Foreign Direct Investment Inflows and Human Capital Development, Apparent Links and the Effect of Transmission Mechanism: Evidence from Burkina Faso

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Abstract

Meeting the challenge of human capital development is a concern for governments and development practitioners in developing countries. However, foreign direct investment (FDI) inflows appear to be a means of meeting this challenge by increasing incomes, mobilising tax revenues, boosting productivity and disseminating skills and technologies. The purpose of this paper is to analyse the FDI effects on human capital development through the channel of tax revenue mobilisation. A structural simultaneous equation model, ARDL modelling, and interviews, were used to analyse the data. The results indicate that FDI is a vehicle for tax revenue mobilisation. They also show that tax revenues increase spending on primary, secondary and tertiary education, while FDI significantly enhances primary and tertiary education levels in the long term but reduces secondary education levels in Burkina Faso. In the short-term, FDI reduces tertiary education levels but does not affect primary and secondary education levels. The results further show that the Corporate Social Responsibility (CSR) channel is also an effective means of developing human capital through FDI.

Keywords: *Foreign Direct Investment, Human Capital, Tax Revenue, Simultaneous Equations, ARDL*

1. Introduction

In the early 1990s, Burkina Faso embarked on reforms aimed at a greater liberalisation of its economy and at attracting foreign direct investment (FDI). As a result, the 1990s and subsequent decades have seen greater FDI flows into the country. Similarly, most human capital accumulation indicators, such as secondary and tertiary school enrolment rates, have improved significantly.

This improvement in the education indicators, resulting from the opening-up of the economy and from FDI inflows, raises the question of the impact of these FDI inflows on human capital accumulation in Burkina Faso. Theoretically, the channels through which FDI inflows lead to the improvement of human capital have been identified, notably through the analytical framework proposed by Te Velde (2002). According to this framework, by modifying either the demand for or the supply of education, FDI inflows can lead to an increase in human capital accumulation through four main channels: labour productivity, the returns to education, tax revenues, and the transfer of new technologies.

Yet, from an empirical point of view, the expected positive impact of FDI inflows on human capital development has not always been observed. For example, a review of case studies of Chinese investment in Africa by Calabresse and Tang (2020) highlighted the lack of FDI impact on labour productivity. Similarly, unlike the positive impacts on skills development reported for FDI flows into the automobile industry in Morocco (Riera and Paetzold, 2018) and into ICT in Kenya (AfDB, 2019; Osano and Koine, 2016), FDI inflows into the oil sector in Nigeria have had very little effect on human capital accumulation (Houeland, 2015 and Fajana, 2005). Likewise, studies by Osondu-Oti (2016) and Ndulu (2013) found the same very limited impact of FDI inflows into the zinc-mining sector in Zambia on human capital accumulation.

The case studies reported above seem to indicate that the origin of FDI flows and the investment sector (whether Greenfield or Brownfield investment) are important in determining the effects of these types of investment on the accumulation of human capital, and that the time factor is also key. Indeed, Greenfield investment implies the installation of a new production unit and new means of production. Therefore, it can take around 1 to 2 years before becoming operational. Its impact on demand for education (in the form of an increase in the number of people enrolled in higher education) will therefore take longer to be felt. As for Brownfield investment, it involves the acquisition of an existing foreign investment facility. Its impact on education is

therefore likely to be limited, given that it mainly involves a change of ownership, with no new jobs being necessarily created. However, some technical or managerial know-how may be transferred, and on-the-job training may be provided with the help of expatriate professionals or managers and engineers hired specifically for this purpose. Still, this transfer of skills is not expected to significantly increase the returns to education in the national economy. These two types of FDI coexist in Burkina Faso.

Since the country's opening-up of its economy in the early 1990s, the banking, cotton, telecommunications, and mining sectors have all attracted FDI (CNUCED [UNCTAD], 2009). In Burkina Faso, FDI has been made not only in the natural resources extraction sector (cotton, mining) – a sector which, due to its very nature, has little impact on capital development – but also in the ICT and finance sectors, where FDI has led to the development of skills and increased incomes in the countries mentioned earlier. Given the shortfall in public funding for education and the high poverty levels among the population, FDI is a source of resource mobilisation through tax revenues, which can be used to fund social sectors, particularly education and health, and thus reduce poverty. The tax revenue channel remains little-explored in Burkina Faso, and yet it is the most promising channel through which FDI can make an effective contribution to meeting the challenge of developing human capital in the country.

This study aims to answer the following general question: To what extent has the accumulation of FDI affected the development of human capital in Burkina Faso? From this general question arise the following specific ones:

1. How strong is the relationship between FDI inflows and the categories of human capital accumulation indicators in Burkina Faso?

2. What are the channels through which FDI inflows impact human capital development in Burkina Faso?

The rest of the paper is structured as follows: Section 2 presents the stylised facts concerning the trends in the interaction of FDI inflows and human capital accumulation indicators, and the public policies underlying those trends. Section 3 reviews the literature on the relationship between FDI inflows and human capital development. Section 4 presents the methodology and data used to estimate the effects of FDI on human capital accumulation. Section 5 presents and discusses the estimation results. Section 6 concludes the paper and makes economic policy recommendations.

2. Economic liberalisation and openness, foreign direct Investment, and human capital accumulation in Burkina Faso

After four decades of development efforts through a proactive industrial policy (1960-1990), Burkina Faso, in the early 1990s, embarked on an industrial and development policy focused on the private sector (Zagré, 1994, *Ministère de l'Économie et du Développement* [Ministry of Economy and Development], 2001). This change in approach to economic policy management began in 1991 with the implementation of the first Structural Adjustment Programme (SAP) between 1991 and 1993, followed later by three other SAPs between 1994 and 2002 (*Ministère de l'Économie et du Développement*, 2001). The country's government implemented those SAPs to put an end to economic interventionism. As part of them, in 1991, it launched a programme to privatise 59 State-owned companies, to liberalise most commercial sectors, and to reform the banking system. The SAPs were also aimed at controlling public spending, increasing tax revenue, and implementing reforms to encourage private sector development (*CNUCED* [UNCTAD], 2009).

With a view to liberalising the economy and attracting foreign private investment, the government adopted four successive investment codes in 1992, 1995, 2010 and 2018, thereby enhancing investment incentives (*CNUCED* [UNCTAD], 2009 and MCIA, 2018[3]).

The law establishing a special tax and customs regime applicable to investment agreements signed with the government as part of the implementation of the 2011-2015 Strategy for Accelerated Growth and Sustainable Development (*Stratégie de croissance accélérée et de développement durable, SCADD*) was passed in 2012, while the law on the promotion small- and medium-sized enterprises in Burkina Faso was passed in 2017, with a view to enhancing private sector incentives to invest in Burkina Faso. Other sector-specific laws aimed at facilitating investment in the mining, agricultural, sustainable development, and electricity sectors, and at attracting investment in small- and medium-sized enterprises, were adopted by the government over time (MCIA, 2018). Institutions and structures aimed at promoting the private sector and facilitating the creation and conduct of business were also set up (*CNUCED* [UNCTAD], 2009).

As taxation is an important factor in attracting FDI, the tax and customs codes were overhauled to streamline and reduce business taxation. These changes included the replacement of the turnover tax (TOT) by the value added tax (VAT) in 1992; the introduction in 1992 of the informal sector contribution, which excluded any other

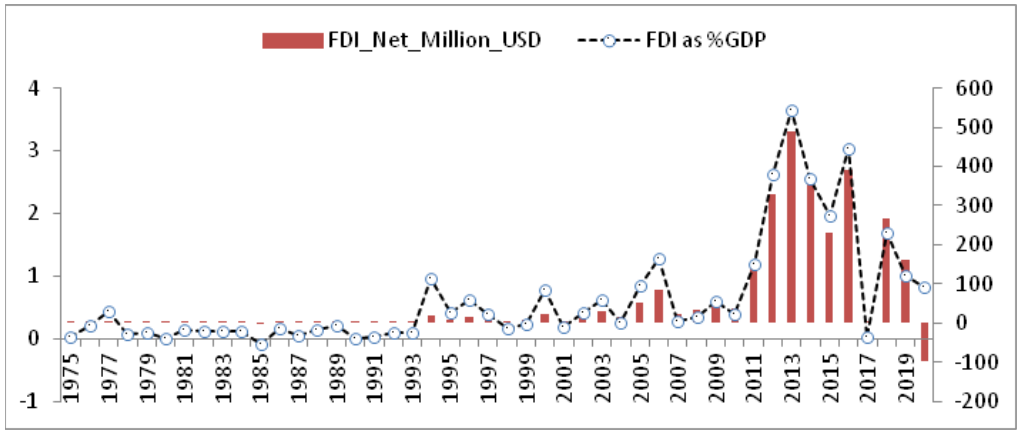
form of levy; the introduction in 1993 of the tax on industrial and commercial profits (BIC); and in 1994 the introduction of tax on property income. In 2005, the tax code was amended to better define the scope of the tax regimes in force in Burkina Faso[4]. This was followed in 2008 by a reduction in the tax on industrial and commercial profits (BIC) from 35% to 30%, after having been reduced from 45% to 35% in 2000. In 2010, the rate of the same (BIC) tax was reduced to 27.5%, while the rate of the tax on income from securities was cut from 15% to 12%[5] (*CNUCED* [UNCTAD], 2009) and *BIT* [ILO], 2010). The economic reforms outlined above were accompanied by liberalisation of the banking system, which saw the Central Bank gradually opt, from 1990, for a monetary policy that fostered indirect instruments for liquidity management.

These measures taken to liberalise the economy and attract FDI had the following effects on the privatisation programme for State-owned enterprises: 27 State-owned enterprises were taken over by private entities at the end of 2007, 6 were liquidated, 13 were restructured, while the process of privatising 6 others continued (*CNUCED* [UNCTAD], 2009). By 2020, of these 6 enterprises still under privatisation, only the Air Transport and National Oil and Gas Company (*Société de Transport Aérien and Société Nationale des Hydrocarbures, SONABHY*) had not been sold to a private buyer (*Commission nationale de Privatisation* [National Privatisation Commission], 2020).

The economic liberalisation undertaken under the 1991-1993 Structural Adjustment Programme paved way for the takeover of the *BRAKINA* brewery by the French Castel Group, the *CIMAT* cement plant by the Swiss Umar Holderbank Group, and the *SOSUCO* sugar factory by the Agha Khan Group. This first wave of privatizations of state-owned companies led to a slight but significant increase in FDI inflows. Net FDI inflows, which hardly ever exceeded 0.1% of GDP per year between 1980 and 1992, rose to 0.7% of GDP in 1994 (Figure 2.1). Between 1994 and 2005, the rise in the FDI curve, although fluctuating and not a steep one, was due to an influx of foreign investment into the financial sector, which saw the takeover of two state-owned banks and the opening of new commercial banks. The rise in the curve was also due to the award of mobile phone licences, followed by the partial privatisation of the national telecommunications company. During the same period, the cotton sector saw the privatisation of the national fibre and textile company and the opening of two new cotton companies. Between 1992 and 2007, the telecommunications sector accounted for around 55% of total FDI inflows. However, since then, the main sector attracting FDI, particularly from Canada, Australia, and South Africa (according to UNCTAD), has been the mining sector, where a number of exploration and exploitation licences have been granted to private companies. As of 2016, more than 300 mining exploration licences had been granted and 17 mines were in operation before the suspension of activities in 2021 and 2022 at 4 industrial mines due to the deteriorating security situation in the country. The FDI flows into this sector resulted in a rapid rise in the volume of FDI inflows, which peaked in 2013 at 3.6% of GDP, but then fell to 3.1% in 2016, before falling sharply between 2017 and 2020 due to the rise in terrorism-related insecurity in the Sahel.

Finally, according to data from the Ministry of Trade, since the beginning of economic liberalisation, small investors have represented another significant source of foreign capital. This category of foreign investment, which comes from both legal entities and individuals, is mainly concentrated in the small-scale industry, the distribution sector, catering, hotels, and professional services.

Figure 2.1: FDI inflows to Burkina Faso (net flows)



Source: Based on the World Bank (2022), World Development Indicators 2022 database

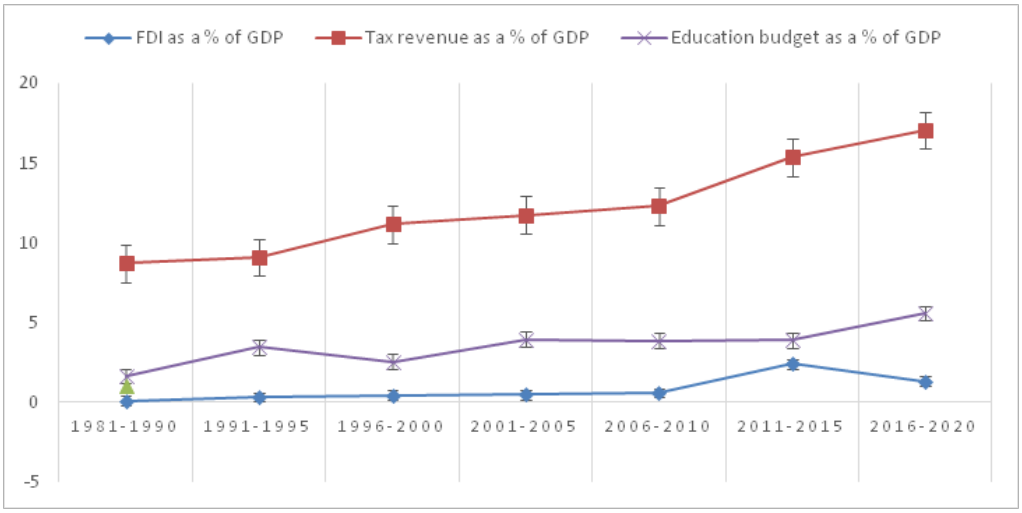
At the macroeconomic level, the policies aimed at liberalising the economy and attracting foreign capital have gradually improved tax revenue collection and increased the openness of the national economy. The increase in tax revenue has made it possible, over time, to increase budget allocations, particularly to the education sector. Indeed, the data in Table 2.1 show a gradual improvement in FDI inflows, which rose from less than 0.01% of GDP between 1981 and 1990, to 0.32% between 1991 and 1995, before rising to 0.58% between 2006 and 2010, then to 2.40% between 2011 and 2015. However, FDI inflows fell to 1.32% between 2016 and 2020. The increase in FDI inflows led to a similar increase in tax revenue collection, which was used to finance education spending. The tax burden rate, which was 8.7% in the 1980s, rose steadily to 11.2% in the second half of the 1990s, to 12.3% between 2006 and 2010, to 15.5% between 2011 and 2015, and to 17.1% between 2016 and 2020. As for the degree of economic openness, which was 19.1% of GDP in the 1980s, it first deteriorated slightly from the beginning of the 1990s to 2005, but recovered from 19.4% between 2006-2010 to around 30.1% in the 2010s.

Table 2.1: FDI inflows, tax revenue, degree of economic openness, and budget for education funding

	1981-1990	1991-1995	1996-2000	2001-2005	2006-2010	2011-2015	2016-2020
FDI as a % of GDP	0.098	0.318	0.439	0.467	0.58	2.396	1.317
Tax revenue as a % of GDP	8.69	9.09	11.15	11.74	12.30	15.36	17.06
Degree of trade openness	19.1	17.2	18.7	16.3	19.4	30.1	29.6
Education budget as a % of GDP	1.648	3.451	2,5495	3.941	3.855	3.879	5.583

Source: Based on the World Bank (2022), World Development Indicators database, and on data from Burkina Faso's Ministry of Economy and Finance, for the tax-revenue-to-GDP ratio.

Figure 2.2: FDI inflows and fiscal variables



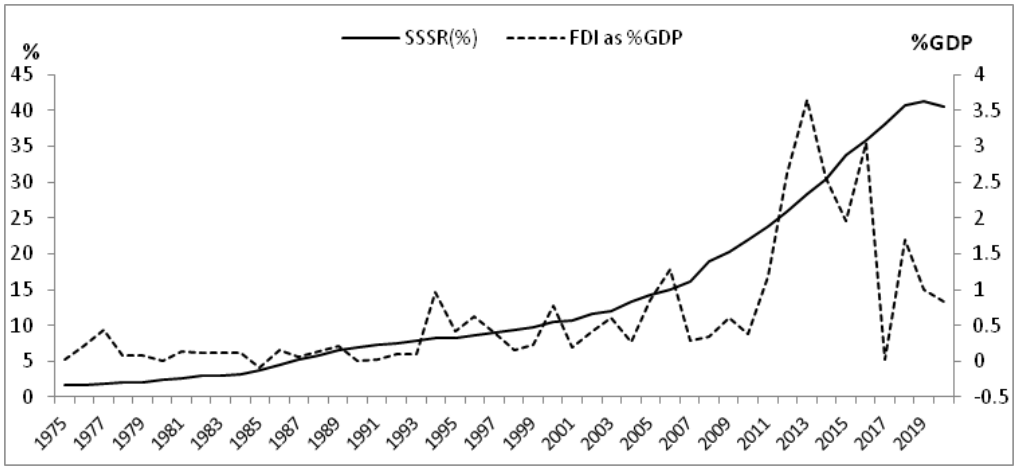
Source: Compiled by the authors
NB: FDI as a % of GDP; Tax incomes as a % of GDP; Education budget as a % of GDP

In terms of the relationship between FDI inflows and human capital development, Figure 2 shows that between 1996 and 2020, FDI inflows to Burkina Faso grew rapidly from a low of 0.16% of GDP in 1998 to a high of 3.65% in 2013, before dropping drastically to 0.8% in 2020. Over the same period, human capital development indicators such as gross secondary school enrolment rate rose rapidly, before declining in turn from 2019 onwards. If we take the gross secondary school enrolment rate as an indicator of human capital accumulation, Figure 2 shows that it rose rapidly from a low of 9.8% in 1999 to a high of 40.7% in 2018, before declining slightly to around 40.0% in 2019 and 2020.

Figure 3 provides an overview of the trends in the returns-to-education rates and FDI inflows in Burkina Faso. It shows the same positive co-variation between the human capital development variable and FDI inflows. However, the decline in the curve for this second human capital accumulation variable between 2016 and 2020 is close in magnitude to that of the FDI curve.

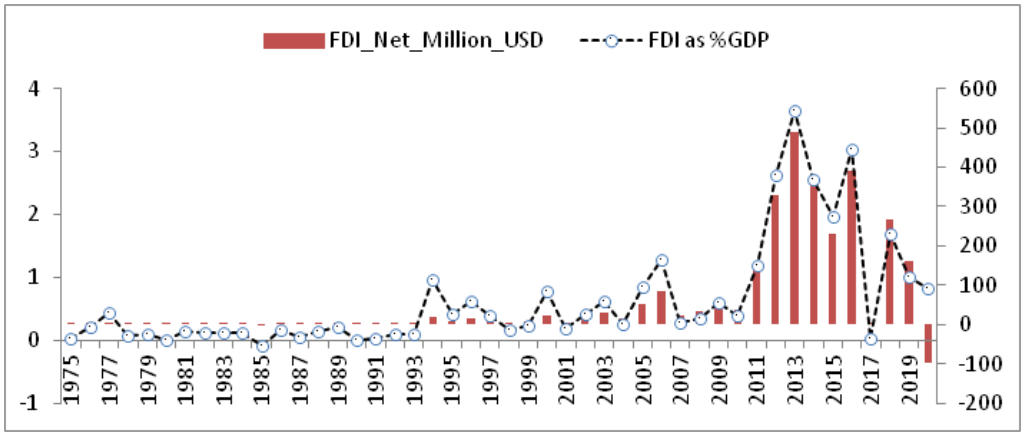
But is this contrast in the nature and extent of the apparent relationship between FDI and human capital development variables inherent in the very nature of these variables? Is there a rather strong relationship between FDI and returns to education, which is the outcome variable for education? Or, on the contrary, is the relationship less clear-cut between FDI and the school enrolment rate, which is the variable for participation in, or access to, education? The weakness of this relationship may also mean that factors other than human capital accumulation are among the determinants of FDI inflows, and vice versa.

Figure 2.3: Co-variation between FDI inflows and the secondary school enrolment rate



Source: Based on the World Bank (2022) World Development Indicators database
NB: Secondary school enrolment rate; FDI as a % of GDP

Figure 2.4: Co-variation between FDI inflows and returns to education



Source: Based on the World Bank (2022) World Development Indicators database
NB: FDI as a % of GDP

3. Theoretical framework and literature review

This research is based on two complementary strands of literature: the literature on the effects of human capital development on FDI inflows and that on the FDI effects on human capital development.

The first strand of the literature, which primarily refers to an analysis of the determinants of FDI inflows, has been the subject of numerous attempts at conceptualiSation and of empirical analyses. Dunning's (1993) pioneering theoretical framework makes FDI inflows dependent on four parameters: a) the search for resources (raw materials, labour, infrastructural resources); b) the search for markets; c) the search for efficiency; and d) the search for or access to strategic assets (research and development, innovation, technological advances). This analytical framework already recognised the importance of skilled labour; i.e. human capital, in attracting FDI. According to Hanushek and Kimko (2000), Newman et al. (2015) and Keller (2010), countries with adequate and efficient education systems generally attract the type of FDI that compensates for weaknesses in domestic investment and facilitates technology transfer. According to the same authors, multinational companies need a qualified workforce for jobs requiring a certain level of expertise. For Cai et al. (2020), economies in which the public, the private and the academic sectors work in perfect collaboration are a source of successful adaptation of human capital supply to actual business requirements. When this is the case, access to vocational, secondary, and higher education is a means of attracting foreign direct investment. In the same vein, Noorbakhsh et al. (2001), Te Velde and McGrath (2005), and Te Velde (2005) argue that human capital development is an important determinant of foreign direct investment. In addition, Dupuch and Milan (2005) point out that investors are attracted not only by the low cost of labour, but also by how qualified the workforce is.

The second strand of literature focuses on the idea that foreign direct investment has an important role to play in the development of human resources through its ability to enhance new skills. Indeed, this mechanism takes place through a number of transmission channels, namely: enhanced levels of schooling, educational attainment, employee labour productivity, and the quality of both vocational and technical training.

Studies have shown that there is a greater volume of employee training in companies where the majority shareholding is in the hands of foreign investors, and international organisations (Miyamoto and Todo, 2008; Tan and Lopez-Acevedo,

2003; Te Velde, 2002; Ritchie, 2001; and Gershenberg, 1987. It is usually less difficult for foreign investors to provide the funds needed for training through loans, as they have easier access to foreign capital and information on training techniques and organisations worldwide.

When acquiring domestic companies, foreign investors often take into account the level of employee training, choosing companies with a higher proportion of university graduates. Since their main objective is to achieve a much higher productivity-enhancing effect on the part of educated employees, companies with a higher proportion of highly qualified employees are more likely to provide training opportunities (Tan and Lopez-Acevedo, 2003).

Furthermore, Te Velde (2002) and Slaughter (2002) argue that not only can FDI bring new technologies and knowledge to recipient countries, but it can also contribute to human capital accumulation by increasing the demand for skilled labour, thus encouraging individuals to enrol for higher education or for short-term specialised training. It follows, therefore, that in the short-term, foreign investors can contribute to skills development indirectly by supporting local educational institutions (Te Velde, 2002) as they can influence their choice of academic programmes and the quality and quantity of vocational training provided by those institutions (Slaughter, 2002). Multinational companies generally employ skilled workers, offer more training opportunities and pay better than local ones (Te Velde, 2002; 2019; Te Velde and Morrissey, 2003; Te Velde and Morrissey, 2004).

Foreign direct investment can increase the level of schooling and training through formal education. In this regard, Miyamoto (2003) observes that certain multinational companies (such as Intel and Toyota) are committed to formal education, for example by granting scholarships or participating in joint research projects with universities in developing countries where they have set up production units. Using data from 29 Chinese provinces from 1978 to 1999, Zhuang (2008) reports that FDI contributes to the training of skilled labour and promotes primary school enrolment. An increase in the proportion of people with primary education level and vocational and technical education is greater in the provinces of China with economic and technological development zones than in other parts.

Another channel through which FDI contributes to the development of human capital is in the returns to education. Multinational companies offer better pay and working conditions than their domestic counterparts. As a result, they increase the returns to education in FDI recipient countries. Egger et al. (2005) studied the link between capital market integration, higher education and growth, and found a positive impact of net FDI inflows on individual incentives to obtain higher education. They show that net FDI inflows increased individual incentives to obtain higher education, thereby raising the relative marginal productivity of skilled workers, compared to that of the unskilled ones, thus leading to stronger economic growth.

4. Methodology and data

This section first presents the research methodology and then the data used.

Methodology for analysing the effects of FDI on human capital development

This section describes the theoretical model and the variables used to estimate the empirical model.

Theoretical basis for the analysis model

The modelling of the relationship between human capital development and FDI flows is based on Te Velde and Xenogiani's (2007) model, which is an improved version of the basic model proposed by Wood and Ridao-Cano (1999). According to the model, trade openness affects the supply of education in an unequal way, through an increase in secondary and higher education enrolments, when incomes and skill levels in countries are high. This model is derived from the Heckscher-Ohlin model of two countries with two factors (skilled vs unskilled labour) and two goods (skill-intensive goods vs labour-intensive goods). In terms of this specification, the demand for labour is a function of the number of skilled workers versus that of the unskilled ones (n) and FDI or the trade openness rate (TR), while labour supply is a function of the relative number of skilled and unskilled workers, education opportunities (EO) and skills acquisition, irrespective of the current level of demand.

$$D(n, FDI\ or\ TR) = S(n, EO) \quad (1)$$

The reduced form of this function is written as follows:

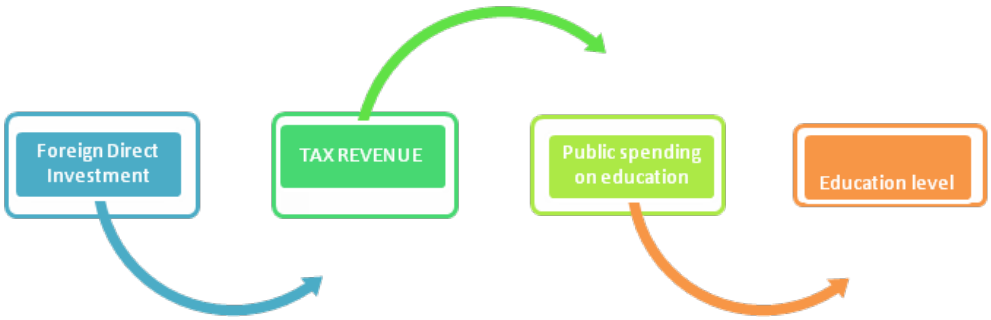
$$n = f(FDI\ or\ TR, EO) \quad (2)$$

The development of human capital depends on foreign direct investment and on the variables relating to opportunities for access to education, such as public spending on education, income levels, etc.

$$DCH = f(ide, OE) \quad (3)$$

Equation (3) captures the direct effects of foreign direct investment on human capital.

To analyse the effects of FDI through the tax revenue mobilisation channel, a structural model with simultaneous equations was derived from this equation (3), based on the idea that the financial resources used to finance public spending on education come from tax revenue, and that FDI helps to increase the level of tax revenue. This characterisation of the channel through which net FDI flows impact on human capital accumulation in Burkina Faso, and can be schematised as follows:



Data and empirical specification of the analytical model

Choice of variables and data sources

Usually, the indicator used in the literature to measure human capital is the primary and/or secondary school enrolment rate (Mankiw et al., 1992; Levine and Renelt, 1992; Borensztein et al.,1998; Nunnenkamp, 2002). However, we think that higher education is also a relevant indicator of human capital in developing countries, notably in Burkina Faso. There are three reasons for this: firstly, primary school and secondary school education are becoming compulsory in more and more developing countries. Secondly, education is often the government's responsibility and responds more to public policy preferences than to individual choices and market forces. Finally, higher education can be used as an indicator of human capital development, which is partly provided for by the government through grants and scholarships, financed by tax revenue, and is also supported by FDI, since this type of investment requires certain technical, professional, and managerial skills.

The choice of variables for this study was essentially based on the existing literature. As for secondary data, they were obtained from the World Bank databases (World Development Indicators), UNCTAD annual reports, the Heritage Foundation, and Barro and Lee database (PWT, 9.1). The data relate to time series covering the longest possible period, namely between 1990 and 2021. Table 4.1 summarises the variables and their sources.

Table 4.1: Variables and their sources

Variables	Abbreviation	Source
Primary education spending	Dép_educ_prim	WDI
Secondary education spending	Dép_educ_sec	WDI
Higher education spending	Dép_educ_sup	WDI
Tax revenue	RF	WDI
Income levels	Gdphbt	WDI
Quality of primary education	Qual_ed_Prim	WDI
Quality of secondary education	Qual_ed_sec	WDI
Quality of higher education	Qual_ed_sup	WDI
Primary school enrolment rate	DCH_prim	WDI
Secondary school enrolment rate	DCH_sec	WDI
Tertiary enrolment rate	DCH_sup	WDI
Initial endowment for skills	RE	PWT.9.1 (Barro et Lee)
Government effectiveness	Eff_gouv	WGI
Political stability and absence of terrorism or violence	Stab_abs_ter	WGI
Corruption control	Cont_corrup	WGI
Foreign Direct Investment as % of GDP	IDE	UNCTAD

Source: Compiled by the authors

Descriptive statistics

Table 4.2 summarises the descriptive statistics of the variables used in the econometric estimations. It shows that there was considerable variation in foreign direct investment over the period 1960 to 2021, with a standard deviation of 0.98 and a mean of 0.56. There was less variation in the net rates for primary, secondary and tertiary enrolment over time. Those rates were 1.58, 12.63 and 2.16, respectively. However, the net enrolment rate for tertiary education varied more than the average over time.

Table 4.2: Descriptive statistics for the variables

Variable	Observations	Mean	Std. dev.	Minimum	Maximum
Foreign direct investment	32	1.02008	1.129768	0.0130531	4.510909
Rule of law	26	-0.4532247	0.1922656	-0.9332216	0.1115191
Regulation quality		-0.257357	0.1370889	-0.4423672	0.1115191
Political stability	26	-0.4047931	0.5368679	-1.551598	0.3076967
Corruption control	32	-0.1311648	0.194875	-0.5229404	0.1115191
Initial endowment for skills	32	1.134556	0.0806522	1.029605	1.258523
Tax revenue	32	11.15891	2.70754	7.55606	15.50009
Higher education	32	3.011568	2.184562	0.70098	7.09613
Secondary education	32	19.50334	12.24789	6.89189	41.3111
Primary education	32	2.542167	1.392298	0.65018	5.52065
Higher education quality	32	18.27985	3.930178	10.37588	29.80317
Secondary education quality	32	25.14181	3.135199	21.65206	31.34198
Primary education quality	32	48.01215	5.561191	39.72173	59.77943
Mining income	32	1.368412	1.90269	0.0006293	7.061493
Inflation	32	2.846469	4.573097	-3.967781	17.39082
Income level	32	2.5187	2.419726	-3.21126	7.987484
Higher education spending	32	11.25175	4.680763	3.356209	21.71843
Secondary education spending	32	19.01838	8.059263	7.80982	34.15789
Primary education spending	32	66.9364	12.52373	50.18851	98.66846

Source: Computed by the authors

Testing for the stationarity of variables

Testing for stationarity is essential before using a time series for estimation purposes. In a time series, the Augmented Dickey-Fuller (ADF) (Dickey and Fuller, 1981) and Phillips-Perron (PP) (Phillips and Perron, 1988) unit root tests are used to test the order of integration of the variables. The ADF test is applied to eliminate the possibility of incorrectly rejecting a correct null hypothesis. For their part, PP procedures are used to calculate a residual variance that is robust to autocorrelation. They are commonly used to check the non-stationarity of variables as an alternative to the ADF unit root test. The results of the augmented Dickey-Fuller test show that most of the variables are stationary in first differences. The results are presented in Table 4.3.

Table 4.3: Results of the ADF test for the presence of a unit root

Variables	T-statistic	Critical value	Stationarity decision
Primary education spending	-10.164	-4.251	(1) ***
Growth in GDP per capita	-13.954	-4.130	(1) ***
Pupil-teacher ratio (primary school)	-6.102	-4.159	(1) ***
Income tax	-3.972	-4.380	(1) **
Mining income	-6.189	-4.150	(1) ***
Education efficiency and duration	-3.280	-3.174	(1) *
Government effectiveness	-22.717	-4.380	(1) ***
Foreign direct investment (fdigdp)	-11.404	-4.150	(1) ***
Foreign direct investment (stock)	-5.716	-4.148	(1) ***
Secondary education spending	-10.830	-4.224	(1) ***
Pupil-teacher ratio (secondary school)	-13.305	-4.159	(1) ***
Higher education spending	-10.469	-4.224	(1) ***
Student-teacher ratio (tertiary institutions)	-11.043	-4.159	(1) ***
Inflation	-5.144	-4.128	(0) ***
Political stability: absence of violence and terrorism	-6.644	-4.380	(1) ***
Regulation quality	-10.639	-4.380	(1) ***
Corruption control	-5.095	-4.380	(1) ***
Tax revenue	-4.532	-4.125	(1)**
Primary education level	-8.754	-4.159	(1) ***
Secondary education level	-3.335	-3.182	(1) *
Tertiary education level	-7.181	-4.159	(1) ***

Significance threshold: * =10%, ** = 5% and ***=1%.
(0), level stationary; (1), first difference stationary
Source: Computed by the authors

After establishing the order of the levels of integration of the variables, we need to test for possible cointegration between the variables.

Tests for the cointegration of variables

The aim of the cointegration test is to determine the long-term equilibrium relationship between variables. The Johansen trace test is used to test for cointegration between variables, which implies that the variables must be in the same order of integration, I (1) or I (2), if they are not stationary in their level forms. Indeed, the null hypothesis for the trace test is that the number of cointegrating vectors is less than or equal to 0, to 1, or to 2, respectively. The null hypothesis is tested against an alternative hypothesis for each case to estimate the number of cointegrating vectors in the model. The approach developed by Johansen (1988) and Johansen and Juselius (1990) is commonly used to avoid the issues arising from the methodology proposed by Engel and Granger

(1987), which allows us to study a cointegrating relationship between independent variables and a dependent variable. The Johansen cointegration test is one of the most reliable techniques, compared with alternative methods for small samples. The existence of cointegration between variables eliminates the possibility of spurious correlation. That is why, before estimating the long-term coefficients, the existence of cointegration between the variables must be established. To this end, we applied the Johansen test to equations 5, 6 and 7 below. The results show that there are at least 4 cointegrating relationships for primary education, 5 for secondary education ,and 3 for tertiary education. As for labour productivity, there are 4 cointegrating relationships. The results of the various tests are summarised in the following tables.

Equation (3) captures the role of FDI in the development of human capital at different education levels in Burkina Faso. For its part, equation (4) captures the importance of FDI in the development of human capital at the primary level.

$$DCH_{it} = \beta_0 + \beta_1 RE_t + \beta_2 fdi_t + \beta_3 dep\_edu_{it} + \beta_4 PT_t + \beta_5 Quality\_edu_{it} + \theta X_t + \varepsilon_t \quad (4)$$

In this equation, human capital is measured in relation to education levels (primary, secondary, tertiary) and to labour productivity. The level of human capital is brought in as a function of the different education levels.

$$DCH_{it}, where\ i = \ primary, secondary\ and\ tertiary\ levels$$

T=1990…., 2021

The FDI effects on primary education are determined in Equation (5).

$$DCH_{primt} = \beta_0 + \beta_1 RE_t + \beta_2 fdi_t + \beta_3 dep\_edu_{primt} + \beta_4 PT_t + \beta_5 Qual\_ed_{primt} + \theta X_t \quad (5)$$

Table 4.4: Results of the cointegration test for the primary education equation

Rank	Params	LL	Eigenvalue	Trace statistic	Critical value
0	8	-214.45193	.	266.5125	156.00
1	23	-162.93337	0.98378	163.4754	124.24
2	36	-136.3484	0.88078	110.3054	94.15
3	47	-115.8616	0.80582	69.3318	68.52
4	56	-101.90322	0.67263	41.4151*	47.21
5	63	-92.822503	0.51638	23.2536	29.68
6	68	-86.324291	0.40539	10.2572	15.41
7	71	-83.280145	0.21615	4.1689	3.76
8	72	-81.195683	0.15359		

Source: Computed by the authors

The FDI effects on secondary education are determined by Equation (6).

$$DCH_{sect} = \beta_0 + \beta_1 RE_t + \beta_2 fdi_t + \beta_3 dep\_edu_{sect} + \beta_4 PT_t + \beta_5 Qual\_ed_{sect} + \theta X_t + \varepsilon_t \; 1 \quad (6)$$

Table 4.5: Results of the cointegration test for the secondary education equation

Rank	Params	LL	Eigenvalue	Trace statistic	Critical value
0	8	-187.25816	.	314.5838	156.00
1	23	-127.7676	0.99143	195.6027	124.24
2	36	-94.48296	0.93025	129.0334	94.15
3	47	-70.02361	0.85868	80.1147	68.52
4	56	-55.105534	0.69683	50.2786	47.21
5	63	-43.621217	0.60098	27.3099*	29.68
6	68	-37.551126	0.38468	15.1698	15.41
7	71	-32.713816	0.32090	5.4951	3.76
8	72	-29.966245	0.19733		

Source: Computed by the authors

The FDI effects on higher education are determined by Equation (7).

$$DCH_{supt} = \beta_0 + \beta_1 RE_t + \beta_2 fdi_t + \beta_3 dep\_edu_{supt} + \beta_4 PT_t + \beta_5 Qual\_ed_{supt} + \theta X_t + \varepsilon_t \quad (7)$$

Table 4.6: Results of the cointegration test for the higher education equation

Rank	Params	LL	Eigenvalue	Trace statistic	Critical value
0	8	-172.93926	.	270.4026	156.00
1	23	-120.76811	0.98460	166.0603	124.24
2	36	-91.540564	0.90350	107.6052	94.15
3	47	-71.629926	0.79665	67.7839*	68.52
4	56	-53.018651	0.77438	30.5614	47.21
5	63	-46.157973	0.42239	16.8400	29.68
6	68	-42.089174	0.27784	8.7024	15.41
7	71	-39.17547	0.20792	2.8750	3.76
8	72	-37.737955	0.10863		

Source: Computed by the authors

Econometric specification

Econometric specification of the model for analysing the direct FDI effects on human capital

In view of the results of the cointegration test, analysing the FDI effects using an ARDL model that captures the FDI effects in the short- and the long-term is appropriate. The general form of the model is written as follows:

$$Y_t = \varphi + a_1 Y_{t-1} + \cdots + a_P Y_{t-P} + b_0 X_t + \cdots + b_q X_{t-q} + e_t \quad (8a)$$

Written another way, Equation (8) is as follows:

$$Y_t = \varphi + \sum_{i=1}^{p} a_i Y_{t-i} + \sum_{j=0}^{q} b_j X_{t-j} + e_t \quad (8b)$$

where $e_t \sim iid(0, \sigma)$ *is* the error term and b_0 designates the short-term effect of X_t on Y_t

We can consider the long-term or established equilibrium relationship as follows:

$$Y_t = k + \emptyset X_t + u \quad (9),$$

and then calculate the long-term effect of X_t on Y_t, which is defined as follows:

$$\emptyset = \frac{\sum b_j}{(1 - \sum a_i)} \ .$$

As with any dynamic model, the Akaike Information Criterion (AIC) is used to determine the optimal lag that will allow the model to display a minimum value.

$$AIC(p) = log\left|\hat{\Sigma}\right| + \frac{2}{T} n^2 p$$

Where $\hat{\Sigma} =$ covariance-variance matrix of the estimated residuals, T= number of observations; p = lag of the estimated model, and n = the number of regressors.

The existence of cointegration between the variables of the different models requires the use of an ARDL model. Therefore, equations 4, 5, 6 and 7 will be reformulated as follows:

$$\Delta DCH_{it} = \beta_0 + \sum_{i=1}^{p} \beta_{1i} \Delta DCH_{t-i} + \sum_{j=0}^{q} \beta_{2j} \Delta fdi_{t-j} + \sum_{j=0}^{q} \beta_{3j} \Delta RE_{t-j} + \sum_{j=0}^{q} \beta_{4j} \Delta dep\_edu_{t-j} \quad (9)$$

$$+ \sum_{j=0}^{q} \beta_{5j} \Delta PT_{t-j} + \sum_{j=0}^{q} \beta_{6j} \Delta quali\_ed_{t-j} + \alpha_1 DCH_{t-1} + \alpha_2 fdi_{t-1} + \alpha_3 RE_{t-1}$$

$$+ \alpha_4 dep\_edu_{sect} + \alpha_5 PT_{t-1} + \alpha_6 Qual\_ed_{sect} + \varepsilon_t$$

In this equation:

- $\beta_{i1}, \beta_{i2}, \beta_{i3}, \beta_{i4}, \beta_{i5}, \text{and } \beta_{i6}$ are the short-term effects.
- $\alpha_1, \alpha_2, \alpha_3, \alpha_4, \alpha_5 \text{ and } \alpha_6$ are the long-term effects.
- ε_t is the error term.
- Δ is the first difference.

In this human capital equation, we introduce the type of human capital to determine the extent of its relationship and apparent effects, with foreign direct investment (FDI). Thus, we have:

ΔDCH_{it} = primary,secondary,and tertiary level

$$\Delta DCHPRIM_{it} = \beta_0 + \sum_{i=1}^{p} \beta_{1i} \Delta DCHPRIM_{t-i} + \sum_{j=0}^{q} \beta_{2j} \Delta fdi_{t-j} + \sum_{j=0}^{q} \beta_{3j} \Delta RE_{t-j} \quad (10)$$

$$+ \sum_{j=0}^{q} \beta_{4j} \Delta dep\_edu_{t-j} + \sum_{j=0}^{q} \beta_{5j} \Delta PT_{t-j} + \sum_{j=0}^{q} \beta_{6j} \Delta quali\_ed_{t-j} + \alpha_1 DCH_{t-1}$$

$$+ \alpha_2 fdi_{t-1} + \alpha_3 RE_{t-1} + \alpha_4 dep\_edu_{sect} + \alpha_5 PT_{t-1} + \alpha_6 Qual\_ed_{sect}$$

$$+ \varepsilon_t$$

The equation for the secondary level is described as follows:

$$\Delta DCHSEC_{it} = \beta_0 + \sum_{i=1}^{p} \beta_{1i} \Delta DCHSEC_{t-i} + \sum_{j=0}^{q} \beta_{2j} \Delta fdi_{t-j} + \sum_{j=0}^{q} \beta_{3j} \Delta RE_{t-j} + \sum_{j=0}^{q} \beta_{4j} \Delta dep\_edu_{t-j} + \sum_{j=0}^{q} \beta_{5j} \Delta PT_{t-j} + \sum_{j=0}^{q} \beta_{6j} \Delta quali\_ed_{t-j} + \alpha_1 DCH_{t-1} + \alpha_2 fdi_{t-1} + \alpha_3 RE_{t-1} + \alpha_4 dep\_edu_{sect} + \alpha_5 PT_{t-1} + \alpha_6 Qual\_ed_{sect} + \varepsilon_t \quad (11)$$

The equation for the higher education access rate is:

$$\Delta DCHSUP_{it} = \beta_0 + \sum_{i=1}^{p} \beta_{1i} \Delta DCHSUP_{t-i} + \sum_{j=0}^{q} \beta_{2j} \Delta fdi_{t-j} + \sum_{j=0}^{q} \beta_{3j} \Delta RE_{t-j} + \sum_{j=0}^{q} \beta_{4j} \Delta dep\_edu_{t-j} + \sum_{j=0}^{q} \beta_{5j} \Delta PT_{t-j} + \sum_{j=0}^{q} \beta_{6j} \Delta quali\_ed_{t-j} + \alpha_1 DCH_{t-1} + \alpha_2 fdi_{t-1} + \alpha_3 RE_{t-1} + \alpha_4 dep\_edu_{sect} + \alpha_5 PT_{t-1} + \alpha_6 Qual\_ed_{sect} + \varepsilon_t \quad (12)$$

Specifying the model for analysing the effects of FDI through the tax revenue channel

To understand the mechanism by which foreign direct investment affects the development of human capital, we estimated a structural model with simultaneous equations inspired by Equation (3). The model is defined as follows:

$$\begin{cases} RF_t = \beta_0 + \beta_1 ide_t + \beta_2 stabi_{pol\ t} + \beta_3 contr_{corrup\ t} + \beta_4 inf_t + \beta_5 dota_{int_{comp}\ t} + \beta_6 mining\_income_t + \varepsilon_t \\ Dep_{edu\ it} = \propto_0 + \propto_1 RF_t + \propto_2 ide_t + \propto_3 min\_income_t + \propto_4 ratio_{el\ it} + \propto_5 contr_{corup\ t} + \propto_6 gdphbt_t + \varepsilon_t \\ Level\ of\ _{scola\ it} = \delta_0 + \delta_1 dep_{educ\ it} + \delta_2 fdi_t + \delta_3 contr_{corrup\ t} + \delta_4 gdphbt_t + \delta_5 rule\_law_t + \delta_6 mining\_income_t + \varepsilon_t \end{cases} \quad (13)$$

In this equation

i = primary,secondary and tertiary,while t=1990 to 2021

The results are analysed simultaneously and according to the different education levels.

5. Results and discussion

This section first presents the results of qualitative analysis and then those of the econometric analysis.

Results of qualitative analysis

The results of the interview with company managers clearly indicate that foreign direct investment is a vector for the development of human capital, not only through tax mobilisation to finance public spending on education, but also through increased income and the direct training of employees, the education of pupils and students, internships and scholarships. For example, telecommunications and banking-sector companies participate in the development of human capital through employee and trainee training and management development programmes.

As for the mining companies, in addition to the taxes they pay, and as part of their corporate social responsibility (CSR), they contribute through the mining fund for local development, to the construction of educational and health infrastructure. For example, BISSA GOLD's CSR strategy can be summed up in the following various achievements in the socio-economic and environmental fields, according to the company's community relations office: BISSA GOLD invested more than CFAF 736,000,000 in 2021 in areas such as education, health, youth training, the building of community infrastructure, agriculture and livestock, and award of contracts to sub-contractors. The company's recruitment policy focuses primarily on unskilled jobs, which it offers in their entirety to the communities affected. Its recruitment system is based on quotas, from the most affected commune to the least affected one. The most affected commune is Sabcé, to which 40% of the unskilled jobs are allocated. The second most affected is Mané, which gets 30% the third one is Gibaré, which gets 20% and the fourth one is Koungoussi, which gets 10%. These are the quotas for unskilled jobs. For skilled jobs, priority is given to local communities, and when there are no applications, BISSA extends the demand to the rest of the country.

The IAMGOLD ESSAKANE SA mining company is also an example of human capital development. The mine has 2,480 direct employees, 97% of whom are Burkina Faso nationals. About 37% of its employees are nationals of the Sahel region. Women account for 11% of its employees. On average, 200 days labourers are recruited per month. Around 1,000 direct jobs are generated in the community thanks to purchases by the entrepreneurs from the Sahel region.

Diversity is a key value at IAMGOLD. The company recognises the importance of a diverse workforce and of maintaining and respecting the rights and differences of its employees. The ESSAKANE mine is a leader in Burkina Faso in taking gender initiatives in the mining sector. Since the start of its operations, symbolic and courageous measures have been taken to increase and maintain the number of female employees, including an exceptional maternity leave of 14 months, the establishment of an Essakane Village Women's Committee, the inclusion of gender into community investment criteria, and support for sectoral initiatives to promote gender in the mining sector through collaboration with the Women Miners' Association (*Association des Femmes Minières, AFEMIB*) and the Burkina Chamber of Mines.

Since 2012, a succession development plan (*Plan de Développement de la Relève, PDR*) has been implemented to ensure that the company has a Burkinabe workforce that will gradually replace the expatriate employees. To enhance the employability of young people, IAMGOLD ESSAKANE has set up an internship programme in partnership with universities and public and private colleges in Burkina Faso, North Africa, and Canada. The aim of this programme is to provide opportunities for students to familiarise with the workplace. Since 2014, more than 600 young people have benefited from work placements, with opportunities for integration. In 2017 and 2018, the mining company awarded two (2) excellence scholarships for international studies to the best high school graduates in Burkina Faso and the Sahel region. In 2018, the company signed a financing agreement with the ministry in charge of higher education for CFAF 400 million, benefiting the *Ecole Normale Supérieure d'Ingénieurs de Fada* (*ENSIF*) and the public university of Dori. In 2018, it granted ten (10) internship positions to students from *ENSIF* and 200 internships nationwide for 2019. In 2019, it signed a framework partnership agreement with the International Institute for Water and Environmental Institute (*Institut International d'Ingénierie de l'Eau et de l'Environnement, 2IE*) to strengthen collaboration in the areas of continuing education, research, professional integration, etc. Around 1,000 young people from the Sahel region have been trained in crafts in partnership with *ANPE-Dori* (*Agence Nationale pour la Promotion de l'Emploi* [National Bureau for Employment Promotion]).

The ESSAKANE mining company is also a major player in Burkina Faso's economy. Between 2010 and 2020, it contributed more than CFAF 433 billion in various taxes. It has also developed a wealth-sharing strategy that makes local supply the keystone of its contribution to national development. Since 2010, its supply chain has generated more than CFAF 1,000 billion in sales to companies based in Burkina Faso. At the Sahel regional level, nearly CFAF 30 billion in sales has been generated by Sahel companies since 2012. Orders for goods and services placed with entrepreneurs in the Sahel region have generated around 1,500 indirect jobs. It is estimated that more than 60% of the company's profits are reinjected into the national economy.

For its part, the HOUNDE GOLD mining company has been contributing to the development of social sectors such as education, health, drinking water, sanitation, and institutional support. It makes such investments through its Local Development Mining Fund. The company paid out CFAF 217,232,881 in 2017, CFAF 1,454,409,497

in 2018, CFAF 1,460,566,222 CFA in 2019, CFAF 2,440,488,527 in 2020, and CFAF 2,896,908,385 in 2021. The total of these sums is CFAF 8,469,605,512. As of 28 February 2022, the mine employed 405 people from the town of Houndé, representing around 33% of employees from Houndé, against 63.5% from the rest of Burkina Faso and 3.5% expatriates. All these people were directly employed by the mining company. There are also jobs created by subcontracting companies employing local young people. Training initiatives for young people include the training of a group of 123 young people in mining jobs, the training of around 20 master craftsmen in motorcycle/auto mechanics, the awarding of internships in *HGO* departments (80 young people per group of 20), of university scholarships and internships in universities and training centres for 26 high-school leavers from Tuy province.

To better understand the transmission mechanism of the FDI effects on the development of human capital and to contextualise these effects over time, we used econometric estimations.

Results of the econometric analysis

This section first presents the results of FDI effects on the development of human capital through the tax revenue channel and according to the different education levels and then the results of the decomposition of FDI effects in terms of long-term and the short-term. The maximum likelihood estimator was used to estimate the model's parameters. In addition, statistical tests such as the LR-test, as a test for simultaneity, and the coefficient of determination (R-squared), were used to validate the need for simultaneous equations and for the validity of the results.

Effects of foreign direct investment on human capital development through the tax revenue channel

This section presents the results of the FDI effects on human capital development at the primary, secondary, and tertiary levels through the tax revenue mobilisation channel.

The FDI effect on primary education level through the tax revenue channel

The results of the maximum likelihood estimations show that FDI contributes to a significant increase in the education level at the primary school level through the financing of education spending from tax mobilisation.

The results of the estimation of the model using the maximum likelihood method show that FDI in Burkina Faso contributes to an increase in tax revenue. The coefficient associated with the foreign direct investment variable is positive and significant at the 1% significance level. Thus, a 1% increase in FDI leads to a 1.26% increase in tax revenues, all other things being equal. Indeed, in terms of contribution to the

government budget, the ESSAKANE mining company contributed more than CFAF 433 billion between 2010 and 2020, representing various taxes and duties. Tax revenues had a positive and significant effect on public spending on primary education at the 5% significance level. This result can be explained by the fact that, as in other developing countries, education in Burkina Faso is largely government-funded through taxation. A 1% increase in tax revenue leads to a 1.02% increase in public spending, all other things being equal.

A 1% increase in public spending on primary school education leads to a significant 0.2% increase in the enrolment rate, all other things being equal. However, if we consider several factors that may affect the level of primary school enrolment, we find that the coefficients are stable in terms of significance, and that the coefficients of the variables of interest vary less significantly. Taking other factors into account, we observe that FDI has a positive and significant impact on the level of tax revenue in Burkina Faso. A 1% increase in FDI leads to a 0.19% increase in tax revenue. The results show that a 1% increase in tax revenue leads to a 1.06% increase in primary education spending. This means that tax revenue is an effective means of financing primary education. In relation to education spending on enrolment levels, it has a positive and significant effect at the 5% significance level on primary enrolment levels, but with a low coefficient. The low coefficient can be explained by the low level of resources allocated to primary school education. In addition, the institutional environment also has a bearing on FDI effects on human capital. Indeed, political stability and the absence of terrorism have a significant negative impact on the mobilisation of tax revenue and public spending, and on the level of primary education. This result can be explained by the fact that for a decade, Burkina Faso has been experiencing political instability and growing terrorism, leading to the closure of schools and certain businesses. In this regard, as of 7 October 2022, the Technical Secretariat for Education in Emergency Situations (*Secrétariat Technique de l'Éducation en Situation d'Urgence, ST-ESU*) had recorded 4,609 schools that were closed, 351 more than in previous years. Corruption control had a negative impact on the level of tax revenue but a positive one on the level of public spending and that of primary education. The effect of corruption can be explained by the fact that in Burkina Faso, access to public schools is sometimes conditional on bribes and other forms of corruption, which means that many pupils are unable to enrol because private schools are out of reach for most citizens.

The education sector development in Burkina Faso faces a number of hurdles that hinder the government's determination to provide inclusive, quality education for all. One of them is funding. The first step for the government to overcome those hurdles and develop strategies for innovative financing of education is to set up a fair tax system aimed at increasing education budgets by making most of FDI inflows. The second step is to draw up an education development plan in conjunction with multinational companies, who provide support as part of their corporate social responsibility (CSR). Finally, the government must work to improve the business climate and the institutional environment to optimise its resources allocated to education.

Further research will have to look at the different sectors of activity at a micro level to understand FDI impacts by sector and by level of education, and to clearly elucidate the CSR channel, which is still little known and which some multinational companies do not even have.

Table 5.1: Results of the FDI effects on primary education through the tax revenue channel

Variables	Tax revenues	Education spending	Education level	Coeff. Simult_Eq
Foreign Direct Investment	1.261***			
	(0.360)			
Tax revenue		1.022**		
		(0.797)		
Education spending _Primary			0.021***	
			(0.019)	
Var (e.tx_rev)				5.134***
				(1.284)
Var (e.dep_ed_Primary)				144.531***
				(36.133)
Var (e.Tx_Scol_Primary)				1.812***
				(0.453)
Constant	9.872***	78.336***	3.941***	
	(0.544)	(9.149)	(1.314)	
Observations	32	32	32	32

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1
Source: Computed by the authors

Table 5.2 shows the results of the estimation that takes account of the other variables that are likely to impact on the primary education level.

Table 5.2: Results of the FDI effects on primary education through the tax revenue channel, taking several factors into account

Variables	Tax revenue	Education spending	Primary level	Variance of variables
Tax revenue		1.067***		
		(1.479)		
Political stability and absence of terrorism	-3.209***	-2.752**	-1.645***	
	(0.370)	(4.678)	(0.237)	
Corruption control	-3.105**	2.163	-2.124**	
	(1.260)	(10.077)	(1.038)	
Inflation	-0.020	-0.267		
	(0.038)	(0.245)		

continued next page

Table 5.2 Continued

Variables	Tax revenue	Education spending	Primary level	Variance of variables
Income level	-0.143	-0.224	-0.040	
	(0.090)	(0.645)	(0.044)	
Regulation quality	-2.574**	-4.573		
	(1.303)	(10.552)		
Receipts from mining	0.123	-0.785		
	(0.103)	(0.760)		
Quality of higher education		0.569	-0.063	
		(0.635)	(0.038)	
Foreign direct investment	0.190***		0.082**	
	(0.154)		(0.078)	
Primary education spending			0.003**	
			(0.022)	
Rule of law			1.312*	
			(0.740)	
Var (e.tx_rev)				0.476***
				(0.132)
Var (e.dep_ed_Primary)				19.985***
				(5.543)
Var (e.Tx_Scol_Primary)				0.116***
				(0.032)
Constant	9.418***	101.265**	5.135***	
	(0.440)	(40.184)	(1.469)	
Observations	26	26	26	26

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1
Source: Computed by the authors

FDI effects on the secondary education level through the tax revenue channel

The results of the estimation of the model indicate that FDI impacts on the secondary education level through the tax revenue channel. However, its effects are not significant as one moves from secondary education spending to secondary education level.

A 1% increase in foreign direct investment (FDI) leads to a 1.26% increase in tax revenue, all other things being constant. There is a positive and significant impact of tax revenue on education spending at the 1% significance level. All other things being constant a 1% increase in tax revenue leads to a 0.69% increase in secondary education spending. As is the case with other levels of public education in Burkina Faso, spending on secondary education is financed through tax revenue, grants, and loans. Public spending on secondary education has a positive effect on the secondary

education level, but the effect is not significant. This result can be explained by the low level of public spending on secondary education. It should be noted that in Burkina Faso, there are more private schools than government ones, but some parents cannot afford to send their children to the former.

Looking at the other factors that can have an impact on the secondary education level, we find that FDI has a positive and significant effect on tax revenue at the 10% significance level. Tax revenues have a significant and positive impact on public spending on secondary education at the 10% significance level. Public spending on secondary education has a positive and significant impact at the 5% significance level on the secondary education level. This result can be explained by the inclusion of institutional variables such as political stability, corruption control and the rule of law, all of which have a significant effect on the secondary education level. Indeed, the effect of public spending on secondary education depends on the institutional environment in place. A 1% increase in public spending leads to a 0.37% increase in secondary education level. This spending makes it possible to finance the construction of classrooms for public secondary schools and to ensure that they function properly. In addition, the level of income has a positive and significant effect on the secondary education level. A 1% increase in per capita income leads to a 0.99% increase in the secondary education level.

Multinational companies employ workers who use their income to finance their children's education. For example, the IAMGOLD ESSAKANE SA mining company employs a total of 2,480 direct employees, 97% of whom are Burkina Faso nationals. 37% of employees are nationals of the Sahel region. Women account for 11% of all its employees. On average, 200 days labourers are recruited per month. Around 1,000 direct jobs are generated in the community through purchases by entrepreneurs in the Sahel region. In addition, the company's agriculture and livestock support programme focuses mainly on supporting market gardens, which provide an income opportunity for more than 600 women producers organised into market-garden cooperatives, which enables them to educate their children.

The results of the estimations are shown in Tables 5.3 and 5.4.

Table 5.3: Results of the FDI effects on secondary education through the tax revenue channel

Variables	Tax receipts	Education spending	Education level	Coeff. for Simult_Eq
Foreign direct investment	1.261***			
	(0.360)			
Tax revenue		0.690*		
		(0.512)		
Secondary school spending			0.134	
			(0.268)	

continued next page

Table 5.3 Continued

Variables	Tax receipts	Education spending	Education level	Coeff. for Simult_Eq
Var (e.tx_rev)				5.134***
				(1.284)
Var (e.dep_ed_Second)				59.539***
				(14.885)
Var (e.Tx_Scol_Second)				144.189***
				(36.047)
Constant	9.872***	26.721***	22.057***	
	(0.544)	(5.872)	(5.514)	
Observations	32	32	32	32

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1
Source: Computed by the authors

Table 5.4: Results of the FDI effects on the secondary level through the tax revenue channel, taking several factors into account

Variables	Tax revenue	Education spending	Education level	Coeff. for Simult_Eq
Tax revenue		0.495*		
		(0.989)		
Political stability and absence of terrorism	-3.209***	-0.368	-19.927***	
	(0.370)	(4.167)	(1.689)	
Corruption control	3.105**	3.037*	5.069*	
	(1.260)	(7.081)	(5.936)	
Inflation	-0.020	-0.318*		
	(0.038)	(0.192)		
Income level	-0.143	1.331***	0.993**	
	(0.090)	(0.485)	(0.456)	
Regulation quality	-2.574**	1.885		
	(1.303)	(7.018)		
Mining revenue	0.123	0.470		
	(0.103)	(0.534)		
Quality of higher education		-0.713**	0.742**	
		(0.362)	(0.344)	
Foreign direct investment	0.190*		0.491	
	(0.154)		(0.775)	
Spending on secondary education			0.377**	
			(0.180)	

continued next page

Table 5.4 Continued

Variables	Tax revenue	Education spending	Education level	Coeff. for Simult_Eq
Rule of law			10.565***	
			(3.537)	
Var (e.tx_rev)				0.476***
				(0.132)
Var (e.dep_ed_Second)				11.884***
				(3.296)
Var (e.Tx_Scol_Second)				10.780***
				(2.990)
Constant	9.418***	24.514**	-4.891	
	(0.440)	(11.148)	(9.723)	
Observations	26	26	26	26

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1
Source: Computed by the authors

FDI effect on the higher-education level through the tax revenue channel

The results clearly establish the relationship between foreign direct investment (FDI) and the higher education level in Burkina Faso, precisely through the channel of tax revenue. This revenue has an impact on public spending on tertiary education.

Firstly, the results indicate a positive and significant FDI effect on the higher education level at the 1% significance level. A 1% increase in foreign direct investment leads to a 1.26% increase in tax revenue in Burkina Faso, all other things being constant. Public revenues increase through the taxes paid by multinational companies operating in the country. Secondly, tax revenue significantly increases education spending at the 1% significance level; A 1% tax increase leads to an 0.86% increase in higher education funding, all other things being constant. Finally, higher education spending has a positive and significant effect on the higher education level at the 1% significance level; a 1% increase in public spending leads to a 0.26% increase in higher education enrolment, all other things being equal.

If we consider the variables that can impact on the level of higher education, we can see that FDI has a positive and significant effect at the 5% significance level on tax revenue in Burkina Faso: A 1% increase in FDI leads to a 0.19% increase in tax revenue. The results also show that a 1% increase in tax revenue leads to a 1.81% increase in public spending on higher education. Indeed, educational opportunities, grants, scholarships and other forms of social benefits (through the National Fund for Education and Research [Fonds National pour l'Education et la Recherche] and the Centre for Information, Educational Guidance and Scholarships [Centre d'Information, d'Orientation Scolaire et des Bourses]) are provided by the government through public spending. This underlines the strategic role of tax revenue in funding higher education. Spending on higher education has a positive and significant impact on higher education

at the 5% significance level. An increase in higher education spending leads to a 0.12% increase in the higher education level. The government's granting of social allowances and scholarships and the construction of university centres have helped to enhance the higher education level. The government is committed to decentralising higher education, which is why it has been building university centres across its various regions.

The results are summarised in Tables 5.5 and 5.6.

Table 5.5: Results of the FDI effects on higher education through the tax revenue channel

Variables	coeff higher educ	coeff higher educ	coeff higher educ	coeff higher educ
Foreign direct investment	1.261***			
	(0.360)			
Tax revenues		0.868***		
		(0.264)		
Secondary education spending			0.262***	
			(0.068)	
Var (e.tx_rev)				5.134***
				(1.284)
Var (e.dep_ed_Sup)				15.879***
				(3.970)
Var (e.Tx_Scol_Sup)				3.165***
				(0.791)
Constant	9.872***	1.570	0.062	
	(0.544)	(3.033)	(0.830)	
Observations	32	32	32	32

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1
Source: Computed by the authors

Table 5.6: Results of the FDI effects on higher education through the tax revenue channel, taking several factors into account

Variables	Tax revenue	Education spending	Education level	Coeff. Simult_Eq
Tax revenue		1.810***		
		(0.637)		
Political stability and absence of terrorism	-3.209***	-3.015	-3.061***	
	(0.370)	(2.348)	(0.250)	
Corruption control	-3.105**	-14.742***	0.601	
	(1.260)	(3.960)	(1.240)	
Inflation	-0.020	-0.114		
	(0.038)	(0.128)		

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Table 5.6 Continued

Variables	Tax revenue	Education spending	Education level	Coeff. Simult_Eq
Income level	-0.143	1.095***	-0.120	
	(0.090)	(0.282)	(0.078)	
Regulation quality	-2.574**	9.810**		
	(1.303)	(4.120)		
Mining income	0.123	0.103		
	(0.103)	(0.313)		
Higher-education quality		0.166	-0.061*	
		(0.149)	(0.034)	
Foreign direct investment	0.190**		0.008*	
	(0.154)		(0.132)	
Higher education spending			0.122**	
			(0.050)	
Rule of law			1.111	
			(0.689)	
Var (e.tax revenue)				0.476***
				(0.132)
Var (e.dep_ed_higher educ)				4.172***
				(1.157)
Var (e.Tx_Scol_higher educ)				0.281***
				(0.078)
Constant	9.418***	-15.627*	2.808***	
	(0.440)	(8.121)	(0.673)	
Observations	26	26	26	26

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1
Source: Computed by the authors

Effects of foreign direct investment on education levels

This section presents the results of the ARDL model on the education components of human capital, firstly according to the education level in primary school, then in secondary school, and finally in higher education institutions.

Estimation of the direct FDI effect on the primary education level

The estimation of the model in (9) is valid overall, as the R-squared is of the order of 0.65 and the recall force is significant and negative. This indicates a degree of adjustment to equilibrium. The results show that foreign direct investment has

a positive and significant direct effect at the 1% significance level in the long-term on primary school enrolment, but no effect in the short-term. In fact, a 1% increase in FDI improves primary school enrolment by 24.3%. This means that FDI increases the provision of education in Burkina Faso. This result can be explained by the fact that most major educational projects are financed through FDI as part of the investors' corporate social responsibility (CSR), and through the FDI-induced increase in tax revenues and public spending on education. In fact, some partners currently intervene in the form of sectoral budgetary aid through a common fund managed in the form of a special Treasury appropriation account (*Compte d'affectation spéciale du Trésor, CAST*). As an example, the following educational facilities have been constructed: 8 schools, a general education secondary school (*collège d'enseignement général, CEG*) at the ESSAKANE Site, 13 literacy centres, and 17 functional school canteens and 6 school gardens. Also, energy infrastructure has been built in the form of the electrification of the village of the ESSAKANE site in partnership with SONABEL for a total of CFAF 360,000,000. These findings are similar to those reported in Zhuang's 2008 study, which used data from 29 Chinese provinces from 1978 to 1999.

Public spending on primary education has a positive and significant long-term effect on the level of schooling at the primary school level. In the short term, however, it has a negative and significant effect on the level of schooling. In addition, the returns to education and the quality of teaching at the primary school level foster enrolment at this very level. The results are summarised in Table 5.7.

Table 5.7: Foreign direct investment and primary school enrolment rates

Variables	Adjustment to equilibrium	Long-term effects	Short-term effects
Foreign direct investment		0.243***	
		(0.0777)	
Labour productivity		0.0101	
		(0.0248)	
Quality of education		0.0388*	
		(0.0285)	
Primary education spending		0.0264***	
		(0.00785)	
Returns to education		19.98***	
		(2.034)	
L. Net primary level	-0.836***		
	(0.138)		
D. Primary education spending			-0.0102
			(0.00579)

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Table 5.7 Continued

Variables	Adjustment to equilibrium	Long-term effects	Short-term effects
D. Returns to education			-21.69
			(14.33)
LD. Returns to education			-63.43***
			(15.67)
Constant			-19.42***
Observations	35	35	35
R-squared	0.653	0.653	0.653

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1
Durbin–Watson d-statistic (10, 35) = 2.123342
Source: Computed by the authors

Direct FDI effect on secondary education

The results of the estimation of Equation (11) show that in the short-term, FDI does not have a direct effect on secondary school enrolment rate, but that in the long-term it does have a negative, though non-significant effect. This result can be explained by the fact that secondary school education receives less international support and is largely left to domestic investors, and that there are no scholarships or other types of support from foreign direct investors.

The results also indicate that the long-term returns to the education foster further studies a great deal. Given the high level of household poverty in Burkina Faso, a large number of students are obliged to stop their schooling to take up jobs in foreign companies offering very attractive wages. Moreover, this finding can be partly explained by the fact that with at least primary education level, a pupil possesses knowledge that can enable him or her to obtain a job and to re-enrol in short-term vocational training courses, as multinational companies seek to take advantage of the low cost of an abundant unskilled labour available in the country. The greater supply of jobs and the higher wages offered by those companies have been a strong incentive for teenagers to delay or abandon education to enter the labour market in both the mining and telecommunications industries. FDI inflows could, therefore, reduce school enrolment rate in the short and/or the long-term. The BISSA company's recruitment policy, which focuses primarily on unskilled jobs that it offers in their entirety to the affected communities, attracts young people. The same is true of the IAM ESSAKANE GOLD mining company, where some 1,000 young people from the Sahel region have been trained in various crafts in partnership with the *ANPE-Dori* (*Agence Nationale pour la Promotion de l'Emploi* [National Bureau for Empolyment Promotion]). Because of that, many young people have been able to postpone their decision to continue their studies in favour of jobs in those mines. The results also show that secondary education spending significantly increases the level of schooling at the secondary education level. In Burkina Faso, education is generally provided by the State through public spending.

A summary of the results is presented in Table 5.8.

Table 5.8: Effect on net secondary school enrolment

Variables	Adjustment to equilibrium	Long-term effect	Short-term effect
LD. Quality of teaching			0.320**
			(0.127)
D. Quality of teaching			0.284***
			(0.0681)
LD. Quality of teaching			0.217***
			(0.0752)
L2D. Quality of education			0.0988*
			(0.0534)
D. Secondary education spending			-0.0314**
			(0.0127)
D. Returns to education			-74.72**
			(28.03)
Foreign direct investment		-0.0910	
		(0.169)	
Labour productivity		0.0254	
		(0.0547)	
Quality of education		-0.350***	
		(0.0843)	
Secondary education spending		0.121***	
		(0.0245)	
Returns to education		162.0***	
		(2.550)	
L. Net secondary attainment	-0.529***		
	(0.0881)		
Constant			-82.71***
			(13.53)
Observations	40	40	40
R-squared	85.9	85.9	85.9

Standard errors in parentheses ***p<0.01, ** p<0.05, * p<0.1
Durbin–Watson d-statistic (13, 40) = 2.01848
Source: Computed by the authors

Direct FDI effects on higher education

The results of the estimation of the model in (12) reveal that it is globally significant and the long-term equilibrium adjusts quickly, as the coefficient is negative and significant at the 1% significance level. In the short-term, foreign direct investment

has a negative effect on the net rate of access to higher education. However, in the long-term, it has a positive impact on this same rate. This counter-intuitive short-term finding can be explained by the nature of FDI, depending on whether it is Greenfield or Brownfield FDI, since these two categories of FDI co-exist in Burkina Faso. Net inward FDI increases individual incentives to acquire higher education. Indeed, FDI has not only brought new technologies and knowledge to Burkina Faso, but it has also contributed to human capital accumulation by increasing the demand for skilled labour and thus contributed to encouraging individuals to enrol in higher education or short courses. This could explain the FDI impact in both the short- and the long-term. This finding corroborates the one made by Mughal and Vechiu (2015) about developing countries from 1998 to 2008. The results are presented in Table 5.9.

Table 5.9: Direct FDI effect on the higher education level

Variables	Adjustment to equilibrium	Long-term effect	Short-term effect
LD. Level of access to higher education			-0.0763
			(0.123)
L2D. Level of access to higher education			-0.465***
			(0.161)
L3D. Level of access to higher education			0.481**
			(0.175)
D. Foreign direct investment			-0.0722**
			(0.0359)
D. Quality of higher education			0.0203**
			(0.00897)
LD. Quality of higher education			0.0246**
			(0.00953)
D. Returns to education			-24.65**
			(8.852)
L2D. Returns to education			19.11**
			(9.197)
Foreign direct investment		0.00565**	
		(0.0904)	
Labour productivity		-0.00626	
		(0.0166)	
Quality of higher education		-0.0498**	
		(0.0181)	
Higher education spending		0.00744	
		(0.00585)	
Returns to education		29.05***	
		(1.275)	

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Table 5.9 Continued

Variables	Adjustment to equilibrium	Long-term effect	Short-term effect
L. Net level of access to higher education	-0.523***		
	(0.129)		
Constant			-14.95***
			(3.608)
Observations	40	40	40
R-squared	0.820	0.820	0.820

Standard errors in parentheses, *** p<0.01, **p<0.05, * p<0.1
Durbin–Watson d-statistic (17, 40) = 1.913
Source: Computed by the authors

6. Conclusion and economic policy implications

The aim of this study was to analyse the role of foreign direct investment in the development of human capital in Burkina Faso. Since the 1990s, the country has liberalised a large number of businesses to capitalise on the benefits of foreign direct investment. According to the literature, foreign direct investment (FDI) accelerates human capital accumulation by FDI recipient countries through the transfer of skills and technologies, the training of employees, the mobilisation of tax revenue, and so on. The study followed a two-stage methodology. At the first stage, it used an ARDL model for its short-term and long-term estimations, and a simultaneous equations model to analyse FDI effects through the tax revenue channel. Secondly, data from a number of companies was used to support the analysis.

The study's results indicate that the effects of foreign direct investment differ in the short- and long-term and depend on the nature of FDI (whether Greenfield or Brownfield). Firstly, in the long-term, FDI has a positive and significant effect on the level of primary and tertiary education, whereas in the short-term it has no effect on the primary education level, although it has a negative effect on tertiary education level. FDI has no direct effect on the secondary education level in the short-term, but in the long-term it reduces the secondary education level. In addition, the results indicate that tax revenue is an important means for foreign investors to develop human capital in Burkina Faso. Tax revenue increases the level of public spending, which in turn improves the level of schooling. However, these effects are conditional upon institutional quality. In addition, data from companies shows that these contribute directly to enhancing the level of schooling by financing education, health and nutrition in the geographical areas where they operate.

In Burkina Faso, the development of the education sector faces a number of hurdles that hinder the government's determination to provide inclusive, quality education for all. One of them is funding. This means that the first step for the government to overcome those hurdles is to develop strategies for innovative financing of education, by setting up a fair tax system aimed at increasing education budgets by making most of FDI inflows. The second step is to draw up an education development plan in conjunction with multinational companies, who could provide support as part of their corporate social responsibility (CSR). Finally, the government must work to improve the business climate and the institutional environment to optimise the resources allocated to education.

Further research will have to look at the different sectors of activity at a micro level to understand the impact of FDI by activity sector and by education level, and clearly elucidate the CSR channel, which is still little known and which some multinational companies do not even have.

Notes

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