Title: Sectoral FDI and food security in Developing Countries: Does institutional quality matter?

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Abstract

Developing countries (DCs) have high population growth and food demand. Food security still one of the main goals in these countries. Moreover, foreign direct investment (FDI) is at the heart of their investment policy. For DCs attract FDI is an instrument to improve the economic growth and to generate positive spillovers on the economy. However, some negative effects could contradict this optimistic view. Taking into account the importance of local institutional quality, we investigate the effects of sectoral FDI on food security. Our results show that FDI inflows are determinant for economic growth and given certain institutional quality thresholds, primary and secondary FDI can improve food security. Our recommendation is that it is in DCs' interest to improve their institutional quality and target the attraction of FDI.

Keywords: Food security, FDI, Income inequality, Developing countries
JEL Classifications : F1 ; O1 ; Q1

1. Introduction:

Food security is a global challenge that concerns all countries, in particular developing ones (DCs). DCs are vulnerable to food insecurity. The achievement of food security is a crucial objective, with many underlying factors. At the same time, to boost economic growth, DCs compete to attract foreign direct investment (FDI). In addition to their impact on employment, these investment flows are important since they represent a funding source and generate spillovers. In other words, these countries depend upon FDI for economic growth. Growth, which is due to the increase in national production, needs, in reality, an increase in production factors. Economic literature often uses the percentage change in per capita income to measure growth, or rather economic performance (Acemoğlu et al., 2001; Rodrik et al., 2004). Nevertheless, the inequality of income distribution stills one of the main issues in DCs. Dividing national production by the population does not indicate that the entire population is benefiting from the increase in national wealth, so it does not necessarily reflect an improvement in the quality of life in the society. The distribution of income is a crucial factor that influences food security (Timmer, 2000).

Following the same reasoning, FDI inflows may increase economic performance through technology, knowledge transfer, and spillovers. Strong economic performance, combined with good governance within local institutions, generates externalities by making food accessible with improved consumption conditions. On the one hand, institutional quality plays an important role in this process because it has the role of the adjudicator to shape the economy and to guaranty that people benefit from the prosperity of their nation. The institution "shapes" economic behavior by influencing the investment in physical and human capital and technology, and the organization of production (North, 1990; Acemoğlu et al., 2005). On the

other hand, institutional quality showcases the country. It is an attractive factor and an important actor in exploiting FDI efficiently (Anwar and Cooray, 2015).

According to the economic literature, several authors like North (1990), Acemoğlu et al. (2001, 2005), and Rodrik et al. (2004) have emphasized the endogenous role of institutional quality on economic performance. However, the impact of FDI on economic performance and welfare, in general, is still ambiguous. Most research papers have used aggregated data of FDI inflows, and few papers use data on a disaggregated level. Moreover, the study of FDI effects has become a transdisciplinary question. Sociologists have largely discussed this topic in the food security context (Wimberley, 1991; Firebaugh, 1992; Firebaugh and Beck, 1994; Jenkins and Scanlan, 2001; Mihalache-O'Keef and Li, 2011). Economists have been more interested in the effects of FDI on economic growth and firms' productivity (Findlay, 1978; Wang, 1990, 2009; Wang and Blomstrom, 1992; de Mello, 1999; Lipsey and Sjöholm, 2004; Cieślik and Tarsalewska, 2011). Ben Slimane et al. (2016) have focused on the role of agricultural production in addition to the sectoral FDI inflows in improving food security. Their findings argue that agricultural production is a vital factor for food security and is a channel for FDI's spillovers effects.

Starting from the idea that achieving food security is the government's responsibility, we attempt to re-examine the role of sectoral FDI in improving food security by considering the institutional quality of DCs. The improvement of income makes the economic access to food easier. An important gap in the empirical literature concerns the interrelation between the macroeconomic environment and food security. The existing empirical literature has focused on three main economic aggregates: institutions, FDI inflows, and economic performance. The purpose is often a review of institutional quality and FDI inflows' effects on economic growth. In this context, works that have examined food security are scarce. We formulated

our motivation in a few questions. Do sectoral FDI inflows influence economic performance? Then, does the improvement of income impact food security? What is the role of domestic institutions in this process? Finally, does income inequality matter?

To answer these questions, firstly, we extended the food security measure of Ben Slimane et al. (2015) by adding a second indicator with principal component analysis (PCA). The second one is calculated from three indicators: the share of dietary energy supply derived from cereals, roots, and tubers, and prevalence of anemia among pregnant women and children under five years of age. These three indicators reflect the health side in the concept of food security, where were neglected in Ben Slimane et al. (2015) index. We consider, secondly, that FDI influences economic performance by increasing income per capita. The presence of good institutional quality explains a part of this positive effect, which is important in shaping the economy and in absorbing the positive spillovers of FDI. Thirdly, economic performance leads to improved food security by increasing income and providing the necessary environment to facilitate access to available food. We believe that using disaggregated data for FDI can give us a clearer picture of the nature of the interaction between FDI and institutions' quality and its ability to influence income and food security; so, we use the sectoral level of FDI on primary, secondary and tertiary sectors. Finally, we use the Gini index of Solt (2014) to control for the inequality of income distribution.

The remainder of the paper is organized as follows. Section 2 presents the theoretical background. Section 3 describes the econometric methodology and the data used in this study. The empirical results are reported in Section 4, and Section 5 concludes.

2. Literature review

The economic literature relies on some models to explain economic performance. The exogenous growth models (Solow, 1956; Cass, 1965; Koopmans, 1965), followed by the first

wave of endogenous growth models, such as Romer (1986) and Lucas (1988), where they take into account the spillover effects from investing in physical and human capital. Industrial innovation is considered to be the engine of growth (Romer, 1990; Aghion and Howitt, 1992). Capital accumulation is always considered an important economic process to explain economic performance. Previous economic research concretely showed that FDI inflows influence economic performance through capital accumulation and knowledge transfer (de Mello, 1999). The contribution of FDI is due to externalities and spillovers; in this context, several modeling attempts have been made to exploit the channel through which FDI affects growth and to examine whether FDI can be a channel for spillovers (Findlay, 1978; Wang, 1990; Wang and Blomström, 1992). According to Acemoğlu et al. (2005), these traditional growth models "*only provide proximate explanations of comparative growth*," and for this reason, these authors have considered economic institutions to "*shape*" economic incentives, and thus influence economic outcomes (Acemoğlu et al., 2001; 2005). Consistent with North and Thomas (1973), they consider institutions to be the "deep" of economic performance. Hausmann and Rodrik (2003) argue that economic growth requires foreign technology and good institutions, and that is why developing countries may grow faster if they have reached higher standards with respect to property rights.

In sum, the economic literature provides proof that FDI and institutional quality influence economic performance, but there is a lack of empirical literature when the discussion extends to food security. Hence, we examine the state of food security of DCs in the presence of foreign capital and institutions.

2.1. Domestic institutions' effects on the host economy

In the era of globalization, the economic literature on the topic of institutions is rather abundant. Institutions take the role of a regulator of an individual's relationships. North

(1990) included in his research the importance of humans' role in the concept of institutions. He provides the most widely known definition of institution. He said, "*Institutions are the rules of the game in a society or, more formally, are the humanly devised constraints that shape human interaction. In consequence, they structure incentives in human exchange, whether political, social, or economic…*". Indeed, the type of institution is very important in order to distinguish its impact on economic performance. It can be inclusive or extractive. Enhancing economic growth and prosperity characterizes an inclusive institution because it strenghtens property rights protection to encourage investment, to use better resources and technologies, to encourage innovation, and it provides some degrees of equality in society. In contrast, the extractive institution is harmful to prosperity because it may give the most power to a small elite that governs the rest of society. This minority will make the institutional structure and the distribution of wealth work in its favor, which discourages the rest of society from being creative and innovative (Acemoğlu et al., 2001, 2005; Acemoğlu and Robinson, 2011).

Moreover, the literature provides proof that economic institutions are strongly linked to the capital market, which in turn has a central role in investment. The imperfection of capital markets hinders growth and investment in both the short and the long run (Galor and Zeira, 1993). According to Acemoğlu et al. (2005), economic institutions are the pillar of economy and prosperity. They pointed out that the difference in prosperity across societies is that humans create their advantages by organizing their societies in a way that provides some degree of opportunity (for example, the institutions ensure equality before the law and investment opportunity). To this end, conflicts will arise between the different groups and individuals in society and will turn out favorably for whoever has the most political power. Here is where the central role of political institutions to manage conflict and reduce inequalities comes into play. The work of Alesina and Rodrik (1994) examined the role of

institutions. The authors have proposed an endogenous growth model with distributive conflicts of how the political regime, distribution of wealth and growth are connected. Their model suggests that democracies with an uneven distribution of wealth lead to lower growth than democracies with more equally distributed resources.

The literature also shows the link between institutional quality and FDI and how they interact to get positive spillovers on host economy. Institutional quality attracts investors, and according the sector of investment FDI could enhance the quality of institution. Indeed, investors are obliged to cooperate with local institutions. Reducing the difficulties caused by bureaucracy and securing property rights leads to an efficient allocation of resources for these investors (Stern, 1991; see also Shah et al. 2016; Aziz 2018).

From the point of view of foreign investors, institutional quality is the main criterion for relocation. For example, Mina (2012) emphasizes the host government's stability as a factor to attract FDI inflows. The role of the host countries' institutions aims at protecting property rights, the enforcement of contracts and facilitating collective action (Dixit, 2009). To enhance the income level, DCs must provide a suitable institutional and economic environment for foreign capital. Despite the importance given to institutions, the gap between countries in terms of institutional quality remains large, which makes host institutions a source of comparative advantage (Nunn and Trefler, 2014). In this context, past studies have shown that countries with good institutions present an attractive investment destination (Hall and Jones, 1999; Paarlberg, 2002; Anghel, 2005; Bénassy-Quéré et al., 2007; Mina, 2012).

The institutional quality of the host country is an important determinant for attracting FDI. As shown by Bénassy-Quéré et al. (2007), the quality of institutions matters for FDI inflows. A

stable political and economic climate, protection of property rights, lack of corruption, and fast and flexible bureaucratic procedures are very important in the decision of foreign investors to relocate. Some other factors can influence the absorptive capacity of FDI, such as the degree of openness to trade and the size of the domestic market. However, inflation presents a constraint for FDI because it harms macroeconomic performance (de Mello, 1997, 1999; Bénassy-Quéré et al., 2007).

Several domestic factors can explain the relocation of multinational corporations (MNCs) to DCs. For example, Botswana has received the highest rates of FDI per capita in Sub-Saharan Africa thanks to its low political risk (Coolidge and Rose-Ackerman, 2001). Countries that have a bad government and/or do not respect private contracts and/or neglect transport and communication infrastructures are less attractive for foreign investors. These indicators have an impact on the investment decision of the new MNCs and the MNCs already in place. For instance, the lack of peace, property protection, and contract enforcement in Africa has reduced investment (Paarlberg, 2002). The robustness of institutions is the main criterion considered by investors. Institutional quality is the main determinant for foreign investors to make a relocation decision. Investors relocate their business to markets where they can undertake their activities efficiently (World Trade Organization [WTO], 1996). Good institutions encourage the accumulation of skills, the development of new goods and production techniques, and reassure investors. An economic policy that protects investors and enhances government stability can promote FDI inflows (Mina, 2012). Good institutions allow for the reduction of transaction costs and investor risks, which are important for the investment climate (Hallam, 2011). By contrast, low institutional quality encourages rent seeking, corruption, and theft (Hall and Jones, 1999). The role of governments is crucial to earning greater profits from FDI inflows. Low government efficiency reduces the attractiveness to foreign investors (Anghel, 2005). In this respect, many African countries

have worked in this direction. They have provided a stable investment environment by creating investment promotion institutions. Agricultural development is a crucial factor for food security and institutions can support it, for example, by the creation of R&D centers to improve agricultural productivity, providing infrastructure facilities and improving water management (United Nations Convention on Trade and Development [UNCTAD], 2009).

As for the link between institutions, trade, and growth, the empirical literature shows that higher institutional quality is a factor in economic growth. For example, Dollar and Kraay (2003) suggested that both institutions and trade affect income in the long run, but with a small impact from trade in the short run. Similarly, Rigobon and Rodrik (2005) found a strong relationship between the rule of law and incomes. According to Daude and Stein (2007), institutions might affect growth by increasing FDI.

Recent empirical research still emphasizes the key role of institutions such as the work of Kwon and Kim (2014), Flachaire et al. (2014) and Anwar and Cooray (2015). While Kwon and Kim (2014) were interested in poverty reduction through good governance, Flachaire et al. (2014) found that political institutions are one of the deep sources of growth. To our knowledge, the most recent work that deals with the institutional quality, FDI, and income is Anwar and Cooray (2015). They suggest that the interaction between FDI and institutional quality has a positive effect on per capita income, which means that in the presence of good institutional quality, the income per capita rises when the FDI inflows increase.

A strong example of institutions' role is the Korean Peninsula's experience where two types of institutions have influenced the current state of North and South Korea. While the two countries were approximately at the same level of development at the separation date, with North Korea being somewhat more technologically advanced at the time, the two countries have taken two opposite paths of institutional and economic development (see Acemoğlu et

al., 2005). Today, North Korea is less developed and more vulnerable to famine and food insecurity compared to South Korea; a situation traced back to the difference in the quality of institutions, conflict, poor policy design and lagging implementation which disrupted the production and distribution of food. Here domestic institutions are the main driver of food insecurity, but this is not always the case because institution may contribute with other factors to harm food security (Boyd and Wang, 2011; Pereira and Ruysennar, 2012; Candel, 2014). For example, Pazvakavambwa (2011) explained how poor governance in Tanzanian has led to agricultural failure and food insecurity. According to the author, a part of the problem is that basic inputs are not accessible for all farmers because of the prevalence of nepotism and influential people, and because of delayed stage-managed imports and delivery of inputs which force them to buy at high prices from the informal market.

2.2. FDI's effects on the host economy

The literature on FDI's effects is abundant and very ambiguous. From an economic point of view, FDI may and may not enhances economic growth. For sociologists, FDI may lead to economic modernization or economic dependency.[1] Certainly, FDI has positive and negative spillovers. Also, sectors in which these investments are involved will be affected differently. Beginning with the negative effects, FDI appears not to be a good instrument to boost growth and improve welfare (Jenkins and Scalan, 2001) because this type of capital increases spatial inequality in economic development and leads to the dependency of host developing countries on developed countries. A phenomenon known as "Land Grabbing," often cited in the literature in recent years, has been considered a harmful result of some factors like FDI in food production and the increased demand of foreign investors for biofuels and non-food agricultural commodities (Zoomers, 2010). Also, FDI can negatively affect the current

[1] Both theories have influenced the economic literature since they analyse the effect of the phenomenon of globalization. However, sociologists focus more on the social level while economists are mostly limited to estimating the economic impact of FDI with neglect to the social dimensions of this phenomenon

account balance (Tausch, 2003); for example, if foreigners bring home profits and foreign firms do not boost exports but rather increase imports of raw materials for local production. It can also be problematic in the international taxation context when transfer pricing becomes an issue between entities within a company. Regarding competitiveness, domestic firms are most often weaker than foreign firms (Leonard, 2006), and consequently they are not able to face strong competition. Often, the losers will reduce the number of employees, and hence unemployment is increased.

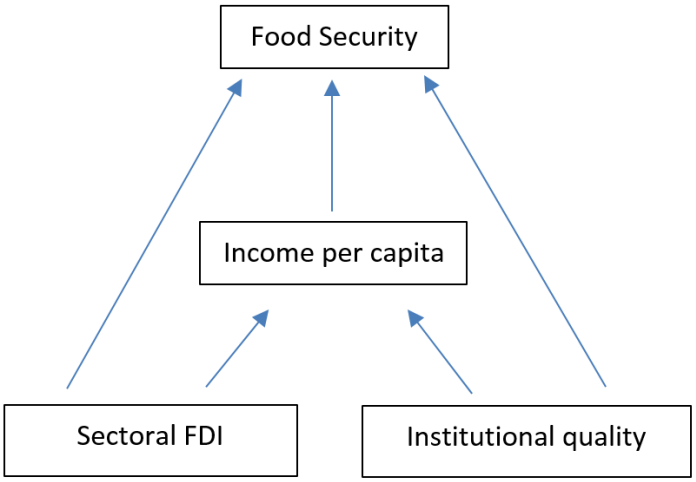
However, in the last decade, the tendency is rather that FDI generates more benefits than adverse costs, which explains the race to attract FDI in DCs. Many economists believe that FDI boosts economic growth and imposes positive social welfare effects. For example, Cieślik and Tarsalewska (2011) found that FDI and trade contribute to economic growth by improving the GDP per capita. FDI is an instrument to attract investments, increase wages, lead to technology transfer, diffuse knowledge, improve human capital and firm productivity, and boost exports, thus improving economic growth (Javorcik, 2004; Leonard, 2006). At the micro level, FDI has a potential impact on wages. In the Indonesian manufacturing sector, wages have increased in the presence of FDI inflows (Lipsey and Sjöholm, 2004). In the end, the beneficiaries will be able to have access to food more than others. At the sectoral level of FDI, the work of Wang (2009) points to the effect of sectoral FDI on economic growth. He finds that FDI in manufacturing enhances economic growth. [2]

Two other works have investigated the relationship between FDI and food security, Mihalache-O'keef and Li (2011) and Ben Slimane et al. (2016). The first authors found that

[2] This result was expected because the sample is composed of 12 Asian economies well known for the attractiveness of manufacturing FDI.

FDI inflows in the primary sector affect food security negatively, FDI in the secondary sector has a positive effect, but FDI in the tertiary sector has an ambiguous effect. However, the second set of authors focused on the agricultural channel by which sectoral FDI can improve food security, and their results showed that FDI in agriculture could be a good instrument for improving availability and utilization of food. However, FDI in the industrial sector has positive spillover explained by technology transfer and know-how in the production process, but environmental pollution shows some negative spillovers. FDI in services has negative spillovers explained by the change in social structure through increasing the gap between poor and rich, and indirectly encouraging the movement of rural people to cities because the job opportunities are better than in rural areas. Nevertheless, this attraction of people is followed by a rise in demand for food products, which contributes to a rise in prices and less access to food security.

Figure 1: Hypothesized relationships between FDI, institutional quality, and food security through the income channel



To sum up, the literature provides several sources of proof that FDI is closely related to the quality of institutions, but it seems there is a gap in the literature on the question of how institutional quality affects food security through the FDI transmission channel. As revealed

in the literature, host countries benefit from technology transfers and know-how generated by FDI, which explains why DCs compete to redirect these flows to their economies. In Figure 1 we summarize our hypotheses on the links between our main variables. Good economic performance must be reached in a first step, then food security can be improved in a second one. FDI influences income and food security through spillovers. The interaction of FDI with good institutional quality leads to positive spillovers and vice versa. In the next section, we present our method and our data used to provide answers to our problem.

3. The empirical model

To investigate the links between sectoral FDI, institutional quality, income, and food security, we propose the following estimation strategy. As shown in Figure 1, sectoral FDI inflows and institutional quality influence income per capita. We specified income's determinants by reference to the empirical literature on the traditional growth model. Precisely, our first specification is the determinants of income per capita (see for example Borensztein et al., 1998; Makki and Somwaru, 2004; Alguacil et al., 2011):

$$Y_{it} = \alpha_0 + \sum_{k=1}^{3} \alpha_k FDI_{kit} + \gamma\, INS_{it} + \sum_{k=1}^{3} \delta_k INS_{it} \times FDI_{kit} + \sum_{j=1} \sigma_j X_{jit} + \mu_i + \vartheta_t + \varepsilon_{it} \quad (1)$$

Where: i, t, k, j stand for the country, the time, the sector and the control variable, respectively. Y_{it} is the income per capita. FDI_{kit} is the vector FDI inflows according to the sector k. INS_{it} is the institutional quality. $INS_{it} \times FDI_{kit}$ is the interaction between institutional quality and the sectoral FDI inflows. X_{jit} is a vector of control variables (Gini index, trade openness, and domestic investment). α_0 is the constant term. α_k, γ, δ_k and σ_j are

the coefficients to be estimated. μ_i and ϑ_t are the country and year effects, and ε_{it} is the error term.

Our second equation concerns the determinants of food security. Therefore, we write the equation as:

$$Z_{it} = \beta_0 + \varphi Y_{it} + \sum_{k=1}^{3} \beta_k \, FDI_{kit} + \pi \, INS_{it} + \sum_{k=1}^{3} \theta_k \, INS_{it} \times FDI_{kit} + \sum_{j=1} \rho_j \, X_{jit} + \mu_i + \vartheta_t + \varepsilon_{it} \quad (2)$$

Z_{it} is the food security variable; Y_{it} is the income per capita; INS_{it} is the institutional quality, $INS_{it} \times FDI_{kit}$ is the interaction between institutional quality and the sectoral FDI inflows. β_0 is the constant term. φ, β_k, π , θ_k and ρ_j are the coefficients to be estimated. μ_i and ϑ_t are the country and year effects, and ε_{it} is the error term.

3.1. Data

Table A1 in the appendix summarizes the data used in the paper and Table A2 shows the correlation coefficients between all variables. Our sample is composed of an unbalanced panel of annual data for some developing countries (between 47 and 57 according to the specifications) between 1995 and 2010. The dataset has a large number of missing observations due to the lack of data for sectoral FDI inflows.

Our first key variables are the sectoral FDI inflows, which we express as a percentage of GDP to measure the FDI in primary, secondary and tertiary sectors of the economy. Tables A3, A4, and A5 in the appendix show the composition of each sector.

Next, we use the six indicators built by Kaufmann et al. (2010) to measure the quality of the institution. Indeed, all these indicators are highly correlated (see Table A6 in Appendix A); this means that we are unable to include these indicators in the same regression, so we follow Easterly and Levine (2003) and we calculate the average of the six institutional quality indicators. The first indicator is governance effectiveness, which "*captures the quality of public and civil services and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies*". The second is the control of corruption, which captures "*the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as 'capture' of the state by elites and private interests*". The third is political stability and the absence of violence and terrorism, "*which captures the likelihood of political instability and/or politically-motivated violence, including terrorism*". The fourth is regulatory quality, which is supposed to capture "*the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development*". The fifth one is the rule of law, which is supposed to capture "*the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence*". The sixth is voice and accountability, which are supposed to capture "*the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media*" (Kaufmann et al., 2010). The Kaufmann indicators range from -2.5 (bad quality) to 2.5 (good quality)[3].

[3] Each Kaufmann indicator is built from many indicators taken from many sources. For more information see http://info.worldbank.org/governance/wgi/index.aspx#faq-7

Income level represents economic performance and is measured by the GDP per capita in purchasing power parity (PPP). The GDP per capita gives information of the approximate individual income in a country and reflects the results of a government's policy to reduce poverty (Food and agriculture organization of the United Nations [FAO], 2012, 2013). However, this indicator has two main limits; it does not reflect the real living conditions of the entire population and does not inform whether the recorded economic performance has affected the entire population or not. In brief, this indicator is weak if we do not control for income inequality in a country. Nevertheless, it must be said that GDP per capita has played an important role in the reduction of poverty in some developing countries (FAO, 2013). We consider that economic access endogenously affects the availability and utilization of food because we believe that a population with low incomes may have some difficulties to access and use food. We control for the physical access to government effectiveness[4]. For instance in the Kwara State of Nigeria, at the micro level, the income received from off-farm activities helps to better access food and nutrition during the lean season (Babatunde and Qaim, 2010), which means that farmers who have an off-farm income are more secure regarding their access to food. To control for income inequality, we include the Gini Index from Solt (2014). The indicator ranges from 0 (perfect equality) to 100 percent (perfect inequality).

Among the main factors stimulating economic performance, we also take into account domestic investment measured by gross fixed capital formation as a percentage of GDP and the degree of trade openness measured by the sum of exports and imports as a percentage of GDP. Openness is a conditional factor to encourage foreign investors to invest in host countries. The literature suggests that trade openness is often positively associated with income (Frankel and Romer, 1999; Bekaert et al., 2005; Wacziarg and Welch, 2008).

[4] Infrastructure quality is included by Kaufmann to build the indicator of government effectiveness.

3.2. Principal components analysis to build food security composite indicators

Food security is a very complex and multidimensional concept with approximately 200 definitions and 450 indicators (Hoddinott, 1999). A large part of these indicators is for microeconomic analysis and is often calculated from field surveys. Nevertheless, with regards to the food security concept, we need to choose the appropriate measure. The literature has discussed many indicators (see, De Haen et al. (2011) and Masset (2011)), but very few authors have attempted to build composite indicators of food security. The most known composite indicators are the Global Hunger Index developed by Wiesmann et al. (2006), the Poverty and Hunger Index (PHI) developed by Gintilini and Webb (2008), and the Global Food Security Index (GFSI) developed by the Economist Intelligence Unit (2012). Unfortunately, the data of these indicators is not available for a long period. While the techniques used differ from one author to another, the goal remains the same: the construction of an indicator that best reflects food security. Using a microeconomic approach, Mahadevan and Hoang (2015) applied the Latent Class Model on data from the Vietnamese Household Living Standard Survey 2010. The authors have built composite food security indicators for rural and urban households by controlling for the quantitative and latent aspect of food security. However, in our paper we apply a macroeconomic approach, so we used only macroeconomic indicators provided by the Economic and Social Development Department of the FAO. Our objective is to build composite indicators to express the major part of the food security concept.

The definition of food security reflects four main dimensions that the FAO uses to deal with food security issues: food availability, food access, food utilization and food stability. Some indicators characterize each dimension, so to face the difficulty of using all indicators in the literature, we focused on the most commonly used and available indicators on four

dimensions. The four dimensions are complementary in the sense that the availability of food must be accessible and used in good conditions for all people.

Food availability is measured by average dietary energy supply adequacy, the average value of food production per capita, and the share of dietary energy supply derived from cereals, roots, and tubers. The last indicator provides information about the quality of the available diet. A good diet is one that includes animal and vegetal sources, so an increase in the share of dietary energy supply derived from cereals, roots and tubers means bad quality of the available diet. Food utilization is mainly focused on the ways human health is protected. FAO (2013) considered that the handling, the preparation and the stock of food influence food utilization, in particular, body health. Therefore, access to clean water and good sanitation is very important to achieve this goal. Another indicator used by the FAO to measure this dimension is the prevalence of anemia. This health indicator measures the percentage of pregnant women and children under five years of age whose hemoglobin level is lower than 110 grams per liter at sea level. Nutritional deficiencies are one of the common causes of anaemia. Access to water sources and sanitation facilities are two important factors for a good utilization of food. On the other hand, food access is split by the FAO (2013) into two pillars. The first one is economic access, expressed by the GDP per capita based on PPP, and the second one is physical access, expressed by the infrastructure quality in a country. Nevertheless, having a high income and good infrastructure quality does not mean that food security is reached. For this reason, we do not include the access dimension in our composite indicator, considering it to be the instrument that allows reaching the other food dimensions.

The same is true for the food stability dimension. Political stability and the absence of violence and terrorism[5] in a country may lead to a better economic and social environment to satisfy the three above dimensions. Thus we include the third Kaufmann indicator in the average institutional quality calculation.

We build a composite indicator using principal components analysis (PCA) corrected for outlying observations (Verardi, 2009). PCA captures the variance of each of the correlated variables and predicts an indicator with the maximum information from all variables. Our methodology consists of testing the correlation between all food security indicators in the FAOSTAT database. However, we were constrained by two factors in the data i) some indicators have a low number of observations ii) it is difficult to find a correlation between all indicators. These two factors can affect the amount of information in the composite indicator and later at the estimation stage.

Table 1. Correlation test between the food security indicators

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(1) Average dietary energy supply adequacy	1.00						
(2) Average value of food production per capita	0.49	1.00					
(3) Access to improved sanitation facilities	0.56	0.57	1.00				
(4) Access to improved water sources	0.57	0.50	0.86	1.00			
(5) Share of dietary energy supply derived from cereals, roots, and tubers	-0.38	-0.66	-0.68	-0.71	1.00		
(6) Prevalence of anaemia among pregnant women	-0.46	-0.55	-0.80	-0.74	0.69	1.00	
(7) Prevalence of anaemia among children under 5 years of age	-0.34	-0.42	-0.72	-0.62	0.52	0.79	1.00

Source: authors' calculations

The methodology used to build a robust composite indicator is based on a few steps. First, we test the correlation between the variables. As shown in Table 1, there are high correlations between our variables. Second, we choose the composite indicator according to two criteria i)

[5] Food stability is also affected by external shocks; for example, an increase in prices in international markets or a natural disaster, but this is not at the heart of our paper.

the cumulative variance so that at least 60 to 70% of the total information is explained and ii) the Kaiser criterion (Kaiser, 1960), which is used to keep the principal components that have an eigenvalue higher than one.[6]

We made a preliminary attempt to build a composite indicator from our seven indicators of food security. Results show the presence of two composite indicators with an eigenvalue higher than one. However, the cumulative information for the first component is very weak (see Table 2).

Table 2. Total variance of principal components for seven indicators of food security

Components	Eigenvalue	Proportion	Cumulative
PC1	3.07	0.44	0.44
PC2	1.34	0.19	0.63
PC3	0.93	0.13	0.76
PC4	0.63	0.09	0.86
PC5	0.58	0.08	0.94
PC6	0.26	0.03	0.97
PC7	0.15	0.02	1.00

Source: authors' calculations

To correct this issue, we split our indicators into two groups according to the correlation's sign; the first group includes indicators whose growth leads to a better food security situation, while the second group includes indicators whose growth is harmful to food security. Then, we applied the PCA technique for each group of indicators.

In Table 3, results show an improvement of cumulative information. For the first component, the eigenvalue is more than one with more than 60 percent of information; hence, we choose only the first component for each group.

Table 3. Total variance of principal components

	Group 1			Group 2		
Components	Eigenvalue	Proportion	Cumulative	Eigenvalue	Proportion	Cumulative
PC1	2.59	0.65	0.65	1.81	0.61	0.61

[6] Tests are performed with Stata 12.

PC2	0.82	0.20	0.85	0.79	0.26	0.87
PC3	0.49	0.12	0.97	0.39	0.13	1.00
PC4	0.08	0.02	1.00	--	--	--

Source: authors' calculations

Now let us move to the calculation of food security composite indicators. Table 4 shows the indicators' weights, which are equal to the weight of each indicator in the component indicator score. For example, for the first composite indicator, energy supply adequacy represents 12 percent; however, access to improved water sources is about 33 percent of the global score.

Table 4. Weights of indicators on the two components

Variables	Weights
The first composite food security indicator:	
Average dietary energy supply adequacy	0,12
Average value of food production per capita	0,23
Access to improved sanitation facilities	0,32
Access to improved water sources	0,33
The second composite food security indicator:	
Share of dietary energy supply derived from cereals, roots, and tubers	0,24
Prevalence of anaemia among pregnant women	0,42
Prevalence of anaemia among children under five years of age	0,34

Source: authors' calculations

4. Estimation results

Tables 5, 6, and 7 present our estimations results. All regressions are with year and country fixed effects. Table 5 is the estimations of Equation 1. We test if sectoral FDI and institutional quality influence income per capita. We also check whether the inclusion of control variables affects the estimation results.

In Column 1, we estimated our baseline specification, where we explain income by sectoral FDI and institutional quality. Results show that FDI in the secondary sector and institutional quality influence income per capita with an opposite effect. The first has a negative and significant coefficient, while the second has a positive one. Then, we consider income

inequality expressed by the Gini index (Column 2), interaction variables (Column 3), Trade openness (Column 4) and domestic investment (Column 5).

Table 3.5. Links between sectoral FDI and income in the presence of institution variable

Panel A : dependent variable= Income per capita					
	(1)	(2)	(3)	(4)	(5)
Primary FDI	-0.001	-0.001	0.004***	0.004***	0.003**
	(-0.90)	(-1.11)	(3.06)	(3.00)	(2.34)
Secondary FDI	-0.002***	-0.002***	-0.001	-0.001	-0.001*
	(-3.10)	(-3.03)	(-1.59)	(-1.63)	(-1.72)
Tertiary FDI	0.000	0.000	0.000	0.000	-0.000
	(0.85)	(1.29)	(1.39)	(1.21)	(-0.09)
Institutional quality	0.253***	0.250***	0.144***	0.147***	0.084*
	(4.30)	(4.24)	(2.69)	(2.75)	(1.65)
Gini index		-0.003	-0.001	-0.001	-0.004
		(-0.52)	(-0.28)	(-0.29)	(-0.88)
Primary FDI× institution			0.005***	0.005***	0.006***
			(3.31)	(3.31)	(3.37)
Secondary FDI× institution			0.004***	0.004***	0.004***
			(2.68)	(2.86)	(3.35)
Tertiary FDI × institution			0.000	0.000	0.000
			(0.49)	(0.39)	(0.17)
Trade openness				0.001	0.001*
				(1.61)	(1.65)
Domestic investment					0.009***
					(4.71)
R-squared	0.851	0.850	0.864	0.865	0.879
N	409	386	386	386	380
Numbers of countries	50	50	48	48	48

Notes: *t*-statistics are in parentheses. Significance at the 1, 5 and 10 percent levels is denoted respectively by ***, **, *. The constant is not reported.

Once these are included, the estimated coefficient for institutional quality remains statistically significant. However, FDI in the primary sector became statistically significant with a positive effect after the inclusion of interaction variables, in Columns 3, 4 and 5. The coefficient of the first interaction variable is positive and significant at the level of 1 percent, which suggests that in the presence of good quality institutions, FDI in the primary sector is better in terms of efficiency in increasing income. The same finding goes for the second interaction variable where the coefficient is positive and significant at the level of 1 percent, which means that FDI's effect on the secondary sector becomes positive when institutional quality reaches a

threshold of 0.25.[7] Trade openness and domestic investment have positive and statistically significant coefficients at levels of 10 and 1 percent, respectively.

Table 6 is the estimations of Equation 2. We evaluate the direct effects of sectoral FDI and institutional quality on food security. Columns 1-2 test the links between the income per capita and sectoral FDI separately with the food security indicator.

Table 3.6. Links between sectoral FDI and food security in the presence of institution

	Dependent variable: FSI1							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Income per capita	0.405***		0.633***	0.619***	0.484***	0.450**	0.444**	0.504**
	(4.01)		(4.38)	(3.30)	(2.63)	(2.27)	(2.28)	(2.53)
Primary FDI		0.001	0.000**	0.000	-0.000	0.000	0.000	0.000
		(1.10)	(2.00)	(1.57)	(-0.94)	(0.02)	(0.00)	(0.15)
Secondary FDI		0.001	0.002	0.001	0.000	0.004**	0.004**	0.004**
		(0.55)	(1.26)	(0.43)	(0.25)	(2.31)	(2.28)	(2.30)
Tertiary FDI		-0.002***	-0.003***	-0.002**	-0.002*	-0.002***	-0.002***	-0.002**
		(-3.22)	(-3.47)	(-2.26)	(-1.91)	(-2.70)	(-2.67)	(-2.49)
Institutional quality				0.023	0.067	0.036	0.039	0.054
				(0.19)	(0.56)	(0.32)	(0.34)	(0.47)
Gini index					-0.022***	-0.023***	-0.023***	-0.022***
					(-3.99)	(-4.06)	(-4.08)	(-3.61)
Primary FDI× institution						0.000	0.001	0.000
						(0.31)	(0.34)	(0.03)
Secondary FDI× institution						0.013***	0.013***	0.013***
						(2.99)	(2.97)	(2.91)
Tertiary FDI × institution						-0.006***	-0.006***	-0.006***
						(-3.01)	(-3.00)	(-3.04)
Trade openness							0.001	0.001
							(0.40)	(0.44)
Domestic investment								-0.005*
								(-1.73)
R-squared	0.669	0.699	0.721	0.720	0.745	0.766	0.767	0.760
N	856	531	512	404	381	381	381	375
Numbers of countries	56	52	51	50	48	48	48	48

Notes: *t*-statistics are in parentheses. Significance at the 1, 5 and 10 percent levels is denoted respectively by ***, **, *. The constant is not reported.

[7] The threshold is calculated as follows: $\frac{\partial Y}{\partial FDI} = \beta + \delta\, INS = 0$ which means $\beta = -\delta\, INS$ therefore $INS = -\frac{\beta}{\delta}$. So the effect of FDI becomes positive if $INS > -\frac{\beta}{\delta}$

Column 1 shows that the effect of income is positive and statistically significant at the level of 1 percent. In Column 2, we include only sectoral FDI, and we find that FDI in the primary and secondary sectors is not statistically significant. However, the coefficient of FDI in the tertiary sector is negative and significant at the level of 1 percent. In Column 3, we regressed all previous variables, and we find that the coefficients of income and FDI in the secondary sector are significant and retain the same signs as in previous regressions. FDI in the primary sector has a significant coefficient, but with a low positive effect. In Column 4, we add institutional quality and results almost remain the same, demonstrating that there is no significant effect from institutional quality. We add the Gini index, in Column 5, to control for income inequality and we found that income inequality has a negative and significant effect on food security. This finding is consistent with our intuition because the unequal distribution of income interrupts the access to and the utilization of food. Then we include interacted variables, and we found that the coefficient of FDI in the secondary sector became significant. Also, when FDI in the secondary and tertiary sectors interacted with institutional quality, they have, respectively, a positive and a negative effect on food security (see Column 6). In the last two columns (7 and 8), we add trade openness and domestic investment to see how they influence our results. Coefficients remain significant with approximately the same effects, but it appears that the coefficient of domestic investment does not haave the expected sign and it is slightly significant. For the interaction between FDI in the primary sector and institutional quality, the estimated coefficient is not significant. However, the interacted variables for the two others types of FDI are statistically significant at the level of 1 percent. FDI in the secondary sector seems to be efficient and diffuses more spillovers that are positive in the presence of a good quality of institutions, which is particularly true when institutional quality is lower but not lower than a threshold of -0.3. For FDI in the tertiary sector, the link seems to be negative even with good institutional quality.

Overall, our results show a weak link between sectoral FDI and food security, but in the presence of good quality of institutions, links become clearer and stronger, confirming the important role of domestic institutions in absorbing FDI. However, it is important to check these links with another measure of food security.

In Table 7, we try to explain the second composite indicator FSI2 with the same macroeconomic variables used previously. Here, we look at the channel by which sectoral FDI and institutional quality influence food security. As mentioned before, an increase in this indicator means that food security worsens, so we expect opposite signs for estimated coefficients compared to the results in the previous section.

We check for the endogeneity of income on our dependent variables with the Durbin-Wu-Hausman test under the null hypothesis that income is exogenous. According to this test, income per capita is endogenous in our models. To solve this issue, we use instruments which are expected to affect income but not the dependent variables. We use the labor force as a percentage of the population and domestic investment as a percentage of GDP as instruments for income. Three different tests validate this choice[8].

Table 7. Estimation results of IV fixed effects model with FSI2 as the dependent variable

	(1)	(2)	(3)	(4)
Panel A: First stage: endogenous variable = Income per capita				
Primary FDI	-0.001*	-0.002***	0.003**	0.003**
	(-1.84)	(-2.76)	(2.44)	(2.42)
Secondary FDI	-0.002***	-0.002***	-0.001	-0.001
	(-2.85)	(-2.98)	(-1.56)	(-1.59)
Tertiary FDI	0.000	0.000	0.000	0.000
	(0.18)	(0.88)	(0.66)	(0.57)
Institutional quality	0.203***	0.197***	0.091*	0.094*
	(3.18)	(3.29)	(1.78)	(1.85)
Labor force (% population)	0.006	0.006	0.003	0.002
	(1.03)	(1.03)	(0.60)	(0.33)
Domestic investment	0.007***	0.008***	0.009***	0.009***
	(3.19)	(3.97)	(4.70)	(4.53)
Gini index		-0.011*	-0.009*	-0.009*

[8] We performed all tests by using the Stata command of Schaffer (2010).

		(-1.85)	(-1.86)	(-1.87)
Primary FDI× institution			0.006***	0.006***
			(3.49)	(3.50)
Secondary FDI× institution			0.003**	0.003***
			(2.52)	(2.63)
Tertiary FDI × institution			0.000	0.000
			(0.24)	(0.16)
Trade openness				0.001
				(1.20)
R-squared	0.863	0.867	0.883	0.884
Panel B: Two-stage Least Squares: Dependent variable = FSI2				
Income per capita	-1.829*	-1.738*	-1.536*	-1.428*
	(-1.82)	(-1.89)	(-1.92)	(-1.73)
Primary FDI	-0.001	-0.001	0.003	0.003
	(-0.72)	(-0.89)	(0.60)	(0.56)
Secondary FDI	-0.001	-0.001	-0.004	-0.003
	(-0.32)	(-0.45)	(-1.60)	(-1.58)
Tertiary FDI	0.001	0.001	0.001	0.001
	(0.57)	(0.79)	(1.13)	(1.16)
Institutional quality	0.008	0.038	-0.072	-0.093
	(0.03)	(0.15)	(-0.41)	(-0.52)
Gini index		-0.010	-0.004	-0.003
		(-0.56)	(-0.29)	(-0.23)
Primary FDI × institution			0.005	0.004
			(0.75)	(0.66)
Secondary FDI × institution			-0.011**	-0.012**
			(-2.14)	(-2.21)
Tertiary FDI × institution			0.007***	0.007***
			(3.09)	(3.19)
Trade openness				-0.001
				(-0.61)
R-squared	0.338	0.357	0.422	0.439
Number of observations	388	366	366	366
Endogeneity test	4,039**	5.057**	6.138**	5.201**
Hansen *p*-value	0.2838	0.1974	0.1364	0.1315
Weak identification test (<15%)	11.076	13.657	15.952	13.749
Under-identification test	18.259***	21.687***	23.326***	19.301***
Number of countries	49	47	47	47

Notes: Panel A reports the corresponding first stage of IV estimation. Panel B reports the corresponding two-stage least squares estimates, instrumenting for income per capita using domestic investment and labor force as a percentage of total population. The constant is not reported. *T*-statistics are in parentheses. Significance at the 1, 5 and 10 percent levels is denoted respectively by ***, **, *.

First, we tested the null hypothesis that the equation is under-identified by using the Kleibergen and Paap (2006) rk-statistic, and we used the Kleibergen and Paap (2006) rk Wald F statistic to check the weakness of the instruments. The test consists of comparing the Stock

and Yogo (2005) critical values with the Kleibergen-Paap Wald rk F statistic. We found that all statistics are well above the critical value of 15% (see results in Table 7). Third, we used the Hansen (1982) test to see if the instruments are valid instruments and we found that all p-values are higher than 15%, which means that the instruments are valid.

The first estimated model is in Column 1 of Table 7. In the rest of the columns, we add additional variables as we did in previous tables. Note that all regressions include the country and year fixed effects.

Panel A reports the first stage of instrumental variable (IV) estimation and Panel B reports the two-stage least squares estimation. Column 1 shows that the estimated coefficient of institutional quality has a positive and significant impact on income, but for sectoral FDI, only the coefficient of FDI in primary and secondary sectors has a negative and significant effect on income. At the second stage, the effect of income is significant and affects, as expected, the composite indicator of food insecurity negatively.

In Column 2, income inequality (measured by the Gini index) has a negative influence on income. This result is consistent with our previous estimation and with our expectation that an increase in income inequality hinders economic performance. In Columns 3-4, we include the interaction variables between sectoral FDI and institutional quality. The only difference between these two regressions is that we added trade openness in Specification 4. With this latter variable, we test whether trade openness has an impact on our specification and the reported result shows that the p-value is well above one percent, as happened in Specifications 7 and 8 of Table 6. Turning to the same Column 3 in Panel B, we find that the income coefficient has negative signs and is significant at the level of 10 percent. When FDI in the secondary sector interacts with institutional quality, their effect becomes significant and

reduces food insecurity, but this is not the case for FDI in the tertiary sector where it enhances food insecurity.

In Column 4, we include trade openness. The results remain the same with a slight decrease in the institutional quality effect in panel A and the income effect on food insecurity in Panel B. However, the coefficient of the interactive term between FDI in the primary sector and institutional quality is positive and significant as in the two previous estimates. This finding indicates that the effect of FDI in the primary sector becomes positive when institutional quality reaches a threshold of -0.5. An average institutional quality higher than this value gives host countries the possibility to benefit from positive spillovers of FDI in the primary sector. For FDI in the secondary sector, the threshold is about 0.33. Under this value, the effect on income becomes negative. This result confirms the importance of the capacity for absorption in benefiting from FDI. At low levels of institutional quality, FDI has negative effects on income. The reverse holds for high levels of institutional quality.

In the second stage, income seems to have a negative impact on food insecurity. In the latter, however, FDI in the tertiary sector has negative spillovers on food security even after interaction with the economic institutions variable.

If institutional quality is less than a threshold of -0.25, spillovers from FDI in the secondary sector become harmful to food security. FDI in the tertiary sector always has a negative effect on food security. Indeed, FDI in the tertiary sector can influence income levels positively (unfortunately, we did not find a significant coefficient), but on food security, it has negative spillovers. This type of FDI inflows is located in urban cities, encourages rural exodus, and

thus amplifies poverty and inequality in the society. The negative and significant sign of income inequality confirms our intuition.

5. Conclusion

This paper examines whether institutional quality leads to better exploiting FDI and thus improving food security in developing countries. Motivated by the important role of economic and political institutions in shaping the economy, we examined the effects and the interaction effects of sectoral FDI and the quality of institutions on income and food security. We conducted a review of the economic literature. At the empirical level, we used an unbalanced panel of several developing countries, and we specified a fixed effects model with and without the instrumental variable techniques.

Our first important finding was that FDI inflows have mixed effects and using a disaggregated FDI gives a clearer picture of these effects. Indeed, the economic literature did not sufficiently investigate the disaggregated level of FDI data. Our results confirm that sectoral FDI and food security have indirect links, i.e. through spillovers effects, on the host economy. Good institutional quality makes FDI more efficient in the primary and secondary sectors by increasing income and thus ensuring access to available food. It seems that institutional quality is primordial for determining the direction of the spillovers effect. Results show that FDI in the secondary sector becomes a factor of growth only if institutional quality exceeds some thresholds. For FDI in the tertiary sector, the effect is always harmful to food security. Otherwise, FDI in the services sector targets capitals and urban areas, which encourages the rural population to leave their area and go to urban ones. This rural exodus makes food less available because of the high demand and less accessible because food prices will be higher. Testing for the effect of the Gini index, we found that income inequality presents a strong

constraint to income and to the improvement of food security, which is consistent with the negative effect of FDI in services.

To sum up, FDI may be a source of capital accumulation and technology transfer, but it is far from being the best instrument to enhance food security in the presence of the actual economic and political institutional quality. Reforms aimed at fighting corruption and increasing government transparency are necessary to benefit from FDI and to begin the race towards eradicating food insecurity.

We should mention that this work has several limitations. The composite indicator could include more information about food security, but unfortunately there are insufficient data for several indicators.

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Appendix

Table A1. Decomposition of primary sector

Primary sector
Agriculture, hunting, forestry, and fishing
Agriculture and hunting
Forestry
Fishing
Mining, quarrying and petroleum
Mining and quarrying
Petroleum

Source: Industrial and geographical breakdown UNCTAD. Available at: http://unctad.org/en/Pages/DIAE/Industrial-and-Geographical-Breakdown.aspx

Table A2. Decomposition of secondary sector

Secondary sector	
Food, beverages, and tobacco	Metal and metal products
Food products and beverages	Basic metals
Tobacco products	Fabricated metal products
Textiles, clothing, and leather	Machinery and equipment
Textiles	Electrical and electronic equipment
Clothing	Office, accounting and computing machinery
Leather and leather products	Electrical machinery and apparatus
Wood and wood products	Radio, television and communication apparatus
Manufacture of wood and wood products	Precision instruments
Paper and paper products	Motor vehicles and other transport equipment
Publishing, printing and reproduction of recorded media	Motor vehicles, trailers, and semi-trailers
Coke, petroleum products and nuclear fuel	Other transport equipment
Chemicals and chemical products	Other manufacturing
Rubber and plastic products	Recycling
Non-metallic mineral products	

Source: Industrial and geographical breakdown UNCTAD. Available at: http://unctad.org/en/Pages/DIAE/Industrial-and-Geographical-Breakdown.aspx

Table A3. Decomposition of tertiary sector

Tertiary sector	
Electricity, gas, and water	Rental activities
Construction	Computer and related activities
Trade	Research and development
Automotive trade and repair	Other business activities
Wholesale trade	Public administration and defense
Distributive trade	Education
Hotels and restaurants	Health and social services
Transport, storage, and communications	Community, social and personal service activities
Transport and storage	Sewage and waste disposal, sanitation activities
Land transport including pipelines	Membership Organizations N.E.C.
Water transport	Recreational, cultural and sporting activities
Air transport	Other services
Supporting and auxiliary transport activities	Service activities incidental to oil and gas extraction excluding surveying
Post and communications	Other service activities
Finance	Private households with employed persons
Financial intermediation	Extra-territorial organizations and bodies
Insurance and pension funding	Private buying and selling of property
Activities auxiliary to financial intermediation	Unspecified
Business activities	
Real estate	

Source: Industrial and geographical breakdown UNCTAD. Available at: http://unctad.org/en/Pages/DIAE/Industrial-and-Geographical-Breakdown.aspx

Table A4. Summarized data

Variable	Obs	Mean	Standard deviation	Min	Max
Average dietary energy supply	886	114.10	14.36	72	163
Average value of food production	886	274.72	146.01	67	997
Access to improved sanitation facilities	896	66.82	26.69	3	100
Access to improved water sources	901	83.05	16.64	20	100
Share of dietary energy supply derived from cereals, roots and tubers	886	53.59	13.70	26	84
Prevalence of anaemia among pregnant women	890	39.89	15.25	17.8	77.2
Prevalence of anaemia among children under 5 years of age	890	35.95	8.88	20.5	61.9
Log GDP per capita=Income per capita	887	8.39	0.84	5.82	9.97
Primary FDI (% GDP)	578	12.25	37.63	-15.51	470.95
Secondary FDI (% GDP)	590	8.96	9.95	-14.88	97.70
Tertiary FDI (% GDP)	627	20.97	26.01	-16.13	241.53

Average of Kaufmann's indicators = institutional quality	688	-0.36	0.44	-1.33	1.02
Gini index	825	40.95	7.70	20.66	56.95
Trade openness	911	79.26	37.86	14.93	220.40
Gross fixed capital formation (% GDP)	883	21.52	6.32	5.38	57.70
Labor force (% population)	928	42.69	6.01	27.65	58.40

Source: authors' calculations

Table A5. Correlation between institutional indicators of Kaufmann.

	(1)	(2)	(3)	(4)	(5)	(6)
(1) Control of corruption	1.00					
(2) Government effectiveness	0.78	1.00				
(3) Political stability	0.54	0.38	1.00			
(4) Regulatory quality	0.69	0.78	0.39	1.00		
(5) Rule of law	0.82	0.77	0.58	0.66	1.00	
(6) Voice accountability	0.60	0.47	0.44	0.58	0.52	1.00

Table A6. Correlation between variables

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) Primary FDI	1.00							
(2) Secondary FDI	-0.01	1.00						
(3) Tertiary FDI	-0.04	0.24	1.00					
(4) Gini index	-0.24	-0.09	-0.19	1.00				
(5) Institutional quality	-0.22	0.22	0.21	-0.07	1.00			
(6) Income per capita	-0.05	0.00	0.18	-0.02	0.53	1.00		
(7) Trade Openness	0.08	0.25	0.23	-0.23	0.30	0.21	1.00	
(8) Domestic investment	0.41	0.12	0.16	-0.10	0.00	0.03	0.16	1.00

Source: authors' calculations.