

DO COUNTRIES'  
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RENEWABLE ENERGY RESOURCES  
MATTER FOR FDI ATTRACTION?  
A CROSS-COUNTRY  
ECONOMETRIC ANALYSIS

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# DO COUNTRIES' ENDOWMENTS OF NON-RENEWABLE ENERGY RESOURCES MATTER FOR FDI ATTRACTION? A CROSS-COUNTRY ECONOMETRIC ANALYSIS

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## Abstract

The vast existing empirical literature on Foreign Direct Investment (FDI) puts forward an extensive list of determinants that may explain the investment of multinational firms in a particular location. However, only a small fraction of these studies concerns the importance of natural resources in attracting FDI. Despite their valuable scientific contribution, the few studies that deal with these two themes are limited in two regards: their focus on specific geographical regions (e.g., Central and Eastern Europe, Central Asia, Sub-Saharan Africa, Middle East and North African countries); and their neglect of Non-Renewable Energy Resources (NRER). In this context, this paper intends to add empirical evidence to this research area. Specifically, it analyzes the impact of countries' endowments of NRER (introducing here a new measure - proven reserves of coal, gas and oil) in attracting FDI in a wide set of countries, controlling for other factors that are traditionally considered as influencing FDI (e.g., market size, human capital, openness of the economy, political stability). Examining 125 host countries (75 of which have proven reserves of NRER), the empirical results show that a country's endowment of NRER does not matter for FDI attraction whereas some 'traditional' factors, most notably, human capital and openness of the economy emerge as critical determinants of FDI. These results have important and encouraging policy implications for countries' development, in particular for less developed countries that are not endowed by nature with NRER. Indeed, our results firmly indicate that development, through FDI attraction, is possible as long as countries intentionally devote resources to the enhancement of their human capital and convincing efforts are made to open up their economies to international trade.

Keywords: FDI, Eclectic Paradigm, determinants of FDI, Non-Renewable Energy Resources

*JEL-Codes:* F21, F23, C4, O13

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## 1. Introduction

Foreign direct investment (FDI) is regarded as a driving force behind economic growth (Wang, 2009). Many governments from developed and developing countries see FDI as a way of dealing with stagnation and even the poverty trap (Brooks *et al.*, 2010). In this context the detailed analysis of the determinants of FDI has provided invaluable information. But, as Faeth (2009) notes, this analysis should not be based simply on a single theoretical model, but on a combination of models that include factors intrinsic to the firm (ownership advantages, cost reduction and economies of scale), and market specific factors, such as barriers to entry, availability of resources, political stability, and market size.

Notwithstanding the quantity and quality of studies on the determinants of FDI, few of them include a country's supply of non-renewable energy resources (NRERs) such as coal, oil or natural gas (e.g., Mina, 2007; Ledyeva, 2009). Some studies (e.g., Velthuisen, 1999) suggest that these resources are closely linked with economic growth since their scarcity, measured by proven reserves,<sup>1</sup> can limit growth.

In an age when energy security is a global concern, and when countries such as China are attempting to take positions in mining companies around the world to ensure future supply and thereby continued economic growth (Moran, 2010), it is important to understand how far the endowment in non-renewable energy resources is, or is not, a factor that attracts inward FDI.

Despite the enormous amount of literature on FDI (e.g., Faeth, 2009; Mohamed *et al.*, 2010) and non-renewable energy resources (e.g., Crawford *et al.*, 1984; Mitchell, 2009), considered separately, not many studies have looked at the two topics together, that is, establishing and appraising a (possible) correlation and causality between these two variables. The few studies there are in this domain focus on a limited number of regions and countries including Sub-Saharan Africa (SSA) (Asiedu, 2006), the Middle East and North African countries<sup>2</sup> (Mohamed and Sidiropoulos, 2010), China (Cheung and Qian., 2009), India (Kumar and Chadha, 2009), Eurasia (Poland, Hungary and the Baltic states) (Deichmann *et al.*, 2003), the Southern African Development Community<sup>3</sup> (Mhlanga *et al.*, 2010) and the nations from the ex-Soviet Union (Ledyeva, 2009). Furthermore, these studies do not tend to look specifically

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<sup>1</sup> Proven reserves are the economically extractable fraction of a resource using current technology (Grafton *et al.*, 2004).

<sup>2</sup> MENA countries – Saudi Arabia, Algeria, Bahrain, Djibouti, Egypt, United Arab Emirates, Yemen, Iran, Iraq, Israel, Jordan, Kuwait, Lebanon, Libya, Malta, Morocco, Oman, Qatar, Syria, Palestinian Territories.

<sup>3</sup> SADC countries: South Africa, Angola, Botswana, Democratic Republic of Congo, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, Seychelles, Swaziland, Tanzania, Zambia and Zimbabwe.

at the possible correlation and causality between FDI and NRER, not at the particular relevance of the latter as determining the former.

This study sets out to add evidence to this research area by analysing the role of NRERs in attracting FDI, controlling for a set of factors that are traditionally regarded as influencing this last macroeconomic variable (e.g. human capital, market size, political stability, openness of the economy) (Faeth, 2009). For this we have used multivariate econometric techniques involving a wide group of countries that receive FDI, including some with NRER endowments, to assess which countries perform best in terms of attracting FDI and what role is played by the NRERs in their performance.

The paper is organised as follows. Section 2 gives a brief overview of the literature on endowments of natural resources and FDI. The methods employed are described in Section 3, with details on the econometric model, the proxy variables and relevant data sources and a short account of the model's variables. The empirical results of the model are presented in Section 4. The last section sets out the main results of the study, their limitations and future lines of research.

## **2. FDI and natural resource endowments: literature review**

Theoretical approaches to FDI (see Faeth (2009) for a summary of them) include the following among such relevant factors relevant to attracting FDI: infrastructure; human capital; economic stability; production costs; corruption; political instability; institutional quality; financial and tax incentives; market size; market growth, and openness of the economy.<sup>4</sup> Several studies on the propensity of a country to attract FDI which examine the determinants that explain the direct investment by multinationals in a particular location tend to confirm the importance of some factors mentioned in the theoretical approaches, including infrastructure (e.g., Biswas, 2002; Asiedu, 2006), human capital (e.g. Cleeve, 2008; Asiedu, 2006), market size (e.g. Mohamed e Sidiropoulos, 2010; Vijayakumar *et al.*, 2010), political instability (e.g. Asiedu, 2006; Mohamed e Sidiropoulos, 2010), and openness of the economy (e.g. Asiedu, 2006; Botrić e Škuflić, 2006).

With respect to the part natural resources play in attracting FDI, Dunning and Lundan (2008) believe that companies can improve competitiveness by investing in certain places that will

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<sup>4</sup> A detailed discussion of FDI theories is beyond the scope of this work. A review of these can be found in Faeth (2009).

give them access to particular natural resources of better quality and at a lower real cost than in the country of origin. This motivation is especially important for industrial firms since this policy could ensure the minimisation of production costs and security of sources of supply (Dunning and Lundan, 2008). So a significant statistically positive relation was expected between the natural resources endowments and FDI (cf. Table 1). This outcome was confirmed by most empirical studies (Deichmann *et al.*, 2003; Asiedu, 2006; Cheung and Qian, 2009; Ledyaeva, 2009; Mohamed and Sidiropoulos, 2010), apart from Mhlanga *et al.* (2010), who used a dummy variable to measure the natural resources endowments in the SADC countries, and whose results were inconclusive.

**Table 1: Factor endowments in natural resources and FDI – summary of empirical studies**

| FDI target <sup>a</sup>   | Proxy  | Method                  | Effect | Author(s) (year)               |
|---------------------------|--|-------------------------|--------|--------------------------------|
| 22 SSA countries          | X fuels+minerals/total X                                     |                         | +      | Asiedu (2006)                  |
| 12 MENA; 24 PVD           | X fuels/total X  |                         | +      | Mohamed & Sidiropoulos (2010)  |
| 14 SADC                   | Investment in mining industry (dummy)                        | Multivariate regression | 0      | Mhlanga <i>et al.</i> (2010)   |
| 50 largest host countries | X fuels+ores+minerals/total X                                |                         | +      | Cheung & Qian (2009)           |
| Eurasia                   | Variable =0 – poor endowment RN;<br>=1 - moderate; =2 - high |                         | +      | Deichmann <i>et al.</i> (2003) |
| Ex-USSR                   | Production index oil+gas                                     | Panel data              | +      | Ledyaeva (2009)                |
| n/a                       | n/a  | Descriptive             | n/a    | Kumar & Chadha (2009)          |

*Legend:* + positive effect & statistically significant; - negative effect & statistically significant; 0 effect not statistically significant.

*Notes:* <sup>a</sup> Country is the analysis unit for all studies cited.

*Source:* Compiled by the authors.

Asiedu (2006), Cheung and Qian (2009) and Mohamed and Sidiropoulos (2010) used very similar proxies to measure the natural resources endowments and the differences are due to the type of natural resources found in the countries they studied. Thus, Asiedu (2006) used the weight of fuel and mineral exports in overall exports since their sample was based on Sub-Saharan African countries that have huge endowments of fuels and minerals. Mohamed and Sidiropoulos (2010), however, only used fuels since these are the natural resources most important to the MENA countries. Analysing FDI from the investor's point of view, Cheung and Qian (2009), used a wider proxy (including ores, too) which represents the demand for sundry raw materials in the various countries.

Controlling for a huge set of factors that may influence the inflow of FDI to these countries in the period 1989-1998 (e.g., reform measures; importance of private sector in the economy, GDP and per capita GNP, inflation rate, number of years the economy is (was) under central planning, rule of law, investment climate; human and social capital) and focusing on countries in Eurasia, Deichmann *et al.* (2003) concluded that the endowment of natural resources is a

necessary condition for FDI. The authors specifically mention the countries of Central Asia, rich in oil and natural gas, that would not be attractive were it not for these resources.

Ledyeva (2009) looked at the nations from the ex-USSR in the period 1995-2005 and noted that the regions richer in natural resources, measured by the oil and natural gas production index, attract higher amounts of FDI.

All the empirical studies mentioned above use econometric models to gauge the relevance of natural resources in attracting FDI in various countries. Only Kumar and Chadha (2009) opted for a comparative descriptive study of India and China to find the main differences in the FDI determinants that motivate each country in the steel sector. Even though Indian FDI in the mining industry rose nearly 10% between 2000 and 2004 (there was virtually none in 2000), the authors concluded that natural resources are not the main determinant of Indian FDI, since the goal of those firms was to achieve a global dimension. Chinese FDI, on the other hand, is clearly designed to acquire resources so as to secure the country's supply of natural resources.

It can be seen that, even though the studies that examine the relevance of natural resources to attracting FDI are unanimous as to the importance of this determinant (e.g., Asiedu, 2006; Cheung and Qian, 2009; Kumar and Chadha, 2009; Mhlanga *et al.*, 2010), most of them do not look specifically at NRERs. Those that do, i.e., Deichmann *et al.* (2003), Ledyeva (2009) and Mohamed and Sidiropoulos (2010), who tried to see if the regions with the largest oil and natural gas endowments tend to attract more FDI, focus on very specific regions of the world (Central and Eastern Europe, Central Asia and the MENA countries).

Thus our study is intended to add empirical evidence on the special relevance of NRERs and their (possible) correlation with FDI. We use multivariate econometric techniques and look at a large group of countries, including countries having NRER endowments, with the aim of establishing a relation between a country's endowment of such resources and its performance in terms of FDI attraction.

### **3. FDI and non-renewable energy resources: methodological approaches**

#### **3.1. Econometric model and its variables**

Multivariate estimation techniques are used to estimate to what extent the endowment of NRER affects inward FDI, controlling for the set of factors relevant to attracting FDI. Theoretical approaches to FDI (see Faeth (2009) for a summary of them) include the

following among such relevant factors: infrastructure; human capital; economic instability;<sup>5</sup> production costs; corruption; political stability<sup>6</sup>; institutional quality; financial and tax incentives; market size; market growth, and openness of the economy. Equation below expresses the econometric model adopted:

$$\text{FDI / GDP} = f(\mathbf{X}; \text{NRER})$$

where FDI/GDP measures the importance of foreign investment flow in GDP for a country in a certain period, on average, and X is the other variables capable of influencing FDI flows.

The econometric analysis focuses on a large group (125) of countries (analysis unit) over the most recent quinquennium for which data are available (2004-2008), with 75 having NRER endowments of NRERs and 50 not having proven reserves of these resources.<sup>7</sup>

The dependent variable was measured in average terms so as to take in its variation over the period analysed. The data relating to the initial period of the analysis (1998-2005) were used for the independent variables, to create the context of the basic economic situation of the countries in the sample and establish a causality relation. The independent variables, the respective proxies, source and expected effect are summarised in Table 2.

According to existing empirical literature, several indicators can be used as a proxy for FDI. While some authors (e.g., Cleeve, 2008; Vijayakumar *et al*, 2010) use FDI flows, others (e.g., Schneider and Frey, 1985) opt for per capita FDI, or even for the weight of FDI in GDP (e.g., Biswas, 2002; Asiedu, 2006; Mohamed and Sidiropoulos, 2010). Given that the FDI data reflect the total absolute sum of inflows and outflows included in the balance of payments (Mohamed and Sidiropoulos, 2010), and our theoretical model was based on FDI flows in the host country's economy, it was decided to define the dependent variable as the percentage net flow of GDP (FDI/GDP), so as to relativize the FDI flows of the host country in terms of its economic size (Mohamed and Sidiropoulos, 2010). The required information was taken from the World Bank database.

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<sup>5</sup> Even though the theoretical approaches and empirical studies alike cite economic stability, when building the model the term 'economic instability' was employed since the proxy used / inflation rate (and the consequent expected effect) – is a measure of instability.

<sup>6</sup> Similar to the previous note, where the literature refers to 'political instability' the term 'political stability' was used to build the model, since the proxy used is the political stability index (so in our case a positive effect is expected of this determinant).

<sup>7</sup> Note that, even though the United Arab Emirates and Qatar had the highest proven reserves (18 612 and 10 985 Giga TOE, respectively) they are not part of the sample. This is because they are not FDI receiver countries as the legal framework for foreign investment is very restrictive (AICEP, 2011).

With respect to the independent variables, starting with infrastructure, two proxies were used to measure their quality: the number of phone lines per 100 inhabitants and net installed electricity generation capacity per capita. As the sample includes a range of countries with widely divergent degrees of development – developed countries and developing countries – from all over the world, the first proxy should fit the development level of the developing countries better and the second should identify the different degrees of development among the developed countries. Bearing in mind the relevant literature, it is expected that good infrastructure (expressed by the high number of phone lines and/or a large net installed electricity generation capacity per capita) would be attractive to foreign investors (Biswas, 2002; Asiedu, 2006).

**Table 2: Model to be estimated – summary of variables and their proxies**

| Determinant                  | Proxy  | Source                         | Expected effect on FDI |
|------------------------------|--|--------------------------------|------------------------|
| Dependent variable FDI       | FDI/GDP  | World Bank                     |                        |
| Infrastructure               | No. phone lines per 100 inhabitants                      | UNStats <sup>a</sup>           | Positive               |
|                              | Net installed electricity generation capacity per capita | CIA (world factbook)           |                        |
| Human capital                | Rate of adult literacy                                   | CIA (world factbook)           | Positive               |
| Economic instability         | Inflation rate   | CIA (world factbook)           | Negative               |
| Production costs             | Labour regulation index                                  | Doing Business                 | Negative               |
|                              | Cost of imports  |                                | Negative               |
| Corruption                   | Transparency index (CPI <sup>b</sup> )                   | Transparency International     | Positive <sup>c</sup>  |
| Political stability          | Political stability index                                | World Bank                     | Positive               |
| Institutional quality        | Effectiveness of rule of law                             | World Bank                     | Positive               |
| Financial and tax incentives | Total tax rate (% profits)                               | World Bank                     | Negative <sup>d</sup>  |
| Market size                  | Per capita GDP   | World Bank                     | Positive               |
| Market growth                | Rate of real GDP growth                                  | UNCTAD <sup>e</sup>            | Positive               |
| Openness of economy          | (X+M)/GDP  | World Bank                     | Positive               |
| Factor endowments            | X fuels/total X  | International Trade Centre     | Positive               |
|                              | Proven reserves  | BP <sup>f</sup> / world energy |                        |

Notes: <sup>a</sup> United Nations Statistics; <sup>b</sup> Corruption Perceptions Index; <sup>c</sup> The positive effect expected due to proxy used being the transparency index; <sup>d</sup> The negative effect expected due to proxy used being the total tax rate; <sup>e</sup> United Nations Conference on Trade and Development; <sup>f</sup> BP Statistical Review of World Energy

Source: Compiled by the authors.

With respect to human capital, we decided to measure this determinant through the adult literacy rate since it reflects the accumulated stock of human capital (Cleeve, 2008), indicating the education and skills level of the population. The average number of years of schooling of the working-age population would be a more robust choice (Teixeira, 2005), but availability of this indicator for such a broad group of countries constrains its use. In either



case, it is expected that human capital plays an important part in attracting FDI (Teixeira and Tavares, 2007).

Since high or volatile rates of inflation are a clear sign of economic instability (Botrić and Škuflić, 2006), the rate of inflation was chosen as a proxy for measuring each country's economic instability. High inflation rates distort economic activity and reduce investment in productive industries, leading to lower economic growth (Mohamed and Sidiropoulos, 2010). So it is expected that high inflation is a disincentive to foreign investment.

Issues of cost reduction and increasing competitiveness often tempt firms to relocate their production facilities in places where such costs are lower (Dunning and Lundan, 2008), specifically labour costs, with worker's wage being the proxy most often referenced in the literature (e.g., Schneider and Frey, 1985; Biswas, 2002). It may therefore be expected that low production costs tend to attract larger FDI inflows. In our study, the large size of the sample, on the one hand, and the inclusion of countries with scanty statistical information on the other mean that this indicator could not be used.<sup>8</sup> Two other indicators were chosen instead. The first is the global index of labour regulation, which measures the rigidity of the labour market and includes such indicators as the flexibility of employment contracts, duration of employment, compensation payable to workers, among others, and that can take values between 0 and 100. The higher the index the more rigid the regulation and the less attractive it will be for investors. The second indicator relates to the cost of imports (measured in USD by container). This includes all import costs - administrative charges, the cost of keeping customs facilities, transport, customs clearance, and other expenses - that can be a determinant in the choice of location, since this can be a significant cost in raw materials or machinery that has to be imported.

In line with the empirical literature (e.g., Asiedu, 2006; Cleeve, 2008), we chose the Corruption Perceptions Index (CPI), calculated by Transparency International, as a proxy for a country's level of corruption.<sup>9</sup> The higher the CPI (maximum 10), the greater the transparency (lower the corruption level). Low CPI scores are thus linked to lower foreign

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<sup>8</sup> Among the sources used were the World Bank, UNCTAD, the IMF (International Monetary Fund), OECD, ILO (International Labour Organisation), to try and find the labour cost per employee; some organisations (e.g., World Bank and IMF) do not provide this indicator and in others it is only available for a very small number of countries, rendering it useless for the model.

<sup>9</sup> The diversity of countries in the sample caused some problems in obtaining certain data. So the CPI score for the Central African Republic, Guinea and Togo relate to 2006, since that was the first year for which Transparency International published this indicator for them.

investment, given the poor transparency in trading relations (Transparency International, 2004).

Some authors, such as Mhlanga *et al.* (2010), use the risk rating of a country to measure political stability. But given the difficulty in obtaining this indicator, an alternative was chosen: the political stability and absence of violence and terrorism index, calculated by the World Bank. This index measures the perceived likelihood of a government being toppled by unconstitutional or violent means, expressing the country's political risk. It can take values from 0 to 100 and the higher the score the greater the stability. It is expected that high indexes of political stability, which reflect low political risk, tend to attract more FDI.

With respect to institutional quality, we followed Asiedu (2006) and took the degree of effectiveness of the rule of law as a proxy. This index measures the impartiality of the legal system and the degree of compliance with the law. The closer to 100% (maximum) the greater the impartiality. It is thus expected that a high degree of effectiveness of the rule of law should attract investors, since it offers them greater security.

Even though the empirical literature suggests temporary tax exemptions, tax concessions and ease of repatriation of profits as indicators of financial and tax incentives (Cleeve, 2008), the large size of the sample meant that none of these data could be obtained for all the countries. So the total tax rate (as percentage of profits) was chosen instead, since this indicator expresses all the taxes payable by a firm. According to the literature it is expected that countries with lower tax rates will tend to attract greater inward flows of FDI.

Market size is seen by the empirical literature as being crucial to attracting FDI (e.g., Schneider and Frey, 1985; Mhlanga *et al.*, 2010), such that countries with a bigger domestic market will be more attractive to investors because of the greater number of potential consumers. Some authors (e.g., Botrić and Škuflić, 2006; Mohamed and Sidiropoulos, 2010) use the number of inhabitants as a proxy of this determinant. But it is felt that this indicator does not give a true picture of the attractiveness of the market, especially in a broad sample of countries which includes underdeveloped, developing and developed nations, as a large population need not translated into a large number of consumers if they lack purchasing power (Ietto-Gillies, 2005). Based on the empirical literature, therefore, per capita GDP was deemed a more suitable indicator to measure the influence of market size.

When it comes to potential for market growth, the literature (e.g., Mhlanga *et al.*, 2010; Mohamed and Sidiropoulos, 2010) generally suggest using the GDP or GNP growth rate as a

proxy for this determinant. A high growth rate for the market should attract more FDI since a growing economy offers more opportunities for higher profits. So the real GDP growth rate is used as a proxy as it is corrected for the effect of price variation, thereby giving more credible information on GDP growth.

Openness of the economy is seen in the literature as one of the key determinants of FDI (Vijayakumar *et al.*, 2010). A country can increase its attractiveness by adopting a policy that favours foreign trade, encouraging domestic producers to export, increasing their profitability and attracting foreign investors (Mohamed and Sidiropoulos, 2010). Based on the empirical literature (e.g., Botrić and Škuflić, 2006; Cleeve, 2008), it was decided to use the weight of foreign trade in GDP to measure the degree of openness, such that the greater the ratio the more open the country and the more FDI it would attract (Cleeve, 2008). A positive relation of this determinant with FDI is thus expected.

According to some authors (e.g., Velthuisen, 1999), natural energy resources, especially non-renewable (NRERs) such as oil, coal and natural gas, have been playing a key role in economic development. The NRERs are currently at the centre of the discussion about energy security (Moran, 2010) which is why our study focuses on them, to estimate their impact on inward flows of FDI. In this context, and following the scarce literature available (e.g., Mohamed and Sidiropoulos, 2010), one of the proxies used to measure NRER endowments is the weight of fuel exports in total exports. However, a number of countries, such as Cameroon and Chad, although they do not have 'proven reserves' of NRERs nonetheless register a high ratio of fuel exports in their total exports, which may distort the analysis of the impact of these resources on attracting FDI.

Most non-renewable resources are not wholly available for extraction, since only a small fraction of minerals overcomes the mineralogical barrier, with 'proven reserves' being the economically extractable part of a resource (Grafton *et al.*, 2004). Although it is technically possible to extract resources from beyond the mineralogical barrier, the cost is excessively high and so extraction takes place only up to the barrier. Proven reserves are thus confined to a small part of existing resources (Grafton *et al.*, 2004), which affects the scarcity of resources and stresses the importance of such reserves to economic development (Cleveland and Stern, 1999). It is therefore pertinent to use a proxy based on proven reserves in addition to the more traditional proxy. To the best of our knowledge no empirical study has yet been published that examines the effect of holding oil, coal and natural gas reserves on FDI attraction.

Given that the proven reserves of each of the three resources are expressed in different units (oil in barrels, coal in tonnes and natural gas in m<sup>3</sup>),<sup>10</sup> for comparability purposes they have been converted to TOE (tonnes of oil equivalent),<sup>11</sup> taking barrels of oil to be American barrels (42 US gallons being approximately 158.9873 litres).

### 3.2. Short descriptive analysis of the model's variables

The descriptive analysis of the model's variables (cf. Table 3), shows a considerable discrepancy between the various countries with respect to FDI attraction.

**Table 3: Descriptive analysis of the variables**

| Determinant                  | Proxy  | Minimum | Maximum  | Mean      | Standard deviation |
|------------------------------|--|---------|----------|-----------|--------------------|
| FDI (dependent variable)     | Mean FDI/GDP 2004-2008                                   | -0.0361 | 0.2438   | 0.046150  | 0.0441270          |
| Infrastructure               | No. phone lines per 100 inhabitants                      | 0.02    | 70.84    | 18.9228   | 20.65772           |
|                              | Net installed electricity generation capacity per capita | 0.00    | 25893.50 | 2996.3093 | 4139.77505         |
| Human capital                | Rate of adult literacy                                   | 21.80   | 100.00   | 82.3480   | 20.46665           |
| Economic instability         | Inflation rate   | -6.80   | 295.00   | 14.8946   | 39.09334           |
| Production costs             | Labour regulation index                                  | 20      | 79       | 52.70     | 13.270             |
|                              | Cost of imports  | 1.00    | 994.00   | 269.0614  | 370.35192          |
| Corruption                   | Transparency index (CPI)                                 | 0.04    | 10.00    | 4.0640    | 2.20419            |
| Political stability          | Political stability index                                | 0.96    | 99.52    | 42.4578   | 26.67397           |
| Institutional quality        | Effectiveness of rule of law                             | 2.38    | 100.00   | 47.2038   | 28.63549           |
| Financial and tax incentives | Total tax rate (% profits)                               | 14.40   | 287.10   | 52.7704   | 36.43058           |
| Market size                  | Per capita GDP   | 93.34   | 36543.8  | 6074.247  | 9180.3941          |
| Market growth                | Rate of real GDP growth                                  | -12.2   | 84.9     | 3.570     | 8.28533            |
| Openness of economy          | (X+M)/GDP  | 19      | 369      | 79.32     | 47.602             |
| Factor endowments            | X fuels/total X  | 0.00    | 98.40    | 17.9845   | 27.27390           |
|                              | Proven reserves  | 0.00    | 183.04   | 7.2211    | 24.35383           |

*Note:* The number of observation/countries is 125; the independent variables relate to the 1998-2005 period, to create the context of the basic economic situation of the countries in the sample and establish a causality relation between the former and the variable to be explained (FDI in GDP).

The dependent variable (FDI/GDP) mean is 0.046 for all countries in the sample. Hungary has the highest value (0.2438) and Ireland has a negative mean (around 0.361) in the period studied, since it suffered disinvestment with FDI outflows exceeding inflows, making a negative flow. In the period analysed the FDI for Hungary rose significantly due to its joining the European Union (World Finance, 2008).

<sup>10</sup> Natural gas reserves are expressed in trillions of m<sup>3</sup>, so the scientific scale is used to convert them into TOE. Note that there are two scales for large numbers: a short scale or scientific/American scale, where on trillion has 12 zeros, and a long scale, where one trillion has 18 zeros.

<sup>11</sup> BOE (barrel of oil equivalent) = 0.14 TOE; TCE (tonne of coal equivalent) = 0.7 TOE (Soares, 2010); 10<sup>3</sup> m<sup>3</sup> = 0.82 TOE (Heitor *et al.*, 2000).

In terms of total proven reserves, the mean is around 7.22 Giga TOE, with the USA standing out (183.04 Giga TOE), along with Russia (153 Giga TOE), China (83.39 Giga TOE) and India (60.31 Giga TOE) as the nations with the largest NRER endowments. Note that, apart from Russia, where the reserves amount to around 72%, coal represents over 95% of proven reserves in these countries. The country with the largest proven oil reserves (Saudi Arabia) ranks 7<sup>th</sup>, with this resource accounting for about 88% of total reserves.

Within the factor endowments, and analysing the weight of fuel exports in total exports, which averages around 17.9%, the stand out countries are Nigeria (96.5%) and Angola (96.4%), with a weight of more than 95%, and Kuwait (93.6%).

Briefly examining the other variables of the model, starting with infrastructure, it was found that for the number of phone lines per 100 inhabitants, the mean is around 18.92, with Switzerland having the highest figure of 70.84 and the Democratic Republic of the Congo the lowest, 0.02. In terms of installed electricity generation capacity, meanwhile, the mean is 2996.31 kwh, the stand out countries being Norway with an installed capacity of 25893.50 kwh, Canada (18061.20 kwh) and Sweden (17699.55 kwh).

In terms of (rate of) adult literacy, the mean is 82.4%, with Burkina Faso having the lowest figure: 21.8%. At the other end of the scale are Finland, Georgia and Norway with 100% literacy rates.

Looking at inflation, it was found that this variable, despite averaging around 14.9%, reached very high levels in Belarus (295%), Angola (270%) and Laos (140%), which denotes high economic instability in those countries. Countries such as Lithuania, however, with 0.3%, Sweden and Singapore (both with 0.4%) have the lowest inflation rates, thus showing low economic instability.

With respect to the labour regulation index (with a mean of 52.7), the most inflexible regimes are in Portugal and Panama, both with an index of 79.0, as opposed to Singapore, which is the most flexible and has an index of 20.0. When it comes to import costs, the mean for this variable is 269.06 USD per container, with Portugal being the most expensive (994.00 USD) and Spain the cheapest (1.00 USD).

Corruption, as measured by the transparency index, has a mean of 4.06, with the least corrupt nations being Denmark (10.0), Finland (9.8), Sweden and New Zealand (both with a CPI of 9.4). As for political stability, with an average of 42.46, the most stable is Finland (99.52) while Ivory Coast has the lowest index (0.96) of the sample. Finland is also the country with

the highest effectiveness of the rule of law (100%), much higher than the mean for the variable (47.2%), while Angola whose legal system shows least impartiality (2.4%).

The mean total tax rate is 52.8%, and the Democratic Republic of the Congo (287.1%), Sierra Leone (272.4%) and Yemen (195.3%) are the countries with the highest tax rates. At the other end of the scale, with the lowest taxes, we have Kuwait (14.4%), Saudi Arabia (14.5%) and Zambia (16.5%).

Regarding GDP per capita, Norway (USD 36543.88), Japan (USD 35828.38) and the USA (USD 34053.31) are well above the mean, which is USD 6074.25. The countries with the lowest figures for GDP per capita are the Democratic Republic of the Congo (USD 93.34), Ethiopia (USD 120.89) and Sierra Leone (USD 148.52). The stand out countries with respect to real GDP growth (the average being 3.6%) are Australia (84.9%), Albania (13.5%) and Ireland (10.7%), which have the highest growth rates. Negative growth rates were posted by Serbia (12.4%), Sierra Leone (8.1%) and Ecuador (6.3%).

The average figure for openness of the economy is 79.3%, and the three countries with the highest figure are Singapore (369%), Hong Kong (291%) and Malaysia (199%), while those with the lowest level of openness are Zimbabwe (19%), Japan (21%) and the USA (23%).

#### **4. FDI and non-renewable energy resources. Empirical results**

##### **4.1. Descriptive results**

Before we turn to the multivariate analysis, it is important to carry out an exploratory analysis which will allow us to ‘get to know’ the data.

Given the importance of the flows of Foreign Direct Investment in the Gross Domestic Product (FDI/GDP) and country endowments of Non-Renewable Energy Resources (NRER) for the analysis, we defined two groups of countries: 1) countries with a below average FDI/GDP versus countries with an above average FDI/GDP; and 2) countries with NRER endowments versus countries without NRER endowments.

For our descriptive analysis we used the non-parametric Kruskal-Wallis test,<sup>12</sup> which allows us to assess whether there are statistically significant differences between the means for countries in each of the groups, for the various determinants analysed.

Based on the Kruskal-Wallis test for differences in the means between countries that are above and below the FDI/GDP average (cf. Table 4), we find statistically significant differences only for human capital, openness of the economy and factor endowments (using, in the case of the latter, proven resources as a proxy).

**Table 4: Average differences between countries whose FDI/GDP is below average and those with FDI/GDP above average – Kruskal-Wallis non-parametric test**

| Determinant                  | Proxy  | All countries | FDI/GDP below ave. | FDI/GDP above ave. | K-W (p-value) |
|------------------------------|--|---------------|--------------------|--------------------|---------------|
| Infrastructure               | No. phone lines per 100 inhabitants                      | 18.923        | 17.925             | 20.636             | 0.162         |
|                              | Net installed electricity generation capacity per capita | 2996          | 3077               | 2857               | 0.173         |
| Human capital                | Rate of adult literacy                                   | 82.348        | 78.573             | 88.830             | 0.017         |
| Economic instability         | Inflation rate   | 14.895        | 17.905             | 9.724              | 0.973         |
| Production costs             | Labour regulation index                                  | 52.700        | 53.090             | 52.040             | 0.852         |
|                              | Cost of imports  | 269.061       | 257.795            | 288.410            | 0.951         |
| Corruption                   | Transparency index (CPI)                                 | 4.064         | 4.090              | 4.020              | 0.794         |
| Political stability          | Political stability index                                | 42.458        | 40.458             | 45.893             | 0.229         |
| Institutional quality        | Effectiveness of rule of law                             | 47.204        | 46.709             | 48.054             | 0.751         |
| Financial and tax incentives | Total tax rate (% profits)                               | 52.770        | 51.360             | 55.194             | 0.765         |
| Market size                  | Per capita GDP   | 6074          | 6364               | 5575               | 0.914         |
| Market growth                | Rate of real GDP growth                                  | 3.357         | 3.887              | 2.447              | 0.519         |
| Openness of economy          | (X+M)/GDP  | 79.320        | 67.680             | 99.300             | 0.000         |
| Factor endowments            | X fuels/total X  | 17.985        | 21.437             | 12.055             | 0.218         |
|                              | Proven reserves  | 7.221         | 9.853              | 2.701              | 0.014         |

In terms of human capital, using the adult literacy rate as a proxy, the mean for countries that have a below average FDI/GDP is around 79%, while for the remainder it is around 89%, which suggests that this determinant may be a relevant factor in attracting FDI.

The analysis also suggests that market openness (measured by the ratio of exports plus imports to GDP) may play a potentially important role in attracting FDI, given that for the first group of countries (below average FDI/GDP) the mean is 68%, compared with 99% for the second group (above average FDI/GDP).

With respect to factor endowments (i.e. proven reserves), the effect is the opposite to what would be expected, with the average in the case of countries with below average FDI/GDP being 10 Giga TOE, whereas it is only 3 Giga TOE for countries with above average

<sup>12</sup> The Kruskal-Wallis test tests the null hypothesis that the means of two different samples from the same population are equal (Maroco, 2007).

FDI/GDP. This suggests that the endowment of proven reserves may not be a key determinant for FDI attraction.

Regarding the differences in the means for countries with and without endowments of proven reserves, the Kruskal-Wallis test points to statistically significant differences for several of the determinants analysed (cf. Table 5).

**Table 5: Average differences between countries with and without proven reserves – Kruskal-Wallis non-parametric test**

| Determinant                  | Proxy  | All countries | No proven reserves | With proven reserves | K-W (p-value) |
|------------------------------|--|---------------|--------------------|----------------------|---------------|
| Dependent variable FDI       | FDI/GDP  | 0.046         | 0.057              | 0.039                | 0.033         |
| Infrastructure               | No. phone lines per 100 inhabitants                      | 18.923        | 13.142             | 22.777               | 0,003         |
|                              | Net installed electricity generation capacity per capita | 2996          | 1857               | 3755                 | 0,000         |
| Human capital                | Rate of adult literacy                                   | 82.348        | 75.826             | 86.696               | 0,019         |
| Economic instability         | Inflation rate   | 14.895        | 14.716             | 15.014               | 0,793         |
| Production costs             | Labour regulation index                                  | 52.700        | 53.120             | 52.430               | 0,858         |
|                              | Cost of imports  | 269.061       | 235.854            | 291.200              | 0,980         |
| Corruption                   | Transparency index (CPI)                                 | 4.064         | 3.574              | 4.391                | 0,055         |
| Political stability          | Political stability index                                | 42.458        | 38.692             | 44.968               | 0,183         |
| Institutional quality        | Effectiveness of rule of law                             | 47.204        | 41.457             | 51.035               | 0,096         |
| Financial and tax incentives | Total tax rate (% profits)                               | 52.770        | 52.056             | 53.247               | 0,689         |
| Market size                  | Per capita GDP   | 6074          | 3918               | 7510                 | 0,002         |
| Market growth                | Rate of real GDP growth                                  | 3.357         | 3.321              | 3.381                | 0,263         |
| Openness of economy          | (X+M)/GDP  | 79.320        | 90.380             | 71.950               | 0,063         |
| Factor endowments            | X fuels/total X  | 17.985        | 8.602              | 24.240               | 0,000         |

In the case of the dependent variable, we find that countries without NRER endowments have higher average FDI/GDP (0.057) when compared with countries with proven reserves (0.039), which supports the conclusion arrived at in the test for the first group of countries (countries with a below average FDI/GDP versus countries with an above average FDI/GDP), that is, that the endowment of proven reserves might not be a key determinant for attracting FDI.

The analysis suggests that countries with NRER endowments have better infrastructure (for both the proxies used) and a higher level of human capital, reflected by the higher literacy rates. Regarding infrastructure, the average for countries without NRER endowments, for both proxies, is below the global average, and above for countries with proven reserves. In terms of human capital, the average for countries without reserves is around 76%, compared with 87% for countries with reserves.

The differences in the means are also statistically significant for corruption, where the group that has NRER is more transparent (4.4 CPI against 3.6 for the group without reserves); this is



also the case for institutional quality, where the average for the first group of countries is 41%, compared with 51% for the second group, suggesting a higher degree of impartiality in the legal system in countries with proven reserves. The analysis therefore suggests that countries that have NRER have a lower level of corruption (they are more transparent – the higher the CPI, the higher the degree of transparency, that is, the lower the level of corruption) and a better institutional quality.

We also find that countries with proven reserves have, on average, a larger market size, with an average GDP per capita of 7511 USD, against 3918 USD for the remaining countries. In terms of the openness of the economy, countries without reserves tend to have a higher degree of openness (90%) than countries with NRER endowments (72%). Lastly, regarding the other indicator of factor endowments, the weight of fuel exports, this is higher in countries with reserves (24%) than in the remainder (9%).

To complement the statistical tests (Kruskal-Wallis), we carried out an analysis of the correlation matrix between the relevant variables (cf. Table 6).

Based on the Pearson coefficient estimates, we find a significant positive correlation between the dependent variable (FDI/GDP) and the adult literacy rate (0.240), the political stability index (0.183) and the degree of openness of the economy (0.510). This analysis suggests that, on average and from a bivariate perspective, countries with higher literacy rates (human capital), a higher level of political stability and that are more open tend to attract larger flows of FDI, which supports the conclusions drawn from the Kruskal-Wallis test regarding human capital and the openness of the economy.

Looking at the independent variables, we find there are several cases where they are strongly correlated, which may lead to multicollinearity problems in the estimation. There are two possible interpretations for this: either the variables are measuring the same determinants, or they jointly depend on another variable that has not been included in the model (Maroco, 2007). We find, for example, that the variable ‘number of phone lines per 100 inhabitants’ is strongly correlated with the transparency index (0.837), the effectiveness of the rule of law (0.814) and per capita GDP (0.887). There are other correlations that, although they are not as problematic as the former, may also raise problems in the estimation. This is the case, for example, with the adult literacy rate, which is highly correlated with all of the variables in the ‘institutional’ dimension, with GDP per capita (0.445), the cost of imports (0.277) and the degree of openness (0.231).

**Table 6: Correlation matrix**

|   |                     | 1     | 2     | 3        | 4        | 5      | 6        | 7        | 8         | 9         | 10        | 11       | 12        | 13        | 14       | 15       | 16      |
|---|---------------------|-------|-------|----------|----------|--------|----------|----------|-----------|-----------|-----------|----------|-----------|-----------|----------|----------|---------|
| 1. Mean FDI/GDP 2004-2008                               | Pearson Correlation | 1.000 | 0.135 | -0.007   | 0.240*** | -0.102 | 0.064    | 0.183**  | 0.128     | -0.007    | 0.002     | -0.055   | -0.067    | 0.120     | 0.510*** | -0.173*  | -0.116  |
|   | Sig. (2-tailed)     |       | 0.132 | 0.941    | 0.007    | 0.257  | 0.480    | 0.041    | 0.156     | 0.938     | 0.984     | 0.541    | 0.456     | 0.183     | 0.000    | 0.054    | 0.199   |
| 2. No. phone lines per 100 inhabitants                  | Pearson Correlation |       | 1.000 | 0.776*** | 0.616*** | -0.135 | 0.837*** | 0.732*** | 0.814***  | -0.128    | 0.887***  | 0.145    | -0.324*** | 0.270***  | 0.209**  | -0.169*  | 0.169*  |
|   | Sig. (2-tailed)     |       |       | 0.000    | 0.000    | 0.134  | 0.000    | 0.000    | 0.000     | 0.156     | 0.000     | 0.106    | 0.000     | 0.002     | 0.020    | 0.060    | 0.059   |
| 3. Installed electricity generation capacity per capita | Pearson Correlation |       |       | 1.000    | 0.493*** | -0.132 | 0.733*** | 0.594*** | 0.654***  | -0.128    | 0.809***  | 0.122    | -0.329*** | 0.276***  | 0.085    | 0.044    | 0.225** |
|   | Sig. (2-tailed)     |       |       |          | 0.000    | 0.143  | 0.000    | 0.000    | 0.000     | 0.155     | 0.000     | 0.174    | 0.000     | 0.002     | 0.344    | 0.625    | 0.012   |
| 4. Adult literacy rate                                  | Pearson Correlation |       |       |          | 1.000    | -0.004 | 0.449*** | 0.457*** | 0.476***  | -0.178*   | 0.445***  | 0.032    | -0.096    | 0.277***  | 0.231*** | -0.068   | 0.143   |
|   | Sig. (2-tailed)     |       |       |          |          | 0.961  | 0.000    | 0.000    | 0.000     | 0.047     | 0.000     | 0.721    | 0.288     | 0.002     | 0.009    | 0.453    | 0.111   |
| 5. Inflation rate                                       | Pearson Correlation |       |       |          |          | 1.000  | -0.195** | -0.137   | -0.308*** | 0.201**   | -0.190**  | -0.067   | 0.257***  | -0.175*   | 0.069    | 0.210**  | 0.038   |
|   | Sig. (2-tailed)     |       |       |          |          |        | 0.030    | 0.127    | 0.000     | 0.024     | 0.034     | 0.455    | 0.004     | 0.051     | 0.446    | 0.018    | 0.675   |
| 6. CPI  | Pearson Correlation |       |       |          |          |        | 1.000    | 0.784*** | 0.847***  | -0.192**  | 0.852***  | 0.229**  | -0.443*** | 0.349***  | 0.235*** | -0.181** | 0.098   |
|   | Sig. (2-tailed)     |       |       |          |          |        |          | 0.000    | 0.000     | 0.032     | 0.000     | 0.010    | 0.000     | 0.000     | 0.008    | 0.043    | 0.277   |
| 7. Political stability index                            | Pearson Correlation |       |       |          |          |        |          | 1.000    | -0.837*** | 0.166*    | -0.811*** | -0.200** | 0.412***  | -0.419*** | -0.185** | 0.185**  | -0.159* |
|   | Sig. (2-tailed)     |       |       |          |          |        |          |          | 0.000     | 0.065     | 0.000     | 0.026    | 0.000     | 0.000     | 0.039    | 0.038    | 0.076   |
| 8. Effectiveness of rule of law                         | Pearson Correlation |       |       |          |          |        |          |          | 1.000     | -0.257*** | 0.795***  | 0.204**  | -0.363*** | 0.344***  | 0.230*** | -0.217** | 0.061   |
|   | Sig. (2-tailed)     |       |       |          |          |        |          |          |           | 0.004     | 0.000     | 0.022    | 0.000     | 0.000     | 0.010    | 0.015    | 0.501   |
| 9. Total tax rate (% profits)                           | Pearson Correlation |       |       |          |          |        |          |          |           | 1.000     | -0.128    | -0.107   | 0.225**   | -0.176**  | -0.148   | 0.067    | -0.017  |
|   | Sig. (2-tailed)     |       |       |          |          |        |          |          |           |           | 0.155     | 0.235    | 0.012     | 0.049     | 0.100    | 0.458    | 0.847   |
| 10. Per capita GDP                                      | Pearson Correlation |       |       |          |          |        |          |          |           |           | 1.000     | 0.156    | -0.436*** | 0.234***  | 0.147    | -0.079   | 0.181** |
|   | Sig. (2-tailed)     |       |       |          |          |        |          |          |           |           |           | 0.083    | 0.000     | 0.009     | 0.103    | 0.383    | 0.043   |
| 11. Rate of real GDP growth                             | Pearson Correlation |       |       |          |          |        |          |          |           |           |           | 1.000    | -0.163    | 0.146     | -0.012   | -0.077   | 0.209** |
|   | Sig. (2-tailed)     |       |       |          |          |        |          |          |           |           |           |          | 0.070     | 0.104     | 0.894    | 0.392    | 0.019   |
| 12. Employment laws index                               | Pearson Correlation |       |       |          |          |        |          |          |           |           |           |          | 1.000     | -0.173*   | -0.170*  | 0.046    | -0.163* |
|   | Sig. (2-tailed)     |       |       |          |          |        |          |          |           |           |           |          |           | 0.053     | 0.058    | 0.612    | 0.070   |
| 13. Cost of imports                                     | Pearson Correlation |       |       |          |          |        |          |          |           |           |           |          |           | 1.000     | 0.100    | -0.058   | -0.024  |
|   | Sig. (2-tailed)     |       |       |          |          |        |          |          |           |           |           |          |           |           | 0.269    | 0.522    | 0.789   |
| 14. (X+M)/GDP   | Pearson Correlation |       |       |          |          |        |          |          |           |           |           |          |           |           | 1.000    | -0.015   | -0.174* |
|   | Sig. (2-tailed)     |       |       |          |          |        |          |          |           |           |           |          |           |           |          | 0.865    | 0.052   |
| 15. X fuels/total X                                     | Pearson Correlation |       |       |          |          |        |          |          |           |           |           |          |           |           |          | 1.000    | 0.136   |
|   | Sig. (2-tailed)     |       |       |          |          |        |          |          |           |           |           |          |           |           |          |          | 0.131   |
| 16. Proven reserves (Giga TOE)                          | Pearson Correlation |       |       |          |          |        |          |          |           |           |           |          |           |           |          |          | 1.000   |
|   | Sig. (2-tailed)     |       |       |          |          |        |          |          |           |           |           |          |           |           |          |          |         |

Legend: \*\*\* (\*\*)\* statistically significant at 1%(5%)[10%]. Greyed parts show all the statistically significant correlations.

## 4.2. Econometric estimation

Following our exploratory analysis of the data, in this section we carry out an analysis of causality using multivariate econometric techniques, in particular logistic models. Specifically, we want to test whether a country's NRER endowment plays a role in attracting FDI, controlling for a collection of factors that are likely to explain the attraction of FDI (infrastructure, human capital, economic instability, production costs, corruption, political stability, institutional quality, financial and fiscal incentives, market size, market growth and openness of the economy).

In order to ensure the robustness of the results, we estimated the theoretical model using ordinary least squares linear regression methods (using the natural logarithm of the FDI/GDP ratio as a proxy for the dependent variable), and logistic regression methods, estimated by maximum likelihood, where the proxy for the dependent variable is a dummy (binary) variable that takes on the value 1 for countries that have an above average FDI/GDP ratio (and 0 otherwise). The estimation results from using these two estimation methods are broadly identical. We can therefore argue that these results are robust. We therefore decided to present and interpret the estimation results from the logistic regression here, which are given in Table 7.

Given that we have two alternative proxies for the variables 'infrastructure' (number of phone lines per 100 inhabitants and net installed electricity generation capacity per capita) and 'factor endowments' (fuel exports/total exports and proven reserves), four models were estimated (cf. Table 7). In models I and II, the proxy used for infrastructure is the number of phone lines per 100 inhabitants, and model I uses proven reserves to measure factor endowments, while model II uses the weight of fuel exports in total exports. In models III and IV, the variables used to measure factor endowments vary as above, while infrastructure is captured by the net installed electricity generation capacity per capita.

The goodness of fit tests (Hosmer-Lemeshow test, and the percent correctly predicted) suggest that the models fit the data quite well. In fact, for the Hosmer-Lemeshow test, the p-value above 0.10 means we accept the null hypothesis of the test, that is, that the models are an accurate depiction of reality. Moreover, around 80% of the estimated values for the dependent variable are correctly predicted by the models.

**Table 7: Empirical results of FDI attraction determinants based on logistic regression (dependent variable – dummy variable that takes value 1 if the country has an above average FDI/GDP ratio and 0 otherwise)**

| Determinant                  | Proxy  | Model I       | Model II      | Model III     | Model IV      |
|------------------------------|--|---------------|---------------|---------------|---------------|
| Infrastructure               | No. phone lines per 100 inhabitants                      | 0.218         | 0.131         |               |               |
|                              | Net installed electricity generation capacity per capita |               |               | 0.314         | 0.239         |
| Human capital                | Rate of adult literacy                                   | 5.896***      | 4.417**       | 5.309**       | 3.779*        |
| Economic instability         | Inflation rate   | -2.075*       | -2.274        | -2.153*       | -2.513        |
| Production costs             | Labour regulation index                                  | -0.940        | -1.107        | -0.854        | -1.082        |
|                              | Cost of imports  | -0.021        | -0.016        | -0.025        | -0.018        |
| Corruption                   | Transparency index (CPI)                                 | 1.245         | 0.471         | 1.298         | 0.471         |
| Political stability          | Political stability index                                | 0.677         | 0.920         | 0.753         | 0.972         |
| Institutional quality        | Effectiveness of rule of law                             | 0.043         | -0.067        | 0.144         | 0.002         |
| Financial and tax incentives | Total tax rate (% profits)                               | 1.351**       | 1.253*        | 1.301*        | 1.225*        |
| Market size                  | Per capita GDP   | -0.702        | -0.376        | -0.762*       | -0.444        |
| Market growth                | Rate of real GDP growth                                  | -5.554        | -5.355        | -5.147        | -5.321        |
| Openness of economy          | (X+M)/GDP  | 1.436**       | 1.746***      | 1.447**       | 1.757***      |
| Factor endowments            | X fuels/total X  |               | -1.904*       |               | -2.042*       |
|                              | Proven reserves  | -1.239**      |               | -1.341**      |               |
|                              | Constant   | -5.727        | -6.583        | -7.372        | -7.339        |
|                              | N  | 125           | 125           | 125           | 125           |
|                              | FDI above average  | 46            | 46            | 46            | 46            |
|                              | Other  | 79            | 79            | 79            | 79            |
| Adjustment quality           | Hosmer and Lemeshow (p-value)                            | 7.672 (0.466) | 4.468 (0.813) | 8.030 (0.431) | 4.780 (0.781) |
|                              | % correct  | 80.8          | 80.0          | 79.2          | 80.8          |

Legend: \*\*\* (\*\*)[\*] statistically significant at 1%(5%)[10%].

Overall, for all four models the results suggest that on average, *ceteris paribus* and controlling for all other variables, factor endowments are not a key determinant in attracting FDI. Whatever the proxy used – weight of fuel exports in total exports or proven reserves – the negative and statistically significant signs on the estimated coefficients imply that countries with higher ratios of fuel exports in total exports and/or that have greater proven reserves of NRER tend, on average, to attract a lower amount of FDI as a proportion of GDP. This result may be explained by the fact that countries with NRER endowments are fairly productive mainly in the mining sector, neglecting other economic sectors (Anyanwu and Obasi, 2010).<sup>16</sup> Countries less endowed with NRER tend to be more diversified in terms of economic activities, which allow them to attract more FDI (which is spread across the various economic sectors).

In contrast, human capital, economic stability and the openness of the economy appear to play a crucial role in attracting FDI. Regardless of the model used (as the coefficient estimates of

<sup>16</sup> This argument is related to the Dutch Disease phenomenon, widely studied in the literature on the economic development of countries (see, for example, Gylfason, 2001; Torvik, 2002).

the variables in Table 7 show), the adult literacy rate (a proxy for human capital) and the weight of exports and imports in GDP (a proxy for the degree of openness of the economy) have a statistically significant positive impact on attracting FDI. This means that, on average, *ceteris paribus*, countries with higher literacy rates and more open economies will tend to have higher FDI to GDP ratios. In addition, and in the case of the models that use proven reserves as a proxy for factor endowments, we find that countries with higher levels of economic instability, as measured by the rate of inflation, tend to attract lower flows of FDI on average.

In terms of the total tax rate (a proxy for financial and fiscal incentives), and contrary to what would be expected, the results suggest a significant positive effect, that is, countries with higher tax rates attract more FDI. It is important, however, to emphasise that tax rates are not the only aspect which should be taken into account when measuring a country's tax burden (UNCTAD, 2000). Tax incentives and deductions, such as tax exemptions on imports for specific goods (raw materials and equipment) or for specific economic sectors, partial tax refunds when profits are reinvested, accelerated depreciation of tangible fixed assets, extension of the period for tax loss relief or beneficial conditions for the repatriation of profits, play an equally important role in the decision of companies to invest in a specific location (UNCTAD, 2000). As an alternative to tax exemptions, many countries (mainly developed countries) prefer to offer financial incentives, by subsidising investment in training or in research and development (UNCTAD, 2000). The fact that our model does not include these variables, combined with the possible strong correlation between them, may explain the results for this proxy.<sup>17</sup> Additionally, as Bellack *et al.* (2009) pointed out, a country with higher taxes can also attract FDI if the country compensates for it by offering better infrastructure.

It is also noteworthy that some traditional determinants that have been identified in the literature as playing a crucial role in attracting FDI, such as infrastructure (e.g., Mhlanga *et al.*, 2010), market size (e.g., Cleeve, 2008), market growth (e.g., Mohamed and Sidiropoulos, 2010), corruption and/or political instability (e.g., Asiedu, 2006), and production costs (e.g., Schneider and Frey, 1985), did not stand out in the sample analysed here.

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<sup>17</sup> We should point out that some countries in our sample that have the highest tax rates, such as Yemen (195.3%) or Algeria (76.9%), offer incentives such as accelerated depreciations, which are not reflected in this proxy, and which imply a reduction in the effective tax rate (UNCTAD, 2000).

## 5. Conclusions

Over the last twenty years, economic development policies have tended to neglect investment in the mining sector (UNCTAD, 2007). However, the growing search for natural resources, in particular for non-renewable energy resources, by economies that are growing rapidly, has led to an increase in commodity prices, resulting in a renewed interest by countries in exploiting energy resources and a redirectioning of FDI towards this sector (UNCTAD, 2007).

Therefore, it is important to understand to what extent a country's endowment of Non-Renewable Energy Resources (NRERs) does (or does not) play a role in attracting FDI. In this study we have analysed the impact of a country's NRER endowment in attracting FDI, based on a wide range of countries, controlling for a number of factors traditionally believed to influence FDI (e.g., market size, human capital, openness of the economy, and political stability) and resorting to multivariate estimation techniques.

The proxy traditionally used to measure a country's NRER endowment is the weight of fuel exports in the country's total exports. However, it has been found that various countries, such as the Cameroon or Chad, although they do not have 'proven resources' of NRERs, have a high fuel export ratio. This nonconformity could distort the analysis of the importance of NRER endowments in attracting FDI. We therefore decided to use the variable 'proven reserves', as well as the traditional proxy; to the best of our knowledge no other empirical study has been published to date that analyses the effect of a country's effective endowments (i.e. proven reserves) of oil, coal and natural gas in attracting FDI. The few studies that exist in this field cover a relatively small and homogenous number of countries and focus on specific geographical regions (e.g., Sub-Saharan Africa - Asiedu, 2006; MENA countries - Mohamed and Sidiropoulos, 2010).

Based on a total of 125 countries from various regions across the globe, including 75 with proven reserves of NRERs, we find that, regardless of the proxy used, factor endowments have an opposite effect to the one found in the more recent literature in the field (e.g., Asiedu, 2006; Ledyeva, 2009; Mohamed and Sidiropoulos, 2010), according to which a country's natural resource endowments foster FDI. We have argued that this result may be related to the extremely high reliance of many of the countries with NRER endowments on the mining sector, and the related neglect of other sectors, limiting the attraction of FDI due to the lack of diversity in the opportunities/activities in which to invest. This result – that NRER endowments are not a key determinant in attracting FDI – is nevertheless an encouraging

factor in terms of economic development, highlighting the importance of policy measures, in particular the importance of investing in human capital and the openness of the economy, in other words, people's action, against the discretionary character of Nature.

Supporting the conclusions of earlier studies, the results confirm that human capital (e.g., Asiedu, 2006; Cleeve, 2008), economic stability (e.g., Schneider and Frey, 1985; Mohamed and Sidiropoulos, 2010) and the openness of the economy (e.g., Botrić and Škuflić, 2006; Mhlanga *et al.*, 2010) play an important role in attracting FDI. Although it was found to be a (statistically) significant factor, the amount of the taxes, as measured by the total tax rate, was the opposite of what was expected (Cleeve, 2008). Specifically, the results show that this determinant has a (significant) positive impact, suggesting that, on average, higher tax rates attract more FDI. However, as mentioned before, the tax rate is just one of the factors that should be taken into account when analysing a country's tax burden, since the tax deductions and financial and fiscal incentives granted by countries may result in a reduction of the effective tax rate. Additionally, countries can compensate for high tax rates with better infrastructure, as Bellack *et al.* (2009) report.

We can draw three important policy implications from our main empirical results:

The first implication is related to human capital. As stated above, the availability of qualified workers influences a company's decision to enter new markets, which is why government education and professional qualifications policies are crucial.

The second implication is related to the openness of the economy and follows from the result that countries that receive less FDI can become more attractive by implementing reforms that promote the liberalisation of their economies, specifically by adopting export-oriented policies, eliminating import duties and capital taxes.

The third and final implication suggests that development based on FDI does not depend on natural/exogenous factors, given that NRER endowments do not play a decisive role in attracting FDI. While these conclusions are encouraging for countries that do not have endowments, for those that do have proven reserves and rely on the know-how of foreign companies to extract the resources they are a warning, highlighting the need for governments in these countries to implement public policies that foster other factors, such as human capital or the openness of the economy, which will help attract companies to engage in other tradable goods activities.

While this study has included an aspect which has so far received little attention in the literature on FDI – the importance of proven NRER in attracting FDI – it is important to highlight a limitation of our analysis: the fact that we did not consider the different final uses of the three types of resource – oil, coal and natural gas – which may lead to interesting conclusions on the targeting of FDI based on the type of fuel. Future research could explore this issue. Another interesting topic for future research would be to investigate to what extent FDI can influence the productivity of the mining sector in countries with NRER endowments.

## References

- AICEP Portugal (2011), “EAU Condições legais de acesso ao mercado”, in <http://www.portugalglobal.pt/PT/Biblioteca/Paginas/Detalhe.aspx?documentId=b011ef43-86aa-49fc-9aea-25b6d03c7646>, accessed on February 16, 2011.
- AICEP Portugal (2011), “Qatar Condições legais de acesso ao mercado”, in <http://www.portugalglobal.pt/PT/Biblioteca/Paginas/Detalhe.aspx?documentId=8ade4d33-7767-416a-9e45-9c6876683595>, accessed on February 16, 2011.
- Anyanwu, S.O.; Obasi, P.V. (2010), “Comparative analysis of aggregate agricultural productivity between low and high external input technology farms in Nigeria”, *African Journal of Biotechnology*, 9 (34): 5530-5534.
- Asiedu, E. (2002), “On the determinants of foreign direct investment to developing countries: Is Africa different?”, *World Development*, 30 (1): 107-119.
- Asiedu, E. (2006), “Foreign direct investment in Africa: The role of natural resources, market size, government policy, institutions and political instability”, *The World Economy*, 29 (1): 63-77.
- Bellak, C.; Leibrecht, M.; Damijan, J. (2009), “Infrastructure Endowment and Corporate Income Taxes as Determinants of Foreign Direct Investment in Central and Eastern European Countries”, *The World Economy*, 32 (2): 267-290.
- Bénassy-Quéré, A.; Coupet, M.; Mayer, T. (2007), “Institutional determinants of foreign direct investment”, *The World Economy*, 30 (5): 764-782.
- Biswas, R. (2002), “Determinants of foreign direct investment”, *Review of Development Economics*, 6 (3): 492-504.



- Bond, E.W.; Samuelson, L. (1986), "Tax holidays as signals", *American Economic Review*, 76 (4): 820-826.
- Botrić, V.; Škuflić, L. (2006), "Main determinants of foreign direct investment in the southeast European countries", *Transition Studies Review*, 13 (2): 359-377.
- Brooks, D.H.; Hasan, R.; Lee, J.-W.; Son, H.H.; Zhuang, J. (2010) "Closing development gaps: challenges and policy options", ADB Economics Working Paper Series 209, Manila: Asian Development Bank.
- Caves, R. (1971), "International corporations: the industrial economics of foreign investment", *Economica*, 38 (149): 1-27.
- Cheung, Y-W.; Qian, X. (2009), "Empirics of China's outward direct investment", *Pacific Economic Review*, 14 (3): 312-341.
- Choong, C.K.; Lam, S.Y. (2010), "The determinants of foreign direct investment in Malaysia: A revisited", *Global Economic Review*, 39 (2): 175-195.
- Cleeve, E. (2008), "How effective are fiscal incentives to attract FDI to Sub-Saharan Africa?", *The Journal of Developing Areas*, 42 (1): 135-153.
- Cleveland, C.J. e Stern, D.I. (1999), "Indicators of natural resource scarcity: a review and synthesis", in Jeroen C.J.M van den Bergh (org.), *Handbook of Environmental and Resource Economics*, Massachusetts: Edward Elgar Publishing, pp. 89-107.
- Crawford, V.P.; Sobel J.; Takahashi I. (1984), "Bargain, strategic reserves, and international trade in exhaustible resources", *American Journal of Agricultural Economics*, 66 (4): 472-480.
- Deichmann, J.I.; Eshghi, A.; Haughton, D.M.; Sayek, S.; Teebagy, N.C. (2003), "Foreign direct investment in the Eurasian transition states", *Eastern European Economics*, 41(1): 5-34.
- Dunning, J.H. (1993), "The international operations of national firms: a study of foreign direct investment", in John H. Dunning (org.), *The Theory of Transnational Corporations*, London: Routledge, pp 23-43.
- Dunning, J.H. (2002), "Trade, location of economic activity and the multinational enterprise: a search for an eclectic approach", in John H. Dunning (org.), *Theories and Paradigms*

- of International Business Activity – the Selected Essays of John H. Dunning*, Cheltenham: Edward Elgar Publishing Limited, pp 52-76.
- Dunning, J.H.; Lundan, S.M (2008), “Theories of foreign direct investment”, in John H. Dunning e Sarianna M. Lundan (orgs.), *Multinational Enterprises and the Global Economy*, Cheltenham: Edward Elgar Publishing Limited, pp 79-115.
- Faeth, I. (2006), “Consequences of FDI in Australia - Causal links between FDI, domestic investment, economic growth and trade”, *Research Paper n° 977*, University of Melbourne: Department of Economics.
- Faeth, I. (2009), “Determinants of foreign direct investment – a tale of nine theoretical models”, *Journal of Economic Surveys*, 23 (1): 165-196.
- Francis, J.; Zheng, C.; Mukherji, A. (2009), “An institutional perspective on foreign direct investment: A multi-level framework”, *Management International Review* 49 (5): 565-583.
- Gylfason, T. (2001), “Natural resources education, and economic development”, *European Economic Review*, 45 (4-6): 847-859.
- Grafton, R.Q.; Adamowicz, W.; Dupont, D.; Nelson, H.; Hill, R.J.; Renzetti, S. (2004), *The Economics of the Environment and Natural Resources*, Malden: Blackwell Publishing.
- Heitor, M.; Ferrão, P; Diogo, A. (2000), “Perspectivas sobre a utilização racional de energia no sector da cristalaria: a utilização do gás natural”, Instituto Superior Técnico: Centro de estudos em inovação, tecnologia e políticas de desenvolvimento, in <http://in3.dem.ist.utl.pt/laboratories/PDF/Energia.pdf>, accessed on June 6, 2011.
- Hill, C. (2007), “Foreign Direct Investment”, in Charles Hill (org.), *International Business: Competing in the global marketplace*, MacGraw-Hill, pp. 236-261.
- Ietto-Gillies, G. (2005), “Dunning’s eclectic framework”, in Grazia Ietto-Gillies (org.), *Transnational Corporations and International Production*, Edward Elgar Publishing, pp. 112-121.
- Kumar, N.; Chadha, A. (2009), “India’s outward foreign direct investments in steel industry in a Chinese comparative perspective”, *Industrial and Corporate Change*, 18 (2): 249-267.

- Ledyeva, S. (2009), “Spatial econometric analysis of foreign direct investment determinants in Russian regions”, *The World Economy*, 32 (4): 643-666.
- Markusen, J.R. (1984), “Multinationals, multi-plant economies, and the gains from trade”, *Journal of International Economics*, 16 (3-4): 205-226.
- Markusen, J.R. (2002), *Multinational Firms and the Theory of International Trade*. Massachusetts: Institute of Technology.
- Maroco, J. (2007), “Análise estatística com utilização do SPSS”, Lisboa: Edições Sílabo.
- Martins, G.O. (2005), “Economia política”, Universidade Lusíada de Lisboa: Faculdade de direito, in [http://www.lis.ulusiada.pt/old/cursos/graduacao/licenciaturas/direito/documentos/2005\\_2006\\_cap\\_14.pdf](http://www.lis.ulusiada.pt/old/cursos/graduacao/licenciaturas/direito/documentos/2005_2006_cap_14.pdf), accessed on January 10, 2011.
- Mhlanga, N.; Blalock, G.; Christy, R. (2010), “Understanding foreign direct investment in the southern African development community: an analysis based on project-level data”, *Agricultural Economics*, 41 (3-4): 337-347.
- Mina, W. (2007), “The location determinants of FDI in the GCC countries”, *Journal of Multinational Financial Management*, 17 (4), 336-348.
- Mitchell, T. (2009), “Carbon democracy”, *Economy and Society*, 38 (3): 299-432.
- Moran, T.H. (2010), “Is China trying to “lock up” natural resources around the world?”, in <http://voxeu.org/index.php?q=node/4684>, accessed on May 4, 2011.
- Mohamed, S.E; Sidiropoulos, M.G. (2010), “Another look at the determinants of foreign direct investment in MENA countries: an empirical investigation”, *Journal of Economic Development*, 35 (2): 75-95.
- Peng, M. (2009), “Institutions, cultures and ethics”, in Peng, M. (org.), *Global Strategic Management*, Cincinnati: South-Western Cengage Learning, pp 90-122.
- Root, F.R.; Ahmed, A.A. (1978), “The influence of policy instruments on manufacturing direct foreign investment in developing countries”, *Journal of International Business Studies*, 9 (3): 81-93.
- Sahu, M. (2008), “Inverted Development and Oil Producers in sub-Saharan Africa: a Study”, *Working Paper n° 3*, Centre for African Studies from University of Mumbai.
- Schneider F.; Frey B.S. (1985), “Economic and political determinants of foreign direct investment”, *World Development*, 13 (2): 161-175.

- Soares, I. (2010), “Economia e política da energia”, Faculdade de Economia da Universidade do Porto, in [https://sigarra.up.pt/fep/conteudos\\_geral.conteudos\\_ver?pct\\_pag\\_id=1639&pct\\_parametros=p\\_ano\\_lectivo=2010/2011-y-p\\_cad\\_codigo=2EE307-y-periodo=1S&pct\\_disciplina=&pctgrupo=8785#8785](https://sigarra.up.pt/fep/conteudos_geral.conteudos_ver?pct_pag_id=1639&pct_parametros=p_ano_lectivo=2010/2011-y-p_cad_codigo=2EE307-y-periodo=1S&pct_disciplina=&pctgrupo=8785#8785), accessed on March 13, 2011.
- Teixeira, A.A.C. (2005), “Measuring aggregate human capital in Portugal: 1960-2001”, *Portuguese Journal of Social Science*, 4 (2): 101-120.
- Teixeira, A.A.C.; Tavares-Lehmann, A.T. (2007) *Investimento Directo Estrangeiro, Capital Humano e Inovação: Uma Aplicação ao Caso Português*, Porto: Vida Económica.
- The PRS Group (2011), “ICRG methodology”, in [http://www.prsgroup.com/ICRG\\_Methodology.aspx](http://www.prsgroup.com/ICRG_Methodology.aspx), accessed on January 7, 2011.
- Torvik, R. (2002), “Natural resources, rent seeking and welfare”, *Journal of Development Economics*, 67 (2): 455-470.
- Transparency International (2004), “Global corruption report 2004”, in [http://www.transparency.org/publications/gcr/gcr\\_2004](http://www.transparency.org/publications/gcr/gcr_2004), accessed on March 29, 2011.
- UNCTAD (2000), “Tax incentives and foreign direct investment – a global survey”, *ASIT Advisory Studies n° 16*.
- UNCTAD (2007), Transnational corporations, extractive industries and development, World Investment Report 2007, in [http://www.unctad.org/en/docs/wir2007\\_en.pdf](http://www.unctad.org/en/docs/wir2007_en.pdf), accessed on October 7, 2010.
- UNCTAD (2010), Employment, globalization and development, Trade and development report 2010, in [http://www.unctad.org/en/docs/tdr2010\\_en.pdf](http://www.unctad.org/en/docs/tdr2010_en.pdf), accessed on May 17, 2011.
- Velthuisen, J.W.; Worrel, E. (1999), “The economics of energy”, in Jeroen C.J.M van den Bergh (org.), *Handbook of Environmental and Resource Economics*, Massachusetts: Edward Elgar Publishing, pp. 177-194.
- Vernon, R. (1966), “International investment and international trade in the product cycle”, *Quarterly Journal of Economics*, 80 (2): 190-207.

- Vijayakumar, N.; Sridharan, P.; Rao, K.C.S. (2010), “Determinants of FDI in BRICS countries: A panel analysis”, *International Journal of Business Science and Applied Management*, 5 (3): 1-13.
- Wang, M. (2009), “Manufacturing FDI and economic growth: evidence from Asian economies”, *Applied Economics*, 41 (8), 991-1002.
- World Bank (2005), “World development report – A better investment climate for everyone”, in <http://web.worldbank.org/WBSITE/EXTERNAL/EXTDEC/EXTRESEARCH/EXTWDRS/EXTWDR2005/0,menuPK:477681~pagePK:64167702~piPK:64167676~theSitePK:477665,00.html>, accessed on May 17, 2011.
- World Finance (2008), “Hungary: A magnet for FDI”, in <http://www.worldfinance.com/news/world-market//article213.html>, accessed on March 21, 2011.

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