The Impact of Income Inequality on Domestic Investment in Resource-Rich Countries

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Abstract

This paper examines a relation between income inequality, natural-resource rents and domestic investment in resource-rich countries. While previous studies have found that the unequal distribution of natural-resource rents has a negative impact on general economic performance, little is known about its direct implications for domestic investment. In this paper, I apply difference and system generalized method-of-moments estimators to a dynamic panel of 57 resource-rich countries, for the period from 1982 to 2015. My findings show that, on average, countries with higher income inequality contribute relatively lower proportions of their natural-resource rents to domestic investment than do countries with lower income inequality. This result is robust to a variety of income-inequality measures, estimation approaches, and alternative specifications. The results could help resource-rich countries in their efforts to achieve higher growth using their resource endowments.

Key words: domestic investment, natural resource curse, income inequality

JEL classification: E22, F21, F63

1 Introduction

The paradox of plenty has been a long-standing issue in economics. It states that many countries with large natural-resource endowments experience worse economic outcomes

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relative to countries with fewer natural resources (Corden & Neary, 1982). This phenomenon is commonly referred to as the natural-resource curse (NRC) (Sachs & Warner, 2001). Many factors can explain this paradox: low levels of domestic investment and high levels of income inequality. As suggested by Solow (1974), since the stock of natural resources is finite, if resource-rich countries wish to maintain their present consumption levels, then they should increase their rates of investment to offset the eventual absence of this income source. This is commonly referred to as *Hartwick's rule*, (Hartwick, 1978). However, at first glance, investment-to-GDP ratios show the opposite pattern. For example, over the period 1982-2015, the median investment-to-GDP ratio of non-resource-rich countries was roughly 28% compared to 16% for resource-rich countries.[1] It is important to understand the lower levels of investment that take place in these resource-rich countries compared to investment levels in non-resource rich ones because it has been shown that investment is a key driver of economic growth in developing countries (e.g., Collier, Van Der Ploeg, Spence, and Venables (2010)).

In this paper, I investigate the impact of resource-rent inequality on the contribution of natural-resource rents to domestic investment. I address this question by using longitudinal data on 57 resource-rich countries from 1982-2015. Since there exists no publicly available measure of resource-rent distribution, I use income inequality, specifically the Gini coefficient of income, as a proxy. In estimating this relationship, I control for country-specific heterogeneity and attempt to address the fact that many variables are jointly determined (endogenous relationships). To do so, I estimate two different generalized method-of moments (GMM) models. First, I use a difference GMM estimator that employs lagged levels of the regressors as instruments (Arellano & Bond, 1991). Second, given that these lagged levels may be weak instruments to use in difference equations as in Blundell and Bond (1998), I also employ a system GMM estimator that uses past changes in the regressors as instruments for the current-level regressors.

Resource-rent inequality may affect investment through different mechanisms. For instance, it may potentially distort incentives for domestic investment in many ways. If resource-rent inequality is high, this may deter investors from investing in public goods since the payoffs may disproportionately accrue to those who do not invest in public goods (non-investors). Behzadan, Chisik, Onder, and Battaile (2017) note that income

[1] Resource-rich countries constitute countries with a positive share of natural-resource rents to GDP. Non-resource-rich countries are those with limited endowments of natural resources.

inequality is a key impediment to economic growth in resource-rich countries. Since, in many countries, domestic investment comprises a non-negligible share of gross domestic product, roughly one-fifth of GDP, as is emphasized above, it is plausible that income inequality also adversely affects domestic investment. Moreover, resource-rent inequality discourages investors since the investment returns are distributed among all populations. This would contribute to a lower level of investment in the economy. However, no existing literature has examined the link between income inequality, natural-resource-rent usage, and domestic investment.

The literature on domestic investment provides two insights. First, the explanations for domestic investment have emphasized that domestic savings, GDP, and foreign aid play positive roles in contributing to domestic investment (Bernanke, 1983; Ndikumana, 2000; Strum, 2001). Factors that have negative impacts on domestic investment are a higher cost of debt servicing, terms of trade, general government final consumption expenditures, and the poor quality of institutions (Ahmed & Miller, 2000; Bleaney & Greenaway, 2001; Lim, 2013; Ndikumana, 2000; Nguyen, Clements, & Bhattacharya, 2003). The second insight from this literature is about why domestic investment is low. One explanation points to overconsumption (Neumayer, 2004; Weinstein & Zeckhauser, 1975). If the economy exhibits overconsumption, then by definition, the level of domestic investment will be lower (abstracting from any international flows of capital). Lower levels of domestic investment translate into lower levels of capital stock and output (Bernanke, 1983; Gylfason & Zoega, 2006). Another explanation is that domestic rents have been invested in foreign countries where they can potentially earn higher rates of return (Collier et al., 2010) or face lower levels of taxation or regulation (Azémar & Dharmapala, 2019; Darby, Ferrett, & Wooton, 2014). In this regard, Hartwick (1978) emphasizes that a significant fraction of resource rents should be invested domestically in economic, reproductive assets to generate an additional source of income. I control for these key variables to study the relation between income inequality, natural resource rents, and domestic investment.

My paper relates to studies which emphasize the *Dutch Disease* as one explanation for the NRC (Corden, 1984; Corden & Neary, 1982; Davis & Tilton, 2005; Frankel, 2010; Sachs & Warner, 2001). This phenomenon describes how countries' trade sectors may be adversely affected by an exported natural resource(s). Higher demand for domestic currency drives up the real exchange rate, decreases the competitiveness of exported goods and services, and increases the attractiveness of imports. This event depresses trade sectors, making the economy less diverse and more resource-dependent. If a country's stock of natural resources is depleted or an important natural resource becomes subject to a negative price shock, then its economy can experience a sharp contraction (Papyrakis & Gerlagh, 2004; Sachs & Warner, 1995; Van Wijnbergen, 1984). One strategy to limit the consequences of Dutch Disease is to impose capital controls that limit the impact of a natural resource on this exchange-rate channel (García-Cicco & Kawamura, 2015). For example, countries like Norway have placed their excess foreign exchange in sovereign wealth funds (SWF).[2] This limits the appreciation of their domestic currency and lays money aside for domestic investment (Collier et al., 2010).

This paper also relates to the literature that emphasizes the role of income inequality in resource-rich countries. In particular, I discuss two of the most closely related studies. Goderis and Malone (2011) focus on how natural-resource booms (price or quantity) affect income inequality. These authors find that a natural-resource boom leads to a decrease in income inequality in the short run but a persistent rise in income inequality in the long run. A second closely related work is Behzadan et al. (2017), who find that income inequality has a negative effect on the economic performance of resource-rich countries: resource-rich countries with higher income inequality experience lower economic growth. The authors propose a model that includes a two-country economy—one with a high level of income inequality and one with low inequality—with three sectors that each producing one good: a manufactured good, a natural-resource good, and a non-tradeable luxury good. An increase in natural-resource rents in the high-inequality country leads to a larger share of the non-tradeable luxury good consumption. This phenomenon leads to a contraction in the labor supply in the sector whose labor force benefits from learning-by-doing. This contraction in the labor force in the tradable sector has two effects. First, a reduction in labor leads to lower productivity growth through the learning-by-doing mechanism. Second, it leads to a higher likelihood of importing manufactured goods. Once the natural resource is depleted, the country will experience subpar economic performance. These authors empirically show that income inequality plays an important role in economic growth.

The results in my paper suggest that, on average, countries with higher income inequality assign lower proportions of their natural-resource rents to domestic investment.

[2]A sovereign wealth fund (SWF) is a state-owned investment fund or entity that comprises pools of money that are derived from a country's reserves. These reserves are funds that have been set aside for investment to benefit the country's economy and its citizens.

According to the estimates, countries with Gini coefficients above 0.43, on average, make less domestic investment when the natural resource rents increase. While this investigation into domestic investment is new, the results are broadly consistent with the existing literature that examines the role of income inequality, resource-rent usage, and economic outcomes. For example, Behzadan et al. (2017) find that countries with higher income inequality experience lower economic growth. I build on their empirical model to reinforce this point and emphasize the role of income inequality in the NRC.

This paper, to my knowledge, is the first to link income inequality, natural-resource-rent usage, and domestic investment. I include not only natural resource rents and income Gini coefficient but also other key determinants of domestic investment from the literature as regressors. The proposed channel herein suggests that countries with higher income inequality contribute less of their natural-resource rents to domestic investment, leading to lower capital stock and output levels in these countries. This result is in line with what Behzadan et al. (2017) found that income inequality affects economic growth negatively. They use output determinants as independent variables to investigate whether income inequality affects natural resource rents' contribution to economic growth. In this paper, I use their findings as a point of departure for my investigation by using the same methodology as in their paper.

The rest of the paper is organized as follows. In Section 2, I discuss the data and empirical methodology. Section 3 presents a discussion of the results and some robustness checks. Section 4 concludes.

2 Empirical Strategy and Data

2.1 Empirical Strategy

Some countries experienced a noticeable decrease in domestic investment after a significant increase in natural-resource rents. Table A5 list those countries such as Peru, Venezuela, Botswana, and South Africa. They experienced significant growth in natural-resource rents, followed by a decrease in growth in domestic investment that ranged from 1.03% to 15.19% over the period 1982-2015.[3] To answer the question as to whether countries with higher income inequality invest less of their natural-resource rents domestically,

[3]Both natural-resource rents and domestic investment are expressed as a percentage of GDP.

several determinants of domestic investment are considered in the estimation. Specifically, some of the empirical literature discuss the determinants that positively affect domestic investment, such as domestic savings, GDP, and foreign aid (Ndikumana, 2000; Strum, 2001). Output is the primary determinant of domestic investment (Bernanke, 1983). The domestic interest rate, or the cost of capital, is a major determinate of the savings level. Thus, the lower the interest rate, the higher the demand for new capital (and investment) (Bayoumi, 1990; Dooley, Frankel, & Mathieson, 1987; Feldstein & Horioka, 1979). Most foreign aids assist in creating conditions that promote sustainable growth, for instance, in improving infrastructure (Strum, 2001).

Some empirical papers discuss other determinants that negatively affect domestic investment, such as higher debt servicing, general government final consumption expenditures, and lower institutional quality (Ahmed & Miller, 2000; Bleaney & Greenaway, 2001; Lim, 2013; Ndikumana, 2000; Nguyen et al., 2003). To be more specific, higher debt servicing crowds out investment, and this effect becomes stronger as debt servicing absorbs a growing share of GDP (Nguyen et al., 2003). The overall structure of governmental institutions also plays a role in encouraging or discouraging investment. Institutional quality can influence aggregate investment through measures such as contract enforcement and protecting property rights (Lim, 2013). The terms of trade can also work as a proxy for external shocks that can negatively or positively impact private domestic investment. On the one hand, A decline in the terms of trade, which means the price of exports falls relative to imports, might worsen the current account deficit and, in turn, negatively affect domestic investment. On the other hand, an increase in the terms of trade can have a positive impact on private domestic investment (Ajide & Lawanson, 2012). To assess the importance of income inequality to the contribution of resource rents to domestic investment, my baseline specification takes the following form:

$$Invs_{it} = \beta_0 + \beta_1 Invs_{it-1} + \beta_2 Nr_{it} + \beta_3 (Gini_i \cdot Nr_{it}) + \beta_4 X_{it} + \delta_i + \delta_t + \varepsilon_{it}, \tag{2.1}$$

where $Invs_{it}$ is the domestic investment as a share of GDP in country i at time t. I include a lagged investment as an explanatory variable in the estimation since, for many countries, domestic investment is a highly persistent process (Bernanke, 1983; Lim, 2013; Ndikumana, 2000). Nr_{it} is the sum of the natural-resource rents (profits from oil, natural gas, coal, minerals, and forestry), and $Gini_i$ is the income Gini coefficient. In this paper, ideally, I should use the Gini coefficient on the distribution of natural-resource rents. Since this measure is not available, I use the income Gini coefficient by country to proxy each country's natural-resource-rent distribution. Due to data-availability issues, I treat the Gini coefficient as fixed and take the average coefficient value over the sample period for each country. The rationales for treating the Gini coefficient as fixed are (i) missing random observations for many countries and (ii) the fact I am interested in the evolution of natural-resource rents and their relationship with an overall measure of income inequality not year-to-year changes in income inequality.

To answer the question posed in this paper—whether countries with higher income inequality display lower levels of domestic investment in the presence of larger natural-resource rents—I include an interaction term between the Gini coefficient and the natural-resource rents. Finally, X_{it} contains a vector of the control variables the existing literature emphasizes as being important determinants of domestic investment. Specifically, this vector includes institutional quality and the interaction between the quality of governmental institutions and natural-resource rents, as in Mehlum, Moene, and Torvik (2006), and also inflation, growth in the terms of trade, government final consumption expenditures, the log of real GDP per capita, foreign aid, total debt servicing and gross domestic savings. Finally, I include country-specific intercepts and time-fixed effects to capture unobserved heterogeneity.

In estimating equation 2.1, several econometric issues need to be addressed. First, including a lagged dependent explanatory variable and country-specific intercepts is problematic. This issue is the well-known Nickell bias, which arises because there exists a correlation between the dependent variable, domestic investment, from the previous period and the current error term (see Nickell (1981)). Second, many of the explanatory variables are jointly determined. Thus, it is unclear whether the causality is unidirectional (e.g., the causality may run from GDP to domestic investment or from domestic investment to GDP). To overcome these issues, I use two different approaches. First, I estimate equation 2.1 using a first-difference Arellano-Bond GMM estimator (AB-GMM) (Arellano & Bond, 1991). The AB-GMM is a dynamic panel estimator in first differences. The AB-GMM estimator circumvents the issues described above since (i) taking the first-difference of the equation removes the country-specific intercepts, and (ii) the AB-GMM estimator uses lagged levels of the independent variables as instruments for potentially endogenous variables.

To estimate equation 2.1, I consider the possibility that all of the independent variables are endogenous; the exception is for any term that interacts with the Gini coefficient (the term of interest), for which I do not use an instrument since it is averaged over the period 1982-2015. Any interaction term with an averaged Gini coefficient (a lagged one) is not a valid instrument. In a first-difference equation, I do not use the first lag as an instrument because $Invs_{it-1} - Invs_{it-2}$ is correlated with $\varepsilon_{it} - \varepsilon_{it-1}$. At the same time, since there is no serial correlation of the error terms (see Table A9), $\Delta\varepsilon_{it}$ is uncorrelated with $\Delta Invs_{it-\tau}$ for $\tau \geq 2$ so that the additional lags are valid when used as instruments in an instrumental variable estimation. I also consider the growth rate of the terms of trade as being exogenous, and I do not use an instrument for that variable as in Bleaney and Greenaway (2001) and Behzadan et al. (2017). Instrumenting for potentially endogenous variables removes concerns about endogeneity and reverse causality since the correlation between the instrumented variables and the error term should be zero. If there is not enough variation in Nr_{it} within countries, then the interaction term is strongly correlated with the fixed effects. Table A6 provides some evidence that there is enough time variation in Nr_{it} within and across countries. The first-difference equation is depicted below:

$$\Delta Invs_{it} = \beta_1 \Delta Invs_{it-1} + \beta_2 \Delta Nr_{it} + \beta_3 (Gini_i \cdot \Delta Nr_{it}) + \beta_4 \Delta X_{it} + \Delta\delta_t + \Delta\varepsilon_{it}. \quad (2.2)$$

One well-known issue with the AB-GMM framework is that it may have a weak-instruments problem. For example, Bond, Hoeffler, and Temple (2001) argue that the lagged levels of the regressors in the AB-GMM estimation are poor instruments to use in the first-difference equation. For instance, if there is a unit root problem in the panel, then the lagged levels of the series might be weakly correlated with the subsequent first differences. To address this issue, Im, Pesaran, and Shin (2003) propose unit-root tests for dynamic heterogeneous panels that are based on the mean of the individual unit-root statistics. In particular, it offers a standardized t-bar test statistic based on the (augmented) Dickey-Fuller statistics averaged across the groups in the study. However, it is not certain whether lagged values are uniformly valid instruments. I use Im et al. (2003)'s unit-root test as in Behzadan et al. (2017) to investigate whether the panel has a unit-root problem. As shown in the unit-root test in Table A7 in appendix A, there is no non-stationary problem in the panel.

To address the weak-instruments problem, I implement a second GMM approach based on Blundell and Bond (1998) (system GMM), which I refer to as a BB-GMM estimator. This estimator is based on a system of two equations, where the first equation is the regression equation in the levels and the second equation is the regression equation in the first-difference. The first equation (which is in levels) uses lagged differences as instruments, whereas the second equation (in differences) uses lagged levels as instruments, and this approach is more likely to make the instruments valid (Bond et al., 2001; Roodman, 2009). However, since the estimation is a system that contains levels, this potentially introduces Nickell-bias issues. However, Blundell and Bond (1998) argue that this approach is valid as long as changes in any instrumenting variables are uncorrelated with the fixed effects.

Finally, both GMM approaches rely on assumptions about the instruments' exogeneity and no autocorrelation between the error terms, which would make some lags invalid as instruments. In the AB-GMM setup, one instrument per variable would lead to exact identification. However, this would not allow me to test the validity of the instruments. Thus, I use two lags as instruments in the AB-GMM estimation, which allows me to test the validity of the instruments. I report the Hansen test statistics using two lags for the AB-GMM and one lag for the BB-GMM in Table A8 in appendix A. This result validates the assumptions that the instruments are exogenous. I also report the Arellano-Bond test statistics in Table A9 in appendix A. These results verify that there is no error autocorrelation in the chosen lagged instruments.

2.2 Data

The data used in this paper were obtained from the World Bank World Development Indicators (WDI);[4] the exception is for one variable: the quality of institutions. The data for institutional quality were obtained from the International Country Risk Guide (ICRG) database. In this study, I use an unbalanced panel that consists of 57 countries for the period 1982-2015 (annual frequency). The choice of countries was based on having a positive share of natural-resource rents to GDP and the availability of data on the explanatory variables. Unfortunately, this dataset does not have complete information for all countries. For example, data on the independent variables in this study are missing

[4] There are other databases but none of them were superior to this one.

for resource-rich Canada and Norway.

In this paper, I use the data from WDI for natural resource rents. This is the only source of data that includes the information for the most extended period across many countries. Regarding the natural resource rents data, one concern is the reliability of the data for some countries and whether the same variable has been measured consistently over time and across countries for natural resource rents. To consider this concern, I exclude Gulf countries where the credibility of the data is questioned. Furthermore, natural resource rents are considered depleted, such as fuels or metals (non-renewable resources) to investigate the question posed in this paper. Renewable resources can be used repeatedly since renewable resources can be exploited sustainably. Thus the flow of income from the resource is steady. In contrast, non-renewable resources are used only for a limited time, resulting in Dutch disease.

The data on gross domestic investment consists of outlays on additions to the fixed assets of the economy plus net changes in the level of inventories. Fixed assets include land improvements, plants, machinery, equipment purchases, roads, railways, schools, offices, hospitals, private residential dwellings, and commercial and industrial buildings. One of the concerns here is that the data on investment includes information on productive investment and unsustainable investment, such as residential structures or buildings. Thus, it is not possible to distinguish between these two types of investment due to data availability which might affect the credibility of the results.

Table 1 reports the summary statistics for the variables. In appendix A, Table A4 includes a list of countries in the data. I dropped any countries that were classified as communist since the literature is in doubt over the accuracy of the reported statistics on inequality (e.g., Behzadan et al. (2017)). Four countries were classified as communist, leading to $N = 57$ after dropping them. All variables as a percentage of GDP were retrieved from the WDI, except for the data on foreign aid. To obtain this variable, I divided the net official development assistance received (current USD) by the total GDP (current USD) (both from the WDI) to find the percent GDP share of foreign aid. This paper will use both public and private components of gross capital formation.

Table 1: Summary statistics for the period 1982-2015

Variables	Number of observations	Mean	Std. Dev.	Min	Max
Domestic investment (% of GDP - Annual change)	1864	-0.011	3.563	-25.351	18.478
Domestic investment (% of GDP - Level)	1869	21.453	7.31	1.763	50.688
Natural resource rents (% of GDP)	1926	7.246	8.036	0.011	63.52
Gini coefficient (Constant)	1938	0.452	0.074	0.301	0.621
Institutional quality (Average of 4 indices)	1910	0.495	0.146	0.045	0.954
Inflation, GDP deflator (Annual %)	1924	0.705	0.799	-0.276	267.62
Growth rate of terms of trade (2000 = 100)	1913	0.006	0.152	-0.622	3.494
Government expenditures on consumption (% of GDP)	1863	13.421	4.921	2.057	54.515
Log of real GDP per capita (Constant 2010 USD)	1927	7.663	1.138	5.572	10.856
Total debt service (% of GNI)	1725	5.212	4.068	0.101	73.282
Gross domestic saving (% of GDP)	1869	17.429	11.572	-15.545	60.49
Foreign aid (% of GDP - Current USD)	1875	0.0516	0.0787	-0.0062	0.740

Sources: World Development Indicators and International Country Risk Guide. More information about the sources, definition and construction of these variables is included in Tables A1-A3. Some outliers for some variables have not been eliminated, such as total debt servicing and inflation; however, these outliers might affect the results.

3 Results

3.1 Results using the Arellano-Bond method

Table 2 shows the estimates that were obtained using the AB-GMM approach. The term of interest is the natural resource rents that interacts with the Gini coefficient. I use different combinations of explanatory variables to indicate that the coefficient sign on the term of interest is stable. First, one might assume that countries that earn natural-resource rents contribute more to domestic investment. In column (1), I estimate the impact of natural-resource rents on domestic investment while only controlling for the lagged investment and the squared lagged investment. While the coefficient for the natural-resource rents is positive, it is not statistically significant at conventional levels. In column (2), I try to check if income inequality might distort incentives for domestic investment in resource-rich countries. Thus, I add the interaction term between the natural-resource rents and the Gini index. In this estimation, the coefficient for natural-resource rents is positive. However, the coefficient for the interaction term is negative but not significant. This result could suggest that countries with higher income inequality (all else being equal) contribute less of their natural-resource rents to domestic investment. In particular, income inequality could have an important role in contributing natural resource rents to domestic investment in resource-rich countries.

Columns (3), (4), and (5) show that the choice of determinants does not affect the sign of the coefficient of the interaction term. My main focus in both approaches (AB-GMM and BB-GMM) is on a specification that includes all explanatory variables (see column (5)). While the coefficient for the interaction term remains negative, it does not exhibit statistical significance. However, it is important to highlight that the independent variables are instrumented due to the endogenous relationships among the jointly determined variables, such as domestic investment and GDP. Additionally, Bond et al. (2001) argue that the lagged levels of the regressors in the AB-GMM estimation are poor instruments to correlate with the first-difference regressors. To address the well-known potential issue that the AB-GMM might include weak instruments, I also use the BB-GMM approach. Column (6) includes the estimation results for the period 1982-1997, which is the shorter period as in Behzadan et al. (2017). Table A10 reports the summary statistics for this analysis. The purpose of this estimation is that it provides a similar benchmark to compare the results from Behzadan et al. (2017). Their analysis finds that the interaction term on the resource rents and the Gini index is negative (-4.358) and significant (at the 1% level) for economic growth.

3.2 Results using the Blundell-Bond method

Table 3 shows the estimates obtained when using the BB-GMM approach. I estimate the same six equations to compare the results obtained from different specifications. Column (1) again estimates the impact of natural-resource rents on domestic investment, only controlling for the lagged investment and the lagged investment squared. The coefficient on the natural-resource rents is positive and significant at the 1% level. In addition, the coefficient is nearly twice as large as the coefficient in column (1) in Table 2. In column (2), I add the interaction term between the resource rents and the Gini index. Again, the interaction coefficient is negative and significant at the 10% level, with a nearly identical magnitude to the one estimated when using the AB-GMM approach.

Columns (3), (4), and (5) show estimates of this relationship when additional control variables are included. In contrast to the results obtained when using the AB-GMM, the coefficient on the interaction term between the natural-resource rents and the Gini index is significant at the 5% level and negative across all specifications. This result suggests that the contribution of natural-resource rents to domestic investment is lower for countries

Table 2: Arellano-Bond estimation results

D.Invs	AB-GMM (1)	AB-GMM (2)	AB-GMM (3)	AB-GMM (4)	AB-GMM (5)	AB-GMM (6)
Natural resource rents	0.162	6.056	10.207	6.769*	5.385*	9.313
	(0.104)	(7.599)	(13.329)	(4.122)	(3.145)	(6.639)
Natural resource rents×Gini index		-12.458	-18.859	-15.249	-11.678	-19.792
		(15.922)	(28.331)	(9.405)	(7.385)	(16.159)
Investment (lagged one period)	-1.83***	-1.745**	-0.484	-0.510*	-0.765***	-0.86
	(0.506)	(0.795)	(0.463)	(0.269)	(0.265)	(1.157)
Investment (lagged one period) squared	0.028***	0.026*	0.004	0.006	0.008	0.001
	(0.009)	(0.015)	(0.007)	(0.005)	(0.005)	(0.019)
Lag Log of GDP			13.027	12.975**	5.707	-36.219
			(18.073)	(5.625)	(5.768)	(21.962)
Government expenditures on consumption			-0.0007	-0.243	0.249	1.056
			(0.002)	(0.198)	(0.225)	(1.006)
Inflation			0.0932		-0.002***	0.001
			(0.588)		(0.0007)	(0.002)
Natural resource rents×Institutional quality			-3.383		.009	-0.974
			(5.438)		(0.61)	(3.025)
Institutional quality			14.574		0.794	15.204
			(37.918)		(7.118)	(20.013)
Growth rate of terms of trade				-2.308	-4.191**	-2.711
				(1.519)	(1.715)	(2.405)
Total debt service				0.1	-0.477**	0.058
				(0.196)	(0.192)	(0.333)
Gross domestic savings				0.077	0.252	0.106
				(0.209)	(0.188)	(0.724)
Foreign aid				0.209	0.373	0.104
				(0.329)	(0.714)	(0.124)
Time span	1982-2015	1982-2015	1982-2015	1982-2015	1982-2015	1982-1997
Number of observations	1811	1754	1727	1558	1550	652
Number of countries	57	57	57	57	57	57

Note: Values in parentheses are standard error. Dependent variable is domestic investment (Gross Capital Formation-% of GDP) measured by $(Invs_t - Invs_{t-1})$. Year Fixed effects are included in all of the estimations. Arellano-Bond estimation follows a two-step GMM procedure. All variables, except the interaction term with Gini index, the growth rate of terms of trade, and the year fixed effects, are instrumented with a maximum of 1 further lag for the lagged investment and two further lags for the rest of the variables. The last column includes the estimation result for a shorter period as in Behzadan et al. (2017). ***P<%1, **P<%5, *P<%10

with higher income inequality. The last column includes the estimation results for the period 1982-1997, which is the shorter period as in Behzadan et al. (2017). Table A10 reports the summary statistics for this analysis. For the remaining discussion, I treat the results obtained in column (5) in Table 3 as the baseline results in the paper.

The additional control variables in the regressions exhibit the expected signs. The total amount of the debt servicing has a negative and significant effect, which is consistent with previous empirical findings (Greene & Villanueva, 1991; Leung, 2003). The rationale for this finding can be derived from three related theories: (1) a higher debt implies a larger portion of output committed to debt servicing, and this reduces consumption and investment (Krugman, 1988), (2) higher debt obligations can reduce the supply of loan funds available to a country (i.e., credit rationing), and (3) higher levels of debt increase

Table 3: Blundell-Bond estimation results

D.Invs	BB-GMM (1)	BB-GMM (2)	BB-GMM (3)	BB-GMM (4)	BB-GMM (5)	BB-GMM (6)
Natural resource rents	0.291***	5.596*	4.262*	2.924**	3.855*	1.565*
	(0.097)	(2.964)	(2.197)	(1.38)	(1.94)	(0.873)
Natural resource rents×Gini index		-11.531*	-12.327**	-6.642**	-8.914**	-3.514*
		(6.583)	(5.84)	(3.127)	(4.327)	(2.129)
Investment (lagged one period)	-0.679***	-0.499**	0.058	-0.519***	-0.127	-0.52***
	(0.17)	(0.219)	(0.141)	(0.178)	(0.143)	(0.189)
Investment (lagged one period) squared	0.008**	0.004	-0.005*	0.007**	-0.002	0.004
	(0.003)	(0.004)	(0.003)	(0.003)	(0.002)	(0.003)
Lag log of GDP			-0.167	3.087*	0.820	-0.553
			(1.416)	(1.574)	(3.007)	(1.178)
Government's consumption expenditures			-0.0005	-0.186	-0.178*	0.329***
			(0.0004)	(0.207)	(0.092)	(0.12)
Inflation			-0.118		-0.0005	-0.00008
			(0.096)		(0.0007)	(0.0005)
Natural resource rents×Institutional quality			2.779*		0.0878	-0.169
			(1.541)		(0.33)	(0.364)
Institutional quality			3.516		1.679	10.88**
					(2.819)	(4.189)
Growth rate of terms of trade				-2.329**	-1.920**	-3.104***
				(1.082)	(0.944)	(0.875)
Total debt service				-0.111	0.351**	-0.099
				(0.164)	(0.171)	(0.141)
Gross domestic savings				0.0515	-0.154	0.264***
				(0.091)	(0.072)	(0.067)
Foreign aid				0.437	0.304	0.293
				(0.789)	(0.535)	(0.328)
Time span	1982-2015	1982-2015	1982-2015	1982-2015	1982-2015	1982-1997
Number of observations	1811	1811	1785	1645	1604	703
Number of countries	57	57	57	57	57	57

Note: Values in parentheses are standard error. Dependent variable is domestic investment (Gross Capital Formation-% of GDP) measured by $(Invs_t - Invs_{t-1})$. Year Fixed effects are included in all of the estimations. Blundell-Bond estimation is by a two-step GMM procedure. All variables, except the growth rate of terms of trade, the interaction term with income inequality indices, and the year fixed effects, are instrumented with a maximum of 1 further lag. The last column includes the estimation result for a shorter period consistent with Behzadan et al. (2017). I treat the results obtained in column (5) as the baseline results in the paper. ***P<%1, **P<%5, *P<%10

macroeconomic uncertainty (e.g., the chance of default), which reduces the incentive to invest. The coefficient for gross domestic savings is positive and significant, which is consistent with the previous findings (Bayoumi, 1990; Dooley et al., 1987; Feldstein & Horioka, 1979). This finding can be justified from a long-standing view that the savings level is a major determinate of the domestic interest rate and, thus, the cost of capital (abstracting from an international perspective). A lower interest rate leads to a higher demand for new capital and investment.

To emphasize the importance of controlling for income inequality, consider the impact of a marginal change in natural-resource rents on domestic investment. This marginal effect can be captured by the following equation,

$$\frac{\partial \Delta In\hat{v}s_{it}}{\partial N\hat{r}_{it}} = \hat{\beta}_2 + \hat{\beta}_3(Gini_i) + \hat{\beta}_4(Institutional\ quality_i). \tag{3.1}$$

Using equation (3.1) I can solve for what Behzadan et al. (2017) refers to as the *critical level of income inequality.* This critical level implies that for any income inequality beyond a certain level, a marginal increase in natural-resource rents will lead to a fall in domestic investment (in their case, growth). Conversely, income inequality below a critical level suggests that a marginal change in natural-resource rents will increase domestic investment. I set the results of equation (3) to zero to obtain this critical value,

$$Gini^* = \frac{-(\hat{\beta}_2 + \hat{\beta}_4(Institutional\ quality_i))}{\hat{\beta}_3} = \frac{-3.898}{-8.914} \approx 0.43. \tag{3.2}$$

In this calculation, institutional quality is set to be the average of institutional quality for all 57 countries in Table 1. Thus, for any country with a Gini index level above (below) 0.43, an increase in natural-resource rents as a share of GDP will lead to a negative (positive) change in domestic investment. In Table A11, I list the countries above and below this critical level of income inequality, such as Botswana and Chile for the former and Algeria and Niger for the latter. Since the cutoff point is a function of the parameters, its measurement includes some uncertainties that resulted from the estimated parameters. To compute the variance of the cutoff point ($Gini^*$), I use the multivariate Delta method. Using this method, the standard error of the cutoff point is 0.145.[5] The t-statistics, for the tests that the cutoff point is significantly different from zero and one, are respectively 2.812 and -4.060. Therefore, the null hypothesis is rejected at the 5% level in both cases.

These results suggest that if income inequality is a good proxy of rents inequality when rents are concentrated within a small number of (potential) investors, this is detrimental to domestic investment. This result is in line with a model in which unequal rent distributions disincentivize investors since the payoffs are shared across the population and thereby disproportionately accrue to non-investors over investors. This phenomenon would lead to lower investment, capital, and output levels. On the contrary, when resource rents

[5]See the calculations of the variance and formulas In appendix B.

are equally distributed (a country with low income inequality), this would lead investors to invest in more capital. Gaitan and Roe (2012) also develop an infinite-horizon, two-country model of trade in which countries are identical, except that one country is endowed with natural resources and the other is not. They show that this phenomenon can be explained in part by an inelastic demand for the natural resource that increases growth in trade revenues and induces the resource-abundant country to invest relatively less than the country lacking in natural resources. My result has important implications since there exists a close connection between the level of investment and the rate of economic growth, as documented by previous studies (Ben-David, 1997; Khan & Reinhart, 1990; Kormendi & Meguire, 1985). Thus, understanding the drivers of income inequality may also have implications for economic growth.

3.3 Robustness Checks

Next, I test the robustness of my baseline results by using different measures of income inequality, subsets of the sample, addressing the potential collinearity between income inequality and institutional quality, using the principal component analysis method as an alternative measure of institutional quality, by changing the controlling variables and performing a subsample analyses. The result of these specifications is reported in Table 4. The main results from this robustness analysis are as follows:

Income held by the top 10%. In the baseline results in the paper, the Gini index is used as the measure of income inequality. As an alternative, I consider the income held by the top 10% of a population as the measure of a country's income inequality. I find that the Gini income coefficient and the income share of the top 10% are highly correlated, with a correlation coefficient of 0.75. To remain consistent with the baseline specification, I take the average of the top 10% share of income from 1982-2015. Table 4 column (1) reports these estimates. Qualitatively, I find similar signs to those in the main results. The coefficient on the natural-resource rents is positive and significant, and the coefficient on the interaction term between income inequality and natural-resource rents is negative and significant at the 10% level. One rationale for this outcome is that natural-resource rents may disproportionately accrue to those in the top 10% of the income distribution. In Table A12, I list countries that are above and below the critical level of income inequality. The critical level of income inequality using equation (3.1) in

Table 4: Blundell-Bond estimation results—Robustness checks

D.Invs	BB-GMM (1) Top 10%	BB-GMM (2) SWIID	BB-GMM (3) Residuals	BB-GMM (4) Excluded countries	BB-GMM (5) PCA	BB-GMM (6) Excluding financial crisis	BB-GMM (7) Exchange rate
Natural resource rents	5.986*	2.606*	0.171	14.824*	4.346*	2.835	-0.453
	(3.098)	(1.019)	(0.502)	(8.752)	(2.365)	(1.835)	(1.143)
Natural resource rents×Gini index				-31.51*	-9.817*	-7.158*	-1.706
				(19.485)	(5.326)	(4.235)	(1.492)
Natural resource rents×Top 10%	-16.205*						
	(8.488)						
Natural resource rents×SWIID		-5.558*					
		(2.279)					
Natural resource rents×Residuals			-1.373**				
			(0.517)				
Investment (lagged one period)	-0.625***	0.061	-0.436	0.6004	-0.129	-0.302**	-0.394
	(0.163)	(0.125)	(0.384)	(0.489)	(0.131)	(0.131)	(0.363)
Investment (lagged one period) squared	0.006*	-0.002	0.003	-0.018	-0.002	0.001	-0.0004
	(0.004)	(0.002)	(0.005)	(0.011)	(0.002)	(0.002)	(0.006)
Lag log of GDP	0.608	4.576***	-1.133	10.395	1.64	2.116*	-0.766
	(1.957)	(1.6)	(1.64)	(7.254)	(2.773)	(1.158)	(0.905)
Government's consumption expenditures	0.106	-0.138*	-0.18	-1.150*	-0.177**	-0.090	0.222
	(0.165)	(0.074)	(0.242)	(0.625)	(0.083)	(0.102)	(0.177)
Inflation	-0.003*	-0.001	0.002	0.007*	-0.0005	-0.0006	-0.027
	(0.001)	(0.0004)	(0.002)	(0.003)	(0.0005)	(0.0005)	(0.027)
Natural resource rents×Institutional quality	-0.977	0.035	-0.8	-2.737		0.712**	2.135
	(0.689)	(0.214)	(1.301)	(1.925)		(0.307)	(2.352)
Institutional quality	35.71*	1.729	-4.165	24.557	-0.076	1.427	-4.504
	(20.79)	(2.151)	(33.277)	(17.637)	(0.351)	(2.468)	(10.495)
Natural resource rents×PCA					0.058		
					(0.044)		
Growth rate of terms of trade	-2.809**	-1.569**	-1.383	10.755	-2.203*	-2.312***	1.424
	(1.144)	(0.588)	(2.771)	(7.96)	(1.12)	(0.683)	(3.183)
Total debt service	-0.199	.0700	0.124	1.782*	0.339*	0.095	0.019
	(0.228)	(0.0943)	(0.082)	(1.06)	(0.197)	(0.113)	(0.125)
Gross domestic savings	0.024	0.077	0.182	-0.559*	0.008	0.122	0.329*
	(0.124)	(0.061)	(0.142)	(0.324)	(0.07)	(0.0614)	(0.182)
Foreign aid	0.005	-1.370	0.145	0.404*	0.141	-0.026	-3.548
	(0.056)	(4.274)	(0.733)	(0.182)	(0.571)	(0.373)	(210.71)
Volatility of exchange rate							0.0004
							(0.0006)
Time span	1982-2015	1982-2015	1982-2015	1982-2015	1982-2015	1982-2008	1994-2015
Number of observations	1571	1444	1604	1448	1604	1205	118
Number of countries	57	57	57	51	57	57	7

Note: Values in parentheses are standard error. Dependent variable is domestic investment (Gross Capital Formation-% of GDP) measured by ($Invs_t - Invs_{t-1}$). Year Fixed effects are included in all of the estimations. Blundell-Bond estimation follows two-step GMM procedure. All variables, except the growth rate of terms of trade, the interaction term with income inequality indices, and the year fixed effects are instrumented with a maximum of 1 further lag. ***P<%1, **P<%5, *P<%10

this specification is as follows,

$$\textit{The top 10\% share of income}^* = \frac{-(6.436 + (0.541 \times 0.494))}{-16.933} = \frac{-6.703}{-16.933} \approx 0.40. \quad (3.3)$$

Standard World Income Inequality Database (SWIID). The SWIID provides measures of income equality that were computed using a Bayesian estimation approach. This measure standardizes observations that have been collected from a variety of different databases.[6] By using multiple data sources, the SWIID potentially provides a more accurate description of income inequality. The Bayesian measure is also highly correlated with the Gini index (0.82), Table A14. Consistent with the variable construction in the baseline specification, I average the measure of inequality for each country over the

[6] Solt (2016) provides a thorough discussion of this methodology.

period 1982-2015. Table 4 column (2) shows the results obtained when using this measure. Similar to the baseline specification results, the interaction term between natural-resource rents and income inequality is negative and significant at the 10% level. However, the coefficient on natural-resource rents alone is no longer significant. Table A13 lists the countries that are above and below the critical level of income inequality. The critical level of income inequality using equation (3.1) in this specification is as follows:

$$SWIID^{*} = \frac{-(2.606 + (0.035 \times 0.494))}{-5.558} = \frac{-2.623}{-5.558} \approx 0.47. \tag{3.4}$$

Relationship between the Gini index and institutional quality. One potential issue in the baseline specification is that the income inequality in many countries is strongly correlated with these countries' institutional quality. Behzadan et al. (2017) emphasizes that this correlation might be either linear or non-linear. To investigate this correlation, I regress the Gini index on institutional quality and a quadratic term of this variable and obtain the residuals. I replace the Gini index values with the residuals, which should be linearly and quadratically independent from institutional quality. I re-run the estimation using this measure of income inequality. The results are reported in Table 4 column (3). I again find that the coefficient of interest (the interaction term) is both negative and significant at the 5% level.

Countries with non-negligible shares of natural-resource rents. The choice of resource-rich countries in the baseline specification coincides with those chosen in Behzadan et al. (2017). However, there are some countries where the contribution of natural resource rents to GDP is relatively low. Since there is not much variation in natural-resource rents among these countries, I exclude those where natural-resource rents are negligible (countries that receive less than 0.75% of their GDP from natural-resource rents). This cutoff point is chosen based on the first decile in the sample. The contribution of natural resource rents to GDP for some countries known to be resource-rich is low. For instance, this ratio for Austria is 0.21%; for the United States, it is 1.22%; and for Brazil, it is 2.91%. So, the cutoff point (the first decile in the sample) is not too low to drop countries with negligible shares of natural-resource rents. Table 4 column (4) shows the estimated coefficients. I find that the point estimate is larger (-31.51 instead of -2.418) compared to the baseline results and is statistically significant at the 10% level.

PCA. In the baseline specification, the variable "institutional quality" is constructed using an average of four measures from the ICRG, which covers the rule of law, government corruption, bureaucratic quality, and ethnic tensions. Table A15 reports the summary statistics for these measures. These four categories capture what is most often referred to as institutional quality. However, a simple arithmetic average may potentially decrease the variation between countries. To address this concern, I use principal component analysis (PCA) on the measures reported from the ICRG. PCA uses an orthogonal linear transformation to convert a set of observations of possibly correlated variables into a set of linearly uncorrelated variables (referred to as *principal components*). I use the first principal component, which captures the largest variability in the data (Jolliffe, 1986). I re-estimate the baseline equation using this measure of institutional quality. These results are reported in Table 4 column (5). The coefficient on the interaction term between income inequality and natural-resource rents is negative and significant at the 10% level, nearly identical to the baseline results.

Excluding the Global Financial Crisis. The Global Financial Crisis of 2008 was one of most serious financial crises to have taken place since the Great Depression of the 1930s. To eliminate the impact of this phenomenon, I create a subsample that excludes the years after 2008. Thus, I average the measure of income inequality over 1982-2008 for each country to obtain an averaged Gini index. I re-estimate the baseline equation for 1982-2008 to investigate whether the result is robust to this change. These results are reported in Table 4 column (6). The coefficient on the interaction term between income inequality and natural-resource rents is negative and significant at the 10% level, nearly identical to the baseline results.

Exchange rate volatility. Some resource-rich countries might invest their natural-resource rents in foreign countries, where these investments can potentially provide higher rates of return. This means Foreign Direct Investment (FDI) is one of the factors that might crowd out domestic investment. To capture the differential in this investment opportunity, I include the exchange-rate volatility as another explanatory variable in the estimation not only because the exchange rate volatility deters FDI but also the exchange-rate uncertainty can have a positive or negative impact on the investment (Bahmani-Oskooee & Hajilee, 2013). Most studies argue that exchange-rate volatility results in price volatility. Price volatility, in turn, could have positive or negative effects on domestic investment (Hartman, 1972). I use exchange-rate data from the IMF's dataset to construct this variable. This data is normally quoted in U.S. dollars and is reported daily to the

IMF by the issuing central bank. This data is available for a limited set of countries, so the number of observations is small in this specification. To obtain the real exchange rate, I take the last observation of each month, multiply it by the monthly U.S. CPI and then divide it by the monthly domestic CPI. Based on the monthly data, I compute the standard deviation for each year to obtain the exchange-rate volatility. I re-run the estimation while including the exchange-rate volatility to capture this effect. The results are shown in Table 4 column (7). The coefficient on the interaction term is also negative but not significant since the number of observations smaller.

More domestic-investment lags as explanatory variables. In the baseline specification, I include one lag in domestic investment as an explanatory variable in the estimation. Arezki, Ramey, and Sheng (2015) discuss the impact of a large oil discovery on economic indicators. They indicate that after this oil discovery, investment experiences a boom that lasts for about five years. Other macroeconomic variables are likely to be affected by this discovery during these five years. Further, since domestic investment is a highly persistent process for many countries (Bernanke, 1983; Lim, 2013; Ndikumana, 2000), using multiple lags in domestic investment as explanatory variables could be relevant to determining whether the results are robust. To do so, I include two to five lags of this variable in the estimation. These results are reported in Table A16 in appendix A. Column (1) reports the results of the baseline specification in the estimation. The coefficient on the interaction term between income inequality and natural-resource rents is negative and significant at the 10% level in all specifications except when using five lags on investment as explanatory variable.

4 Conclusion

Economic theory suggests that endowments of natural resources should benefit countries since they can act as a windfall of wealth. However, in reality, these countries often struggle to develop and achieve rates of growth that are comparable to those of countries with few natural resource endowments. As highlighted by Solow (1974), if resource-endowed countries wish to maintain their present consumption paths, then their investment rates should be higher than those of non-resource-rich countries so as to offset the decline in their stock of natural resources. Empirically, however, resource-rich countries exhibit lower relative investment rates than non-resource-endowed countries do. In this paper, I set out to investigate one contributor to this empirical fact: income inequality.

The findings show that, on average, countries with higher income inequality contribute less of their natural-resource rents to domestic investment. The magnitude of this effect is economically large and robust. A variety of studies in the social sciences emphasize what is known as the *alarming Gini coefficient level* in income (above 0.40), which coincides with increased political instability and social tensions (see, e.g., Tao, Wu, and Li (2014)). The results of this paper are in line with the alarming level of income inequality among countries that invest lower proportions of their resource rents domestically. I find that countries with Gini coefficients above 0.43, on average, reduce domestic investment when there is an increase in the natural resource rents. This result is robust to various sensitivity checks, including alternative measures of income inequality and institutional quality, changes to the econometric framework and the controlling variables, and sub-sample analyses.

Income inequality has become a predominant issue in many countries around the world. The emphasis on inequality has generally focused on social and political instability, crime, health outcomes, education, and economic growth. However, this paper shows that lower levels of domestic investment should also be added to the list of the negative consequences of income inequality pointing to the increasing need to address one of the most important issues of the 21st century.

Appendices

Table A1: Sources of the variables

Source of Data	Variables Name
World Bank World Development Indicators (2018)	Domestic investment, Natural resource rents, Gini coefficient, Inflation, Growth rate of terms of trade, Government's consumption expenditures, Log of real GDP per capita, Total amount of debt servicing, Gross domestic savings, Foreign aid.
International Country Risk Guide (ICRG) Database	Institutional quality

Table A2: Main variables' definition

Variables	Definition and Comments
Domestic investment (% of GDP)	Gross capital formation (land improvements; plant, machinery, and equipment purchases; and construction of roads, railways, including schools, offices, hospitals, private residential dwellings, and commercial and industrial buildings).
Natural resource rents (% of GDP)	Total natural resource rents are the sum of oil rents, natural gas rents, coal rents (hard and soft), mineral rents, and forest rents. The estimates of natural resources rents are calculated as the difference between the price of a commodity and the average cost of producing it. This is done by estimating the price of units of specific commodities and subtracting estimates of average unit costs of extraction or harvesting costs. These unit rents are then multiplied by the physical quantities countries extract or harvest to determine the rents for each commodity as a share of gross domestic product.
Gini coefficient (Constant)	Average of Gini index between the years 1982-2015. A Gini index of 0 represents perfect equality, while an index of 1 implies perfect inequality.

Note: Dependent variable is domestic investment in differences. Natural resource rents is included in the estimation separately and jointly with Gini index.

Table A3: Other explanatory variables' definition

Variables	Definition and Comments
Institutional quality	Average of 4 variables, Corruption in government, Rule of law, Bureaucratic quality, Ethnic tensions indexed between 0 and 1 (1 represents highest quality).
Inflation, GDP deflator	Inflation is measured by the annual growth rate of the GDP implicit deflator shows the rate of price change in the economy as a whole. The GDP implicit deflator is the ratio of GDP in current local currency to GDP in constant local currency.
Growth rate of terms of trade	The percentage ratio of the export unit value indexes to the import unit value indexes, measured relative to the base year 2000.
Government's consumption expenditures	General government final consumption expenditure (% of GDP) - all government current expenditures for purchases of goods and services. It also includes most expenditures on national defense and security but excludes government military expenditures that are part of government capital formation.
Log of real GDP per capita	GDP per capita (constant 2010 USD and divided by midyear population). GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Data are in constant 2010 U.S. dollars.
Total debt services	Sum of principal repayments and interest (% of GNI) actually paid in currency, goods, or services on long-term debt, interest paid on short-term debt, and repayments (repurchases and charges) to the IMF.
Gross domestic savings	Gross domestic savings (% of GDP) are calculated as GDP less final consumption expenditure (total consumption).
Foreign aid	Net official development assistance received (% of GDP) which consists of disbursements of loans made on concessional terms (net of repayments of principal) and grants by official agencies of the members of Development Assistance Committee (DAC), by multilateral institutions, and by non-DAC countries to promote economic development and welfare in countries and territories in the DAC list of ODA recipients. Data are in current U.S. dollars.

Sources: World Bank - World Development Indicators (WDI), Institutional Quality: ICRG Data Set.

Table A4: List of countries

Algeria	Egypt, Arab Rep.	Mali	Thailand
Angola*	El Salvador	Mexico	Togo
Argentina	Ethiopia*	Morocco	Trinidad and Tobago
Bangladesh	Gabon	Mozambique*	Tunisia
Bolivia	Gambia, The	Namibia	Turkey
Botswana	Ghana	Nicaragua	Uganda
Brazil	Guatemala	Niger	United States
Burkina Faso	Guinea	Nigeria	Uruguay
Cameroon	Guinea-Bissau	Pakistan	Venezuela, RB
Chile	Honduras	Panama	Zambia
China*	India	Paraguay	
Colombia	Indonesia	Peru	
Congo, Dem. Rep.	Jordan	Philippines	
Costa Rica	Kenya	Senegal	
Cote d'Ivoire	Madagascar	South Africa	
Dominican Republic	Malawi	Sri Lanka	
Ecuador	Malaysia	Tanzania	

Note: There are four communist countries in the data set. Although low income inequality is a matter of ideology in communist countries, the same cannot be said for accurate reporting of economic statistics. Therefore, a restricted sample is created, and the communist countries are excluded from the analysis. After excluding those communist countries, there are 57 countries included for the estimation.

Table A5: Countries with noticeable decrease in domestic investment accompanied by an increase in natural resource rents

Country	Year	Natural resource rents	Growth rate of Nr	Growth rate of Invs	Gini index
Venezuela, RB	1989	18.13	1.34	-15.19	0.49
Honduras	1982	8.27	0.93	-6.96	0.55
Nicaragua	1990	6.72	1.41	-8.19	0.51
Colombia	1999	3.40	1.41	-6.85	0.55
Dominican Republic	1985	1.45	0.83	-3.73	0.49
South Africa	1985	10.07	0.96	-3.49	0.62
Ecuador	1999	6.58	1.27	-4.37	0.51
Dominican Republic	2003	1.15	1.85	-6.19	0.49
Venezuela, RB	2000	18.37	0.83	-2.35	0.49
Argentina	1999	1.13	0.79	-1.92	0.47
Argentina	2000	2.10	0.87	-1.82	0.47
Argentina	1989	3.07	1.57	-3.13	0.47
Peru	2000	1.90	0.75	-1.03	0.50
Uruguay	1982	0.75	1.22	-1.59	0.44
Argentina	2002	4.83	1.84	-2.22	0.47
Botswana	2006	7.99	1.09	-1.25	0.60

Note: This table indicates some countries which experience noticeable decrease in domestic investment after a significant increase in natural-resource rents.

Table A6: Standard deviation of annual natural resource rents

	Std. Dev.		Std. Dev.		Std. Dev.		Std. Dev.
Algeria	6.432	Egypt, Arab Rep.	4.505	Malaysia	7.292	Sri Lanka	0.186
Argentina	1.531	El Salvador	0.382	Mali	3.747	Tanzania	2.376
Bangladesh	0.419	Gabon	8.171	Mexico	2.455	Thailand	0.794
Bolivia	4.703	Gambia, The	1.576	Morocco	1.651	Togo	6.852
Botswana	2.703	Ghana	4.407	Namibia	8.303	Trinidad and Tobago	4.426
Brazil	1.404	Guatemala	0.654	Nicaragua	1.641	Tunisia	2.720
Burkina Faso	4.404	Guinea	5.686	Niger	3.282	Turkey	0.286
Cameroon	2.389	Guinea-Bissau	4.523	Nigeria	12.283	Uganda	4.969
Chile	4.839	Honduras	1.419	Pakistan	0.722	United States	0.604
Colombia	2.024	India	1.206	Panama	0.105	Uruguay	0.500
Congo, Dem. Rep.	9.830	Indonesia	2.478	Paraguay	0.510	Venezuela, RB	5.257
Costa Rica	1.897	Jordan	1.550	Peru	4.601	Zambia	5.913
Cote d'Ivoire	1.687	Kenya	1.136	Philippines	0.993		
Dominican Republic	1.229	Madagascar	2.281	Senegal	1.115		
Ecuador	4.156	Malawi	2.677	South Africa	2.532		

Weighted average of within-country variations	5.320
Total variation in the dataset	8.036
Ratio of within-country variation to total variation	0.662

Note: This table displays the within-country-variation of Nr_{it}. To have the interaction term not correlated with the fixed effects, the variation-within-countries of Nr_{it} should be large enough. First, I summarize the standard deviation of Nr_{it} by country for the 1982-2015 period. To differentiate among countries, the results are weighted by the relative natural resource shares. Second, I calculate the total variance in natural resources (this includes variations within and across countries). Third, I take the within-country variation to the total variation. This calculation implies that 66% of the variations in Nr_{it} come from within-countries.

Table A7: Im-Pesaran-Shin unit-root test of the panel

H_0: All panels contain unit roots	Number of panels = 57
H_1: Some panels are stationary avg.	Number of periods = 32.79

	Statistic	p-value
W-t-bar	-6.5558	0

Note: The null hypothesis in IPS unit root test stated that all the series included have unit root or in a simpler way are non-stationary. While, on the other hand, alternative hypothesis stated that some of the series included in the panel are stationary. In this test, the dependent variable is included in the null hypothesis. Thus, rejection of the null means that there is no integration of order one in the panel and the domestic variable is stationary. IPS is the average of augmented Dicky fuller test statistics and follows a normal distribution.

Table A8: Hansen over-identification test of validity of instruments

Table 2	AB-GMM (1)	AB-GMM (2)	AB-GMM (3)	AB-GMM (4)	AB-GMM (5)	AB-GMM (6)
Hansen Test	0.52	0.17	0.10	0.17	0.21	0.75
Table 3	**BB-GMM (1)**	**BB-GMM (2)**	**BB-GMM (3)**	**BB-GMM (4)**	**BB-GMM (5)**	**BB-GMM (6)**
Hansen Test	0.04	0.47	0.22	0.20	0.99	0.31

Note: The values for the Hansen test are P-values. The Hansen test for validity of instruments has a null hypothesis that the instruments are exogenous, and the alternative as not exogenous. If P-value is higher than 10%, the null hypothesis cannot be rejected. H_0: Instruments are exogenous. H_A : Instruments are not exogenous.

Table A9: Test of Arellano-Bond for autocorrelation of error terms

Table (1)	BB-GMM (1)		BB-GMM (2)		BB-GMM (3)	
Orders	z	P-value	z	P-value	z	P-value
1	-5.45	0.00	-4.56	0.00	45.85	0.00
2	-1.34	0.18	-1.52	0.13	-0.82	0.41
3	0.98	0.32	-0.37	0.71	-0.19	0.84
	BB-GMM (4)		BB-GMM (5)		BB-GMM (6)	
Orders	z	P-value	z	P-value	z	P-value
1	-4.68	0.00	-3.72	0.00	-4.12	0.00
2	-1.96	0.14	-0.98	0.32	-0.98	0.33
3	1.51	0.13	0.04	0.26	-0.55	0.58

Note: The test for AR (1) in first differences is not informative. Since $\Delta\varepsilon_{it} = \varepsilon_{it} - \varepsilon_{it-1}$ is mathematically correlated to $\Delta\varepsilon_{it-1} = \varepsilon_{it-1} - \varepsilon_{it-2}$, because of the term ε_{it-1} negative first-order serial correlation is expected in differences. The test for AR (2) and above in first differences is more important, because it detects autocorrelation in levels. Thus to check the first-order serial correlation in levels, the second-order correlation in differences should be considered, because this will show the correlation between the ε_{it-1} in $\Delta\varepsilon_{it}$ and the ε_{it-2} in $\Delta\varepsilon_{it-2}$. In baseline result, there is no statistically significant autocorrelation in the error terms at order 2 and above in all regressions. Thus, using two further lags as instruments is appropriate.

Table A10: Summary statistics for the period 1982-1997

Variables	Number of Observations	Mean	Std. Dev.	Min	Max
Domestic investment (% of GDP - Annual change)	868	-0.177	3.899	-25.351	18.478
Domestic investment (% of GDP - Level)	872	20.742	7.365	1.763	48.396
Natural resource rents(% of GDP)	902	6.897	8.008	0.011	63.52
Gini coefficient (Constant)	912	0.45	0.074	0.301	0.621
Institutional quality (Average of 4 indices)	884	0.494	0.165	0.045	0.954
Inflation, GDP deflator (Annual %)	899	1.383	11.625	-0.208	267.62
Growth rate of terms of trade (2000 = 100)	893	-0.0009	0.137	-0.523	0.976
Government's consumption expenditures (% of GDP)	867	13.63	5.704	2.975	54.515
Log of real GDP per capita (Constant 2010 USD)	902	7.534	1.089	5.608	10.62
Total debt service (% of GNI)	790	6.642	4.641	0.22	73.282
Gross domestic saving (% of GDP)	872	16.575	10.759	-15.545	56.943
Foreign aid (% of GDP - Constant USD)	873	0.0664	0.0968	-0.004	0.740

Note: Summary statistics for column (6) of Table 2 and 3 which display the estimation results for shorter period (1982-1997) consistent with Behzadan et al. (2017). Some outliers for some variables have not been eliminated, such as total debt servicing and inflation; however, these outliers might affect the results.

Table A11: Gini index—Baseline result

Countries with Gini index below the critical level of income inequality							
Algeria	0.34	Guinea	0.41	Niger	0.37	Tunisia	0.39
Bangladesh	0.30	India	0.35	Pakistan	0.31	Turkey	0.40
Congo, Dem. Rep.	0.42	Indonesia	0.39	Philippines	0.42	Uganda	0.42
Cote d'Ivoire	0.40	Jordan	0.36	Sri Lanka	0.36	United States	0.40
Egypt, Arab Rep.	0.31	Madagascar	0.42	Tanzania	0.37		
Gabon	0.42	Mali	0.40	Thailand	0.41		
Ghana	0.39	Morocco	0.39	Trinidad and Tobago	0.41		
Argentina	0.47	Costa Rica	0.47	Kenya	0.49	Paraguay	0.51
Bolivia	0.53	Dominican Republic	0.48	Malawi	0.5	Peru	0.49
Botswana	0.6	Ecuador	0.51	Malaysia	0.47	Senegal	0.43
Brazil	0.57	El Salvador	0.47	Mexico	0.49	South Africa	0.61
Burkina Faso	0.43	Gambia, The	0.47	Namibia	0.62	Togo	0.43
Cameroon	0.43	Guatemala	0.54	Nicaragua	0.5	Uruguay	0.44
Chile	0.52	Guinea-Bissau	0.43	Nigeria	0.43	Venezuela, RB	0.48
Colombia	0.55	Honduras	0.55	Panama	0.54	Zambia	0.52

Note: There are 25 countries in this estimation which an increase in natural resource rents leads to an estimated higher domestic investment.

Table A12: Income held by top 10%—Robustness check

Countries with Gini index below the critical level of income inequality							
Algeria	0.34	Ghana	0.39	Jordan	0.36	Tanzania	0.37
Bangladesh	0.30	India	0.35	Morocco	0.39	Tunisia	0.39
Egypt, Arab Rep.	0.31	Indonesia	0.39	Niger	0.37	Pakistan	0.31
						Sri Lanka	0.36
Argentina	0.47	Dominican Republic	0.48	Malawi	0.50	Senegal	0.43
Bolivia	0.53	Ecuador	0.51	Malaysia	0.47	South Africa	0.61
Botswana	0.60	El Salvador	0.47	Mali	0.40	Thailand	0.41
Brazil	0.57	Gabon	0.42	Mexico	0.49	Togo	0.43
Burkina Faso	0.43	Gambia, The	0.47	Namibia	0.62	Trinidad and Tobago	0.41
Cameroon	0.43	Guatemala	0.54	Nicaragua	0.50	Turkey	0.40
Chile	0.52	Guinea	0.41	Nigeria	0.43	Uganda	0.42
Colombia	0.55	Guinea-Bissau	0.43	Panama	0.54	United States	0.40
Congo, Dem. Rep.	0.42	Honduras	0.55	Paraguay	0.51	Uruguay	0.44
Costa Rica	0.47	Kenya	0.49	Peru	0.49	Venezuela, RB	0.48
Cote d'Ivoire	0.40	Madagascar	0.42	Philippines	0.42	Zambia	0.52

Note: There 13 countries in this specification in which an increase in natural resource rents as a share of GDP leads to an estimated higher domestic investment as a share of GDP. The critical level of income inequality in this exercise is 0.40.

Table A13: SWIID data—Robustness check

Countries with Gini index below the critical level of income inequality							
Algeria	0.34	Ghana	0.39	Morocco	0.39	Thailand	0.41
Bangladesh	0.30	Guinea	0.41	Niger	0.37	Trinidad and Tobago	0.41
Burkina Faso	0.43	Guinea-Bissau	0.43	Nigeria	0.43	Togo	0.43
Cameroon	0.43	India	0.35	Pakistan	0.31	Tunisia	0.39
Congo, Dem. Rep.	0.42	Indonesia	0.39	Philippines	0.42	Turkey	0.40
Cote d'Ivoire	0.40	Jordan	0.36	Senegal	0.43	Uganda	0.42
Egypt, Arab Rep.	0.31	Madagascar	0.42	Sri Lanka	0.36	United States	0.40
Gabon	0.42	Mali	0.40	Tanzania	0.37	Uruguay	0.44
Argentina	0.47	Dominican Republic	0.48	Kenya	0.49	Panama	0.54
Bolivia	0.53	Ecuador	0.51	Malawi	0.5	Paraguay	0.51
Botswana	0.6	El Salvador	0.47	Malaysia	0.47	Peru	0.49
Brazil	0.57	Gambia, The	0.47	Mexico	0.49	South Africa	0.61
Costa Rica	0.47	Guatemala	0.54	Namibia	0.62	Venezuela, RB	0.48
Chile	0.52	Honduras	0.55	Nicaragua	0.5	Zambia	0.52
Colombia	0.55						

Note: There are more countries in this specification in which an increase in natural resource rents as a share of GDP leads to an estimated higher domestic investment as a share of GDP. The critical level of income inequality in this exercise is 0.47.

Table A14: Correlation of Gini index with other alternatives

Variables	Gini coefficient	Income held by top 10\%	SWIID
Gini coefficient	1		
Income held by top 10\%	0.75	1	
SWIID	0.82	0.71	1

Note: There is almost high correlation between Gini index and other measures which leads to a similar estimation results.

Table A15: Summary statistics of institutional quality's measures

Variables	Number of Observations	Mean	Std. Dev.	Min	Max
Corruption of government	1873	2.611	0.936	0.083	6
Rule of law	1906	2.942	1.165	0.416	6
Ethnic tensions	1901	3.671	1.397	0.166	6
Bureaucratic quality	1704	1.96	0.76	0.166	4

Note: The data for these four institutional quality variables is from the International Country Risk Guide (ICRG) database for the period 1982-2015. Average of 4 variables indexed between 0 and 1 (1 represents highest quality) is considered to obtain institutional quality.

Table A16: Using more lags of investment as explanatory variables —Robustness checks

D.Invs	BB-GMM (1) one lag of Investment	BB-GMM (2) two lags of Investment	BB-GMM (3) three lags of Investment	BB-GMM (4) four lags of Investment	BB-GMM (5) five lags of Investment
Natural resource rents	3.855*	3.47*	4.126*	3.28*	4.511
	(1.94)	(2.024)	(2.26)	(1.992)	(3.012)
Natural resource rents×Gini coefficient	-8.914**	-8.239*	-9.868*	-8.042*	-9.738
	(4.327)	(4.536)	(5.116)	(4.68)	(7.016)
Investment (lagged one period)	-0.127	-0.299*	-0.299*	-0.116	-0.585*
	(0.143)	(0.149)	(0.149)	(0.237)	(0.344)
Investment (lagged two periods)		0.012	-0.014	-0.048	-0.069
		(0.024)	(0.066)	(0.072)	(0.057)
Investment (lagged three periods)			0.083*	0.122	0.122
			(0.036)	(0.104)	(0.087)
Investment (lagged four periods)				-0.034	0.086
				(0.114)	(0.113)
Investment (lagged five periods)					-0.0003
					(0.087)
Investment (lagged one period) squared	-0.002	-0.00006	-0.0007	-0.003	0.004
	(0.002)	(0.002)	(0.003)	(0.003)	(0.006)
Lag log of GDP	0.820	-0.572	2.08	-0.552	1.498
	(3.007)	(1.16)	(2.384)	(2.81)	(1.741)
Inflation	-0.178*	-0.0008	-0.0003	0.00001	0.0007
	(0.092)	(0.0006)	(0.0007)	(0.0007)	(0.0008)
Government's consumption expenditures	-0.0005	-0.103	-0.201	-0.272*	-0.224
	(0.0007)	(0.073)	(0.164)	(0.13)	(0.136)
Natural resource rents×Institutional quality	0.0878	0.241	0.278	0.366	-0.776
	(0.33)	(0.524)	(0.37)	(0.574)	(0.797)
Institutional quality	1.679	-1.53	-4.489	2.898	-7.124
	(2.819)	(4.033)	(5.227)	(8.412)	(7.287)
Growth rate of terms of trade	-1.920**	-2.115*	-1.58	-0.315	-2.103
	(0.944)	(1.078)	(1.132)	(1.134)	(1.71)
Total debt service	0.351**	0.207	0.32	0.313*	0.525
	(0.171)	(0.153)	(0.238)	(0.184)	(0.211)
Gross domestic savings	-0.154	0.062	0.125*	0.034	0.121
	(0.072)	(0.066)	(0.067)	(0.101)	(0.117)
Foreign aid	0.304	-0.127	0.267	-0.193	0.541
	(0.535)	(0.362)	(0.528)	(0.899)	(0.620)
Time span	1982-2015	1982-2015	1982-2015	1982-2015	1982-2015
Number of observations	1604	1600	1595	1590	1584
Number of countries	57	57	57	57	57

Note: Values in parentheses are standard error. Dependent variable is domestic investment (Gross Capital Formation-% of GDP) measured by ($Invs_t - Invs_{t-1}$). Year Fixed effects are included in all of the estimations. Blundell-Bond estimation is by two-step GMM procedure. All variables, except the growth rate of terms of trade, the interaction term with income inequality indices, and the year fixed effects are instrumented with a maximum of 1 further lag. I treat the results obtained in column (1) as the baseline results in the paper. ***P<%1, **P<%5, *P<%10

Table A17: Correlation matrix

Variables	Domestic invs	Natural resource rents	Gini coeff	Inst quality	Inflation	Growth terms of trade	Gov's consumption	Log-GDP	Total debt service	Gross domestic savings	Foreign aid	Lagged invs	Lagged invs squared
Domestic investment	1												
Natural resource rents	-0.05	1											
Gini coefficient	-0.056	-0.09	1										
Institutional quality	0.215	-0.29	0.189	1									
Inflation	-0.053	0.03	0.031	-0.073	1								
Growth terms of trade	-0.04	0.07	0.023	-0.014	-0.024	1							
Government's consumption	0.15	-0.08	0.231	0.256	0.018	-0.024	1						
Log-GDP	0.238	-0.13	0.316	0.507	-0.038	0.0005	0.134	1					
Total debt service	0.05	-0.03	0.056	0.148	-0.003	-0.005	0.081	0.225	1				
Gross domestic savings	0.474	0.24	0.056	0.187	-0.058	0.052	-0.02	0.541	0.166	1			
Foreign aid	-0.053	0.18	-0.352	-0.31	-0.018	0.001	-0.145	-0.512	-0.239	-0.186	1		
Lagged of investment	0.879	-0.05	-0.059	0.217	-0.076	-0.016	0.172	0.246	0.074	0.445	-0.072	1	
Lagged of investment squared	0.849	-0.01	-0.074	0.172	-0.051	-0.014	0.153	0.197	0.055	0.428	-0.066	0.97	1

Note: The correlation matrix indicates that there is a negligible correlation between the variables in the estimation.

A Appendix

The estimated cutoff point obtained from equation (3.1) in which $\bar{Q}_i$ represents the average of institutional quality for all 57 countries in the sample is as follows:

$$Gini^* = \frac{-(\hat{\beta}_2 + \hat{\beta}_4 \bar{Q}_i)}{\hat{\beta}_3} = \frac{-\hat{\beta}_2 - \hat{\beta}_4 \bar{Q}_i}{\hat{\beta}_3} = 0.437$$

To calculate the standard error of the cut-off point as a function of standard error of the parameters, I use the multivariate Delta method.

$$V(Gini^*) = (\frac{\partial Gini^*}{\partial \hat{\beta}_2})^2 V(\hat{\beta}_2) + (\frac{\partial Gini^*}{\partial \hat{\beta}_3})^2 V(\hat{\beta}_3) + (\frac{\partial Gini^*}{\partial \hat{\beta}_4})^2 V(\hat{\beta}_4) +$$

$$2(\frac{\partial Gini^*}{\partial \hat{\beta}_2})(\frac{\partial Gini^*}{\partial \beta_3}) Cov(\hat{\beta}_2, \hat{\beta}_3) + 2(\frac{\partial Gini^*}{\partial \hat{\beta}_2})(\frac{\partial Gini^*}{\partial \hat{\beta}_4}) Cov(\hat{\beta}_2, \hat{\beta}_4) + 2(\frac{\partial Gini^*}{\partial \hat{\beta}_3})(\frac{\partial Gini^*}{\partial \hat{\beta}_4}) Cov(\hat{\beta}_3, \hat{\beta}_4)$$

$$V(Gini^*) = (\frac{-1}{\hat{\beta}_3})^2 V(\hat{\beta}_2) + (\frac{\hat{\beta}_2 + \hat{\beta}_4(\bar{Q}_i)}{\hat{\beta}_3{}^2})^2 V(\hat{\beta}_3) + (\frac{-\bar{Q}_i}{\hat{\beta}_3})^2 V(\hat{\beta}_4) +$$

$$2(\frac{-1}{\hat{\beta}_3})(\frac{\hat{\beta}_2 + \hat{\beta}_4 \bar{Q}_i}{\hat{\beta}_3{}^2}) Cov(\hat{\beta}_2, \hat{\beta}_3) + 2(\frac{-1}{\hat{\beta}_3})(\frac{-\bar{Q}_i}{\hat{\beta}_3}) Cov(\hat{\beta}_2, \hat{\beta}_4) + 2(\frac{-\bar{Q}_i}{\hat{\beta}_3})(\frac{\hat{\beta}_2 + \hat{\beta}_4 \bar{Q}_i}{\hat{\beta}_3{}^2}) Cov(\hat{\beta}_3, \hat{\beta}_4)$$

$$V(Gini^*) = 0.021$$

Using this method, by looking at the variance of $Gini^*$, it is clear that the variance of the cut-off point is equal to 0.021 and the standard error is equal to 0.145.

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