# HEC MONTRÉAL

## The Role of Foreign Direct Investment in Natural Resource Dependency in the Middle East and North Africa Region

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# Executive Summary

This study analyses the role of foreign direct investment (FDI) in natural resource dependency in the Middle East and North Africa region.

Our main research objective is to determine whether FDI reinforces or weakens reliance on natural resources in the MENA region and to explore if this effect varies for countries which we identify as resource dependent.

Our study focuses on 19 countries from MENA, with panel data on a yearly basis from 1985 to 2020. We use instrumental variables for FDI and the Generalized Method of Moments system to address simultaneity bias concerns.

The initial results suggest that FDI tends to reduce natural resource reliance in the MENA region. However, when subsequently considering resource dependency in interaction with FDI, we find that the impact of FDI on natural resource rents becomes positive for non-resource dependent countries and remains negative for resource dependent countries. Further, when exploring the impact of FDI on the rents of each natural resource type individually, we find that FDI tends to decrease oil and natural gas reliance but is associated with an increase in coal and mineral rents, and a null effect on forest rents.

Key words: Foreign direct investment, natural resource dependency, Middle East and North Africa, economic development, resource curse, instrumental variables.

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# Chapter 1: Introduction

The Middle East and North Africa (MENA) region holds over 60% of the world's proven oil reserves and nearly half of its natural gas reserves, making it reliant on natural resources and vulnerable to fluctuations in international prices[1]. Since 1980, production structures in MENA have experienced little diversification, as the relative sizes of the manufacturing and service sectors have stayed relatively stable in the last few decades, unlike global trends[2]. Natural resource rents in MENA accounted for 19.63% of GDP in 2021, an increase compared to the average of 13.9% for the years 2015-19 and a high score compared to patterns observed worldwide.[3] As many MENA countries navigate the dynamics of resource dependency, the role of foreign direct investment (FDI) presents a potential factor in either promoting diversification or reinforcing reliance on natural resources that remains relatively understudied in the literature. This study aims to clarify FDI's role in the region's economic dynamics.

Economic literature suggests that natural resource dependency can negatively impact the growth potential of least developed countries (LDCs) by limiting economic diversification opportunities. While some studies highlight success stories of nations which have effectively harnessed their resources through substantial investments in infrastructure and education (Fasano, 2002; Acemoglu et al., 2003), much of the literature is dominated by the 'resource curse' argument, which posits that resource-rich countries struggle to achieve long-term economic growth (Ross, 1999; Sachs and Warner, 1995, 2001; Van der Ploeg, 2011; Frankel, 2012; Venables, 2016). This is attributed to the vulnerability of these countries to economic shocks from fluctuating commodity prices and resource depletion (Devlin and Titman, 2004; Van der Ploeg and Poelhekke, 2009; Venables, 2016). Empirical evidence points to a negative relationship between resource dependence and growth (Sachs and Warner, 1995, 2001; Brückner, 2010). The considerable theoretical and empirical literature documenting these adverse conditions suggests that policymakers in LDCs should be cautious about over-relying on resource extraction for economic growth.

The services sectors in resource-rich MENA countries are observing effects of the 'Dutch disease', which refers to the negative impact on a country's economy when a boom in natural resources leads to currency appreciation and thereby renders other sectors less competitive (Diop et al., 2012). While this effect typically harms manufacturing, it's also affecting services in MENA, as their share of GDP declines with rising per capita incomes. This trend is attributed to the significant rents generated by natural resources as these rents inflate wages and non-resource tradable prices, thereby appreciating the real exchange rate and making it harder for local service providers to compete. Indeed, MENA has struggled to maintain undervalued exchange rates, which were

[1] https://documents1.worldbank.org/curated/en/145231468052756612/pdf/NonAsciiFileName0.pdf
[2] See, World Bank Development Indicators
[3] See, World Bank Development Indicators

crucial in other regions to mitigate market failures and the adverse effects of weak institutional frameworks on the non-resource traded sectors. Moreover, the real effective exchange rate in MENA has shown greater volatility than in comparable groups of countries, hindering the development of new industries outside the resource sectors (Diop et al., 2012).

Given the well-documented negative effects of natural resource dependency, investigating whether FDI exacerbates or mitigates this dependency is crucial for deeper insights. While this study does not empirically assess the ‘resource curse’ phenomenon, it evaluates the impact of FDI on natural resource rents and whether this effect is more pronounced in resource-dependent countries. A large body of literature suggests that FDI can promote economic growth by enhancing competition, improving capital productivity, and generating technological spillovers (Balasubramanyam et al., 1996; Borensztein et al., 1998; De Mello, 1999; Markusen and Venables, 1999). Based on this, one might expect FDI to contribute to the reduction of resource dependency by stimulating growth in non-resource sectors such as manufacturing and services. Following this line of reasoning, FDI could alleviate over-reliance on natural resources by diversifying the economy, fostering a more balanced and sustainable development. However, FDI could also deepen resource dependency, as shown by Long et al. (2017). This can occur when FDI concentrates on natural resource extraction, thereby boosting resource rents and reinforcing the host economy's reliance on natural resources.

This study seeks to further the relatively limited debate on whether FDI amplifies or reduces reliance on natural resources. By doing so, it addresses a significant gap in the literature and offers critical insights that can inform policymaking and investment strategies aimed at fostering long-term development. This question is especially pertinent in a context where, across MENA, FDI has seen a significant upward trend in recent decades. From modest levels in the 1980s and 1990s, FDI inflows into the region experienced substantial growth.[4] The Sustainable Development Goals (target 10.b) also explicitly encourage LDCs to attract greater FDI in alignment with their national plans and programs[5], making the topic relevant in contemporary policy discussions.

While several studies establish that the availability of natural resources may attract FDI (UNDP, 2020; Asiedu, 2006), questions persist regarding the reverse relationship – whether FDI also encourages natural resource extraction or dependency, magnifying the proportion of GDP derived from natural resource rents in LDCs as a result. To our knowledge, the study by Long et al. (2017) constitutes the only empirical study in the literature which analyzes the impacts of FDI on natural resource dependency specifically. Its findings suggest that FDI significantly contributes to the generation of natural resource rents in LDCs, reinforcing natural resource reliance. However, a primary concern with this study is that it does not rigorously address simultaneity bias, a source of endogeneity that arises when the explanatory variable and the dependent variable influence each other simultaneously. Indeed, while FDI can lead to increased resource extraction, the presence of

[4] See, World Bank Development Indicators

[5] https://sdgs.un.org/goals/goal10#targets_and_indicators

abundant natural resources can also attract more FDI, making it difficult to determine whether FDI is driving resource extraction or vice versa. To address this issue, our study will use instrumental variables (IVs) and the Generalized Method of Moments (GMM) system to mitigate the impact of endogeneity. The two IVs for FDI used in our study are air passengers carried and armed forces personnel. We also incorporate one-period lags on our IVs to enhance their exogeneity, ensuring they are not influenced by current fluctuations in natural resource rents and allowing us to minimize potential biases from contemporaneous relationships between FDI and our IVs. Lastly, our study also offers to explore a new angle of the question by analyzing if the impact of FDI on natural resource reliance varies for countries that we classify as dependent on natural resources, as FDI could have a more pronounced effect on natural resource rents for economies which rely heavily on natural resource sectors.

Our main research question in this study is the following: does FDI reinforce or weaken reliance on natural resources, and how does this effect vary for resource-dependent countries? The central hypothesis we seek to verify is that FDI has an unfavorable impact (i.e., positive) on natural resource dependency, and that this effect is more pronounced for countries which we identify as resource dependent.

Our study focuses on 19 countries from MENA and is based on yearly panel data across 1985-2020. We analyze the effect of FDI on total natural resources rents as a % of GDP, which are the sum of oil rents, natural gas rents, coal rents, mineral rents, and forest rents, and subsequently we present the regression results individually for each natural resource type. We include region-specific fixed effects and period effects to address regional differences and the impact of cyclical economic shocks, respectively.

We find that the evidence supporting our hypothesis are nuanced and appear to depend on the level of nature resource dependency. The results show that FDI tends to reduce natural resource reliance in the MENA region, but we find the impact of FDI on natural resource rents becomes positive for non-resource dependent countries when considering resource dependency both as a control variable and in interaction with FDI. Unlike our hypothesis positing that the positive impact of FDI on resource reliance is more pronounced for resource-dependent countries, we find that not only the impact is not more pronounced, but it is also in fact even negative for resource-dependent countries. Further, when exploring the impact of FDI on the rents of each natural resource type individually, we find that FDI tends to decrease oil and natural gas dependency but is associated with an increase in coal and mineral rents, and a null effect on forest rents.

The study is structured as follows: in the second chapter, we will present a literature review on FDI and natural resource dependency. We will then analyze the few sources discussing the relationship between FDI and natural resource dependency. In the third chapter, we present our data sources, our econometric strategy, and the variables we used. In the fourth chapter, we present the results of the empirical analysis conducted to examine the impact of FDI on natural resource rents in the

MENA region using various regression models, including OLS, 2SLS, and GMM with both lagged and non-lagged IVs. This chapter also explores the impacts of FDI on different types of natural resources and how the relationship between FDI and natural resource rents varies when accounting for the interaction between FDI and natural resource dependency. The fifth chapter presents different robustness tests. Finally, the sixth chapter presents a summary, recommendations, the limitations of our study and the avenues for future research.

# Chapter 2: Literature Review

The following section will present a literature review on FDI and natural resource dependency. We will first analyze the literature linking FDI to economic growth and subsequently review the limited research discussing the relationship between FDI and natural resource dependency.

## 2.1 Relation between FDI and economic growth

FDI has been an important element in the economic development literature, with extensive research exploring its impacts on economic growth. This following section gives an overview of the literature on the relationship between FDI and economic growth, beginning with a clear definition of FDI. We will then examine the various channels through which FDI has been shown to influence economic growth, such as technological advancement and productivity improvements, and discuss the mixed empirical findings regarding the effects of FDI on economic growth.

### 2.1.1 FDI definition

According to the World Bank, FDI refer to 'the net inflows of investment to acquire a lasting management interest (10 percent or more of voting stock) in an enterprise operating in an economy other than that of the investor.' This definition is outlined in the sixth edition of the Balance of Payments Manual (2009) by the IMF and is considered by the World Bank as the internationally accepted definition of FDI. It includes long-term capital such as equity capital and reinvested earnings, and short-term capital as recorded in the balance of payments. For an investment to be counted as FDI, the IMF argues that it should account for 10 percent or more of the voting power. The IMF also emphasizes that FDI should seek to create a sustained interest in, or to gain significant managerial control over, a business in a foreign country, often by establishing long-term facilities abroad, such as warehouses or manufacturing plants. Direct investment involves various forms, including greenfield investment, joint ventures, and mergers and acquisitions.

In this study, we use FDI data from the World Bank Development Indicators database, which primarily relies on FDI data from the IMF's balance of payments statistics. As such, we will rely on this definition for our analysis. It is important to note that the OECD's definition of FDI is consistent with that provided by the World Bank and IMF, particularly as it considers ownership of a minimum of 10 percent of the voting stock in an enterprise to be evidence of a long-term interest. This consistency highlights alignment among international organizations in defining FDI.

### 2.1.2 Links between FDI and economic growth

The literature on the relationship between FDI and economic growth reveals a complex and nuanced picture. According to neoclassical theory, FDI stimulates economic growth as it contributes to increasing gross capital formation, thereby increasing the rate of capital formation and tax revenues and encouraging urbanization. As such, numerous studies suggest that FDI can enhance capital productivity by fostering competition, facilitating technological developments, and generating spillover effects. This in turn promotes the expansion or creation of industries, boosting employment and consumer demand.

Numerous studies suggested that FDI inflows have positive impacts on economic growth through the enhancement of competition and capital productivity, and the generation of technological spillover effects (Balasubramanyam et al., 1996; Borensztein et al., 1998; De Mello, 1999; Markusen and Venables, 1999). For example, Dunning (2009) finds that FDI stimulate employment growth through knowledge and technology transfer to domestic firms, thereby enhancing local productivity. Bwalya (2006) explores technology spillovers in Zambia and reports significant inter-industry spillovers, with local downstream firms benefiting from the technology of foreign firms in upstream sectors. Overall, the various positive impacts identified in the literature include the introduction of new managerial expertise, technological knowledge transfers, and know-how into domestic markets, as well as the establishment of international production networks, employee training initiatives, and integration into worldwide financial systems (Barro and Sala-i-Martin, 1997; Grossman and Helpman, 1991; De Mello, 1997).

Building on this research, Grekou and Owoundi (2020) find that FDI inflows drive urbanization in Africa by improving job opportunities and services. Using data from 49 African nations from 1979 to 2016 and using individual and time fixed and random effects, they report that FDI inflows tend to increase urbanization rates. Overall, the neoclassical theory posits that FDI inflows stimulate growth and thereby urbanization as they increase capital influx, revenue, and taxes, leading to the expansion or creation of industries and boosting employment. This in turn creates a cycle of increased economic activity and demand, which promotes specialization and shifts production toward less resource-intensive sectors like manufacturing and services. Liu et al. (2015) and Zhang (2002) show that economic growth shifts demand towards non-resource specialized sectors like manufacturing and services, which typically concentrate in metropolitan areas to minimize transportation costs (Moomaw and Shatter, 1996; Deng et al., 2010). This concentration, along with improved living conditions and employment opportunities, drives rural-to-urban migration. As such, Zhang (2002) identifies FDI as a key factor explaining the different urbanization rates between China's coastal and inland regions.

Another interesting study is that of Fernandes and Paunov (2012) which investigates the role of FDI in Chile's service sector on the total factor productivity (TFP) of manufacturing firms. Their findings show a positive impact of service-FDI on the TFP of Chilean manufacturing firms. This suggests that the service sector offers positive spillovers from FDI, and that reducing barriers to FDI in the service sector could enhance TFP in manufacturing sectors in LDCs.

However, despite extensive acceptance of the positive relationship between FDI and economic growth in the literature, empirical findings remain inconclusive. Agosin and Machado (2005) find that in Latin America, FDI has predominantly negative effects, as it often crowds out domestic investment rather than complementing it. This suggests that, in some cases, FDI can undermine local economic growth by superseding domestic investment rather than enhancing it. Further, Carkovic and Levine (2005) did not find substantial evidence supporting a positive exogenous impact of FDI on growth.

This ambiguity in findings could stem from a failure to account for contingent factors in the relationship between FDI and growth. For example, Hermes and Lensink (2003) find that the impact of FDI on growth depends on the development of the host country's financial markets, as developed financial markets mitigate the risks associated with technology adoption incurred by local firms. Edison et al. (2002) similarly reported that developed financial systems can more efficiently absorb capital inflows. Similarly, Alfaro et al. (2004) concluded from the results of their linear interaction model that while FDI alone has an unclear effect on economic growth, well-developed financial markets significantly enhance its positive impact. A drawback of this empirical approach is that it presumes that the influence of FDI on growth uniformly rises with financial development, not considering that a specific degree of financial development is necessary before host nations can capitalize on FDI benefits. As such, Azman-Saini et al. (2010) propose a regression model based on threshold effects, with financial market indicators acting as regime-switching triggers. Analyzing cross-country data from 91 nations between 1975 and 2005, they find strong evidence that the positive impact of FDI on growth emerges only when financial development surpasses a certain threshold; prior to this point, the benefits of FDI are nonexistent.

Durham (2004) finds that institutions also play a role in influencing the FDI-growth relationship. Using a five equation two-stage least squares (2SLS) system, the regression results emphasize the role of the financial and institutional variables, suggesting that countries with better-developed financial markets and institutions have better absorptive capacity to leverage FDI for growth.

While numerous studies point to FDI's potential to stimulate technological advancement, the literature also suggests that initial technological development and human capital can also maximize the benefits of FDI. As such, the extent of FDI's impact depends on the skill level of its labor force and the extent of technological expertise embedded in the host countries (Chamarbagwala et al., 2000). Using an endogenous growth model, Borensztein et al. (1998) investigate FDI's role in technology diffusion and economic growth in LDCs. Their study finds that FDI significantly encourages technology transfer, and they identify a strong complementary relationship between

FDI and human capital, with FDI's growth impact being stronger in countries with higher human capital levels.

In summary, the extensive literature on FDI and economic growth suggests that while FDI has the potential to stimulate economic growth, its impact is dependent on several contingent factors, such as the development of financial markets, institutional stability, technological capabilities, and human capital. It is worth noting that several works mentioned above tried to address endogeneity by instrumenting FDI flows with their lagged value (Borensztein et al. 1998; Durham, 2004, Alfaro et al., 2004), the real exchange rate (Alfaro et al., 2004), country size (Borensztein et al. 1998), political stability (Borensztein et al. 1998) or institutional quality (Borensztein et al. 1998). That is due to endogeneity concerns, as the simultaneity between FDI and growth makes it difficult to determine whether FDI directly contributes to economic growth or if growing economies are simply more attractive to foreign investors. There are concerns about the validity of these instruments in our study as they are likely to have a direct effect on our dependent variable apart from their influence on FDI. In this paper, we will also address the endogeneity concerns in studying the relationship between FDI and natural resource dependency and we will explain how the instruments we suggest are less likely to directly impact our dependant variable.

## 2.2 Relation between FDI and natural resource dependency

Based on the extensive literature suggesting that FDI promotes economic growth, one might assume that FDI would also help reduce natural resource reliance as FDI can target sectors beyond natural resource extraction, such as manufacturing and services. However, the relationship is not straightforward. The following section delves deeper into the nuanced reality depicted in the literature.

### 2.2.1 Natural resource dependency definition

To measure resource dependency, two main definitions are commonly used in the literature. The first is the export share of natural resource commodities such as oil, gas, coal, and minerals (Mehlum et al., 2006; Brunnschweiler and Bulte, 2008; Asiedu and Lien, 2011, Lashitew et al., 2021; Arezki et al., 2023). The second measure, which we apply in this analysis due to better data accessibility for our region of interest, is the total natural resource rents from coal, forests, minerals, natural gas, and oil as a percentage of GDP (UNDP, 2020; Long et al., 2017). The World Bank provides data for the latter by subtracting the average production costs of a commodity from its price, and subsequently multiplying the unit rents by the quantities extracted or harvested to calculate each commodity's rent as a GDP share. A UNDP study (2020) classifies a country as resource-dependent if its annual average total natural resource rents equaled or exceeded 10% of its GDP during the period from 2006 to 2018. In line with this definition, we will consider a country as resource-dependent if its annual average total resource rents equal or exceeded 10% of its GDP during the period of our study, 1985-2020.

### 2.2.2 Natural resource dependency on economic growth

Contrasting perspectives regarding the implications of natural resource dependency for LCDs' economic advancement are documented in the literature. One perspective posits that reliance on natural resources leads to various macroeconomic issues collectively referred to as the 'resource curse' (e.g., Ross, 1999; Sachs and Warner, 2001; Van der Ploeg, 2011; Frankel, 2012; Venables, 2016). This view suggests that natural resource reliance makes resource-rich nations subject to economic shocks due to fluctuating commodity prices and the depletion of resources (Devlin and Titman, 2004; Van der Ploeg and Poelhekke, 2009; Venables, 2016). Countries such as Bolivia, Sierra Leone, and Venezuela are examples of the resource curse argument which suggests that resource-rich countries perform worse economically than resource-poor nations like the Asian Tigers. Sachs and Warner (1995, 2001) support the resource curse argument by showing a significant negative correlation between the share of primary product exports in GNP and per capita GDP growth. Brückner (2010) cautions that using this share as an indicator of natural resource dependence without considering non-tradable goods—whose prices differ between poor and rich countries—can lead to overstating the economic importance of resource exports in poorer nations. He finds that a purchasing power parity (PPP) adjusted measure reveals a stronger negative relationship between resource dependence and growth, with a 5% increase in the PPP-adjusted share of primary exports in GNP reducing per capita GDP growth by over half a percentage point per year throughout 1970–1990. However, there are noteworthy exceptions to this trend identified in the literature. For instance, Fasano (2002) and Acemoglu et al. (2003) show that the United Arab Emirates and Botswana, respectively, successfully leveraged their resources by investing in long-term growth, modern infrastructure and education. Further, Mehlum et al. (2006) offer an interesting nuance by arguing that resource dependence negatively impacts growth primarily in countries with weak institutions (e.g., with a poorly defined legal system or a high expropriation risk), while it may even promote growth in those with strong institutions. Brückner (2010) also highlights that the resource curse is more pronounced in countries with high corruption and thereby aligns with the literature associating the curse to rent-seeking and inefficient policies (Tornell and Lane, 1999; Auty, 2001; Torvik, 2002; Mehlum et al., 2006; Robinson et al., 2006), suggesting that institutional reform could help mitigate the resource curse.

One macroeconomic issue associated with the resource curse is known as 'Dutch disease', where resource dependence leads to an appreciation of the real exchange rate. This appreciation shrinks the non-resource tradable sector, contributing to de-industrialization, and expands the import market (Sachs and Warner, 1995, 2001; Venables, 2016). Explanations for the resource curse hypothesis vary, with some scholars suggesting that prioritization of resource exportation may overshadow the manufacturing sector and thereby reduce exports of finished products and impede economic growth (Sachs and Warner, 2001). Lashitew et al. (2021) presents evidence for the Dutch disease by finding that resource-rich countries showed slower average growth in service value added and exports from 1981 to 2014 than resource-poor countries.

Extensive research also suggest that natural resource reliance weakens state institutions, worsening growth prospects, or exacerbates the negative effects of poor institutions on growth. Numerous scholars (Ross, 1999, 2003; Baland and Francois, 2000; Auty, 2001; Torvik, 2002; Mehlum et al., 2006, and Robinson et al., 2006, 2014) emphasize how resource dependency tends to encourage rent-seeking and corruption, harming the economy. State-controlled natural resource rents typically embolden the incentives for state capture, resulting in inefficient policymaking when robust institutions are already lacking. As such, over relying on extractive industries can hinder the growth of political and market institutions that support broader economic development (Pritchett et al., 2017). Lane and Tornell (1996, 1999) discuss the 'voracity effect' where lack of clearly defined and enforced property rights leads to aggressive rent-seeking practices in resource-rich countries, potentially impeding economic growth. However, certain scholars refute the resource curse hypothesis and argue instead that natural resource extraction promotes economic development and enhances institutional quality (e.g., Brunnschweiler, 2008; Brunnschweiler and Bulte, 2008). Other academics suggest that empirical analyses supporting the resource curse hypothesis overlook empirical flaws and misinterpret results (Wright and Czelusta, 2004; Ding and Field, 2005; Brunnschweiler, 2008; Saad-Filho and Weeks, 2013).

Given the potential negative effects of natural resource dependency, it is important to assess the role of FDI in exacerbating or mitigating resource reliance. This study assesses whether FDI influences the extent of resource rents, and if this effect is more pronounced in resource-dependent countries, providing valuable insights to inform investment strategies and policy decisions.

### 2.2.3 Impact of FDI on natural resource dependency

The relationship between FDI and natural resources has garnered increasing attention in academic research, particularly within the context of LDCs. Asiedu (2006) finds that natural resource endowments foster a rise in FDI inflows in Sub-Saharan Africa due to resource extraction opportunities. A UNDP study (2020) finds that resource-dependent-fragile and conflict-affected countries (FCAs) tend to attract higher ratios of FDI-to-GDP compared to non-resource-dependent-FCAs. The authors attribute this finding to the specific determinants of resource-seeking FDI, which is driven primarily by global commodity prices and the size and accessibility of resource deposits. As such, they suggest that resource-seeking FDI is unlikely to result in significant transfers of technology, skills, or know-how, since the extractive industries tend to rely on imported machinery and equipment with minimal reliance on local production inputs. Nevertheless, resource-FDI can produce substantial government revenues which could be allocated to health, education, social services, and infrastructure.

While several studies establish that natural resources may attract FDI inflows, questions persist regarding the reverse relationship – whether FDI also stimulates greater natural resource extraction or dependency, consequently amplifying the proportion of GDP derived from resource exports.

Bunker and Ciccantell (2005) present a theoretical framework which suggests that FDI-driven resource extraction in LDCs may accelerate the depletion of natural resources to sustain production, making LDCs foreign investment dependent (Chase-Dunn, 1975; Bornschier and Chase-Dunn, 1985; Dixon and Boswell, 1996; Firebaugh, 1996). This view aligns with the ecostructural theory put forth by Jorgenson et al. (2010), which posits that FDI encourages economic restructuring in resource-rich LDCs, often at the expense of ecological sustainability. This framework suggest that developed countries and their transnational corporations view LDCs as both resource providers and waste disposal sites, driven by a transnational production organization and the pursuit of inexpensive resource suppliers. A similar study by Assa (2018) analyzes the impact of FDI on environmental degradation in Sub-Saharan Africa (SSA) and finds that while FDI can generate positive environmental outcomes in countries with strong governance, weak law enforcement and high corruption levels in SSA contribute to extensive forest area reduction driven by FDI. These studies overall suggest that FDI may exacerbate resource depletion. While resource depletion can indicate increased reliance on natural resources, it is not used in the literature as a measure of natural resource dependency, unlike natural resource rents. Resource depletion points to the environmental impacts and physical extraction levels, whereas natural resource rents capture the resources' significance in the economy. In other words, while depletion provides insights into the extent of resource use, it doesn't directly reflect how integral those resources are to a country's economy.

To our knowledge, the study by Long et al. (2017) constitutes the only empirical study in the literature which analyzes the impacts of FDI on natural resource dependency specifically. The authors focus on two main questions: (1) how FDI impacts the level of natural resource extraction, or depletion, in LDCs, and (2) how FDI affects natural resource rents as a proportion of GDP in these countries. They find that FDI significantly contributes to the depletion of natural resources, defined as the ratio of extracted resources to remaining reserves, and to the increase of natural resource rents in LDCs. Using panel data from 2005 to 2013 for 125 LDCs, the study employs fixed-effects models which control for country characteristics not included explicitly in the model to analyze initially the relationships between FDI and natural resource depletion, and subsequently natural resource rents, controlling for various socio-economic and political factors such as democracy and gross capital formation. Their model is specified as follows:

$$Y_{\mathrm{ct}} = X_{\mathrm{ct}}B + \alpha_{\mathrm{c}} + e_{\mathrm{ct}} \text{ for } t = 1, \ldots, T \text{ and } c = 1, \ldots N$$

where $Y_{ct}$ is the dependent variable for the country $c$ at time $t$, representing either natural resource depletion or natural resource rents, $X_{ct}$ is a 1 by $k$ matrix of predictor variables, $\alpha_c$ is the unobserved time-variant country effect, and $e_{ct}$ is the error term. They find that increases in FDI stocks are associated with increases in all forms of natural resource depletion and rents, except for energy rents. This suggests that FDI contributes to driving natural resource depletion in LDCs, leading to environmentally non-sustainable practices and greater ecological disorganization involving both the depletion and the environmental externalities from resource extraction. This aligns with the ecostructural theory of foreign investment dependence put forth by Jorgenson et al. (2010) outlined above. More relevant for our purposes, the increase in natural resource rents indicates suggests that FDI makes LDCs more dependent on natural resource sectors, reinforcing economic dependency on developed nations and raising concerns about the 'resource curse'.

While being the only study on the topic based on our knowledge, a primary concern is simultaneity bias, a source of endogeneity that arises when the explanatory variable and the dependent variable influence each other simultaneously. Indeed, while FDI can lead to increased resource extraction, the presence of abundant natural resources can also attract more FDI. This reciprocal influence complicates the causal interpretation of the results, making it difficult to determine whether FDI is driving resource extraction or vice versa. To address this, the study conducted Granger causality tests to test for endogeneity, but this approach may not fully resolve endogeneity concerns. To address this issue, our study will use instrumental variables (IVs) and the Generalized Method of Moments (GMM) system to mitigate the impact of endogeneity, providing more reliable estimates of the causal relationship. To further enhance the exogeneity of our instruments for FDI, we will incorporate one-period lags on our instruments to ensure they are not influenced by current fluctuations in natural resource rents, allowing us to minimize potential biases from contemporaneous relationships between FDI and our IVs. Further, the Long et al. (2017) study only includes data of 2005-2013, making the timeframe potentially too narrow to capture long-term trends or effects of major events that occurred before 2005 or after 2013 and providing an incomplete understanding of the relationship. Our study offers to look at data from 1985-2020. Lastly, our study also fills a literature gap by analyzing how the impact of FDI on natural resource reliance varies for countries that we identify as resource dependent.

## 2.3 Summary

The literature on FDI and economic growth reveals a complex relationship whereby FDI tends to stimulate economic growth through increased capital formation, technological advancement, and employment opportunities, although this impact is contingent on factors such as financial market development and institutional stability. The relationship between FDI and natural resource dependency reported in the literature is even more nuanced. While FDI can promote economic activity in LDCs, it may also exacerbate natural resource extraction and economic dependence on these resources, reinforcing the 'resource curse'. However, the issue of simultaneity bias complicates the causal interpretation, necessitating the use of more advanced econometric methods to clarify the FDI-natural resource dependency relationship dynamics.

# Chapter 3: Methodology

In this chapter, we present the data and empirical methodology employed to examine the effects of FDI on natural resource rents. We outline the econometric model and the variables employed in our estimations, along with providing an overview of the estimation techniques used and the descriptive statistics of the variables.

## 3.1 Data and descriptive statistics

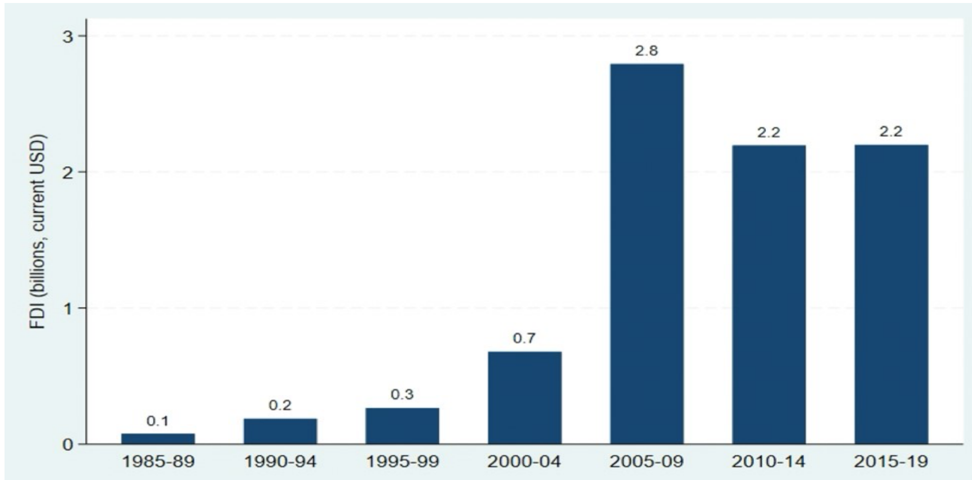
Our study focuses on 19 countries from the MENA, with data collected annually from 1985 to 2020. The countries included are Algeria, Bahrain, Egypt, Iran, Iraq, Jordan, Kuwait, Lebanon, Libya, Mauritania, Morocco, Oman, Qatar, Saudi Arabia, Sudan, Syria, Tunisia, the United Arab Emirates, and Yemen. It is important to note that the MENA region lacks a standardized definition, which results in various classifications among international organizations such as United Nations agencies and programs. Definitions given by these organizations often contradict one another and may apply only to specific studies or reports. For our study, we selected these countries based on their consistent inclusion in multiple definitions and the availability of relevant data for the designated period.

The data for our dependant and independent variable come from the World Bank's World Development Indicators database. Data for control variables originate from various sources such as the World Bank, United Nations Statistics Division and Polity 5. The data for our first instrumental variable was collected from multiple sources compiled by World Bank, including the International Civil Aviation Organization. The data for our second instrumental variable was also gathered from multiple sources compiled by the World Bank, such as the International Institute for Strategic Studies. Appendix A outlines the definitions, sources, and notation for each variable.

Figure 1 illustrates the evolution of FDI in our selected MENA countries between 1985 and 2019. A significant upward trend in FDI inflows is evident throughout this period. From modest levels in the 1980s and 1990s, FDI experienced significant growth in the early 2000s, followed by the highest peak of 2.8 billion USD on average in 2005-09. The graph sheds light on a notable increase in FDI inflows into the region since the 1980s, despite a slight decline in 2010-14 and 2015-19.

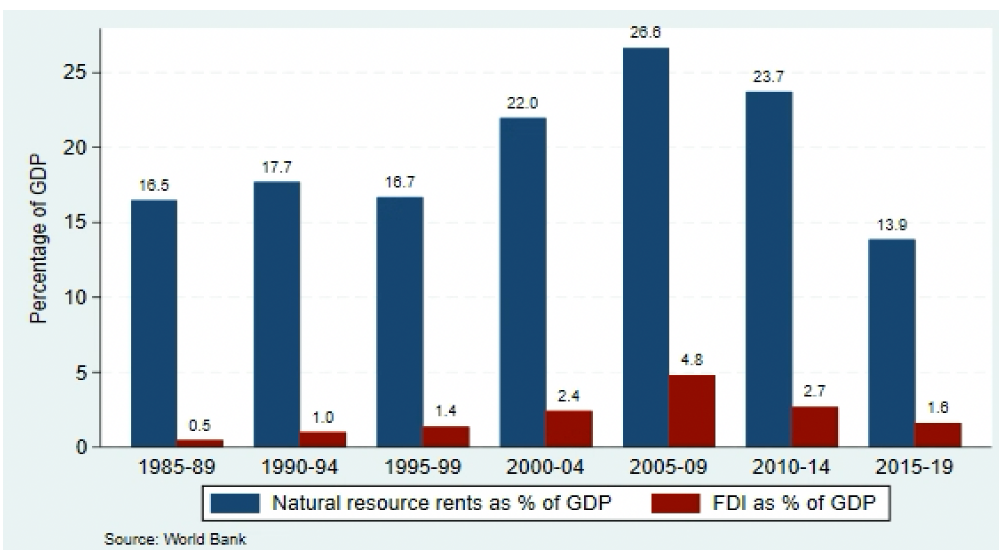
Figure 2 compares the evolution of FDI and natural resource rents as a percentage of GDP from 1985 to 2019. Over this period, natural resource rents exhibited a relatively slight downward trend, starting at an average of 16.5% of GDP in 1985-89 and declining to 13.9% by 2015-19. In contrast, FDI inflows overall notably increased over time, though they constitute a much smaller percentage of GDP. As such, while the importance of natural resources in the MENA region's economy has slightly declined over time, FDI has gained prominence.

**Figure 1: Evolution of FDI inflows in MENA region, 1985-2019**




Note: We represent graphically the evolution of FDI inflows in our selected MENA countries between 1985 and 2019 using averages across intervals of five years. Source: Author's calculations based on data from the World Bank Development Indicators.

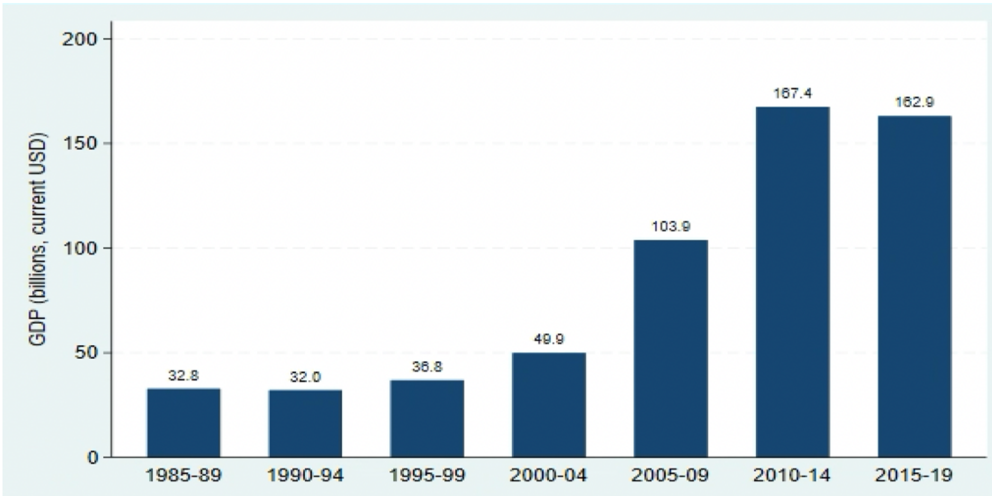
**Figure 2: Compared evolution of FDI and natural resource rents in MENA, 1985-2019**




Note: We represent graphically the evolution of FDI and natural resource rents as a % of GDP in our selected MENA countries between 1985 and 2019. The red and blue bars represent averages across five years of FDI inflows as a % GDP and natural resource rents as a % GDP, respectively. Source: Author's calculations based on data from the World Bank Development Indicators.

Figure 3 depicts the significant growth in GDP over 1985-2020, specifically from 2000–2004 to 2005–2009, where GDP more than doubled from $49.9 to $103.9 billion. This substantial growth

**Figure 3: Evolution of GDP in MENA region, 1985-2019**

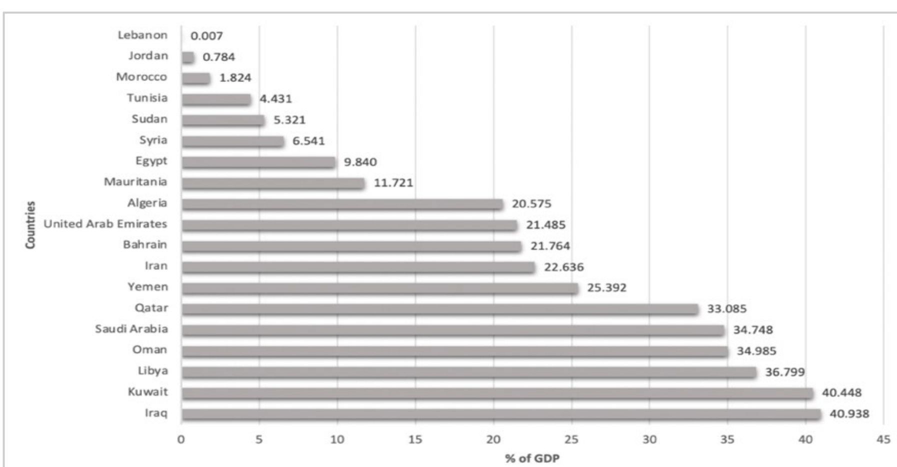



Note: We represent graphically the evolution of GDP in our selected MENA countries between 1985 and 2019 using averages across intervals of five years. Source: Author's calculations based on data from the World Bank Development Indicators.

helps explain why, despite a 4x increase in FDI inflows from 2000–2004 to 2005–2009 (as shown in Figure 1), FDI as a percentage of GDP only doubled (Figure 2). This expansion of GDP highlights the dynamic economic environment during 2005–2009, which likely diluted the relative share of FDI to the overall economy.

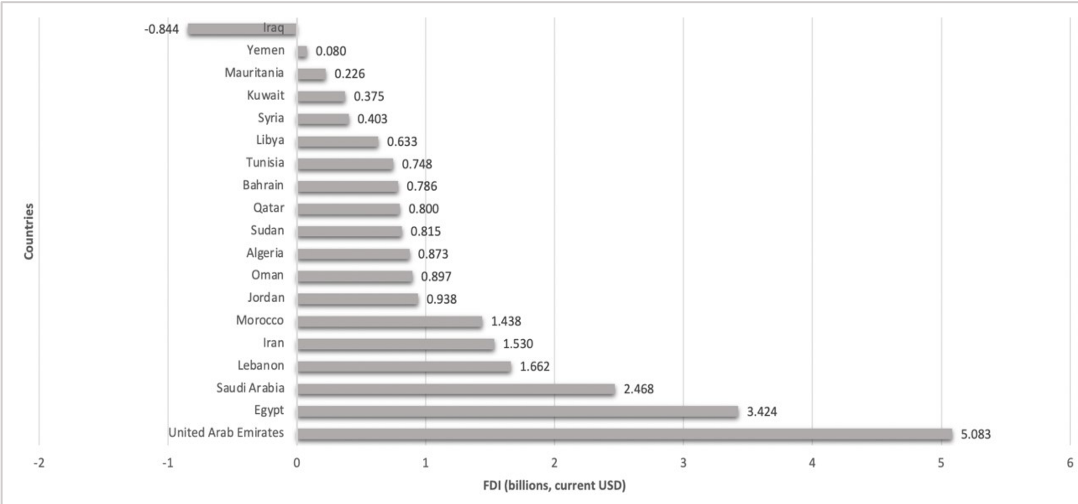
Figures 4 and 5 show the average natural resource rents and FDI, respectively, across 1985-2020 for each country. The countries with the highest natural resource rents average are Iraq, Kuwait and Libya, while the countries with the highest FDI averages are the UAE, Egypt and Saudi Arabia. Lebanon, Jordan and Morocco reported the lowest natural resource rents averages, while Iraq, Yemen and Mauritania exhibited the lowest FDI inflows averages.

**Figure 4: Average natural resource rents in MENA per country, 1985-2020**




Note: We show the average natural resource rents across 1985-2020 for each country. Source: Author's calculations based on data from the World Bank Development Indicators.

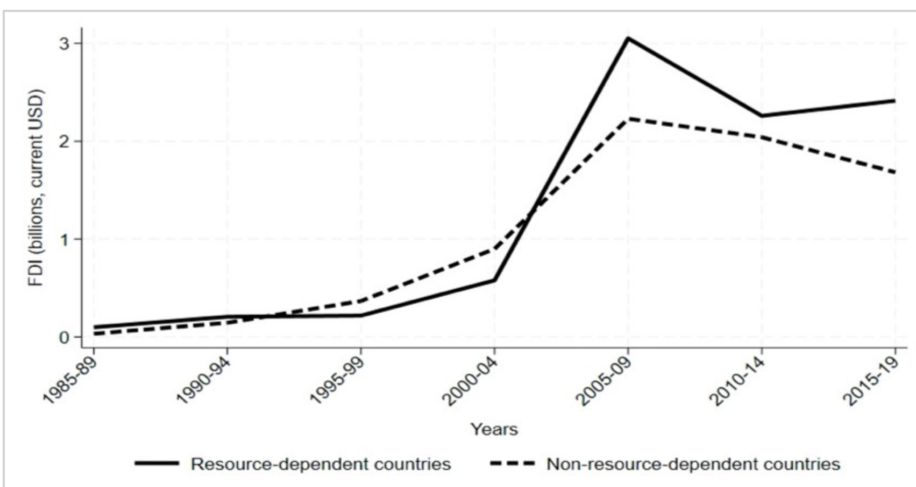
**Figure 5: Average FDI inflows in MENA per country, 1985-2020**




Note: We show the average FDI inflows (in billions, current USD) across 1985-2020 for each country. Source: Author's calculations based on data from the World Bank Development Indicators.

Figures 6 and 7 show the evolution of FDI and natural resource rents for both resource and non-resource dependent (RD) countries. As previously defined in the literature review section, we consider RD countries to be those with average natural resource rents equal to or exceeding 10% of GDP during the period 1985-2020. Figure 6 shows that while both RD and non-RD countries witnessed a significant increase in FDI inflows since the early 2000s, this uptick was starker for RD countries, suggesting that RD countries attract more FDI.

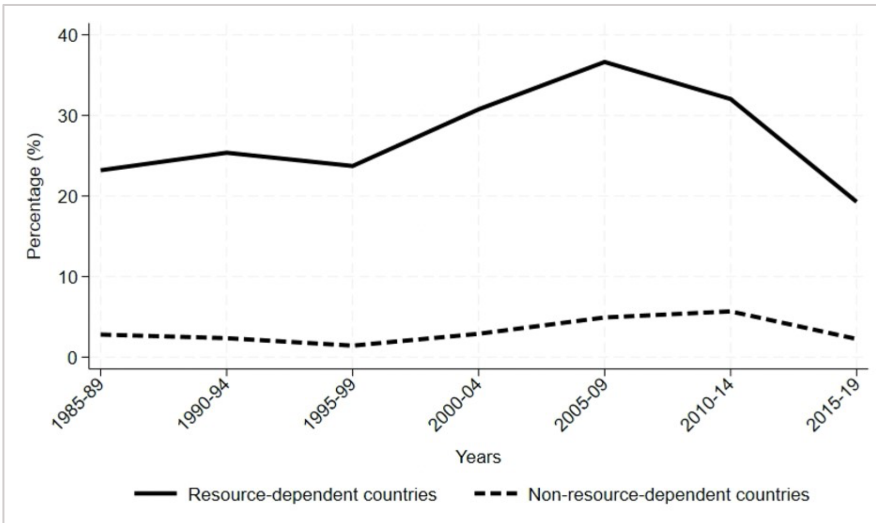
**Figure 6: Compared evolution of FDI for resource and non-resource dependent countries**




Note: We show the evolution of FDI inflows (in billions, current USD) for both resource and non-resource dependent countries using five-year averages across 1985-2019. Resource-dependent countries are represented by the solid line and non-resource dependent countries by the non-continuous line. Source: Author's calculations based on data from the World Bank Development Indicators.

Intuitively, Figure 7 shows that RD countries exhibit higher natural resource rents averages throughout the period. However, the evolution of natural resource rents has been similar for both groups, with both only slightly decreasing over the period.

**Figure 7: Compared evolution of natural resource rents for resource vs non-resource dependent countries**




Note: We show the evolution of natural resource rents as a % of GDP for both resource and non-resource dependent countries using five-year averages across 1985-2019. Resource-dependent countries are represented by the solid line and non-resource dependent countries are represented by the non-continuous line. Source: Author's calculations based on data from the World Bank Development Indicators.

Table 1 displays the descriptive statistics of the variables employed in our research. The number of observations varies by variable because some countries have missing data for specific years within the 1985-2020 period due to factors such as conflict or not being able to report data regularly due to lack of statistical capacity. In general, the table underscores considerable variability across countries in terms of natural resource rents. The mean natural resource rents as a percentage of GDP for our countries from 1985 to 2020 is 19.4%, reflecting the region' reliance on natural resources. Natural resource rents range from a minimum of virtually 0% to a maximum of 67.4%, while the standard deviation, which measures the average deviation from the mean, is 16.2%. Overall, these statistics highlight substantial heterogeneity in natural resource rent levels the region. The same observation can be made for oil rents specifically due to a similar standard deviation (16.1%), minimum (0%) and maximum (65.2%). That the mean oil rents (17.3%) is close to the average natural resource rents suggests that oil rents represent a significant component in the natural resources' composition in the region. The similarity in standard deviations suggest that the variability in oil rents is comparable to the variability in total natural resource rents, further underscoring the importance of oil in the overall resource rents in the region. Natural gas rents occupy the second most significant resource type, with a mean of 1.3%, followed by mineral rents

(0.5%), forest rents (0.2%), and coal rents (0.2%). Note that, while the minimum value for total natural resource rents as a % of GDP shows 0.000, this value is rounded from a very small number which is virtually zero but not exactly zero. However, for each individual component of natural resource rents, the minimum value in the data is recorded as exactly 0 in the data, as seen in table 1. These zero values do not seem to be not the result of missing data, which are represented by blank values in the World Bank's data. Rather, zero rents from a particular resource type seems to reflect that either this resource type was not extracted during a particular year, or, in an unlikely scenario, that the revenue generated from extraction equaled exactly the production costs.

**Table 1: Descriptive statistics, 1985-2020**

| Variable | Obs. | Mean | Std. Dev. | Min. | Max. |
|---|---|---|---|---|---|
| Total natural resources rents (% of GDP) | 664 | 19.442 | 16.150 | 0.000 | 67.443 |
| Oil rents (% of GDP) | 664 | 17.317 | 16.128 | 0 | 65.158 |
| Mineral rents (% of GDP) | 667 | 0.540 | 2.309 | 0 | 24.834 |
| Forest rents (% of GDP) | 667 | 0.165 | 0.421 | 0 | 3.373 |
| Natural gas rents (% of GDP) | 664 | 1.263 | 1.623 | 0 | 9.630 |
| Coal rents (% of GDP) | 664 | 0.156 | 0.764 | 0 | 9.075 |
| FDI (billions, current USD) | 659 | 1.209 | 2.577 | -10.176 | 21.955 |
| IV1: Air passengers (millions) | 654 | 5.249 | 10.983 | 0.018 | 95.758 |
| IV2: Armed forces personnel (thousands) | 617 | 190.937 | 223.575 | 2.8 | 1390 |
| Urbanization rate | 684 | 67.064 | 20.718 | 18.373 | 100 |
| Agriculture VA (% of GDP) | 602 | 10.650 | 10.189 | 0.094 | 45.042 |
| Industry VA (% of GDP) | 579 | 37.745 | 15.726 | 6.638 | 86.670 |
| Exports of goods and services (% of GDP) | 641 | 38.253 | 21.213 | 0.005 | 104.805 |
| Polity score (democracy) | 618 | -5.453 | 4.204 | -10 | 7 |
| Gross fixed capital formation (billions, constant 2015 US$) | 680 | 23.107 | 32.326 | 0.196 | 196.534 |
| Inflation | 593 | 11.270 | 31.027 | -16.117 | 448.500 |
| Private credit (% of GDP) | 604 | 45.832 | 34.773 | 1.266 | 239.316 |
| Age dependency ratio | 684 | 64.233 | 22.958 | 16.172 | 116.934 |

Note: We display the descriptive statistics across 1985-2020 of the variables employed in our research, including the number of observations, the mean, standard deviation, and minimum and maximum values reported. Source: Author's calculations based on data from various sources such as the World Bank Development Indicators, United Nations Statistics Division and Polity 5 (see Appendix A for the definitions, sources, and notation for each variable).

In terms of FDI, the average net inflows across our countries amounts to 1.2 billion current USD, suggesting a relatively limited amount of FDI in MENA countries. The standard deviation of 2.6 billion USD indicates considerable variability in FDI levels among MENA countries, further underscored by the minimum and maximum levels of FDI recorded at −10.2 billion and 22 billion

USD, respectively. Negative FDI inflows occur when the outward direct investment made by residents of the reporting economy to foreign economies, or in other words, FDI flowing out of a country (FDI outflows) exceeds the inward direct investment from foreign investors coming into the reporting economy (FDI inflows). This could suggest that foreign investors have withdrawn more capital than they have invested, or that earnings are being reinvested abroad rather than within the reporting economy. The average value for our first IV, the number of air passengers, is about 5.2 million, with a standard deviation of 11 million. The minimum observed value is virtually 0 million, while the maximum reaches 95.8 million, indicating significant variation in air travel across MENA nations. Regarding our second IV, which represents armed forces personnel, the average stands at approximately 190.9 thousand. The standard deviation of 223.6 thousand reveals a wide disparity in military personnel numbers across the region, further evidenced by the gap between the minimum (2.8 thousand) and maximum (1390 thousand) recorded value.

Over the period 1985-2020, the sample countries exhibited diverse economic and demographic landscapes as reflected by the reported statistics for our control variables. Inflation averaged 11.3% with a high standard deviation of 31%, indicating substantial volatility. The minimum inflation rate recorded was -16.1%, suggesting deflation in some cases, while the maximum reached 448.5%, indicating hyperinflation. The average Polity Score (21-point scale democracy measure) was -5.5 with a standard deviation of 4.2, highlighting varying political systems from autocratic to more democratic. Gross fixed capital formation averaged 23.1 billion USD, with a wide variability of 32.3 billion USD. Exports of goods and services as a percentage of GDP averaged 38.3%, with a significant range from nearly 0% to 104.8%, indicating varying trade dependency levels. Private credit as a percentage of GDP averaged 45.8%, with a large spread from 1.3%, to 239.3%, reflecting various financial sector development levels. Urbanization rate averaged 67.1, suggesting high urbanization in countries sampled, despite some variation (20.7%). Industry value added averaged 37.7% of GDP, compared to agriculture, forestry, and fishing at 10.7%. Lastly, the age dependency ratio averaged 64.2%, indicating a substantial proportion of non-working-age individuals, which can impact economic productivity and resource management.

## 3.2 Econometric model

Despite limited empirical research on the impact of FDI inflows on natural resource dependency, several authors have examined the influence of FDI on economic growth (Balasubramanyam et al., 1996; Borensztein et al., 1998; Azman-Saini et al, 2010). We draw upon econometric models developed in this area, and on the study by Long et al. (2017) identified above as the only study to our knowledge on the influence of FDI on natural resource dependency, to develop our empirical approach for estimating the impact of FDI on natural resource rents.

The central hypothesis we seek to verify is as follows: FDI has an unfavorable impact (i.e., positive) on natural resource dependency and this effect is more pronounced for countries which we identify as RD.

Our model equation, inspired by that of Long et al. (2017), can be rewritten as follows:

$$N_{it} = \alpha + \beta_1 FDI_{it} + X_{it}\beta_2 + \mu_{ri} + \lambda_t + \varepsilon_{it}, \mathbf{(1)}$$

where $N_{it}$ is the dependant variable and corresponds to the total natural resource rents (as a % of GDP) of a given country '$i$' observed at time '$t$'. Total natural resources rents are the sum of oil, natural gas, coal, mineral, and forest rents. We will also analyse the regression results using as dependent variable each natural resource type separately and as such, $N_{it}$ will change accordingly. The variable $FDI_{it}$ corresponds to our independent variable, or net inflows of FDI in billions of current USD. $X_{it}$ corresponds to a matrix of control variables that account for the effect of factors that influence both natural resource rents and the relationship between FDI and natural resource rents. We also include region-specific fixed effects ($\mu_{ri}$with $ri$ referring to the region to which observation $i$ belongs) and period effects ($\lambda_t$) to address regional differences and the impact of cyclical shocks on the economy, respectively. The idiosyncratic error term is represented by $\varepsilon_{it}$

As control variables, we include:

1. Inflation. Inflation was used as a control variable in similar studies on the impact of FDI on economic growth (Borensztein et al., 1998; Alfaro et al., 2004). Asiedu and Lien (2011) use inflation as a control variable and measure of macroeconomic uncertainty in their study of the impact of the relationship between democracy and FDI for resource and non-resource exporting countries. Inflation affects macroeconomic stability, production costs and currency exchange rates, serving as a proxy for economic uncertainty. It can impact resource revenue outcomes and key economic aspects relevant to the impact of FDI on natural resource rents. While inflation can increase prices and potentially raise rents, high inflation also increases operating costs, such as wages, which can undermine profit margins. Moreover, inflation can introduce market uncertainty, affecting investor confidence for resource projects. As such, the expected coefficient is negative.
2. Gross fixed capital formation (GFCF), constant 2015 USD. Asiedu and Lien (2011) use GFCF as a control variable and measure to capture the level of infrastructure development. Countries with higher GFCF tend to have better infrastructure and more advanced technology, potentially impacting both natural resource rents and the productivity of resource extraction process by FDI. We expect the variable coefficient to be positive.
3. Exports of goods and services (as % of GDP). Long et al. (2017) use this control variable in their study on FDI's influence on natural resource rents, considering this a measure of trade dependency. High trade dependency can affect natural resource rents directly by making the country more exposed to global market prices, leading to more volatility in

rents, while also positively affecting rents due to heightened international demand for exported resources. High trade dependency also makes countries more attractive to FDI, as investors seek markets with strong export channels. In turn, this reliance on exports can foster competition, incentivizing productivity in resource extraction processes and encouraging companies to enhance their efficiency to meet global standards.

4. Democracy. The 'Polity Score' represents a 21-point scale measuring the spectrum of regime authority, ranging from -10 (hereditary monarchy) to +10 (consolidated democracy). It assesses the extent of political openness and the presence of institutions that encourage political participation. Many studies use this variable as a proxy for governance quality (Grekou and Owoundi, 2020; Asiedu and Lien, 2011). Since governance quality influence investor confidence and the ease of doing business, it positively impacts the natural resource extraction process and the effect of FDI on natural resource rents.
5. Private credit by deposit money banks and other financial institutions (% of GDP). It is a measure of banking sector development in many studies (Alfaro et al., 2004; Azman-Saini, et al., 2010; Levine et al., 2000). Private credit by deposit money banks generally has a positive impact on natural resource rents as it can increase investment in resource exploration and technological advancements, thereby enhancing resource extraction profitability. It can also enhance the ability of FDI to invest in resource sectors.
6. Urban population (% of total population). Urban areas typically have a high demand for goods and services, which can increase resource consumption. The shift in demand as economies urbanize not only influences the exploitation of natural resources but can also reflect a change in economic structure from primary to secondary and tertiary sectors, affecting the extent of FDI interaction with natural resource sectors. Further, urban areas typically have better infrastructure, which can facilitate more efficient production processes. Overall, we expect the coefficient sign for this variable to be positive.
7. Industry value added (% of GDP) and Agriculture, forestry, and fishing, value added (% of GDP). Controlling for these variables, as done by Long et al. (2017), helps to isolate the effects of FDI on resource rents from the broader influences of sector-specific dynamics. A greater prominence of these sectors can indicate a shift away from resource-intensive industries and influence the FDI's impact on natural resource reliance by shaping investor preferences, determining how FDI flows into different sectors. We expect their impact on natural resource rents to be positive or negative. A higher share of industry value added indicates a more industrialized economy, potentially boosting rents through enhanced resource extraction processing. However, it could also result in a deviation away from resource sectors towards more technology-intensive industries. Further, while a higher share of agriculture, forestry, and fishing value added suggests greater reliance on primary resource sectors, indicating greater natural resource dependency, this dependency can also incur overexploitation if not managed sustainably, depleting resources and lowering rents.
8. Age dependency ratio (% of working-age population). A high dependency ratio, indicating a larger proportion of non-working-age individuals, can strain the working-age population

and reduce labor force availability and productivity, lowering resource management efficiency. For FDI, a high dependency ratio can create fiscal pressures and resource constraints, potentially reducing the effectiveness of FDI in resource extraction processes.

$\beta_1$ *and* $\beta_2$ are the parameters to be estimated. In particular, $\beta_1$ is the coefficient of interest and represents the marginal effect of FDI inflows (in billions, current USD) on natural resource rents. Our hypothesis is that this coefficient is positive and statistically different from zero. As such, we expect FDI to have a statistically significant positive marginal effect on natural resource rents, which would indicate that an increase in FDI tends to increase natural resources rents. This expectation aligns with the limited literature indicating that FDI exacerbates resource dependency in LDCs. While many studies suggest that FDI brings advanced technology and expertise, leading to more efficient resource extraction processes, this increased efficiency can also heighten the dependency on FDI. Further, FDI flows tend to concentrate in the resource sectors (World Bank, 2011). We expect this positive effect to be greater for countries that are RD. If the coefficient is positive and significant statistically, an increase in FDI of one billion current USD tends to raise natural resource rents by $\beta_1$ percentage points, all else being equal.

The expected effects of the various variables are summarized in Appendix B.

We include region-specific fixed effects and time effects to address regional differences and the impact of cyclical economic shocks, respectively. Regional effects account for region-specific, unobserved characteristics that may influence natural resource rents and the impact of FDI on natural resource dependency, such as cultural practices or geographical factors. In this study, we prefer regional fixed effects instead of country fixed effects, as region-specific fixed effects can capture shared regional characteristics and control for variations that are not unique to individual countries. This can avoid the risk of overfitting associated with including excessive country-specific parameters. If these region-specific characteristics are associated with explanatory variables in our model, not accounting for them may lead to biased estimates due to omitted variable bias.[6] Time effects are also included to mitigate omitted variable bias by accounting for cyclical shocks affecting all countries, such as global financial crises or economic recessions.

In our study, we also compare how FDI affects natural resource rents differently in countries that rely heavily on natural resources or are natural-resource dependent. This approach can provide insights into the effect of FDI in the context of resource-rich economies. A UNDP report (2020) defines a RD country as a country for which its annual average total resource rents constitute a minimum of 10% of GDP over a defined period. As such, to evaluate the FDI impact for resource-dependent countries (>10% of GDP), we modify our basic econometric model (Equation 1) as follows:

[6] Omitted variable bias occurs when important variables that affect both the dependent variable (in this case, natural resource rents) and the explanatory variables are not included in the model.

$$N_{it} = \alpha + \beta_1 FDI_{it} + X_{it}\beta_2 + \beta_3 Dep_i + \beta_4 Dep_i \, x \, FDI_{it} + \mu_{ri} + \lambda_t + \varepsilon_{it}, \textbf{(2)}$$

where $Dep_i$ is a dummy variable indicating dependence on natural resource rents (1 if ≥10% of GDP, 0 otherwise). In our sample countries, we identified 13 countries out of 19 being RD: Algeria, Bahrain, Egypt, Iran, Iraq, Kuwait, Libya, Mauritania, Oman, Qatar, Saudi Arabia, United Arab Emirates and Yemen.

This modified model (Equation 2) allows us to analyze how the interaction between FDI and high natural resource dependency ($Dep_i \, x \, FDI_{it}$) influences natural resource rents, providing insights into the economic dynamics of resource-rich economies. The coefficient of the interaction term, $\beta_4$, would represent the marginal effect of FDI (in billions, current USD) on natural resource rents for countries which are RD. This would allow us to determine the impact of FDI on natural resource rents for RD economies specifically. In RD countries, FDI could have a more pronounced effect on natural resource rents because these economies rely heavily on their natural resource sectors for revenue generation. $\beta_3$ represents the marginal impact on natural resource rents associated with being a RD country.

### 3.3 Estimation methods

We acknowledge endogeneity issues may arise during our analysis. Since we are using panel data, we face the risk of unobserved heterogeneity, which refers to differences among entities that are not directly observable. This heterogeneity can introduce correlations between the independent variable (e.g., FDI) and the dependent variable (e.g., natural resource rents), as well as with omitted unmeasured variables that affect both variables simultaneously. Unobserved heterogeneity can cause endogeneity and thereby bias results if it is related to both an explanatory variable and the dependant variable and is not accounted for in the regression. These omitted variables would appear in the error term, violating the orthogonality assumption of the explanatory variables.

In addition to omission of relevant explanatory variables, endogeneity can stem from two other sources: (i) reverse causality, which may be the most significant in our case; and (ii) measurement errors in the explanatory variables (Wooldridge, 2010). Regarding (i), a common issue raised in empirical studies is that a simultaneity bias can arise due to growth and FDI inflows being determined simultaneously (Borensztein et al., 1998; Durham, 2004). Similarly, the relationship between FDI inflows and natural resource rents may be bidirectional. Natural resource rents, reflecting profitability in resource extraction and resource availability, can attract FDI as investors seek to capitalize on lucrative opportunities, and may thus increase FDI inflows. Simultaneously, as suggested in the literature, FDI inflows can enhance technology, infrastructure, and managerial practices in resource sectors, potentially increasing resource extraction productivity and boosting natural resource rents. This reverse causality between FDI and natural resource rents complicates establishing a clear causal relationship and thereby necessitates the use of advanced econometric techniques to disentangle these intertwined effects and provide more reliable estimates.

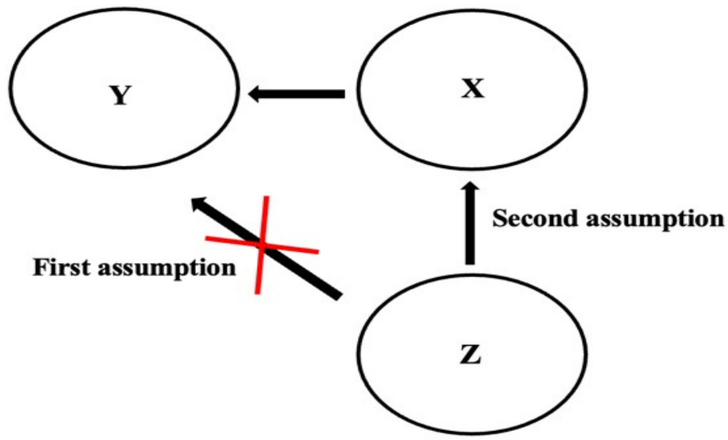
Using IVs for FDI inflows helps address endogeneity arising from the mutual determination of FDI and natural resource rents. FDI inflows are often influenced by factors that also affect natural resource rents, creating simultaneity and potential bias in estimating causal effects. IVs allow us to isolate exogenous variations in FDI that are independent of the error term in our model equation, leading to more reliable coefficient estimates. By using IVs, researchers seek to isolate the exogenous variation in the endogenous regressor and obtain unbiased estimates. For example, Alfaro et al.'s study on FDI and economic growth (2004) instruments FDI with one-period lagged FDI and real exchange rates. Further, the incorporation of one-period lags on our IVs on some specifications will help enhance the exogeneity of our instruments by ensuring they are not influenced by current fluctuations in natural resource rents.

Here are the two assumptions of the instrumental variable approach, illustrated in Figure 8:

1. Assumption 1: exclusion restriction. The instruments should affect the dependent variable only through their impact on the endogenous variable. The instrument Z must be correlated with the endogenous explanatory variable, X, but should not be directly correlated with the error term $eit$ in the regression equation. In other words, Z should affect X but should not be influenced by factors that also affect the dependent variable, Y, independently of X. This ensures that Z provides valid variation to isolate the causal effect of X on Y. Z should not have an effect on Y apart from its influence on X. In econometric terms, after accounting for Z's correlation with X, Z should not be correlated with other factors that independently affect Y (Wooldridge, 2020).
2. Assumption 2: relevance**.** The instrumental variables must be correlated with the endogenous explanatory variable, X. The correlation between Z and X is crucial because Z should provide variation that helps identify the causal effect of X on the dependent variable, Y. This correlation ensures that Z affects Y through its impact on X (Wooldridge, 2020).

Given the limited literature on FDI and natural resource rents, we lack established instruments for FDI specifically in this context. Studies of the impact of FDI on economic growth used different instruments for FDI, such as the real exchange rate (Alfaro et al., 2004), country size (Borensztein et al. 1998), political stability (Borensztein et al. 1998), and institutional quality (Borensztein et al. 1998). The fundamental problem is that those instruments are not suitable for our study, as they are likely to have a direct effect on natural resource rents apart from their influence on FDI and to thereby violate the exclusion restriction. As such, we propose two new instruments for FDI. While these instruments are not yet established in the literature, we use statistical tests to demonstrate that their validity cannot be rejected. Additionally, we provide a qualitative justification below of how they satisfy the assumptions of the instrumental variable approach.

**Figure 8: Assumptions of the instrumental variable approach**




Note: We represent graphically the two assumptions of the instrumental variable approach: exclusion restriction (first assumption) and relevance (second assumption).

The two IVs used in our study are:

1. **Air transport: total air passengers carried**, including both domestic and international passengers of air carriers registered in the country. Firstly, we believe this IV satisfies the relevance assumption because countries with greater air traffic tend to be more accessible and connected internationally, making them more attractive destinations for FDI. Investors are more likely to invest in countries where they can easily travel for business, establish operations, and maintain connections with their home countries and other markets. The frequency of air travel often reflects the level of international business activity, tourism, and overall economic openness, all of which can attract FDI. Higher levels of tourism and business travel can imply a larger client base for foreign businesses, offering greater market potential which makes it easier for foreign investors to operate. Secondly, while air transport may facilitate FDI, it is unlikely to violate the exclusion restriction by directly influencing the income derived from natural resources. While one may argue that an increase in air transport passengers is an indicator of better infrastructure, which can directly impact natural resource rents, changes in air transport travel usually result from non-infrastructure-related factors, such as a global pandemic or changes in tourism trends, which affect air passenger travel, and consequently FDI, without directly influencing natural resource rents. This makes air transport a suitable IV as it allows us to capture variations in FDI that are exogenous to the natural resource sector itself.

   **Total armed forces personnel**. Firstly, the presence of armed forces personnel is likely correlated with FDI because an increased military presence signals a stable and secure environment, making a country more attractive to foreign investors seeking secure and reliable investment opportunities. Secondly, the total number of armed forces personnel is unlikely to have a direct influence on natural resources rents, satisfying the exclusion restriction. While one might argue that military presence could enhance the security of natural resource extraction and thus impact rents, the number of armed forces personnel is determined by broader national defense policies and geopolitical concerns, which tend to be independent of the specific economic outcomes related to natural resource revenues. Therefore, using armed forces personnel as an IV helps address endogeneity by isolating the impact of FDI on natural resource rents from confounding factors.

Initially, we estimate Equation 1 using an Ordinary Least Squares (OLS) method and controlling for fixed and time effects. OLS estimates the parameters of a linear regression model and aims to minimize the sum of squared residuals. We address unobserved heterogeneity using fixed effects at the regional level, which removes the influence of unobserved time-invariant regional characteristics instead of leaving such factors in the error term, alleviating endogeneity resulting from time-invariant omitted variables that may be correlated with the explanatory variables (Wooldridge, 2020). Additionally, controlling for time effects allows us to address omitted variable bias that arises from leaving out unobserved factors in the error term that change over time but remain constant across different entities, such as global economic trends (Wooldridge, 2020). By addressing both regional and time effects, our model seeks to mitigate endogeneity concerns arising from both time-invariant and time-variant omitted variables respectively, ensuring more reliable findings of the impact of FDI on natural resource rents.

In our second specification, we employ a Two-Stage Last Squares (2SLS) strategy with our IVs. We also control for fixed and time effects in this second specification, but IVs help address the potential endogeneity that can persist even after controlling for fixed and time effects, as there may remain omitted variables that influence both FDI and the dependent variable. By incorporating IVs, we seek to isolate exogenous variations in FDI that are not correlated with these omitted variables, allowing for a more accurate estimation of the impact of FDI on natural resource rents. In the first stage, we regress the endogenous variable, FDI, on each IV and control variables to identify the exogenous portion of FDI that is uncorrelated with the error term. This first step shows results for each IV separately, allowing us to assess the relevance assumption through the statistical significance of the coefficient of each IV and evaluate the strength of each IV in explaining FDI variation. In the second stage, we use the predicted FDI values from the first stage to evaluate their impact on the dependant variable. Showing the results for the IVs together in this step allows us to evaluate the significance of the overall influence of the IVs on natural resource rents.

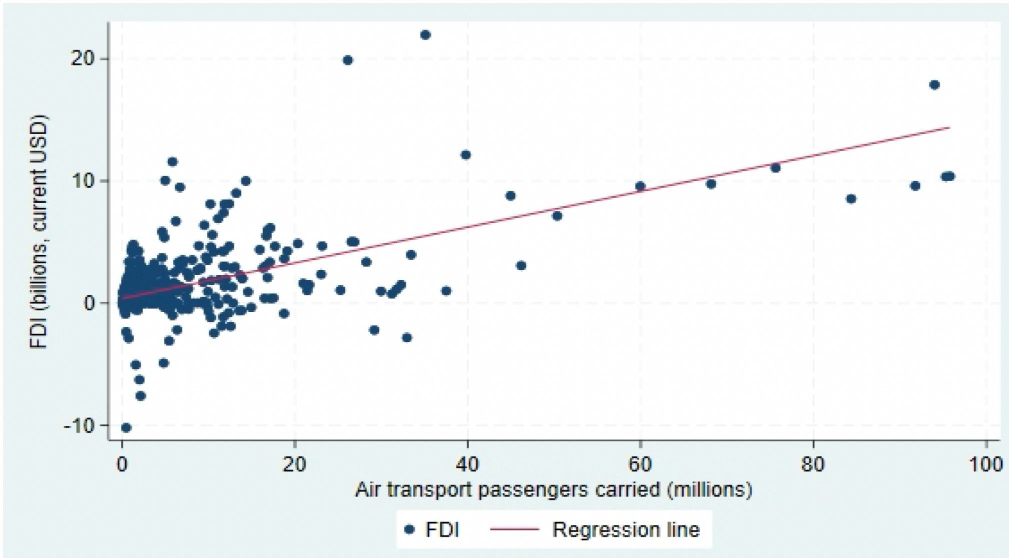
In our third specification, we use 2SLS with the same IVs, controlling again for regional and time effects, but we incorporate one-period lags on our IVs. This enhances the exogeneity of our IVs as it ensures they are not influenced by current fluctuations in natural resource rents, which would create a problem of endogeneity since instruments should only affect natural resource rents through FDI and not through any direct effect or correlation with the error term (exclusion restriction). This temporal adjustment strengthens the validity of our instrumental variable strategy, minimizing potential biases from contemporaneous relationships between FDI and our IVs.

In our fourth specification, we tackle endogeneity beyond the use of 2SLS by employing the Generalized Method of Moments in dynamic panel system (System GMM). System GMM not only addresses unobserved heterogeneity but also corrects endogeneity arising from reverse causality, omitted variables, and measurement errors. Unlike 2SLS, system GMM corrects for endogeneity across all endogenous explanatory variables simultaneously (Blundell and Bond, 1998; Asiedu and Lien, 2011). This is achieved using lagged levels and differences of the variables and combining the original levels equation with its first-differenced version to form a system of equations. By incorporating both levels and first differences of the variables, system GMM helps mitigate problems associated with weak or poor instruments and takes advantage of the additional moment conditions to improve the efficiency and consistency of parameter estimates, thereby potentially providing more efficient estimates than 2SLS. Additionally, we continue to include regional and time effects. This methodological framework ensures a comprehensive analysis that captures both the dynamic and structural dimensions of the relationship between FDI and natural resource rents, offering nuanced insights that surpass the capabilities of 2SLS models alone. Our fifth specification only differs from the fourth in the addition of one-period lags on IVs, which further enhances the exogeneity of our instruments for FDI.

To evaluate the validity of our IVs, we employ the Hansen overidentification test. This test is preferred over the Sargan one due to its robustness to heteroskedasticity, which is common in panel data analysis. The joint null hypothesis affirms that the instruments are valid, meaning they are uncorrelated with the error term and appropriately excluded from the estimated equation. Under this null hypothesis, the test statistic follows a chi-squared distribution based on the number of overidentifying restrictions. We consider our instruments valid if the p-value of the Hansen test exceeds 10%, implying we can’t reject the null hypothesis of instrument validity (Hayashi, 2000).

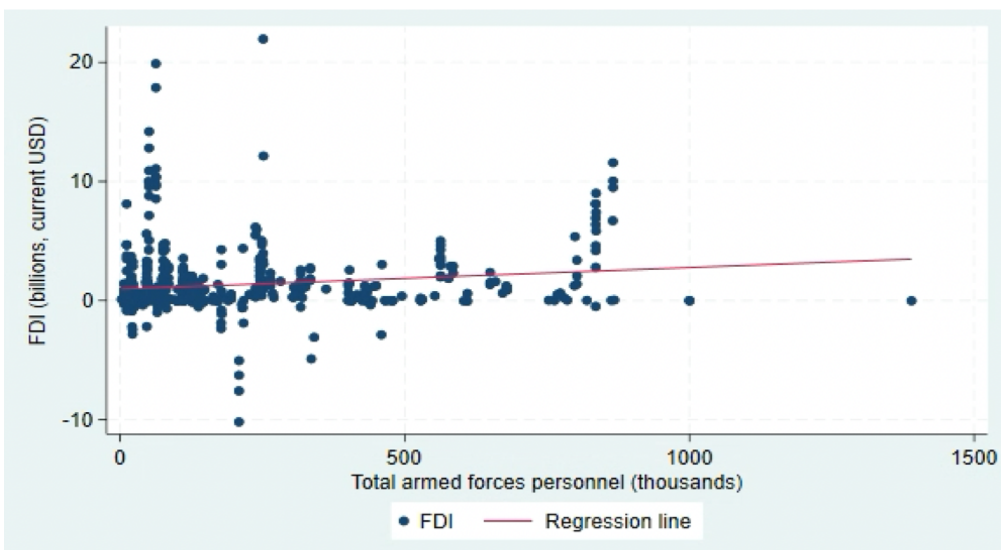
We also look at the Anderson-Rubin Wald test which provides robust inference against weak instruments for testing the significance of endogenous regressors. It estimates the structural equation using all instruments as regressors and tests the null hypothesis that the coefficients of the excluded instruments are jointly zero and that the overidentifying restrictions are valid. We interpret the results of this test by examining the reported test statistic, which is compared against critical values from the chi-squared distribution. We look at the p-value of Anderson Rubin chi-squared test of endogenous regressors. A low p-value implies rejection of the null hypothesis, indicating that the instruments are likely valid (i.e., not correlated with error term) and relevant (i.e., they help explain FDI). This statistic follows a chi-squared distribution with k degrees of freedom, where k is the number of instruments. It is valuable because has properties that are unaffected by weak instruments, the exclusion of relevant instruments, and distribution errors in its reduced form when there are endogenous explanatory variables (Dufour, 2003).

**Figure 9: Graphic representation of relation between FDI and IV1**




Note: We plot air passengers measured in millions on FDI in billions of current USD across our 19 countries between 1985 and 2020. The red line represents a fitted OLS regression. Source: Author's calculations based on data from the World Bank and multiple sources compiled by World Bank, including International Civil Aviation Organization.

**Figure 10: Graphic representation of relation between FDI and IV2**




Note: We plot armed forces personnel measured in thousands on FDI in billions of current USD across our 19 countries between 1985 and 2020. The red line represents a fitted OLS regression. Source: Author's calculations based on data from the World Bank and multiple sources compiled by World Bank, including International Institute for Strategic Studies.

Lastly, we use the first-stage F-test of excluded instruments to gauge the collective validity of the instruments as a group. This test evaluates whether the excluded instruments jointly contribute significant explanatory power beyond what is explained by the included variables in our model. A F-statistic greater than 10 suggests that the set of IVs collectively strengthens the model's explanatory ability (Staiger and Stock, 1997). A positive result here reinforces the robustness of our instrumental variable strategy, indicating that the instruments chosen contribute meaningfully to our understanding of the relationship between FDI and natural resource rents.

Figures 9 and 10 show graphic depictions of the association between FDI and IV1, as well as FDI and IV2, respectively. The positive slopes of the regression lines confirm that FDI exhibits a positive relationship with both IV1 and IV2, albeit a more noteworthy one with IV1. This analysis aims to preliminary assess whether our IVs satisfy the relevance assumption.

However, this analysis highlights correlation rather than causation. In the next chapter, we will employ the mentioned econometric models and statistic tests to analyze the validity of our instruments and rigorously test the validity of our hypothesis.

# Chapter 4: Results

In this chapter, we present the results of the empirical analysis conducted to examine the impact of FDI on natural resource rents in the MENA region. The findings from various specifications, including OLS, 2SLS, and GMM with both lagged and non-lagged IVs, are discussed. We also explore the impacts of FDI on the different types of natural resources separately to provide a comprehensive view of the relationship between FDI and natural resource reliance. Lastly, we will examine how the relationship between FDI and natural resource rents varies for RD countries.

## 4.1 Main results

The regression results from Equation 1 are presented in table 2. The IVs used for FDI are air transport passengers and total armed forces personnel. Column 1 displays the results of our first model: an OLS regression with regional and time effects. Columns 2 and 3 correspond to the 2SLS model, incorporating our two IVs, with Column 3 applying a one-period lag to these IVs. Both models account for regional and time effects. Columns 4 and 5 present the results from our GMM system model, again using the same IVs, with Column 5 also incorporating a one-period lag for the IVs, while maintaining regional and time effects.

The results suggest that FDI tends to reduce natural resource reliance in the MENA region. Across all models, the coefficient for FDI is negative, and it is statistically significant in all but the first model, which is less reliable due to the endogeneity issues previously discussed when using FDI. In model 1, a $1 billion increase in FDI is associated with a 0.2 percentage point decrease in natural resource rents as a percentage of GDP, or a 1.2 decrease in natural resource rents as a percentage of GDP relative to the mean resource rent dependency of 19.4%[7]. Scaling this result to a smaller and more realistic change, a $100 million increase in FDI is associated with a 0.12 decrease in natural resource rents as a percentage of GDP. However, this result is not statistically significant (p-value = 0.369), indicating that we cannot confidently assert an impact of FDI on natural resource rents in this model. By contrast, Models 2-5 reveal a highly significant negative effect of FDI on natural resource rents, showing that a $1 billion increase in FDI is associated with a 1.3, 1.4, 1.3, and 1.4 percentage point decrease, respectively, or a 6.7, 7, 6.7 and 7 decrease in natural resource rents as a percentage of GDP respectively relative to the mean resource rent dependency.[8] In a smaller scale, $100 million increase in FDI is associated with a 0.13, 0.14, 0.13 and 0.14 decrease in natural resource rents as a percentage of GDP in Models 2-5 respectively. These results are statistically significant at the 1% level (p-value = 0.000), representing a robust and significant negative relationship between FDI and natural resource rents as a share of GDP.

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[7] This number was calculated by dividing the decrease of 0.243 percentage points by the mean resource rent dependency of 19.442% and multiplying by 100.

[8] These numbers are calculated by dividing the decrease of 1.303, 1.370, 1.296, and 1.370 percentage point respectively by the mean resource rent dependency of 19.442% and multiplying by 100.

The validity of the instruments across columns 2-5 can be assessed with the F-test of excluded instruments, the Hansen J test, and the Anderson-Rubin test. Firstly, the F-test of excluded instruments is crucial for assessing the strength of the instruments. A general rule of thumb is that an F-test value above 10 indicates that the instruments are sufficiently relevant. In this case, models 2, 3, 4 and 5 record an F-test value of excluded instruments of 47.9, 39.6, 47.9, and 39.6, respectively. All these values significantly exceed the threshold of 10, suggesting that the instruments used in models 2-5 are robust and relevant. Further, the Hansen J test evaluates the validity of the instruments by testing the null hypothesis that the instruments are uncorrelated with the error term, with high p-values indicating that we cannot reject this null hypothesis and that the instruments are likely valid. In 2SLS and GMMS models without lagged IVs, the Hansen J test p-value is 0.7, while in 2SLS and GMMS models with lagged IVs, it is 0.9. Since these p-values are all well above the typical significance level of 0.10, there is no evidence that they are correlated with the error term, suggesting that the instruments are valid across all these models. Lastly, the Anderson-Rubin Wald test checks that the instruments are correlated with the endogenous regressor and that the overidentifying restrictions are valid. For all models (2-5), the A-R Wald test p-value is virtually 0, suggesting that the instruments are relevant and valid.

The similarity in the FDI coefficients and tests mentioned above between the 2SLS and GMMS models 2 and 4 (without IV lags) and between the 2SLS and GMMS models 3 and 5 (with IV lags) is likely attributed to the use of the same IVs, the presence of strong instruments, and the consistent model specifications. If the IVs used are relevant and valid, both 2SLS and GMM would yield similar coefficients for FDI because, in the presence of strong instruments, both methods should consistently estimate the true causal effect of FDI on natural resource rents. GMMS is often used because it is more efficient than 2SLS when there are multiple instruments and heteroskedasticity in the error term. However, when the model is well-specified and the instruments are strong, the efficiency gains of GMM over 2SLS may not lead to significantly different coefficient estimates.

Overall, the results consistently show that an increase in FDI leads to a decrease in natural resource rents. The combination of F-test values of excluded instruments and p-values for A-R and Hansen J tests in models 2-5 indicates that the instruments are both relevant and valid. The robustness and consistency of the results across different estimation methods suggests that the negative impact of FDI on natural resource rents is a reliable finding, unaffected by the choice of estimation method.

Regarding the control variables, the results are overall aligned with our coefficient expectations. As predicted, an increase in the urban population by 1% of the total population is associated with a positive increase in natural resource rents as a percentage of GDP across all models. Specifically, it corresponds to an increase of 0.1 percentage points in models with lagged IVs, with similar results for models without lags and the OLS model, albeit the latter shows less statistical significance. This could be attributed to the concentration of industrial activities in urban areas which drive up resource consumption. Consistent with our expectations as well, an increase in private credit is associated with higher natural resource rents in most models, but the coefficients' lack of statistical significance suggests that the effect may not be strongly supported.

**Table 2: Impact of FDI on natural resource rents**

| **Dependant variable:** | **OLS** | **2SLS** | | **GMM System** | |
|---|---|---|---|---|---|
| **Natural resource rents** | (1) | (2) | (3) | (4) | (5) |
| **FDI** | **-0.243** | **-1.303***** | **-1.370***** | **-1.296***** | **-1.370***** |
| | **(0.369)** | **(0.000)** | **(0.000)** | **(0.000)** | **(0.000)** |
| Urbanization rate | 0.168 | 0.103* | 0.095* | 0.102* | 0.095* |
| | (0.053) | (0.017) | (0.030) | (0.018) | (0.029) |
| Agriculture VA | 0.282 | 0.258*** | 0.245*** | 0.256*** | 0.246*** |
| | (0.061) | (0.000) | (0.001) | (0.000) | (0.001) |
| Industry VA | 1.022*** | 0.958*** | 0.949*** | 0.962*** | 0.948*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Exports | 0.085 | 0.127** | 0.140*** | 0.121** | 0.142*** |
| | (0.356) | (0.002) | (0.001) | (0.001) | (0.000) |
| Polity score | 0.362 | 0.311*** | 0.291** | 0.310*** | 0.291** |
| | (0.058) | (0.001) | (0.001) | (0.001) | (0.001) |
| GFCF | 0.068*** | 0.101*** | 0.105*** | 0.100*** | 0.105*** |
| | (0.001) | (0.000) | (0.000) | (0.000) | (0.000) |
| Inflation | 0.030 | 0.041* | 0.050** | 0.041* | 0.050** |
| | (0.344) | (0.024) | (0.009) | (0.025) | (0.009) |
| Private credit | -0.001 | 0.005 | 0.008 | 0.006 | 0.008 |
| | (0.955) | (0.652) | (0.439) | (0.588) | (0.441) |
| Age dependency | 0.245* | 0.207*** | 0.211*** | 0.205*** | 0.211*** |
| | (0.028) | (0.000) | (0.000) | (0.000) | (0.000) |
| Obs. | 414 | 377 | 364 | 377 | 364 |
| R2 | | 0.870 | 0.875 | 0.870 | 0.875 |
| F test | | 79.011 | 78.865 | 79.064 | 78.876 |
| F test excluded instruments | — | 47.864 | 39.633 | 47.864 | 39.633 |
| One-period lag on IVs | — | No | Yes | No | Yes |
| Hansen test (p-value) | — | 0.711 | 0.925 | 0.711 | 0.925 |
| A-R Wald test (p-value) | — | 0.000 | 0.000 | 0.000 | 0.000 |

Note: P-values, based on robust standard errors, are presented in parentheses. Significance levels are indicated as follows: * for $p < 0.05$, ** for $p < 0.01$, *** for $p < 0.001$. FDI is instrumented with IV1 (total air passengers carried) and IV2 (total armed forces personnel) in columns 2-5. All specifications control for time and regional effects and encompass the period 1985-2020. The A-R Wald test refers to the Anderson-Rubin Wald test, which assesses instrument relevance and validity. The F-test of excluded instruments evaluates instrument relevance, while the Hansen test examines instrument validity.

As anticipated, an increase of 1 billion units in GFCF is associated with a statically significant increase in natural resource rents as a percentage of GDP across all models by approximately 0.1. This indicates that higher investments in infrastructure and capital assets tend to increase natural resource reliance. The positive relationship suggests that investments in fixed capital may enhance the resource extraction efficiency, leading to greater reliance on natural resources. Further, an increase in the democracy score by 1 point is associated with a positive increase in natural resource rents across all models, although the OLS model does not show significance. The coefficients are approximately 0.3 for 2SLS and GMMS models. As predicted, higher democracy levels tend to increase natural resource rents, likely due to improved management of resources and investor confidence resulting from better governance quality.

Regarding exports, the results suggest that a 1% increase in exports as a percentage of GDP leads to a statistically significant increase in natural resource rents by 0.1 percentage points approximately for 2SLS and GMMS models. The OLS model also shows a positive, though not statistically significant, coefficient. As expected, higher export activity is positively associated with natural resource rents. This result might reflect how increased exports can drive higher demand and prices for resources, or it could be due to the presence of a strong economic focus on resource-intensive sectors contributing to exports.

However, some results are less aligned with our initial expectations. Table 2 shows that the inflation coefficient is positive in all models, albeit non-significant in the OLS model. The coefficients are virtually 0 in models without IV lags and around 0.1 in models with IV lags. This could be attributed to rising prices boosting the value of resources on the global market, potentially offsetting higher operational costs and affecting overall revenue positively, and to the tendency of countries to increase their reliance on natural resource income as a buffer against the economic uncertainties and revenue pressures associated with higher inflation. Further, table 2 reveals a positive coefficient of around 0.2 for the age dependency ratio, while we expected a negative relationship. This suggests that countries with higher age dependency ratios might be compensating for the reduced labor force availability by increasing their reliance on natural resource rents to offset the economic pressures from a higher non-working population, thereby increasing revenue for social services and welfare systems.

Lastly, on sectoral composition variables, the industry VA as a % of GDP is associated with a statistically significant increase in natural resource rents across all models. The increase is of around 1 percentage point for models without lags and OLS, similar to results for models with lags (0.9). This suggests that the positive impact of a more industrialized economy, which can increase efficiency and investment in resource extraction, outweighs any potential negative effect on natural resources resulting from a shift away from natural resource sectors towards technology-driven industries. As such, greater industrial activity tends to increase demand for resources in industrial processes, driving up their value and associated rents, and efficiency. Similarly, an increase in agriculture, forestry, and fishing VA by 1% of GDP is associated with a statistically significant increase in natural resource rents as a percentage of GDP of about 0.3 percentage points for models without IV lags, with similar results for models with lags. This indicates that growth in these sectors, which are intrinsically linked to natural resource utilization, is positively related to increased natural resource rents, and suggests that the positive impact of these sectors on resource rents outweighs the potential risks associated with overexploitation and resource depletion.

## 4.2 Impact of FDI on different types of natural resource rents

Differentiating between various types of natural resources can provide valuable insights and nuance into the impact of FDI on natural resource rents. Table 3 presents sectoral analysis results, where the dependent variable in Equation 1 is broken down into oil, coal, forest, mineral, and natural gas rents as a percentage of GDP in columns 1 through 5, respectively. Table 3 focuses exclusively on one model specification per column: 2SLS with lagged IVs, with regional and time effects. This model, along with GMMS with lagged IVs, demonstrated the best results according to the findings in Table 2. We are using the same IVs as we did in 4.1.

The results strongly indicate that FDI tends to reduce oil resource dependency in the MENA region. The negative coefficient for FDI is statistically significant, with column 1 showing that a $1 billion increase in FDI is associated with a 1.4 percentage point decrease in oil rents as a percentage of GDP, or an 8% decrease in natural resource rents as a percentage of GDP relative to the mean oil rent dependency of 17.3%[9]. In a smaller scale, a $100 million increase in FDI is associated with a 0.14 decrease in oil rents as a percentage of GDP. This result is significant with a p-value of virtually 0, highlighting a significant negative relationship between FDI and oil rents. This coefficient is comparable to the effect of FDI on total resource rents from the equivalent 2SLS model with lagged IVs presented in Table 2 (approximately -1.4) and aligns with descriptive statistics in table 1 showing that oil rents are a substantial component of total resource rents. The robustness of column 1 is supported by the F-test value of excluded instruments of 39.6 exceeding the threshold of 10, indicating that the instruments used are relevant. Additionally, the Hansen J test p-value of around 0.3 is well above the conventional significance level of 0.10, suggesting that the instruments are valid, and the A-R Wald test p-value of virtually 0 implies that the instruments are likely valid and relevant.

Column 5 reveals a negative coefficient for FDI, suggesting that increased FDI is associated with a reduction in natural gas rents. Specifically, a $1 billion increase in FDI corresponds to a 0.2 percentage point decrease in natural gas rents as a percentage of GDP, with this effect being statistically significant at the 1% level. Alternatively, a $100 million increase in FDI is associated

[9] This number was calculated by dividing the decrease of 1.385 percentage points by the mean oil rent dependency of 17.317% and multiplying by 100.

with a 0.02 decrease in natural gas rents as a percentage of GDP. The F-test value of excluded instruments (39.6) and the A-R Wald test p-value of nearly 0 indicate that the instruments are relevant and valid. However, the Hansen J p-value, which is virtually 0, raises concerns about the exogeneity of the instruments, casting doubt on the reliability of the estimates.

**Table 3: Impact of FDI on the rents of different types of natural resource**

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| **Dependant variable:** | **Oil rents** | **Coal rents** | **Forest rents** | **Mineral rents** | **Natural gas rents** |
| **FDI** | **-1.385*** ** | **0.027** | **0.000** | **0.227** ** | **-0.239*** ** |
| | **(0.000)** | **(0.140)** | **(0.978)** | **(0.010)** | **(0.000)** |
| Urbanization rate | 0.084 | 0.002 | 0.000 | 0.032** | -0.023*** |
| | (0.077) | (0.417) | (0.843) | (0.006) | (0.000) |
| Agriculture VA | 0.132 | 0.037*** | 0.002 | 0.084** | -0.010 |
| | (0.087) | (0.000) | (0.641) | (0.007) | (0.356) |
| Industry VA | 0.849*** | 0.024*** | 0.001 | 0.057** | 0.019* |
| | (0.000) | (0.000) | (0.683) | (0.004) | (0.035) |
| Exports | 0.123** | 0.003 | 0.003 | 0.000 | 0.012* |
| | (0.002) | (0.242) | (0.099) | (0.965) | (0.047) |
| Polity score | 0.257** | 0.020** | -0.012 | 0.020 | 0.006 |
| | (0.007) | (0.002) | (0.073) | (0.611) | (0.738) |
| GFCF | 0.095*** | 0.002 | 0.001 | 0.001 | 0.006 |
| | (0.000) | (0.078) | (0.235) | (0.755) | (0.075) |
| Inflation | 0.055** | -0.003** | -0.001 | -0.010 | 0.009*** |
| | (0.004) | (0.002) | (0.548) | (0.066) | (0.000) |
| Private credit | -0.066*** | 0.018*** | 0.004*** | 0.060*** | -0.008*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Age dependency | 0.131** | 0.020*** | 0.014*** | 0.102*** | -0.057*** |
| | (0.004) | (0.000) | (0.000) | (0.000) | (0.000) |
| Obs. | 364 | 364 | 364 | 364 | 364 |
| R2 | 0.843 | 0.729 | 0.530 | 0.597 | 0.440 |
| F test | 53.621 | 4.595 | 8.503 | 3.090 | 7.588 |
| F test excluded instruments | 39.633 | 39.633 | 39.633 | 39.633 | 39.633 |
| One-period lag on IVs | Yes | Yes | Yes | Yes | Yes |
| Hansen test (p-value) | 0.280 | 0.054 | 0.427 | 0.537 | 0.000 |
| A-R Wald test (p-value) | 0.000 | 0.033 | 0.721 | 0.022 | 0.000 |

Note: P-values, based on robust standard errors, are presented in parentheses. Significance levels are indicated as follows: * for $p < 0.05$, ** for $p < 0.01$, *** for $p < 0.001$. The dependant variable for columns 1-5 is oil, coal, forest, mineral and natural gas rents as percentage of GDP, respectively. FDI is instrumented with IV1 (total air passengers carried) and IV2 (total armed forces personnel) in columns 1-5. All specifications employ a 2SLS approach with a one-period lag on IVs, control for time and regional effects, and encompass the period 1985-2020. The A-R Wald test refers to the Anderson-Rubin Wald test, which assesses instrument relevance and validity. The F-test of excluded instruments evaluates instrument relevance, while the Hansen test examines instrument validity.

Columns 2 and 4 reveal a positive effect of FDI on coal and mineral rents, contrasting with the negative coefficients observed for oil, natural gas, and total natural resource rents. A $1 billion increase in FDI is associated with a positive but negligible (virtually zero) increase in coal rents, while it is associated to a 0.2 percentage point increase in mineral rents (or, in smaller scale, a $100 million increase in FDI is associated with a 0.02 increase in mineral rents as a percentage of GDP). While the effect on coal rents is not statistically significant, the increase in mineral rents is significant at the 1% level. F-tests for excluded instruments provide robust results for both columns, with values of 39.6, indicating that the instruments are relevant. A-R Wald test results further support this, with p-values of nearly 0, rejecting the null hypothesis that the coefficients of the endogenous variables are jointly equal to zero at the 5% level. The Hansen J test, however, is only solid for column 4 (0.5), but it takes a lower value for column 2 closer to 0 that can still be enough to fail to reject the null hypothesis of non-correlation with error term if we consider a significance level of 0.05, as done in some studies.

Lastly, the effect of FDI on forest rents seems to be neither positive nor negative as the coefficient is null, albeit being statistically insignificant. The F-test for excluded instruments and the Hansen J test p-value are robust, with values of 39.6 and 0.4, respectively. However, the A-R Wald test shows a p-value of 0.7, indicating weaker support for the validity and relevance of the instruments in this test.

Regarding control variables, the coefficient signs are largely consistent across columns 1-5 and align overall with the findings in table 2 for total natural resource rents. However, there are notable exceptions. In column 5, urbanization, agriculture VA, private credit, and age dependency all show a negative sign, contrary to the positive signs observed in the other columns and in table 2. Additionally, the Polity score exhibits a negative sign at the 8% significance level in column 3, despite being positive in other columns of table 3 and all columns in table 2. Interestingly, inflation displays a negative coefficient in columns 2, 3, and 4, with the result being statistically significant in columns 2 and 4, at the 2% and 7% levels, respectively. However, the coefficient is positive in columns 1 and 5 as well as in all columns of table 2. This suggests that the impact of inflation on natural resource rents might vary depending on the specific resource being analyzed.

Furthermore, while private credit shows an overwhelmingly positive but not significant effect in table 2, it shows a negative and statistically significant coefficient in column 1 (oil rents) at the 1% level in table 3. The overall effect observed in table 2 might be driven by the positive effects on other types of natural resources. If private credit has a positive impact on rents from resources other than oil, this could offset the negative effect observed for oil rents, leading to an overall positive but not significant effect on total resource rents. This finding challenges the intuition that a more developed financial sector should positively impact resource rents by facilitating investment in resource exploration and technological advancements, which are expected to enhance resource extraction efficiency and profitability.

## 4.3 Impact of FDI on natural resource rents for resource-dependent countries

This study also offers to fill a literature gap by examining the effect of FDI on natural resource rents on RD countries specifically, an angle of the FDI-natural resource rents relationship which has yet to be explored to our knowledge. As previously defined, RD countries are those with average natural resource rents equal to or exceeding 10% of GDP during the period 1985-2020. Although Egypt had an average of 9.8% of GDP, we decided to include it as an RD country to avoid missing out on a country that is very close to the threshold but might exhibit significant characteristics of resource dependence.

The regression results for Equation 2 are presented in table 4. The IVs used for FDI are the same as those used in previous sections. Table 4 displays the same models as in table 2, starting with an OLS specification with regional and time effects in column 1. Columns 2 and 3 show results for a 2SLS model accounting for regional and time effects, with column 3 applying a one-period lag to the instrument. Lastly, columns 4 and 5 reflect a GMM system model which also includes regional and time effects, with column 5 introducing a one-period lag for the instruments.

Our analysis reveals results which contrast with our initial findings regarding the impact of FDI on natural resources. Indeed, table 4 shows that the FDI coefficients are positive and significant, indicating a different dynamic. The FDI coefficients indicate that a $1 billion increase in FDI corresponds to an increase in natural resource rents as a percentage of GDP by approximately 2.8, 2.3, 2, 2.3, and 1.9 percentage points in Columns 1, 2, 3, 4, and 5, respectively, or a 14.6, 11.8, 10.3, 11.7 and 10 increase in natural resource rents as a percentage of GDP respectively relative to the mean resource rent dependency.[10] These coefficients are significant at the 1% level in columns 1, 2, and 4, and at the 5% level in columns 3 and 5. In a smaller and more realistic scale, a $100 million increase in FDI is associated with a 0.28, 0.23, 0.2, 0.23, and 0.19 increase in natural resource rents as a percentage of GDP. This suggests that in general, an increase in FDI is associated with an increase in natural resource rents. However, the interaction coefficients between FDI and resource dependency are consistently negative and statistically significant at the 1% level across all models, including the least reliable, OLS. These coefficients indicate that the positive effect of FDI on natural resource rents diminishes in RD countries by 3.2, 4, 3.7, 3.9, and 3.6 percentage points of natural resource rents as a percentage of GDP in columns 1 to 5, respectively.

[10] These numbers are calculated by dividing the increase of 2.837, 2.286, 1.995, 2.274, and 1.943 percentage point respectively by the mean resource rent dependency of 19.442% and multiplying by 100.

As such, for RD countries, the beneficial marginal impact of FDI inflows on natural resource rents decreases and even becomes negative, due to the coefficients of the interaction effect being greater in size than the non-interacted FDI coefficient for all models. In other words, while FDI increases

**Table 4: Impact of FDI on natural resource rents for resource dependent countries**

| **Dependant variable:** | **OLS** | **2SLS** | | **GMM System** | |
|---|---|---|---|---|---|
| **Natural resource rents** | (1) | (2) | (3) | (4) | (5) |
| **FDI** | **2.837*** ** | **2.286** ** | **1.995*** | **2.274** ** | **1.943*** |
| | **(0.000)** | **(0.009)** | **(0.018)** | **(0.008)** | **(0.020)** |
| **(FDI)*(dependency** | **-3.242*** ** | **-3.961*** ** | **-3.672*** ** | **-3.947*** ** | **-3.603*** ** |
| **dummy)** | **(0.000)** | **(0.000)** | **(0.000)** | **(0.000)** | **(0.000)** |
| Dependency dummy | 8.986*** | 9.559*** | 8.627*** | 9.551*** | 8.560*** |
| variable | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Urbanization rate | 0.241*** | 0.156*** | 0.141*** | 0.157*** | 0.142*** |
| | (0.001) | (0.000) | (0.001) | (0.000) | (0.001) |
| Agriculture VA | 0.419*** | 0.390*** | 0.382*** | 0.391*** | 0.387*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Industry VA | 0.905*** | 0.834*** | 0.848*** | 0.834*** | 0.847*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Exports | 0.122 | 0.187*** | 0.192*** | 0.187*** | 0.192*** |
| | (0.073) | (0.000) | (0.000) | (0.000) | (0.000) |
| Polity score | 0.307* | 0.220* | 0.232** | 0.222* | 0.239** |
| | (0.035) | (0.015) | (0.007) | (0.011) | (0.004) |
| GFCF | 0.062** | 0.104*** | 0.108*** | 0.104*** | 0.107*** |
| | (0.003) | (0.000) | (0.000) | (0.000) | (0.000) |
| Inflation | 0.041 | 0.056** | 0.060** | 0.055** | 0.058** |
| | (0.147) | (0.003) | (0.002) | (0.003) | (0.002) |
| Private credit | -0.021 | -0.016 | -0.009 | -0.016 | -0.009 |
| | (0.230) | (0.189) | (0.416) | (0.183) | (0.416) |
| Age dependency | 0.251** | 0.203*** | 0.200*** | 0.203*** | 0.200*** |
| | (0.007) | (0.000) | (0.000) | (0.000) | (0.000) |
| Obs. | 414 | 377 | 364 | 377 | 364 |
| R2 | | 0.884 | 0.886 | 0.884 | 0.887 |
| F test | | 77.385 | 80.153 | 81.371 | 84.578 |
| F test excluded instruments | — | 30.108 | 24.934 | 30.108 | 24.934 |
| One-period lag on IVs | — | No | Yes | No | Yes |
| Hansen test (p-value) | — | 0.996 | 0.874 | 0.996 | 0.874 |
| A-R Wald test (p-value) | — | 0.000 | 0.000 | 0.000 | 0.000 |

Note: P-values, based on robust standard errors, are presented in parentheses. Significance levels are indicated as follows: * for $p < 0.05$, ** for $p < 0.01$, *** for $p < 0.001$. FDI is instrumented with IV1 (total air passengers carried) and IV2 (total armed forces personnel) in columns 2-5. All specifications control for time and regional effects and encompass the period 1985-2020. The A-R Wald test refers to the Anderson-Rubin Wald test, which assesses instrument relevance and validity. The F-test of excluded instruments evaluates instrument relevance, while the Hansen test examines instrument validity.

natural resource rents for non-RD countries, its effect is negative in RD countries. This result contradicts our hypothesis regarding the impact of FDI on RD countries, as we initially posited that FDI would exacerbate resource reliance for countries which are RD.

While this finding may seem counterintuitive, it can be attributed to many factors. Since FDI is often directed toward resource extraction industries in RD countries, it could be that natural resources are depleted faster than they can regenerate if extraction practices are unsustainable or if resources are over-exploited by foreign investors. Further, governance and institutional capacity tend to be weaker in many resource-rich countries, which makes FDI regulation more difficult and can potentially lead to corruption and misallocation of revenues by FDI, or to poor contract terms that favor foreign investors at the expense of national revenues. Another explanation could be that FDI crowds out domestic investors, limiting the development of local industries. This can reduce the country's ability to capture significant resources rents as the profits go to foreign firms.

Intuitively, we observe that resource dependence has a positive and statistically significant impact on natural resource rents. Being a RD country is associated with increases in total natural resource rents by nearly 9, 9.6, 8.6, 9.6 and 8.6 percentage points of GDP in Columns 1, 2, 3, 4, and 5, respectively. All these coefficients are statistically significant at the 1% level.

Overall, these results consistently suggest that FDI positively impacts natural resource rents in non-RD countries and negatively in RD countries. The robustness of the results across different estimation methods suggests that this finding is reliable and unaffected by the estimation method. Indeed, the combination of high F-test values, low A-R Wald p-values results, and high Hansen J p-values across columns 2-5 indicates that the instruments are likely both valid and relevant.[11]

Regarding the control variables, our findings are largely consistent with the results presented in table 2. An increase in the urban population by 1% corresponds to a rise in natural resource rents as a percentage of GDP, with increases ranging from 0.1 to 0.2 across all models. An additional 1 billion USD of GFCF is associated with an increase in natural resource rents of around 0.1 across models, suggesting again that higher investments in fixed capital may improve resource management efficiency. Moreover, a 1-point increase in the democracy score is linked to a rise in natural resource rents by approximately 0.2 to 0.3 percentage points, demonstrating that greater levels of democracy are associated with greater resource rents. In terms of exports, a 1% increase in exports as a percentage of GDP leads to an increase in natural resource rents by around 0.1 to 0.2 percentage points. Similarly, a 1% rise in inflation is associated with a positive, albeit minor,

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[11] In Table 4, the F test of excluded instruments takes a value of 30.1, 24.9, 30.1 and 24.9 for columns 2-5 respectively. Since all these values significantly exceed the threshold of 10, it suggests that the instruments used in Models 2-5 are robust and relevant. Further, high Hansen J test p-values suggest that the instruments are likely valid. In 2SLS and GMMs models without lagged IV, the Hansen J test p-value is nearly 1, and in 2SLS and GMMS models with lagged IVs, the Hansen J test p-value is 0.9. These p-values, all well above the typical significance level of 0.10, suggest that the instruments are valid across all models. Lastly, the A-R Wald test p-value is virtually 0 across columns 2-5, confirming that the instruments are likely relevant and valid.

increase in natural resource rents across all models. Additionally, a 1% increase in the age dependency ratio correlates with a rise in natural resource rents as a percentage of GDP by 0.2 to 0.3 percentage points. Regarding sectoral composition, an increase in industry VA by 1% of GDP is associated with an increase in natural resource rents by 0.8 to 0.9 percentage points across all models. Likewise, an increase in agriculture, forestry, and fishing VA by 1% of GDP is linked to an increase in natural resource rents by around 0.4 percentage points across all models.

However, private credit now exhibits a negative sign across all our specifications, indicating a decrease in natural resource rents as a percentage of GDP, though these results are also statistically insignificant as they were in table 2 when the coefficient signs were mostly positive. Overall, the control variables' coefficients in Equation 2 are consistent with those observed in Equation 1.

# Chapter 5: Robustness checks

In this section, we examine the robustness of our results. Specifically, we assess the reliability of our results by introducing additional control variables, using lagged FDI as an alternative instrument and lastly by incorporating one new IV—tourism expenditure. By doing so, we aim to ensure that our findings remain consistent across different methodologies.

## 5.1 Additional control variables

We test Equation 1 and 2 with the inclusion of two new control variables: number of deaths in armed conflicts and GDP per capita (constant 2015 USD). The number of deaths is a relevant control variable given the occurrence of wars in many countries during our study period, such as in Lebanon, Syria and Libya, which may influence both foreign investment and natural resource production. However, it was excluded from our main analysis due to the high number of zero values in the dataset and was kept in the robustness chapter as it helps assess the stability of the results under different conditions. Further, GDP per capita can be an omitted variable correlated with the instrument, although it was not included in the main analysis due to potential redundancy with other variables such as the urbanization rate. We test results with the same IVs used in Chapter 4 and our 2SLS and GMMS model without lags, which gave us the most robust results in Chapter 4. Table C.1 shows alignment with the results of table 2 and 4. Equation 1 results (columns 1 and 3) show that FDI negatively affects natural resource rents as a percentage of GDP in both 2SLS and GMMS models. Specifically, a $1 billion increase in FDI is associated with a decrease of 1.1 and 1.2 percentage points in natural resource rents for 2SLS and GMMS respectively. However, equation 2 (columns 2 and 4) results again show that FDI positively affects natural resource rents in non-RD countries (by 3.4 percentage points) but negatively in RD countries (-4.7 and -4.6 for 2SLS and GMMS respectively). Our statistical tests again suggest instrument relevance and validity.

## 5.2 Using lagged FDI as instrument

Our second robustness check involves incorporating a one-period lag of FDI as an instrument for FDI in our GMMS model.[12] This approach is inspired by the work of Wheeler and Mody (1992), who suggest that FDI tends to be self-reinforcing, meaning that the existing stock of foreign investment strongly influences current investment decisions. Consequently, we use lagged FDI as an alternative instrument in our robustness analysis. This method is further supported by various country-level studies in the literature who tried to address endogeneity by instrumenting FDI flows with their lagged value (Borensztein et al. 1998; Durham, 2004, Alfaro et al., 2004) or who

[12] We initially tested two specifications, one with GMMS and one with 2SLS. However, the results reported identical coefficient and test values. This is likely due to the strength of the instrument used, the model specifications being well-defined, and/or the level of endogeneity in the data not being severe.

considered lagged FDI as a determinant of FDI (Markusen and Maskus, 1999). As in chapter 4, we control for regional and time effects in this robustness check.

Table C.2 reports our findings for Equation 1 and 2 and shows alignment with the results of table 2 and 4. We see initially with the results of Equation 1 (in column 1) that FDI negatively affects natural resource rents as a percentage of GDP. Specifically, a $1 billion increase in FDI is associated with a decrease of 0.5 percentage points in natural resource rents. The F-test value of excluded instrument and low Anderson-R test p-values suggest instrument relevance and validity. However, on the results of Equation 2 (in column 2), this time defining RD countries as those with median natural resource rents equal to or exceeding 10% of GDP during 1985-2020 (i.e., Algeria, Bahrain, Iran, Iraq, Kuwait, Libya, Oman, Qatar, Saudi Arabia, UAE and Yemen), we again find that FDI positively affects natural resource rents in non-RD countries (by 0.7 percentage points) but negatively in RD countries (-1.4), despite a small F-test for the excluded instrument.

## 5.3 Using one new IV as instrument

In this section, we introduce one new instrument: tourism expenditure. Here's why we consider this variable a suitable instrument:

1. **Tourism expenditure**. International tourism receipts for travel items represent expenditures by international inbound visitors in the reporting economy. Tourism receipts can positively affect the local economy. This increased economic activity may improve the overall investment climate, making a country more attractive to foreign investors. Further, we believe that tourism receipts themselves do not directly influence natural resource rents. While it may be argued that spending of international visitors can boost local economic activity and thereby influence natural resource production, it is not evident that this increased spending by tourists translates directly into higher demand for natural resource extraction or affects natural resource rents. Instead, we argue that tourism expenditure influences natural resource rents through its impact on FDI, driven by the enhanced investment climate that tourism spending helps to foster.

Figures C.1 illustrates the relationship between FDI and IV3 from the years 1995-2021. Table C.3 displays the descriptive statistics of that new IV for the same period. Table C.4. reveals results of Equation 1 and 2 using our new IV, again defining RD countries with the median definition. Our results align with our initial findings regarding the impact of FDI on natural resources. Table C.4 shows that FDI positively affects natural resource rents in non-RD countries but negatively in RD countries. The results are supported by high F-test values and low A-R p-values overall, although A-R p-values are slightly above 0.05 (0.07) for columns 2 and 4.

# Chapter 6: Recommendations and conclusions

## Summary

This study seeks to advance the debate the impact of FDI on natural resource reliance, which is an understudied topic in literature. Building on the study by Long et al. (2017), we verify the hypothesis that FDI has an unfavorable impact (i.e., positive) on natural resource dependency, and that this effect is more prominent for resource-dependent (RD) countries.

Our study focuses on 19 countries from MENA and uses panel data on a yearly basis across 1985-2020. We initially analyze the effect of FDI on total natural resources rents as a % of GDP, which are the sum of oil, natural gas, coal, mineral, and forest rents, and subsequently we present the regression results individually for each natural resource type. To address simultaneity bias, our study uses two instrumental variables (IVs), which are air passengers carried and armed forces personnel, and the Generalized Method of Moments (GMM) system. We also incorporate one-period lags on our IVs to enhance their exogeneity, as well as region-specific effects and time effects to account for regional differences and the impact of cyclical economic shocks.

The initial results suggest that FDI tends to reduce natural resource reliance in the MENA region, contradicting the findings of Long et al. (2017) and our hypothesis that FDI has an unfavorable impact on natural resource reliance. However, when considering resource dependency in interaction with FDI, we find that this effect becomes positive but only for non-RD countries. This could be due to factors such as RD countries attracting FDI focusing on resource extraction, leading to heightened resource depletion through unsustainable practices. Another potential explanation is the presence of weak governance and institutional capacity in many RD countries which can result in poor regulation, corruption, or unfavorable contracts that benefit foreign firms at the expense of national wealth. FDI may also crowd out domestic investors and hinder the development of local industries, reducing the country's ability to capture resource rents as profits go to foreign firms. Further, we also find that FDI tends to decrease oil and natural gas dependency but increase coal and mineral rents, and it has a null effect on forest rents. This varying impact highlights the importance of policies tailored to particular types of resources when managing FDI.

## Recommendations

The results overall seem to suggest that non-RD countries seeking to reduce reliance on natural resources should attract less FDI, while RD countries with the same goal should attract more FDI. However, RD countries first have to ensure that this reduction in natural resource rents observed is not attributable to factors such as resource depletion through unsustainable practices, FDI crowding out domestic investors, and weak governance and institutional capacity resulting in corruption or unfavorable contracts that benefit foreign investors at the expense of national wealth. As such, RD countries in MENA could benefit from establishing strong institutions that promote good governance, transparency, and accountability. Indeed, Kyobe et al. (2011) reports that the quality of public investment in resource-rich countries in MENA is lower than in resource-poor ones based on the public investment management index. Efforts to enhance administrative capacity would help curb corruption, ensure better regulatory oversight, and foster a business environment conducive to productivity.

In general, both RD and non-RD countries seeking to become less reliant on natural resources should focus on promoting economic diversification through government-led efforts to avoid attracting FDI in resource sectors. Policy efforts to boost economic diversification should focus on addressing weak links to avoid government spending on unviable sectors. Addressing weak inter-sector connections—especially in non-traded goods—can improve productivity and make these sectors more competitive (Diop et al., 2012). Policy efforts should also aim at reducing entry barriers in service sectors and maintaining flexible exchange rates and consistent fiscal measures to prevent real exchange rate overvaluation, sustaining competitiveness in non-resource sectors.

## Limits and future research

Despite the potential explanations we provided for the negative relationship between FDI and natural resource rents in RD countries, the reasons behind this finding remain elusive. Although the accessibility for sectoral FDI data is limited, previous reports, although dated, suggest that FDI inflows tend to target resource sectors, making this finding seem counterintuitive. For instance, a World Bank report (2011) shows that between 2003 and 2011, nearly two-thirds of FDI inflows in MENA was directed towards the real estate and fuel sectors, with each sector receiving about one-third, and that the share for manufacturing and tourism was significantly lower. Future research is crucial to explore the dynamics behind these findings. While outside the scope of this study, investigating the impact of FDI on natural resource depletion in RD and non-RD countries could help clarify whether the negative relationship observed for RD countries is attributable to FDI targeting resource extraction sectors and encouraging faster resource depletion through unsustainable practices.

Lastly, the study's lack of sectoral FDI data limits its ability to identify which industries are receiving FDI and optimally assess the impact of FDI on natural resource dependency since investments in non-resource sectors may promote economic diversification, unlike investments in resource industries. As such, further research considering sectoral FDI information needs to be conducted as it would allow for a more nuanced analysis of how FDI influences natural resource dependency and would enable policymakers to identify the FDI sectors that contribute the least or most significantly to economic diversification.

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# APPPENDICES

# Appendix A: List of variables used

| Variable | Source | Description and notation |
|---|---|---|
| FDI, net inflows | World Bank Development Indicators (WDI) | Foreign direct investment refers to direct investment equity flows in the reporting economy. It is the sum of equity capital, reinvestment of earnings, and other capital.<br><br>Current USD |
| IV1 | Multiple sources compiled by World Bank, including International Civil Aviation Organization. | Total of air passengers carried. Domestic and international passengers of airlines registered in the country. |
| IV2 | Multiple sources compiled by World Bank, including International Institute for Strategic Studies. | Total armed forces personnel. |
| IV3 | UN Tourism (UNWTO) | Tourism expenditures by international inbound visitors in the reporting economy.<br><br>Current U.S. dollars. |
| Inflation | WDI | Inflation, consumer prices (annual %). |
| GFCF | United Nations Statistics Division | Gross fixed capital formation (including Acquisitions less disposals of valuables).<br><br>Constant 2015 USD. |
| Urban population | WDI | Urban population as % of total population. |
| Exports of goods and services | WDI | Exports of goods and services (% of GDP). |
| Democracy | Polity 5 | The Polity Score captures this regime authority spectrum on a 21-pont scale ranging from -10 (hereditary monarchy) to +10 (consolidated democracy). |
| Private credit | World Bank Global Financial Development Database | Private credit by deposit money banks and other financial institutions (% of GDP). |
| Industry VA | WDI | Industry value added (% of GDP). |

| | | |
|---|---|---|
| Agriculture, forestry, and fishing VA | WDI | Agriculture, forestry, and fishing, value added (% of GDP). |
| Age dependency ratio | WDI | Age dependency ratio (% of working-age population). |
| Deaths in armed conflicts | Uppsala Conflict Data Program and Natural Earth | Number of deaths in armed conflicts, including combatants and civilians due to fighting in armed conflicts that were ongoing that year. |
| GDP per capita | WDI | GDP per capita<br><br>Constant 2015 USD |

## Appendix B: Summary of expected signs/effects of the explanatory variables

| Explanatory variable | Expected signs/effects | Justification |
|---|---|---|
| Foreign direct investment, net inflows | Positive coefficient | We make the hypothesis that FDI increases natural resource rents as it can heighten the dependency on foreign investment, and FDI flows tend to concentrate in the resource sectors. |
| Inflation | Negative coefficient | Inflation increases operating costs, potentially diminishing profit margins unless resource prices rise accordingly. Additionally, inflation creates market uncertainty and volatility, which can undermine investor confidence in resource projects. |
| Gross fixed capital formation (GCFC) | Positive coefficient | Improved infrastructure and better technology can boost the efficiency and productivity of resource extraction processes. |
| Exports of goods and services (% of GDP) | Positive coefficient | Higher trade dependency can lead to increased global demand for exported resources. |
| Democracy (Polity score) | Positive coefficient | Political stability enhances investor confidence and the ease of doing business. |
| Private credit (% of GDP) | Positive coefficient | Private credit facilitates investment in resource exploration and technological advancements, enhancing resource extraction efficiency. |
| Urban population (% of total population) | Positive coefficient | Urban areas generally exhibit higher demand for goods and services, increasing resource consumption, and are associated with improved infrastructure, influencing resource management and efficiency positively. |
| Industry value added as % of GDP | Positive or negative coefficient | While a higher share of industry value added suggests a more industrialized economy, which may boost resource extraction efficiency, this shift could also lead to a shift away from natural resource sectors toward more technology-intense sectors. |
| Agriculture, forestry, and fishing, value added (% of GDP) | Positive or negative coefficient | While a higher share of agriculture, forestry, and fishing value added reflects greater reliance on primary resource sectors, this dependency presents a risk of overexploitation if not managed sustainably, potentially leading to resource depletion. |

| | | |
|---|---|---|
| Age dependency ratio (% of working-age population) | Negative coefficient | A high age dependency ratio reduces labor force availability and can strain the working-age population, affecting labor resource productivity. |

## Appendix C: Robustness checks

**Table C. 1: Impact of FDI on natural resource rents with additional control variables**

| Dependant variable: | 2SLS | | GMM System | |
|---|---|---|---|---|
| Natural resource rents | (1) | (2) | (3) | (4) |
| **FDI** | **-1.073**** | **3.422**** | **-1.154***** | **3.388**** |
| | **(0.001)** | **(0.001)** | **(0.000)** | **(0.001)** |
| **(FDI)*(dependency dummy)** | **—** | **-4.687***** | **—** | **-4.632***** |
| | | **(0.000)** | | **(0.000)** |
| Dependency dummy variable | — | 10.367*** | — | 10.377*** |
| | | (0.000) | | (0.000) |
| Urbanization rate | 0.123** | 0.195*** | 0.125** | 0.203*** |
| | (0.003) | (0.000) | (0.003) | (0.000) |
| Agriculture VA | 0.303*** | 0.504*** | 0.309*** | 0.526*** |
| | (0.000) | (0.000) | (0.000) | (0.000) |
| Industry VA | 1.011*** | 0.940*** | 0.997*** | 0.938*** |
| | (0.000) | (0.000) | (0.000) | (0.000) |
| Exports | 0.127** | 0.200*** | 0.141*** | 0.203*** |
| | (0.003) | (0.000) | (0.000) | (0.000) |
| Polity score | 0.266** | 0.171* | 0.267** | 0.206* |
| | (0.004) | (0.043) | (0.004) | (0.014) |
| GFCF | 0.092*** | 0.091*** | 0.095*** | 0.090*** |
| | (0.000) | (0.000) | (0.000) | (0.000) |
| Inflation | 0.047* | 0.066*** | 0.048** | 0.067*** |
| | (0.011) | (0.000) | (0.009) | (0.000) |
| Private credit | 0.009 | -0.011 | 0.006 | -0.012 |
| | (0.459) | (0.407) | (0.603) | (0.349) |
| Age dependency | 0.185*** | 0.163*** | 0.185*** | 0.159*** |
| | (0.000) | (0.000) | (0.000) | (0.000) |
| Deaths in conflicts | 0.000 | -0.000 | -0.000 | -0.000 |
| | (0.956) | (0.906) | (0.944) | (0.920) |
| GDP per capita | -0.000 | -0.000*** | -0.000 | -0.000*** |
| | (0.078) | (0.000) | (0.114) | (0.001) |
| Obs. | 368.000 | 368.000 | 368.000 | 368.000 |
| R2 | 0.881 | 0.902 | 0.878 | 0.902 |
| F test | 92.609 | 88.943 | 93.234 | 91.502 |
| F test excluded instruments | 52.145 | 25.831 | 52.145 | 25.831 |
| One-period lag on IVs | No | No | No | No |
| Hansen test (p-value) | 0.295 | 0.055 | 0.295 | 0.055 |
| A-R Wald test (p-value) | 0.000 | 0.000 | 0.000 | 0.000 |

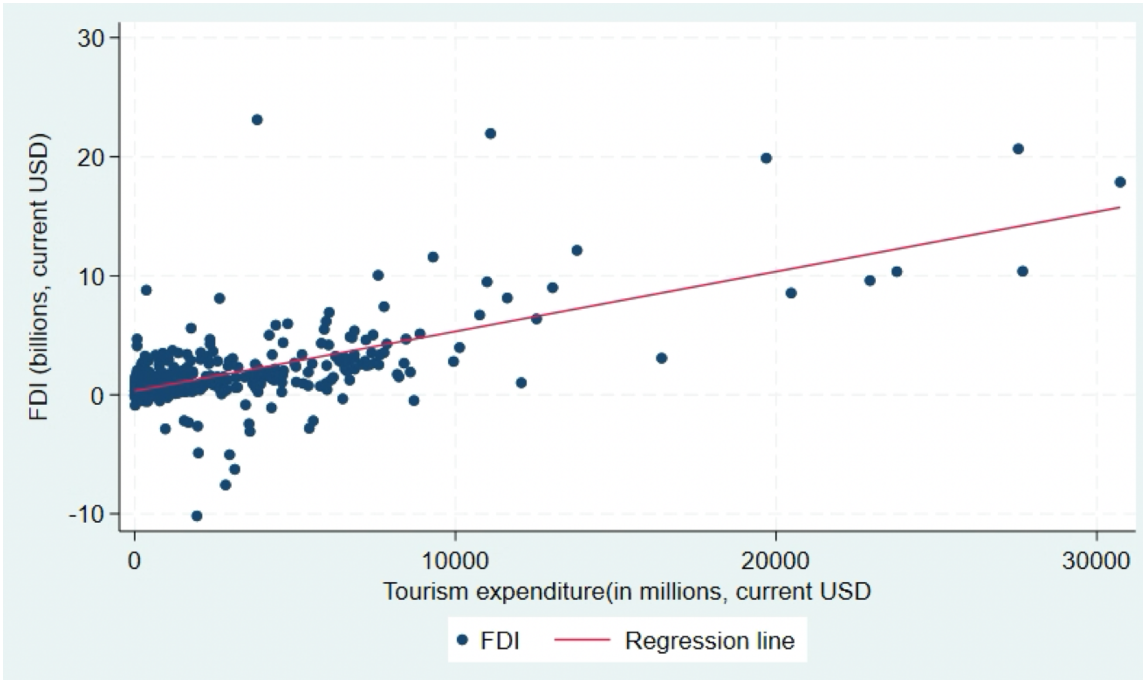
Note: P-values, based on robust standard errors, are presented in parentheses. Significance levels are indicated as follows: * for $p < 0.05$, ** for $p < 0.01$, *** for $p < 0.001$. FDI is instrumented with IV1 (total air passengers carried) and IV2 (total armed forces personnel) in columns 1-4. The specification controls for time and regional effects and encompasses the period 1989-2020. The A-R Wald test refers to the Anderson-Rubin Wald test, which assesses instrument relevance and validity. The F-test of excluded instruments evaluates instrument relevance, while the Hansen test examines instrument validity

**Table C. 2: Impact of FDI on natural resource rents, using one-period lagged FDI as instrument**

| **Dependant variable: Natural resource rents** | **GMM System** | |
|---|---|---|
| **FDI** | **-0.533*** | **0.728**** |
| | **(0.021)** | **(0.002)** |
| **(FDI)*(dependency dummy)** | — | **-1.416***** |
| | | **(0.000)** |
| Dependency dummy variable | — | 13.016*** |
| | | (0.000) |
| Urbanization rate | 0.150*** | 0.234*** |
| | (0.000) | (0.000) |
| Agriculture VA | 0.267*** | 0.411*** |
| | (0.000) | (0.000) |
| Industry VA | 1.000*** | 0.762*** |
| | (0.000) | (0.000) |
| Exports | 0.097** | 0.103** |
| | (0.004) | (0.002) |
| Polity score | 0.330*** | 0.136 |
| | (0.000) | (0.057) |
| GFCF | 0.076*** | 0.052*** |
| | (0.000) | (0.000) |
| Inflation | 0.032 | -0.004 |
| | (0.056) | (0.803) |
| Private credit | -0.002 | 0.016 |
| | (0.857) | (0.093) |
| Age dependency | 0.234*** | 0.291*** |
| | (0.000) | (0.000) |
| Obs. | 413 | 413 |
| R2 | 0.885 | 0.914 |
| F test | 103.784 | 107.692 |
| F test excluded instruments | 12.114 | 2.852 |
| Hansen test (p-value) | — | — |
| A-R Wald test (p-value) | 0.016 | 0.000 |

Note: P-values, based on robust standard errors, are presented in parentheses. Significance levels are indicated as follows: * for $p < 0.05$, ** for $p < 0.01$, *** for $p < 0.001$. FDI is instrumented with one-period lagged values of FDI. The specification controls for time and regional effects and encompasses the period 1985-2020. The A-R Wald test refers to the Anderson-Rubin Wald test, which assesses instrument relevance and validity. The F-test of excluded instruments evaluates instrument relevance. Since our model is exactly identified (i.e., the number of instruments equals the number of endogenous variables), the Hansen J test is not applicable because there are no over-identifying restrictions to test.

**Figure C. 1: Graphic representation of relation between FDI and IV3**




Source: Author's calculations based on data from UN Tourism and the World Bank. Note: We plot tourism expenditure (millions, current USD) on FDI (billions, current USD) across our 19 countries between 1995 and 2021. The line represents a fitted OLS regression

**Table C. 3: Descriptive statistics of IV3, 1995-2021**

| Variable | Obs | Mean | Std.Dev. | Min | Max |
|---|---|---|---|---|---|
| IV3: Tourism expenditure (in millions, current USD) | 427 | 2629.650 | 4019.950 | 1 | 30730.600 |

Note: We display the descriptive statistics across 1995-2021 of the new instrumental variable included in our robustness checks: tourism expenditure (in millions of current USD). The statistics reported include the number of observations, the mean, standard deviation, and minimum and maximum values. Source: Author's calculations based on data from UN Tourism.

**Table C. 4: Impact of FDI on natural resource rents using new IV**

| Dependant variable: Natural resource rents | 2SLS (1) | 2SLS (2) | GMM System (3) | GMM System (4) |
|---|---|---|---|---|
| **FDI** | **-0.693**** | **0.781*** | **-0.693**** | **0.781*** |
| | **(0.004)** | **(0.032)** | **(0.004)** | **(0.032)** |
| **(FDI)*(dependency dummy)** | **—** | **-0.934*** | **—** | **-0.934*** |
| | | **(0.049)** | | **(0.049)** |
| Dependency dummy variable | — | 12.163*** | — | 12.163*** |
| | | (0.000) | | (0.000) |
| Urbanization rate | 0.124** | 0.239*** | 0.124** | 0.239*** |
| | (0.001) | (0.000) | (0.001) | (0.000) |
| Agriculture VA | 0.352*** | 0.454*** | 0.352*** | 0.454*** |
| | (0.000) | (0.000) | (0.000) | (0.000) |
| Industry VA | 1.068*** | 0.885*** | 1.068*** | 0.885*** |
| | (0.000) | (0.000) | (0.000) | (0.000) |
| Exports | 0.071* | 0.010 | 0.071* | 0.010 |
| | (0.021) | (0.794) | (0.021) | (0.794) |
| Polity score | 0.514*** | 0.273** | 0.514*** | 0.273** |
| | (0.000) | (0.001) | (0.000) | (0.001) |
| GFCF | 0.084*** | 0.037* | 0.084*** | 0.037* |
| | (0.000) | (0.017) | (0.000) | (0.017) |
| Inflation | 0.075 | 0.008 | 0.075 | 0.008 |
| | (0.051) | (0.796) | (0.051) | (0.796) |
| Private credit | 0.054* | 0.074** | 0.054* | 0.074** |
| | (0.031) | (0.004) | (0.031) | (0.004) |
| Age dependency | 0.231*** | 0.307*** | 0.231*** | 0.307*** |
| | (0.000) | (0.000) | (0.000) | (0.000) |
| Deaths in conflicts | 0.000 | 0.000* | 0.000 | 0.000* |
| | (0.267) | (0.020) | (0.267) | (0.020) |
| Obs. | 296.000 | 296.000 | 296.000 | 296.000 |
| R2 | 0.919 | 0.938 | 0.919 | 0.938 |
| F test | 123.452 | 142.793 | 123.452 | 142.793 |
| F test excluded instruments | 78.683 | 21.213 | 78.683 | 21.213 |
| One-period lag on IVs | No | No | No | No |
| Hansen test (p-value) | — | — | — | — |
| A-R Wald test (p-value) | 0.002 | 0.071 | 0.002 | 0.071 |

Note: P-values, based on robust standard errors, are presented in parentheses. Significance levels are indicated as follows: * for $p < 0.05$, ** for $p < 0.01$, *** for $p < 0.001$. FDI is instrumented with IV3 (tourism expenditure in millions, current USD). The specification controls for time and regional effects and encompasses the period 1989-2020. The A-R Wald test refers to the Anderson-Rubin Wald test, which assesses instrument relevance and validity. The F-test of excluded instruments evaluates instrument relevance. Since our model is exactly identified (i.e., the number of instruments equals the number of endogenous variables), the Hansen J test is not applicable because there are no over-identifying restrictions to test.