Energy Transition Metals and Economic Development in Latin America

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Abstract

This paper aims to analyze the role of energy transition metals (ETM) in the development of regions, in Latin America countries, conditional on the local quality of institutions. As an increase in the demand of ETM is expected in line with the energy transition needs, several countries, ETM producers, may profit from the bonanza or, on the contrary, may fall into a natural resources curse. We aim to identify these effects at a disaggregated level. To do this, we construct and use an original dataset on 18 Latin American countries, at regional level, employing geo-localized data on the ETM mines locations. We also build a new regional index of the quality of institutions. We find that ETM do not have a direct impact on regional growth, rather its effect is conditional to the quality of institutions.

JEL: O13, O47, O54, Q32
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1 Introduction

Limiting global warming and achieving the climate objectives put forward by United Nations Climate Change Conference (COP) Agreement will require a profound restructuring of economic activity. This implies a transition to a less energy-intensive economy and a low/zero-carbon future. The energy transition will involve a reduction in demand for fossil fuels, which will affect the producers of these resources but will also lead to an increase in the demand for Energy Transition Metals' (ETM)[1]. The ETM are required for the transmission, storage, and subsequent expansion of green energy. The World Bank Group (2017) estimated the increase in the demand of ETM by 2050 to meet different targets (e.g., 2°C, 4°C, and 6°C increase in temperature) and showed, for example, that depending on the scenario, the demand for metals needed to make electric batteries could increase by up to 1000%.

The objective of decarbonization implies that the consumption of some mineral resources, such as copper, iron, lithium, etc., will increase dramatically. This shift in the demand for natural resources [2] represents a global opportunity for developing countries that are rich in these resources: Latin American economies have significant deposits of copper, iron ore, silver, lithium, aluminum, nickel, manganese, and zinc; Africa has platinum, manganese, bauxite, and chromium; Asian economies have rare earths, iron, steel, and titanium among other metals(World Bank Group, 2017).

The World Bank (2019???) emphasizes the potential benefits of increased demand for ETM in developing countries and highlights the lack of awareness of resource-rich countries. It maps the known reserves of ETM to increase awareness of the opportunities available for emerging and developing nations. However, it is important also to take into account both the opportunities and the potential drawbacks related to ETM extraction. The resource curse literature suggests that countries with abundant natural resources may experience a slowdown in economic growth (Sachs and Warner (2001), Frankel (2010), Humphreys et al. (2007), Ross (2001), etc.). The existing literature on the topic yields conflicting outcomes. In the case of Latin America and the Caribbean (LAC) the literature also shows mixed results (Papyrakis and Pellegrini (2019), Toscani (2017)).

The role of natural resources in the economy has been a topic of extensive research in the literature. Scholars have noted that the impact of these resources can be shaped by the institutional environment (Mehlum et al. (2006), Ross (2001), Bhattacharyya and Hodler (2010), de Vaal and Ebben (2011)). This notion has gained attention due to its potential to reconcile the mixed results

[1] For the rest of the text ETM will refer to minerals and metals needed to meet the demand of the required deployment of technology in order to meet a carbon-constrained scenario.

[2] We use the terms natural resources and commodities as synonyms: both refer to traded, unbranded, bulk goods with little to no processing.

of the resource curse.

The idea of institutional environment shaping economic outcomes is a concept that has been increasingly recognized in recent years. Indeed, many scholars (Acemoglu and Robinson (2012), North (1990), and Rodrik et al. (2004), among others) argue that the quality of institutions is a key factor for sustainable development. This strand of development represents a challenge for LAC. According to the World Governance Indicators (WGI), LAC have a lower quality of institutions than high-income countries (See figure A1) and it doesn't seem that the quality of their institutions has improved in time.

This paper focuses on the impact that ETM have on economic growth in Latin America (LA) at the subnational level. We focus on LA countries as they have significant endowments of ETM and represent a significant proportion of global supply. LA countries represent almost 50% of the global supply of silver and 40% of the supply of copper (See figure A2).

LAC economies are largely dependent on natural resources. For example, net commodity exporters countries represent 93% of LAC GDP (Sinnot et al., 2011). Figure A3 presents the dependency (measured as a percentage of the total exports) of primary products and non-renewables in LAC. While we can observe a clear decrease, it is still higher than the dependency of developed countries (around 18%) or developing economies of others regions such as East Asia and the Pacific (29.9%) (ECLAC, 2021).

Given LAC's dependency on natural resources, it is important to examine how the energy transition metals (ETM) sector could impact regional economic development. One factor to consider is the heterogeneous development paths of regions within LAC, as capital regions tend to account for a large part of the economic activity. For instance, in our sample, these regions represent 29.5% of countries' GDP on average, and as much as 68% in some cases. The impact that ETM possibly have on the regional economy may contribute or reduce the divergence in the path of development. Consequently of such heterogeneity the contribution of ETM to the economy may get diluted at national level. Therefore, to capture the effect of ETM on economic development, we propose an analysis at the department level, which can provide a more nuanced understanding of the impact of ETM on regional development paths.

Next in order to better assess the role ETM, we focus on quality of institutions. There is an increase in the awareness of the role of local institutions (Rodríguez-Pose (2013), Danson and Whittam (1999)), however empirical evidence is scarce and shows mixed results (Tabellini (2010), Gennaioli et al. (2012)). To address this research gap, we attempt to construct an index of institutional quality at the regional level for Latin American countries. To the best of our knowledge, this is the first attempt to develop such an index for the region.

We investigate the effect of ETM on the economic growth of the LA regions, conditional on the quality of institutions in place; to the best of our acknowledge, this is a first attempt to exploit regional data in 18 countries covering 334 sub-national units in Latin America to analyze the effect of natural resources -particularly ETM - on economic development. To control for theinstitutional quality, we create a novel index of the quality of institutions at a regional level. To the best of our knowledge, this is the first index of this type built for LAC. We find that ETM do not have a direct effect on regional economic development, however, depending on the quality of institutions of the region, its effect can be positive or negative.

The rest of the paper is divided as follows: Section 2 is dedicated to the literature review. Section 3 presents the data. Section 4 reports the results followed by robustness checks. The last section concludes.

2 Literature Review

The literature regarding the relationship between natural resources (NR) and development is vast and mainly focused on the resource curse. It highlights the negative relation between resources abundance and economic development (see Sachs and Warner (2001), Frankel (2010), Humphreys et al. (2007), Ross (2001), etc.). However in the case of LAC the results are inconclusive: Sinnot et al. (2011) states that Latin American countries have escaped this curse, while Papyrakis and Pellegrini (2019) find mixed results.

The literature highlights different channels through which natural resources can lead to poor economic performance: i) in general, the sector has little to no spillover effects on the rest of the economy (Humphreys et al., 2007). ii) The high rents from the sector can lead the economy to Dutch disease (Gylfason, 2001), i.e., the increase in commodity exports leads to an appreciation of the real exchange rate, which in turn affects and drains resources from other sectors. iii) The high rents from NR can undermine institutions, hence affecting development in the long run.

The intrinsic relationship between natural resources and institutions has been largely discussed in the literature. We could divide the findings into direct effects, mainly anti-democratic effects (See Ross (2001) for details) and rise of corruption (Knutsen et al. (2016), Sala-i Martin and Subramanian (2013) and Leite and Weidmann (1999))and conditional effects, which refer to the impact of NR on the outcome of interest - usually economic growth - given the institutional environment; that is, natural resources can be a curse or a blessing depending on the quality of institutions in a country. If the institutional quality is high (producer friendly) then natural resources will spur growth, but if the quality is low (grabber friendly) –referring to rent-seeking activities- then nat-

ural resources will hinder development (Mehlum et al. (2006), Bhattacharyya and Hodler (2010), Couttenier et al. (2017), Epo and Nochi Faha (2019)).

Moreover, empirical evidence on the role of institutions focuses on whether the effect is significant (and, of course, positive) or not (North (1990), Rodrik et al. (2004), Holmberg et al. (2009)). The discussion of corruption or rent-seeking activities-commonly defined as the abuse of public office for private gain ((World Bank Group, 2020))-usually stands as a separate issue with mixed results.

Ross (2001) states that oil and minerals can undermine democracy, especially if the country is poor. The anti-democratic effect of oil is channelled to the state via (i) a rentier effect, when high rents allow the government to reduce taxes and avoid accountability, (ii) a repression effect, when government uses rents to invest more in national security, which allows the state to prevent any democratic movement, and (iii) a modernization effect, which suggests that a highly educated and specialized working class will demand accountability and democracy, but due to the characteristics of oil and mineral extraction, the government is either not interested in investing in education or people would opt for rent-seeking activities, which in turn would delay democratization.

The idea behind is that democracy is closely linked to accountability (as well as transparency) which will deter the discretionary power of public offices and leads to better quality of institutions Holmberg et al. (2009), and thus improved development. Similar effects are found with regards to the increase in corruption (Knutsen et al. (2016), Sala-i Martin and Subramanian (2013), Sinnot et al. (2011) and Leite and Weidmann (1999)).

The literature can be summarized in the positive (*grease the wheels*) and negative (*sand the wheels*) impacts of corruption on economic performance. The *grease the wheels* hypothesis states that if the government has pervasive and inefficient regulations, then corruption can loosen or remove bureaucratic rigidities, allocate investments or speed up process, in other words, bribery can boost economic performance (Leff (1964), Méon and Sekkat (2005), Ahmad et al. (2012)). The counterpart states that corruption *sand the wheels* slows down the economy by reducing investment (Paulo et al. (2022), Gyimah-Brempong and de Gyimah-Brempong (2006), Mo (2001)), reducing government investment in education and health (Gyimah-Brempong and de Gyimah-Brempong (2006), Mo (2001), Leite and Weidmann (1999)) and causing misalocation of resources (Méon and Sekkat (2005), Tanzi and Davoodi (2000)).

While most of the literature finds a negative effect of corruption on economic development, the empirical and theorical studies that find positive effects of corruption on GDP growth are usually based on the institutional environment, i.e., corruption has a positive (negative) effect in a given country when the quality of institutions is weak (strong) (Ahmad et al. (2012), Malanski and

Póvoa (2021), de Vaal and Ebben (2011), Bhattacharyya and Hodler (2010), Méndez and Sepúlveda (2006), Dzhumashev (2014)).

The literature on the resource curse is vast, however empirical evidence regarding its implication at the subnational level is less abundant and even scare in developing countries. In the general case, Gennaioli et al. (2012) find that institutional quality is not an important determinant of growth at the regional level while natural abundance does matter. In the case of developed countries, the literature shows mostly positive spillover effects (increase in consumption) from fossil energy extraction (see Marchand and Weber (2017) for a synthesis of the literature), however it may lead to negative spillover effects such as negative labor market effects (Marchand and Weber, 2017) and an increase in the violence rate depending on the institutional environment (Couttenier et al., 2017).

Mixed results are also found with respect to developing countries in Africa. Positive effects are generally found in consumption Bazillier and Girard (2020), urbanization (Mamo et al., 2019) or other (Axbard et al. (2021), Benshaul-Tolonen (2018)). Negative spillover effects are found in productivity (Aragón and Rud, 2015), health (von der Goltz and Barnwal, 2018) and increase in corruption (Knutsen et al., 2016).

In the case of LAC the literature also shows mixed results. For instance, gold mining in Peru shows positive spillover effects (Aragón and Rud, 2013), while oil activity in Brazil does not (Caselli and Michaels, 2013). Our work attempts to further contribute to this research stream and to fill the gap in the LAC literature.

3 Data and Specification

3.1 Data

3.1.1 Natural resources extraction

We use three databases to construct the variables related to energy transition metals, fossil fuels and precious metals mining. We rely on the dataset of Minex to construct our main variable of interest. Further, S%P Global and the U.S. Geological Survey (USGS) are used for the construction of covariates and alternative measures of ETM.

The datasets of S&P and Minex have similar scope, both covering from medium size (or bigger) mineral deposits. We use the Minex dataset to generate six variables: number of active mines that extract ETM, number of active

mines where ETM is the primary metal and number of mines that extract precious metals. We also use the value of the deposits prior exploitation for energy transition metals (etm_deposit) and for precious metals (precious_deposit). Figure 1 shows the distribution of mines by status. Note that in general, due to missing values in the datasets, the variables of value of mining in a region do not correspond to number of mines (the latter has more observations).

We consider our measures of ETM as signals that are received by the economy. *etm_deposit* is a signal of the size of the operation installed in a region (note that this variable is continuous). *etm_minex* measure the number of active mines in a given region, therefore, the signal is rather simpler and does not take into account the size of the sector. In that sense if the latter measures are significant but deposit is not, we argue that is the presence of ETM rather than the size of the operation what matters for economic growth.

We construct two variables using the S&P dataset for robustness purposes, the number of active ETM mines in a given region the value of the ETM production per year. We construct the value of the capacity installed of ETM and fossil fuels (oil and gas) for a given region based on the information available in the U.S. Geological Survey (USGS) dataset. The database provides information about the major known mineral commodities, their characteristics and geographical location (Cunningham et al., 2005) Because the survey is time invarying and does not present initial or close up year, when needed the variation of the variables is given by the international prices of the commodities.

Because of the scope of the data bases, the number of observations available for LAC is different. Table A1 presents the number of observations by country of each of our sources, we observe that Minex and S&P present more observation points than USGS. For ilustration purposes figures A4, A5, A6, show the distribution of the deposits in LA from our different sources.

Lastly, we match the information of the mines to regions using geolocation data, we double check the locations using a process of reverse geocoding using the service of Openstreetmap Abdishakur (2019).

Figure 1: Mines location (Minex)

3.1.2 Regional quality of institutions index

This document shows to our understanding a first attempt to construct an index of the institutions' quality, at regional level, for Latin American countries. We followed the procedure presented by Charron et al. (2019) for the construction of the European Quality of Governance Index (EQI) data on regional governance in EU countries.

We use information from Latino barometer to perform the analysis. Latino barometro is a public opinion survey conducted on a regular basis analyzing the evolution of democracy, economy and society in selected LAC countries. We use 8 rounds (2009-2018) using in particular the questions related to confidence and trust in institutions and perceived corruption. Table A2 shows the countries included. Table O.A1 presents number of questions and regions included in each of the waves used for this study.

On average, we employed 27 questions related to the quality of institutions in our study. To standardize the variables, we rescaled them using Z-scores,

wherein lower values indicate poor institutional quality and higher values indicate better quality.

Subsequently, we conducted a factor analysis to determine the latent variables associated with the survey. Table O.A2 presents the results of the factor analysis conducted in 2018. We followed Kaiser's rule, retaining factors with an eigenvalue greater than one in each round.

We used factor loadings to identify the component related to institutional quality based on the distribution of the questions. For instance, in the 2018 wave, table O.A3 presents the factor loadings, wherein questions related to corruption were loaded in factor 1, questions related to trust in factor 2, and questions related to government effectiveness in factor 3.

We use the factors and selected World Governance Indicators (WGI) from the World Bank to construct the index. We use control of corruption, for factors related to corruption, regulatory quality for factors related to trust and government effectiveness for factors related to the provision of public goods.

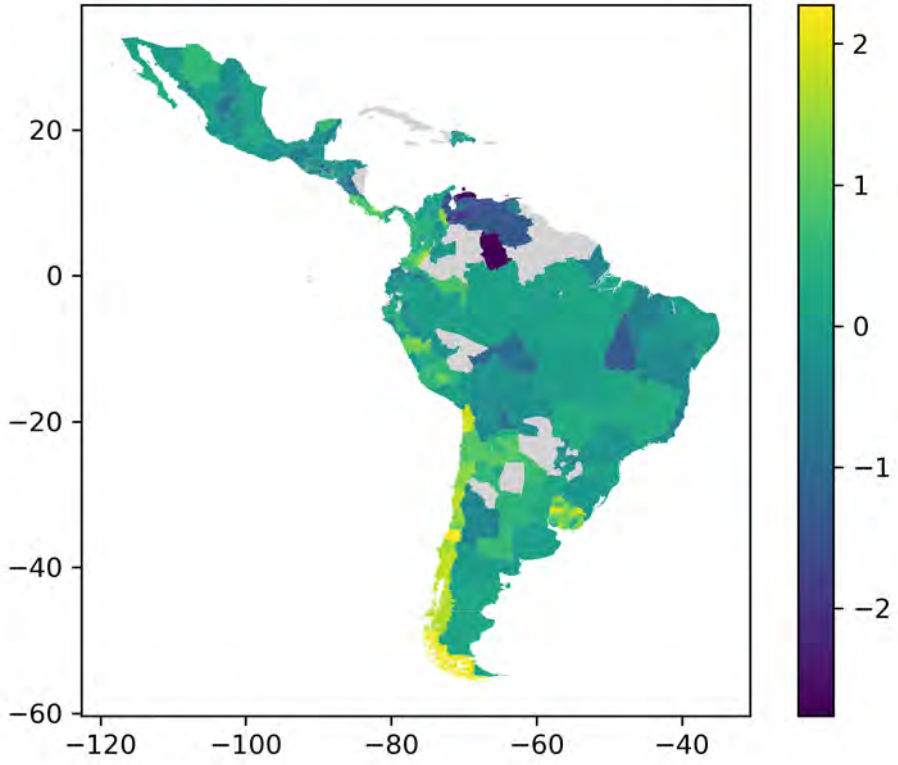
$$I_i = WGI_c + (R_i - \overline{R}_c) \tag{1}$$

Equation 1 is used for the construction of the index. Where i and c represent region and country respectively. I_i represent the index of quality of institutions, WGI_c represents the country quality of institution score given in the WGI, R_i represent the factor of the region and $\overline{R}_c$ represent the weighted average of regions' factors using population. Note that the index of quality of institution of each region will be a deviation from the mean depending on the WGI of each country.

The scores of the index of quality of institutions are shown in Table O.A4 and figure 2 mapped the index for LAC. For the year of 2018, the region with the lowest score in terms of quality of institutions is the Amazonas region from Venezuela followed by the Falcon region from the same country (-2.75 and -2.57 respectively). The highest scores are from the regions of Magallanes & Antarctic (2.06) in Chile and Paysandú (1.91) in Uruguay. Further the closest to the mean (which should be zero) are the region of Buenos Aires in Argentina (-0.004) and Itapúa in Paraguay (0.0022).

For statistical purposes some regions were added to the sample in order to fill the gap between the information on mines location and the survey of Latino Barometer: for those regions absent in the latter, the average score of the higher order aggregation was used (constructed with the available regions). We also fill the gaps of the survey (2012 and 2014) using the average score of t+1 and t-1.

Figure 2: Quality of institutions in Latin America



Note: High values imply high quality of institutions

3.1.3 Other variables

The construction of the regional GDP is made in two steps. First we construct a measure of the percentage participation on the GDP of each region in the country. We calculate the region's GDP using World Bank's country GDP at constant US dollars (year 2010). Table A3 shows the source of the participation percentage of the regions and its source. In general, when available the regional GDP from OECD was used, otherwise from the national statistic office or equivalent for each country. If not available, we used a proxy for the GDP participation either from ONG's or other government institute. When no information was found in all previously mentioned sources, we proxy the GDP using population.

The information of population comes from the institute of national statistics (or the equivalent) of each country [3]. This information is used to construct the

[3]INDEC-Argentina (2015); INE-Bolivia (2021); IBGE-Brazil (2018); INE-Chile (2019);

quality of institutions index and per capita variables.

We use an index of number of companies per capital per region to control for physical capital accumulation. Due to the heterogeneity of information across countries, we construct the variable using a similar procedure of the quality of institutions index. We begin by measuring the number of companies (when available) or economic units by region per capita. Table O.A5 shows the source used for each country. Second, we transform the data using Z-score by country. Finally we construct the index using investment as a proportion of the GDP from the World Bank (WB) as a base following equation 2

$$biz_i = Inv_c + companies_i \tag{2}$$

Where biz_i is the index of companies, inv is investment as a percentage of the GDP and $companies_i$ is the Z-score of the number of companies per capita. i and c represent region and country respectively. Note that this variable will measure the level of companies per capita as a deviation from the mean (which will be given by the WB investment). We consider that this variable should proxy accurately the level of physical capital accumulation.

We use life expectancy and average years of schooling from Global Data Lab Smits and Permanyer (2019) to control for human capital accumulation. We use percentage of tropical land from Kottek et al. (2006) and average temperature at 2m of the surface from ERA5 Monthly Aggregates - Latest Climate Reanalysis Produced by ECMWF / Copernicus Climate Change Service dataset (C3S) to control for geographical conditions. Finally we use number of conflicts and number of deaths -due to conflicts- from UCDP (Uppsala University, 2022) as additional covariates.

3.2 Methodology

To investigate the effect of of ETM on regional growth conditional on quality of institutions we rely our empirical strategy on a Barro (1991) style estimation. that is, we use our variable of interest, i.e. ETM, and we further control for the other strands of the economic growth literature. The modelling framework is constructed in a cross section approach, set at department level (for a region i):

$$y_i = \beta_0 + \beta_1 etm_i + \beta_2 etm_i * ins_i + \beta_3 ins_i + \beta G_i + \beta X_i + e_i$$

DANE (2018); INEC-Costa Rica (2021); ONE-Dominic Republic (2016); INEC-Ecuador (2012); DISGESTYC - El Salvador (2021); INE-Guatemala (2020); INE-Honduras (2021); CONAPO (2018); INIDE-Nicaragua (2021); INEC-Panama (2013); INE-Paraguay (2015); INEI-Peru (2019); INE-Uruguay (2014); INE-Venezuela (2021)

Where y_i is GDP growth. Our variable of interest is etm_i that is an aggregation of ETM activity in a given region. ins_i represents quality of institutions; note that we use an interaction term to control for the conditional effect of natural resources. In this sense a positive value would imply that the quality of institutions helps spur the effect of ETM activity on the development of a region and a negative coefficient would imply that the quality of institutions hinder the benefits of ETM in the sample.

To account for other relevant determinants of growth. we include a set of controls G_i for geography,We use percentage of tropical land of the region as well as the average temperature of the region. Additionally, we include another set of controls X_i that account for economic inputs such as the average years of schooling, life expectancy, and an index for physical capital accumulation. Finally, we include an error term, e_i, to account for any unexplained variance in the model.

G_i is a set of controls for geographical characteristics. We use percentage of tropical land of the region and average temperature. X_i encompass controls for inputs of the economy, we use average year of schooling, life expectancy and an index for physical capital accumulation. Last, e_i represents the error term. Table A4 shows descriptive statistics of the variables used and table A5 presents a small definition and sources of the variables.

We rely our baseline estimation strategy in a 2SLS due to the possible endogeneity of the covariates. Our reference year is 2018 We treat geographical controls as exogenous variables. We use in the first stage the first two lags of the other independent variables as instruments.

4 Results

4.1 Main results

We use a two-step least square (2SLS) with instrumental variables and robust errors for the estimations. The results present our two proxies for ETM operation in a region.

Table 1 presents the results, columns (1) and (2) show the results without the proxy for physical capital accumulation and in (3) and (4) it is included at the cost of a sample reduction. We observe a pattern in the results: first, the direct effect of ETM is not robust and it can be positive, negative, or null. Second, in (1) and (2) institutional quality matter. Third in (3) and (4) the conditional effect of institutions is positive, but our index of quality of institutions is not significant.

In all cases Wooldridge's (1995) robust score test and a robust regression-based test are reported. These tests are perform to determine whether endogenous regressors are in fact exogenous, as we reject the null hypothesis, our specification is correct. Additionally a Sargan test of over-identifying restrictions is used, because the test is not significant, we consider that our instruments are valid.

We interpret the results as evidence of the intrinsic relationship of institutional quality and ETM, further, it is important to note that the positive effect of the interaction term, implies that the effect of ETM can be positive or negative in the economy: if the quality of institution is high, then ETM will have a positive effect but if the institutional quality is low, then ETM will be a curse. In that regard our results are in line with the literature.(Epo and Nochi Faha (2019), Mehlum et al. (2006), Sala-i Martin and Subramanian (2013), Bhattacharyya and Hodler (2010))

In the subsequent sections we first make some robustness tests to check the validity of our results, next we further analyze the relationship of ETM and quality of institutions.

4.2 Robustness check

We find that ETM do not have a robust direct effect on economic growth, however the conditional effect of ETM given the institutional framework can lead to positive or negative spillovers to the economy. To test the robustness of our results, we run several checks along three lines: considering different ways of approaching natural resources and the inclusion of covariates, using a sample selection, and changing our estimation method.

We first test whether our results are robust to different measures of ETM, we rely on three additional measures,number of mines where ETM is the primary extracted material ($etm\_primary$) from Minex, we argue that this measure help us to isolate the effect of ETM in the economy. Additionally we use a second measure of number of mines (etm_sp) and value of production in a given year ($etm\_production$) both from S&P Global. Note that the first two measures are signals that received the economy of the size of the mining sector; on the contrary the value of the production reflects the operation of the mines in a given region.

The results are quantitatively the same (See Table A6 in appendix), if we exclude the business index the results remain unchanged, that is, the direct effect of ETM is positive but not robust and institutional quality presents a direct effect on the economy. Columns 4-6 presents the results with a reduce sample where the interaction term is significant and positive. We are disappointed of the results of the value of production as we were expecting a robust direct effect.

Table 1: 2SLS Results I

	(1)	(2)	(3)	(4)
etm_deposit	0.00909		-0.417*	
	(0.03)		(-1.86)	
etm_minex		0.362**		-0.0869
		(2.34)		(-0.84)
Interaction	0.117	-0.0643	0.620**	0.591***
	(0.39)	(-0.31)	(2.56)	(3.97)
reg_quality	3.897***	4.048***	0.940	0.937
	(3.13)	(3.19)	(0.90)	(0.83)
school	-1.336***	-1.345***	-0.964***	-1.017***
	(-3.76)	(-3.79)	(-2.69)	(-2.74)
life_exp	0.0164	0.0114	-0.355*	-0.351*
	(0.07)	(0.05)	(-1.94)	(-1.89)
temp	-0.0559	-0.0319	0.0506	0.0642
	(-0.66)	(-0.37)	(0.55)	(0.68)
tropical1	4.641***	4.768***	2.121***	1.962**
	(3.71)	(3.79)	(2.65)	(2.39)
biz_index			0.880**	0.982***
			(2.53)	(2.70)
N	215	215	130	130
R^2	0.245	0.249	0.243	0.253
Wooldridge	24.67***	26.26***	12.69***	12.58***
Regression	24.36***	26.52***	3.52***	3.81***
Sargan	3.880	0.0599	4.372	0.183

t statistics in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Dependent variable: GDP growth. Year: 2018. Estimation method: IV (2SLS), Average temperature and % of tropical are used as exogenous variables. We use as instruments the lags of the dependent variables. Estimations (3) and (4) includes ARG, BOL, BRA, CHL, CRI, DOM, ECU, MEX, PER, URY.

We conducted additional tests to examine the robustness of our results when controlling for omitted variables. Specifically, we investigated whether our findings were driven by other types of natural resources beyond the ones included in our baseline. Previous studies on the resource curse have largely focused on fossil fuels and precious metals, and it is possible that the negative effect of the resource curse is confined to these resources. To address this concern, we included two additional measures of precious metals in our analysis: the value of deposits prior to mining ($precious\_deposit$) and the number of mines extracting precious metals ($Precious$). We also controlled for fossil fuels by including the value of the installed capacity related to oil and gas (oil_gas_value) from the US Geological Survey. The results showed that our main findings were robust to these controls, with a significant interaction term and a zero direct effect of the extractive industry intensity measure on economic growth. The detailed results are presented in Table A7.

We further test whether our results for omitting variables. We first test if the results are driven by other types of natural resources, most of the literature of resource curse is written based fossil fuels and precious metals, hence it may happen that the negative effect of the resource curse is only driven by this type of natural resources. We partially cover this by using our measure of $etm\_primary$. We test this by controlling for fossil fuels and precious metals. For the latter we use two measures constructed in a equivalent way of ETM baseline, that is we use value of the deposit prior mining of precious metals in a given region ($precious\_deposit$) and the number of mines that extract precious metals ($Precious$). To control for fossil fuels we use value of the capacity installed related to oil and gas (oil_gas_value) from USGV. The results are qualitatively the same, the interaction term is significant and the direct effect of ETM is zero -hence not robust- (See Table A7).

We also tested whether social tension might affect our results. We addressed this issue by including conflict covariates, as conflict could potentially discourage investment and exploration in areas of conflict, or conversely, exacerbate the impact of the mining sector. We use two measures to control for this issue, $conflicts$, that account for the number of conflicts registered in a region and deaths that sum the number of deaths related to conflicts (Uppsala University, 2022). However, we found that the results remained unchanged from our previous analysis, indicating that our main results were not affected by the presence of social tensions.

We run several test to account for sample selection, our baseline results already show a variation in the results due to the change in the sample when we include the control for physical capital accumulation. We further test this issue in three lines. We remove capital cities, to account for the importance that capital cities and urban areas tend to have in the economic dynamics of LAC (Bárcena et al. (2018), Gennaioli et al. (2012)). Second, we divide our sample by the median GDP per capita, this test should allow us to see the variation

in the results between the more and least developed regions. Third, we run the regression with those countries for which we have a measure of GDP.

Removing capital cities do not affect the results (results upon request). Table A8 show the results when we divide the sample. The results above the median are qualitatively the same as the baseline, however the results for the least developed regions are significantly different, we observe that quality of institutions is not significant and ETM do not present a robust effect; the results using biz_index are not presented as the estimations are not robust, however show the same behavior. Finally using the portion of the sample for which we have measures of GDP show similar results when the regression is robust (results available upon request).

We use GMM as an alternative estimation method, as in the 2SLS we treat geographical controls as exogenous variables and the rest are instrumented using lag values. We do not use GMM as our preferred estimation method because of the short horizon of our panel (2010-2018), the characteristics of the ETM data and the quality of institutions. Further, in the case of ETM passing from exploration to extraction can take 10-15 years, and the extraction usually takes decades.

Table A9, presents the results,when the estimation is robust, we observe that ETM do not present a direct effect on the economy and the conditional effect with quality of institutions is not robust. However the result is sensitive to the inclution of covariates, sample selection, and changes in difference equation.

The robustness check show two results, first, our results are driven by the heterogeneity of the sample, then changing the sample, changes our results. Second, the results show that ETM do not have a robust direct effect on development, however the interactions with quality of institutions tend to be positive, as a consequence, we find evidence that ETM can have a positive or a negative effect depending on the institutional environment.

To better understand the results related to the quality of institutions, we decompose our index of quality of institutions on its three components, control of corruption, trust and government effectiveness. Table A10 shows the results.

It is interesting to see that the direct effect of ETM the value of deposit prior mining is negative and robust to the sample reduction with similar values. However, it can be compensated or at least mitigated by the quality of institutions. The interactions that are significant reflect the expected sign, that is ETM will be a bless (curse) if quality of institutions is high (low). We also observe that the direct effect of the institutional quality index is driven by trust in institutions and control of corruption; however control of corruption do not present the expected sign, an increase in the control of corruption have a negative effect on the economy, we could interpret this result as evidence of *grease*

the wheels hypothesis. The results regarding the components of the institutional quality present the same behavior that the baseline with respect to the robustness of the results, that is, the results regarding control of corruption and trust in institutions are largely robust to the inclusion of covariates, control of corruption, control of corruption survives the change in the estimation method, and the results are sensitive to the change in the sample (See online appendix).

Overall our results suggest that ETM do not have a robust direct effect on economic growth, however its effect depends on the institutional environment, then depending on the institutional quality ETM can be a bless or a curse for the economy.

4.3 ETM and quality of institutions

Towards the previous section we analyze the interaction term setting a certain level of quality of institutions, we drop that assumption and we cover the possible nonlinear relationship of the quality of institutions and ETM, further we test whether ETM have an effect on quality of institutions.

The first scenario cover the idea that natural resources (NR) may act as an double-edge sword, then depending on the quality of institutions in place, NR -in our case ETM- may have a positive (negative) effect when the institutional quality is high (low) (Epo and Nochi Faha (2019), Mehlum et al. (2006)). We rely on a Dynamic Panel Data Threshold Effects Model with Endogenous Regressors (PTR).

Tables O.A7 to O.A10 in the online appendix show the results, for the index of quality of institutions and its components, in general we observe that the effect is not robust to the change in the ETM measure, further, results over the threshold, that is, when the quality of institutions is high are not significant and when the quality of institutions is low show mixed results depending on the measure of institutions and ETM.

The second scenario try to analyze the effect of ETM in the quality of institutions, towards this paper we assume that the institutional environment was not affected by ETM mining, however, it may happen that quality of institutions is affected by ETM mining. We couldn't find robust evidence of non-linearities using ETM as a regime for our sample. Hence we proceed to analyze it using a dynamic panel.

Table O.A6 presents the results when the estimation is robust, we observe that ETM tend to have a positive effect on the institutional environment, particularly, the size of the ETM sector in a department. ETM deposit present a consistent significant effect on institutional quality. Taking into account the components of quality of institutions, ETM has a positive effect on control of

corruption and on trust but a negative effect on government effectiveness. The result is intriguing, we should expect an increase in the government capacity due to the windfall coming from the sector, this would explain the positive effect on trust and control of corruption, however it also implies an improvement on government effectiveness. Further research is need it to understand the impact of ETM on the institutional environment, particularly to understand the transmission channels at regional level.

5 Conclusion

In this study, we have analyzed the role of Energy Transition Metals (ETMs) in the economic development of Latin American regions, taking into account the quality of institutions. To the best of our knowledge, this is the first index of its kind constructed for LAC countries at the department level. Our findings suggest that the presence of ETMs in a region does not have a direct impact on economic growth. However, depending on the quality of institutions, their effect can be positive or negative. Therefore, ETMs in LAC can be both a blessing and a curse, depending on the institutional environment.

In summary, our results confirm two important ideas: the effect of ETMs in LAC is not uniform and can vary depending on the characteristics of each region; and secondly, natural resources can affect institutions at the regional level. Further research is needed to fully address this issue.

It is important to note that the demand for ETMs is expected to increase due to global commitments to address climate change. While Latin America has a rich endowment of ETMs, caution is needed when mining them. Our study shows that the association between ETMs and institutions can lead to negative spillover effects in the long term.

It is important to recall that this research can be extended in several ways. Another option to control for institutional quality would add rigor to the results. Analysis is necessary to identify the possible effect of ETM on welfare. It is well known that mining activities have an environmental impact, and may trigger social discomfort among local residents due to the potential negative health and safety effects by creating hot spots of environmental and social problems Lèbre et al. (2020). Addressing this issue and possible effects of ETMs on sustainable development remains a task for future research.

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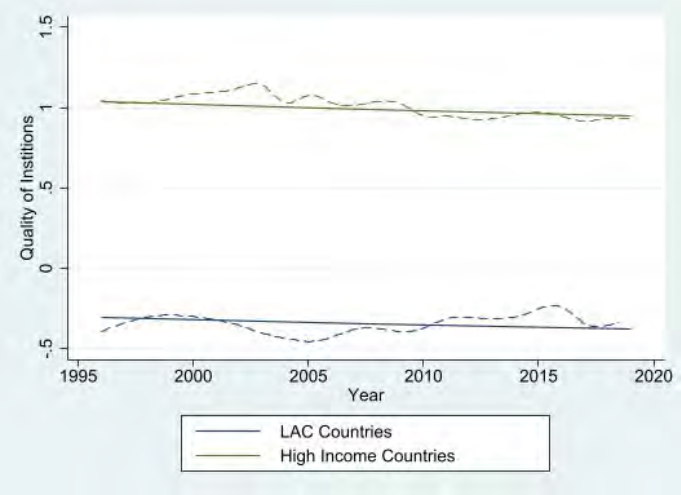
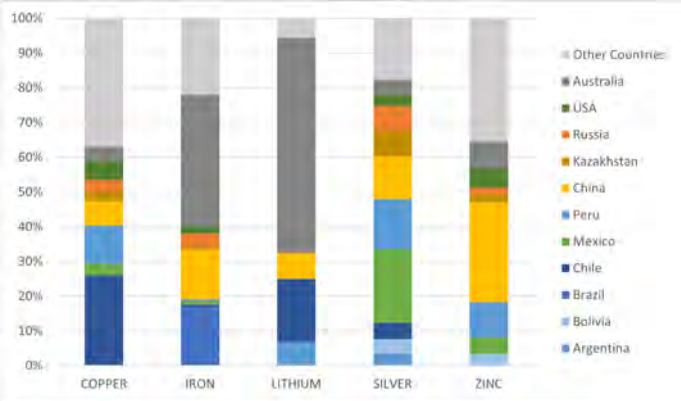
6 Appendix

Figure A1: Evolution of Quality of Institutions



We use the average value of 6 WGI that goes from -2.5 to 2.5. The solid line represent the linear fitted value and the dash line represents the median-spline. LAC excludes high income countries (Chile and Uruguay). High income countries included based on World Bank classification. Source: Kraay et al. (2010). Own elaboration

Figure A2: Global Supply of ETM



Global supply of selected ETM by country in 2018.
Source: U.S. Geological Survey (2020). Own elaboration

Figure A3: Natural Resources Dependency of LAC

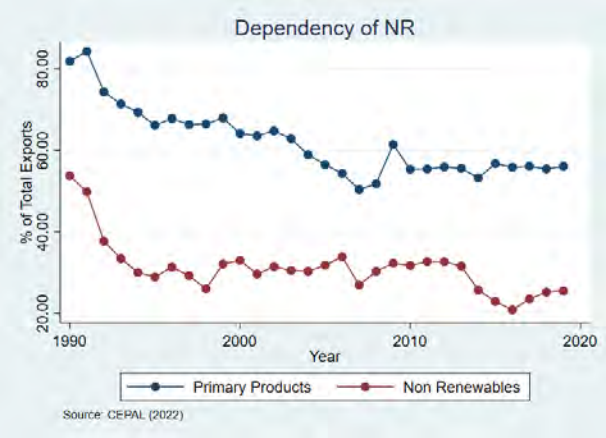


Figure A4: Mineral activities location (USGV)

Figure A5: ETM mines location (Minex)

Note: includes mines that produce ETM as secondary products

Figure A6: ETM mines location (S&P)

Note: All mines have ETM extraction

Table A1: Number of observation on minerals related activities

Country	Minex	S&P	USGV
Argentina	165	189	147
Bolivia	119	163	134
Brazil	1219	1172	1187
Chile	1163	1271	166
Colombia	125	127	148
Costa Rica	16	13	112
Dominican Republic	17	114	11
Ecuador	131	127	117
El Salvador	13	12	18
Guatemala	16	112	17
Honduras	12	17	16
Mexico	1193	1271	164
Nicaragua	15	15	15
Panama	112	19	12
Paraguay	11	11	12
Peru	1131	1220	1102
Uruguay	12	11	12
Venezuela	110	120	139
Total	900	1214	649

Table A2: Countries in the Sample

Country Code	Country Name	N° of Regions⋆	On the index†
ARG	Argentina	22	13
BOL	Bolivia	9	9
BRA	Brasil	27	24
CHL	Chile	15	15
COL	Colombia	25	20
CRI	Costa Rica	7	7
DOM	Dominic Republic	31	30
ECU	Ecuador	23	18
GTM	Guatemala	22	22
HND	Honduras	17	17
MEX	Mexico	32	32
NIC	Nicaragua	17	16
PAN	Panama	10	10
PER	Peru	22	19
PRY	Paraguay	16	10
SLV	El Salvador	14	14
URY	Uruguay	19	18
VEN	Venezuela	24	23

⋆ includes overall sample

† includes regions with information available for the construction of the index

Table A3: GDP Proxy per country

Country	Type of proxy	Source
Argentina	Energy consumption participation	Ministerio de Hacienda Argentina
Bolivia	Regional GDP	INE-Bolivia
Brasil	Regional GDP	OCDE
Colombia	Regional GDP	OCDE
Chile	Regional GDP	OCDE
Costa Rica	Energy consumption participation (per capita)	UNDP, University of Costa Rica
Dominic Republic	Population	
Ecuador	Regional GDP	Central Bank of Ecuador
El salvador	Population	
Guatemala	Regional GDP (per capita)	FUNDESA
Honduras	Population	
Nicaragua	Population	
Panama	Regional GDP	MINERPA
Paraguay	Proxy consumo energetico per capita (Population)	UNDP
Peru	Regional GDP	OCDE
Uruguay	Regional GDP	OTU, OPP
Venezuela	Population	

Table A4: Descriptive Statistics

Variable	Obs	Mean	Std. dev.	Min	Max
Quality Index	2,760	0.016	0.770	-2.763	3.198
C. Corruption	2,785	0.003	0.950	-3.456	4.223
Trust	2,816	0.001	0.965	-4.298	3.380
Effectiveness	2,861	0.025	0.954	-3.818	3.500
GDP %	2,813	3.048	6.973	-42.860	107.453
etm_deposit	3,563	0.275	2.953	0	63.991
etm_minex	3,563	0.546	1.963	0	25
etm_produc n	3,563	1.738	12.024	0	241.632
etm_primary	3,563	0.369	1.602	0	24
etm_value	3,563	2.140	14.792	0	242.209
etm_sp	3,563	0.789	2.269	0	26
Precious_t	3,563	0.525	1.754	0	19.000
precious_d t	3,563	0.146	0.871	0	11.791
Oil & Gas	3,563	0.087	0.718	0	14.415
Temperature	3,460	294.562	5.146	277.735	302.879
% Tropical	3,280	0.234	0.349	0	1
School	3,024	7.707	1.763	2.903	13.010
Life exp	3,042	74.797	2.453	61.920	81.760
Biz_index	1,270	0.000	0.973	-1.917	4.897
Deaths	3,510	13.960	148.891	0	4355
Conflict	3,510	1.609	14.161	0	411

Table A5: Variables description

Variable	Definition	Source
ETM (capacity)	Value of the capacity installed to extract and produce ETM in a region	USGV
ETM (deposit)	Value of the deposit related to ETM prior mining in a region	Minex
ETM (production)	Value of the production of ETM	S&P Global
ETM (S&P)	Number of mines with ETM activity (either as primary or secondary product)	S&P Global
ETM (minex)	Number of mines with ETM activity (either as primary or secondary product)	Minex
ETM (primary)	Number of ETM where ETM is the primary product	Minex
Precious	Number of mines with precious metals activities (either as primary or secondary product)	Minex
Precious deposit	Value of the deposit related to precious metals prior mining	Minex
Oil & Gas	Value of the capacity installed to extract and produce Oil and Gas in a region	USGV
Quality Index	Index of quality of institutions (See Appendix for details of the construction)	Latino Barometro
C. Corruption	Component of the index of quality of institutions. Refers to the capacity to control corruption	Latino Barometro
Trust	Component of the index of quality of institutions. Refers to the trust in the institutions	Latino Barometro
Effectiveness	Component of the index of quality of institutions. Refers to the government effectiveness	Latino Barometro
Tropical	Percentage of tropical land in a region	Kottek et al. (2006)
Temp	Average temperature at 2m of the surface	Copernicus Climate Change
School	Average year of schooling	Global Data Lab
Life exp	Life expectancy	Global Data Lab

Variable	Definition	Source
Biz_index	Business index: index based on number of companies per capita and investment as a percentage of GDP	World Bank and others
Conflict	Number of conflicts	UCDP
Deaths	Number of deaths associated with conflicts	UCDP

Table A6: Robustness check I: ETM Measures

	(1)	(2)	(3)	(4)	(5)	(6)
etm_primary	0.455**			-0.107		
	(2.10)			(-0.79)		
etm_sp		0.0351			-0.0196	
		(0.15)			(-0.12)	
etm_production			0.111***			-0.0116
			(2.76)			(-0.32)
Interaction	-0.134	0.334	-0.0700	0.626***	0.492**	0.0810**
	(-0.53)	(1.10)	(-1.57)	(3.59)	(2.56)	(2.10)
reg_quality	4.066***	3.751***	4.026***	1.024	0.935	0.966
	(3.22)	(2.80)	(3.22)	(0.92)	(0.82)	(0.92)
school	-1.330***	-1.321***	-1.337***	-1.009***	-0.997***	-1.045***
	(-3.76)	(-3.70)	(-3.79)	(-2.74)	(-2.63)	(-2.87)
life_exp	0.0118	-0.00339	0.0231	-0.361**	-0.368**	-0.380**
	(0.05)	(-0.01)	(0.10)	(-1.96)	(-2.02)	(-2.16)
temp	-0.0324	-0.0438	-0.0363	0.0617	0.0631	0.0590
	(-0.38)	(-0.51)	(-0.43)	(0.65)	(0.68)	(0.63)
tropical1	4.698***	4.646***	4.666***	1.984**	2.089**	2.107***
	(3.75)	(3.71)	(3.72)	(2.41)	(2.57)	(2.62)
biz_index				0.961***	0.994***	0.991***
				(2.69)	(2.69)	(2.77)
N	215	215	215	130	130	130
R^2	0.248	0.251	0.253	0.249	0.242	0.275
Wooldridge	26.19***	27.33***	25.38 ***	12.67***	13.44***	13.51***
Regression	26.18***	41.17***	25.48***	3.888***	4.689***	3.997***
Sargan	0.0678	0.768	0.356	0.263	0.651	0.487

t statistics in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.
Estimations (4) - (6) includes ARG, BOL, BRA, CHL, CRI, DOM, ECU, MEX, PER, URY.

Table A7: Robustness check II: covariates

	(1)	(2)	(3)	(4)
etm_deposit	0.0112		-0.361	
	(0.04)		(-1.51)	
etm_minex		0.170		-0.596
		(0.30)		(-1.08)
inter	0.122	0.0499	0.560**	0.836**
	(0.40)	(0.14)	(2.19)	(2.29)
reg_quality	3.925***	4.086***	1.024	1.131
	(3.20)	(3.26)	(1.02)	(1.03)
school	-1.380***	-1.382***	-0.975***	-1.063***
	(-3.83)	(-3.82)	(-2.71)	(-2.74)
life_exp	0.0197	0.00882	-0.373**	-0.380**
	(0.08)	(0.04)	(-2.09)	(-2.06)
temp	-0.0422	-0.0194	0.0599	0.0796
	(-0.49)	(-0.23)	(0.66)	(0.86)
tropical1	4.569***	4.693***	1.907**	1.880**
	(3.63)	(3.71)	(2.38)	(2.25)
oil_gas_value	0.607***	0.520***	0.203	0.244
	(3.02)	(2.84)	(1.05)	(1.30)
precious_deposit	0.0264		-0.347	
	(0.14)		(-1.51)	
Precious_t		0.171		0.533
		(0.30)		(0.97)
biz_index			0.806**	0.972***
			(2.33)	(2.65)
N	215	215	130	130
R^2	0.242	0.244	0.242	0.252
Wooldridge	23.52***	25.39***	10.59*	11.26**
Regression	23.50***	26.14***	2.882**	3.734***
Sargan	4.985	0.0800	6.695	3.112

t statistics in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Dependent variable: GDP growth. Year: 2018. Estimation method: IV (2SLS), Average temperature and % of tropical are used as exogenous variables. We use as instruments the lags of the dependent variables. Estimations (3) and (4) includes ARG, BOL, BRA, CHL, CRI, DOM, ECU, MEX, PER, URY.

Table A8: above the median 1-4 below 5-6

	Above GDP median		Below GDP median	
	(1)	(2)	(3)	(4)
etm_deposit	0.314		-3.776**	
	(1.05)		(-2.19)	
etm_minex		0.495***		0.390
		(2.65)		(1.47)
inter	-0.168	-0.196	6.379**	1.038
	(-0.52)	(-0.85)	(1.97)	(0.98)
reg_quality	4.867***	5.058***	-0.541	-2.259
	(3.36)	(3.40)	(-0.19)	(-0.67)
school	-1.752***	-1.676***	-0.120	-0.0828
	(-3.54)	(-3.32)	(-0.31)	(-0.22)
life_exp	0.113	0.127	-0.182	-0.160
	(0.27)	(0.30)	(-0.66)	(-0.57)
temp	-0.0590	-0.0152	-0.0969	-0.0631
	(-0.40)	(-0.10)	(-1.03)	(-0.66)
tropical1	5.127***	5.333***	6.290*	7.189**
	(3.35)	(3.45)	(1.96)	(2.07)
N	114	114	100	100
R^2	0.434	0.438	0.0334	0.0119
Wooldridge	23.23***	22.46***	11.65**	12.75**
Regression	19.88***	18.26***	3.034**	6.027***
Sargan	2.480	2.254	4.754*	0.106

t statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A9: GMM Results

	(1)	(2)
etm_deposit	0.0423	
	(0.85)	
etm_minex		-0.197
		(-1.05)
gdp_{t-1}	0.106**	0.101**
	(2.22)	(2.12)
inter	0.00448	0.163**
	(0.26)	(2.08)
reg_quality	0.229	0.448
	(0.50)	(0.89)
temp	-0.132**	-0.156***
	(-2.47)	(-2.70)
school	-1.099***	-1.098***
	(-4.84)	(-4.21)
life_exp	-0.159	-0.325
	(-0.72)	(-1.51)
biz_index	0.898	0.962
	(0.99)	(0.95)
N	971	971
sargan	370.6 ***	389.1***
hansen	206.7	205.3

t statistics in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Dependent variable: GDP growth. Years: 2010 - 2018. Estimation method: GMM. Average temperature and % of tropical are used as exogenous variables. We use as instruments the lags of the dependent variables.

Table A10: 2SLS Results III

	(1)	(2)	(3)	(4)
etm_deposit	-0.489*		-0.568*	
	(-1.75)		(-1.87)	
etm_minex		0.232		-0.240
		(1.09)		(-1.48)
Interaction	0.454*	0.435**	-0.0311	0.112
C. Corruption	(1.66)	(2.02)	(-0.10)	(0.59)
Interaction	0.262*	-0.256	0.361**	0.267*
Trust	(1.85)	(-1.36)	(2.32)	(1.68)
Interaction	-0.545	-0.218	0.390	0.282
G. Effectiveness	(-1.27)	(-0.86)	(0.87)	(1.49)
reg_corruption	-2.339**	-2.339**	-0.703	-0.749
	(-2.53)	(-2.51)	(-1.44)	(-1.53)
reg_trust	4.814***	4.820***	0.719	0.990
	(5.81)	(5.77)	(0.77)	(1.16)
reg_effec	1.371*	1.392	0.405	0.270
	(1.66)	(1.59)	(0.93)	(0.59)
school	-0.889**	-0.894**	-0.955**	-0.977**
	(-2.38)	(-2.41)	(-2.36)	(-2.38)
life_exp	-0.0218	-0.0181	-0.245	-0.265
	(-0.08)	(-0.07)	(-1.36)	(-1.55)
temp	-0.0919	-0.0661	0.00649	0.0356
	(-1.04)	(-0.74)	(0.08)	(0.44)
tropical1	3.317***	3.390***	1.976***	1.528**
	(2.66)	(2.72)	(2.59)	(2.00)
biz_index			0.858***	0.938***
			(2.70)	(2.80)
N	215	215	130	130
R^2	0.130	0.131	0.269	0.274
Wooldridge	29.64***	29.50***	13.55**	15.52**
Regression	14.87***	14.05***	3.078***	3.055***
Sargan	3.258	1.292	4.109	3.475

t statistics in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Dependent variable: GDP growth. Year: 2018. Estimation method: IV (2SLS), Average temperature and % of tropical are used as exogenous variables. We use as instruments the lags of the dependent variables. Estimations (3) and (4) includes ARG, BOL, BRA, CHL, CRI, DOM, ECU, MEX, PER, URY.

Online Appendix

A1 Tables and Figures

Table O.A1: Information used for the index of quality of institutions

Wave	N. Regions	N. Questions
2009	309	26
2010	310	30
2011	314	31
2013	308	22
2015	324	52
2016	295	17
2017	311	19
2018	319	24

Table O.A2: Factor Analysis I (for 2018)

Factor analysis/correlation		Number of obs:	11,441
Method: principal factors		Retained factors:	3
Rotation: (unrotated)		Number of params:	69

Factor	Eigenvalue	Difference	Proportion	Cumulative
Factor1	6,77226	4,0396	0,67	0,67
Factor2	2,73266	1,56089	0,2704	0,9404
Factor3	1,17177	0,76902	0,1159	1,0563
Factor4	0,40275	0,21081	0,0398	1,0962
Factor5	0,19195	0,05662	0,019	1,1152
Factor6	0,13532	0,01833	0,0134	1,1285
Factor7	0,11699	0,06454	0,0116	1,1401
Factor8	0,05245	0,02731	0,0052	1,1453
Factor9	0,02514	0,0204	0,0025	1,1478
Factor10	0,00474	0,02355	0,0005	1,1483
Factor11	-0,01881	0,01917	-0,0019	1,1464
Factor12	-0,03798	0,00953	-0,0038	1,1426
Factor13	-0,0475	0,01958	-0,0047	1,1379
Factor14	-0,06708	0,01399	-0,0066	1,1313
Factor15	-0,08108	0,00593	-0,008	1,1233
Factor16	-0,087	0,00984	-0,0086	1,1147
Factor17	-0,09684	0,01444	-0,0096	1,1051
Factor18	-0,11128	0,01974	-0,011	1,0941
Factor19	-0,13101	0,00344	-0,013	1,0811
Factor20	-0,13445	0,00328	-0,0133	1,0678
Factor21	-0,13773	0,02163	-0,0136	1,0542
Factor22	-0,15936	0,02412	-0,0158	1,0384
Factor23	-0,18349	0,02149	-0,0182	1,0203
Factor24	-0,20498		-0,0203	1

Table O.A3: Factor Analysis II (loading's)

Variable	Factor1	Factor2	Factor3	Uniqueness
Q15-B Confidence in Police		0,4857		0,6685
Q15-C Confidence in Church				0,8797
Q15-D Confidence in National Congress		0,6451		0,524
Q15-E Confidence in Government		0,7093		0,4384
Q15-F Confidence in Judiciary		0,6861		0,4486
Q15-G Confidence in Political Parties		0,6388		0,5527
Q15-H Confidence in Electoral institution		0,6379		0,5002
Q16*-A NGO			0,5529	0,6424
Q16*-B National Companies			0,6202	0,555
Q16*-C Trade Unions		0,3096	0,4619	0,6791
Q16*-D Media			0,512	0,6731
Q16*-E International companies			0,679	0,5018
Q16*-F Banks			0,602	0,5675
Q16*-G Multilateral organizations			0,6593	0,5115
Q71-A Corruption of The president and officials	0,6604			0,4999
Q72-B Corruption of Members of parliament	0,7157			0,4333
Q73-C Corruption of Gov. officials	0,7052			0,4888
Q74-D Corruption of Local gov. councilors	0,7399			0,4257
Q75-E Corruption of Police	0,7091			0,4703
Q76-F Corruption of Ministry of finance	0,7586			0,404
Q77-G Corruption of Judges	0,7491			0,4121
Q78-H Corruption of Religion	0,6019			0,6048
Q79-I Corruption of Business executives	0,6666			0,531
Q80 Evolution of corruption				0,9108

Blanks <0.3. * Questions if the organization operate to improve the quality of life

Table O.A4: Index quality of institutions (2018)

Region	Corrup.	Trust	Effectiv.	**Index**
CO: Bogotá D.C.	0,173	0,105	0,076	**0,118**
CO: Amazonas	0,899	1,123	0,464	**0,829**
CO: Antioquia	0,725	0,175	0,555	**0,485**
CO: Atlántico	-0,258	0,453	0,212	**0,136**
CO: Bolívar	0,780	0,326	-1,004	**0,034**
CO: Boyacá	0,913	-0,553	-0,251	**0,036**
CO: Caldas	-0,135	-0,249	0,549	**0,055**
CO: Cauca	1,021	1,167	0,644	**0,944**
CO: César	-0,149	0,018	0,425	**0,098**
CO: Córdoba	0,055	0,066	0,080	**0,067**
CO: Cundinamarca	-1,062	0,881	0,991	**0,270**
CO: Huila	1,676	0,671	2,287	**1,545**
CO: Magdalena	0,746	-0,097	0,005	**0,218**
CO: Meta	0,205	0,139	-0,685	**-0,114**
CO: Nariño	0,409	1,219	0,083	**0,570**
CO: Norte de Santander	0,824	2,286	0,976	**1,362**
CO: Risaralda	-1,437	0,606	-0,650	**-0,494**

Region	Corrup.	Trust	Effectiv.	**Index**
CO: Santander	-0,372	-0,090	0,137	**-0,108**
CO: Tolima	-0,110	1,536	0,294	**0,573**
CO: Valle del cauca	0,207	0,542	0,056	**0,268**
CO: Sucre	0,107	0,216	-0,072	**0,084**
CO: La Guajira	0,107	0,216	-0,072	**0,084**
CO: Chocó	0,546	0,976	0,261	**0,594**
CO: Putumayo	0,552	0,631	-0,111	**0,357**
AR: Capital Federal	0,969	0,208	0,431	**0,536**
AR: Cuyo/Mendoza	0,002	-1,419	0,268	**-0,383**
AR: Noreste/Chaco	1,515	-0,013	0,631	**0,711**
AR: Noreste/Corrientes	0,568	-0,362	0,511	**0,239**
AR: Noreste/Entre Ríos	0,605	-0,271	0,549	**0,294**
AR: Noroeste/Salta	2,426	0,024	0,415	**0,955**
AR: Noroeste/Tucumán	-0,273	0,236	0,509	**0,157**
AR: Pampeana/Buenos Aires	0,141	-0,196	0,310	**0,085**
AR: Pampeana/Córdoba	0,781	0,350	0,345	**0,492**
AR: Pampeana/La Pampa	0,809	-1,810	2,873	**0,624**
AR: Pampeana/Santa Fé	0,516	0,626	0,220	**0,454**
AR: Patagónica/Neuquén	-0,215	0,044	0,142	**-0,010**
AR: Patagónica/Río Negro	0,254	-0,547	0,391	**0,032**
AR: Chubut	0,282	-0,771	1,135	**0,216**
AR: Jujuy	1,076	0,130	0,462	**0,556**
AR: San luis	0,002	-1,419	0,268	**-0,383**
AR: San Juan	0,002	-1,419	0,268	**-0,383**
AR: Santa Cruz	0,282	-0,771	1,135	**0,216**
AR: Catamarca	1,076	0,130	0,462	**0,556**
AR: Tierra de Fuego	0,282	-0,771	1,135	**0,216**
BO: Beni	-0,105	-0,489	0,163	**-0,144**
BO: Chuquisaca	-0,642	-1,625	-0,198	**-0,822**
BO: Cochabamba	-0,595	-0,734	0,108	**-0,407**
BO: La Paz	-0,014	-0,524	-0,083	**-0,207**
BO: Oruro	0,296	-0,949	-0,015	**-0,223**
BO: Pando	1,359	-2,519	-1,978	**-1,046**
BO: Potosí	-0,142	-0,662	-0,097	**-0,301**
BO: Santa Cruz	-0,215	-0,358	-0,072	**-0,215**
BO: Tarija	1,316	-0,859	0,489	**0,315**
BR: Federal distric	-0,753	2,580	-1,978	**-0,050**
BR: Bahia	-0,408	-0,124	-0,587	**-0,373**
BR: Ceará	-0,013	-0,228	0,349	**0,036**
BR: Espírito Santo	-0,658	-0,028	-1,085	**-0,591**
BR: Goiás	0,412	0,402	-0,249	**0,188**
BR: Maranhão	0,341	-0,986	-1,104	**-0,583**
BR: Mato Grosso	0,251	0,129	-0,251	**0,043**

Region	Corrup.	Trust	Effectiv.	**Index**
BR: Mato Grosso do Sul	0,552	0,393	0,053	**0,333**
BR: Minas Gerais	0,355	0,061	0,596	**0,337**
BR: Para	0,715	0,270	-0,447	**0,179**
BR: Paraíba	-0,473	0,271	0,683	**0,160**
BR: Paraná	-0,427	0,018	0,059	**-0,117**
BR: Pernambuco	0,874	0,000	-1,323	**-0,150**
BR: Piauí	0,046	0,015	-0,537	**-0,159**
BR: Río de Janeiro	-0,299	-0,311	-0,215	**-0,275**
BR: Rio Grande do Norte	-0,452	-0,868	1,187	**-0,045**
BR: Rio Grande do Sul	0,908	-1,059	-0,071	**-0,074**
BR: Rondônia	-1,515	-0,011	-1,067	**-0,864**
BR: Santa Catarina	0,529	0,045	-0,048	**0,175**
BR: Alagoas	0,067	-0,449	-0,029	**-0,137**
BR: Amazonas	0,364	0,042	-0,164	**0,081**
BR: São Paulo	0,124	-0,245	-0,131	**-0,084**
BR: Sergipe	0,814	-0,172	-0,018	**0,208**
BR: Tocantins	-2,084	-0,714	-0,977	**-1,258**
BR: Amapá	-0,630	-0,103	-0,664	**-0,466**
CL: Metropolitana	1,879	1,097	1,275	**1,417**
CL: Tarapacá	1,557	2,394	1,585	**1,845**
CL: Antofagasta	0,697	1,672	0,392	**0,920**
CL: Atacama	1,870	0,685	1,577	**1,377**
CL: Coquimbo	2,502	1,542	1,120	**1,721**
CL: Valparaíso	0,937	1,095	2,386	**1,473**
CL: O´Higgins	1,138	0,817	1,582	**1,179**
CL: Maule	2,094	2,070	2,662	**2,275**
CL: Bío-Bío	1,652	0,910	2,104	**1,556**
CL: a Araucanía	0,630	2,775	2,073	**1,826**
CL: Los Lagos	1,637	1,096	2,578	**1,770**
CL: Aysén	1,292	1,949	1,872	**1,704**
CL: Magallanes y Antártica	1,633	2,781	1,896	**2,103**
CL: Los Ríos	0,771	1,518	2,939	**1,743**
CL: Arica y Parinacota	3,384	2,054	0,877	**2,105**
CR: San José	1,244	0,494	0,744	**0,827**
CR: Alajuela	1,493	0,537	0,703	**0,911**
CR: Cartago	1,521	1,051	-0,030	**0,847**
CR: Heredia	0,525	-0,121	1,193	**0,532**
CR: Guanacaste	0,510	0,088	2,214	**0,937**
CR: Puntarenas	1,746	0,276	1,092	**1,038**
CR: Limón	-0,290	1,920	0,483	**0,704**
DO: Distrito Nacional	0,137	0,605	-0,156	**0,195**
DO: Azua	-1,175	0,684	0,229	**-0,088**

Region	Corrup.	Trust	Effectiv.	**Index**
DO: Baoruco	-1,861	0,618	0,720	**-0,174**
DO: Barahona	-2,246	0,706	0,213	**-0,443**
DO: Dajabón	-0,909	-0,251	-0,029	**-0,396**
DO: Duarte	0,632	-0,007	-0,621	**0,001**
DO: El Seibo	-1,224	0,236	0,508	**-0,160**
DO: Espaillat	-1,000	0,037	-0,347	**-0,437**
DO: Hato Mayor	-0,567	0,134	0,265	**-0,056**
DO: Hermanas Mirabal / Salcedo	0,253	-0,099	-0,515	**-0,120**
DO: La Altagracia	-1,202	-0,145	-0,193	**-0,513**
DO: La Romana	0,741	1,421	-1,374	**0,263**
DO: La Vega	-0,722	-0,043	0,020	**-0,248**
DO: María Trinidad Sánchez	-0,759	-1,255	0,726	**-0,429**
DO: Monseñor Nouel	-0,443	0,183	-0,295	**-0,185**
DO: Montecristi	-0,334	-0,841	-1,010	**-0,728**
DO: Monte Plata	-0,705	0,440	0,080	**-0,062**
DO: Pedernales	-0,470	-1,269	-0,002	**-0,580**
DO: Peravía	0,282	-0,402	-1,931	**-0,684**
DO: Puerto Plata	0,316	0,604	0,024	**0,315**
DO: Samaná	-0,249	0,046	-0,169	**-0,124**
DO: Sánchez Ramírez	0,492	0,471	1,556	**0,840**
DO: San Cristóbal	-0,644	0,539	-0,089	**-0,065**
DO: San José de Ocoa	-0,736	1,405	-0,456	**0,071**
DO: San Juan	0,054	-0,348	0,438	**0,048**
DO: San Pedro de Macorís	-1,293	-1,408	1,133	**-0,523**
DO: Santiago	-0,293	-0,580	-0,721	**-0,531**
DO: Santiago Rodríguez	0,170	0,219	0,511	**0,300**
DO: Provincia Santo Domingo	0,000	0,137	-0,075	**0,021**
DO: Valverde	0,474	-0,523	0,575	**0,175**
EC: Azuay	0,427	-0,482	-0,602	**-0,219**
EC: Bolívar	-0,207	-0,983	0,804	**-0,129**
EC: Chimborazo	1,156	-1,150	0,293	**0,100**
EC: Cotopaxi	0,258	-0,569	-0,440	**-0,250**
EC: El Oro	0,245	-0,819	0,446	**-0,043**
EC: Esmeraldas	-1,410	-1,401	0,888	**-0,641**
EC: Guayas	-0,188	-0,465	0,009	**-0,214**
EC: Imbabura	-0,506	-0,484	-0,505	**-0,499**
EC: Loja	0,405	-1,244	1,722	**0,294**
EC: Los Ríos	0,211	-0,871	0,092	**-0,189**
EC: Manabí	-0,038	-0,494	0,042	**-0,163**
EC: Morona Santiago	0,348	-0,745	1,336	**0,313**
EC: Orellana	0,544	1,482	-0,171	**0,618**
EC: Pichincha	-0,054	-0,508	-0,290	**-0,284**
EC: Santa Elena	-0,248	-1,308	0,690	**-0,289**
EC: Santo Domingo de los Sachilas	-0,157	-0,602	-0,203	**-0,321**

Region	Corrup.	Trust	Effectiv.	**Index**
EC: Sucumbios	-2,152	0,615	-0,995	**-0,844**
EC: Tungurahua	-0,016	-0,796	0,032	**-0,260**
EC: Pastaza	-0,420	0,451	0,057	**0,029**
EC: Napo	-0,420	0,451	0,057	**0,029**
SV: Occidental/Ahuachapán	-0,533	-0,090	-0,926	**-0,516**
SV: Occidental/Santa Ana	0,350	0,110	-0,475	**-0,005**
SV: Occidental/Sonsonate	-0,421	0,219	-0,711	**-0,304**
SV: Central/La Libertad	0,288	0,350	0,227	**0,288**
SV: Central/Chalatenango	0,737	0,119	0,281	**0,379**
SV: Central/Cuscatlán	-1,130	-0,040	0,832	**-0,113**
SV: Central/San Salvador	-0,049	0,207	-0,363	**-0,068**
SV: Central/La Paz	-0,427	0,183	-0,740	**-0,328**
SV: Central/Cabañas	1,758	-1,670	1,134	**0,408**
SV: Central/San Vicente	-0,552	0,464	-0,169	**-0,086**
SV: Oriental/Usulután	0,064	-0,621	0,302	**-0,085**
SV: Oriental/San Miguel	-0,353	0,876	-0,751	**-0,076**
SV: Oriental/Morazán	-0,838	1,374	1,096	**0,544**
SV: Oriental/La Unión	-0,593	-0,003	0,365	**-0,077**
GT: Metropolitana/Guatemala	-0,483	-0,124	-0,378	**-0,328**
GT: Norte/Alta Verapaz	-0,991	-0,140	-0,290	**-0,474**
GT: Norte/Baja Verapaz	-0,359	0,120	-0,806	**-0,348**
GT: Nororiental/Chiquimula	-0,195	1,144	-0,868	**0,027**
GT: Nororiental/El Progreso	-0,979	-0,681	-0,884	**-0,848**
GT: Nororiental/Izabal	-0,242	-0,267	0,911	**0,134**
GT: Nororiental/Zacapa	-1,881	-1,449	-2,295	**-1,875**
GT: Suroriental/Jalapa	-1,093	-0,233	-0,274	**-0,533**
GT: Suroriental/Jutiapa	-0,201	-0,694	-0,862	**-0,586**
GT: Suroriental/Santa Rosa	-0,819	-0,783	-0,458	**-0,687**
GT: Central/Chimaltenango	1,311	0,200	-0,577	**0,312**
GT: Central/Escuintla	0,049	-0,795	-1,593	**-0,780**
GT: Central/Sacatepequez	-0,074	0,287	-0,950	**-0,245**
GT: Suroccidental/Quetzaltenango	-0,385	-0,141	-0,433	**-0,320**
GT: Suroccidental/Retalhuleu	-0,131	1,592	0,990	**0,817**
GT: Suroccidental/San Marcos	-0,344	0,142	-0,427	**-0,210**
GT: Suroccidental/Solola	-1,266	-0,140	-0,812	**-0,739**
GT: Suroccidental/Suchitepéquez	-0,380	0,066	0,226	**-0,030**
GT: Suroccidental/Totonicapan	1,346	1,138	-0,381	**0,701**
GT: Noroccidental/Quiché	-0,836	0,250	-0,860	**-0,482**
GT: Noroccidental/Huehuetenango	0,215	-0,030	-0,167	**0,006**
GT: Nororiental/Petén	-0,108	0,342	-0,581	**-0,116**
HO: Atlántida	0,081	0,459	0,327	**0,289**
HO: Choluteca	-0,108	0,146	0,279	**0,106**

Region	Corrup.	Trust	Effectiv.	**Index**
HO: Colón	-0,662	-1,416	0,390	**-0,563**
HO: Comayagua	-0,361	0,395	-0,456	**-0,141**
HO: Copán	-0,032	0,054	0,016	**0,013**
HO: Cortés	-0,261	-0,122	-0,572	**-0,318**
HO: El Paraíso	1,101	-0,715	-1,478	**-0,364**
HO: Francisco Morazán	0,132	-0,250	-0,655	**-0,258**
HO: Gracias a Dios	0,106	-0,328	-0,881	**-0,368**
HO: Intibucá	1,175	0,236	1,165	**0,859**
HO: La Paz	-0,743	-0,007	0,477	**-0,091**
HO: Lempira	-1,973	-1,454	-0,334	**-1,254**
HO: Ocotepeque	-0,737	-1,438	-1,504	**-1,226**
HO: Olancho	0,515	-0,469	-0,538	**-0,164**
HO: Santa Bárbara	-0,330	-0,597	-0,247	**-0,392**
HO: Valle	-0,651	0,983	-0,093	**0,079**
HO: Yoro	-0,455	-0,293	-0,859	**-0,536**
MX: Baja California	-0,716	1,809	-0,869	**0,075**
MX: Baja California Sur	-0,273	1,168	0,306	**0,400**
MX: Coahuila	-0,009	-0,372	-0,265	**-0,215**
MX: Chihuahua	0,604	0,320	0,714	**0,546**
MX: Durango	0,213	0,338	-0,288	**0,088**
MX: Nuevo León	-0,634	0,329	0,833	**0,176**
MX: San Luis Potosí	-0,130	-0,033	0,334	**0,057**
MX: Sinaloa	-0,519	-0,504	0,515	**-0,169**
MX: Sonora	-1,172	0,641	0,549	**0,006**
MX: Tamaulipas	0,258	0,406	-0,211	**0,151**
MX: Zacatecas	-0,973	-0,305	-1,089	**-0,789**
MX: Aguascalientes	0,769	-0,578	-0,142	**0,016**
MX: Colima	-0,695	0,431	1,709	**0,481**
MX: Guanajuato	-0,739	-0,136	-0,264	**-0,380**
MX: Jalisco	-0,402	-0,236	0,205	**-0,145**
MX: Michoacán	-0,099	0,114	-0,280	**-0,088**
MX: Nayarit	-1,360	1,514	0,383	**0,179**
MX: Querétaro	-1,487	0,805	0,700	**0,006**
MX: Ciudad de México	-0,062	0,405	-0,314	**0,010**
MX: Hidalgo	-0,585	1,434	0,191	**0,347**
MX: México	-0,190	0,418	0,573	**0,267**
MX: Morelos	-0,101	0,898	-1,106	**-0,103**
MX: Puebla	-0,159	0,606	0,418	**0,288**
MX: Tlaxcala	1,600	-1,531	0,450	**0,173**
MX: Campeche	-2,155	-0,078	1,574	**-0,220**
MX: Chiapas	-1,497	-0,118	0,152	**-0,488**
MX: Guerrero	0,196	0,389	-0,275	**0,103**
MX: Oaxaca	-0,727	0,389	-0,172	**-0,170**
MX: Quintana Roo	-0,690	-0,692	0,083	**-0,433**

Region	Corrup.	Trust	Effectiv.	**Index**
MX: Tabasco	0,417	-0,423	0,078	**0,024**
MX: Veracruz	-0,621	0,518	0,100	**-0,001**
MX: Yucatán	-0,382	0,345	2,009	**0,657**
NI: Managua	-1,006	-0,719	-0,538	**-0,754**
NI: Chinandega	-1,377	-1,271	-0,061	**-0,903**
NI: León	-0,548	-0,365	-0,919	**-0,611**
NI: Masaya	-0,606	-0,497	-0,283	**-0,462**
NI: Granada	-0,709	-0,116	-0,483	**-0,436**
NI: Carazo	-1,018	-1,344	0,132	**-0,743**
NI: Rivas	-1,042	0,002	-1,130	**-0,723**
NI: Chontales	-0,648	-0,666	-0,697	**-0,670**
NI: Boaco	-2,100	-1,200	-0,743	**-1,348**
NI: Matagalpa	-1,045	-0,966	-0,862	**-0,958**
NI: Jinotega	0,203	-0,278	-2,076	**-0,717**
NI: Estelí	-0,177	-0,707	0,085	**-0,266**
NI: Nueva Segovia	-0,916	-0,602	-0,507	**-0,675**
NI: Río San Juan	-0,387	0,450	-2,475	**-0,804**
NI: R.A.A.S	-0,140	-0,111	-0,185	**-0,145**
NI: R.A.A.N	1,365	1,443	-0,176	**0,877**
NI: Madriz	-0,833	-0,924	-0,506	**-0,755**
PA: Panamá	-0,169	0,244	0,269	**0,115**
PA: Colón	-0,493	0,163	0,718	**0,129**
PA: Bocas del Toro	1,025	1,356	1,343	**1,241**
PA: Coclé	-0,592	0,926	0,334	**0,223**
PA: Chiriquí	-0,044	1,422	0,808	**0,729**
PA: Herrera	-0,080	-0,642	-0,184	**-0,302**
PA: Los Santos	-1,144	0,981	0,885	**0,241**
PA: Veraguas	1,088	0,799	0,097	**0,661**
PA: Darién	-0,323	0,796	0,844	**0,439**
PA: Comarca Ngäbe Buglé	0,773	-0,317	-1,143	**-0,229**
PY: Asunción	-0,469	0,117	-0,470	**-0,274**
PY: San Pedro	-0,501	0,426	-0,629	**-0,235**
PY: Cordillera	1,623	-1,767	-0,241	**-0,128**
PY: Caaguazú	0,077	0,071	-0,842	**-0,232**
PY: Caazapá	-0,111	0,594	-0,235	**0,083**
PY: Itapúa	-0,143	0,641	-0,636	**-0,046**
PY: Paraguari	0,530	-0,230	-2,058	**-0,586**
PY: Alto Paraná	-0,946	-0,061	-0,728	**-0,578**
PY: Central	-0,630	0,165	0,486	**0,007**
PY: Amambay	-0,528	0,332	-1,517	**-0,571**
PE: Lima	-0,027	0,373	-0,253	**0,031**

Region	Corrup.	Trust	Effectiv.	**Index**
PE: Amazonas	-1,338	0,088	0,345	**-0,301**
PE: Áncash	0,827	1,477	0,981	**1,095**
PE: Apurímac	1,950	2,561	-1,134	**1,126**
PE: Arequipa	-0,040	0,612	-0,561	**0,004**
PE: Ayacucho	-0,175	0,824	0,874	**0,508**
PE: Cajamarca	0,306	0,418	0,861	**0,528**
PE: Cusco	-0,217	0,582	1,307	**0,557**
PE: Huancavelica	0,282	1,501	0,003	**0,596**
PE: Huánuco	0,672	1,767	1,430	**1,289**
PE: Ica	0,737	1,005	-0,053	**0,563**
PE: Junín	0,521	0,449	-0,282	**0,229**
PE: a libertad	-0,353	0,346	-0,074	**-0,027**
PE: Lambayeque	-0,605	0,103	-0,449	**-0,317**
PE: Loreto	-0,694	0,970	-0,236	**0,013**
PE: Piura	-0,617	0,925	0,694	**0,334**
PE: Puno	-0,060	0,341	-0,318	**-0,012**
PE: San martín	-0,118	-0,035	-0,350	**-0,168**
PE: Tacna	-0,767	-0,142	0,649	**-0,087**
PE: Pasco	0,492	1,239	0,384	**0,705**
PE: Moquegua	-0,061	0,575	0,227	**0,247**
PE: Ucayali	-0,716	0,341	-0,080	**-0,152**
UY: Montevideo	1,984	0,578	1,035	**1,199**
UY: Artigas	1,904	0,388	1,708	**1,333**
UY: Canelones	1,678	0,614	1,070	**1,121**
UY: Cerro Largo	2,278	1,500	2,032	**1,937**
UY: Colonia	0,208	0,406	0,946	**0,520**
UY: Durazno	1,421	1,452	0,842	**1,238**
UY: Flores	2,605	0,191	0,800	**1,199**
UY: Florida	1,636	1,358	0,285	**1,093**
UY: Lavalleja	1,087	-1,475	1,598	**0,403**
UY: Maldonado	1,595	0,921	0,939	**1,152**
UY: Paysandú	3,440	0,866	1,781	**2,029**
UY: Río Negro	0,607	0,521	2,592	**1,240**
UY: Rivera	2,414	-0,146	-0,145	**0,708**
UY: Rocha	1,743	1,015	1,224	**1,328**
UY: Salto	2,236	0,172	0,098	**0,835**
UY: San José	2,091	1,046	1,405	**1,514**
UY: Soriano	1,326	0,244	0,787	**0,786**
UY: Tacuarembó	2,346	0,677	0,944	**1,322**
UY: Treinta y Tres	1,603	0,588	0,351	**0,847**
Distrito Capital	-0,934	-1,862	-2,032	**-1,609**
VE: Amazonas	-3,458	-2,871	-1,957	**-2,762**

Region	Corrup.	Trust	Effectiv.	**Index**
VE: Anzoátegui	-1,020	-1,864	-1,043	**-1,309**
VE: Apure	-0,863	-1,927	-0,988	**-1,259**
VE: Aragua	-1,180	-1,948	-1,549	**-1,559**
VE: Barinas	-1,684	-2,294	-1,716	**-1,898**
VE: Bolívar	-0,969	-2,149	-0,967	**-1,361**
VE: Carabobo	-1,267	-2,221	-1,578	**-1,688**
VE: Cojedes	-2,157	-0,063	-2,204	**-1,475**
VE: Falcón	-0,851	-3,166	-3,694	**-2,570**
VE: Guárico	-0,785	-1,763	-1,607	**-1,385**
VE: Lara	-0,648	-1,793	-1,722	**-1,388**
VE: Mérida	-1,560	-2,267	-0,806	**-1,544**
VE: Miranda	-1,039	-1,887	-1,590	**-1,505**
VE: Monagas	-0,315	-0,259	-1,142	**-0,572**
VE: Nueva Esparta	-1,404	-2,268	-1,771	**-1,814**
VE: Portuguesa	-0,879	-1,625	-2,022	**-1,509**
VE: Sucre	-0,780	-1,379	-2,337	**-1,498**
VE: Táchira	-0,821	-2,448	-2,139	**-1,803**
VE: Trujillo	0,536	-1,886	-0,006	**-0,452**
VE: Vargas	-0,509	-2,583	-1,595	**-1,562**
VE: Yaracuy	-0,645	-1,604	-1,980	**-1,410**
VE: Zulia	-1,290	-1,847	-1,264	**-1,467**

Table O.A5: Number of companies information source

Country	Source
Argentina	OEDE
Bolivia	Fundempresa
Brasil	IBGE - Brazil
Colombia	DANE
Chile	BCN
Costa Rica	INEC - Costa Rica
Dominic Republic	ONE - Dominic Republic
Ecuador	INEC - Ecuador
El salvador	DIGESTYC
Guatemala	INE - DINESE
Honduras	INE - Honduras
Nicaragua	INIDE-Nicaragua
Panama	INEC - Panama
Paraguay	INE - Paraguay
Peru	INEI - Peru
Uruguay	INE - Uruguay

Table O.A6: GMM: Quality of institutions

	reg_quality		reg_corruption		reg_trust		reg_effec	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
etm_deposit	0.00877***		0.0122***		0.0186***		-0.00540**	
	(3.14)		(2.85)		(4.15)		(-2.29)	
etm_minex		0.0218		0.00342		0.0754***		-0.0232*
		(0.03)		(0.00)		(3.34)		(-1.94)
L.reg_quality	0.502***	0.505	0.405***	0.424	0.489***	0.458***	0.746***	0.755***
	(12.78)	(0.17)	(8.49)	(0.32)	(12.01)	(10.90)	(18.36)	(18.67)
school	-0.106***	-0.110	-0.167***	-0.164	-0.132***	-0.162***	-0.0120	-0.00318
	(-4.09)	(-0.03)	(-3.72)	(-0.16)	(-3.33)	(-3.59)	(-0.55)	(-0.14)
life_exp	0.0841***	0.0811	0.115***	0.129	0.0976***	0.0968***	0.0272	0.0256
	(4.18)	(0.05)	(4.00)	(0.15)	(3.00)	(2.81)	(1.58)	(1.43)
temp	-0.0224***	-0.0208	-0.0338***	-0.0283	-0.0145*	-0.0116	-0.0135***	-0.0139***
	(-4.40)	(-0.05)	(-4.13)	(-0.15)	(-1.85)	(-1.26)	(-2.92)	(-3.04)
lreg_gdpp_pop	0.108**	0.108	0.0382	0	0.0192	0.0314	0.126**	0.124**
	(2.03)	(0.02)	(0.42)	(.)	(0.24)	(0.36)	(2.47)	(2.37)
biz_index	-0.0366	0.0265	-0.100	-0.0709	-0.0345	0.118	-0.0973*	-0.105*
	(-0.58)	(0.01)	(-0.94)	(-0.02)	(-0.32)	(0.96)	(-1.70)	(-1.73)
N	922	922	924	924	930	930	995	995
sargan	403.1***	398.4***	374.1***	373.5***	408.2***	409.5***	722.2***	702.9***
hansen	181.0	198.7	160.8	249.5**	180.5	176.4	195.6	193.0

t statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table O.A7: PTR: Institutional Quality Index

	etm_deposit		etm_minex	
	(1)	(2)	(3)	(4)
ETM	-0.236	-0.297	3.166*	3.672*
$(ins_{it} \leq \hat{\gamma})$	(-0.37)	(-0.67)	(1.94)	(1.77)
ETM	-0.0658	0.0686	2.971*	4.085**
$(ins_{it} > \hat{\gamma})$	(-0.32)	(0.31)	(1.84)	(2.03)
reg_quality	-0.151	-0.812	0.0274	-0.418
	(-0.26)	(-1.05)	(0.05)	(-0.53)
gdp_{t-1}	0.0703***	0.0366	0.0731***	0.0260
	(3.21)	(1.00)	(3.34)	(0.71)
temp	-0.736***	-0.428***	-0.675***	-0.465***
	(-9.67)	(-3.10)	(-7.47)	(-3.32)
school	-7.904***	-3.416***	-7.755***	-2.511*
	(-12.01)	(-2.77)	(-9.22)	(-1.83)
life_exp	1.466***	0.968	1.235***	0.439
	(4.76)	(1.12)	(3.42)	(0.51)
precious_deposit	1.141	-0.433		
	(1.38)	(-0.26)		
biz_index		-6.894*		-12.17***
		(-1.91)		(-3.24)
Precious_t			-3.278*	-6.250***
			(-1.72)	(-2.72)
N	2081	971	2081	971
$\hat{\gamma}$	0.557	0.555	0.941	0.555
Upper bound	1.087	1.463	1.087	1.463
Lower bound	-0.849	-0.571	-0.849	-0.571

t statistics in parentheses

Dependent variable: GDP growth. Years: 2010-2018. Threshold (γ): Institutional quality index. Estimation method: panel threshold regression. Average temperature and % of tropical are used as exogenous variables. We use as instruments the lags of the dependent variables.

Table O.A8: PTR: Control of Corruption

	etm_deposit		etm_minex	
	(1)	(2)	(3)	(4)
ETM	-2.113***	-2.209***	2.404	3.108
$(ins_{it} \leq \hat{\gamma})$	(-3.46)	(-3.19)	(1.46)	(1.46)
ETM	-0.160	-0.0346	2.617	3.936*
$(ins_{it} > \hat{\gamma})$	(-0.80)	(-0.16)	(1.61)	(1.87)
reg_corruption	-0.617*	-1.790***	-0.430	-1.233***
	(-1.89)	(-3.76)	(-1.31)	(-2.59)
gdp_{t-1}	0.0683***	0.0435	0.0715***	0.0372
	(3.13)	(1.21)	(3.28)	(1.03)
temp	-0.780***	-0.558***	-0.694***	-0.508***
	(-10.98)	(-4.13)	(-8.04)	(-3.69)
school	-7.827***	-3.712***	-7.767***	-2.597*
	(-12.19)	(-3.04)	(-9.35)	(-1.91)
life_exp	1.394***	0.914	1.220***	0.435
	(4.78)	(1.10)	(3.51)	(0.52)
precious_deposit	1.508*	-0.155		
	(1.83)	(-0.09)		
biz_index		-7.911**		-11.78***
		(-2.31)		(-3.29)
Precious_t			-2.339	-6.064***
			(-1.23)	(-2.62)
N	2092	974	2092	974
$\hat{\gamma}$	-0.302	-0.380	-0.268	-0.518
Upper bound	0.0572	0.0693	1.422	1.717
Lower bound	-0.565	-0.629	-1.002	-0.797

t statistics in parentheses

Dependent variable: GDP growth. Years: 2010-2018. Threshold (γ): Control of corruption component. Estimation method: panel threshold regression. Average temperature and % of tropical are used as exogenous variables. We use as instruments the lags of the dependent variables.

Table O.A9: PTR: Trust in institutions

	etm_deposit		etm_minex	
	(1)	(2)	(3)	(4)
ETM	23.83***	30.10***	4.615***	4.538**
$(ins_{it} \leq \hat{\gamma})$	(2.91)	(3.35)	(2.66)	(2.14)
ETM	-0.110	-0.105	3.195**	2.820
$(ins_{it} > \hat{\gamma})$	(-0.57)	(-0.54)	(1.97)	(1.38)
reg_trust	0.136	0.867*	0.144	0.617
	(0.40)	(1.85)	(0.42)	(1.30)
gdp_{t-1}	0.0653***	-0.00827	0.0850***	0.0299
	(2.91)	(-0.21)	(3.88)	(0.82)
temp	-0.718***	-0.355***	-0.601***	-0.339**
	(-10.04)	(-2.75)	(-6.81)	(-2.42)
school	-7.843***	-2.365*	-7.808***	-1.770
	(-11.91)	(-1.94)	(-9.36)	(-1.27)
life_exp	1.457***	0.0119	1.428***	0.0842
	(4.89)	(0.01)	(4.09)	(0.10)
precious_deposit	1.297	-0.316		
	(1.58)	(-0.20)		
biz_index		-4.105		-8.316**
		(-1.21)		(-2.25)
Precious_t			-2.864	-4.818**
			(-1.51)	(-2.13)
N	2092	974	2092	974
$\hat{\gamma}$	-1.325	-0.986	-0.841	-0.900
Upper bound	1.167	1.412	1.167	1.412
Lower bound	-1.325	-1.103	-1.325	-1.103

t statistics in parentheses

Dependent variable: GDP growth. Years: 2010-2018. Threshold (γ): Trust in institutions component. Estimation method: panel threshold regression. Average temperature and % of tropical are used as exogenous variables. We use as instruments the lags of the dependent variables.

Table O.A10: PTR: Government Effectiveness

	etm_deposit		etm_minex	
	(1)	(2)	(3)	(4)
ETM	19.74**	40.04***	2.974	3.555
$(ins_{it} \leq \hat{\gamma})$	(2.37)	(4.84)	(1.61)	(1.45)
ETM	-0.189	-0.141	3.009*	3.370
$(ins_{it} > \hat{\gamma})$	(-0.87)	(-0.61)	(1.65)	(1.38)
reg_effec	-0.181	-1.014	0.0243	-0.277
	(-0.41)	(-1.38)	(0.05)	(-0.33)
gdp_{t-1}	0.0548**	-0.0534	0.0643***	-0.0164
	(2.34)	(-1.34)	(2.70)	(-0.40)
temp	-0.834***	-0.416***	-0.665***	-0.273*
	(-10.83)	(-2.80)	(-7.16)	(-1.74)
school	-9.425***	-2.718**	-10.28***	-1.966
	(-13.96)	(-2.02)	(-11.85)	(-1.22)
life_exp	1.992***	0.466	2.231***	0.292
	(6.43)	(0.51)	(6.07)	(0.30)
precious_deposit	1.852**	0.612		
	(2.04)	(0.32)		
biz_index		-3.284		-3.639
		(-0.94)		(-0.96)
Precious_t			-0.723	-4.411
			(-0.33)	(-1.64)
N	2137	1001	2137	1001
γ	-0.666	-0.642	0.840	0.445
Upper bound	-0.658	-0.604	1.248	1.703
Lower bound	-0.820	-0.649	-1.082	-0.649

t statistics in parentheses

Dependent variable: GDP growth. Years: 2010-2018. Threshold (γ): Government Effectiveness component. Estimation method: panel threshold regression. Average temperature and % of tropical are used as exogenous variables. We use as instruments the lags of the dependent variables.

End of appendix