sales and marketing, logistics, and business services—are increasing both in absolute and relative terms. Moreover, these foreign investments are unevenly spread across subnational regions and have introduced new economic activities along with a shifting demand for labour with different skills, thereby posing challenges for the existing regional human capital base. Against this background, Indonesia and Vietnam provide appropriate case studies to assess the extent to which greenfield FDI inflows in different GVC functions have broader effects on human capital development.

This paper contributes to the study of FDI's broader societal impacts in circumscribed subnational geographies (Wiessner et al., 2023) by adding to the scant quantitative evidence on the relationship between FDI and human capital development through the labour market. Whilst the focus on vocational training sheds light on a relatively understudied dimension of human capital development, we improve existing studies by considering one type of FDI, namely,

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[1] We use the UNESCO worldwide classification of educational systems (UNESCO, 2011). Formal education (provided by public or private institutions) has two orientations. General education (also referred to as academic education) is intended to develop general knowledge, skills and competencies, as well as literacy and numeracy skills. Vocational education and training (or professional education) is designed to impart the knowledge, skills and competencies specific to a particular occupation, trade, or class of occupations or trades. In this paper we will use the terms *general education* and *vocational training* to refer to the two orientations. When referring to the formal educational system as a whole, we also refer to its components as the general education subsystem and the vocational training subsystem (TVET).

greenfield investments introduced into the relevant subnational regional labour markets. Moreover, we explore the heterogeneous effects of FDI on the regional human capital development process by assessing the effects of new FDI jobs in different segments of the value chain in the context of GVCs.

Background literature

Human capital development and global value chains

Human capital development may be understood as the process by which a territory's initial endowment of human capital is converted via multiple channels—general education, technical and vocational training, and relevant services such as labour market intermediation, and information—into a source of competitive advantage for firms and industries in a given territory (Faggian et al., 2019; Galor & Tsiddon, 1997; Gennaioli et al., 2013). To the extent that firms' performance depends on localised region-specific intangible assets embodied in a knowledge and competence base rooted in particular institutional settings, subnational regions have been increasingly recognised as sources of competitive advantages (Boschma, 2004) and most importantly, as the main source of *sustained* competitive advantages in an interdependent world economy (Humphrey & Schmitz, 2002; Maskell & Malmberg, 1999). In a context of increasing within-country inequalities, the human capital development process is likely to take distinct forms across subnational regions, since socioeconomic characteristics differ markedly at the subnational scale (Faggian et al., 2019). Therefore, human capital development is critical for competitiveness and sustained economic development at the local or regional level.

In recent decades, major shifts in international trade and investment flows—driven by transformations in institutional frameworks, technological changes, and changing geopolitics—have resulted in a particular configuration of the global economy. This global organisational structure of economic activity has been encapsulated by different academic standpoints in the concept of global value chains (GVC) or in the closely related construct of global production networks (GPN). A discussion on the nuances of these associated but distinct frameworks is beyond the scope of this paper (see Kano et al., 2020 for a multidisciplinary literature review). However, in its broadest sense, the GVC notion captures the contemporary architecture of the world economy, as it reflects the disaggregation and geographic dispersion across various parts of the value-creating processes (Kano et al.,

2020). It offers a conceptual framework for the present paper as it links to the particular mechanisms through which subnational spaces and their institutions are integrated into, and shaped by global production networks or GVCs through MNEs and their FDI activities (Coe et al., 2004).

MNEs have taken a prominent role as the primary shapers and movers of the international business environment through their trade and investment activities (Dicken, 2015). Typically, MNEs are the orchestrators of GVCs, as they are able to disaggregate their value chains while selecting the activities and locations over which to maintain control or ownership (Buckley & Casson, 1976; Dunning, 1993; Kano et al., 2020). MNEs' strategic decisions can be driven by a quest to leverage and create highly specialised capabilities based on resources existing in specific locations (Mudambi et al., 2018). Hence, MNEs continuously define the firm's organisational boundary by constructing and reshaping complex intra- and inter-firm relationships (Dicken, 2015). Building on different theories, the literature suggests that different motivations for MNEs result in three broad modes of GVC governance: market, hierarchy, and network (Gereffi et al., 2005). The scope of the present paper falls into the second category, in which MNEs retain full control of wholly owned subsidiaries, namely through greenfield FDI (Collinson et al., 2020), and the implicit assumption here is that these GVC functions are coordinated through hierarchies within a vertically integrated parent firm.

The GVC framework allows us to better understand the development and dependency outcomes for a constellation of subnational regional economies that are connected into global production systems through FDI activities by MNEs (Li & Bathelt, 2018; Turkina & Van Assche, 2018). This approach enables consideration of the multiple possible outcomes—both positive and negative—of such intersections (Coe & Yeung, 2019). Therefore, a given place's involvement in different economic stages along GVCs, through greenfield FDI by MNEs, may have distinct effects on local labour markets by increasing demand for workers with skill sets that match the demand and standards of MNEs (Taglioni & Winkler, 2014).

The link between the different stages of the value chain and their reliance on human capital is rooted in the intensity of the application of knowledge and creativity in their business activities (Jona-Lasinio et al., 2019). Increasingly, value has migrated towards the upstream and downstream ends of the value chain, where there is a higher reliance on applied knowledge, creativity and skills (Mudambi, 2007, 2008). Whilst high-income economies typically specialise in higher value-adding activities—upstream and downstream ends of GVCs—middle-income countries are more concentrated in the midstream stages of the value chain (Palpacuer

& Parisotto, 2003). Ultimately, moving up the development ladder requires continuous human capital development by acquiring or upgrading skills and increasing dexterity and productivity on the part of workers in the productive process (Barrientos et al., 2011). Therefore, regions and countries must continuously develop their human capital base to enable them to move into higher value-adding nodes of GVCs and compete successfully in a globalising economy (Coe et al., 2008; Ernst & Kim, 2002).

The role of inward FDI in regional human capital development

There is little doubt that MNEs are carriers of important productive knowledge (Blomström & Kokko, 1998; Caves, 1974; Markusen, 2002). Hence, MNEs have acquired a prominent role in contributing to human capital development in the host economies (Blomström & Kokko, 2002; Miyamoto, 2003). FDI's role in human capital development can take several forms; for example, interactions with local suppliers, direct collaboration with local educational institutions, or in-house training (Blomström & Kokko, 2002; Miyamoto, 2003; Slaughter, 2004). In this paper, however, we centre the analysis on one labour market mechanism through which FDI may indirectly influence human capital development in the host region—namely, the relative labour demand. MNE subsidiaries tend to pay, on average, higher wages for workers (Lipsey, 2004; Lipsey & Sjöholm, 2004) by reason of enjoying competitive advantages over domestically owned firms in the host region. These attractive employment opportunities are likely to modify relative wages, thereby influencing incentives for individuals in the host economies to acquire certain skills either through general education or vocational training. If individuals in host economies have access to formal education systems, they should be able to respond to wage signals emerging from the labour market (Slaughter, 2004), raising the uptake of specific educational programmes and thereby increasing the supply of skills.

Overall, the evidence points to a positive association between MNE presence and demand for high-skilled workers,[2] which may arguably contribute to human capital development in the host economy (Iammarino & McCann, 2013). However, where MNEs increase the demand for low-skilled

labour in the host economy (Braconier et al., 2005), a disincentive for higher educational attainment is introduced instead, which may hold back skills formation (Atkin, 2016; Coniglio et al., 2015; Federman & Levine, 2005; Ibarra-Olivo, 2021) or lead to job polarisation (Amoroso & Moncada-Paternò-Castello, 2018; Davies & Desbordes, 2015).[3] Either positively or negatively, MNEs are likely to shape human capital development through their direct investment decisions. Moreover, this relationship is not homogeneous across space. The role of FDI in shaping human capital development is likely to take different forms across subnational regions since socioeconomic characteristics—importantly, human capital levels and access to education (Faggian et al., 2019)—are markedly different across national territories. The question of which FDI-induced labour market effect dominates over the other in host subnational regions is the one we address in this paper.

The bulk of studies pertaining to the relationship between FDI and skills focus mainly on relative wages and do not consider a direct measure of human capital or educational outcomes—for example, attainment, enrolments or graduates—therefore falling short of assessing the full extent of this association. Empirical studies devoted to directly exploring the effect of FDI on human capital accumulation are scarcer, and the evidence on educational outcomes is rather mixed (Arbache, 2004; Asali et al., 2016; Checchi et al., 2007; Egger et al., 2010; Ibarra-Olivo, 2021; Kar, 2013; Kheng et al., 2017; Mughal & Vechiu, 2010; Wang & Wong, 2011; Zhuang, 2008, 2017). Moreover, the focus is largely on general education, and up to now little is known about how inward FDI affects human capital development through vocational training. Aside from some qualitative studies indicating that MNEs actively collaborate to upgrade local TVET subsystems in order to ensure a rising supply of well-skilled future graduates (Fuchs et al., 2016; Kleibert, 2015; Manning et al., 2012; Wrana & Revilla Diez, 2016; Wrana et al., 2019), there is a considerable gap, particularly in the context of middle-income economies, for which vocational training has been considered a crucial component of human capital development.

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[2] Evidence is vast for both developed (e.g. Aitken et al., 1996; Doms & Jensen, 1998; Figini & Görg, 1999; Girma & Görg, 2007; Taylor & Driffield, 2005) and developing host economies (e.g. Aitken et al., 1996; Arbache, 2004; Feenstra & Hanson, 1997; Ibarra-Olivo, 2019; Lipsey & Sjöholm, 2004; Noria, 2015; Te Velde & Morrissey, 2004).

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[3] MNEs through their FDI activities may have broader social impacts in the host location. Whilst FDI has been associated with positive effects such as technology transfer, job creation, productivity gains and economic spillovers in the host economy (Barba Navaretti & Venables, 2004), FDI may also be associated with negative effects, for example, child labour exploitation (e.g., Doytch et al., 2014), environmental degradation (e.g., Duan & Jiang, 2021), tax avoidance (e.g., Windsor, 2017), human rights violations (Wettstein et al., 2019), and social and income inequalities (e.g., Ibarra-Olivo & Rodríguez-Pose, 2022).

Human capital development and vocational training

Given their position in the value chain, middle-income economies tend to have an imbalance between vocational and general education, which typically leads to ineffectiveness of the TVET subsystem, making it difficult for graduates to develop the skills required for employment in these global industries (Fernandez-Stark et al., 2012), whilst employers complain of skill shortages and mismatches in the labour force (Tan et al., 2010). The level of human capital stock depends to a great extent on countries' investment in education for their populations (O'Mahony, 2012), yet efforts to proactively improve the effectiveness of skills upgrading at the national level are not widespread (Fernandez-Stark et al., 2010). Notable exceptions are the late-comer industrialising Asian economies that have successfully caught up by attracting FDI as well as developing technical skills and well-functioning TVET subsystems to cater to the skill demands of their current and future economy (Ashton et al., 2002; Gee & Hou, 1993; Wong, 2001).

Notwithstanding, in many middle-income economies, TVET is still a neglected or insufficiently developed educational subsystem (Wiemann & Fuchs, 2018; Wrana et al., 2019). Despite considerable efforts to strengthen TVET regulatory frameworks (Pavlova, 2014), some challenges remain for these institutions, including a lack of quality, difficulties in teaching the skills demanded by the private sector, and lack of prestige compared to universities, as technical and vocational education is perceived to have lower status and income potential (de Moura Castro & García, 2003; Song Seng, 2008). Consequently, MNEs operating in these host countries often face a skill mismatch; Indonesia (Di Gropello et al., 2011) and Vietnam (World Bank, 2014) are no exception.

Bridging the gap: hypothesis and contributions

In particular, our aim is to understand the impact of MNEs' greenfield FDI activities on the local processes of skills formation and human capital development in the context of GVCs, by going beyond the focus on aggregate FDI and extending the analysis to the functional position of FDI projects along GVCs as well as the local TVET educational systems in which they are embedded (Ramirez & Rainbird, 2010).

Surprisingly, up to now, empirical studies devoted to exploring the effect of FDI on human capital development have omitted the vocational training dimension of this process, seldom distinguishing among FDI in different segments along the value chain or considering the regional dimension of the host countries. By adopting a GVC perspective, we improve on existing studies in three main ways. First, the empirical

exercise is centred on FDI projects by MNEs that exert direct control and ownership over the subsidiaries, i.e. greenfield FDI (Collinson et al., 2020). Second, we account for heterogeneous effects of FDI on TVET across GVC stages; this framework allows us to overcome the high-low-skilled labour demand dichotomy by relying instead on the implicit knowledge intensity of each GVC stage. Third, the regional perspective addresses the spatial variation of both FDI and TVET across subnational territories; in other words, how regional characteristics may affect the localised process of human capital development through FDI.

As different GVC functions require different skill levels from the host region's labour force (Amoroso & Moncada-Paternò-Castello, 2018; Davies & Desbordes, 2015; Fernandez-Stark et al., 2012), it is likely that the effects of FDI on human capital development depend on the type and skill intensity of the GVC function in which investments by MNEs are made. If FDI activities by MNEs in a given value chain function increase the demand for certain skill sets that could be attained by participating in the vocational training subsystem, individuals in the host region may respond to FDI-induced labour market incentives and acquire the necessary TVET certification to be eligible to work for the MNE, then our hypothesis is:

H: There is a significant relationship between the inflows of greenfield FDI and the supply of vocational training in a host region, and this relationship varies according to the segment of the GVC in which it occurs.

Empirical strategy

The model

Our interest lies in assessing the extent to which multinationals—through their greenfield FDI activities—affect the local human capital development process by incentivising skill acquisition by the labour force. In particular, we investigate the effects of regional FDI on the proportion of the labour force with a TVET certification. The main mechanism through which this relationship operates is the labour market. The provision of attractive employment opportunities by MNEs may incentivise individuals to undertake specific TVET programmes that will make them eligible to work for an MNE. For this reason, the basis of our independent variable of interest is the estimated number of jobs created by greenfield FDI in each region. As mentioned before, the relationship between FDI and TVET is heterogenous across GVC stages since the skill requirements vary across nodes along the value chain. To capture these potential differences, we include the breakdown of FDI jobs by GVC function of destination. The classification includes $s = 7$ stages of the value chain (see Table 4 in the Appendix). Furthermore, the effect of an additional FDI job

will depend on its relative contribution to the size of the local labour market. Therefore, we scale the absolute number of FDI jobs by the labour force in the region. This allows a relative effect of FDI jobs to be captured by value chain stage. Thus, our specification takes the following functional form:

$$\text{TVET}_{rt} = \alpha + \sum_s \beta_s \left(\frac{e^s_{rt-1}}{LF_{rt-1}} \right) + \gamma \mathcal{X}_{rt-1} + \theta_r + \delta_t + \varepsilon_{rt},$$

(1)

where the outcome variable TVET_{rt} on the left-hand side is the percentage of the labour force that holds a TVET certificate in region r and year t. The independent variable of interest is the sum of accumulated stocks of FDI jobs e^s_{rt-1} in stages 1 through 7 in region r relative to the size of the labour force LF_{rt-1}, both in the previous year $t-1$. Each of these shares is multiplied by 1000; hence, the variable is measured in FDI jobs per 1000 workers. The coefficients β_s capture the effect of new FDI jobs in each value chain stage s on the relative number of workers with TVET. A positive estimated association means that increases in FDI jobs will lead to a rise in the percentage of workers with TVET, and a negative association means that increases in FDI jobs lead to decreases in the supply of TVET graduates.

Additional control variables associated with TVET are included in vector $\mathcal{X}_{rt-1}$. The first two controls have to do with the different educational choices that are available to the workforce. Although each country has nuances in their national TVET subsystems setup (see Figs. 3 and 4 in the Appendix), in both cases, students have to complete 9 years of primary and lower secondary education, after which they can choose between training and general education. To control for such alternatives, we first include the share of the labour force with upper secondary and tertiary education as the highest level of educational attainment. The effect of these two educational levels on TVET may be either substitutive—if the estimated association is negative—or complementary if the association is positive. We test whether TVET qualifications, which have traditionally been associated with industry and production jobs, have a significant relationship with the region's industry share of GDP. To account for an income effect on TVET, we include regional GDP per capita (in logarithmic form). Additionally, to control for the urban scale effect, we include population density (in logarithmic form), to account for the possibility that more densely populated regions may have a higher provision of vocational training services, producing more TVET graduates. θ_r picks up the region fixed effects, and δ_t the year effects. Finally, ε_{st} is the usual error term. The equations are fitted by ordinary least squares (OLS) with fixed effects (FE) using the within regression estimator.

Biases and endogeneity concerns

Fitting these equations will pose some threats to the internal validity of the estimated coefficients of the effects of FDI jobs. We address two of them in turn. Firstly, omitted variable bias is present if we exclude time-varying characteristics of regions correlated with the dependent variable. For example, the percentage of the labour force with secondary education might also have an impact on the percentage of TVET graduates. Therefore, we have included in vector $\mathcal{X}$ the control variables described above. Moreover, omitting time-invariant characteristics of regions is likely to introduce further bias if unobserved heterogeneity is correlated with the independent variables. For instance, some regions may have a higher concentration of FDI or better formal educational systems to begin with. Such unobserved heterogeneity across units is captured by the region fixed effects. Furthermore, a set of year dummies will capture shocks to the share of workers with vocational training; for example, nation-wide changes in the TVET subsystems in place.

Secondly, it is possible that TVET shares affect the inflows of FDI jobs. Reverse causality may arise if MNEs are motivated to invest in different stages of the value chain based on the relative availability of workers with vocational training across regions. An upward bias may occur if regions with higher shares of TVET graduates attract more FDI jobs in certain stages of the value chain. Conversely, there could be a downward bias if MNEs investing in any GVC stage have less presence in regions with a higher percentage of workers with TVET. We tackle this endogeneity problem in two ways. First, we partially mitigate the simultaneity by using independent covariates in 1-year lags. Admittedly, there is a certain degree of simultaneity between TVET and FDI—since the former may be a locational advantage—however, it is hardly likely that changes in current TVET shares could explain changes in FDI in the past. Importantly, these lags also allow the time that investment decisions take to translate into changes in the share of TVET graduates in the host region to be considered. Second, we deploy an instrumental variable (IV) approach to rule out any remaining endogeneity concerns. We construct our instrument using the "shift-share" approach (Card, 2007; Faggio & Overman, 2014; Moretti, 2010). The instrument uses initial shares of FDI employment by value chain stage (relative to labour force) and the total number of national FDI jobs in the same sector to predict changes in regional FDI jobs. The instrument has two components as follows:

$$\left(\overline{\frac{e^s_r}{LF_r}} \right) \times \left(E^s_{t-1} - e^s_{rt-1} \right),$$

(2)

where $\left(\overline{e^s_r / LF_r} \right)$ is the initial share of stage s FDI jobs relative to labour force in region r at the beginning of the period

Table 1 Summary statistics: FDI jobs and TVET

Variable	Vietnam				Indonesia			
	Mean	SD	Min	Max	Mean	SD	Min	Max
TVET	0.083	0.033	0.022	0.199	0.096	0.051	0.027	0.291
FDI jobs (relative)								
1. Business services	0.130	0.455	0.000	3.640	0.027	0.105	0.000	0.943
2. Headquarters	0.009	0.047	0.000	0.451	0.003	0.022	0.000	0.245
3. Logistics	0.298	0.846	0.000	5.735	0.051	0.115	0.000	0.879
4. Production	8.349	12.109	0.000	56.493	1.641	3.047	0.000	19.869
5. Research & development	0.050	0.235	0.000	1.797	0.006	0.033	0.000	0.336
6. Sales & marketing	0.273	0.650	0.000	4.075	0.120	0.391	0.000	3.092
7. Support & servicing	0.053	0.186	0.000	1.313	0.012	0.041	0.000	0.252
Secondary education	0.137	0.048	0.046	0.276	0.181	0.047	0.086	0.320
Tertiary education	0.121	0.077	0.030	0.457	0.099	0.046	0.037	0.649
Population density (log)	5.687	0.971	3.695	8.265	4.840	1.569	1.843	9.637
GDP per capita (log)	6.870	0.516	5.974	9.408	7.504	0.833	5.532	9.558
Industry share of GDP	0.390	0.168	0.001	0.965	0.368	0.176	0.074	0.825
	Regions = 60; $N = 600$				Regions = 33; $N = 330$			

of study, whilst $\left(E_{t-1}^{s} - e_{rt-1}^{s}\right)$ captures the overall stage s employment in the country, which varies across regions because we exclude own-region employment when calculating the total. The rationale behind the IV is the assumption that in the absence of region-specific employment shocks, each region would have received a share of the total greenfield FDI stage s employment that occurred each year during our study period in proportion to the initial share. The equations are fitted with the two-stage least-squares within estimator.

Data and variables

The data we use to test the model come from two main sources. The greenfield FDI raw data comes from the fDi Markets database, developed by fDi Intelligence (a division of Financial Times Ltd.). The outcome variable and other controls have been collected from Labour Force Surveys (LFS) in each country.[4] Our period of study spans from 2006 to 2016. We estimate the relationship between FDI and TVET for Indonesia and Vietnam separately. The administrative unit for each country is defined by the level of representativeness of the LFS data.[5] Summary statistics are provided in Table 1 and the correlation matrix is in Table 5 (in the Appendix).

The independent variable of interest is the number of jobs created by MNEs in the region of destination by GVC stage. Three points about the variable should be noted. First, by using fDi Markets, we only consider employment created in new investment projects; thus, the estimated effects are restricted to greenfield FDI. A clear advantage of focusing on greenfield FDI is that unlike brownfield FDI, this kind of investment is expected to have direct effects on employment creation in the host economy (Ashraf et al., 2016). Second, the figures reported by the database are the number of jobs that a company has announced it will create; this does not constitute a problem for the empirical exercise, since the mechanism of interest relies on the signals arising from the labour market, such as MNEs announcing the creation of new jobs. Third, the figures reported in the raw data are for new jobs created yearly, thus representing a flow variable. To obtain more stable results and to match the outcome variable, which is a stock of human capital, we calculate the stock of regional FDI jobs by summing the accumulated flow of new FDI jobs. Finally, the variable is scaled by the size of the region's workforce and multiplied by a thousand. This measures the effect of one additional job per 1000 workers.

The outcome variable is constructed as the proportion of working-age individuals holding a TVET certification. To avoid capturing any correlation driven by changes in the size of the labour force, we normalise the yearly measure of regional TVET by using the size of the working-age population in the initial year as a common denominator. Lastly,

Table 2 Accumulated greenfield FDI jobs by GVC stage

Function in the value chain	Vietnam			Indonesia		
	Jobs	%	Rank	Jobs	%	Rank
1. Business services	26,033	3.2	3	6562	1.9	4
2. Headquarters	2423	0.3	7	1452	0.4	7
3. Logistics	21,352	2.6	4	12,249	3.5	3
4. Production	703,029	86.4	1	304,886	86.0	1
5. Research & development	15,371	1.9	5	2872	0.8	5
6. Sales & marketing	40,668	5.0	2	24,798	7.0	2
7. Support & servicing	4899	0.6	6	1841	0.5	6
Total	813,775	100		354,660	100	

The figures in the Jobs columns correspond to the accumulated stock of foreign jobs by GVC stage during the sample period 2006–2016. The percentage (%) column represents the contribution of each stage to total foreign jobs created. The Rank column ranks each function at the national level. See Table 4 in the Appendix for definitions of value chain stages

a number of variables that may be associated with the proportion of individuals in the labour force with TVET are included as controls (BPS, 2018; GSO, 2018): secondary and tertiary education, population density, GDP per capita, and industry share of GDP.

Context of the study

National FDI trends and GVC structure

Southeast Asia constitutes an important destination for FDI in the global economy. In 2019, excluding Singapore, Indonesia was the second largest recipient of inward FDI, having received 23.5% of these stocks, while Vietnam, in fourth position, received 16.3% (UNCTAD, 2020). Both countries have middle-income economies whose economic progress has advanced, to a great extent, hand in hand with FDI inflows. Vietnam has, since its renovation policy in 1986, gradually opened its economy to foreign investors. Consequently, the country has been able to attract large volumes of FDI. In 2019, its inward FDI stock amounted to 60.9% of the country's GDP (UNCTAD, 2020). Indonesia, as a resource-rich and populous country, provides significant locational advantages for MNEs. Consequently, it has attracted significant volumes of FDI since its recovery following the Asian financial crisis (Lindblad, 2015), with an inward FDI stock accounting for 20.5% of its GDP in 2019 (UNCTAD, 2020).

The number of accumulated greenfield FDI jobs during the 2006–2016 period reached over 800,000 jobs in Vietnam and more than 350,000 in Indonesia. Table 2 shows that the two countries have a very similar distribution of FDI across value chain functions, as the vast majority of greenfield FDI jobs are created in production activities—around 86% of the accumulated FDI jobs during the sample period. However, new FDI jobs in other service activities, such as sales and marketing, logistics, and business services, are increasing both in absolute and relative terms. For example, jobs in sales and marketing constitute the second-largest business function in both countries at 5–7% of total jobs created. In recent years, these investments have introduced new economic activities along with a demand for high and low-skilled labour, thereby posing challenges for the domestic human capital base. For all these reasons, Indonesia and Vietnam provide appropriate case studies to assess the extent to which FDI inflows have generated spillovers in the form of changes in the relative supply of TVET graduates in the regional host economies.

Regional distribution of greenfield FDI

Our primary objective goes beyond national trends in trying to explain the relationship between variations in the proportion of the labour force with vocational training and greenfield FDI in value chain stages across different subnational regions. After all, existing regional differences in labour market conditions and educational opportunities are expected to have different effects on individuals' behaviour and educational choices (Levison et al., 2001). We explore the effects of greenfield FDI in terms of the number of jobs created by MNEs relative to the size of the labour force. The maps in Fig. 1 show the spatial distribution of average relative FDI employment stocks—jobs per 1000 workers—throughout our sample period across subnational regions within each country, considering new FDI jobs in all stages of the value chain. The prevalent trend in both countries is one of spatial concentration of FDI jobs. However, most regions had at least some employment generation through greenfield FDI, with only a few not experiencing any. In Indonesia, the highest relative values of new FDI jobs are found in the regions of Banten, Jakarta, West Java, East Kalimantan, and Central and South Sulawesi. In Vietnam, the highest concentration of
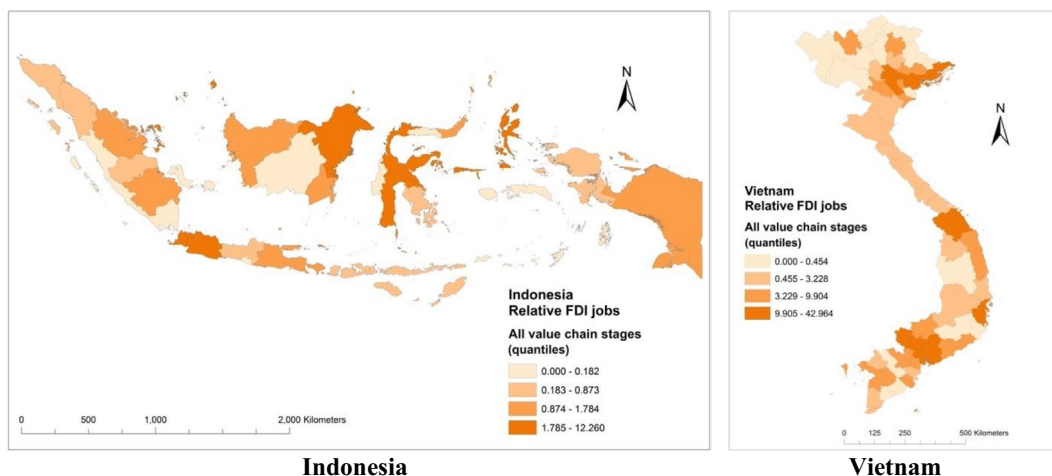
Fig. 1 Regional distribution of FDI employment stocks. *Note* Variable is greenfield FDI jobs per 1000 workers, including all stages of the value chain. Average values 2006–2016 (quantiles). *Source* Authors, using data from fDi Markets

new FDI jobs is in and around Hanoi, Ho Chi Minh City, Khánh Hòa, and Quảng Nam.

The aggregated numbers of FDI jobs give us an idea of the distribution of greenfield FDI, but they conceal the heterogenous spatial patterns of FDI across GVC functions and countries (Figs. 5 and 6 in the Appendix). Naturally, some GVC functions will always be more concentrated than others due to the nature and intensity of the location advantages they rely on. For instance, greenfield FDI in R&D and headquarters are extremely concentrated in fewer regions, while production activities are widespread across each country's subnational space. However, there are also differences in spatial patterns in the same stage between countries; for instance, whilst business services are more spatially widespread in Indonesia, in Vietnam they appear to be slightly more concentrated.

Vocational training across regions

As mentioned in previously, TVET systems are crucial in middle-income economies for human capital development and GVC participation. Governments have undertaken significant efforts to improve their TVET subsystems and match the skill requirements of GVCs. In particular, Vietnam has actively worked to encourage the private sector to expand the provision of TVET offerings (Asian Development Bank, 2018). In contrast, Indonesia has sought to improve the supply of vocational training in specific sectors through public and private partnerships (Dong & Manning, 2017). However, the distribution of TVET graduates differs markedly across the territory, highlighting differences in the provision of these programmes. The regional distribution of the proportion of the labour force that holds a vocational training certification in their region of residence is shown in Fig. 2.

These regional differences in the share of TVET graduates make it possible to analyse the effect of FDI jobs on the development of vocational training subsystems at a regional scale.

Results

Against this background, we aim to assess the extent to which FDI can affect the relative number of TVET graduates. To test our hypothesis, we first introduce the main regressor based on all FDI jobs per 1000 workers, then introduce the breakdown for each of the seven value chain stages. We also test for the exogeneity of our main variable of interest by using the "shift-share" as an instrumental variable. The relevance of the instruments is confirmed by the first-stage F statistics. Since our endogenous variables are exactly identified, we are prevented from directly testing for the exogeneity of our instruments. However, we run an alternative specification with dynamic instruments by including the first- and second-order lags of our instrumental variable. These account for the path dependency of our main variable of interest while reducing serial autocorrelation in the error term. As per the Hansen J test, our instruments are jointly exogenous and thus valid (see Table 6 in Appendix). Estimates for the baseline OLS fixed effects and IV specifications by country are reported in Table 3 for Vietnam (columns 1–3) and for Indonesia (columns 4–6). The control variables, region and year fixed effects are included in all models. Both the outcome variable and the independent regressors of interest are measured in levels, hence they can be interpreted as unit changes.
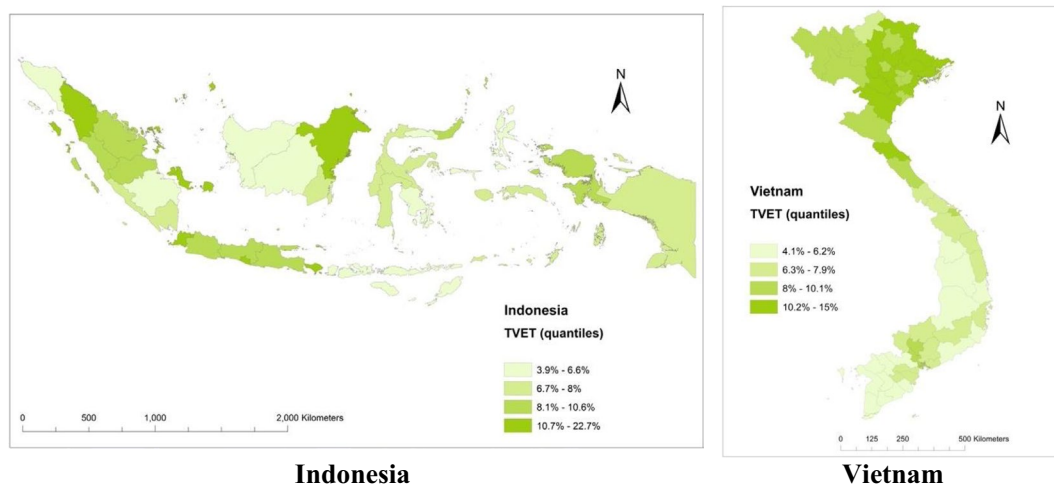
Fig. 2 Regional distribution of TVET graduates. *Note* Proportion of the labour force holding a TVET certification; Average values 2006–2016 (quantiles). *Source* Authors, using data from Labour Force Surveys

Vietnam

The overall relative number of new total FDI jobs does not yield any significant effect on TVET graduates in Vietnam (Table 3, column 1). However, the inclusion of FDI jobs by GVC stage yields heterogeneous effects of FDI (column 2). The estimated coefficients using the instrumental variable (column 3) have the same direction and significance as in the OLS FE regression, although the magnitudes differ slightly. While the overall fit of all regressions is not too high, the economic effects of FDI jobs are non-negligible. We discuss them in turn.

FDI jobs may have a positive effect on the supply of vocational training graduates; increases in these jobs in logistics and sales & marketing are associated with an increase in the share of TVET holders. More specifically, one additional FDI job per thousand workers in these GVC stages is correlated with an increase in the expected relative number of workers with TVET. For example, in the case of sales & marketing, the estimated increase is 2.16%. FDI may also have a negative effect on the supply of TVET. This is the case for headquarters, where an increase in the relative number of FDI jobs is associated with a 14.12% decrease in the expected number of workers with TVET. In some stages, FDI may also have no impact on TVET; additional FDI jobs in business services, production, R&D, and support & servicing have no significant effect on TVET, suggesting that MNEs in these GVC stages may not necessarily hire TVET-educated workers.

Regarding the control variables, it appears that tertiary education is complementary to TVET; an increase in the share of the workforce with this level of educational attainment is associated with an increase in the share of TVET graduates. The rest of the controls are not significant, but their inclusion improves the goodness of fit of the regressions.

Indonesia

Similarly to the case of Vietnam, in Indonesia an increase in the number of total FDI jobs does not yield a significant effect on TVET graduates (Table 3, column 4) and the inclusion of FDI jobs by GVC stage also reveals heterogeneous effects on TVET (column 5). In column 6, we test the exogeneity of FDI jobs by using the "shift-share" as instruments for the 1-year lags. We discuss each of the estimated effects in turn.

Increased FDI jobs in sales & marketing and support & servicing are associated with an increase in the expected relative supply of TVET graduates. More specifically, one additional FDI job per 1000 workers in these GVC stages is correlated with an increase in the expected relative number of workers with TVET. For example, in the case of sales & marketing, the increase is estimated to be 7.7%. Conversely, an increase in the relative number of FDI jobs in production is associated with a slight decrease in the percentage of workers with TVET. Additional FDI jobs in business services, logistics, and R&D have no significant effects on TVET, suggesting that MNEs operating in these GVC stages in Indonesia do not rely heavily on TVET-educated workers. For business services, the effect is estimated to be negative and barely significant in the OLS, but loses significance when endogeneity is partialled out.

With respect to the control variables, it appears that tertiary education as a form of educational attainment has a weak complementary effect, as it loses significance in

Table 3 Vietnam & Indonesia: effects of new FDI jobs on vocational training

Dep. Var. TVET	Vietnam			Indonesia		
	(1)	(2)	(3)	(4)	(5)	(6)
	FE	FE	IV	FE	FE	IV
All FDI jobs	0.0001			0.0004		
	(0.000)			(0.001)		
1. Business services		– 0.0127	– 0.0054		– 0.1339*	– 0.1443
		(0.013)	(0.017)		(0.076)	(0.111)
2. Headquarters		– 0.0842*	– 0.1402*		–	–
		(0.045)	(0.076)		–	–
3. Logistics		0.0045**	0.0040*		0.0058	0.0231
		(0.002)	(0.002)		(0.024)	(0.021)
4. Production		– 0.0002	– 0.0001		– 0.0004	– 0.0008**
		(0.000)	(0.000)		(0.000)	(0.000)
5. Research & development		0.0035	0.0039		– 0.1056	– 0.3119
		(0.005)	(0.005)		(0.123)	(0.189)
6. Sales & marketing		0.0166***	0.0216***		0.0495	0.0771**
		(0.005)	(0.007)		(0.030)	(0.036)
7. Support & servicing		0.0004	– 0.0071		0.4617***	0.3830***
		(0.009)	(0.014)		(0.066)	(0.096)
Secondary education	– 0.0449	– 0.0694	– 0.0733	– 0.1208	– 0.0365	– 0.0343
	(0.058)	(0.053)	(0.053)	(0.126)	(0.131)	(0.139)
Tertiary education	0.0946***	0.0891***	0.0863***	0.0199**	0.0119	0.0098
	(0.032)	(0.030)	(0.030)	(0.008)	(0.010)	(0.009)
Industry share of GDP	– 0.0180	– 0.0159	– 0.0148	0.0196	– 0.0016	0.0051
	(0.014)	(0.015)	(0.015)	(0.032)	(0.024)	(0.025)
Log GDP per capita	0.0084	0.0163	0.0186	– 0.0192*	– 0.0044	– 0.0062
	(0.013)	(0.014)	(0.014)	(0.010)	(0.008)	(0.008)
Log population density	– 0.0211	– 0.0143	– 0.0210	0.0054	0.0008	0.0024
	(0.018)	(0.017)	(0.020)	(0.008)	(0.006)	(0.006)
Observations	600	600	600	330	330	330
R-squared	0.427	0.447	0.443	0.646	0.717	0.705
Number of regions	60	60	60	33	33	33
Region FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Clustered standard errors in parentheses. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$ *Note* Headquarters stage is omitted in the case of Indonesia because all FDI jobs are located in Jakarta

the fuller models. Moreover, increases in GDP per capita appear to be associated with decreases in the share of TVET graduates, but the effect turns out to be insignificant in the full model. The remaining controls are not significant but increase the goodness-of-fit, suggesting that they have some explanatory power for TVET.

Discussion

Adopting a GVC approach has allowed us to better understand the human development outcomes for a constellation of subnational regions that are connected to GVCs through the FDI activities by MNEs. Results for Indonesia and Vietnam show that the inflow of FDI jobs per se does not have any influence on a host region's number of vocational training graduates. While MNEs modify local labour market conditions by offering more attractive employment opportunities—relative to domestic firms—our results suggest that when considering the aggregate relative number of new greenfield FDI jobs, the estimated effect on TVET graduates is not significant. However, we find consistent evidence that favours our hypothesis; increases in the relative number of FDI jobs have heterogeneous effects on TVET across GVC stages, thus confirming the importance of accounting for heterogeneous FDI effects by considering the different value chain stages and the subnational regional context in which investment takes place.

The results indicate that greenfield FDI projects have the potential to contribute to the host region's human capital development via the introduction of incentives in the local labour markets. We find that FDI jobs in *service-based* GVC segments may be associated with an increase in the supply of TVET graduates in the host region. Conversely, FDI jobs in headquarters or production may lead to declining supply of technical and vocational skills in the region. And, in other value chain segments, FDI have no significant effects on TVET. The presence of both positive and negative effects of FDI on human capital development in terms of TVET is in line with existing insights holding that FDI-induced labour market effects either incentivise or disincentivise human capital development in host economies depending on the type of skills demanded (Braconier et al., 2005; Iammarino & McCann, 2013). Distinguishing between different GVC stages allows these different effects to be captured, since different GVC stages rely on different skill levels of the host region's labour force (Amoroso & Moncada-Paternò-Castello, 2018; Davies & Desbordes, 2015; Fernandez-Stark et al., 2012). Importantly, we find that effects are heterogenous not only across value chain segments but across countries as well. We argue that these differences are contingent on (i) the economic activities and tasks in which MNEs' investment is made along GVCs, (ii) the ability of workers to respond to labour market incentives, and (iii) the availability and flexibility of TVET subsystems to adapt their output to changing skill demands of inward FDI. Other possible explanations for distinct effects between similar countries are home-country characteristics of the investing MNE as well as the motivations for investment.

The policy implications stemming from our results are paramount for middle-income economies. Developing human capital to keep pace with changing skill demands should be a policy priority in preventing a slowdown in economic growth and the risk of becoming stuck in mid-value-adding GVC activities. Moving up along GVCs necessitates the *strategic coupling* of regional assets and MNE assets, whereby an intentional convergence and articulation of actors in both regional economies and global value chains for mutual gains and benefits (Yeung, 2015) may facilitate the process of creation, enhancement, and capture of value, upon which regional economic development ultimately depends (MacKinnon, 2012). Our tale of two Southeast Asian economies indicates that FDI in service-oriented value chain segments increases the number of TVET graduates at the subnational region level, suggesting that greenfield FDI through hierarchical control of subsidiaries could provide middle-income countries with the opportunity to reap wider employment benefits from GVC segments, such as sales & marketing as well as support & servicing, and contribute to human capital development. This empirical evidence is in line with the findings by Kleibert (2014) on offshored service industries through FDI in the Philippines. Amoroso and Moncada-Paternò-Castello (2018) show that FDI in ICT—as part of support and servicing—leads to skills upgrading. *FDI-assisted* human capital development should build on the principle of aligning the type of FDI that suits the local skill availability, but emphasising the importance of supporting further investment in the longer value chain (Becker et al., 2020), while continuing to develop the human capital base in order to move into higher value-adding nodes of GVCs (Coe et al., 2008; Ernst & Kim, 2002).

Our results suggest that in attempting to enhance human capital development, it seems reasonable to upgrade both vocational and general education simultaneously, as they appear to be complementary. In the context of middle-income economies, locational upgrading along GVCs requires, among other conditions, a solid human capital base (Crescenzi & Harman, 2022) drawn from both TVET and university graduates (Gereffi et al., 2011). An excessive focus on improving the number and quality of general education graduates risks depleting a well-endowed labour force with a sufficiently developed technical skill set matching the requirements of MNEs participating in higher-value-adding GVC stages. Due to a perceived mismatch between skills supply and demand, MNEs will tend to focus more on on-the-job-training rather than collaborating directly with local TVET providers (Vind, 2008). As a result, general education graduates often work in jobs for which they are overqualified, a misallocation of resources. Especially in times of rapid technological change and high investor mobility, policymakers should develop a diverse regional labour force that includes graduates of general higher education and vocational training in order to build a resilient economy and labour market (Becker et al., 2020). Promotion of MNE engagement in public or private partnerships in both general and vocational education programmes could help to align the supply and demand of skill sets.

However, there are detrimental effects of relying excessively on *MNE-led* human capital development; in other words, there exist some *dangers of external dominance* (Dicken, 2015). In tailoring the domestic skill supply to the specific needs of greenfield FDIs, caution should be exercised: Unless the total number of TVET graduates rises in the local economy, it is plausible that domestic companies will see little benefit from human capital development, which may prevent these local companies and subnational regions from developing the absorptive capacity necessary to leave the mid-value chain. As GVCs become increasingly task-oriented, rather than product- or industry-specific (Pietrobelli et al., 2021), favouring task- and transferable skills-oriented TVET systems can assist middle-income economies in developing their human capital base in a less narrow manner, allowing the flexible use of skilled labour

in a changing global economy, whilst reducing the dangers of external dominance and building resilience; for example, requiring that MNEs guarantee to support TVET beyond their own labour demand, through public–private partnerships, so that local companies can absorb the surplus of skilled labour, therefore developing the "right" skills and raising the overall level of local human capital. Finally, FDI policy on this issues may help reduce territorial inequalities (Iammarino, 2018), by implementing place-sensitive TVET provision for lagging regions, enabling a broader regional spread of human capital development.

Conclusion

In sum, our paper contributes to advancing the existing understanding of the role of FDI in human capital development in middle-income economies in three important ways. First, we put forward evidence on a less-studied orientation of formal education, namely vocational training. We show for two Southeast Asian economies that FDI has the potential to contribute to an increase in vocational training graduates and therefore have a positive impact on human capital development. However, this process is neither guaranteed nor automatic, hence public policy should be aimed at strengthening this educational subsystem. Second, we add to the GVC literature by highlighting the strengthening of the link between FDI in serviced-based activities and human capital development. By focusing on greenfield FDI, we put forward evidence on one GVC governance mode, namely hierarchical control of wholly owned subsidiaries, and its effect on the skill acquisition process. Third, we also contribute to the regional literature by shedding light on the relationship between FDI and human capital development on a subnational scale. Territorial inequalities in middle-income economies are commonplace. The marked differences in regional economic structure and local provision of TVET programmes will result in diverse economic development paths as regions strive to increase and improve their participation in GVCs.

Given the limitations of our study and building on the findings herein, we put forward some open questions for further research. For example, what are the conditions under which a closely coupled labour force may lead to GVC upgrading and regional development in specific locations?

The potential constraints of this link should also be further explored, such as whether GVC participation could hamper human capital development by hindering the ability of domestic firms to upgrade and retain skilled workers. Along the same lines, considering the different GVC governance mechanisms (market, hierarchy, and network) will help cast additional light on the conditions under which MNEs may enable or hinder human capital development. Finally, further research is needed to shed light on the dynamic interactions between human capital development, GVC participation, and economic upgrading; for example, whether skill upgrading necessarily leads to deeper forms of economic upgrading—such as functional or chain upgrading—and ultimately to economic growth.

Appendix

See Tables 4, 5, 6, Figs. 3, 4, 5, 6.

Table 4 Definition of value chain stages

GVC function	Industry activity (*fDi Markets* classification)
1. Business services	Business services [legal, finance, public affairs and government relations, accounting]
2. Headquarters	Headquarters
3. Logistics	Logistics, distribution & transportation
4. Production	Construction
	Electricity
	Extraction
	Manufacturing
5. Research & development	Design, development & testing
	Research & development
6. Sales & marketing	Retail
	Sales, marketing & support
7. Support & servicing	Customer contact centre
	Education & training
	ICT & internet infrastructure
	Maintenance & servicing
	Technical support centre
	Shared services centre
	Recycling

Adapted from Crescenzi et al. (2014) and Sturgeon (2008)

Table 5 Correlation matrix

Indonesia		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
(1)	TVET	1												
(2)	Business services	0.49***	1											
(3)	Headquarters	0.39***	0.93***	1										
(4)	Logistics	0.47***	0.68***	0.70***	1									
(5)	Production	0.27***	0.28***	0.25***	0.26***	1								
(6)	Research & development	0.41***	0.94***	0.98***	0.70***	0.26***	1							
(7)	Sales & marketing	0.49***	0.95***	0.89***	0.70***	0.25***	0.92***	1						
(8)	Support & servicing	0.64***	0.85***	0.76***	0.58***	0.35***	0.80***	0.85***	1					
(9)	Secondary education	0.47***	0.24***	0.18***	0.25***	0.39***	0.18***	0.22***	0.37***	1				
(10)	Tertiary education	0.47***	0.40***	0.35***	0.39***	0.24***	0.35***	0.40***	0.40***	0.52***	1			
(11)	Industry share of GDP	0.34***	−0.062	−0.066	0.24***	0.16***	−0.056	−0.047	0.081	0.18***	0.0015	1		
(12)	Log GDP per capita	0.60***	0.37***	0.29***	0.48***	0.27***	0.32***	0.37***	0.42***	0.45***	0.41***	0.55***	1	
(13)	Log population density	0.49***	0.50***	0.43***	0.32***	0.078	0.48***	0.58***	0.54***	0.019	0.28***	−0.12**	0.12**	1

Vietnam		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
(1)	TVET	1												
(2)	Business services	−0.0014	1											
(3)	Headquarters	−0.024	0.88***	1										
(4)	Logistics	0.0091	0.31***	0.24***	1									
(5)	Production	0.059	0.38***	0.23***	0.51***	1								
(6)	Research & development	0.068*	0.82***	0.78***	0.34***	0.30***	1							
(7)	Sales & marketing	0.058	0.86***	0.70***	0.46***	0.46***	0.71***	1						
(8)	Support & servicing	−0.013	0.44***	0.47***	0.13***	0.26***	0.31***	0.38***	1					
(9)	Secondary education	0.51***	0.43***	0.32***	0.22***	0.43***	0.42***	0.49***	0.28***	1				
(10)	Tertiary education	0.32***	0.14***	0.10**	0.061	0.025	0.12***	0.16***	0.086**	0.25***	1			
(11)	Industry share of GDP	0.24***	0.11***	0.018	0.29***	0.55***	0.17***	0.17***	0.18***	0.43***	0.0025	1		
(12)	Log GDP per capita	−0.028	0.45***	0.33***	0.67***	0.70***	0.49***	0.49***	0.21***	0.31***	0.0086	0.54***	1	
(13)	Log population density	0.078*	0.47***	0.37***	0.26***	0.46***	0.42***	0.48***	0.16***	0.53***	0.049	0.34***	0.52***	1

Legend: $***p < 0.01$, $**p < 0.05$, $*p < 0.1$

Table 6 Robustness tests: dynamic vs. static instruments

Dep. Var. TVET	Vietnam			Indonesia		
	(1)	(2)	(3)	(4)	(5)	(6)
	FE	IV	IV lags	FE	IV	IV lags
Foreign jobs						
1. Business services	– 0.0127	– 0.0054	– 0.0220	– 0.1339*	– 0.1443	– 0.1500
	(0.013)	(0.017)	(0.022)	(0.076)	(0.111)	(0.093)
2. Headquarters	– 0.0842*	– 0.1402*	– 0.1783***	–	–	–
	(0.045)	(0.076)	(0.049)	–	–	–
3. Logistics	0.0045**	0.0040*	0.0225**	0.0058	0.0231	0.0373
	(0.002)	(0.002)	(0.011)	(0.024)	(0.021)	(0.025)
4. Production	– 0.0002	– 0.0001	– 0.0009**	– 0.0004	– 0.0008**	– 0.0007
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
5. Research & development	0.0035	0.0039	– 0.0128	– 0.1056	– 0.3119	– 0.2370
	(0.005)	(0.005)	(0.020)	(0.123)	(0.189)	(0.150)
6. Sales & marketing	0.0166***	0.0216***	0.0372***	0.0495	0.0771**	0.0798**
	(0.005)	(0.007)	(0.011)	(0.030)	(0.036)	(0.037)
7. Support & servicing	0.0004	– 0.0071	0.0266***	0.4617***	0.3830***	0.4562***
	(0.009)	(0.014)	(0.009)	(0.066)	(0.096)	(0.102)
Secondary education	– 0.0694	– 0.0733	0.0379	– 0.0365	– 0.0343	0.4813***
	(0.053)	(0.053)	(0.042)	(0.131)	(0.139)	(0.080)
Tertiary education	0.0891***	0.0863***	0.0157	0.0119	0.0098	0.0106
	(0.030)	(0.030)	(0.010)	(0.010)	(0.009)	(0.025)
Industry share of GDP	– 0.0159	– 0.0148	– 0.0246	– 0.0016	0.0051	– 0.0085
	(0.015)	(0.015)	(0.015)	(0.024)	(0.025)	(0.028)
Log GDP per capita	0.0163	0.0186	– 0.0013	– 0.0044	– 0.0062	0.0069**
	(0.014)	(0.014)	(0.010)	(0.008)	(0.008)	(0.003)
Log population density	– 0.0143	– 0.0210	– 0.0136	0.0008	0.0024	0.0084
	(0.017)	(0.020)	(0.013)	(0.006)	(0.006)	(0.010)
Observations	600	600	600	330	330	330
R-squared	0.447	0.443	0.005	0.717	0.705	0.598
Number of regions	60	60	60	33	33	33
Region FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	No	Yes	Yes	No
Hansen J statistic (p value)	–	–	0.246	–	–	0.445

Clustered standard errors in parentheses. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$

Fig. 3 Vietnam: Formal education system and subsystems. *Notes* In Vietnam, TVET is provided at three educational levels: elementary training (3–12 months), secondary TVET (up to 2 years) and college training (2–3 years). *Source* World TVET Database, Vietnam. UNESCO-UNEVOC International Centre for Technical and Vocational Education and Training
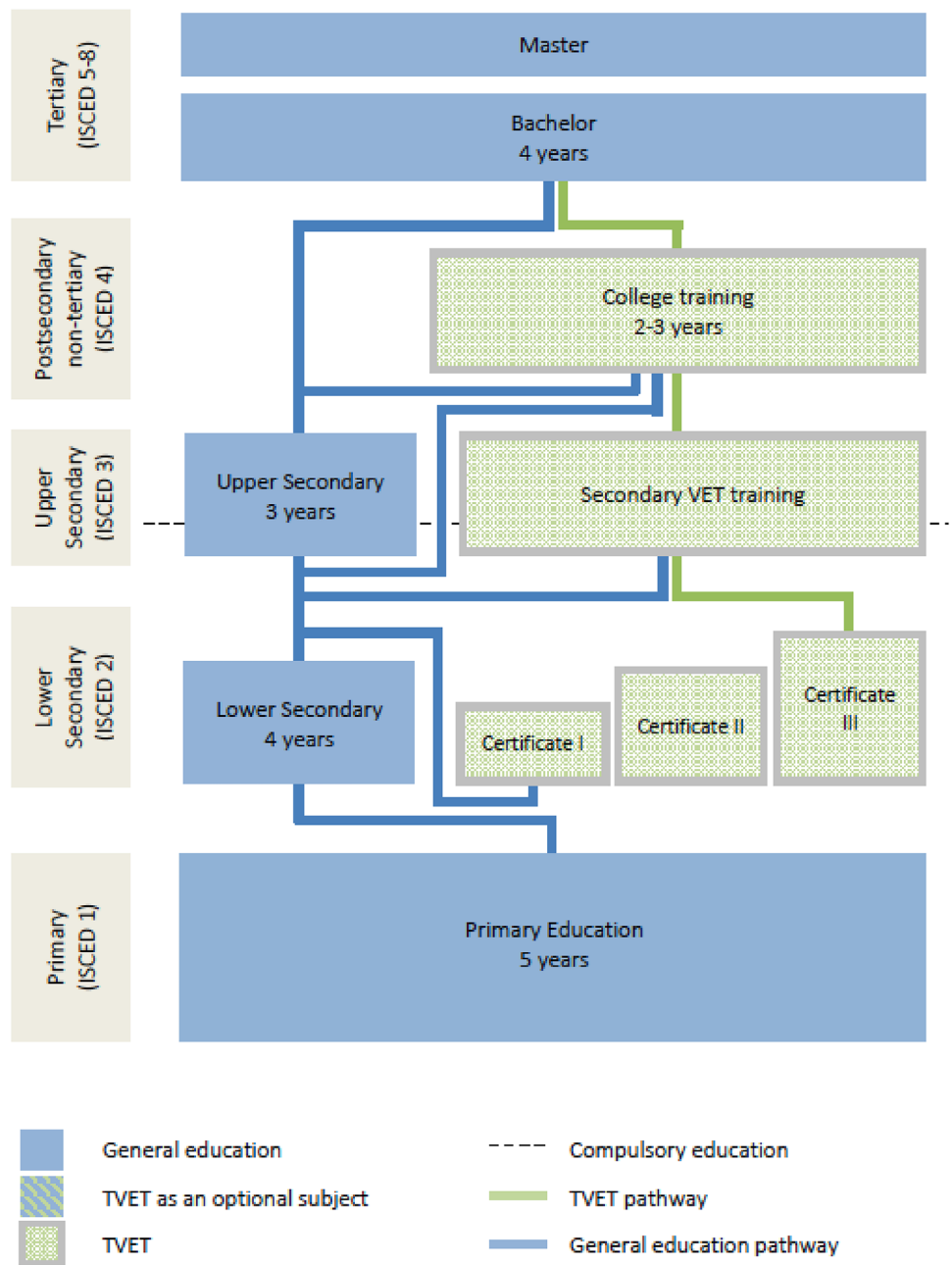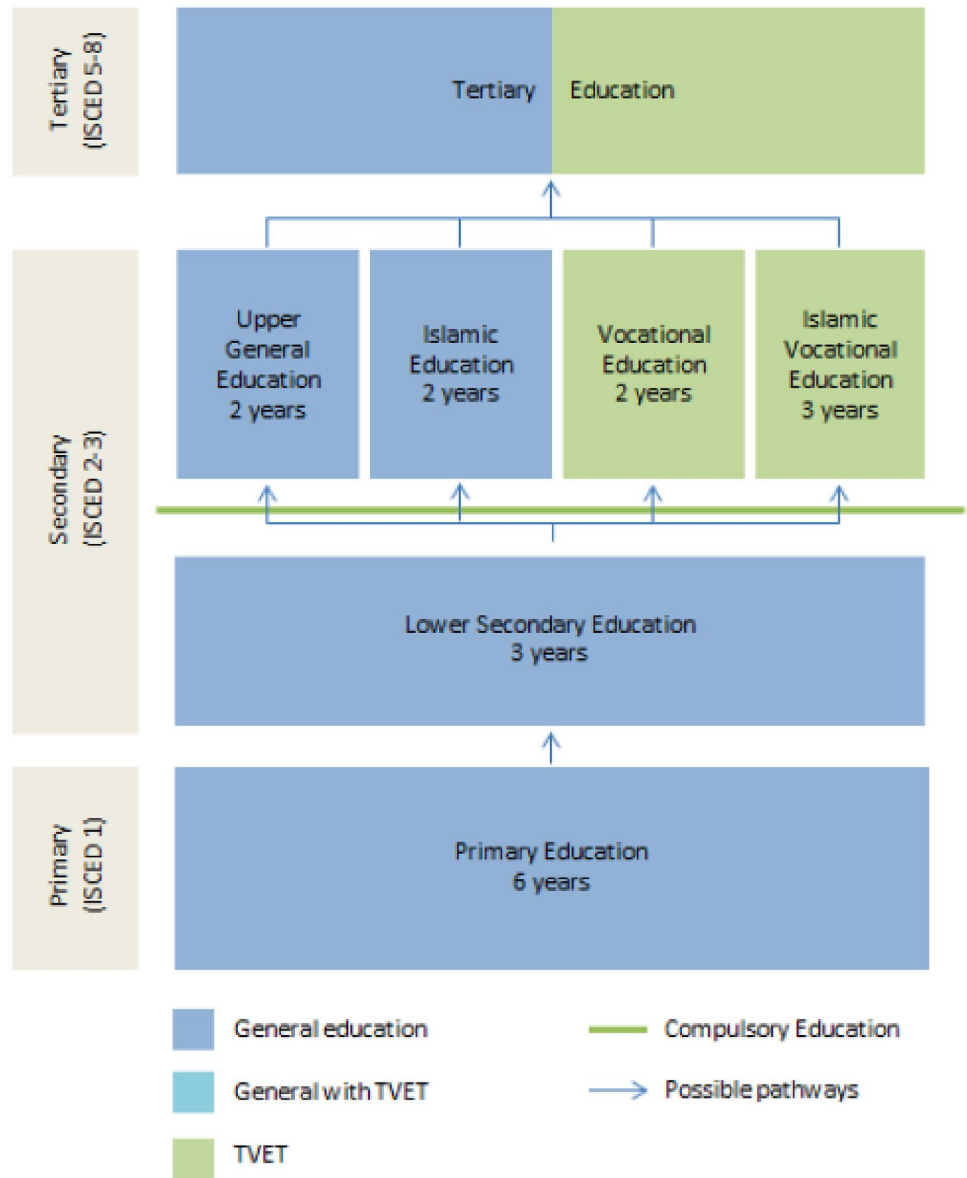
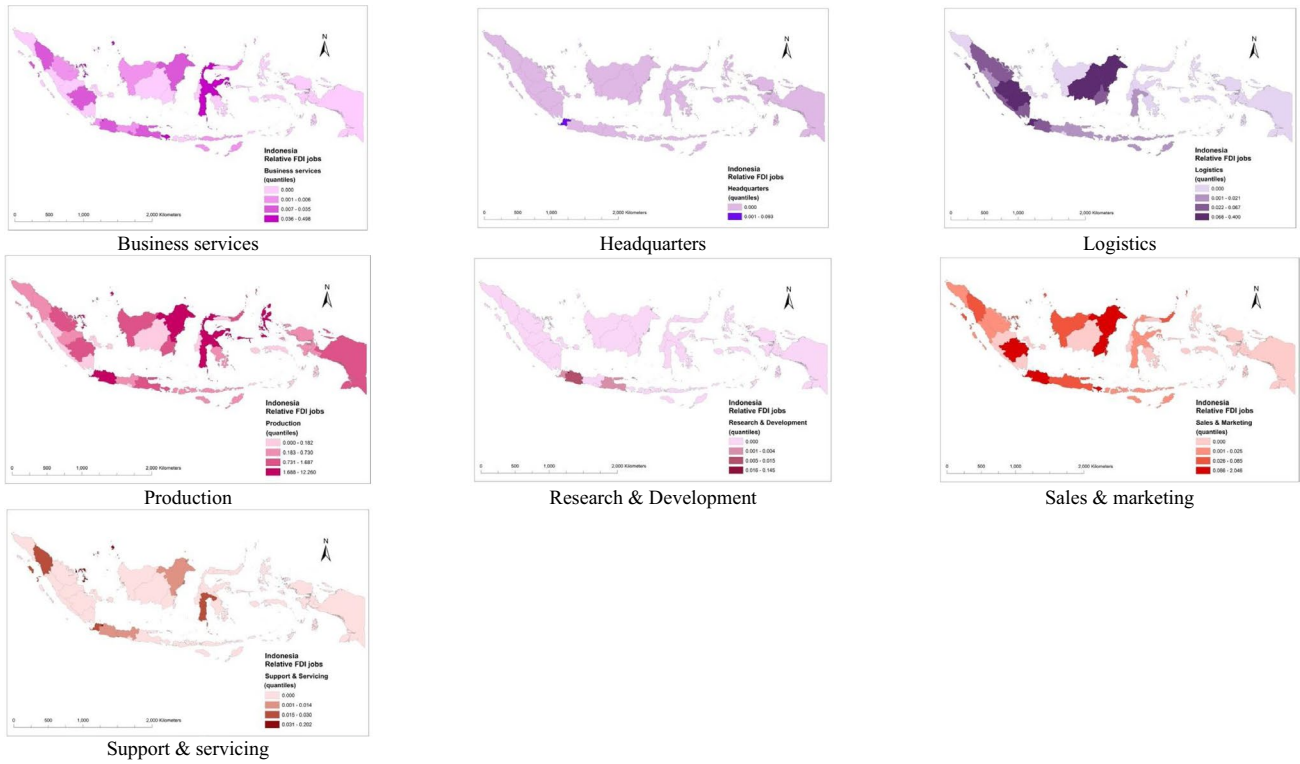**Fig. 4** Indonesia: formal education system and subsystems. *Notes* In Indonesia, TVET consists of provision at two levels: vocational high schools at the secondary level (2–3 years) and the polytechnics and community colleges at the tertiary level. *Source* World TVET Database, Indonesia. UNESCO-UNEVOC International Centre for Technical and Vocational Education and Training

Business services

Headquarters

Logistics

Production

Research & Development

Sales & marketing

Support & servicing

Fig. 5 Indonesia: relative FDI jobs by value chain stage. *Source* Authors, using data from fDi Markets. *Notes* Average values 2006–2016 (quantiles)
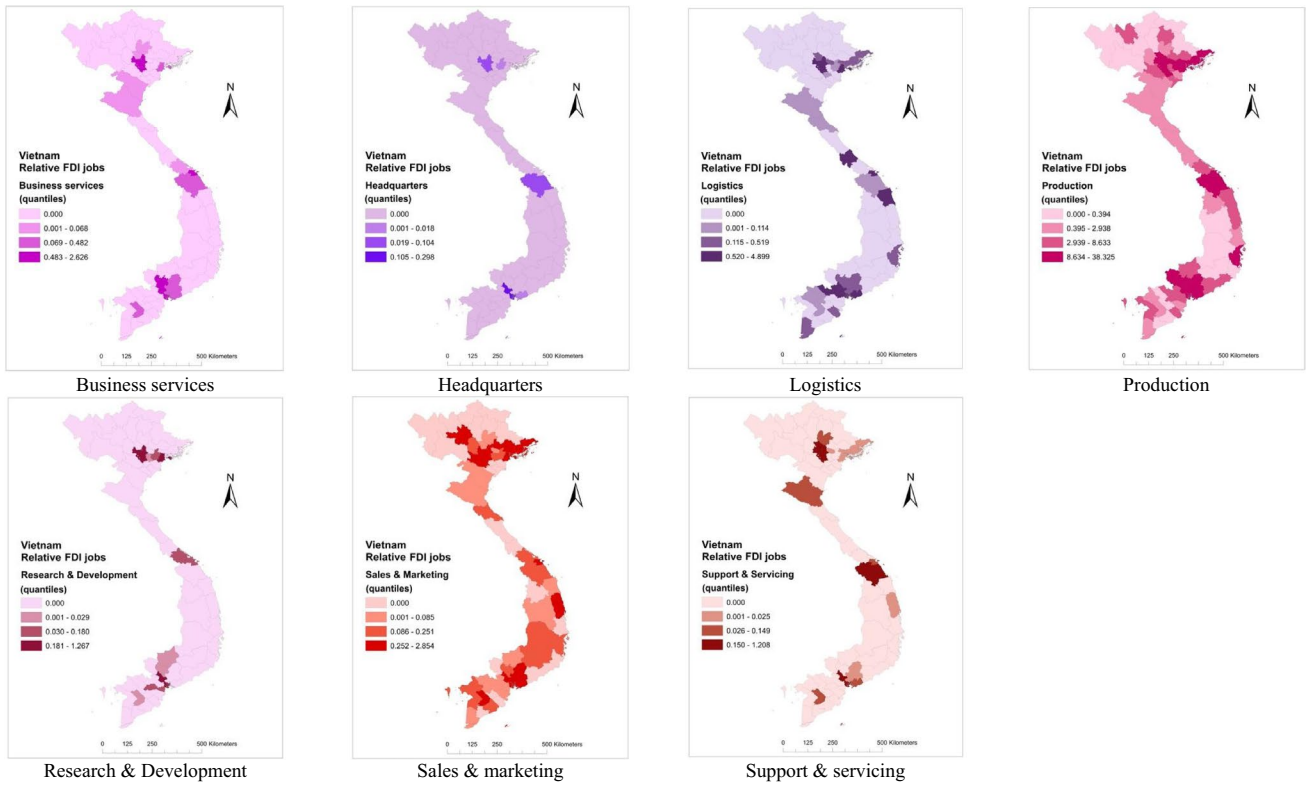
Fig. 6 Vietnam: relative FDI jobs by value chain stage. *Source* Authors, using data from fDi Markets. *Notes* Average values 2006–2016 (quantiles)

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