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FDI Effects on Economic Growth: The Role of Natural Resource and Environmental Policy

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Abstract

Foreign direct investment (FDI) is a crucial ingredient of the global economy. In the Persian Gulf, FDI is a major source of economic growth, employment, technology, and productivity. Because of these benefits, attracting FDI in the Persian Gulf region has become a key element of strategies promoting economic development. Natural resources and environmental policy in host countries may affect the FDI-economic growth relationship.

There has been much dispute as to whether economies that are open and those with more natural capital and lax environmental policy grow faster. This paper examines whether natural resources and environmental policy in Persian Gulf countries alter the relationship between FDI and Persian Gulf's economic growth. We estimate a linear dynamic panel-data model using data from Persian Gulf countries over the period 1980–2012. The results show that the impact of arable land, forest area and the interaction between FDI and environmental policy on economic growth is negative, but renewable internal freshwater resources flows, mineral depletion and energy use have a positive effect.

JEL Classification: F43, N95, O13.

Key Words: Foreign direct investment (FDI), Economics Growth, Natural Resources, Persian Gulf Region.

1. Introduction

Foreign direct investment (FDI) is an important driver of technology transfer, economic growth and development, but many resource-rich countries do not attract as much FDI as resource-poor countries. Natural resources are often extracted by foreign multinationals that bring in capital and knowledge. However, resource FDI is very capital intensive and we conjecture that it leads to fewer spill-over effects in the host economy. FDI seems to promise more scope for spill-over effects and is therefore more attractive for receiving countries. If resource FDI indeed crowds out non-resource FDI, then this is an additional channel through which natural resource abundance can be a drag on economic development.

Technology is essential to growth, necessary to develop a country's productive capacity in all sectors of the economy, and links a country with the global economy and ensures competitiveness. It is seminal to invention, innovation, and wealth creation. In this rapidly evolving environment, Middle East and North African and other developing countries face opportunity costs if they delay greater access to and use of information infrastructure and information technology. Technology contributes to poverty reduction by increasing productivity and providing new opportunities, offers opportunities for global integration while retaining the identity of traditional societies, and enhances the effectiveness, efficiency and transparency of the public sector. Hajer (1995) considers that environmental politics modernize the economy and stimulate technological innovation.

Since the 1980s country barriers to foreign investment have given way to countries actively seeking FDI instead of discouraging it. Governments now compete with each other to win more investment from foreign companies. In this context, it is important to understand what factors attract FDI, a topic much studied in international business, and to understand the increasingly important role of technology infrastructure in this global competition for FDI. In order to successfully restructure their economies to lure foreign investors and ultimately to get and sustain competitive advantages, policy makers need to better understand what makes a market attractive to foreign companies.

Research has identified motivations driving companies to undertake different types of FDI (USAID 2005):

- Natural-resource-seeking FDI—to gain access to a natural resource not available in the company's home market.
- Market-seeking FDI—to gain access to new customers, clients, and export markets.
- Efficiency-seeking FDI—to reduce production costs by gaining access to new technologies or competitively priced inputs and labor.
- Strategic-asset-seeking FDI—to go after strategic assets in a local economy, such as brands, new technologies, or distribution channels.

Among developing countries, natural resources are relatively more prevalent (Perman, 2003). This may to some extent reflect their underdevelopment: the modest size of the modern sector of the economy makes agriculture and other natural-resource-based economic activity relatively more important (Prato, 1998). But there are also clear examples of countries that are genuinely rich in terms of natural resources but still have not been able to sustain economic growth (Barnett and Morse, 1963). It thus appears that the generosity of nature may sometimes – although by no means always – turn out to be a mixed blessing. This paper examines the relation between foreign direct investment (FDI) and economic growth and the role of natural resources in this relation over the period from 1980 through 2012 with special reference to 6 Persian Gulf countries.

2. The Effects of FDI on Economic Growth

The accumulation of capital is an important determinant of economic growth. Since FDI is a component of total investment, it, too, contributes to growth. But the interesting question is whether FDI exerts a positive growth effect beyond the direct effect through increased investment, for example because it facilitates the transfer of knowledge from abroad. Addressing this issue from both an analytical and an empirical point of view may lead to important policy implications: if FDI does foster growth beyond its simple contribution to capital accumulation, policymakers may wish to give special consideration to policies that promote the inflow of FDI.

There are many reasons why FDI might give rise to beneficial externalities that promote economic growth. FDI may allow a country to bring in technologies and knowledge that are not readily available to domestic investors, and in this way increase productivity growth throughout the economy. FDI may also bring in expertise that the country does not possess, and foreign investors may have better access to global markets.

While the FDI-growth linkage is still ambiguous, most macroeconomic studies nevertheless support the notion of a positive role of FDI within particular economic conditions. There are three main channels through which FDI can bring about economic growth. The first is through the release it affords from the binding constraint of domestic savings. In this case, foreign direct investment augments domestic savings in the process of capital accumulation. Second, FDI is the main conduit through which technology spillovers lead to an increase in factor productivity and efficiency in the utilization of resources, which leads to growth. Third, FDI leads to an increase in exports as a result of increased capacity and competitiveness in domestic production. This linkage is often said to depend on another factor, called “absorptive capacity”, which includes the level of human capital development, type of trade regimes and degree of openness (Ajayi, 2006; Borensztein *et al.*, 1998).

There is a preponderance of empirical studies on the FDI-growth nexus and the determinants of FDI inflows. Barro (2001) lists variables like high levels of schooling, good health, low fertility, low government welfare expenditures, rule of law and favorable terms of trade as being pivotal for growth. In his research he establishes a positive relationship between the growth rate of real per capita GDP and initial human capital for 98 countries from 1960-1985. In the aftermath, many studies have followed his lead in investigating these prime variables as the channels through which FDI impacts growth.

Blonigen and Wang (2005) attribute the positive correlation results in most studies to the erroneous sampling of data. They argue that contrary to their approach, most studies lump the two distinctive samples together and often draw conclusions that a positive correlation exists. They also found that FDI has a higher probability of “crowding in” investment in LDCs than DCs.

Li and Liu (2005) found that FDI not only affects growth directly, but also indirectly through its interaction with human capital. Further, they find a negative coefficient for FDI when it is regressed with the technology gap between the source and host economy using a large sample, Borensztein *et al.* (1998) found similar results, i.e. that inward FDI has positive effects on growth with the strongest impact coming through the interaction between FDI and human capital.

3. The Effects of Natural Resources on Economic Growth

Proposals aimed at attracting foreign investment often seek to promote certain specific sectors rather than others. In particular, there is a current debate on whether the exploitation of natural resources is good for growth. This is a particularly important issue for a region. But it is an important topic for all countries interested in FDI. The role of natural resources in economic development touches on many issues, from FDI to the environment to the level and management of exchange rates.

Natural resources are a fixed factor of production and hence, almost by definition, impose a restriction on economic growth potential. This restriction may – depending on the nature of the production technology – cause a growing labour force and a growing stock of capital to run into diminishing returns. This is the first reason for the adverse effect of natural resources on growth found in the literature. Nordhaus (1992) has shown that the steady-state rate of growth of output per capita in an economy with natural resources is proportional to the rate of technological progress adjusted for a “population growth drag” due to diminishing returns as well as a “natural resource depletion drag” due to declining levels of exhaustible natural resources.

Second, huge natural resource rents may create opportunities for rent-seeking behaviour on a large scale on the part of producers, thus diverting resources away from more socially fruitful economic activity (Auty, 2001; Gelb, 1988). For example, Tornell and Lane (1998) show that terms-of-trade windfalls and natural resource booms may trigger political interaction, or games, among powerful interest groups –

games that result in current account deficits, disproportionate fiscal redistribution and reduced growth. In extreme cases, civil wars break out – such as Africa’s diamond wars – which not only divert factors of production from socially productive uses but also destroy societal institutions and the rule of law. Collier and Hoeffler (1998) show empirically how natural resources increase the probability of civil war. Another extreme case involves foreign governments invading with destructive consequences and accompanying defense expenditures. Military expenditures tend to inhibit growth through their adverse effects on capital formation and resource allocation (Knight et al., 1996).

Third, natural resource abundance can lead to the Dutch disease, which can appear in several guises. A natural resource boom and the associated surge in raw-material exports can drive up the real exchange rate of the currency, thus possibly reducing manufacturing and services exports (Corden, 1984). Recurrent booms and busts tend to increase real exchange rate volatility (Gylfason et al., 1999), thus reducing investment in the tradable sector as well as exports and imports of goods and services. The Dutch disease can also strike in countries that do not have their own currency (e.g., Greenland, which uses the Danish krone; see Paldam, 1997).

Fourth, natural resource abundance may reduce private and public incentives to accumulate human capital due to a high level of non-wage income – e.g., dividends, social spending and low taxes. Empirical evidence shows that, across countries, school enrolment at all levels is inversely related to natural resource dependence, as measured by the share of the labour force engaged in primary production (Gylfason et al., 1999). There is also evidence that, across countries, public expenditures on education relative to national income, expected years of schooling and secondary-school enrolment rates are all inversely related to the share of natural capital in national wealth (Gylfason, 2001). This matters because more and better education may be good for growth. For example, Temple (1999) shows that economic growth varies directly with educational attainment across countries once a few outliers have been removed from the sample of Benhabib and Spiegel (1994), who had found limited support in their data for the hypothesis that education is good for economic growth (Sachs and Warner, 1999; Rodriguez and Sachs, 1999). Put differently, abundant natural capital may crowd out social capital in a similar manner as human capital (Woolcock, 1998; Paldam and Svendsen, 2000). Unconditional foreign aid may be a case in point (Burnside and Dollar, 2000).

4. Environmental Policy and FDI

One of the most contentious and hotly debated issues today is the “Pollution Haven Hypothesis” (PHH), which is at the center of debates over international trade and the environment. This hypothesis predicts that stringent environmental regulations in developed countries lead to the relocation of pollution intensive production away from high income countries toward developing countries, where regulations

are relatively weak (Barrett, 1994). If these weak environmental standards in developing countries can be considered another source of comparative advantage, it is reasonable to be concerned that governments may seek to attract foreign direct investment (FDI) by competitively undercutting each other's environmental regulations, and thus turning poor countries into "pollution havens". Alternatively, export or capital inflows can also be deterred by tighter environmental regulations, which Taylor (2004) calls a "pollution haven effect."

Proper examination of this relationship is crucial for several reasons. First, the determinants of trade patterns and the spatial distribution of multinational enterprises (MNE) activity are salient given the dramatic rise in foreign direct investment (FDI) relative to trade volumes over the past two decades. Second, if countries are able to attract (or deter) FDI by manipulating environmental regulations, then international coordination may be necessary to avoid Pareto-inefficient levels of regulation due to trans-boundary pollutions or other spillovers (e.g., Levinson, 1997, 2003). Third, if countries are able to influence the location of MNE activity and ultimately trade patterns through environmental regulation, then bringing environmental policies under the purview of trade agreements may be necessary to realize the intended effects of such agreements (Ederington and Minier, 2005). Fourth, and related to this prior point, existing institutional structures such as the World Trade Organization (WTO) may be used to impede countries from choosing their desired environmental policies if such policies can be shown to impact trade flows between members. Finally, a detailed analysis of the PHH has broader implications for the general study of capital competition (e.g., Wilson 1999).

The measurement of pollution intensity is a key issue in empirical work on pollution havens. Most researchers have used data on abatement expenditures for pollution abatement and on investment in pollution abatement equipment. Levinson and Taylor (2008) point out that if the most pollution-intensive plants within an industry have already relocated at the time expenditure data are collected, pollution abatement expenditures in the remaining plants are likely to be less than the industry average. This effect can bias the coefficient on pollution abatement cost in an investment or net export equation away from showing a pollution haven effect. The absence of a pollution haven effect in Smarzynska and Wei (2004) may be a consequence of such bias.¹

In a case study of four developing countries, Eskeland and Harrison (2003) relate the sectoral composition of inward FDI in the host country to a measure of pollution intensity and control variables in two major source countries. All else equal, a high share of pollution intensive industries in total FDI stock would lend support to the pollution haven hypothesis. Using either pollution abatement cost or normalized actual emissions per sector to proxy for pollution intensity, these authors find no evidence of a pollution haven effect after controlling for unobserved heterogeneity.

¹ - An additional source of bias in their analysis may arise from unobserved heterogeneity in the cluster.

5. The Model and Data Sources

The nature of the relationship between FDI, natural resources and economic growth is not clearly understood, particularly as it pertains to regional environmental effects. The theoretical and empirical literature has identified some of the ‘pre-conditions’ necessary for FDI and natural resources to stimulate national growth, yet their importance may vary dramatically by region. Although the mechanisms through which they stimulate regional economies have largely been ignored, “new” growth theories imply a pivotal role for FDI.

The endogenous growth literature has emphasized the importance of both human and knowledge capital in forestalling decreasing returns to capital accumulation. As such, growth is not limited to exogenous forces that drive the rate of technical change; rather, policies or conditions that environmental policy, trade and an inflow of FDI may actually spur growth. Fundamentally, FDI is a composite bundle of “know-how” that enhances technology transfer and skill diffusion within the importing region. As such, besides directly affecting growth via new inputs, FDI is also expected to generate indirect impacts via knowledge spillovers.

The roles of FDI and natural resources in stimulating regional growth are likely to be as strong as it is in a national context. It is generally taken for granted that foreign-owned firms bring greater inter-firm competition and knowledge diffusion. However, the inter-firm competition and knowledge diffusion flowing from FDI does not occur uniformly across the geographic plane within a host economy. Rather, those specific locales where such investment is initially concentrated are likely to reap the early rewards from of stronger output and employment growth. This suggests that the “spatial root” of economic development is an important source of variation in regional economic performance. In other words, the importance of FDI within specific regions of a host economy is key for explaining geographic variations in output and employment, if only because foreign capital gravitates to certain areas.

Observing from theory the possible growth promoting roles of both FDI and natural resources, our data analysis is modeled in an aggregate production function (APF) framework. The standard APF model has been extensively used in econometric studies to estimate the impacts of FDI inflows and natural resources on growth in many developing countries. The APF assumes that, along with “conventional inputs” of labour and capital used in the neoclassical production function, “unconventional inputs” like FDI, trade and natural resources may be included in the model to capture their contribution to economic growth. The APF model has been used by Kohpaiboon (2004), Mansouri (2005), Feder (1983), Fosu (1990) and Herzer et al. (2006).

Following Herzer et al. (2006), the general APF model to be estimated is derived as:

$$Y_{it} = A_{it}K_{it}^{\alpha}H_{it}^{\beta} \quad (1)$$

Where Y_t denotes the aggregate production of the economy (real GDP per capita) at time t and A_t , K_t , H_t are the total factor productivity (TFP), the capital stock and the stock of labour, respectively. According to Lipsey (2001), the impact of FDI on economic growth possibly operates through TFP (A_t). Moreover, from the Bhagwati hypothesis, any gains from FDI on TFP will surely be dependent on the volume of trade (OP) of a particular host country. We want to investigate the impacts of FDI inflows (FDI) and natural resources on economic growth through changes in TFP.

We include four variables to represent natural resource endowments (energy, land, forest and water). Having defined natural resources in general terms as the sum of forestry products, fish, fuels and mining products, we now present a variety of descriptive statistics on international trade in these products.

Arable land (AL) (hectares per person) includes land defined by the FAO as land under temporary crops (double-cropped areas are counted once), temporary meadows for mowing or for pasture, land under market or kitchen gardens, and land temporarily fallow. Land abandoned as a result of shifting cultivation is excluded.

Forest area (FA), defined by the World Bank, is land under natural or planted stands of trees of at least 5 meters in situ, whether productive or not, and excludes tree stands in agricultural production systems (for example, in fruit plantations and agro-forestry systems) and trees in urban parks and gardens.

Forests represent productive assets that are used as a means for attaining national development objectives, including equity, stability, investment and growth. Programs in community forestry have become central to rural development programs that seek to build more productive relations between rural communities and publicly-owned natural resources. Community forestry programs are widely implemented to strengthen investment incentives and encourage civic participation in the growth and use of forests and trees.

Forests have emerged as significant factors in economic and political relations among nations. For example, forests have taken on foreign policy dimensions through their association with issues concerned with trade and the environment. Forest conditions increasingly affect national dependence on international trade and on processing capacity for wood products and production inputs. Trading patterns grow more complex as wood-exporting nations shift emphasis from primary to secondary and tertiary forms of production, increase their purchasing power and diversify their consumption requirements.

Changes in the extent and quality of forests have become the subject of global environmental concerns: changing forest conditions raise concerns over biological diversity and global climate change. These

developments create pressure on national governments to consider forests in the realm of international relations. Some nations are already moving towards international agreements that tie matters of economic and environmental trade together in the service of larger, global interests.

For all of these reasons, national forest politics and policies have evolved out of a narrow sectoral prerogative to enter the pluralized mainstream of political interests involving highly diverse groups. The perspectives and demands of these politically diverse groups have proliferated, placing a significant strain on the institutions of forest policy that evolved when forests meant only timber belonging to the state and were controlled by a small professional cadre. These competing pressures, combined with a wider understanding of the importance and complexity of forests' non-wood services and values, are strongly influencing forestry policy today.

Renewable internal freshwater resources flows (RI) is internal renewable resources (internal river flows and groundwater from rainfall) in the country.

If water has the characteristic of a non-excludable good subject to congestion, then there are essentially two ways in which water scarcity may affect economic growth. First, as water becomes increasingly scarce in the economy, the government must exploit less accessible sources of fresh water through appropriating and purchasing a greater share of aggregate economic output, in terms of dams, pumping stations, supply infrastructure etc. Second, it is also possible that water utilisation in an economy may be restricted by the absolute availability of water. Thus the influence of water use on growth may be different for a water-constrained economy.

Finally, a measure of the natural resources needed to complete the model is *mineral depletion (MD)*, which is the ratio of the value of the stock of mineral resources to the remaining reserve lifetime (capped at 25 years). It covers tin, gold, lead, zinc, iron, copper, nickel, silver, bauxite, and phosphate.

Thus:

$$A_{it} = f(FDI_{it} * EP_{it}, OP_{it}, EU_{it}, AL_{it}, FA_{it}, RI_{it}, MD_{it}) = (FDI_{it} * EP_{it})^{\gamma} (OP_{it})^{\delta} (EU_{it})^{\theta} (AL_{it})^{\vartheta} (FA_{it})^{\rho} (RI_{it})^{\omega} (MD_{it})^{\tau} \quad (2)$$

Because FDI inflows in countries need to be highly energy intensive, it was decided for this study that some measure of a country's energy endowment would be appropriate. EP is energy efficiency (unit of energy used/GDP), it is the goal to reduce the amount of energy required to provide products and services and a way of managing and restraining the growth in energy consumption. Energy efficiency offers a powerful and cost-effective tool for achieving a sustainable energy future. Environmental benefits can also be achieved by the reduction of greenhouse gases emissions and local air pollution. The countries promote energy efficiency policy and technology in buildings, appliances, transport and industry, as well as end-use applications such as lighting. The International Energy Agency (IEA) developed (in 2008) a

set of 25 energy efficiency policy recommendations for seven priority areas: Cross-sectoral, Transport, Buildings, Industry, Appliances and equipment, Energy utilities, Lighting.

Energy use (EU) (oil equivalent) in kilograms, as reported by the World Bank, was used to represent this resource. According to the World Bank, this measure refers to petroleum-based energy sources, solid fuels such as coal, and energy from other sources such as nuclear or hydroelectric generation.

The interest of using such a quantitative variable is that it gives a real measure of the impact of the preceding variables.² This allows observers to distinguish between countries that apply concrete environmental measures from the ones that adopt a "theoretical" environmental policy that is not really restrictive to firms.

Combining equations (2) with (1), we get:

$$Y_{it} = K_{it}^{\alpha} H_{it}^{\beta} (FDI_{it} * EP_{it})^{\gamma} (OP_{it})^{\delta} (EU_{it})^{\theta} (AL_{it})^{\vartheta} (FA_{it})^{\rho} (RI_{it})^{\omega} (MD_{it})^{\tau} \quad (3)$$

From equation (3), an explicit estimable function is specified, after taking the natural logs of both sides, as follows:

$$Y_{it} = \theta_{it} + \alpha \ln K_{it} + \beta \ln H_{it} + \gamma \ln (FDI_{it} * EP_{it}) + \delta \ln OP_{it} + \theta \ln EU_{it} + \vartheta \ln AL_{it} + \rho \ln FA_{it} + \omega \ln RI_{it} + \tau \ln MD_{it} + \mu_t + \varphi_i + \varepsilon_{it} \quad (4)$$

Where μ_t are the time specific intercepts, φ_i represents country-specific effects that summarize the influence of unobserved variables such as infrastructure, period average climate, history and culture, and which are assumed to be distributed independently across countries, with variance σ_{μ}^2 , and ε_{it} is the stochastic error term for each country i and year t . The time specific intercepts are included to account for time varying omitted variables and stochastic shocks that are common to all countries.

The time period covered in the estimation is 1980-2012 across the 6 Persian Gulf countries (Bahrain, Iran, Oman, Saudi Arabia, Qatar and Kuwait). Data are obtained from the World Bank's 2013 World Development Indicators' (WDI's) CD-Rom and on-line WDI 2013

(<http://publications.worldbank.org/wdi>).

² - Due to a lack of consistent data that would have prevented us from including several countries, we have preferred to consider energy efficiency, which generates similar results (available upon request).

6. Results

We test the stationarity of variables in the model. Therefore, we make the unit root test of Levin, Lin & Chu and Im, Pesaran & Shin W-stat to test for it. The results show that all variables are stationarity at level (Table 1).

TABLE 1: VARIABLES STATIONARITY TESTS

Variables	Im, Pesaran and Shin W-stat - Test	
	Statistic	Prob
Ln K_{it}	4.84604	0.0000
Ln H_{it}	3.84920	0.0001
Ln ($FDI_{it} * EP_{it}$)	-5.38136	0.0000
Ln OP_{it}	-9.23834	0.0001
Ln AL_{it}	4.2302	0.0000
Ln FA_{it}	3.1135	0.0000
Ln RI_{it}	2.4741	0.0000
Ln MD_{it}	3.5621	0.0001

Panel regression is an efficient technique when there is a large number of cross sectional units with diverse qualitative variations. In such situation, an unrestricted intercept term is more plausible. The fixed effects (FE) estimator allows α_{it} to vary across cross-section units so that we get different constants for different countries. In other words, $\theta_{it} = \theta_t$ and $E(\theta_i \varepsilon_i) \neq 0$. Fixed effects regression is the model to use when you want to control for omitted variables that differ between cases but are constant over time. It lets you use the changes in the variables over time to estimate the effects of the independent variables on your dependent variable, and is the main technique used for the analysis of panel data. While, if you have reason to believe that some omitted variables may be constant over time but vary between cases, and others may be fixed between cases but vary over time, then you can include both types by using random effects (RE).

In order to choose the most appropriate panel data estimation methods, first, the Hausman (1978) specification test provides information about the appropriateness of the RE model versus FE model, and the test confirms the suitability of random effect model instead of fixed effect model by accepting the null hypothesis that individual specific unobserved effects are distributed independently of the variables of

interest. The test confirms the absence of orthogonality between the regressors and residuals, suggesting that the fixed effects estimation is more appropriate.

Furthermore, a “Lagrange Multiplier (LM) test for Random Effects” was performed and the result has led to choose the random-effect model (REMO) against the pooled OLS model. Wooldridge's test for autocorrelation in panel data (2002, p. 282) provides a significant F statistic, confirming the existence of serial autocorrelation. The null hypothesis that there is no first order autocorrelation was not rejected. This implies that heteroscedasticity, but no serial correlation detected. According to Wooldridge (2002), if heteroscedasticity is detected but serial correlation is not, then the usual heteroscedasticity-robust standard errors and test statistics can be used using the appropriate estimation techniques, and in this case the random effect model (REM).

In order to verify the consistency of the results from REM, this study also used other appropriate panel data analysis methods such as Feasible General Least Square Method (FGLS) for the reason that heteroskedastic models are usually fitted with feasible generalized least squares (FGLS).

Table 2 shows the estimation results of equation (4) using fixed and random effects using 1980–2012 panel data for the 6 Persian Gulf countries.

**TABLE 2: THE DETERMINANTS OF REAL GDP PER CAPITA
IN MENA REGION**

Explanatory Variables	Fixed Effect ⁽¹⁾		Random Effect	
C	15.45*	(13.83)	51.687*	(3.07)
Ln K _{it}	1.14*	(3.82)	4.87***	(1.87)
Ln L _{it}	.0005565*	(-5.37)	.0009706*	(-3.66)
Ln (FDI _{it} * EP _{it})	-4.26*	(-4.17)	2.41	(1.10)
Ln OP _{it}	1.36	(0.51)	-15.9488	(-0.18)
Ln AL _{it}	-.020122*	(-7.71)	-.0003082	(-0.70)
Ln FA _{it}	-.080572**	(-2.84)	-.10585	(-3.57)
Ln RI _{it}	12.8785*	(6.03)	-4.74408*	(-2.26)
Ln MD _{it}	2.48201*	(3.21)	2.24331*	(2.43)
R ²	0.6910		0.7226	
Groups	13		13	
Number of observation	292		292	
Wald Test	233.74		176.51	
Prob> chi2	0.0000		0.0000	
Breusch and Pagan LM test			413.54	
Prob> chi2			0.0000	
Modified Wald Test for group-wise heteroskedasticity ⁽³⁾	312.78			
Prob> chi2	0.0000			
Test of Hausman ⁽²⁾	$\chi^2(4) = 52.93$			
Prob> chi2	0.0000			
Wooldridge test for autocorrelation in panel data	525.015			
Prob> F	0.0000			

Note: T-statistics are shown in parentheses. Significance at the 99% and 95% confidence levels are indicated by * and **, respectively.

The robust standard errors are White's heteroskedasticity-corrected standard errors.

(1) The acceptance of model by the Hausman test.

(2) The Hausman test tests the null hypothesis that the coefficients estimated by the efficient random effects estimator are the same as the ones estimated by the consistent fixed effects estimator. If they are (insignificant P-value, Prob>chi2 larger than .05) then it is safe to use random effects. If you get a significant P-value, however, you should use fixed effects.

(3) For FE regression model, the modified Wald test for groupwise heteroskedasticity is used while the Wooldridge test for autocorrelation in panel data (Ho: no autocorrelation) is applied.

All else equal, allocating resources more efficiently allows movement from inside the production possibilities frontier to its border—productive capacity is not affected, but total output does rise. In contrast, economic growth occurs when (a) the production possibilities frontiers shift outwards, so that more of all goods can be produced, or when (b) the value in exchange of a national output increases for purposes of international trade. Economic growth entails increases in the value of a nation's productive capacity. Growth is driven by (a) technological advances, (b) increased availability of resources or improvements in their quality, or (c) increased values for the goods in which a country specializes.

Our results show that the impact of arable land, forest area and the interaction between FDI and environmental policy on economic growth was negative, but renewable internal freshwater resources flows, mineral depletion and energy use have positive effect.

Growth occurs when entrepreneurs implement technologies allowing given resources to produce more output. Rapid investment boosts production possibilities in two ways. First, more capital is available. Second, new capital usually embodies technology that is superior to that embodied in older buildings and machinery.

Growth of the labor force and, consequently, economic growth can be fostered through: (a) expanded numbers of workers, or (b) improvements in their productivity. Both the quantity and quality of the workforce affect national output—and how it grows. Government could expand the options to include such strategies as (a) more support for education or on-the-job training programs to facilitate investment in human capital, (b) more efficient policies in areas such as health care and safety in the workplace. Growth of the work force and the economy, both quantitatively and qualitatively, would also be fostered if less costly daycare became available to parents who want to work, but who, instead, spend most of their time tending their kids.

The impact of interaction between FDI and energy efficiency (as an index of environmental policy) on economic growth is negative. The factors that reduce the total amount of energy needed to produce a dollar's worth of GDP, therefore, also act to reduce the environmental impact of economic growth in exactly the same way as they reduce energy consumption. A shift from lower to higher quality energy sources not only reduces the total energy required to produce a unit of GNP but also may reduce the environmental impact of the remaining energy use. The environmental impact of energy use may also change over time due to technological innovation by FDI that reduces the emissions of various pollutants or other environmental impacts associated with each energy source. This is in addition to general energy conserving technological change that reduces the energy requirements of production. If there are limits to substitution and technological change then the potential reduction in the environmental intensity of economic production is eventually limited. Innovations due to FDI that reduce one type of emission often produce a different type of waste that must be disposed of as well as other disruptions required to

implement the technology. So, energy use decrease causes innovations due to FDI and therefore economic growth increase.

The relations between forest area and economic growth are negative. Decreasing the area of forest our results in an increasing in land used for agriculture production, agriculture land area has obvious potential as a negative correlate of relation between arable land, forest area and economic growth.

Pressures on the land and natural resource base in developing countries come from the overall demands of economic development. The major cause of arable and forest land loss in developing countries is conversion to agriculture. The pattern of agricultural development increases the agricultural export share of total exports. This would suggest that policies that influence the structure of agricultural production and overall development in the region could have a substantial influence on the future demand for cultivated land. The positive relationship between the share of agricultural exports in total merchandise exports and land expansion in the region confirms that the increased resource dependence of an economy may be correlated with greater exploitation of its natural resource and land base and that agricultural land expansion and natural resource exploitation by primary sector activities are fundamental to economic development in a region. However, if per capita income is to be sustained or increased in these economies, then any depreciation of natural resources must be offset by investment in other productive assets.

Fresh water supplies and use rates vary considerably across the regions within a country. A country as a whole may appear to have sufficient fresh water supplies relative to demand, but specific regions and sectors may not. Variability in climate, rainfall, demographics and economic activity may also contribute to problems of localised water scarcity. In particular, arid and semiarid regions of the world are the most vulnerable to future water stress (Vörösmarty *et al.* 2000). A critical factor in assessing the actual amount of fresh water available in a country is that many rivers, lakes, groundwater aquifers and other water bodies often cross political boundaries or are difficult to exploit for legal, technical or economic reasons (Gleick, 2000). While water-scarcity constraints on overall economic growth may be less likely, fresh water availability could be more problematic for key sectors in some countries, such as agriculture. Water scarcity may become a key factor behind global food insecurity, reduced production growth, rising international cereal prices and reduced exports of agriculture production (Falkenmark and Rockström, 1998; Seckler *et al.*, 1999; Rosegrant & Cai, 2001).

Water is a component of all stage of human economic activity. In some cases it can be substituted for but only rarely is it replaced. The early development of civilized society was heavily influenced by water availability. Water sources for humans and animals are a critical part of pastoral society and early-sustained agriculture was a function of irrigation in the region. The beginning of the Industrial Revolution was predicated on water power and regular water supply industrial processing, and today the location of

nuclear power plants is in part a function of water for cooling processes. In a parallel sense the viability and longevity of our fast growing worldwide network of cities is heavily depend on access to economically sustainable sources of water.

The relations between mineral depletion and economic growth are positive. Mineral depletion leads to economic expansion and decreasing poverty. The economic advantages of mineral depletion are: higher tax incomes for states thanks to mining activity, improving services and increasing employment in local communities and the raised demand for goods and services makes the economy of local communities thrive.

7. Conclusions

More recently, following the impressive surge in FDI flows into several developing and emerging economies, there has been renewed interest in empirical analysis of the FDI-growth nexus. Such interest has been stimulated by new developments in growth theory. The “endogenous growth” model identifies knowledge accumulation as the driving force explaining the long-term growth of the economy (Bassanini and Scarpetta, 2001).

Natural resources are an important source of national wealth around the world (Tietenberg and Lewis, 2012). Yet, experience shows that natural riches are neither necessary nor sufficient for economic prosperity and progress (Daniels and Walker, 2001). In this paper, we have proposed a linkage between FDI and Persian Gulf countries’ economic growth through natural resources over the period 1980–2012. The results show that the impact of arable land, forest area and the interaction between FDI and environmental policy on economic growth was negative, but renewable internal freshwater resources flows, mineral depletion and energy use have a positive effect.

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