# The Effects of Natural Resources on Gender Inequality: An Explanation for the Resource Curse?

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**Abstract**

This paper examines the relationship between the dependence on natural resources, gender inequality in education and economic growth. I study whether resource-rich countries experience greater gender inequality, and thereof reduced economic growth. My results indicate that both point (oil, minerals) and diffuse (agricultural products) resource-intensive countries tend to suffer from higher levels of gender inequality. However, there are significant differences in the relationships between resource types, institutions and gender inequality. With strong legal institutions, more point resources increase gender inequality, while in the presence of weak legal institutions, more point resources reduce gender inequality. Additionally, there is an indirect link between point resources and gender inequality that operates through corruption. Conversely, the effect of diffuse resource dependence on gender inequality is always negative but its magnitude depends on the level of corruption within the political system. Finally, I find no strong evidence linking gender inequality in education to slower growth in resource-rich countries.

*Keywords:* Natural resources, gender inequality, institutional quality, growth

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## 1. Introduction

Gender equality has recently become a key focus of many development policies, and has been recognized as a precondition for reducing world poverty. The importance of gender equality today is highlighted by the inclusion of a gender specific goal in the United Nations Millennium Development Goals: "Eliminate gender disparity in primary and secondary education by 2005 and at all levels by 2015" (United Nations 2006). However, despite this increased global attention to the issue of gender inequality, progress has been very slow and limited. For example, as recently as 2010, the ratio of female to male primary school enrollment in Angola, a major oil exporter, was only 81%. What makes this example particularly relevant is that Angola is only one of the many natural resource-rich countries that suffer from poor social development and also, slower economic growth.

Conventional economic theory suggests that countries that possess abundant natural resource endowments are fortunate, as their stock of natural resources expands their production possibilities and should support greater economic growth and development. However, since the 1990s when Sachs and Warner (1995, 1997, 1999) demonstrated that natural resource-rich countries tend to grow much slower than their resource-poor counterparts, a significant amount of empirical evidence has emerged supporting that very argument, now termed the 'resource curse'. Numerous studies have offered evidence indicating that countries with abundant natural resources are more likely to experience negative economic, political and social outcomes. These include poor economic performance, low levels of human welfare, increased income inequality, prevalence of poverty, low levels of democracy, and high levels of corruption (Ross

1999, 2001; Bulte et al. 2005; Collier 2003; Nankani 1979; Isham et al. 2005). Consequently, the resource curse refers to the paradox that countries endowed with natural resources have been unable to successfully translate that resource wealth into economic or social development.

Natural resources themselves are not detrimental to economic growth and socio-political development; rather their negative effects manifest through intermediate links, which are harmful to the economy and/or society. There is no consensus within the literature regarding these intermediate links/transmission mechanisms but among those regularly named in the literature are: the Dutch disease, rent-seeking and institutional quality, and neglect of human capital. Most of the mechanisms that have received great scholarly attention are either economic or political (e.g. the Dutch disease and institutional quality channels), while the social development aspect (e.g. the human capital channel) has received less attention.

Furthermore, the theories that have been presented within this social development and natural resource literature usually do not distinguish between the genders. It is necessary to make this distinction, however, because natural resources cause certain tendencies in the economy that generate and/or amplify existing gender inequalities. For instance, due to the fact that natural resource production is often male dominated (e.g. mining), natural resource dependence might discourage women from joining the labor force. Reductions in women's labor force participation rates might have adverse social consequences, which include reduced investments in female education and higher fertility rates. Furthermore, natural resource abundance could lead to a situation whereby the dominant group – typically men – capture all the resource rents, leaving women at a

socio-economic and political disadvantage and further increasing the gender gap in various dimensions.

Distinguishing between the different effects of natural resources on men and women is also important because of the positive linkages between gender equality and economic growth. A number of theoretical and empirical studies have offered evidence that there is a negative relationship between gender inequality in education and economic growth (Galor and Weil 1996; Klasen 2002; Dollar and Gatti 1999; Klasen and Lammana 2003). Gender-based inequalities in education are detrimental to economic growth because they reduce the average level and quality of human capital in a society and limit a society's benefit from the externalities of female education, which include reduced fertility levels, child mortality levels and increased human capital formation of the next generation.[1] Similarly, gender gaps in employment reduce the size of the labor force, which ultimately reduces economic growth.

It is therefore possible that natural resources could negatively impact economic growth indirectly through gender inequality. In this paper, I explore the negative effect of natural resource abundance on gender inequality as an indirect mechanism that can explain the negative correlation between natural resource dependence and growth. I contribute to the limited literature dealing with the nexus between natural resource abundance and gender inequality in two ways. First, I propose a more complete study of the mechanisms linking natural resources and gender inequality. Second, I conduct an empirical analysis of the impact of natural resources on gender inequality over the period 1984-2007 with particular attention to the type of natural resources considered.

[1] This assumes that boys and girls have a similar distribution of abilities – gender-based inequalities in education deprive more able girls of education and encourage less able boys, thereby reducing the average human capital.

My main results indicated that firstly, resource-rich countries tend to suffer from greater gender inequality in education. Furthermore, I find that point-source resources (resources extracted from a narrow geographic or economic base, such as oils and minerals) and diffuse-source resources (resources spatially and economically spread out, such as agricultural produce) affect gender inequality in different ways. The magnitude of the effect of point resources on gender inequality depends on the level of existing legal institutions: in countries with poor legal institutions, point-source resources increase gender inequality while in countries with strong legal institutions, point resources actually enhance gender equality. Additionally, point resources reduce the quality of institutions such that in countries with weak institutions, the negative effect of increased point resources is intensified. On the other hand, while I also find that diffuse resources increase gender inequality, this effect is neither channeled through institutions nor fully mitigated by strong institutions. Lastly, I find that gender inequality does not serve as a resource curse channel for resource-rich countries.

The paper is organized as follows: In section 2, I review the relevant background literature on natural resources, gender and growth. Section 3 explores whether natural resource-rich countries suffer from greater gender inequality while section 4 examines gender inequality as a transmission mechanism for the resource curse. I present my empirical model based on previous research and economic concepts. Section 5 discusses my robustness analysis and Section 6 concludes.

## 2. Gender Inequality and Natural Resources in the Growth Literature

In this section, I review the main economic explanations for the resource curse; the empirical evidence linking natural resources with various inequalities; and the empirical evidence on the role of gender inequality in economic growth.

### 2.1 The Resource Curse – Main Transmission Channels

Why countries endowed with natural resource experience poor economic growth has been a conceptual puzzle for many economists. There have been many theories advanced in the literature to explain this negative relationship. Gylfason (2001) has pointed out that these theoretical explanations have been of the following kind: the abundance of natural resources influences some variable "X" which hurts growth, so natural resources impede economic growth by hurting "X." Below, I expand briefly on the main economic explanations for the resource curse.

The first of these explanations is the Dutch Disease: a resource boom (either in the form of new discoveries or price improvements) leads to a real exchange rate appreciation that diminishes the export competitiveness of the manufacturing sector and other non-natural resource sectors of the economy (Sachs and Warner 1999). The model postulates that by crowding out the manufacturing sector, natural resources reduce overall economic growth. Furthermore, an increase in exchange rate volatility due to commodity price booms and busts reduces foreign trade and investments in the manufacturing and other non-natural resource sectors (Gylfason et al. 1999). This model has been debated in the literature because the conclusion that natural resources leads to lower economic growth relies on the unproven premise that the manufacturing sector, in generating

learning-by-doing and other positive externalities, is "the main engine of growth" (Sachs & Warner 1999).

The second category of explanations revolves around the link between institutions and resource wealth. This literature can be divided into two main strands. The first strand posits that by creating incentives for rent seeking, natural resources reduce the quality of institutions; weak institutions, in turn, serve as the intermediate link that reduces economic growth. The large inflows of revenue that accompany a resource boom increase the temptation on the part of decision-makers to maintain power and control by allocating resources to enrich themselves, rather than for growth-oriented economic policies (Leite & Weidmann 2002). Also, these large revenues spur various interest groups to allocate their resources to appropriating a portion of the resource rents, instead of pursuing other investment opportunities. Hence, rent seeking diverts resources away from productive activities and leads to bribes, corruption, misallocation of resources and distortions in public policies, which constrain economic growth (Sala-i-Martin and Subramanian 2003; Leite and Weidmann 1999). The second strand within the institution-resource curse literature posits that the presence of natural resources does not necessarily weaken the quality of institutions. Instead, natural resources interact with existing institutions and hinder economic growth only when institutions are weak (Mehlum et al. 2005). Therefore, within this strand, sound macroeconomic or microeconomic policies could actually offset the negative effects of natural resources.

The final category of explanations concerns the neglect of education and human capital accumulation by resource-rich states.[2] The main thread in this category is that

[2] There are contradictory results within this literature. Although the finding that there is a negative correlation between natural resources and human capital has been more substantiated, some scholars find

lower levels of human capital (in terms of education and health) reduce the productivity of non-resource sectors of the economy, and lower overall economic growth. There are also two theories within the literature about the role human capital plays in the resource curse. The first is that higher levels of human capital could counteract the negative effects of resource abundance, such that resource abundance is a blessing for economic growth with higher human capital (Bravo-Ortega and De Gregorio 2005). The second is that natural resources crowd out human capital, and that poor economic growth is a consequence of low public expenditure on education and lower levels of schooling (Gylfason 2001). Resource-rich states derive substantial revenues from the sale of their resources and are therefore likely to tax their populations less heavily and engage in greater spending programs to reduce public pressures for accountability, thereby increasing the level of non-wage income within the economy (Ross 2001). Therefore due to the high level of non-wage income e.g. dividends, social spending and low taxes, natural resource abundance states reduce private and public incentives to invest in human capital accumulation (Gylfason et al. 1999).

## 2.2 The Effect of Natural Resources on Inequality

In this section, I briefly discuss the studies within the resource curse literature that have focused on inequality, and pay particular attention to the limited literature on gender inequality.

Majority of the studies that explore the effects of natural resources on various inequalities emphasize that ownership of natural resources, particularly point-source

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that natural resources actually enhance human capital accumulation. See Stijns (2006) and Davis (1995) for contrary evidence.

resources, is typically concentrated amongst a few individuals or groups. This results in an unequal distribution of income, education and productive assets. Davis and Tilton (2005) highlight the role of elite capture, which refers to the view that natural resource rents are typically controlled by the government and urban ruling elite, and largely exclude the poor from the benefits of resource abundance. Isham et al. (2005) show that because of the unequal access to natural resource wealth, resource-rich countries are likely to experience greater social tensions as well as greater economic divisions. Specifically, Fum and Hodler (2010) show that natural resources increase income inequality in ethnically polarized societies, but reduce income inequality in ethnically homogenous societies. Additionally, Buccellato and Mickiewickz (2009) demonstrate, with regard to Russia, that regional oil and gas abundance is associated with high within-region income inequality. They present empirical evidence that highlights that the link between inequality and resource abundance occurs through a corrupted political mechanism and distorted economic institutions. In a nutshell, all these studies have highlighted the role that natural resources play in accentuating the gaps between the rich and the poor, but issues relating to gender disparities are notably understudied.

Ross (2008) makes a huge contribution to the subject of natural resources and gender inequality in his study on the relationship between "Oil, Islam and Women." He provides evidence that oil and gas extraction rather than Islam, reduces the participation of women in the labor force, and thereby reduces their political power. He bases his argument on the Dutch Disease model earlier outlined and argues that increased oil production crowds out the domestic manufacturing sector, and increases the demand for non-traded goods such as construction and services. Occupational segregation within the

oil and gas sector decreases the participation of women in the natural resource sector, and the crowding out of industries that possibly hire large proportions of women increases gender inequality in the workforce as a whole. Limited labor force participation rates further reduce women' opportunities for political influence.

Likewise, within their larger study on inequality and economic growth, Gylfason and Zoega (2002) explore the effects of natural resource abundance on gender inequality. They argue that because of the unequal distribution of natural resource ownership, resource-rich countries have an unequal distribution of education, which in turn reduces economic growth. They find that while natural resource abundance significantly increases gender inequality, measured by the difference between male and female secondary school enrollment rates, gender inequality does not significantly hamper economic growth. In this study, Gylfason and Zoega implicitly assume that the effects of natural resource abundance are uniform across all resource types. Their natural resource measure, natural capital encompasses both subsoil assets (e.g. minerals and oil) and green capital (e.g. timber and pasture land), and therefore, ignores the varied effects different natural resources have on human capital formation, gender inequality and economic growth.

Papyrakis et al. (2009) address this concern raised by Gylfason and Zoega's work by exploring the relationship between both mineral and agricultural resource abundance, gender inequality, and economic growth. They find that resource-rich countries experience higher levels of gender inequality, measured by the relative average years of schooling between females and males. They also find that while gendered education acts as a channel for resource dependent growth, institutions play a significantly larger role in promoting economic growth in resource-rich countries. However, the authors do not

provide the mechanisms that link natural resources to gender inequality. They simply attribute this increased gender inequality to 'structural characteristics or political economy reasons' (Papyrakis et al. 2009, p. 1).

The existing literature on gender inequality and resource abundance does not develop the links between different kinds of natural resources, gender disparities and political institutions. Nonetheless, this is particularly pertinent to study because access to and control of economic resources is often times determined by the quality of political institutions. Therefore, it is worthwhile to determine the role institutions play in the relationship between natural resources various forms of gender inequality.

### 2.3 Gender Inequality and Economic Growth

In this section, I briefly discuss the role that gender equality plays in enhancing economic growth. Within academic circles, there is a nascent literature supporting the notion that gender inequality negatively affects both economic growth and human development in general. Figure 1 presents a framework for understanding the relationships between female empowerment, gender equality, poverty reduction and economic growth. Likewise, figure 2 depicts a positive association (calculated from data on the countries in the sample) between gender equality, measured by the ratio of female to male secondary school enrollment (%) and the average annual growth rate of GDP per capita (%).

Several channels through which gender inequalities are linked with economic growth have been put forward in the literature. These channels include human capital, employment and entrepreneurship, access to productive assets and resources, legal status

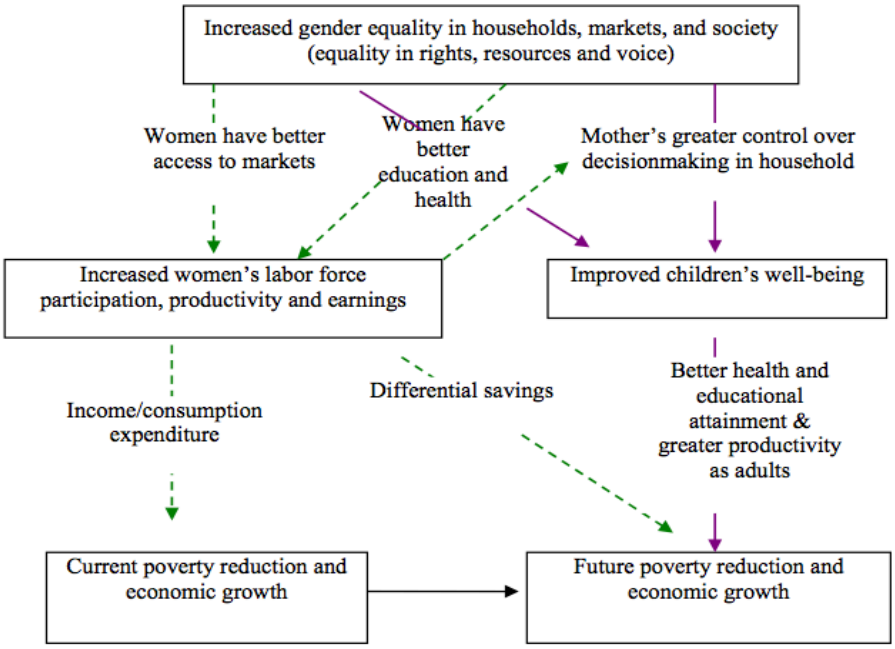
and political voice. I have chosen to focus on gender disparities in education in this study; therefore, I will briefly present the evidence that relates to the effects of gender inequality in education on economic growth. These arguments are closely related to the arguments regarding gender inequalities in employment.

First, gender-based inequalities in education reduce the amount of human capital available within the country, and thus reduce economic growth. By excluding qualified girls and instead favoring less-qualified boys – and thereby restricting the pool of talent from which to draw for education and employment – gender inequality in education harms economic performance (Klasen 2002). Specifically, Dollar and Gatti (1999) find that higher female secondary attainment leads to higher growth rates, while male attainment rates do not significantly affect economic growth.

Secondly, there is strong empirical support in the literature that female education generates positive externalities such as reduced fertility levels, reduced child mortality levels and increased health, education and nutrition of the next generation. These externalities positively affect economic growth (Lagerlof 2003, Klasen 1999).

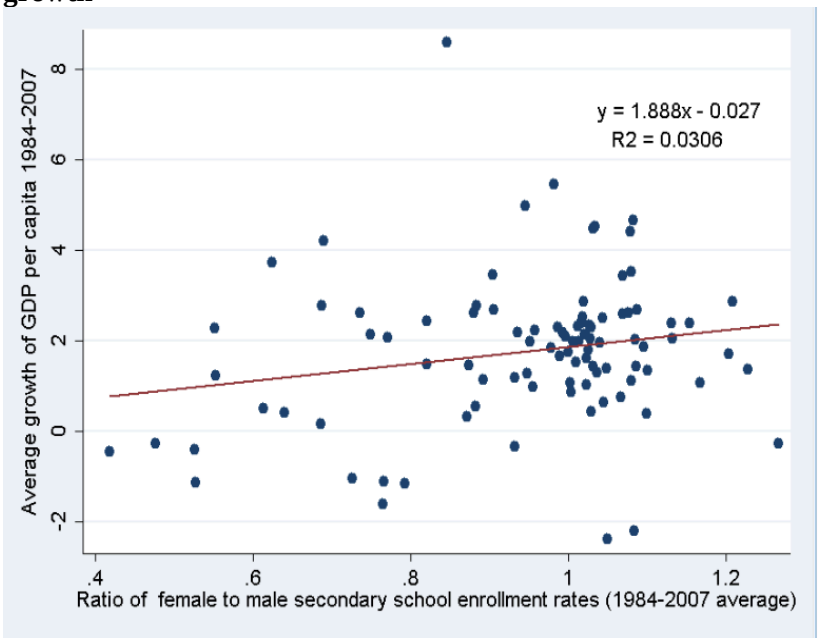
Third, gender inequalities in the labor market reduce the level of total output because of the misallocation of the labor force; skilled female workers are excluded from the positions where they would generate the most output. For example, many East Asian countries have experienced positive growth and maintained international competitiveness through the use of women-intensive export-oriented manufacturing industries (Klasen and Lammana 2002). Gender inequalities in education and employment would reduce the ability of countries to exploit such opportunities.

**Figure 1. A framework for understanding the links between gender equality and growth/poverty reduction**




**Source: Morrisson, Raju and Sinha (2007)**

**Figure 2: Positive Correlation between Secondary Enrollment Ratio and GDP per capita growth**




**Source: WDI**

## 3. Do Natural Resources affect Gender Inequality?

There is an extensive literature on the economic, political and social consequences of resource abundance, but there are only a handful of studies that have addressed the relationship between natural resources and the various dimensions of gender inequality. These dimensions of inequality include access and achievement in education, improvement in health, indexes of legal and economic inequality in society, and measures of political empowerment (Dollar and Gatti 1999). In this paper, I consider gender inequality in education as the indicator of gender inequality for several reasons. First, there is already an extensive literature regarding the effects of natural resources on human capital; therefore I consider whether these effects impact men and women differently. Second, educational inequality could help explain income inequality between men and women (Cornia and Court 2001). Education increases subsequent earnings and expands future opportunities for both boys and girls; therefore, inequalities in education could signal the extent of female involvement in the labor force and also women's ability to purchase healthcare and legal services. Furthermore, there is a general consensus that improvements in gender equality in education improve economic growth.

### 3.1. Theoretical framework

I hypothesize that the abundance of natural resources strengthens the cultural and traditional norms that marginalize women – for example, norms that ascribe greater value to boys over girls, and thereby reduce investments in female education. There are two primary mechanisms through which the dependence on natural resources could exacerbate existing gender inequality. The first reason concerns the allocation of

productive resources within the economy, and the role that institutions play within that framework. As discussed in Section 2.1, there are two main theories regarding the links between institutions and the resource curse: i) that institutions serve as an intermediate causal link; and ii) that resources interact with the quality of institutions. With regard to gender inequality, both possibilities are also likely.

Natural resources could increase gender inequality because they cause a decay of institutional quality. Rent seeking, which is a manifestation of weak institutional quality, diverts public and private resources away from investments in human capital and towards the exploitation of natural resources. In particular, resource rents reduce the political incentives to invest public resources in schooling and health, or to explicitly pursue pro-female policies such as extending property and voting rights to women. This underinvestment in human capital might exacerbate gender inequality because faced with a limited supply of education and healthcare facilities, families in gender unequal societies may choose to invest in male children over female children. Moreover, Dollar and Gatti (1999) have demonstrated that low investment in human capital for women is not an efficient economic choice; religious and cultural preferences explain a large amount of the gender differentials in education and health. Therefore, in resource-rich states with already high gender inequality, a reduction in education and healthcare provisions may disproportionately affect women.

Furthermore, as certain natural resources are easily appropriable and concentrated, government officials and the urban elite in resource-rich countries may appropriate the rents for themselves. This is similar to the elite capture phenomenon, in which a few politically and/or economically powerful groups usurp resources transferred

for the benefit of the masses at the expense of the less powerful groups (Dutta 2009). In resource-rich societies with high gender inequality in access to resources and political participation, the dominant group – typically men – may absorb all the benefits from natural resources. Conversely, in more gender equal societies, resource rents may be shared more or less equally between both men and women.

It is also possible that the presence of natural resources could interact with the quality of institutions to determine the impact on gender inequality. Here, strong political institutions could mitigate the negative effects of natural resources on gender inequality in resource-rich countries. In countries with strong institutions, the ruling elites are unable to monopolize resource rents and are restricted from siphoning funds away from welfare services. On the other hand, where institutions are weak, the negative effects of natural resources prevail.

The second mechanism by which natural resources could increase gender inequality relates to the tendency of natural resource production to limit women's opportunities to work outside the home, and its resultant effects on female human capital accumulation. Natural resource production tends to be relatively capital-intensive (e.g. complex machinery on plantations), skill-intensive (e.g. oil) or occupationally segregated in favor of men (e.g. mining), which discourages female participation in the resource sector.[3] Furthermore, natural resource endowments could reduce the incentives to invest in other sectors and diversify the economy, and could also crowd out other non-traded

[3] The expansion of the diffuse resource sector might actually increase the share of women in the labor force because women constitute a large proportion of agricultural employment. A recent State of Food and Agriculture Report highlighted that women comprise an average of 43 percent of the agricultural labor force in developing countries (FAO 2011). However, this report also emphasized that within the agricultural sector, there are large gender disparities in access to productive resources, which affects women's product yields. Therefore, even when there is a small gender gap in employment numbers, there are significant gender inequalities in other dimensions.

sectors of the economy – most famously, the manufacturing sector (Sachs and Warner 1999). If the manufacturing sector were weakened through natural resource production, female labor participation rates would be further reduced because in many countries, the manufacturing sector is highly feminized. Many export oriented manufacturing industries such as the textile industry heavily rely on women to supply cheap, 'unskilled' labor. Therefore, as supported by the evidence provided by Ross (2001) and Sachs and Warner (1999), occupational segregation in the resource curse sector and the possible contraction of female-dominated sectors increase employment gender gaps between males and females.

The attendant effect of the possible reduction in women's labor participation rates on relative female to male education levels is ambiguous[4]: it could increase women's educational attainment relative to men because women are not occupied with earning wages or it could reduce women's education relative to men for the same reason. Alderman and King (1998) have shown that families devote more resources to male (over female) human capital investment for various reasons: i) the perception that the return from girls' schooling is lower than that for boys; ii) the belief that the expected transfer from child to parent in old age is higher for boys; iii) preference informed by culture and religion. Therefore, one could postulate that as labor demand is biased towards males, families have a greater incentive to invest in the education and health of males rather than females due to anticipated future earnings. But if males were largely being employed in low-skilled occupations, they would not require a high level of education and as such families may actually invest more in female education. It is difficult to determine the

[4] If, on the other hand, agricultural resource expansion increases female employment levels, this would also increase the gender gap because agriculture is often times a low-skilled occupation and does not require high educational attainments.

direction of the effect but as gender differences in investment in human capital arise primarily from decisions at the household level, by reducing women's wage-earning avenues, natural resources might strengthen traditional norms and attitudes and increase gender inequality where a male-dominated structure exists. Furthermore, by indirectly allocating a greater proportion of the resource rents to men (through higher labor participation), resource abundance might increase men's bargaining power within the household and thereby promote education of boys over girls.

### 3.2 Data

The dataset underlying the gender inequality regressions includes 94 developed and developing countries for the years 1984-2007. In this section, I present the definitions and sources of the main variables used in my analysis.

*Natural Resource Measure:* resource exports as a percentage of merchandise exports. The term, 'natural resources' is defined variably and measured in different ways throughout the literature. For instance, Sachs and Warner (1995) measure resource abundance as dependence on primary exports (share of exports of fuel and non-fuel primary products exports in GNP); Bulte et al. (2005) as share of exports of minerals, fuels and agricultural produce on total merchandise exports; and Gylfason (2001) as share of natural capital in total wealth.

I have chosen to use resource exports as a percentage of merchandise exports (export concentration) as my natural resource measure because of its popularity within the literature and its availability over a long time period. Despite the fact that it is one of the most commonly used measures in the literature, this variable has several

shortcomings (which I discuss further in section 5). Recognizing that this natural resource measure excludes the proportion consumed domestically, and that it signals the dependence of the economy on the primary sector rather than resource abundance per se, I have chosen to refer to this variable as 'resource dependence' throughout my study.

Furthermore, I distinguish between point and diffuse natural resource exports. Isham et al. (2005) point out that different types of natural resources affect institutional quality differently, and therefore have varied impacts on the economy. Point resources are negatively correlated with institutional quality, and point resource revenue is typically socio-economically concentrated through technological means or corporate structures. The explanations given for this phenomenon by Isham et al. (2005) include: the urban ruling elite in control of the point resources resist industrialization in order to maintain their grip on power; and that the export of high-rents produce leads to a degeneration of the social structure (such as trust and credibility) which in turn affect political outcomes. On the other hand, diffuse resource revenue is more socio-economically dispersed, and diffuse resources are also not significantly correlated with institutional quality

Accordingly my resource export data is broken up into: i) exports of fuels, ores and minerals as a percentage of merchandise exports, and ii) exports of agricultural products and food as a percentage of merchandise exports. This data is taken from the World Bank's World Development Indicators database (WDI).

*Gender Inequality Measure:* the ratio of female to male secondary school enrollment rates. I have chosen to use enrollment rates as opposed to the other measures of gender inequities in education because school enrollment rates are the most suitable in assessing access to (rather than performance) education at the secondary level. Initial gender

inequality (IGI) is defined as the gender inequality measure lagged by five years. (Source: WDI)

*Control Variables:*

a. The log of GDP per capita, which captures the level of economic development. I expect states with higher per capita GDP to have lower levels of gender inequality. Several studies have shown that increases in income per capita lead to reductions in gender inequality (Dollar and Gatti 1999; Easterly 1997). I use GDP per capita in constant 2000 US$ in all regressions (Source: WDI).

b. Islam: this variable captures the Muslim fraction of each country's population. Several studies have confirmed that Muslim countries tend to have higher gender inequality (Dollar and Gatti 1999; Baliamoune-Lutz 2006). This data was collected from The World Religion Database.

c. Democracy - I expect that states with higher democratic accountability would have lower gender inequality, as they would pursue more pro-female policies in order to assure electoral support from women. The measure of democracy used is from the Polity IV dataset and accounts for political regime, with an index ranging from -10 for autocracies to +10 for pure democracies (Marshall and Jaggers 2010).

d. Two measures of a state's political institutions compiled by the Political Risk Services Group in their International Country Risk Guide. This dataset is the most detailed set of governance indicators collected over a long time period. The indicators I use are: Corruption, which assesses the level of corruption within the political system (e.g. excessive patronage, nepotism, demands for special

payments and bribes); and Rule of Law, which is a measure of the strength and fairness of the legal system as well as the general adherence to the law. Both indexes range from 0 to 6 where, higher scores indicate better institutions. I expect that states with lower corruption and stronger rule of law will have lower gender inequality because resource rents are less easily appropriable and the state is able to more efficiently provide public services.

e. Female share of the total labor force (Source: WDI)

### 3.3 Empirical Procedure

I aim to explore whether the effects of natural resource abundance on gender inequality are channeled through institutions and/or labor participation rates or whether the relationship depends on the level of institutional quality. My empirical approach allows me to test these theories. The main gender inequality regressions all employ the same method of estimation: panel fixed-effects. The advantage of this FE estimation is that it controls for characteristics that are specific to individual countries and constant over time, thereby eliminating some of the potential sources of omitted variable bias. For instance, culture explains a lot of the gender differentials in education, thus the FE estimation is appropriate because it controls for these time-invariant characteristics. I distinguish between point and diffuse resources in all the regressions.

In equation (1), the education gender inequality measure, ratio of female to male secondary enrollment rates (%), is regressed on the natural resource measures, GDP per capita (log) and control variables. The equation is given below:

$$GI_{i,t} = \beta_0 + \beta_1 NR_{i,t-1} + \beta_2 GDPpc_{i,t} + \beta_3 X_{i,t} + \varepsilon_{i,t} \quad (1)$$

where i denotes the country, t denotes the year, X is a series of explanatory variables. To minimize potential endogeneity, GDPpc and NR were lagged by one year in all the regressions.

Second, I examine whether natural resources influence gender inequality through an institutional channel. To do this, I first regress a measure of institutional quality, IQ, on natural resources. I estimate a cross-country OLS regression in which IQ, measured in 2007 depends on NR (averaged over the time period) and several control variables: initial GDP per capita, initial human capital and the fraction of the population speaking English or another European language as first language (Source: Hall and Jones 1999). Following Hall and Jones (1999), the last two exogenous variables are included to minimize the endogeneity between GDP per capita and institutions. I then include the institutional quality measures in the main regression and see if the significance is weakened by the inclusion of these variables. If the estimated coefficient of natural resources is unchanged, that suggests that if there is an effect of natural resources, it is affecting gender inequality through other channels.

Next, I estimate another equation to determine if the effects of natural resources on gender inequality are conditional on the quality of institutions, such that when there are good institutions, natural resources promote gender equality and vice versa. The following equation incorporates an interaction term between natural resources (NR) and institutional quality:

$$GI_{i,t} = \beta_0 + \beta_1 NR_{i,t-1} + \beta_2 GDPpc_{i,t-1} + \beta_3 IQ_{i,t-1} + \beta_4 (IQ*NR)_{i,t-1} + \beta_5 X_{i,t} + \varepsilon_{i,t}, \qquad (2)$$

Fourth, to determine whether natural resources affect gender inequality through the labor force channel, I first regress the female share of the total labor force on the two natural resource proxies and some control variables: log of GDP per capita; log of GDP per capita squared, which accounts for the U-shaped relationship between female labor force participation rates and economic development, such that states with very low and high income states have high female population in the workforce; fertility rate indicates how much time women dedicate to raising children instead of working; and secondary school enrollment rate for females. The data on fertility rate and school enrollment rates are gotten from the WDI.

I then include the female share of the labor force in the main gender inequality regression and see if the significance of NR is weakened by the inclusion of this variable. I include this variable as a regressor with the assumption that it is endogenous. There is a simultaneous relationship between labor participation and education, such that both variables influence each other. Therefore, I use the labor participation rate lagged by 2 years to minimize this problem.

Finally, I attempt to determine whether natural resources exacerbate existing gender inequality by strengthening the cultural norms that encourage gender inequality. However, since it is not possible to estimate that effect directly, I control for these cultural norms by using the 5-year lagged value of the gender inequality measure and interact it with the natural resource variable. The equation is given below:

$$GI_{i,t} = \beta_0 + \beta_1 NR_{i,t-1} + \beta_2 GDPpc_{i,t} + \beta_2 (IGI*NR)_{i,t-1} + \beta_4 X_{i,t} + \varepsilon_{i,t}, \qquad (3)$$

### 3.4 Results of Regression Analyses

*A. Initial Results*

Table 3.I illustrates the estimation for the two natural resource dependence proxies, point and diffuse, where the dependent variable is the ratio of female to male secondary school enrollment rates multiplied by 100 for ease of interpretation. The results indicate that both point and diffuse natural resources have a negative and significant impact on gender inequality in education (see columns 1 and 4 of Table 3.1). The negative coefficient indicates an increase in gender inequality because the variable is calculated as female over male enrollment rates. Therefore, natural resource dependence tends to reduce the percentage of female secondary school students relative to the percentage of male students. A difference of 10 per cent in the share of point resource exports in total exports is associated with a drop in female secondary school enrollment rate of 0.56 per cent compared to the male equivalent (see column 1 of Table 3.1), while the same difference in diffuse resource exports would reduce female enrollment by 1.1 per cent (see column 4 of Table 3.1).

The control variables perform as expected. Democratic institutions and the level of economic development enhance women's education relative to men while the presence of a larger Muslim population increases gender inequality in education, although this variable is insignificant. The stories that emerge from Table 3.1, that are common to both measures of natural resources are that higher GDP per capita and the presence of a democratic regime are strongly associated with higher gender equality in education.

*Table 3.1: Explaining gender inequality*

Panel A: Corruption

Dependent variable: Ratio of female to male secondary school enrollment rates

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| Point resources | -0.056** | -0.048* | 0.67* | | | |
| | (0.071) | (0.013) | (0.035) | | | |
| Point* corruption | | | -0.494*** | | | |
| | | | (0.014) | | | |
| Diffuse resources | | | | -0.109*** | -0.121*** | -0.228*** |
| | | | | (0.028) | (0.067) | (0.038) |
| Diffuse* corruption | | | | | | 0.034*** |
| | | | | | | (0.009) |
| Corruption | | 1.199*** | 2.110*** | | 1.356*** | 0.743** |
| | | (0.288) | (0.344) | | (0.287) | (0.319) |
| Log (GDP per capita) | 12.595*** | 14.305*** | 14.607*** | 9.975*** | 11.646*** | 11.603*** |
| | (1.220) | (1.280) | (1.271) | (1.373) | (1.407) | (1.392) |
| Islam | -23.731 | -18.032 | -19.313 | -15.329 | -8.917 | -10.926 |
| | (18.136) | (18.073) | (17.923) | (18.030) | (17.932) | (17.790) |
| Democracy | 0.364*** | 0.349*** | 0.334*** | 0.381*** | 0.360*** | 0.362*** |
| | (0.071) | (0.071) | (0.070) | (0.070) | (0.070) | (0.069) |
| Constant | 3.153 | -22.612** | -27.173*** | 18.320* | -0.981 | 1.845 |
| | (9.429) | (10.470) | (10.426) | (11.009) | (11.655) | (11.562) |
| Observations | 1376 | 1376 | 1376 | 1376 | 1376 | 1375 |
| Countries | 94 | 94 | 94 | 94 | 94 | 94 |
| R-squared: within | 0.1170 | 0.1288 | 0.1441 | 0.1242 | 0.1393 | 0.1535 |
| R-squared: between | 0.3913 | 0.3676 | 0.3640 | 0.3691 | 0.3283 | 0.3350 |

Note: Standard errors for coefficients in parentheses. *Significant at 10%, ** significant at 5%, *** significant at 1%. Country fixed effects are used in each estimation. See text for descriptions of variables

Panel B: Rule of Law

Dependent variable: Ratio of female to male secondary school enrollment rates

| | (7) | (8) | (9) | (10) |
|---|---|---|---|---|
| Point resources | -0.051* | -0.167*** | | |
| | (0.026) | (0.035) | | |
| Point * rule of law | | 0.035*** | | |
| | | (0.014) | | |
| Diffuse resources | | | -0.111*** | 0.020 |
| | | | (0.06) | (0.038) |
| Diffuse * rule of law | | | | -0.051*** |
| | | | | (0.010) |
| Rule of law | 0.644** | 2.110*** | 0.719*** | 2.09*** |
| | (0.275) | (0.344) | (0.272) | (0.388) |
| Log (GDP per capita) | 11.738*** | 12.103*** | 8.986*** | 7.543*** |
| | (1.271) | (1.272) | (1.420) | (1.437) |
| Islam | -17.980 | -24.693 | -9.193 | -18.811 |
| | (18. 269) | (18.343) | (18.138) | (18.811) |
| Democracy | 0.345*** | 0.334*** | 0.357*** | 0.435*** |
| | (0.071) | (0.070) | (0.070) | (0.071) |
| Constant | -0.781 | -0.794*** | -22.434** | 31.784*** |
| | (9.513) | (9.485) | (11.094) | (11.156) |
| Observations | 1376 | 1376 | 1376 | 1376 |
| Countries | 94 | 94 | 94 | 94 |
| R-squared: within | 0.1208 | 0.1271 | 0.1289 | 0.1452 |
| R-squared: between | 0.3776 | 0.3936 | 0.3393 | 0.3593 |

Note: Standard errors for coefficients in parentheses. *Significant at 10%, ** significant at 5%, *** significant at 1%. Country fixed effects are used in each estimation. See text for description of variables.

*B. Institutions*

I then examine the role that institutions play, either as a channel through which natural resources affect gender inequality, or as an interaction effect that alters the impact of natural resources on inequality. Specifically, I have postulated that natural resources affect gender inequality by weakening institutions or by interacting with the existing institutions.

I will first discuss the evidence that natural resources affect gender inequality in education indirectly through the institutional channel. To do this, I first establish a link between natural resources and institutions. I examine the influence of natural resources on two institutional quality measures, a law and order index which measures rule of law and a corruption index. The indices run from 0 to 6 i.e. when the corruption index is 0, there is high corruption in government and 6, low corruption. The results are presented in Table 3.2. Consistent with the existing literature, the results indicate that point resource dependence is negatively and significantly linked to institutional quality while diffuse resources do not significantly affect institutional quality.

Next, I examine in Table 3.1, whether the effects of NR occur through the institutions channel. I examine the effect of institutions on gender inequality as well as the effect of natural resources once we control for institutional quality. If institutional quality is significantly related to gender inequality, then, given the results in Table 3.3 showing a link between natural resources and institutions, this would suggest that natural resources affect gender inequality indirectly through the institutions channel. The results in Table 3.1 indicate that greater institutional quality is associated with increased gender equality – the signs of the IQ variables' coefficients support this conclusion and the effect

is significant in all the cases. Additionally, the effect of point natural resources on gender inequality is weakened once I control for corruption and rule of law in the regressions; the coefficients diminish in magnitude and the statistical significance of the estimates reduce from the 5% level to the 10% level. These observations indicate that institutional quality is a causal channel through which point resources affect gender inequality in education. However, as evidenced by the estimates presented in Table 3.2 and consistent with the literature, the effects of diffuse natural resources on gender inequality do not operate through the institutional channel.

*Table 3.2: Natural Resources and Institutional Quality*

| | Corruption | Rule of law | Corruption | Rule of law |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Point resources | -0.008* | -0.008* | | |
| | (0.004) | (0.004) | | |
| Diffuse resources | | | -0.002 | -0.003 |
| | | | (0.005) | (0.520) |
| Log (GDP per capita 1984) | 0.352*** | 0.556*** | 0.289** | 0.472*** |
| | (0.103) | (0.107) | (0.115) | (0.120) |
| % English | -0.283 | -0.525 | -0.426 | 0.367 |
| | (0.457) | (0.476) | (0.460) | (0.478) |
| % European language | 0.172 | -1.153*** | 0.331 | -0.952*** |
| | (0.348) | (0.301) | (0.305) | (0.315) |
| Years of schooling (1985) | 0.137** | 0.066 | 0.170*** | 0.102 |
| | (0.061) | (0.064) | (0.060) | (0.620) |
| Constant | -0.743 | -0.480 | -0.617 | -0.175 |
| | (0.566) | (0.589) | (0.779) | (0.810) |
| Observations | 87 | 87 | 87 | 87 |
| Adjusted R-squared | 0.4805 | 0.4943 | 0.4600 | 0.4754 |

Note: Standard errors for coefficients in parentheses. *Significant at 10%, ** significant at 5%, *** significant at 1%. See text for description of variables.

I then explore the theory that the effect of natural resources on gender inequality depends on the level of institutional quality. If the coefficient of the interaction term is positive and statistically significant and the coefficient on natural resources is negative, strong institutions mitigate the negative effects of natural resources on gender inequality. Contrary to my hypothesis, the results indicate that lower corruption would increase gender inequality in education (see column 3 of Table 1A). Conversely, the rule of law supports my hypothesis of an interaction effect. The results suggest that with a high level of rule of law, point resource-rich countries avoid the gender equality in education curse (see column 8 of Table 1B). For countries with a high law and order index (greater than the threshold of 4.77=0.167/0.035), point natural resources do not reduce women's education levels relative to men. Among the 94 countries in the sample, 37 countries have the law and order index (for all/majority of the years in which data is available) sufficient to eliminate the gender inequality resource curse. Most of these successful countries are developed nations with two unsurprising exceptions in the developing world: Botswana and Namibia. Thus, the intuition here is that when legal institutions are bad, point-source natural resources increase gender inequality; when institutions are good, point-source natural resources promote gender equality. Taking into account the fact that dependence on point resources reduces rule of law, the effect of point resource dependence on gender inequality is reinforced as institutions are worse that they were initially.

The fact that rule of law and corruption yield different results merits an explanation; both indices are strongly positively correlated and should go hand-in-hand. However, the indices measure different aspects of institutional quality, with various

corrupt activities not necessarily being illegal.[5] Within the corruption index are various forms of legal corruption: for example, close ties with politics and business could come in the form of economic elites influencing public policy through lobbying or exchange of legal political contributions. Therefore, it is plausible that while the magnitude of the effect of point resources on gender inequality depends on the level of rule of law, the effect could also be channeled through corrupt activities.

The results for diffuse resources are rather different. The results indicate that with lower corruption, countries dependent on diffuse resource resources could experience greater gender equality (see column 6 of Table 3.1A). However, the threshold level of corruption at which diffuse resources benefit rather than hurt women relative to men is 6.71 (=0.228/0.034), which is greater than the corruption index scale. Therefore, while lower corruption mitigates the negative effects of natural resources, it doesn't reverse the resource curse in terms of gender inequality. Additionally, the results suggest counter intuitively that a higher level of rule of law would increase gender inequality in education (see column 10 of Table 3.1B).

In summary, the results suggest that point resources and diffuse resources affect gender inequality in different ways and that the specific institutions matter in the relationships.

[5] The law and order index used in this analysis assesses the strength of the legal system and the popular observance of the law while the corruption index is more concerned with nepotism, job reservations, 'favor-for-favors' and close ties between politics and business.

*C. Female labor force participation*

Natural resources have an ambiguous effect on women's education, and consequently relative female-male education attainment rates. Natural resource abundance could encourage women to spend more time in school because they are unable to pursue wage-earning opportunities. Conversely, natural resource abundance might reduce families' incentives to educate their female children because of their limited wage-earning potential, and possibly reduced intra-household bargaining power.

In order to first determine the relationship between female labor force participation and natural resources, I regress the female share of the total labor force on the two natural resource measures and some controls. The data for the female share of the labor force is only available from the year 1990, so the sample size is smaller than in earlier regressions. The results, presented in table 3.3, suggest that diffuse natural resources reduce female share of the labor force while point natural resources have no significant effect on female labor. This result is inconsistent with the evidence that Ross (2008) presented which suggested that larger oil rents per capita (a point resource) reduced female labor force participation.

I then estimate the benchmark gender inequality regression with the inclusion of female labor force share (lagged by 2 years to minimize endogeneity). The results, which are presented in table 3.4, indicate that women's share of the labor force actually affects gender inequality negatively; it hurts women's education levels relative to men (see columns 2 and 4). Possible explanations for this finding are that: i) women are more concentrated in low-skilled occupations that do not require high educational attainments; and ii) the trade off for work is education; girls (over 15) have to choose one or the other.

Additionally, I examined whether gender inequality in employment, measured by the female share of the labor force, could act as a resource curse channel for resource-dependent economies. The results (not shown here) indicated that female share of the labor force was not a transmission channel; the estimated coefficients for both the point and diffuse resource measures remained the same after the inclusion of the labor force variable. The results further indicated that female share of labor force does not significantly affect growth.

*Table 3.3: Natural resource dependence on female share of the labor force*

| | Dependent variable: female share of the labor force (%) | |
|---|---|---|
| | (1) | (2) |
| Point resources | 0.004 | |
| | (0.005) | |
| Diffuse resources | | -0.023*** |
| | | (0.006) |
| Log (GDP per capita) | -20.605*** | -21.368*** |
| | (1.499) | (1.492) |
| Log (GDP per capita) squared | 1.440*** | 1.466*** |
| | (0.087) | (0.087) |
| Female secondary schooling | 0.007 | 0.006 |
| | (0.004) | (0.004) |
| Fertility rate | -1.634*** | -1.552*** |
| | (0.134) | (0.207) |
| Constant | 111.262*** | 116.632*** |
| | (6.466) | (6.363) |
| Observations | 1109 | 1109 |
| Countries | 93 | 93 |
| R-squared: within | 0.4285 | 0.4372 |
| R-squared: between | 0.0375 | 0.0353 |

Note: Standard errors for coefficients in parentheses. *Significant at 10%, ** significant at 5%, *** significant at 1%. Country fixed effects are used in each estimation. See text for description of variables.

*Table 3.4: Explaining gender inequality: labor force participation*

Dependent variable: ratio of female-male secondary school enrollment rates (%)

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| Point resources | -0.074*** | -0.071*** | | |
| | (0.023) | (0.022) | | |
| Diffuse resources | | | -0.032 | -0.049** |
| | | | (0.024) | (0.024) |
| Female share of the labor force | | -0.418*** | | -0.471*** |
| | | (0.107) | | (0.109) |
| Log (GDP per capita) | 6.396*** | 8.202*** | 5.114*** | 6.782*** |
| | (1.076) | (1.163) | (1.187) | (1.238) |
| Islam | 41.507*** | 48.188*** | 41.142** | 49.228*** |
| | (16.101) | (16.071) | (16.193) | (16.151) |
| Democracy | 0.304*** | 0.308*** | 0.335*** | 0.343*** |
| | (0.079) | (0.079) | (0.080) | (0.079) |
| Constant | 36.139*** | 36.113*** | 46.002*** | 49.362*** |
| | (8.459) | (8.395) | (9.666) | (9.607) |
| Observations | 1024 | 1024 | 1024 | 1024 |
| Countries | 94 | 94 | 94 | 94 |
| R-squared: within | 0.0841 | 0.0989 | 0.0746 | 0.0929 |
| R-squared: between | 0.0002 | 0.0008 | 0.0033 | 0.0004 |

Note: Standard errors for coefficients in parentheses. *Significant at 10%, ** significant at 5%, *** significant at 1%. Country fixed effects used in each estimation. See text for description of variables.

*D. Initial Gender Inequality*

To determine whether natural resources exacerbate existing gender inequalities by reinforcing traditional norms that marginalize women, I estimate equation (3), which is the benchmark gender inequality equation with the inclusion of an interaction term between natural resources and the 5-year lag of the gender inequality measure (ratio of female to male secondary enrollment rates). Table 3.5 illustrates the results of that estimation. The results do not support the theory that the effect of natural resources depends on prior levels of gender inequality. The estimated coefficients of the interaction

terms for both point and diffuse resources are close to zero, which suggests that the effect of initial gender inequality is minimal (see columns 1 and 2 of Table 3.5). The coefficient on point resources is negative and insignificant, whereas the coefficient for diffuse resources is negative and significant at the 10% level. For diffuse resources, this suggests that higher prior gender equality leads to higher gender inequality, but the coefficient is almost 0 so the effect is negligible.

*Table 3.5: Natural Resources and Initial Gender Inequality*

| | Dependent variable: Ratio of female to male secondary school enrollment rates | |
|---|---|---|
| | (1) | (2) |
| Point resources | -0.060 | |
| | (0.057) | |
| Point * IGI | -0.0001 | |
| | (0.000) | |
| Diffuse resources | | -0.013 |
| | | (0.056) |
| Diffuse * IGI | | -0.0008* |
| | | (0.0004) |
| Log (GDP per capita) | 10.552*** | 8.447*** |
| | (1.307) | (1.460) |
| Islam | -22.921 | -17.909 |
| | (19.343) | (18.832) |
| Democracy | 0.475*** | 0.490*** |
| | (0.086) | (0.085) |
| Constant | 11.758 | 29.157** |
| | (10.163) | (11.906) |
| Observations | 1116 | 1116 |
| Countries | 91 | 91 |
| R-squared: within | 0.1159 | 0.1202 |
| R-squared: between | 0.3933 | 0.3614 |

Note: Standard errors for coefficients in parentheses. *Significant at 10%, ** significant at 5%, *** significant at 1%. Country fixed effects used in each estimation. See text for description of variables.

## 4. Explaining the Resource Curse through Gender Inequality

### 4.1. Empirical Procedure

As discussed earlier, the main channels of influence from natural resources to growth that have been identified in the literature are: terms of trade volatility, institutional quality, Dutch disease, crowding out of various forms of capital (human, foreign, physical), reduction in investment etc. My regression for the rate of growth captures these effects: average annual per-capita income growth from 1984-2007 (%) depends on the share of natural resource exports in total merchandise exports (NR); the logarithm of initial per capita income ($GDP_0$) – to test for convergence; the share of investment in GDP (I); volatility in terms of trade[6] (TT), an institutional quality measure (IQ) and a human capital index, the log of the average number of years of secondary schooling (E). The data for the real investment share of GDP are taken from the Penn World Tables 7.1; the terms of trade data are from the WDI (2013); and the data on years of schooling is obtained from Barro and Lee data set. The regression is estimated below:

$$g_i = \beta_0 + \beta_1 \ln(GDP_{i,0}) + \beta_2 I_i + \beta_4 TT_i + \beta_5 NR_i + \beta_6 E_i + \beta_7 IQ_i + \varepsilon_i, \qquad (4)$$

where $_i$ corresponds to each country in the sample.

I then estimate the same growth specification with the inclusion of gender inequality as measured by the ratio of the average female and male secondary enrollment rates in 1984-2007 (%). To recapitulate, my hypothesis is that gender inequality acts as a

[6] Net barter terms of trade index is calculated as the percentage ratio of the export unit value indexes to the import unit value indexes, measured relative to the base year 2000 (WDI). I used the following formula provided by Sachs and Warner (1997) to calculate the average annual percentage growth in terms of trade: 100*1/23*(Ln(TT2007)-Ln(TT1984))

transmission mechanism through which natural resources negatively affect economic growth - natural resource rents are less equally distributed than other assets and that results in a less equal distribution of education. The equation is below:

$$g_i = \beta_0 + \beta_1 \ln(GDP_{i,0}) + \beta_2 I_i + \beta_4 TT_i + \beta_5 NR_i + \beta_6 E_i + \beta_7 IQ_i + \beta_8 GI_i + \varepsilon_i, \qquad (5)$$

**4.2. Results**

Table 4.1 presents the results of the regressions testing whether there is a negative relationship between natural resources and economic growth. As predicted by the resource curse hypothesis, both point and diffuse natural resource dependence are negatively correlated with economic growth (see columns 1 and 3 of Table 4.1). For instance, a 10% increase in point resource exports is estimated to reduce growth by approximately 0.2 percentage points annually.

The signs of the coefficients of the explanatory variables are as expected. Growth is influenced negatively by the initial GDP per capita while human capital and the average rate of investment both significantly increase economic growth. High quality institutions as measured by the corruption index significantly increase growth. Similar results are estimated using the law and order index. The terms of trade measure has an insignificant effect.

The results of the growth regressions are also presented in Table 4.1 and indicate that gender inequality does not serve as a causal channel through which natural resources affect growth (see columns 2 and 4 of Table 4.1). The estimated coefficients for gender inequality are positive but insignificant. Also, the introduction of the gender variable does

not affect the magnitude or significance of the natural resource variables. This suggests that gender inequality in education is not a channel through which natural resources negatively impact economic growth.

*Table 4.1: The resource curse*

| | *Dependent variable: average GDP per capita growth rate 1984-2007* | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Gender Inequality | | 0.001 | | 0.016 |
| | | (0.011) | | (0.011) |
| Point exports | -0.017** | -0.017** | | |
| | (0.007) | (0.007) | | |
| Diffuse exports | | | -0.016** | -0.019** |
| | | | (0.007) | (0.007) |
| Initial Income (log) | -0.593*** | -0.596*** | -0.768*** | -0.812*** |
| | (0.173) | (0.175) | (0.179) | (0.181) |
| Corruption | 0.322* | 0.327* | 0.432** | 0.471** |
| | (0.188) | (0.193) | (0.184) | (0.186) |
| Investment Share | 1.569*** | 1.552*** | 1.178*** | 0.964** |
| | (0.374) | (0.397) | (0.397) | (0.423) |
| Terms of Trade | 0.022 | 0.020 | -0.059 | -0.0719 |
| | (0.060) | (0.063) | (0.053) | (0.054) |
| Schooling | 0.177* | 0.172* | 0.223** | 0.160 |
| | (0.092) | (0.100) | (0.089) | (0.100) |
| Constant | -0.177 | -0.328 | 1.71 | 1.618 |
| | (0.092) | (1.309) | (1.592) | (1.585) |
| Observations | 94 | 94 | 94 | 94 |
| Adjusted R-squared | 0.2790 | 0.2707 | 0.2734 | 0.2809 |

Note: Standard errors for coefficients in parentheses. *Significant at 10%, ** significant at 5%, *** significant at 1%.

## 5. Robustness Check

As noted earlier, there are certain problems associated with using natural resource exports as the natural resource measure. This estimate measures resource dependence rather than resource abundance, such that it is possible for a resource rich country to have a small share of resource exports. Essentially, the natural resource measure may be endogenous to the industrialization process/development level. A more precise measure of natural resources is the actual production of resources both consumed domestically and exported. Natural resource export, in contrast, measures the export intensity of primary exports and may also be capturing the level of development, as dependence on resource exports tends to be higher in poorer countries. Therefore, I use alternative measures of natural resources to test the robustness of my results.

*A. Wealth Accounts*

The World Bank's Wealth of Nations dataset provides a set of "wealth accounts," a set of variables that more accurately measures resource abundance. These variables include subsoil assets (sum of oil, natural gas, coal and mineral wealth), green capital (sum of timber, non-timber forests, and cropland wealth) and natural capital (land resources and subsoil assets), and are estimated for the years 1995, 2000 and 2005. As I have access to this data, I am able to perform a robustness check that addresses my earlier concerns. However, since the data is only available for 3 years, my analysis is confined to a cross section of the countries. I run a cross-section OLS regression that regresses gender inequality in education as measured by the average ratio of female and male secondary enrollment rates in 1984-2007 (%) on these alternative resource abundance estimates and the control variables earlier mentioned.

In Table 4.2, I present the estimated coefficients for the various natural resource estimates. The results largely confirm the main results of my earlier analysis. While there is no significant evidence of a negative effect of a larger share of subsoil assets on gender inequality – the coefficient is negative but insignificant, a larger share of green capital (diffuse resources) and natural capital both increase gender inequality. Furthermore, using this natural resource measure, gender inequality does not serve as a causal channel through which natural resources inhibit growth (results not shown here).

*Table 4.2: Alternative natural resource measures*
Dependent variable: ratio of the average secondary school enrollments of females and males (%). (F/M)

| | Subsoil Assets / Total Wealth | Green capital / Total wealth | Natural capital / Total wealth |
|---|---|---|---|
| Relative education | -0.114<br>(0.109) | -0.371***<br>(10.535) | -0.176***<br>(0.063) |
| Adjusted R-squared | 0.0010 | 0.1087 | 0.0685 |

*B. Natural Resource Exports as Share of GDP*

Despite the evidence presented above, positing that natural resource dependence/dependence on the primary exports sector increases gender inequality is somewhat challenging considering the results observed when I use another alternative measure: natural resource exports as a share of GDP. This measure is more directly related to the estimate used in the main analysis and is one of the more popular natural resource measures found in the literature. I ran the same benchmark gender inequality and growth regressions using this alternate natural resource measure; the results are presented in Tables 4.3 and 4.4 below. I found that while a larger share of natural resource exports on GDP reduces economic growth (see columns 1 and 3 of Table 4.4), it does not significantly affect gender inequality (see columns 1 and 2 of Table 4.3).

*Table 4.3: Explaining gender inequality (NR/GDP)*

| | *Ratio of female-to-male secondary school enrollment rates* | |
|---|---|---|
| | (1) | (2) |
| Point resource exports (% of GDP) | 0.058 | |
| | (0.067) | |
| Diffuse resource exports (% of GDP) | | 0.083 |
| | | (0.087) |
| Log (GDP per capita) | 12.230*** | 12.589*** |
| | (1.224) | (1.242) |
| Islam | -19.677 | -19.799 |
| | (18.059) | (18.060) |
| Democracy | 0.391*** | 0.128*** |
| | (0.069) | (0.035) |
| Constant | -2.580 | -5.616 |
| | (9.431) | (9.719) |
| Observations | 1378 | 1378 |
| Countries | 94 | 94 |
| R-squared: within | 0.1132 | 0.1133 |
| R-squared: between | 0.3877 | 0.3315 |

Note: Standard errors for coefficients in parentheses. *Significant at 10%, ** significant at 5%, *** significant at 1%. Country fixed effects are used in each estimation.

*Table 4.4: The resource curse (NR/GDP)*

| | *Dependent variable: average GDP per capita growth rate 1984-2007* | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Gender Inequality | | 0.0007 | | 0.0133 |
| | | (0.017) | | (0.011) |
| Point resources (% of GDP) | -0.046*** | -0.046*** | | |
| | (.016) | (.017) | | |
| Diffuse resources (% of GDP) | | | -0.065** | -0.070** |
| | | | (0.022) | (0.0228) |
| Initial Income (log) | -0.527*** | -0.529*** | -0.814*** | -0.846*** |
| | (.104) | (.178) | (0.177) | (0.178) |
| Corruption | 0.274 | 0.193 | 0.410** | 0.440** |
| | (0.188) | (0.188) | (0.181) | (0.182) |
| Investment Share | 1.174*** | 1.731*** | 1.416*** | 1.274** |
| | (0.380) | (0.406) | (0.367) | (0.383) |
| Terms of Trade | 0.023 | 0.023 | -0.052 | -0.062 |
| | (0.058) | (0.058) | (0.052) | (0.053) |
| Schooling | 0.164* | 0.161 | 0.269*** | 0.219** |
| | (0.164) | (0.099) | (0.089) | (0.098) |
| Constant | -1.122 | -1.141 | 1.053 | 0.750 |
| | (1.253) | (1.292) | (1.337) | (1.355) |
| Observations | 94 | 94 | 94 | 94 |
| Adjusted R-squared | 0.2960 | 0.2879 | 0.2995 | 0.3036 |

Note: Standard errors for coefficients in parentheses. *Significant at 10%, ** significant at 5%, *** significant at 1%. See text for descriptions of variables.

These results complicate my earlier finding that natural resource export concentration significantly reduces gender inequality. It is difficult to determine exactly why measuring resource exports as a share of GDP (nrGDP) or as a share of total exports (nrEXP) yields different results. Nonetheless, I will offer one possible explanation for this finding: commodity price volatility in world markets. Note that this volatility in commodity prices refers to both point resources (oil, minerals) and diffuse resources (agricultural produce e.g. grain and coffee).

nrGDP depends on various factors besides the size of the resource exports sector. These include the size of the merchandise exports sector, the size of the overall domestic economy and world commodity prices. Therefore, it is possible that while an economy has large natural resource exports, its contribution to GDP is small relative to other sectors of the economy. Also, commodity prices determine how much revenue resource exporting countries generate from the sale of their resources. Resource revenue, in turn affects, both the size of GDP and the percentage share of resource exports. Therefore, price changes in world markets significantly affect nrGDP. On the other hand, while the movements in commodity prices affect the size of nrEXP, the within country variability in that measure is not as large as in nrGDP. Additionally, it takes a while to adjust production levels, especially with capital-intensive production, to match world prices.

Using Algeria, I will briefly offer an example of oil price volatility and the variability in nrGDP. In 1984 Algeria's nrGDP was 23.36% while its nrEXP was 98.04%. In 1987, Algeria's nrGDP had considerably dropped to 12.09% while nrEXP remained close to its 1984 value at 97.78%. An argument could be made here that the economy had diversified such that other sectors of the economy contributed more to GDP

(and also created new wage-earning opportunities as well as advances in education levels for both men and women). However, in 1990, nrGDP had risen to 20.19% while nrEXP remained high at 96.91%. Therefore, it is more plausible that commodity price changes – oil, in this case – affected the variability in nrGDP. The nominal price of crude oil had gone from $28.88 per barrel in 1984 to $18.14 in 1987 and to about $21.73 in 1990 (U.S. Energy Information Administration). It is noteworthy that the oil price changes did not significantly affect nrEXP.

This example has illustrated that changes in the natural resource share of GDP are not always related to the domestic economy, and therefore might not have any effect on the relative education levels of males and females.

## 6. Conclusion

This paper has further extended the resource curse literature by examining the relationship between natural resources, economic growth and an understudied aspect of social welfare: gender inequality. In contrast with other works, I have offered a more complete study of the possible mechanisms linking natural resources to gender inequality and have presented an empirical study using panel data, rather than cross-country data. This study is particularly relevant because gender inequality has recently been at the core of policy debates surrounding development. It is important to determine its root causes in order to promote development.

My main finding that countries rich in both point and diffuse resources tend to suffer from higher gender inequality is consistent with the larger consensus in the resource curse literature that natural resources harm rather than promote economic and

social development. My second main result is that there are significant differences in the ways that point and diffuse resources affect gender inequality. First, the gender inequality impact of an increase in point-source natural resource dependence is negative for most countries, but the magnitude of the effect depends on the extent of the observance of the rule of law. In countries with strong legal institutions, more point-source natural resource exports promote gender equality, while in countries with weak legal institutions, more point-source natural resource exports increase gender inequality. The fact that institutions are endogenous to resource exports suggests that countries with a low institutional quality "face a double burden" because institutions are worse than they initially were (Mehlum et al. 2005, p. 17). Additionally, the effect of point-source natural resource dependence on gender inequality also occurs indirectly through corruption. The two institutional quality measures have different impacts because the indices measure different aspects of institutional quality, with various corrupt activities not necessarily being illegal. Second, the gender inequality impact of an increase in diffuse-source natural resource dependence is negative for all countries but similarly, the magnitude of the effect depends on the extent of corruption within the political system. Additionally, there is no indirect link between diffuse natural resource dependence and gender inequality that operates through corruption or rule of law.

Based on these results, it is apparent that countries that have an export concentration in natural resources need to place greater emphasis on strategies that promote gender equality in education. These strategies could include gender-responsive budgeting and gender mainstreaming in development policies. In order to eventually "eliminate all gender disparity in primary and secondary education," these countries need

to focus on strengthening their legal and political institutions while also taking steps to wipe out both legal and illegal corruption.

My third result indicated that there is no significant evidence of a negative effect of gender inequality on growth when included in the natural resource-growth regression. Therefore, gender inequality does not serve as a causal channel through which natural resources inhibit economic growth. The results of this analysis suggest that gender equality may not always be "smart economics," as the World Bank (2012) has advanced. For resource-rich countries, striving for gender equality should be a matter of human rights, rather than an effort to promote long-term growth. Resource-rich countries should instead prioritize improving the other resource curse transmission mechanisms: investments, institutional quality, general human capital formation, for increased economic growth.

## Appendix

*Table A.1: Summary Statistics – Panel Data*

| | Variables | Mean | Std. Dev | Min | Max |
|---|---|---|---|---|---|
| | Inequality variables: | | | | |
| 1 | Ratio of female to male secondary enrollment (%) | 94.63 | 19.21 | 30.66 | 207.95 |
| 2 | Female share of the total labor force (%) (lagged by 2 years) | 38.48 | 9.77 | 9.66 | 56.03 |
| | Natural resource measures: | | | | |
| 3 | Point exports/GDP † | 5.84 | 9.91 | 0.0001 | 72.65 |
| 4 | Point exports/merchandise exports † | 20.44 | 24.86 | 0.001 | 98.63 |
| 5 | Diffuse exports/GDP † | 6.40 | 6.81 | 0.04 | 50.57 |
| 6 | Diffuse exports/merchandise exports † | 29.75 | 25.68 | 0.16 | 99.75 |
| | Control variables: | | | | |
| 7 | (Log) GDP per capita † | 7.88 | 1.53 | 4.84 | 10.76 |
| 9 | Corruption | 3.22 | 1.37 | 0 | 6 |
| 10 | Law and order | 3.73 | 1.51 | 0 | 6 |
| 11 | Islam | 0.02 | 0.36 | 0 | .99 |
| 12 | Democracy | 3.74 | 6.89 | -10 | 10 |
| 13 | Fertility rates (%) | 3.25 | 1.66 | 1.08 | 7.82 |
| 14 | Female secondary school enrollment rates (% gross) † | 72.02 | 34.34 | 3.09 | 175.06 |

Note: † means that the variable is lagged by one year. Data for 94 countries from 1984-2007

*Table A.2: Summary Statistics – Cross-sectional Data*

| | Variable | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| 1 | Investment share of GDP | 22.27 | 7.39 | 3.65 | 42.06 |
| 2 | Growth rate of GDP per capita | 1.76 | 1.66 | -2.39 | 8.59 |
| 3 | Point Exports (% of merchandise exports) | 22.73 | 25.04 | 0.23 | 96.97 |
| 4 | Point exports (% of GDP) | 6.95 | 10.73 | 0.03 | 52.12 |
| 5 | Diffuse exports (% of merchandise exports) | 30.21 | 24.72 | 0.45 | 91.23 |
| 6 | Diffuse exports (% of GDP) | 6.76 | 6.96 | 0.11 | 42.05 |
| 7 | Average years of schooling | 6.82 | 2.59 | 1.01 | 12.21 |
| 8 | Terms of trade | 0.20 | 2.87 | -7.77 | 12.21 |
| 9 | Corruption | 3.20 | 1.16 | 1.18 | 6 |
| 10 | Law and order | 3.76 | 1.30 | 1.5 | 6 |
| 11 | (Log) GDP per capita 1984 | 7.73 | 1.50 | 4.97 | 10.76 |
| 12 | Subsoil share of total wealth | 6.22 | 17.89 | 0 | 148.73 |
| 13 | Natural capital share of total wealth | 24.51 | 29.77 | 0.69 | 212.47 |
| 14 | Green capital share of total wealth | 12.54 | 17.35 | 0.15 | 119.41 |
| 15 | Ratio of female to male secondary school enrollment rate | 0.94 | 0.18 | 0.42 | 1.27 |

Note: All data for 94 countries (besides the log of GDP per capita, 1984) averaged over the years for which data is available. See text for description.

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