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Fossil Fuels, Development and Aid: Should More Be Done to Help?

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Abstract

Previous works have demonstrated that developing nations rich in fossil fuels typically suffer from lower levels of economic growth than nations without them. Increased foreign aid in these countries could potentially reverse their misfortunes and improve their overall welfare. Three indicators were selected in this study to gauge national welfare; economic growth, improvements in national institutions and changes in life expectancy over time. Using a dataset of more than 100 nations collected from 1983-2010, however, I found foreign aid to have nearly zero effect on any of these measurements of national welfare within fossil fuel rich nations.

1. Introduction

1.1 Topic and Significance

This paper covers the topic of economic development in countries rich in oil and natural gas. Previous studies have been conducted that demonstrated the difficulties of these resource-rich nations to grow at the same pace as their counterparts (Gylfason, 2001; Lynn Karl, 2004; Samargandi, Fidrmuc, & Ghosh, 2014). Due to the demonstrable struggles of these countries, it is worth asking if foreign aid efforts should be concentrated on them. Some studies have brought into question the effectiveness of foreign aid in encouraging prosperity within any developing nation regardless of resources (Djankov, Montalvo, & Reynal-Querol, 2006; Kurihara, n.d.). But for the purposes of this paper, perhaps the relationship of aid with nations saddled by oil and natural gas is fundamentally different and could even make an influx in foreign assistance crucial to changing their otherwise bleak outlook.

1.2 Why Do Resource Rich Countries Struggle?

Reasons for the slow growth of nations that are leaders in fossil fuel production are bountiful. One of the most often cited is the Dutch Disease (Gylfason, 2001). The Dutch Disease was coined by the magazine The Economist to describe the demise of the manufacturing sector in the Netherlands after the discovery of a large natural gas field in 1959. This is a problem that is often found in countries with one dominant industry, typically oil or natural gas. Developing nations, by very definition, do not have particularly robust and diverse economies. The discovery of 'black gold' — oil — or natural gas can become an immediate boon to the economy. When a developing nation becomes an exporter of oil or natural gas, the sector can swell with a sudden burst of foreign demand. But this is not as beneficial to a nation as it may appear. As foreign currency pours into the nation and is exchanged for the domestic currency to purchase these resources, the value of the domestic currency surges. Suddenly, other industries begin to see the market for their goods dry up as the strength of the domestic currency causes the purchasing power of foreigners to shrivel, depleting their demand for the goods. What was once an economic boon to the nation now suffocates its industries. As economic diversity within the country dwindles, this can make exporters of fossil fuels even more susceptible to shocks in energy prices.

Another oft-cited reason for the slow growth of resource rich nations is rent-seeking (Lynn Karl, 2004). Rent was defined by classical economist Adam Smith as being any type of earnings made in excess of relevant costs of production. Essentially, rent-seeking is the profits made from demonstrating market power rather than real economic production. This can manifest itself in many ways. For example, businesses can petition the government (or even bribe it) to create barriers to external competition. This might be done through introducing tariffs or creating domestic subsidies on the production of goods in a specific industry. A lack of competitive pricing through either of these means will allow companies to charge well above the actual costs of production. This distorts the efficient allocation of resources throughout the entire country, disproportionately accruing within the industry that wields the market power.

Other obstacles to development in oil and natural gas producing nations are noted in different studies as being the unpredictability of the energy market, lack of education and the deterioration of government (Lynn Karl, 2004).

1.3 Does Aid Even Work at All?

Many studies have been devoted to the topic of whether aid is even effective at all. Rightfully so, as foreign aid has ballooned into a trillion-dollar industry. The results of these studies have been discouraging. Many of them have concluded that aid has a negligible effect on the development of the receiving countries regardless of resources (Djankov et al., 2006; Kurihara, n.d.).

There are many criticisms of foreign aid, from the way it is distributed to the way it is implemented. Research has shown that nations receive aid based on political feasibility rather than where it will be best served (Alesina & Dollar, 2000). And the level of a corruption within the government of a receiving nation has no effect on the amount of aid that it receives, meaning that a lot of the money that is disbursed does not reach the people it is meant to serve (Alesina & Weder, 2002). People have also argued that aid agencies have broad and overlapping goals. Rather than setting small, distinct goals to measure development, agencies instead set out with goals like 'eradicating poverty' or 'achieving universal primary education' such as are laid out in the United Nations' Millennium Development Goals. And when these wide-sweeping goals are inevitably not met, there is no level of accountability. Every aid agency set out to achieve the same goals. Therefore, there is no one to bear responsibility for failure.

As the economic merits of foreign aid have begun to diminish, the effects of aid on human development are worth measuring. Shockingly, little research has been done to understand the effects of aid on the physical well-beings of individual recipients. One study on the effects of aid within the health sector, however, found that the concentration of health-specific aid did not have significant effects on general measures of physical well-being. These measures were life expectancy, death rate, infant mortality and immunization rate of measles and DPT (Williamson, 2008). None of the aforementioned variables of interest consistently returned a significant positive correlation with foreign aid.

In terms of institutions, the results for aid are slightly more inspiring, albeit minimally. Corruption has been found to decrease in nations that receive aid (Tavares, 2003). Additionally, foreign aid has been found to have a small but statistically positive effect on government institutions. The metric for institutions was a composite of several different aspects: checks within government branches, levels of political terrorism, constraints on executive power, democracy and the political independence of the judicial system (Jones & Tarp, 2016). Whether these small, positive results are worth continuing the steady expansion of aid funding is not for me to say and will not be discussed here.

The purpose of this study is to distinguish the effects of foreign aid specifically on fossil fuel rich nations. While the results of foreign aid overall have not inspired much excitement, there is a possibility that for this specific subset of countries that there are real positive effects. If there are, they should be observed before making any decisions. And there is real hope. The positive effects of aid on institutions and reducing corruption could be more valued in these

countries who struggle with mismanagement of their largest natural assets. And if aid can improve the economic well-being of other industrial sectors, it may help these countries to diversify and make them less prone to shocks in energy prices. Finally, while Claudia Williamson has already performed a sweeping summary of aid's effect on the health sector, she did not control for countries rich in natural resources. The general well-being of citizens in these countries is worth monitoring in case of unforeseeable effects of aid on their physical health. The combination of economic growth, institutional fortitude and life expectancy should give a well-rounded image of the role that aid does — or doesn't — play in improving the welfare of this specific subset of countries. It is for those reasons that these variables of interest have been selected.

Methods

The data was extracted from a 2016 study conducted by Sam Jones and Finn Tarp. The authors derived their numbers on aggregate aid, fossil fuels, life expectancy, economic growth and other relevant variables from the database, AidData. The numbers on institutions were taken from a separate location called the Quality of Government database. As mentioned in the introduction, the variables the authors determined as appropriate indicators for institutional strength were as follows; checks within government branches, levels of political terrorism, constraints on executive power, democracy and the political independence of the judicial system. For the purposes of the study, it should be beneficial to use another author's definition of institutional strength. This eliminates possible bias that would come from creating a personal definition that would be potentially malleable in order to meet desired results.

Since the study specifically observes the change in institutional strength over time, a variable was generated that measured the difference between the present strength of institutions and a lag of the same variable. The same approach was taken in creating a variable that measured changes in life expectancy. The original dataset also did not provide nominal GDP, but rather the logarithmic form of national GDP per capita. It was necessary to invert this logarithm, as well as the logarithmic form of national population, to derive the numbers for population and GDP per capita. The numbers were multiplied to derive nominal GDP which was then used to solicit the rate of growth of each country after the data was organized in a time series panel. As for the main explanatory variable — total aid as a percent of GDP — it was important to use a lag. Since we are trying to gauge the effects of aid on different indicators, it would not make sense to measure the indicators at the same time as the aid is received. Instead, the amount of aid a country received in the past year will be better in explaining present changes in GDP, institutions and life expectancy. To better avoid omitted variable biases, the regression also included two other variables: the log of the country's population and the log of the country's GDP. Both of those variables were lags as well.

Now that the study was equipped with definite standards and measurements of its three indicators of national welfare, it could proceed in deriving the data. The standard OLS (ordinary least squares) regression model was not sufficient for this study. A lack of stationarity became apparent throughout this time series set. Factors such as foreign aid, GDP, and life expectancy have all steadily increased over time. This would skew the results of any OLS regression run on any of our indicators. For example, if we ran an OLS model regression and found GDP Growth

is correlated to higher past levels of GDP, we could not verify the validity of this relationship. That's because both GDP and levels of GDP growth have increased over time anyway. So the highest levels of GDP will occur simultaneously with the highest levels of GDP growth anyway. Therefore, this relationship is due to an outside factor — time — rather than how these two variables interact. To compensate for this fact, it was determined a panel data fixed effects model would be the most appropriate. With this model, the differences that are observed over time are considered. The model will distinguish between the effects of time and the effects of the variables which will allow us to look at these relationships without distortions. For added consideration, all tables will include the statistics of the same model used on non-fossil fuel rich nations to demonstrate the contrasts between them and exporters of oil and natural gas.

Data

Table 1: *Descriptive Statistics of Non-Fossil Fuel Exporting Nations*

	Obs.	Mean	Standard Dev.	Minimum	Maximum
GDP Growth	1,887	3.74	6.289	-51.03	106.28
GDP Per Capita	1,986	3,252.26	3,056.69	100.89	17.441.69
Institutional Rating	2,087	10.05	72.33	-154.88	242.07
Life Expectancy	2,087	59.94	9.98	26.82	79.19
Aid Received as Percent of GDP	2,087	6.15	8.45	0	122.85

Table 2: *Descriptive Statistics of Fossil Fuel Exporting Nations*

	Obs.	Mean	Standard Dev.	Minimum	Maximum
GDP Growth	737	4.16	6.22	-41.30	46.50
GDP Per Capita	744	4,984.02	3698.85	247.89	15,882.04
Institutional Rating	756	-28.38	65.74	-143.82	163.96
Life Expectancy	756	64.18	9.02	40.89	76.90
Aid Received as Percent of GDP	756	2.71	5.62	0	95.09

Tables 1 and 2 are summary statistics for nations distinguished by the presence of natural gas or oil. As you can see, mean GDP Growth, GDP per capita and life expectancy is higher in the nations with natural gas or oil. Mean institutional rating and the amount of aid received, however, are lower. T-tests verify the statistical significance of every one of these differences with the sole exception of GDP growth.

Now that we have a basic understanding of the conditions in these nations, it is important to find what it is about a country that determines the amount of aid that it can expect to receive. To do so, a fixed effects model was run with the amount of aid as a percent of GDP explained by the lagged form of several variables. All the explanatory variables are lagged since the amount of aid rewarded in a given year is better explained by the conditions of the nation in the previous year. The results of that model are listed below in Table 3.

Table 3: *Amount of Aid Received as a Percent of GDP Depending on Different Variables, Fixed Effects Model*

	Coefficients with Standard Deviation
Log of GDP (lag)	**-6.898**
	(.643)
Log of Pop (lag)	**4.291**
	(1.728)
Life Expectancy (lag)	**.138**
	(.045)
Presence of Oil/Gas (lag)	-.575
	(.606)
Institutional Strength (lag)	**.011**
	(.003)
Constant	90.695
R-squared within/between/overall	.611

Note: Bold indicates a correlation that's significant with 95% confidence.

Table 3 shows that as a nation's GDP rises, it can expect to receive less foreign aid. As its population rises, it can expect to receive more. This is fairly intuitive. More aid is also correlated with stronger institutions, though slightly. What does not have any statistical significance in a country's ability to solicit aid is the presence of fossil fuels. This seems contradictory to the descriptive statistics in Tables 1 and 2, but both can hold true. It just requires that nations with and without oil are fundamentally different from each other in GDP, population and other factors that determine the amount of foreign aid it receives. But if aid is disbursed indiscriminately of oil and natural gas reserves, it makes it more imperative to determine if it is effective in those fossil fuel-rich nations. The analysis of which begins below in Table 4.

Table 4: *Different Variables' Effects on a Nation's GDP Growth, Fixed Effects Model*

	Non-Fossil Fuel Exporting Nation	Fossil Fuel Exporting Nation
Total Aid as Percent of GDP (lag)	**.104**	-.015
	(.023)	(.045)
Log of Pop. (lag)	1.640	**-13.056**
	(2.025)	(4.268)
Log of GDP (lag)	**-8.814**	**-8.629**
	(.810)	(1.306)
1-Yr Change in Inst.	**.014**	.005
	(.005)	(.010)
1-Yr Change in Life Exp.	**.713**	**2.024**
	(.337)	(.746)
Constant	179.706	435.625
R-squared within/between/overall	.144/.000/.001	.198/.028/.002

Note: Bold indicates a correlation that's significant with 95% confidence.

The first variable of interest that is analyzed was the effect of aid on the economic growth of the nation. Table 4 demonstrates that foreign aid has a near zero effect on the rate of growth within nations that are exporters of oil or natural gas. This is in direct contrast of the effect of foreign aid on the nations without fossil fuels where the model suggests a statistically significant, positive effect on GDP growth, however small. Other takeaways from Table 4 include the

significant burden of a larger population on economic growth in fossil fuel rich nations that is not present in countries without them. Also, the positive effect of improving national institutions on economic growth is notably voided in nations that export oil or natural gas. And finally, the benefits of improved life expectancy on GDP growth is markedly stronger in nations with fossil fuels.

*Table 5: **Different Variables' Effects on a Nation's 1-Yr Change in Life Expectancy, Fixed Effects Model***

	Non-Fossil Fuel Exporting Nation	Fossil Fuel Exporting Nation
Total Aid as Percent of GDP (lag)	**.008**	.003
	(.002)	(.002)
Log of Pop. (lag)	**-.427**	-.141
	(.143)	(.222)
Log of GDP (lag)	**-.470**	**-.273**
	(.058)	(.069)
1-Yr Change in Inst.	.000	.001
	(.000)	(.001)
GDP Growth	**.004**	**.005**
	(.002)	(.001)
Constant	17.713	9.460
R-squared within/between/overall	.126/.012/.000	.125/.033/.005

Note: Bold indicates a correlation that's significant with 95% confidence.

The next variable that was observed was aid's effect on changes in life expectancy. Again, in nations that are exporters of fossil fuels, the positive effects of foreign aid are no longer present. Interestingly, though unrelated to the main topic, the negative effects of population size and economy size that are noted in countries without fossil fuels are mitigated in the nations with them. In either category, however, GDP growth is a consistent means of improving the life expectancy within a country's population. If improving the well-being of people within developing nations is a priority, this should suggest that improving the economic standards of living in these countries is a consistent way to do so.

*Table 6: **Different Variables' Effects on a Nation's 1-Yr Change in Institutions, Fixed Effects Model***

	Non-Fossil Fuel Exporting Nation	Fossil Fuel Exporting Nation
Total Aid as Percent of GDP (lag)	.042	.102
	(.104)	(.174)
Log of Pop. (lag)	8.347	-12.205
	(9.051)	(16.754)
Log of GDP (lag)	-2.665	-2.565
	(.3.740)	(5.255)
GDP Growth	**.287**	.084
	(.106)	(.151)
1-Yr Change in Life Exp.	-.300	2.910
	(.1.506)	(2.924)
Constant	-78.224	244.158
R-squared within/between/overall	.046/.025/.008	.068/.005/.006

Note: Bold indicates a correlation that's significant with 95% confidence.

The final variable of interest that was examined was the effect of foreign aid on the propensity of a country to enact positive changes within its national institutions. Table 6, however, demonstrates no statistically significant ability of foreign aid to enact positive change on a country's national institutions whether they are an exporter of oil or not. In fact, only one explanatory variable had any statistical significance in the model for either category: GDP growth in a non-fossil fuel exporter was positively correlated with stronger institutions but not in nations that do export fossil fuels.

Conclusion

The models used in this statistical analysis does not support the notion that aid can provide any benefits to the overall welfare of a fossil fuel-rich nation in terms of the three variables of interest described in this study. While aid may have merits in non-fossil fuel exporting countries in improving GDP growth and improving life expectancy, those benefits do not exist in nations with oil or natural gas deposits.

There are many reasons this could be the case but one theory will be offered here. Corruption within the governments of fossil fuel-rich nations is often associated with powerful and wealthy energy magnates bribing officials to rig the rules of trade in their favor (Shaxson, 2007). Additionally, foreign aid has been found to have Dutch Disease effects of its own which might make pre-existing distortions in currency more pronounced in these countries (Rajan & Subramanian, 2011). The combination of these two factors may be responsible for the nullified benefits of aid on GDP growth in countries that are exporters of natural gas or oil. Since life expectancy is correlated with GDP growth — shown in Table 4 and 5 — these economic effects are likely the same reasons that the benefits of aid are mitigated with improving life expectancy as well.

This study is not without its shortcomings, however. There's a strong possibility that omitted variable bias is present within the models. Indeed, the models would've been better served to include the effects of aid on corruption and exchange rates within nations that are exporters in fossil fuels as to better justify the theory on its ineffectiveness. The models also only account for general trends in aid rather than incremental. It is possible that the effects of foreign aid vary at varying amounts. Finally, the examination of aid's effect in this study would be better validated if run through more regressions other than a panel data fixed effects model to establish robustness. In the future, this research could become more valuable if these limitations were accounted for. Based on these results alone, however, it is difficult to justify continued foreign aid programs within fossil fuel-rich nations.

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