UNIVERSITY OF SALERNO

RESEARCH DOCTORATE IN ECONOMICS AND MARKET AND BUSINESS POLICIES

(ECONOMIA E POLITICHE DEI MERCATI E DELLE IMPRESE)

Curriculum: Statistical Methods

- XXX Cycle -

Equal Opportunities to Prosper:

A Statistical Analysis of Macro- and Microeconomic Factors

Candidate: Gianluca Mele

Matricola n. 8801000002

Rapporteur : Ch.ma Prof.ssa Alessandra Amendola

December 2017

INDEX

Introduction

Origin, scope, and features of this doctoral research

Undertaking a doctoral research in economics and statistics had been part of my interests for a long time, immediately after the conclusion of my masters' degree. Due to professional and personal factors, this project could only materialize a few years later, in the academic year 2014/15, when I joined the University of Salerno as a PhD student.

The main motive to start a doctoral research path for me was to strengthen my technical background and skills in statistics and quantitative economics. I have worked as a development economics professional since 2007, initially at the United Nations and more recently at the World Bank Group. In my work, I have dealt with economy policy issues on a daily basis; this often takes the form of economic diagnostics and policy advice resulting from an analysis of in-country specific issues as well as sourcing from international benchmarks and cross-country evidence. Against this background, developing a strong understanding of econometric and statistical approaches can indeed bring significant value added to my expertise, and provide me with more apt tools to operate as a well-rounded development economist.

This research path has also allowed me to be regularly in touch with the academic world, including other PhD candidates, research assistants, and faculties. This exchange over time has been extremely rich and greatly benefited the progression of my work. In addition, the possibility of publishing the results of my research activity on scientific statistical/economic peer reviewed journals, has represented a great opportunity, as it allowed me to contribute more meaningfully to foster opportunities for knowledge-sharing through academic platforms. In this respect, it seems worth noting that the first paper of this monograph was

accepted and published by the "International Journal of Business and Management"[1], and that the second paper was accepted to the peer reviewing phase by the "Oxford Economic Papers" and currently awaits final feedback. The three chapters composing this monograph have also been individually presented at various national scientific conferences on statistics and economics in Italy, as well as they have all been published as work in progress under the World Bank Research Working Paper Series.

One of the main elements that has characterized this doctoral research project has been an in-depth country knowledge and hands-on development economics expertise. This means that in often cases, due my professional duties, I have had an opportunity to access to unique (and for the larger part, not public) datasets. This has added interest to the research and anchored it to concrete policy questions. This permitted to orient the research by actual facts rather than by goals with a high degree of abstraction. In conclusion, on of the *leitmotivs* of this monograph is that various statistical methodologies were selected and adapted to factual cases rather than the other way around, which adds policy relevance to the findings and makes the research especially meaningful.

Synopsys of this work

Societies strive to achieve socio-economic systems that provide equal and broad-based opportunities to their people. The concept of "equal opportunities" is a very complex one, and encompasses many definitions and several different areas of life. 'Equal opportunities' does not only mean to be able to access basic services and ideally with the same quality

[1] See Volume 12 N. 9 (2017)

standards; it may also mean to find a decent job and lead fulfilling professional lives, or also to thrive personally, without facing discriminations or – essentially – moving from the expectation that – if all people are indeed equal – conditions should be such that (while people cannot systematically have the same starting points in life) the resources available and the sociopolitical-economic principles that govern life may help level off the playing field, and provide a fair chance for success to all, without distinctions. Analyzing equality of opportunities has typically translated into the utilization of complex statistics, ranging from concentration indexes (e.g. the Gini coefficient) to sophisticated modeling of growth patterns, poverty outcomes, human behavior and social justice principles.

A quick overview on the main thinkers on inequality cannot fail to omit John Rawls. In his "Theory of Justice"[2], Rawls asserts that nobody is truly "created equal", at least not from morally. Individuals are randomly born and unconsciously placed in various households, which reflect a number of differences related to gender, race, income, etc. Also, the socio-political institutions that may allow individuals to move along the spectrum of opportunities (and thus 'equality') are often reachable through financial means (e.g. schooling), which leads Rawls to highlight the important of social cooperation to mitigate such structural moral injustice. At the same time, Nobel Prize winner Amartya Sen, in his famous "Inequality Reexamined"[3], put the accent on what type of equality a society seeks; to do this, he delved into the diversity of mankind and their features. Sen asserts that, when we consider inequality, we should focus on the diversity among people's capacities (so-called "capability approach") and characteristics, rather than their welfare or financial means. In doing this,

[2] Cfr. : "A theory of justice", by John Rawls - Belknap Press of Harvard University Press - 2003

[3] "Inequality reexamined", by Amartya Sen - Oxford Univ. Press - 2004

Sen was among the first to look at inequality from the perspective of gender. An interesting angle is debated by John Roemer[4], who distinguished a notion of time in the debate on equality. Roemer asserts that the concept of "equality of opportunity" is based on a 'before', i.e. ahead of the competition among individuals, and an 'after', i.e. when the competition has started. In the former segment, Roemer advocates for an equalization of opportunities, supported by policy interventions if needed, while in the latter segment, individuals should compete based on a nondiscrimination principle, and only on the qualities that are relevant to the competition in question (which means, excluding any other attributes such as sex, race, income, etc.).

The three papers presented in this monograph intend to discuss this question from selected and very distinct perspectives: 1) how (and if) financial access benefits peoples' wellbeing; to do this we applied an econometric framework to a case-study based on Mauritania; 2) how natural resource endowment is correlated with economic growth and inequality indicators; in this case we adopted a global perspective and utilized a dataset covering over 40 countries; and 3) if tax incentives can be an effective tool in achieving economic growth in an way that does not distort competition among enterprises; also in this case we utilized a case-study approach, focusing on the experience of the Dominican Republic, to try and determine policy lessons.

More specifically, the first paper presented in this monograph evaluates the impact of access to credit from banks and other financial institutions on household welfare in Mauritania. Household level data were used to evaluate the relationship between credit access, a range of household characteristics, and welfare indicators. In order to address the risks of potential endogeneity, an index of household isolation was used to

[4] "Equality of opportunity", by John E.Roemer - Harvard University Press - 1998

instrument access to credit. As we conducted the analysis, we also provided evidence on the validity of the exclusion restriction, by showing that household isolation is unrelated with households and area characteristics six years prior to the measurements on which this analysis is based. In a nutshell, results show that households with older and more educated heads are more likely to access financial services, as are households living in urban areas. In addition, the analysis shows that greater financial access is associated with a reduced dependence on household production and increased investment in human capital. The policy conclusions from our analysis appear to support public sector's strategies for expanding financial infrastructures in underserved rural areas, as this is expected to translate into improved wellbeing for the local population.

In the second paper, the analysis examines the relationship between nonrenewable resource dependence, economic growth and income inequality. Using a dataset that includes information on 43 countries, going from 1980 to 2012, the paper estimates several model specifications in order to check the robustness of the results under many different assumptions. The analysis also accounts for income-group-related heterogeneity among countries, trying to understand whether structural characteristics of a nation (e.g. its institutional capacity, its development stage, etc., proxied in this case by the income level) can contribute to explain how growth, inequality, and resource endowment interact with each other. Innovating on a large strand of literature based on cross-sectional analysis, this second paper tackles the potential time invariant unobserved heterogeneity, thus exploiting the panel of the data. The findings show that the empirical relationships are associated with the level of economic development. Among higher-income countries, greater dependence is associated with lower income inequality, while no statistically significant correlation exists with GDP per capita. Among the

lower-income group, greater dependence is associated with both higher levels of income inequality and lower per capita GDP.

Finally, the third paper evaluates the impact of fiscal incentives on firms' performance in the Dominican Republic. In recent years, the Dominican government has approved several new corporate tax benefits. While the literature on value-added tax incentives is extensive, the impact of corporate tax incentives is less well studied and is the subject of an ongoing debate. Using firm-level panel data from 2006 to 2015, this analysis uses a propensity score matching to investigate the relationship between tax incentives and firms' performance, considering the measure of Liquidity, GFSAL, ROS, ROA, STS and Turnover as proxies of firms' welfare. The results manage to single out the effect of tax expenditure and show – more specifically – that the Corporate Income Tax exemptions positively impacts the firms' welfare. This evidence is corroborated both by a Nearest Neighbor Matching and a Radius Matching methodology, as well as it is supported by the balancing test.

Quick overview of statistical approaches used in this monograph

This monograph utilizes a wide range of statistical approaches to undertake economic analysis. This section will present the main ones, providing an overview on their main characteristics as well as advantages and/or limitations.

First of all, the analysis makes ample use of descriptive statistics. Descriptive statistics are very diverse techniques that are used to describe the basic characteristics of a dataset. Descriptive statistics provide a simple synthesis of the sample and of the measurements collected. Together with simple graphic analysis, they represent the initial starting point for any quantitative data analysis. Descriptive statistics should not be confused with inferential statistics. While the former are mostly

presenting a description of what is being observed or what the main data traits are, the latter will try to reach conclusions that extend beyond the data collected and which can be to some extent valid also beyond the specific study or experiment that concretely motivated them. In other words, descriptive statistics represent and synthesize a set or sample of data relating to a given population (‘population’ should be intended as the totality of cases, i.e. all the units on which a variable of interest can be detected).

This study also widely utilizes regression analysis as a technique used to exploit a set of data that consists of a dependent variable and one or more independent variables. The purpose of regression analysis is to estimate a possible functional relationship between the dependent variable and the independent variables. In short, the dependent variable (in the regression equation) is a function of independent variable(s) plus an error term. This latter is a random variable and represents an unmanageable and unpredictable variation in the dependent variable. A number of control variables or parameters are typically also estimated to best describe the dataset. One of the most commonly used methods in the regression analysis is the "least squares" (OLS) approach, although several other methods are also used. The essential advantage of regression analysis is that it can be used to make predictions, as well as to test hypotheses, or to model dependency relationships. The analysis in this monograph also utilizes two among the main alternatives to the pooled OSL model, the Fixed Effects Model, and the Random Effects Model.

Looking at the fixed effects model, the main concept is fundamentally that it is possible to break the error term u (i.e. all non-observable variables), in two components, ε and α :

$$u(it) = \alpha(i) + \varepsilon(it)$$

Where α is the part of the error dependent on the observed unit(s), including the effect of all non-observable variables, and ε is the part of the peculiar error of the observation. The fixed effects model essentially focuses on the elimination of the α intercept[5], constant over time, as it contains non-observable values and would therefore be considered an integral part of the model error. These values could be correlated with the explanatory variables x(it), returning a distorted estimate. Excluding the term αi is achieved based on a data demeaning process[6]. Also the random effects model, like the fixed effects model, breaks down the error term *u(it)* into two components *ε(it)* and *α(i)*. However, an intercept is explicitly introduced in the model:

$$y(it) = \beta(0) + \beta(1)x(it,1) + \cdots + \beta(k)x(it,k) + \alpha(i) + \varepsilon(it)$$

So that it is possible to assume that that E(αi) = 0. In the fixed effects model we try to exclude the term *α(i*), as that is supposed to be correlated with one or more explanatory variables. Assuming that *α(i*) is not related to any explanatory variable in all t periods, any modification that excludes the term *α(i*) would lead to an inefficient estimator. When we use a random effects model, unlike the fixed effects model, *α(i*) is not treated as a fixed variable(s), but as a random one (which explains why the designation of "random effects"), which are not correlated to the regressors. By doing this, these effects can be treated in the model as if they were part of the error term. The next step is thus processing data and obtaining a dataset with non-autocorrelated errors. Since the processed data satisfy the assumptions of the Gauss-Markov's theorem, and the final estimates/results can be regarded as efficient.

The "Seemingly Unrelated Regression Equation" is another estimator that this monograph utilizes. It represents a linear regression model consisting

[5] Given a function $y(it) = x(it)\beta + \alpha(i) + \varepsilon(it)$

[6] which consists of subtracting the group mean from each of the variables and in estimating the model without intercepting through the OLS pooled estimator.

of several equations, each of which has their own dependent variables. Each of these equations may be estimated individually, and may also have different explanatory variables. This is the reason why the model is called "seemingly unrelated". However, the error terms are assumed to be correlated across the various equations. In other words, the M equations may result to be "unrelated" in the sense that no simultaneity exists among the variables in the system as well as that each of the equations have their very own explanatory variables. The various equations would still be probabilistically correlated, by means of the errors that are correlated throughout the model's equations.

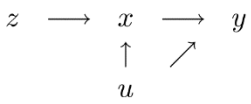
The SURE can be regarded as a model made up of "M" multiple regression equations of the following form:

$$y_{ti} = \sum_{j=1}^{k_i} x_{tij}\beta_{ij} + \varepsilon_{ti},\ t = 1,2,...,T;\ i = 1,2,...,M;\ j = 1,2,...,k_i$$

where y(ti) is the t^{th} observation on the i^{th} dependent variable (to be explained by the i^{th} regression equation). The term x(tij) represents the t^{th} observation in j^{th} explanatory variable, while β(ij) is the coefficient associated with x(tij) for each observation, and finally ε(ti) is the t^{th} value of the disturbances component associated with the equation under consideration (i.e. i^{th}). Summarizing, one could think of the SURE model as a very specific case of simultaneous M equations, with M jointly dependent variable and k distinct exogenous variables, and in which no endogenous variables appear as explanatory in any of the structural equations.

The first paper presented in this monograph largely resorts to the use of Instrumental Variable (IV), which is one of the most important and applied techniques used in econometrics. The main advantage – and reason why – the researcher utilizes IVs is endogeneity, which means that the researcher realizes the possibility that endogenous variables that are

influenced by other variables within the model, may be present. In other words, the risk would be that then, the regression estimates may measure just the magnitude of association, instead of the magnitude and the sign of the causation (which is what we need for policy analysis). If we consider a dependent variable y and a single regressor x, the instrumental variable (or more simply the "instrument") can be defined, as "z", which has the property that any changes in z will be reflected in changes in x, but will not lead to any changes in y. Consequently, z will be uncorrelated with the error terms u. The following diagram can help summarizing this definition:



In more formal terms, given a scalar regression model with the following form:

$$y = \beta x + u$$

a variable z is called an instrument or instrumental variable for the regressor x , if it respects two conditions: a) it must be uncorrelated with the error term u; and b) it is correlated with the regressor x. More specifically, the first condition guarantees that the selected instrument z is also a regressor in the model for y, because if y depended on both x and z and y is regressed on x alone then z would be absorbed into the error term, and consequently z would be related with the error term. The second condition simply states that there must be some level of correspondence between the instrument and the variable being instrumented. One main advantage of the IV estimation is that (like the "Propensity Score Matching" that will be described right after), IVs can fine-tune the model for both observed and unobserved confounding effects, which means that they come on help when there are conditions that may influence both the dependent variable and independent variable, thus causing a spurious

association. Other statistical approaches exist for adjusting for confounding effects, such as the stratification or the multiple regression methods, however these cannot adjust for unobserved confounders. This is what makes IVs particularly helpful in actual/factual applications, when the researcher is investigating matters related to observational data, which are likely indeed to be influenced not only by observed confounders but – in particular – by nonobservable ones. To conclude, one should note that IVs are better suited as an estimator technique when the sample size is sufficiently large. In addition, if the instrument is weak and/or if the relevance of confounders is large (or both) it is likely that the resulting standard errors will also be significant, which would translate into imprecise and biased results. Therefore, IVs are preferably to be used when only moderate to little confounding effects are assumed to exist.

As previously mentioned, also the Propensity Score Matching is mostly used to analyze the causal effect of a treatment using observational data. In other words, the dataset is not generated by an experiment (so-called randomized) but was collected through surveys, experiments, and/or administrative records; this last case is the one of the third paper in this monograph. Matching procedures are used in those situations when the researcher wishes to estimate the impact of a given treatment on a certain output. A large literature exists on the conceptual problems related to the assessment of the impact of a treatment through microeconometric instruments (essentially individual-level surveys), and it points out to fundamental mismeasurement potential issues. For example, one of the most common limitations in this sense is the "self-selection". A typical example is that of an individual enrolling in vocational training. It is likely that this individual carries more motivated than a number of individuals who do not enter the program. This is to say that, while – in an ideal world – assessing a casual treatment effect should be operated by calculating the average difference between the outcomes by the participants after

treatment and the potential that they would have achieved assuming (theoretically) that they had not received the treatment, in the actual world, it is possible to obtain information about the outcome of the treated individuals and the about the outcomes from a second group of individuals who did not receive the treatment. The Propensity Score Matching comes in help to solve these methodological issues: if a matching process allowed each individual (observed in the treatment group) to be associated with an individual in the untreated group that has the most (possible) resembling pre-treatment features, then the limitations described above would be – at least to a certain extent – excluded or reduced. In order to do this, it is important that two conditions are respected. The first condition is that the vector of variables on which the matching (x) is going to be conditioned, should be independent from the treatment. The second condition is that also the output distribution (conditioned by the set x) is independent from the treatment. More specifically, this second condition is known in the literature as "CIA" (that is, Conditional Independence Assumption) and is indeed of crucial importance, since only if the CIA is respected the selection of individuals can be expressed as a function of pretreatment features exclusively. The typical situation faced by micro-economists is that in which three variables of interest X, Y, Z are used, but the database in use does not contain (at all, or just partly) any joint observations of these three variables. Let us suppose that two distinct surveys exist, one containing the variables X and Y, and the other one containing X and Z. In order to integrate the two datasets, the researcher can assume that the information contained in X is adequate to determine both Y and Z; in other words, we move from the assumption that Y and Z are independent vis-à-vis X; i.e.:

$$P(Y, Z \mid X) = P(Y \mid X)\, P(Z \mid X),$$

which is a hypothesis entirely equivalent to the CIA. The next step is to define a criterion (or a set of criteria) to match the variable Z (that is

associated with an individual in the second group, which is most similarly conditioned by a set of common variables X) to each individual in the first group. This process is clearly more efficient than undertaking a new survey (whether at all possible) that would contain all the variables in an integrated database. Ultimately, the propensity score of a unit (may this be treated or untreated) is essentially the probability that a unit is assigned to the treatment given its characteristics prior to treatment. More formally this can be expressed as follows:

$$p(x) \stackrel{\text{def}}{=} \Pr(T = 1|X = x)$$

supposing that we have a binary treatment T, an outcome Y, and background variables X. While most of the literature on 'score matching' has essentially been developed as a response to an impact assessment of economic treatments, more recently the interest on such statistical approaches has also grown in other sectors, as this type of procedures allows to integrate information from different sources in a relatively simple fashion.

Chapter 1:

"An Assessment of the Access to Credit - Welfare Nexus: Evidence from Mauritania" [7]

Keywords Access to Credit; Household Isolation Level; Instrumental Variable; Residuals

1. Introduction

The international literature on financial access and development has not yet identified a direct, unequivocal connection between household-level credit and improvements in poverty and inequality indicators. For example, Beck, Demirgüç-Kunt, and Levine (2007) found that financial access is correlated with lower rates of poverty and income inequality, while Honohan and King (2012) showed that the use of formal banking services is associated with an increase in individual monthly income. The World Bank's Global Financial

[7] *This analysis was conducted jointly with Alessandra Amendola, Marinella Boccia, all affiliated to the University of Salerno.*

Development Report of 2014 finds that financial inclusion plays a central role for development and poverty reduction. Considerable evidence shows that the poor benefit significantly from basic payments, savings, and insurance services; however it also highlights that microcredit experiments draw a mixed picture about the development benefits of microfinance projects targeting specific population groups.

Many studies have focused on the role of microfinance in poverty reduction, and again the positive evidence on welfare is encouraging. (Note 1)Moreover, given the locally specific nature of both poverty dynamics and microfinance institutions, evidence is difficult to compare across cases, and there is no consensus regarding the effect of microfinance on growth and inequality. Illustrating the complexity of isolating the direct antipoverty effects of microfinance, Morduch (1998) found that "the most important potential impacts [of microfinance] are thus associated with the reduction of vulnerability, not of poverty per se, [because] the consumption-smoothing [effect] appears to be driven largely by income-smoothing, not by borrowing and lending".

This paper contributes to the literature on the impact of financial access, as measured by credit from banks and other financial institutions (Note 2), on household welfare in Mauritania. The potential endogeneity of access to credit is addressed using an instrumental variable approach. The analysis draws on data from the Ongoing Survey of Household Living Conditions (*Enquête Permanente sur les Conditions de Vie des Ménages*, EPCV) implemented by the National Statistics Office (*Office National de la Statistique*, ONS). The 2014 EPCV covered 9,557 households across 13 regions (*walleyes*), 53 provinces (*moughatas*) and 647 districts.

The Mauritanian credit market is shallow, fragmented and overwhelmingly informal. Few formal credit providers operate in Mauritania, and most bank branches, ATMs and other financial infrastructure is confined to the capital, Nouakchott. There are also important cultural barriers to credit access—including a strong gender dimension—as well as pervasive information asymmetry between potential borrowers and lenders, and a generally poor legal and governance framework. Mauritania's informal financial sector is extensive, but produces little reliable data. Informal finance is typically offered on simple terms and frequently involves family connections, tribal affiliations or other networks of social trust. Due to data limitations this analysis concentrates exclusively on the formal credit sector.

Among the limitations of this paper is the lack of panel data. Comparing the evolution of agents over time would add valuable information; however, current data do not allow the exploitation of longitudinal dimension. For future research to address these shortfalls, it will be critical to enhance the quality and the availability of official data. In this respect, a strong political commitment and consequent financial engagement to prioritizing statistics are key prerequisites for the revitalization of the analytical efforts that can support decision-makers improving the nexus between financial access and welfare.

2. The International Literature on Financial Access and Poverty

Most research on the relationship between financial access and poverty relies on standard welfare indicators such as household consumption, expenditure and income. Some studies show that the use of formal banking services increases individual monthly income (Honohan and King 2012), while others find that financial access is associated with lower rates of poverty and

inequality, inferring that the use of financial services has a disproportionately positive impact on the poor (Beck, Demirgüç-Kunt and Levine 2007). There is also evidence that financial access is linked to improvements in the severity of poverty (Honohan 2004). Research conducted in Pakistan and India reveals that the expansion of rural financial services is associated with improvements in household welfare (Khandker and Faruqee 2003) and that the development of bank branches increases non-agricultural economic output and reduces rural poverty (Burgess and Pande 2003).

Microfinance has been hailed as a vital tool for the economic empowerment of poor households. Research has shown that access to microfinance correlates with rising household income and consumption levels, less severe income inequality and enhanced welfare (Mahjabeen 2008). Studies have found a positive relationship between household characteristics, borrowing patterns and expenditure levels (Giang et al. 2015). Substantial research has focused on the issue of endogeneity in access to credit, and studies have shown that access to credit significantly influences economic incentives at the household level, improving consumption (Pitt and Khandker 1998) and altering positively consumption and investment decisions and impacting rates of wage growth and capital formation (Kaboski and Townsend 2012).

However, not all studies have found a positive correlation between financial access and improved poverty indicators. Some analyses have failed to show a relationship between microfinance and household welfare, and find that access to credit has a limited impact on per capita incomes, food security and on the nutritional status of credit program beneficiaries (Diagne and Zeller 2001). Others have revealed a regressive distribution of benefits (Mosley and Hulme 1998). Moreover, methodological issues remain a serious concern. According to Desai, Johnson and Tarozzi (2014), “Many proponents claim

that microfinance has had enormously positive effects among borrowers. However, the rigorous evaluation of such claims of success has been complicated by the endogeneity of program placement and client selection, both common obstacles in program evaluations. In this context randomized control trials provide an ideal research design to evaluate the impact." In an effort to increase the analytical rigor of financial access studies, researchers turned to randomized controlled trials. This methodology has been used to estimate the impact of access to microcredit by comparing outcomes among a random sample of individual borrowers to those of non-borrowers with similar socioeconomic characteristics. Some of these studies have found that access to finance produced measurable benefits in the form of increased employment and food consumption (Karlan and Zinman 2010), other have displayed a significant impact on investment by small business, on profits by pre-existing businesses, as well on expenditure in durable goods, but not on consumption (Banerjee, Duflo, Glennerster and Kinnan 2015). Overall, these studies provide strong empirical evidence for a positive correlation between access to finance and household welfare.

3. Methodology

Causal conclusions of this work rely on the ability to instrument for access to credit. (Note 3) More in general: "Microfinance institutions (MFIs) typically choose to locate in areas predicted to be profitable, and/or where large impacts are expected. In addition, individuals who seek out loans in areas served by MFIs and that are willing and able to form joint liability borrowing groups (a model often preferred by MFIs) are likely different from others who do not along a number of observable and unobservable factors. Until recently, the

results of most evaluations could not be interpreted as conclusively causal because of the lack of an appropriate control group" (Desai, Johnson and Tarozzi 2014). In the absence of an experimental design, this issue is addressed by using the household isolation level (HIL) to instrument for access to credit. HIL is defined by using a number of indicators – self-reported by households – on the distance from various institutions and service providers. We assume that credit institutions have approximately the same average distance from households, and on these bases we move to estimate the relationships between access to credit and (i) consumption of household production, (ii) household total spending on non-durable goods and services, (iii) food spending, (iv) education spending and (v) poverty incidence.

The exclusion restriction states that the HIL affects household welfare only through its effects on access to credit. The validity of such restriction is ensured by controlling for all unobservable variables through area-level fixed effects. Unfortunately, data limitations in the panel structure of the dataset prevented us from using household-level fixed effects or longitudinal information to address the endogeneity problem. Nevertheless, this analysis provides evidence in favour of the exclusion restriction, showing that the exogenous variability was unrelated with households and with local patterns six years prior to the measurements on which this analysis is based.

4. Country context: Mauritania

This section provides a broad overview of the country's characteristics and describes the patterns of the banking sector and access to finance.

4.1 Macroeconomic overview

Mauritania is a Sahelian country on the West Coast of Africa with a land area of approximately 1 million square kilometers, most of which is covered by the Sahara desert, and a population of roughly 3.6 million. (Note 4) The country has urbanized rapidly since the 1960s, and its population is now largely concentrated in Nouakchott and other major cities such as Nouadhibou and Rosso.

Mauritania has experienced robust growth in recent years driven by a thriving natural resource sector and high international commodity prices. However, recent global price shocks have underscored the country's high degree of external exposure, which is magnified by a lack of diversification. Mauritania also faces exogenous vulnerabilities related to its ecology and geography, which make it especially sensitive to climate change, and it has a history of political instability, which is exacerbated by an inherently volatile system of tribal loyalties, an informal racial hierarchy, the rise of Islamic fundamentalism in the Maghreb region and persistent tensions with Morocco over Western Sahara.

Poverty is most pervasive and extreme in rural Mauritania, with some of the highest rates registered in the southern regions bordering Senegal. While overall poverty is declining, a combination of continued rural-urban migration and the volatility of the resource-based urban economy may be causing a gradual increase in urban poverty. Nevertheless, most of the country's poor are concentrated in rural areas. (Note 5) About 30 percent of those aged 15-34 are not enrolled in school and do not participate in the labor

force. The capital-intensive mining sector is unable to absorb a rapidly growing number of low-skilled workers, and about 85 percent the labor force is employed in the informal economy, particularly semi-subsistence agriculture. (Note 6)

An adverse business and investment climate undermine Mauritania's economic competitiveness, slowing the growth of its small formal sector and inhibiting diversification. In the mid-2000s Mauritania's manufacturing and retail trade sectors included fewer than 250 formal firms with more than 5 employees. (Note 7) Burdensome procedures for paying taxes, resolving insolvency, starting a business, trading across borders and obtaining credit all present serious obstacles to formalization and expansion, particularly for small and medium enterprises (SMEs).

4.2 Access to the Finance and Banking Sector

The World Bank's *Doing Business* report cites access to finance as the top constraint on the Mauritanian private sector. (Note 8) The banking industry is dominated by a few very large firms, which concentrate almost exclusively on serving specific commercial and industrial groups. Prospective borrowers who do not belong to these groups face considerable difficulty in accessing financial services. (Note 9) Major firms also tend to enjoy strong political connections, which they can use to protect themselves from competition. As a result of regulatory barriers and governance issues Mauritania ranked 168th out of 189 countries in the 2016 *Doing Business* report.

The 2016 *Doing Business* report ranked Mauritania 162nd out of 189 countries in terms of the ease of getting credit, and its scores on several other financial indicators compare poorly with the average for Sub-Saharan Africa and most comparator countries. Information asymmetry is a major obstacle to financial access, especially for SMEs, as few prospective borrowers are able to present

a verifiable credit history. While credit to the economy has grown rapidly, increasing by 300 percent between 2005 and 2014, financial deepening in Mauritania has been far slower than in peer countries. The financial system is dominated by banks, and its structure evolved significantly in recent years, following the establishment of the state-owned Deposit and Development Fund (*Caisse de Dépôts et de Development*, CDD) in 2011, and the entry of several new commercial banks, some foreign-owned.

The small size, shallowness and fragmentation of the Mauritanian financial system are major impediments to the development of financial intermediation services. The assets of the country's largest bank amount to just US$320 million, and total banking-sector assets are estimated at less than US$2 billion. Financial infrastructure is limited, and cash remains the most common means of payment in the domestic economy. The insurance industry and pension schemes play a very minor in the financial system, and the ability of banks to play a decisive role in supporting private-sector development is limited by nonperforming loans, which remained high at over 20 percent of total loans in 2013, though down from 45 percent in 2010.

In 2013 banking-sector assets represented 38 percent of GDP, and credit to the private sector represented 26 percent. (Note 10) The return on assets stood at 2 percent, and the return on equity was 9 percent. In recent years interest rates on credit declined from 15 percent to 10-12 percent as new banks entered the market. However, rates vary little based on counterparty, maturity or type of financing. Headline profitability is mediocre, limiting both the sector's potential for organic growth and its capacity to absorb shocks. The absence of a market for short-term liquidity is a major impediment to the development of intermediation. Indicators of access to financial services in Mauritania remain below the average for Sub-Saharan Africa.

The country's microfinance sector is similarly underdeveloped. In 2013 there were 31 registered microfinance institutions (MFIs) in Mauritania, 10 of which were in the process of losing their licenses. Most MFIs are small, and the country currently has only one large microfinance network, the Public Credit and Savings Fund Promotion Agency (*L'agence de Promotion des Caisses Populaires d'Epargne et de Crédit*, PROCAPEC). Nevertheless, the total number of MFI clients increased from 139,000 in 2006 to over 200,000 in 2014, and MFIs now account for about 5 percent of all loans and 2 percent of all deposits. MFI loan maturities range from 3 months to 2 years, and rates for small businesses average 16 percent. MFIs also provide savings accounts—though these are limited to very short-term non-remunerated deposits—and offer money transfers. Islamic financial products are common, especially non-interest-bearing rent-to-own agreements (*murabaha*), which represent over 74 percent of PROCAPEC loans. (Note 11)

Mauritania's financial sector also faces challenges relate to its geographic isolation, hard infrastructure gaps and general lack of technical capacity. Bank credit to the private sector is overwhelmingly short-term, and information asymmetry severely limits its allocative efficiency. Lack of information about potential borrower leads banks to disregard SMEs in favor of large, well-established firms. As a result, informal financing, including at the international level, is often the only option available for Mauritanian SMEs. Low individual bancarization rates represent a major additional constraint on credit access. Information technology is limited, clearing systems mostly rely on manual entry, and electronic payment instruments are seldom utilized. The government recently began preparing a credit card system in collaboration with the private sector, but this effort is still in its early stages. Finally, weak legal and judicial systems inhibits the enforcement

of contracts, and the legislative framework for protecting creditors' rights is virtually nonexistent.

5. Household Characteristics, Poverty Incidence and Credit Access

The analysis presented below is based on the Mauritania EPCV for 2014. The survey is the result of a partnership between the ONS, the Ministry of Economic Development, the World Bank, and Afristat. The survey covers a wide range of socioeconomic variables collected through questionnaires administered to households and communities. The "basic indicators of wellbeing" module contains data on household composition, labor, education, social capital, health, access to services and credit. The "revenue and expenditure" module includes information on spending, consumption, transfers and income. The household represents the statistical unit of analysis. Of the 9,557 households surveyed in the 2014 EPCV, 55.3 percent were in urban centers and 44.7 percent were in rural areas. As a secondary source of information, the analysis is based on data from the 2008 EPCV. This household survey shares the same structure as the 2014 one, and consists of 13.738 households. The two surveys are cross-sectional representative samples of the underlying population. In the following paragraphs, a number of descriptive statistics set the stage for the main empirical analysis, which will be presented in the next section.

Mauritanian households are generally organized according to a traditional patriarchal model. Sixty-eight percent of households are headed by men, and 32 percent are headed by women. Household size is clearly correlated with poverty, and poverty incidence increases linearly with the number of household members. Households headed by married people tend to both include more children and are poorer than households headed by single

people. Polygamy is relatively common in Mauritania, and polygamous households tend to be among the largest and poorest in the country. Poverty rates declined among all household types between the 2008 and 2014 surveys, with medium-sized households showing the greatest degree of improvement (Figure 1).

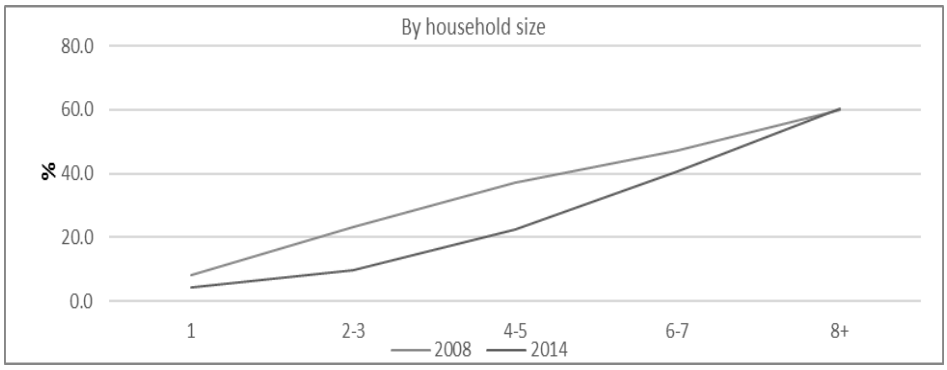


Figure 1. Poverty Incidence by Household Size

The poverty incidence does not appear to depend on the gender of the household head. Male-headed households tended to be marginally poorer both in 2008 and 2014, even when controlling for household size. The age of the head of household also appears to have no effect on poverty levels. Welfare indicators improved among all age groups in 2014, but households headed by younger people showed a more markedly positive trend (Figure 2).

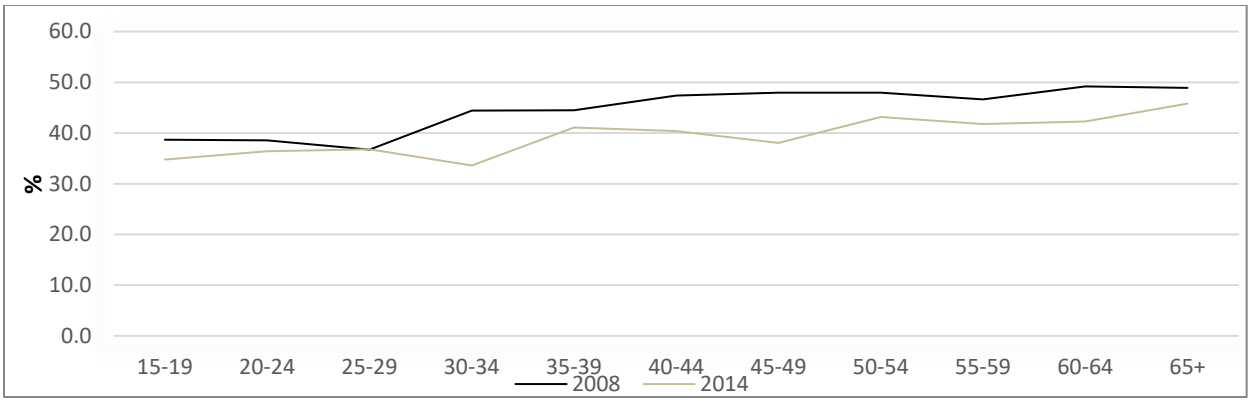


Figure 2. Poverty Incidence by Age Group of Household Head

Households headed by public employees had the lowest poverty rates. Households headed by private employees had higher rates, followed by households headed by self-employed workers outside the agricultural sector. Households headed by self-employed workers in the agricultural sector were the poorest, and their poverty incidence was even higher than that of households headed by unemployed workers or non-participants in the labor force. Finally, households headed by unemployed individuals registered an increase in the incidence of poverty, likely reflecting a severe drought that hit the country in 2012 (Figure 3).

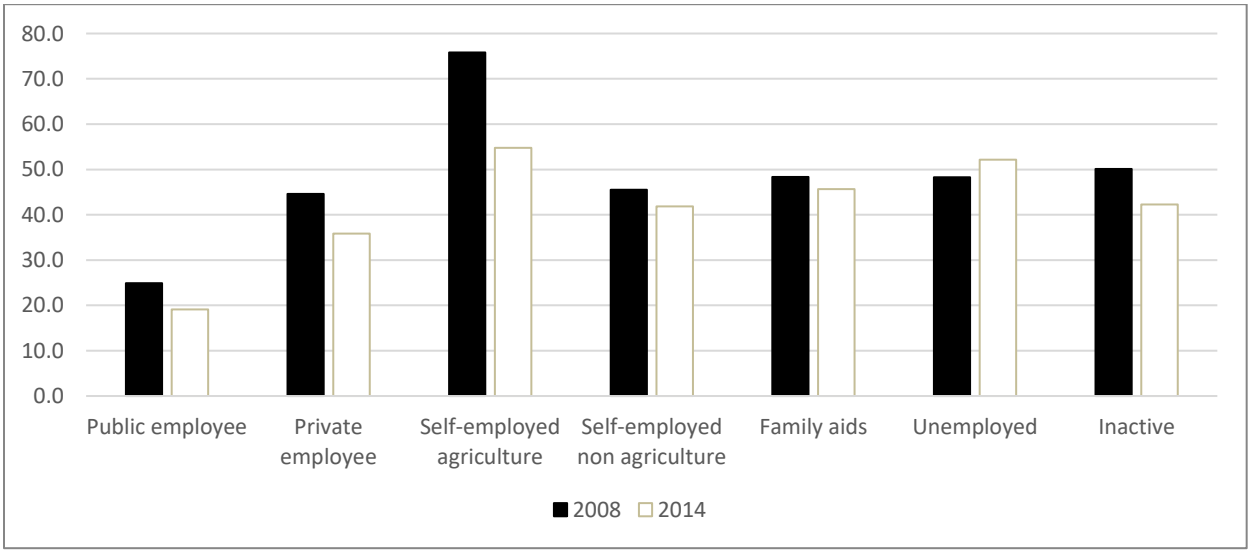


Figure 3. Poverty Incidence by Occupation

The education level of the head of household is negatively correlated with poverty incidence. Primary education is compulsory in Mauritania and lasts 6 years. Secondary school covers a period of 6 or 7 years, depending on whether the student opts for a Professional or Technical Baccalaureate, or a full Baccalaureate. Tertiary education typically lasts 3-6 years; advanced degrees are very rare and are usually obtained from the University of Nouakchott. In addition to the formal school system, traditional qur'anic schools (madrasas) are common in Mauritania. Figure 4 shows the negative correlation between education and poverty at the household level.

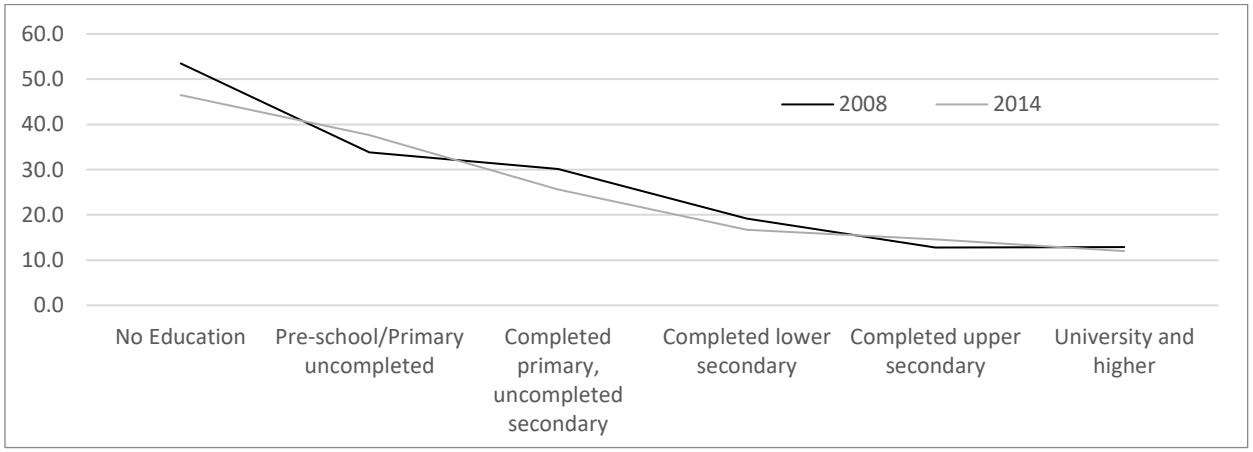


Figure 4. Poverty Incidence by Education Level of Household Head

Most importantly for the aim of this research, very few Mauritanian households have access to credit, and bank presence is almost exclusively restricted to urban areas. The EPCV includes questions designed to gauge household demand for credit during the 5 years prior to the survey. Figure 5 shows the share of households that have applied for credit from a formal financial institution, as well as the share that had their requests approved. Households applying for credit represent a tiny fraction of the population at

just 5.6 percent, down from 8.8 percent in 2008. However, the likelihood of a successful credit application increased between the two surveys, rising from 3.23 percent in 2008 to 4.45 percent in 2014. Credit applications are far more common, and credit approval is far more likely, among urban households as opposed to their rural counterparts (Figure 5). Physical access to banks is even more heavily skewed in favor of urban households, about a quarter of which have access to a bank, compared to just over 1 percent of rural households (Figure 6).

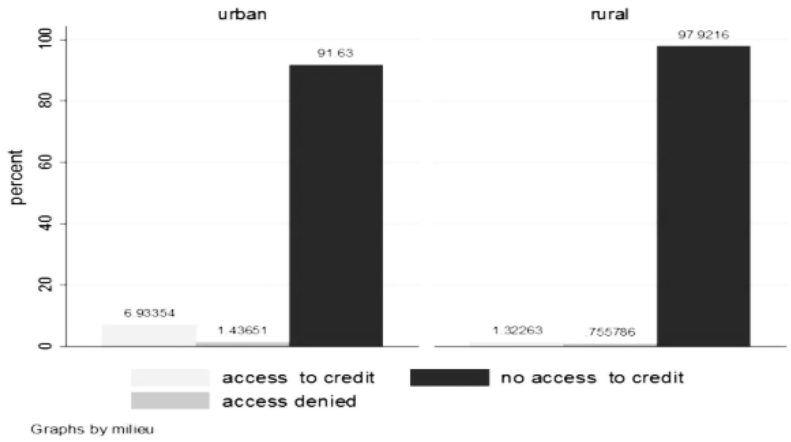


Figure 5. Credit Demand by Area

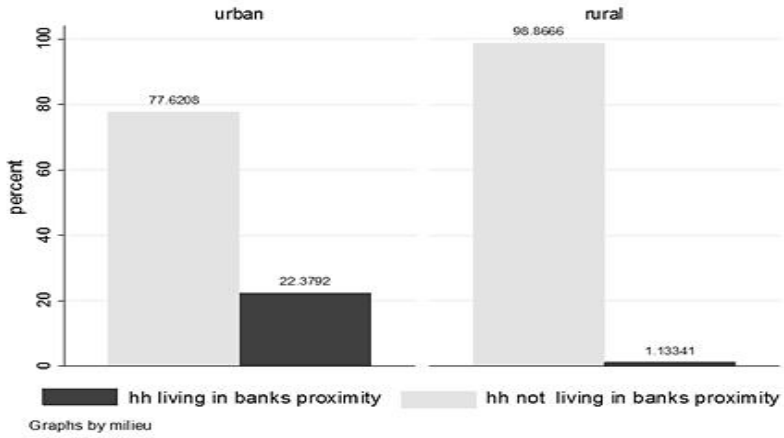


Figure 6. Percentage Households living near Banks by Area

6. Analytical Framework

A comprehensive understanding of household welfare requires an analysis of both income and consumption patterns. Income shocks do not always directly translate into decreased consumption or diminished welfare, and the mitigating factor may be thought of as household resilience. The ability to draw on past savings, to fall back on public assistance or to access credit to address temporary income shocks are all dimensions of resilience. Reflecting a long strand of literature (Note 12) on the importance of consumption rather than income as a primary indicator of household welfare, and taking into account the role of resilience, the analysis considers the following welfare indicators: (i) consumption (Note 13) of household production, particularly agricultural produce; (ii) total spending on nondurable goods, excluding food and education; (iii) food spending; (iv) education spending; and (v) a dummy variable representing household poverty status.

The following equation defines the parameters of interest:

$$\Upsilon_i = \alpha C_i + \sum_{v=1}^{V} \delta_v X_{v,i} + \mu_i + \varepsilon_i. \qquad (1)$$

Where Υ_i is a dependent variable indexed to i (household) and C_i is the dummy variable indicating whether the household has accessed credit from a formal financial institution in the five years preceding the interview. In addition, $X_{v,i}$ represents a set of $V = 14$ households characteristics, including the number of male adults in the household, number of children, total household size, amount of land owned, and dummy variables for urban or rural location, gender, age and education level of the household head. Area-level fixed effects by province (*moughata*) are represented by μ_i, and ε_i is an error term - which is allowed to be heteroskedastic in the analysis. Standard errors are clustered on *moughata*. (Note 14)

6.1 Endogeneity of Access to Credit

The estimation of (1) is most likely affected by the endogeneity of access to credit. This may be due to a number of factors, including: (i) unobserved area-level fixed effects that influence both demand for credit and household income and consumption, such as local prices, infrastructure quality, cultural norms, environmental conditions and natural-disaster risks; and (ii) unmeasured household characteristics that affect both demand for credit and household income and consumption, such as the health, ability, and fecundity of household members, as well as preference heterogeneity. (Note 15) An instrumental variable strategy (IV) based on the concept of the household isolation level (HIL) is used to address the endogeneity problem. The HIL (denoted by Z_i in what follows) is computed by considering the average value of a household's distance from vital infrastructure and facilities. These include the nearest water source, primary and secondary school, government offices, transportation services, healthcare facilities, mobile phone and internet services. Results are robust to alternative sets of variables considered to compute the HIL index. (Note 16)

Table 1 shows the descriptive statistics for this indicator, along with the various components which contribute to its definition. The first two columns report the mean (in meters) and the standard deviation from the full sample. The two central columns report these same statistics for households in urban areas, while households living in rural areas are considered in the last two columns of the table.

The results show that the age, the education level of the household head as well as the household's location (whether in an urban area or not) appear to be significant determinants of credit access. Moreover, households that

successfully obtain credit tend to be less dependent on the consumption of household internal production and are more likely to invest in education.

Table 1. Descriptive Statistics for the proxies Household Isolation Level (HIL)

	TOTAL SAMPLE		URBAN		RURAL	
Variables	Mean	Std dev	Mean	Std dev	Mean	Std dev
Distance from water source	795.4248	1569.986	446.1524	1049.099	1228.571	1953.639
Distance from transportation service	1848.723	2421.069	827.8833	1462.304	3128.778	2573.088
Distance from primary school	1353.707	1999.793	1060.65	1655.723	1721.311	2308.066
Distance from secondary school	3420.595	2654.543	1837.693	2206.809	5403.926	1646.502
Distance from healthcare facility	3201.083	2644.932	2153.571	2340.462	4517.591	2404.349
Distance from government office	4034.412	2503.113	2905.743	2525.988	5454.604	1576.805
Distance from mobile phone and internet service	3911.923	2629.179	2552.726	2606.349	5615.555	1356.178
Household isolation level	6.75e-09	1.740801	-.9687785	1.469942	1.214924	1.208036

6.2 Validity of the exclusion restriction

The HIL index is regarded as a determinant for access to banks and other financial institutions. (Note 17) The location of household in rural and urban areas may follow from sorting along unobservable dimensions. Because of this, household isolation can be itself endogenous in our model, thus invalidating the exclusion restriction needed for identification. The instrumental variation employed here is the residual variability in HIL after

netting off area *unobservables* and characteristics of the households living in those areas.

To see this, the first stage equation is:

$$C_i = \beta Z_i + \sum_{v=1}^{V} \gamma_v X_{v,i} + \mu_i + \varepsilon_i, \quad (2)$$

Which relates the dummy for access to credit to HIL controlling for the same variables already included in equation (1). The parameter β is estimated from the residual variability of the instrument, Z_i, after controlling for household characteristics and the area fixed effects. The extent of this variability in the data can be investigated by taking into account the residuals from the following equation:

$$Z_i = \sum_{v=1}^{V} \partial_v X_{v,i} + \mu_i + \varepsilon_i, \quad (3)$$

Residuals are plotted in Figure 7. The HIL index presents variability that is not fully explained by the control variables included in equation (2). Most importantly, it appears that also in rural areas households can be marginally worse off and, presumably, less likely to have access to formal credit.

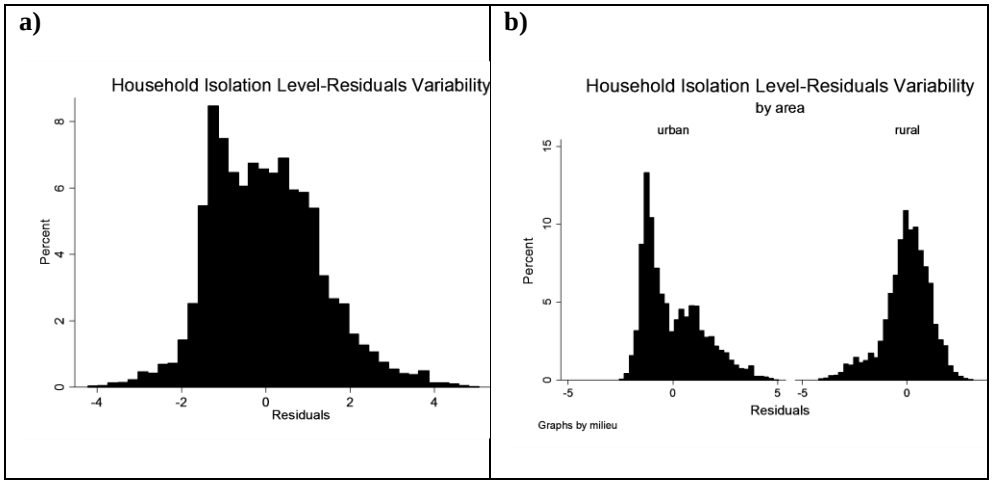


Figure7. Household Isolation Level Residuals Variability

The variability of residuals in equation (3) is a necessary condition for the identification, but does not make the exclusion restriction bulletproof. In an effort to address this problem, we turn to data from the 2008 EPCV and show that residuals in Figure 7 are not predicted by past area and household characteristics. This is shown in Figure 8, where access to credit is considered, along with a set of other variables, over the period 2003-2008. The lack of panel data on household across the two waves (2008 and 2014) forces the analysis at the area (*moughata*) level. We probe empirically the validity of instrument computing the estimation (Note 18) of the average value of residuals E_a^{2014}-in area-(Note 19) on the average value of the variables measured in 2008, E_a^{2008}. More in details, we consider the relationship between the residuals and a number of indicators, such as: educational indicators at different levels, the percentage of households located in urban areas, the average age of the household head, the percentage of households that had access to credit in 2008 and the average value of expenditure on non-durable goods.

The following equation is then estimated:

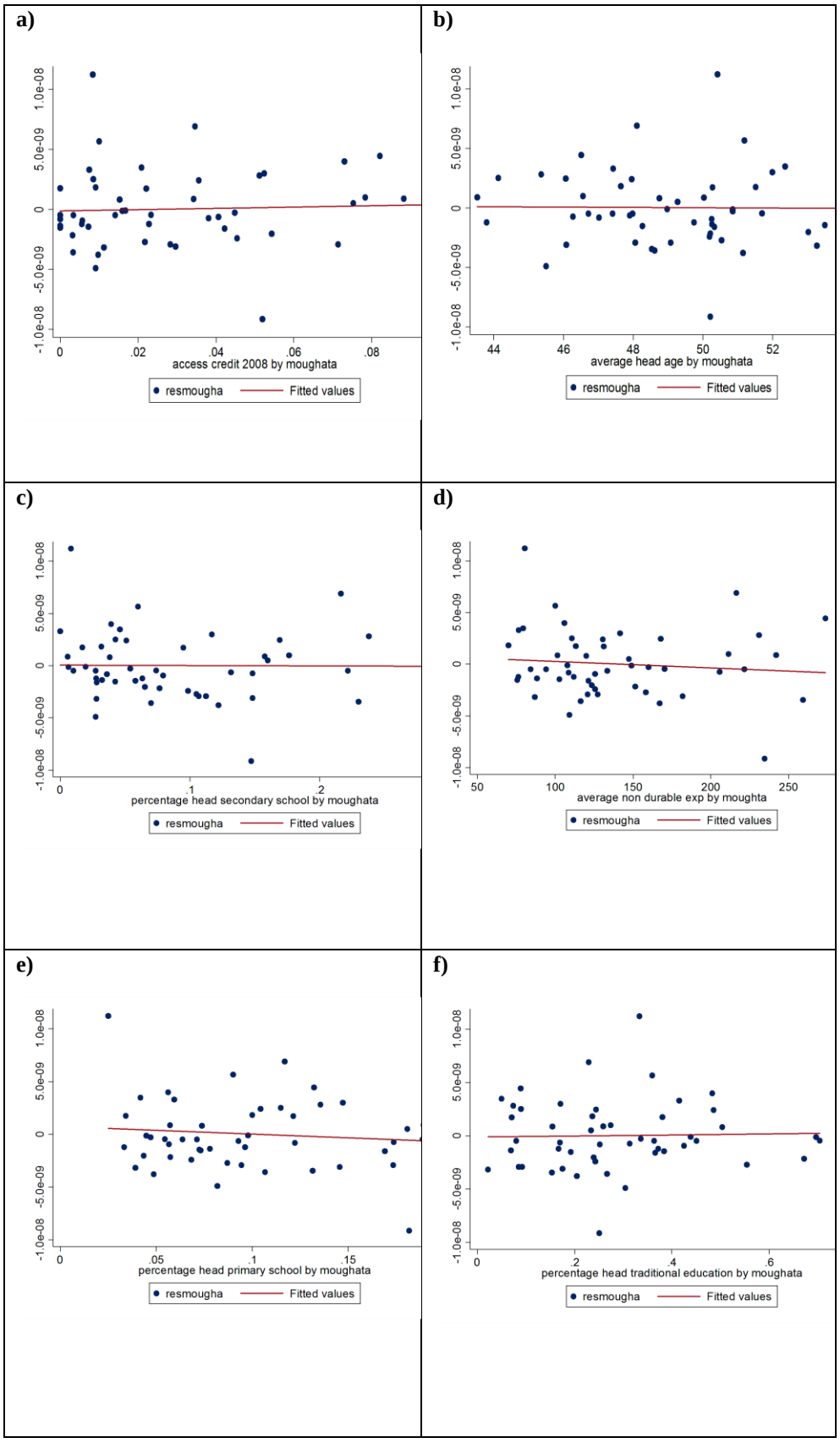
$$E_a^{2014} = \alpha + \rho E_a^{2008} + \varepsilon_a \qquad (4)$$

Table 2 reports the results related to the estimation of equation (4) and shows that the residuals in 2014 are orthogonal to the outcomes measured in 2008. The coefficients are equal to zero or not significant. In addition, Figure 8 reports the scatterplot of these two variables, with a superimposed linear fit from the same regression. The figure offers little evidence of correlation with past characteristics, thus corroborating the exogeneity of the instrument used in the main equation.

Table 2. Residuals in 2014 on Outcomes in 2008- OLS Estimate

Variables	Residuals-2014-moughata	R-squared	Obervations
Age head-moughata	-0	0.000	50
	(1.86e-10)		
Urban-moughata	-5.26e-10	0.004	50
	(1.45e-09)		
Non-durable-expenditure-moughata	-0	0.010	50
	(0)		
Primary school-moughata	-7.16e-09	0.012	50
	(1.06e-08)		
Secondary-school-moughata	-3.66e-10	0.000	50
	(7.96e-09)		
Traditional ed. -moughata	4.56e-10	0.001	50
	(1.99e-09)		
High school-moughata	5.92e-09	0.007	50
	(1.33e-08)		
Access to credit-moughata	5.46e-09	0.002	50
	(1.58e-08)		

Note. The treatment variables are the average value of the head age, the percentage households located in urban area; the percentage of household head educated at primay school, secondary school, traditional level and high school; the average value of non-durable expenditure; the percentage of households that have access to credit. All the variables are at moughataa level. Standard errors in parentheses.


a)
-1.0e-08
-5.0e-09
0
5.0e-09
1.0e-08
0
.02
.04
.06
.08
access credit 2008 by moughata
resmougha
Fitted values
b)
-1.0e-08
-5.0e-09
0
5.0e-09
1.0e-08
44
46
48
50
52
average head age by moughata
resmougha
Fitted values
c)
-1.0e-08
-5.0e-09
0
5.0e-09
1.0e-08
0
1
2
percentage head secondary school by moughata
resmougha
Fitted values
d)
-1.0e-08
-5.0e-09
0
5.0e-09
1.0e-08
50
100
150
200
250
average non durable exp by moughta
resmougha
Fitted values
e)
-1.0e-08
-5.0e-09
0
5.0e-09
1.0e-08
0
.05
.1
.15
percentage head primary school by moughata
resmougha
Fitted values
f)
-1.0e-08
-5.0e-09
0
5.0e-09
1.0e-08
0
.2
.4
.6
percentage head traditional education by moughata
resmougha
Fitted values

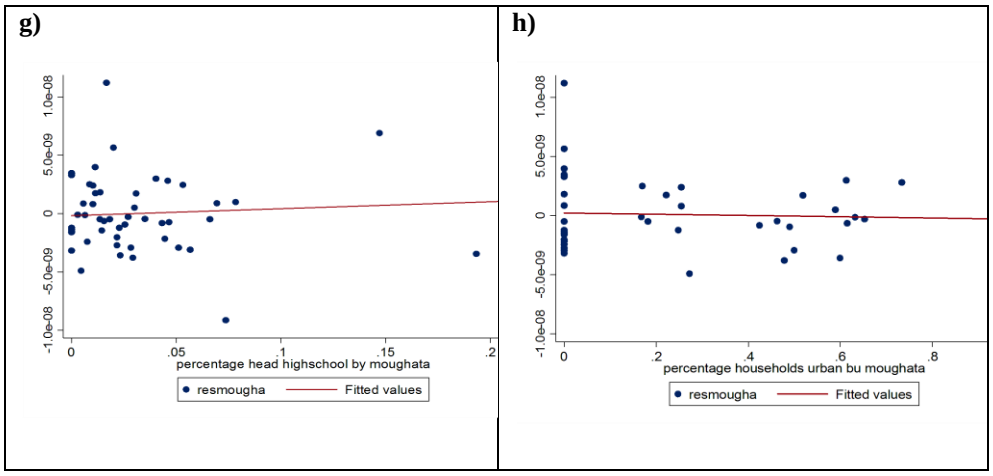


Figure 8. Residuals (2014) Compared with Outcomes (2008), Average Values by Moughata

7. Results

Table 3 and Table 4 provide a probit estimation of Equation 2. The analysis is clustered by *moughata*, and robust standard errors are reported throughout. The results show that HIL is negatively correlated with access to credit (Table 3). The coefficients are statistically significant and economically meaningful, and the results are robust to the inclusion of the household characteristics (Table 4). The age and education level of the head of household and the household's location in an urban area have especially positive and significant effects on the probability of accessing credit. Estimates of β are presented along with standard errors, and statistical significance at the 1, 5 and 10 percent levels is noted.

Table 3. Probit Estimate of HIL and Access to Credit

Variables	Access to credit
Households isolation level	-0.126*** (0.0336)
Constant	-2.039*** (0.0278)
Observations	8,663

Note. The treatment variable is the household isolation level (HIL).Standard errors are clustered by *moughata*

*** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.

Table 4. Probit Estimate of HIL and Access to Credit

Variables	Access to credit
Household isolation level	-0.0871*** (0.0334)
Land ownership	-0.0671 (0.534)
Age head	0.0405*** (0.0140)
Urban	0.321** (0.127)
Number of males	0.0269 (0.0242)
Age household	-0.00169 (0.00336)
Age head square	-0.000359*** (0.000135)
Number of kids	0.00547 (0.0382)
Head female	-0.0164 (0.0757)
Traditional ed.	-0.00707 (0.114)
Primary school	0.351** (0.168)
Secondary school	0.682*** (0.139)
Secondary tec-prof	0.877** (0.381)
High school	1.078*** (0.148)
Size	-0.00642 (0.0165)
Constant	-3.304*** (0.353)
Observations	8,663

Note. The treatment variable is the household isolation level (HIL). The independent variables are a dummy for urban location and for education level, household size, a dummy for female head of household, land ownership, number of adult males, number of children, age of household head, age of household head squared, average age of household members, and area-level fixed effects. Standard errors are clustered by *moughata*.

*** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level

Table 5 and Table 6 present the reduced form (RF) estimates. They show that the HIL is positively correlated with the consumption of household production and poverty incidence and negatively correlated with education spending. These results are robust to the inclusion of all other household characteristics defined in the analysis.

Table 5. Impact of HIL on Welfare-RF Estimates

Variables	Auto-consumption	Non-durable-expenditure	Food-expenditure	Education-expenditure	Poverty
Household isolation level	5.799***	-14.87***	-5.181	-6.512***	0.0308***
	(0.938)	(4.699)	(4.067)	(1,149)	(0.00614)
Constant	36.40***	373.2***	347.3***	76.63***	0.213***
	(0.00710)	(0.0356)	(0.0308)	(0.00870)	(4.65e-05)
Observations	9,472	9,472	9,472	9,472	9,472
R-squared	0.063	0.161	0.085	0.067	0.112

Note. The treatment variable is the household isolation level (HIL). Standard errors are clustered by *moughata*
*** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.

Table 6. Impact of HIL on Welfare-RF Estimates

Variables	Auto-consumption	Non-durable-expenditure	Food-expenditure	Education-expenditure	Poverty
Household isolation level	3.915***	-3.920	1.408	-3.575***	0.0161***
	(1.089)	(4.654)	(4.351)	(0.767)	(0.00463)
Land ownership	45.23***	-48.83	6.172	-5.642	0.0248
	(15.01)	(31.08)	(26.86)	(23.65)	(0.0436)
Age head	1.240***	0.291	1.455	2.665***	-0.00377*
	(0.362)	(1.080)	(0.975)	(0.390)	(0.00193)
Urban	-19.91**	98.18***	58.92***	11.06***	-0.143***
	(8.702)	(18.21)	(15.54)	(3.108)	(0.0233)
Number of males	0.727	-0.586	-0.419	0.676	0.0112***
	(0.700)	(1.862)	(1.485)	(0.738)	(0.00398)
Age household	0.108	1.324***	1.229***	-1.872***	-0.000933
	(0.148)	(0.419)	(0.448)	(0.159)	(0.000989)
Age head square	-0.0112***	-0.00898	-0.0183**	-0.0175***	3.71e-05**
	(0.00340)	(0.00899)	(0.00789)	(0.00313)	(1.75e-05)
Number of kids	-3.219**	-4.338	-7.833***	-21.59***	0.0292***
	(1.492)	(2.684)	(2.614)	(1.520)	(0.00686)
Head Female	-4.574	2.849	0.353	10.61***	0.00822
	(3.771)	(5.655)	(5.858)	(2.021)	(0.00960)
Traditional ed.	2.678	15.27*	13.04	4.266	-0.0109
	(4.194)	(8.769)	(8.699)	(2.769)	(0.0159)
Primary school	-0.580	28.92**	19.66	20.73***	-0.0346*
	(4.902)	(13.66)	(13.19)	(3.055)	(0.0191)
Secondary school	-0.778	66.63***	39.44***	25.06***	-0.0851***
	(4.788)	(12.91)	(12.23)	(4.060)	(0.0186)
Secondary tec-prof	-6.677	117.9**	61.93	21.35***	-0.103***
	(13.35)	(57.05)	(44.67)	(5.134)	(0.0335)
High school	1.597	99.94***	53.16**	41.78***	-0.114***
	(8.110)	(30.46)	(25.83)	(5.373)	(0.0224)
Size	-0.0486	-10.55***	-9.144***	11.91***	0.0383***
	(0.496)	(1.716)	(1.732)	(0.714)	(0.00600)
Constant	13.38	334.3***	302.0***	-34.00***	0.155***
	(11.82)	(31.72)	(30.31)	(7.054)	(0.0499)
Observations	9,472	9,472	9,472	9,472	9,472
R-squared	0.067	0.216	0.122	0.390	0.262

Note. (refers to Table 6, previous page). The treatment variable is the household isolation level (HIL). The independent variables are a dummy for urban location and for education level, household size, a dummy for female head of household, land ownership, number of adult males, number of children, age of household head, age of household head squared, average age of household members, and area-level fixed effects. Standard errors are clustered by *moughata*.
*** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.

Table 7 and Table 8 present Instrumental Variable (IV) estimates of the relationship between access to credit and the key variables used in the analysis. Estimates of α are reported along with standard errors, and statistical significance at the 5 and 10 percent levels is noted.

Table 7. Impact of Access to Credit on Welfare - Instrumental Variable (IV) Estimates

Variables	Auto-consumption	Non-durable-expenditure	Food-expenditure	Education-expenditure	Poverty
Access to credit	-522.2**	1,349*	474.7	586.9***	-2.795**
	(212.5)	(752.0)	(446.6)	(225.0)	(1.329)
Constant	51.13***	377.7***	387.4***	44.45***	0.270***
	(3.184)	(11.27)	(6.691)	(3.371)	(0.0199)
Observations	9,455	9,455	9,455	9,455	9,455

Note. The treatment variable is the access to credit. The instrument used is HIL. Standard errors are clustered by *moughata*.
*** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.

Table 8. Impact of Access to Credit on Welfare - IV Estimates

Variables	Auto-consumption	Non-durable-expenditure	Food-expenditure	Education-expenditure	Poverty
Access to credit	-506.4*	524.4	-168.2	464.0**	-2.116
	(264.3)	(725.2)	(540.5)	(230.7)	(1.421)
Land ownership	51.40**	-55.12	8.301	-11.31	0.0506
	(20.87)	(35.15)	(26.26)	(29.10)	(0.0500)
Age head	2.608***	-1.186	1.856	1.419	0.00206
	(1.011)	(2.337)	(1.807)	(0.998)	(0.00496)
Urban	-12.72	90.44***	61.06***	4.458	-0.112***
	(11.16)	(24.79)	(20.13)	(4.652)	(0.0336)
Number of males	1.756	-1.715	-0.121	-0.276	0.0155**
	(1.555)	(3.177)	(1.967)	(1.322)	(0.00710)
Age household	0.0387	1.381***	1.197***	-1.809***	-0.00121
	(0.191)	(0.446)	(0.461)	(0.182)	(0.00118)
Age head square	-0.0228**	0.00364	-0.0217	-0.00694	-1.26e-05
	(0.00901)	(0.0192)	(0.0150)	(0.00874)	(4.27e-05)
Number of kids	-2.514	-5.113*	-7.661***	-22.28***	0.0319***
	(2.050)	(2.891)	(2.868)	(1.975)	(0.00881)
Head female	-6.306	4.525	-0.329	12.05***	0.00117
	(5.264)	(6.982)	(5.831)	(3.978)	(0.0178)
Traditional ed.	-0.826	19.00*	11.94	7.399	-0.0258
	(6.471)	(10.36)	(8.975)	(5.114)	(0.0238)
Primary school	9.074	19.36	23.18	11.74	0.00554
	(9.644)	(20.88)	(18.31)	(7.987)	(0.0432)
Secondary school	34.19*	30.52	51.15	-7.154	0.0613
	(20.11)	(54.55)	(41.67)	(18.79)	(0.108)
Secondary tec-prof	48.00	61.21	80.14	-28.89	0.125
	(54.49)	(110.8)	(85.59)	(46.78)	(0.248)
High school	87.59**	10.85	82.01	-36.62	0.244
	(44.39)	(123.2)	(95.78)	(37.26)	(0.238)
Size	-0.437	-10.14***	-9.256***	12.28***	0.0367***
	(0.806)	(2.169)	(1.721)	(0.864)	(0.00766)
Constant	-13.80	443.7***	376.4***	-22.14	-0.0386
	(24.45)	(53.02)	(45.73)	(22.29)	(0.103)
Observations	9,455	9,455	9,455	9,455	9,455

Note. The treatment variable is the access to credit. The instrument used is HIL. The independent variables are a dummy for urban location and for education level, household size, a dummy for female head of household, land ownership, number of adult males, number of children, age of household head, age of household head squared, average age of household members, and area-level fixed effects. Standard errors are clustered by *moughata*.

*** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.

Table 7 indicates a strong negative correlation between access to credit and both consumption of household production and poverty incidence, as well as a similarly strong positive correlation with spending on non-durable goods and services and education. Table 8 presents IV estimates for the same outcomes broken down by household characteristics, which underscores the negative correlation with consumption of household production and the positive correlation with education spending. Food spending is not significantly higher among households with access to finance, which is likely due to the relative inelasticity of food spending in general. Also, results highlight a positive but not significant effect of access to credit on poverty reduction as well as on non-durable expenditure.

In addition table 8 presents the Instrumental Variable estimation of access to credit on welfare also vis-à-vis a number of household-level variables. Consumption of household production correlates with land size, almost certainly reflecting a focus on agriculture. Spending on non-durable goods and services and food spending are both higher among urban households, while poverty incidence is lower. Education spending tends to be higher among female-headed households. All expenditure variables decrease as the number of children increases.

8. Conclusions

The first-degree analysis of the relationship between access to credit and household welfare in Mauritania presented above yields a number of insights with potential policy applications. The analysis begins by confirming the intuitive conclusion that household isolation is negatively correlated with access to credit. The related coefficients are statistically significant and economically meaningful, even when controlling for other household characteristics. It seems worth stressing that the objective of the paper is to

provide a strong econometric framework - for the first time- to investigate the linkage between welfare and finance access in Mauritania. The choice of a variable related to spatial distance (and, in particular, used as an instrumental variable) represents an innovation in the access to credit literature. Interestingly, after controlling for endogeneity, the paper also finds no significant effects of access to credit on the actual poverty rate nor on non-durable goods consumption.

The analysis also finds that the age and education level of the head of household and the household's location in an urban area appear to be significant determinants of credit access. This is particularly relevant in the Mauritanian context, where urbanization rates have vastly outpaced improvements in education indicators. The substantive significance of the coefficients appears to reflect quite clearly some of the characteristics of the educational system in the country: as of 2015 only 24 percent of children were enrolled in a secondary school, and only 5.6 percent in tertiary. Were any further argument required in favor of strengthening the coverage and the quality of education in Mauritania, these findings provide statistical evidence that greater educational attainment appears to positively affect access to credit. In fact, some of the strongest correlations with welfare are identified by this paper with the levels of education, and in particular it appears clear that individuals with secondary and high school education enjoy better conditions vis-à-vis non-durable and food expenditure and are less poor (Figure 4).

Moreover, households that successfully obtain credit tend to be less dependent on the consumption of household production and are more likely to invest in education. The former implies higher living standards, greater food security and denser integration into the nonagricultural economy. The

latter, meanwhile, suggests a special preference for investment in human capital, which may be a cause, effect or corollary of a household-level predisposition toward other forms of economic investment.

Finally, the results of this analysis present cause for Mauritanian policy makers to consider strategies for expanding financial infrastructure in underserved rural areas. Provided that progress is achieved in the viability and solvency ratios of the sector (namely by concretely addressing the issues of operational risks, access to reliable credit information, capacity, and poor supervision) an improvement of access to financial services and microcredit programs beyond the country's urban centers may increase inclusion by facilitating rural households' chances of obtaining credit. At present, a household's location in an urban area appears to have a differential impact on credit access, even controlling for other factors. Recent advances in mobile banking technology are already expanding access to finance in underserved areas throughout Sub-Saharan Africa. In this context, infrastructure investment and regulatory reforms designed to encourage the development of financial services in rural areas, particularly combined with efforts to enhance educational service, could spur productivity growth and support welfare improvements among the poorest and most vulnerable households in the country.

Chapter 2:

Do Nonrenewable Resources Support GDP Growth and Help Fight Inequality?[8]

Keywords: Natural Capital, Economic Growth, Income Inequality

JEL codes: C01, C13, C3, E01, D31, D63, O11, O43, Q32

[8] *This analysis was conducted jointly with Antonio Scognamillo (FAO), and Luca Sensini (University of Salerno).*

Introduction and Literature Review

A large body of literature has examined the relationship between natural resources, economic growth, and income inequality, revealing a set of complex and often ambiguous associations.

The relationship between natural resources and economic growth is especially controversial. On the one hand, general economic theory suggests that a booming natural resource sector will boost economic growth, and that it will facilitate—though not necessarily cause—improvements in poverty and shared-prosperity indicators. Ideally, rising natural resource output would increase public revenues, enabling greater public investment in physical and human capital, while the private returns to resource production would encourage greater private investment (both domestic and external), as well as higher rates of household savings. On the other hand, the substantial literature on the so-called "Dutch disease" finds that a resources boom can divert resources away from the non-resource tradable sectors (especially manufacturing), distort the growth of non-tradables (especially services), and put upward pressure on the exchange rate. These effects erode the competitiveness of exports and give imports an advantage over domestic production, undermining long-term growth (Sachs and Warner 1999). More recently, Brahmbhatt, Canuto, and Vostroknutova (2010) suggest that when natural resource-related production increases, the effects on welfare (regarded here as improvement in national income) will depend on whether the declining sectors have some special features that could be instrumental for long-term growth and welfare, such as increasing returns to scale or positive technological spillovers. They also emphasize the effect that fiscal policy can have on mitigating the negative impacts of the Dutch disease, and may play an instrumental role in easing the "spending effect", by making the wealth

increase long-lasting and by adopting counter-cyclical stances to offset inflationary pushes and avoid looping into stop-and-go growth patterns. This is particularly important in low-income countries, where the portion of the newly discovered wealth is more substantial.

As for the relationship between income inequality and natural resources the first contributes dates back to Bourguignon and Morrisson (1990) who find that mineral resource endowments, rather than other variables such as GDP, are an important determinant of the income distribution. More recently, Lopez-Feldman et al. (2006) find that an increase in income due to the extraction of natural resources alleviates inequality through a reduction of the Gini coefficient. Barbier (2014) argues that understanding the depletion of natural capital is crucial to assessing both the extent to which natural capital will contribute to future economic growth and the pace at which inequality has increased over time. According to Barbier (2015), environmental degradation and the widening gap between the world's rich and poor are symptomatic of gradually intensifying structural imbalances in how natural capital is used to create economic wealth and how that wealth is distributed. On the one hand, ecological capital is hard to estimate and tends to be undervalued, especially the valuation of ecosystem services (Barbier, 2013), and thus overexploited. On the other hand, the human capital stock is insufficient to meet demand, which drives rising income inequality. This structural imbalance between natural and human capital creates obstacles to innovation, growth and prosperity. Behzadan et al. (2017) highlights the direct connection between the inequality in the distribution of resource rents and the severity of the impact of the Dutch disease. The more resource rents are broadly distributed, the less marked the effects of the Dutch disease are. In other words, the level of inequality may determine the if and how adverse

or favorable can the exploitation of new natural resources for an economy. Fum and Hodler (2010) focus on the political-economy aspects of resource management and income inequality. They present empirical evidence that ethnic polarization increases the probability that a large stock of natural resources will correlate with inequality.

A different and interesting perspective on the issue of natural resources (from the angle of trade) and growth is offered by Furtado (1954), who focused on the nexus between economic development and price levels. Like for structuralists in general, he regards inflation as the result of ill-distributed growth coupled with adjustments in the demand by countries with sticky money prices and rigid supply structures. In essence, this refers to a change in relative prices that turns into inflation on account of whether (or to what extent) the relevant socio-economic agents are able to maintain their portion of output (also referred as to "social conflict inflation"). In other words, a change in relative prices was assumed to be triggered by the gap between the increases in income and the ability to import, as in the Latin American case postulated by Furtado.

Although many empirical studies have investigated the link between natural capital, growth and inequality, very limited research is available on how all three factors interact. Moreover, much of the existing literature on the subject fails to adequately account for the role of wealth stocks. A thorough review of the literature would seem to indicate that the quantitative relationship between the exploitation of natural resources, economic growth and income inequality has been studied only by Gylfason and Zoega (2002) and Alessandrini and Buccellato (2009). Behzadan et al. (2017) recently furthered the understanding of the effects that an equitable – or less – distribution of natural resource rents may have on the incidence of the Dutch disease, and

find that an unequal distribution in the rents of natural resources leads to more acute cases of Dutch disease.

This study aims to tests the existence of a relationship between the dependence on nonrenewable natural resources (hereafter dependence), GDP per capita (GDPc) and income inequality. The analysis is conducted in the spirit of Sachs and Warner (1995; 2001) and uses panel data for 43 countries for which data is available from 1980 to 2012. The final objective is to test a system of two equations in which the dependent variables are per capita GDP and the Gini index and the independent variable is the dependence on nonrenewable natural resources. While Gylfason and Zoega (2002) and Alessandrini and Buccellato (2009) also used cross-sectional data, this analysis innovates on the existing literature by controlling for the presence of unobserved time invariant country heterogeneity, exploiting the data panel.

The empirical results from the baseline model provide evidence of a negative association between resource dependence and GDP per capita, which is consistent with the existing literature on the Dutch disease effect.

However, considering that previous studies show that Dutch disease is not consistent or inevitable – as it is influenced by the institutional heterogeneity across countries (Bunte 2011) –, we replicate the analysis to account for the heterogeneity of country income groups. In fact, the intensity of Dutch disease effects depends in large part on whether and how natural resource revenues are used to promote social equity through investment in human capital, public goods and services, and targeted poverty-reduction programs. This study tests weather countries 'structural characteristics – captured by the differences in the income levels – influence the empirical relationship between nonrenewables' dependence, GDP per capita and income inequality. Our

findings show that among higher-income countries a greater degree of resource dependence is associated with an *improvement* in the income distribution and has no statistically significant correlation with economic growth. Conversely, greater resource dependence among lower-income countries is associated with a lower GDP per capita even if the association with income inequality suggests an equalizing effect (on average)[9].

These findings imply that the relationship between natural resource dependence and economic growth and income inequality hinges on a given country's income level. Replicating the analysis on a subsample of resource-rich countries confirms the robustness of these findings. These findings further support the idea that the "resource curse" is not caused by natural resource endowments per se, but rather by country-level characteristics (see, e.g. Gylfason, 2001; Robinson, Torvik, and Verdier 2006). Under specific circumstances, the availability of natural resources could be a blessing given the equalizing effect on income distribution. Research by Brunnschweiler and Bulte (2008) suggest that resource-abundant countries do not systematically end up being worse off than resource-poor countries in the long-run, and hint at the existence of significant, direct and indirect, links between country characteristics – particularly the quality of institutions – and economic outcomes.

Following this introductory section, the paper is structured as follows: the second section describes the study's methodology and clarifies the empirical strategy for obtaining consistent parameter estimates under the specific assumptions imposed on the model; the third section discusses the dataset

[9] The sign of the coefficient also suggests that once dependence reaches a certain level the dependence turns to be unequalizing.

constructed for this analysis and provides some descriptive statistics; the fourth section presents the results of the analysis; and the last section draws policy implications and conclusions.

Methodology

This study uses a broad set of specifications and estimation techniques to explore the relationship between nonrenewable resource dependence and income inequality and economic growth. As the observed results are comparable with previous studies, it is necessary to add further controls and assumptions to the model. Moreover, adding further controls and altering certain assumptions enables a more comprehensive evaluation of the overall robustness of the results and enriches the analysis by considering changes in magnitude and the significance of the estimated coefficients on the dependent variable.

The baseline model is a system of two equations that does not take into account the heterogeneity among groups of countries. The recursive model is based on the existing literature but innovates it, by exploiting the panel structure of the database to control for the presence of unobservable country-level heterogeneity, as in Equation 1:

Equation 1: Model Specification

$$GINI_{i,t} = \beta_0 + \beta_1 NKD_{i,t} + \beta_2 X_{i,t} + a_i + u_{1\,i,t}$$
$$GDP_{i,t} = \beta_3 + \beta_4 NKD_{i,t} + \beta_5 Y_{i,t} + a_i + u_{2\,i,t}$$

where the two dependent variables are the country's GINI index and its GDP per capita, NKD is its nonrenewable resources dependence index, X and Y are two vectors of control variables, ai represents the country time invariant unobservable effect, and $u1$ and $u2$ are the equation error terms. Assuming

that the error terms in the two equations are not correlated, each equation is firstly estimated separately using a fixed-effect estimator (FE).[10] However, relaxing this assumption, we have also allowed for a correlation among the equation's error terms through a simultaneous estimate of the two equations via a seemingly unrelated regression estimator (SURE) that is expected to increase the efficiency of the results.

The same estimation procedure is applied to all the model specifications, and for the sake of brevity, each equation is not formalized. The second model specification accounts for heterogeneity related to country income group by adding a dummy variable to each equation that identifies lower-income countries. The interaction of this variable with the nonrenewable resource dependence index allows to distinguish between the empirical associations in lower and higher-income countries. Finally, a third model specification is restricted to a subsample of non-renewable resources rich countries.

Data

The dataset comprises 43 countries from five continents and covers the period from 1980 to 2012. It includes all countries for which complete data on nonrenewable resources are available and nonzero. Using the World Bank classification system, the information contained in the dataset can be divided into four groups, as shown in Table 1: 13 high-income countries, 14 upper-middle-income countries, 12 lower-middle-income countries and 4 low-income countries. Figure 2 illustrates the geographic coverage of the dataset. The countries included on our dataset are: Algeria, Argentina, Australia, Bolivia, Botswana, Brazil, Bulgaria, Cameroon, Canada, Chile, China,

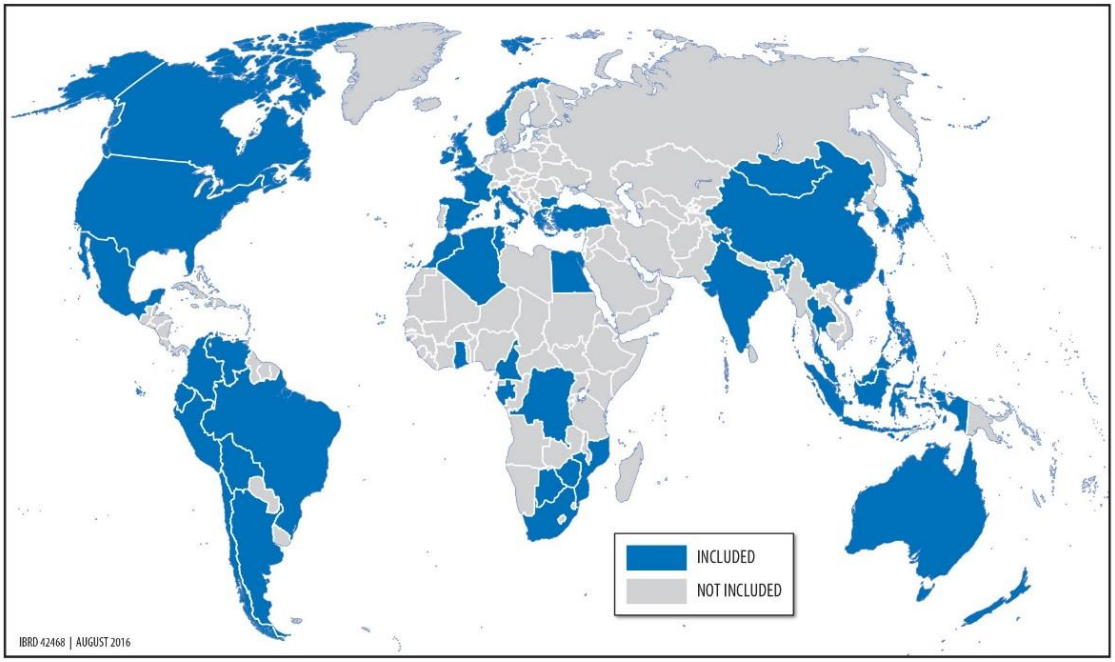
[10] The presence of unobserved country heterogeneity has been tested using a Breusch-Pagan Lagrange multiplier test for random effects, while the Hausman test has enabled the use of a fixed-effects estimator rather than a random-effects estimator.

Colombia, Democratic Republic of Congo, Ecuador, Egypt, France, Gabon, Ghana, Greece, India, Indonesia, Ireland, Italy, Japan, Republic of Korea, Malaysia, Mexico, Mongolia, Morocco, Mozambique, New Zealand, Norway, Peru, Philippines, South Africa, Spain, Thailand, Tunisia, Turkey, United Kingdom, United States, Venezuela and Zimbabwe.

Table 1: Countries classified by Income Groups

Income group	Frequency: Absolute	Relative	Cumulative
High income: OECD	13	30%	30%
Upper middle income	14	33%	63%
Lower middle income	12	28%	91%
Low income	4	9%	100%
Total	43	100%	

Figure 2: Map of countries included in the empirical analysis



Assessing the natural capital available in a country is a complex but necessary task. According to Dasgupta (2010 and 2014) the GDP per capita and other macroeconomic aggregates (such as private consumption, as well as indicators such as the Human Development Index (HDI)) should not be regarded as comprehensive or objective indicators of economic and social welfare. In fact, they do not reflect the depletion of the natural capital stock, and that more sophisticated forms of wealth accounting that include produced, human and natural capital are more appropriate measures of inclusive and sustainable development. The World Bank has long been a major advocate for integrating the sustainable management of natural capital into growth strategies. The institution has built a dataset on national wealth that is our source for historical data on natural capital. The dataset disaggregates the three components of national wealth—produced capital, intangible capital and natural capital—and it decomposes the natural wealth stock into renewable and nonrenewable resources.

This analysis focuses on nonrenewable resources due to the methodological soundness of their estimation.[11] Current techniques for estimating the stock of renewable resources are limited, and their core methodological assumptions may compromise the reliability of the data. The literature uses two different methods for defining the economic importance of nonrenewable resources: "resource abundance," which is the per capita value of the stock of nonrenewable resources, and "resource dependence," which is the value of nonrenewable resources as a share of total national wealth. As noted by Gylfason and Zoega (2002), resource dependence is a measure of the current

[11] Although criticism was expressed (see among others van der Ploeg and Poelhekke (2009)) about the World Bank natural wealth dataset, the assessment of non-renewable natural resource wealth requires a lower number of assumptions relatively to the estimation of the renewable natural capital.

economic relevance of natural resources, while resource abundance reflects the estimated value of the natural resource stock.

Examining the distribution of resource dependence and abundance across countries at different stages of development reveals that the two measures do not evolve according to the same pattern.

shows that average resource dependence is least prevalent among high-income countries (2.1 percent), most prevalent among upper-middle-income countries (15.1 percent) and moderate among both lower-middle-income countries (8.3 percent) and low-income countries (10.8 percent). Meanwhile, resource abundance is also most prevalent among upper-middle-income countries but is more common among high-income countries than it is among lower-middle-income and low-income countries. This is likely due to high-income countries having larger stocks of produced and intangible capital, which offset the economic importance of natural resources. This analysis focuses on resource dependence rather than resource abundance, as the former is more immediately relevant to economic growth and income inequality.

Table 2: Average nonrenewable resource dependence and abundance by income group (1980-2012)

	Dependence	Log_Abundance
High income	2%	7.8
Upper middle income	15%	8.6
Lower middle income	8%	7.3
Low income	11%	6.6

The data on income inequality is sourced from the World Bank's "All-the-Ginis Database," which was last updated in 2014.[12] The database collects Gini indexes from multiple sources into long time series. The data has been standardized for this analysis via the so-called "choice-by-precedence approach," which reflects each dataset's reliability, degree of variable standardization, and consistency of geographical coverage. GDP and population figures have been collected from the United Nation's UNCTAD-STAT database. Table 3 presents the descriptive statistics for per capita GDP and the Gini index by country income group. The Gini index peaks among the upper-middle-income group, falls among the lower-middle-income and low-income groups and is lowest among the high-income group. These data are consistent with the relationship between inequality and GDP described by Kuznets (1955).

[12] Available at http://econ.worldbank.org/projects/inequality

Table 3: GDP per capita and Gini index by income group (1980-2012)

	GDP per capita (US$ thous)	Gini index
High income	34.5	33.9
Upper middle income	8.4	49.1
Lower middle income	2.8	40.5
Low income	1.4	42.7

The data for control variables was collected from different sources. Data on the structural and cyclical characteristics of national economies comes from the World Bank's World Development Indicator Database[13] and UNCTAD-STAT;[14] the figures on education are sourced from Barro & Lee (2013);[15] those on the real effective exchange rate (REER) are taken from Darvas (2012);[16] and metal- and oil-price figures are sourced from the IMF's Primary Commodity Prices database.[17] Referring to the original datasets will provide further details on the methodology and sources used. Table 4 shows income-level-related heterogeneity across countries for the specified variables.

[13] Available at http://data.worldbank.org
[14] Available at http://unctadstat.unctad.org
[15] Available at http://www.barrolee.com
[16] Available at http://bruegel.org
[17] Available at http://www.imf.org

Table 4. Indicators of heterogeneity across countries

Panel A: Variable included in the GINI equation

	Education ratio[18]	CPI	Services value added (% of GDP at market prices)	Manufacturing value added (% GDP at m. prices)	Agriculture value added (% of GDP at m. prices)
High income	4.6	80.9	66.3	17.6	3.9
Upper middle income	0.9	65.3	52.3	17.1	7.9
Lower middle income	0.7	75.7	48.5	18.6	18.1
Low income	0.4	63.7	45.4	14.6	29.4
Average	1.9	73.2	54.8	17.4	11.5

Panel B: Variables included in the GDP equation

(log)Gross fixed capital formation	(log)Export	(log)REER	World oil price index	World metal price index
11.7	11.8	4.5	73.0	91.9
9.7	9.9	4.6	73.0	91.9
9.4	9.4	4.7	73.0	91.9
6.7	7.4	4.8	73.0	91.9
9.9	10.1	4.6	73.0	91.9

[18] Education ratio is the ratio between the share of the population with secondary and tertiary education and the share of population with primary or no education.

Finally, to introduce the empirical analysis Table 5 summarizes the pairwise correlations between the most relevant variables. As shown in the table, resource dependence is positively associated with the Gini index and negatively associated with GDP per capita at a significance level greater than 1 percent. In other words, the simple correlations show that the more dependent a country is on nonrenewable resources, the higher its Gini coefficient and the lower its GDP per capita.

Table 5: Correlation matrix for the main variables

	Resource Dependence	Gini index	Log GDP
Resource Dependence	1		
Gini index	0.242***	1	
GDP per capita	-0.142***	-0.350***	1

Empirical Analysis

This section summarizes the results of the analytical methodology described above. The specifications and the estimation techniques have been systematically adapted according to the different assumptions characterizing each model. The baseline model estimates the average empirical associations for all the countries included in the dataset, and is then adjusted to assess heterogeneity between country income groups. Finally, the model was tested

on a sub-sample of resource-rich countries[19], with a view to test the robustness of the empirical association.

The Baseline Model: Pooling All Countries

Table 6 presents the results from the baseline model. The two equations have been estimated separately using a fixed-effect estimator and simultaneously using SURE plus country-level dummy variables. We find that, on average, nonrenewable resource dependence is negatively associated with both income inequality and GDP per capita. In the simultaneous estimation both coefficients increased because of the correlation between the error terms of the two equations.

[19] Based on an IMF definition of 'resource-rich' countries.

Table 6: Estimated results from the baseline model specification

	Fixed Effect		SURE	
	Gini index	**GDP_c**	**Gini index**	**GDP_c**
Non Renewable resource dependence	-0.059**	-0.087**	-0.149***	-0.132**
High-low education ratio	-0.639***	-	-0.203	-
High-low education ratio square	0.021***	-	0.010**	-
Consumer price index (2005)	-0.001	-	0.002	-
Services value added share	0.078*	-	0.071	-
Manufacturing value added share	-0.047	-	0.069	-
Agriculture value added share	-0.091*	-	-0.112**	-
Log labor force	-	-7.916***	-	-17.991***
Log gross fixed capital formation	-	3.802***	-	7.472***
Log exports of goods and services	-	2.422**	-	3.422***
Log REER	-	5.082***	-	1.353
World oil price index	-	0.067***	-	0.067***
World Metal price index	-	0.013	-	0.006
Observations	1015	1034	873	873
R2	0.058	0.383	0.910	0.858

Note: * ** and *** denote significance at the 10% 5% and 1% levels, respectively.

Overall, these results indicate that a positive variation in the dependencies is empirically associated with a negative variation in both GDP per capita and

the Gini index. In other words, resource dependence is associated with lower levels of GDP per capita, but also with lower income inequality. These results are consistent with the literature on Dutch disease, which explains them as an effect of the diversion of labor and capital from the industrial sector to the natural resource sector, combined with the negative effect of real exchange-rate appreciation on the tradable sector. However, the model's findings suggest that, on average, the inter-sectoral shift in labor patterns—which affects the distribution of income through rising wage differentials between sectors—is offset by the investment of additional fiscal revenue in pro-poor policy interventions. The literature highlights that the sign of the relationship between resource dependence and inequality is likely to depend on each country's institutional framework and the quality of its policy interventions. These factors determine whether—and how—natural resource revenues support rising productivity and consumption among lower-income households. The full-sample findings suggest that, policies designed to promote shared prosperity more than offset the increase in inequality caused by the inter-sectoral wage differential.

However, pooling such a heterogeneous mix of countries may undermine the reliability of the model's conclusions. The next section explores the issue of country-level heterogeneity by adding dummy variables to the baseline specification. The objective is to disentangle the influence of specific countries or groups of countries by disaggregating the dataset based on a likely explanatory variable, which in this case is country income level.

Controlling for Heterogeneity between Income Groups

The model specification presented below attempts to differentiate the impact of resource dependence on higher- and lower-income countries. The model

has been adjusted to include a dummy variable equal to 1 for low- and lower-middle-income countries and to 0 for high- and upper-middle-income countries. Within this framework, the coefficient associated with the interaction variable will measure the association between resource dependence, GDP per capita and the Gini index among lower-income countries, while the coefficient associated with the non-interaction variables permits to isolate the average relationship for higher-income countries. Table 7 summarizes the results obtained from both the sequential and the simultaneous estimation of the model.

Table 7: Estimated results accounting for income-group heterogeneity

	Fixed Effect		SURE	
	Gini index	**GDP_c**	**Gini index**	**GDP_c**
Nonrenewable resource dependence	-0.082***	-0.006	-0.190***	0.124
Lower income	dropped	dropped	4.386*	47.628***
Lower income* Nonrenewable resource dependence	0.068	-0.370***	0.115**	-0.720***
High-low education ratio	-0.622***	-	-0.179	-
High-low education ratio square	0.021***	-	0.010**	-
Consumer price index (2005)	-0.002	-	0.000	-
Services value added share	0.081*	-	0.071	-
Manufacturing value added share	-0.043	-	0.068	-
Agriculture value added share	-0.087	-	-0.110**	-
Log labor force	-	-6.538**	-	-17.058***
Log gross fixed capital formation	-	3.433***	-	7.237***
Log exports of goods and services	-	2.348**	-	3.519***
Log REER	-	5.852***	-	2.742
World oil price index	-	0.068***	-	0.066***
World metal price index	-	0.016	-	0.010
Observations	1015	1034	873	873
R2	0.060	0.392	0.911	0.863

Note: * ** and *** denote significance at the 10% 5% and 1% levels, respectively.

The results show that higher levels of resource dependence are associated with lower levels of income inequality among countries in the higher-income group. However, the association with the GDP per capita is not statistically different from zero for this group of countries. These findings are confirmed in both the fixed effect and the seemingly unrelated regression models. However, it is worth noting that when we consider the seemingly unrelated

system of equations the magnitude of the coefficient is significantly larger than in the other case.

The association within the lower income group shows a different picture. As for the income inequality equation, the estimated coefficient associated with the interaction term is not statistically different from zero using a fixed effect estimator, thus suggesting no association between income inequality and resource dependence. However, the sign turns to be positive and statistically different from zero when the system equations are estimated simultaneously (SURE estimator). The average association in this case is given by the difference between the coefficient of the interaction terms and the coefficient of not interacted dependence. The net effect (-0.190+0.115=- 0.075) is still inequality-reducing although to a lesser degree. Conversely, the coefficients estimated in the GDP equations show that a greater dependence is always associated with a lower level of GDP per capita, regardless of the estimation technique. All in all, the heterogeneity between country income groups allows to disentangle and clarify the results obtained in the pooled baseline models. From a methodological perspective, this heterogeneity affirms the importance of considering structural differences between countries at different stages of development. From a macroeconomic perspective, it lends credibility to the idea that the impact of natural resource dependence on income and inequality is a function of country-specific structural characteristics rather than an ineluctable curse. Within the higher income countries, the dependence from nonrenewable resources could be even a blessing since it resulted to be positively associated with more equal income distribution.

Analyzing a Subsample of Resource-Rich Countries

The model presented below focuses on a subset of countries defined as nonrenewable resource rich according to the IMF's 2013 Resource Governance Index Report.[20] The full sample included countries in which nonrenewable natural resources played a relatively modest economic role. Excluding these countries can shed light on the possibility that the empirical associations between resource dependence and the Gini index and GDP per capita are affected by the relative economic importance of natural resources. Furthermore, focusing on a subsample of resource-rich countries also tests the robustness of the estimated relationships by reducing the original sample by one-third[21]. Table 8 summarizes the subsample's composition by income group of the resulting restricted panel.

Table 8: Countries included in resource-rich sub-group, classified by income groups

	Absolute	Relative
High income	5	16.7%
Upper middle income	11	36.7%
Lower middle income	10	33.3%
Low income	4	13.3%
Total	30	100%

[20] Available at http://www.resourcegovernance.org/resource-governance-index/report

[21] Based on the IMF classification of resource-rich countries (see note 16), thirteen countries are dropped from our original dataset: Argentina, Bulgaria, France, Greece, Ireland, Italy, Japan, Republic of Korea, New Zealand, Spain, Thailand, Tunisia, and Turkey. The resulting sub-group thus comprises the remaining 30 countries.

According to the IMF report, "nations [rich in nonrenewable natural resources] produce 85% of the world's petroleum, 90% of its diamonds and 80% of its copper, generating trillions of dollars in annual profits."

Table 9 summarizes the empirical results of the model estimated for the subsample of resource-rich countries. The figures confirm the results of the full-sample model. The association between dependence and income inequality is negative for both the higher and lower income group) even if to a lesser degree (-0.177+0.129=0.048). As for the association with the GDP, we find no association in the higher income economies and a strong negative association in lower income countries. In other words, the subsample analysis confirms the robustness of the full-sample results. The magnitude of the coefficient, as expected, slightly increases relative to the full-sample model, but the sign of the associations and their economic implications remain unchanged. Restricting the analysis to resource-rich countries supports the conclusion that the impact of resource dependence on income inequality and economic growth depends on country-level characteristics. The following section discusses these results and provides the overall conclusions.

Table 9. Estimated results from the resource-rich subsample

	Fixed Effect		SURE	
	Gini index	**GDP**	**Gini index**	**GDP**
Nonrenewable resource dependence	-0.067**	0.008	-0.177***	0.122
Lower Income	dropped	dropped	6.090**	57.336***
Lower income * Nonrenewable resource Dependence	0.078	-0.362***	0.129**	-0.756***
High-Low education ratio	-0.418***	-	-0.159	-
High-Low education ratio square	0.015***	-	0.008*	-
Consumer Price Index (2005)	-0.010*	-	-0.003	-
Services value added share	0.130***	-	0.117**	-
Manufacturing value added share	-0.006	-	0.064	-
Agriculture value added share	-0.175***	-	-0.154**	-
Log Labour Force	-	-8.651***	-	-26.131***
Log Gross fixed capital formation	-	0.975	-	5.280***
Log Exports of goods and services	-	2.663**	-	6.042***
Log REER	-	5.057***	-	3.325
World Oil price index	-	0.081***	-	0.091***
World Metal price index	-	0.018	-	-0.001
Observations	667	707	580	580
R2	0.096	0.311	0.911	0.864

Note: * ** and *** denote significance at the 10% 5% and 1% levels, respectively.

Conclusions

This study was designed to investigate the empirical relationships between dependence on nonrenewable natural resources and income inequality and the GDP per capita. Innovating on the previous literature, it takes advantage on a wide dataset, which includes information on nonrenewable resource stock,

GDP per capita, income inequality (Gini index) and a bundle of control variables for 43 countries from five continents and covering the period from 1980 to 2012. Exploiting this panel, we estimated the two equations in the model either separately or simultaneously. The simultaneous estimation technique (SURE) allowed us to take into account the potential correlation among the error terms of the two-equation model.

The results of the baseline specification showed that an increase in resource dependence is associated with lower GDP per capita but a more equal income distribution. A subsequent specification addresses the problem of heterogeneity between countries at different income levels, since the descriptive statistics clearly pointed to substantial variations between country income groups. Controlling for the heterogeneity between higher-and lower-income countries reveals dramatically different empirical associations for each of these two groups. Among higher-income countries, resource dependence is associated with lower levels of income inequality while the association with the GDP per capita is not statistically different from zero. However, among lower-income countries greater resource dependence is associated lower per capita GDP and greater income inequality.

A third specification restricted the analysis to a subsample of resource-rich countries, which included about two-thirds of the countries included in the original full sample. The objective of this third specification was to increase the robustness of the findings by excluding the countries with lower endowment in non-renewable capital. The results largely corroborate those from the full-sample analysis. These findings further support the idea that whether natural resources are a blessing or a curse depends on country's structural characteristics.

Taken together, these findings point to a number of important policy implications. While resource dependence initially appears to correlate with lower per capita income, this association is nullified among high-income countries. One prospective explanation for this finding is that wealthier countries are systematically more likely to manage resource revenues effectively, and that they are more capable of mitigating their exposure to the inherent multidimensional volatility of the resource sector. By contrast, poorer countries are more likely to experience boom-and-bust economic cycles driven by unmediated external shocks and pro-cyclical expenditure policies, and due to weaker public financial and administrative systems, they may be less able to use resource revenues to promote broad-based improvements in productivity. These findings appear to confirm the results of previous analyses and literature, and they further underscore the importance of both reinforcing macroeconomic resilience and investing resource revenues in physical and human capital in order to facilitate the growth of the non-resource economy. However, in the absence of a comprehensive dataset providing systematic information on the quality of natural resources management for a broad number of countries (like those considered in this study), these conjectures cannot be thoroughly and empirically tested. Contingent to the availability of this type of data, further analysis investigating the role of the governance dimension in assessing natural resources management, and particularly in shedding light on the effects of policy and institutions on natural resource-rich countries' economic outcomes, would likely further the understanding of these phenomena. At the same time, the heterogeneous results obtained by distinguishing between higher- and lower-income countries strongly suggest that the policy framework plays a decisive role in determining whether natural resources are a blessing or a curse.

Chapter 3:

Fiscal Incentive and Firm's Performance. Evidence from Dominican Republic[22]

Keywords: Corporate Income Tax, Firm's Welfare, Panel data, Fixed and Random Effects

[22] *This analysis was conducted jointly with Alessandra Amendola, Marinella Boccia, and Luca Sensini, all affiliated with the University of Salerno.*

Introduction

Fiscal policy is among the most important means through which governments influence the business cycle. Sound fiscal policies can promote sustained and inclusive development and reinforce both social and economic stability. Tax expenditures, which are fiscally equivalent to more traditional forms of public spending, can play an important role in attracting specific types of private investment and rewarding the production of positive externalities. Tax expenditures include tax exemptions, deductions, tax holidays, and other policies that reduce the tax liability of specific sectors, firms, and individuals. The unique features of tax expenditures have made them both popular and controversial. Unlike public spending, tax expenditures are embedded in the tax code and are not recorded as outlays in the annual budget. They increase the complexity of the tax code, which raises both the private cost of tax compliance and the public cost of tax enforcement, while expanding opportunities for fraud.

Although tax exemptions are often intended to advance worthwhile policy goals, their public benefits can be difficult to gauge, while their private benefits create a strong incentive for firms and investors to lobby for preferential tax treatment, even when such treatment serves no clear policy objective.

Like many other countries, the Dominican Republic (DR) has introduced various tax expenditures designed to advance strategic development objectives. To use tax expenditures effectively, policy-makers must understand how they affect firm incentives and impact performance. Over the last two decades, an extensive empirical literature has emerged on the

determinants of firm productivity, competitiveness, and growth and the effect of taxation on these and other performance variables. Some studies have found that fiscal incentives can spur investment, create jobs, and generate other social and economic benefits (Bora, 2002). However, other research suggests that the costs of fiscal incentives both in foregone revenue and via their adverse effects on governance outweigh the benefits (Cleeve, 2008).

Microeconomic analyses have yielded mixed results. Firms that receive tax incentives appear to exhibit faster growth, better performance and a positive impact on firm productivity. However sometimes tax incentives and subsidized credit were not correlated with changes in total factor productivity. This paper contributes to the international literature by examining the impact of fiscal incentives on firm performance in the DR. The analysis is based on a firm-level dataset from 2006 to 2015, which the Dominican authorities provided to the World Bank.

The most relevant contribution of this analysis is related to the possible policy implications: in fact, as our results show, the existing exemption regime appears to directly affect the performance - and therefore the competitiveness - of firms, and thus the overall productivity of the economy. In particular, reducing the proven tax liabilities divide between the Special Economic Zones (SEZ) and non-SEZ firms would alleviate distortions and promote economy-wide competitiveness, thus contributing to put to an end the country's dual production and export structure.

In this paper a propensity score matching methodology was employed to investigate the potential impacts above described, considering various indicators of: Liquidity, GFSAL, ROS, ROA, STS and Turnover, as proxies of a firm's welfare. The analysis employs both a Nearest Neighbor Matching and a Radius Matching, as well as it allows for a covariates balancing test, in order to provide additional robustness to the results.

The paper is organized as follows: after this introduction, the following (second) section reviews the literature on the impact of fiscal incentive on firm's economic performance. The third section analyzes the role of the fiscal incentive[23]. The data and the empirical strategy are described respectively in the fourth and fifth sections. The sixth section is devoted to some descriptive statistics. The results are presented in the seventh section. Finally, the eighth section present the robustness tests, and the ninth and final section concludes the chapter.

Literature review

Many studies have attempted to evaluate the impact of fiscal incentives on firms' performance. These analyses have examined fiscal incentives in a wide range of countries and for a diverse set of reasons. Examining the effect of tax incentives on firms' gross sales and value added in Uganda, Mayende (2013) found that streamlining the tax-incentive structure would improve firms overall performance.

Ohaka and Agundu (2012) concluded that tax incentives had successfully increased the productivity and competitiveness of strategic sectors in Nigeria. Using propensity score matching, Rapuluchukwu et al. (2016) found that multiple types of fiscal incentives including import duty exemptions, profit tax exemptions, and export financing had a positive effect on firm productivity.

[23] Specifically and exclusively referred to Corporate Income Tax, based on available data.

Czarnitzki et al. (2011) also used a non-parametric matching approach to examine the effects of research and development (RD) tax credits on innovation among Canadian manufacturers and found that firms that received tax credits scored higher on most but not all performance indicators and that tax credits lead to additional innovation output. Lee (1996) examined the impact of the Korean government's industrial-promotion and trade-protection policies on productivity growth in the manufacturing sector, finding that while trade protections such as tariffs and import restrictions were negatively correlated with value addition, capital formation, and total factor productivity, industrial promotion policies and tax incentives in particular were positively correlated with increased output and higher rates of capital formation.

For governments around the world, increasing firm productivity is a critical policy goal. UNCTAD (2015) describes improving firm productivity as a path to sustainable industrial development.

In some cases, policymakers may regard the strategic allocation of fiscal incentives to firms and sectors as a way to offset the negative impact of an inhospitable business environment (Gui-Diby and Renard, 2015; UNCTAD, 2015). Yet despite their flaws, policy makers continue to embrace fiscal incentives as a viable tool for attracting and sustaining investment. To maximize their effectiveness while managing their externalities, some countries have attempted to directly link fiscal incentives to firm performance and narrowly tailor them to advance specific development goals (UNCTAD, 2004). Due to their diverse design features and the unique characteristics of each country's political and economic context, the impact of fiscal incentives on firm productivity varies from case to case.

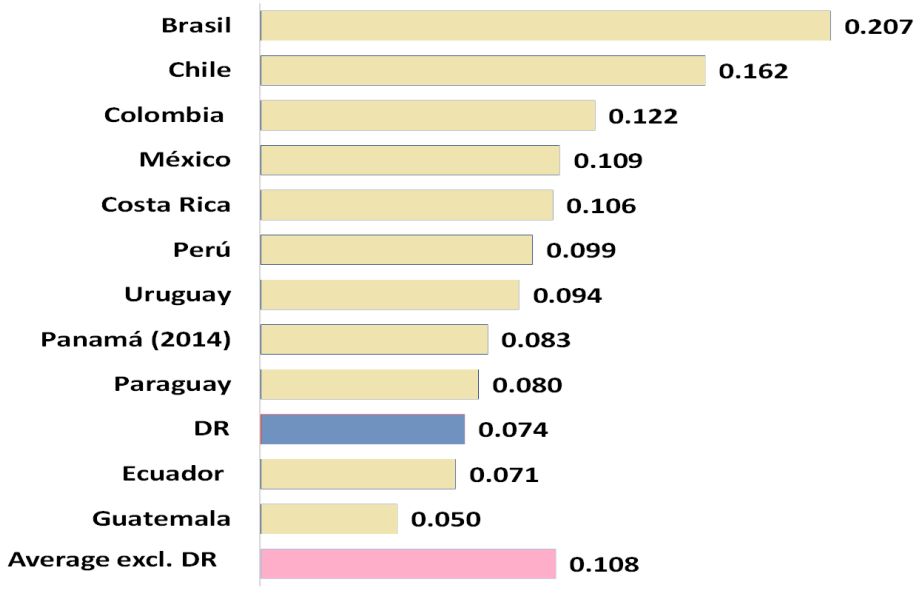
It is pertinent to highlight also the strand of literature referring to the principle of impartiality of the State in the economy, and to a more recent strand referring to concepts like Corporate Social Responsibility and Social Impact

Investment (e.g. Porter and Kramer, 2011), which essentially refer to the fact that corporate practices have the capacity of boosting the efficiency of a firm while – at the same time – pushing the agenda on social and economic macro issues; in other words, this refers to how private sector's choices can strengthen a symbiotic link between core business goals and the aspirations of a society.

Corporate Income Tax in the DR

Corporate income tax (CIT) is the Dominican Republic's second-largest source of tax revenue. It accounts for close to 20 percent of total tax revenues, and was equivalent to 1.6 percent of GDP (average 2002-15). Its rate in the Dominican Republic is among the highest in the region at 27 percent, but its revenue efficiency falls short vis-à-vis most comparator countries (Graph 1)[24].

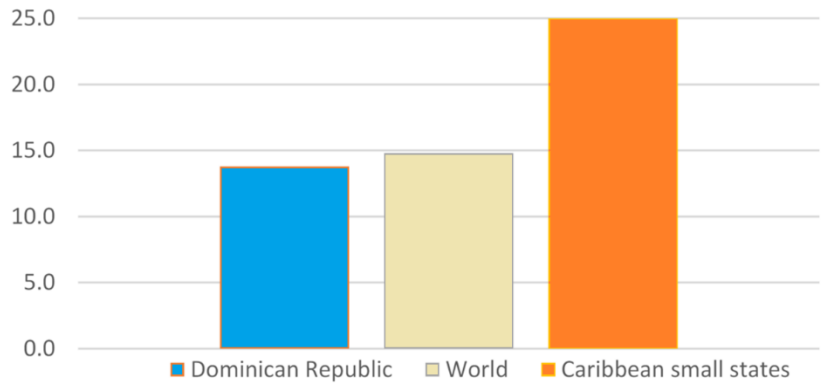
Graph 1. CIT Revenue efficiencies, DR and Regional Comparators, 2015 (source: WB)



[24] Gearing Up Tax Efficiency in the Dominican Republic, World Bank, 2017

In the DR, tax expenditures significantly weaken revenue mobilization and further constrain the governments already limited fiscal space. Despite recent efforts to boost tax efficiency, total public revenues reached just 14.6 percent of GDP in 2016, well below the peak of 16.6 percent observed in 2007. As a result, the DRs tax revenues are below the world average and far below the average for small states in the Caribbean (Graph 2).

Graph 2. Tax Revenue as a Percentage of GDP (2014 or most recent year)[25]



In recent years, the DRs tax expenditures have exceeded 6 percent of GDP, and they represent a larger share of total public spending than in many comparator countries. Tax expenditures include tax exemptions, deductions, tax holidays, and other policies that reduce the tax liability of specific sectors, firms, and individuals. The DRs tax expenditures are ostensibly designed to promote various economic development objectives, and since 2008 the

[25] Source: World Bank Development Indicators (WDI).

government has systematically monitored tax expenditures and published the estimated foregone revenue in a dedicated budget annex.

The DRs tax expenditures have become increasingly costly over time: total foregone revenue rose from 5.5 percent of GDP in 2010-13 to 6.6 percent in 2014-16. The country's National Development Strategy 2030 includes a plan to consolidate all existing tax-expenditure schemes into a single section of the tax code and to establish a coherent and sustainable approach to tax expenditures that reduces their fiscal impact and minimizes their distortive effect on economic incentives. The largest category of tax expenditures are exemptions and deductions from the DRs value-added tax (VAT), which is known as the Tax on the Transfer of Industrial Goods and Services (Impuesto sobre Transferencias de Bienes Industrializados y Servicios, ITBIS). Other major tax-expenditure categories include preferential rates for fuel products, estate tax deductions, and CIT incentives. Most of the latter accrue to firms located in SEZs. The CIT is subject to a complex and generous array of exemptions and tax credits, as well as long periods during which these exemptions can be claimed. In total, the DRs CIT expenditures equal close to 1 percent of GDP. Special CIT regimes apply to firms located in SEZs, tourism-development clusters, and specially designated regions, and many individual firms can claim additional exceptions to the standard regime. Under Law 8-1990, firms established in SEZs are fully exempt from the CIT, ITBIS, and all local taxes. Law 158-2001 exempts firms working in several tourism-development clusters from the CIT, ITBIS, and other taxes and fees. Law 195-2013 extended the tax exemption for newly established firms from 10 to 15 years. Law 28-2001 exempts firms located in border regions from the CIT and ITBIS, while Law 108-2010 provides tax incentives to firms related to the film industry, and Law 66-1997 provides incentives to renewable-energy companies. Whereas previous studies have examined the

impact of ITBIS incentives in the DR, the effects of CIT expenditures on investment and growth has yet to be fully assessed. The following analysis is designed to address that gap in the literature.

Graph 3. Tax expenditure as a percentage of GDP

(source: authors based on national authorities' data)

	Most recent year
Dominican Republic	6.5 (2016)
Uruguay	6,3 (2014)
Ecuador	4,6 (2016)
Chile	4,2 (2016)
Brasil	4.2 (2016)
Argentina	2,8 (2016)
Guatemala	2.5 (2015)
Perú	2.2 (2017)

Data

Data from tax returns can be used to analyze whether the DRs CIT-related tax expenditures correlate with significant difference in firm-level outcome indicators. In 2016, the Ministry of Finance provided an anonymized CIT dataset to the World Bank as a part of the authorities ongoing fiscal policy dialogue. The panel data include administrative CIT declarations for 2006-

2015 from more than 180,000 firms in 31 provinces. Though anonymized, the dataset contains important information about firm characteristics, including the economic sectors in which the firms operate, their ownership and capital structures, and their performance as measured by the outcome indicators described below. The dataset also records estimated forgone CIT revenue for each firm i.e., the amount of tax each firm did not pay due to fiscal incentives. Researchers rarely have access to such extensive and detailed tax information, and analyzing this dataset may yield important insights into the much debated but still ambiguous relationship between tax incentives and firm performance.

Methodology

The analysis utilized a propensity score matching estimator. This methodology (Rubin, 1977; Rosenbaum and Rubin, 1983; Heckman et al., 1997) is a statistical technique that can evaluate the effect of a treatment (for example, a program or public policy) by comparing treated (so-called treatment group) and untreated units (so-called control group).

The goal of the matching is to find, for every treated firm, one or more untreated firms that have similar observable characteristics but do not have access to a given (for instance) public program (Brodaty et al., 2007).

Once the matching has been conducted, the average treatment effect can be calculated for the group with access to the program (Average Treatment effect on the Treated or ATT). The counterfactual analysis enables to identify evaluators to attribute cause and effect between interventions and outcomes.

Let Ti be a binary variable which takes the value $Ti = 1$ for firms i having access to the treatment (Fiscal Incentive) and $Ti = 0$ for non-treated firms. Let Y be the potential outcomes of the treatment: Liquidity, GFSAL, ROS,

ROA, STS and Turnover. For example, considering Y_{i1} is the amount of Turnover of a firm i which has access to the treatment and Y_{i0} is the amount of turnover of a firm i which does not have access to the treatment. The average treatment effect on the treated will be:

$$\Delta ATT = E(Y_{i_1}|T_i = 1) - E(Y_{i_0}|T_i = 1) \qquad (1)$$

Since a given firm cannot simultaneously receive and not receive the treatment, $E(Y_{i0}|T_i = 1)$ is not observable. $E(Y_{i0}|T_i = 0)$ can be substituted to $E(Y_{i0}|T_i = 1)$ because the first is an observable quantity. Yet, doing this assumes that the behavior of a treated firm is identical to that of a non-treated, which holds true only if treated units have the same characteristics as the untreated ones. In order to verify this, we need two identifying assumptions: the common support condition and the conditional independence assumption (CIA).

The common support condition requires the presence of sufficient overlap across treated and non-treated firms' samples. The CIA instead assumes that there is a vector of firm characteristics (area, economic activity, cost of employees, value of building and so on) that describe the firm, irrespective of them having access to the treatment or not. On such assumption, let X be the vector of firm characteristics, thus the conditional independence assumption will be:

$$E(Y_{i_0}|T_i = 1) = E(Y_{i_0}|T_i = 0) \qquad (2)$$

Subsequently, the available information based on untreated units is used to build a counterfactual for each treated unit. This counterfactual measures how the beneficiaries of the exemption would have been, otherwise, in the absence of the given intervention (Bonnard, 2011).

Conditionally to the vector X of firm characteristics, the non-observable counterfactual $E(Y_{i0} \mid T_i = 1))$ is estimated by $E(Y_{i0} \mid T_i = 0))$. This estimation calls for the careful choice of the covariates belonging to vector X. On the one hand, the more accurate the vector X (i.e. the larger the vector X) is, the better the matching process will be. Yet the larger vector X, the harder it will be to find an identical untreated unit (i.e. with exactly the same set of characteristics) for each treated unit.

Rosenbaum and Rubin (1983) suggest matching units using a propensity score built on the basis of vector X to overcome the problem of the size of vector X. The propensity score P(X) is the probability of a firm to belong to the treatment group (i.e. having access to the program) given the vector X of firm characteristics. As Rosenbaum and Rubin (1983) put it:

$$P(X) = P\ (T_i = 1 \mid X).$$

Thus, the property of independence conditional on vector X is also true for P(X). This probability is estimated for the whole sample (treated and untreated units) using a multivariate estimation such as a logit or probit model. In this estimation, the dependent variable is the access or the lack of the access to the policy (i.e. in our case, benefitting from fiscal incentives) and vector X is used as an explanatory variable. As such, the estimated coefficients give the propensity score for each firm.

In line with the common support assumptions, the matching process requires that each treated unit is matched with a untreated unit whose propensity score

is not too far removed from the users score. Given the above, the average effect of the treatment on the treated units is:

$$\Delta ATT = E[E(Y_{i_1}|T_i = 1, P(X)) - E(Y_{i_0}|T_i = 0, P(X))] \qquad (3)$$

Variables choice

Caliendo and Kopeinig (2005) argument about the inclusion (or exclusion) of covariates in the propensity score model. The matching strategy builds on the Conditional Independent assumption(CIA), requiring the outcome variable(s) to be independent of the treatment conditional on the propensity score. Hence, implementing the matching requires choosing a set of variables X that credibly satisfy this condition.

Heckman, Ichimura, and Todd (1997) show that omitting important variables may severely increase the risk of bias in the resulting estimates. The only variables to be included should influence simultaneously the decision to participate and the outcome variable(s) (see also Smith and Todd (2005) or Sianesi (2004)).

It should also be clear that only the variables that are unaffected by the participation (or the anticipation of it) should be included in the model. To ensure this, variables should either be fixed over time or measured before the participation. In the latter case, it must be certain that the variable has not been influenced by the anticipation of participation. For this reason, in this analysis the outcome variables are taken at time t, the treatment (Corporate Income Tax exemption) at time t-1 and the covariates (Value of Buildings, Capital Stock, Land 's Ownership and Cost of employee) at time t-2; while the other covariates (dummies for provinces and for economic activities) are fixed over time.

Variables of Interest

To estimate the impact of CIT exemptions, several outcome indicators were selected as proxies of firms' performance. The profits of firms become income for share-holders and generate spillover and multiplier effects at the individual, household, and economy-wide level. Profitable firms attract more investors and raise greater amounts of capital to possibly finance larger scale and/or more sophisticated projects. Profitable firms also tend to employ more workers and have a greater impact on growth and poverty reduction.

Previous studies have typically approached the concept of firm performance from one of two perspectives. The first uses financial information to evaluate performance in monetary terms. The second uses non-financial information to assess aspects of performance that are more difficult to quantify. This analysis takes the first approach, leveraging the tax information provided by the government to assess the value generated by each firm in quantifiable fiscal and financial terms. The fiscal outcome indicators are the amount of CIT revenue paid by each firm and the amount of CIT revenue foregone due to fiscal incentives. The financial outcome indicators, which are proxies for firm performance, include measures of liquidity, operating structure, profitability, and turnover, each of which is expressed as a ratio (Table 2). The outcome indicators include one measure of liquidity that is the ratio of current assets to fixed assets, and two variables related to the firms' operating structure, the ratio of gross financial expenses to sales (GFSAL) and the ratio of net operating income to sales (ROS), the return on assets (ROA) as a

measure of profitability that is not affected by whether the assets are financed by creditors or shareholders. Finally, the ratio of sales to total assets (STS) and the ratio of sales to current assets represent measures of the turnover. These outcome indicators are the dependent variables of this analysis.

Selected covariates

Several additional firm characteristics are used as covariates. These include the capital stock, which sums the value of a firm's machinery and equipment and reflects its productive capacity (Arnold, Mattoo and Narciso (2008), Clarke (2012), and Rapuluchukwu et al. (2016)); the value of buildings, which reflects the quality of a firm's facilities and environs; the total cost of wage, which can be used as a measure of human capital (Arnold, Mattoo and Narciso, 2008) and the value of urban land owned by the firm is treated as a proxy for firm size. Firm size is an especially crucial explanatory variable, because larger firms tend to have greater productive capacity and resources, which enables them to take advantage of economies of scale. Large firms are also more likely to have access to qualified personnel. They tend to be more diversified, and are generally better able to weather economic shocks. Consequently, firm size is positively correlated with profitability. In this respect, it is worth noting that confirming Baumols size-profits hypothesis, Hall and Weiss (1967) also found a positive relationship between firm size and firm profitability, and this relationship was further supported by the findings of Nunes et al. (2008) and Babalola (2013).

Other explanatory variables are also included in the analysis. The impact of a firm's geographic location is accounted for by considering the provinces in which the DR is divided in which all firms enjoy broadly similar locational

advantages. The descriptions of both the outcomes of interest and the covariates selected are presented in the following tables (1 and 2).

Table 1: Outcomes of Interest

Term	**Variable**	**Indicator Type**
Liquidity	Current assets to Fixed assets	Liquidity
GFSAL	Financial Expenses to Sales	Operating Structure
Return on Sales (ROS)	Net Operating Income to Sales	Operating Structure
Return on Assets ROA	Net Income to Total assets	Profitability
STS	Sales to Total Assets	Turnover
Turnover	Sales to Current assets	Turnover

Table 2: Covariates Selected

Variables	**Description**
Capital stock	Value of a Firm's Machinery and Equipment
Building	Value of Buildings-capturing the firm's dimension
Employees Cost	Total Cost of Wage
Urban Land	Value of Land
Economic Activities	Dummies for Economic activities: Public administration; Rental; Trade; Communications; Construction, Grain Crop, Traditional Crops; Electricity, Gas and Water; Mining and Quarrying; Livestock, Forestry and Fisheries; Hotels Bars and Restaurants; Financial Intermediation, Insurance and Others; Manufacturing; Other Services; Agricultural Services; Teaching; Health Services, Transportation and Storage
Provinces	Dummies for Provinces

Treatment Indicator

The information regarding the materialization or not of fiscal incentives (given by the government to specific firms) is captured by the data. The treatment variable is a dummy variable called 'Corporate Income Tax' that takes the value of one if firms receive the Fiscal Incentive and pay no tax, or a value of zero otherwise. As clarified, the dataset provides exact information about the recipients of these incentives and their materialization.

Descriptive Statistics

This section summarizes the differences in the characteristics between beneficiary and non-beneficiary firms (Table 3). After carrying out the t-tests for continuous variables, the results suggest that there were differences among some of the firms that have access to the Corporate Income Tax exemption in most of the selected covariates. We also performed a chi-square test for categorical variables, but do not report it for brevity. All in all, causal inference requires to control for potential sources of bias; which is the reason why this analysis opted for a propensity score matching method.

Table 3. Differences in characteristics of beneficiaries and non-beneficiaries firms

Variables	Beneficiaries mean	Non-Beneficiaries mean	t-test.
Capital stock	3179562	6157773	***
Building	1.08e+07	1.05e+07	ns
Employees Cost	6827028	1.12e+07	***
Urban Land	4441331	5498850	**

Notes:* Significant at 10 per cent;** significant at 5 per cent;*** significant at 1 percent; ns non-significant.

Results

This section presents the results of the evaluation impact of Corporate Income Tax exemption in the Dominican Republic. The first part will discuss the determinants of such benefits, allowing for a Probit estimation; while the second part analyzes the effects of these incentives on firm's welfare, through a Nearest Neighbor Matching (NNM) and a Radius Matching (RM) estimation methods.

Determinants of Fiscal Incentives

In carrying out a PSM, the first step is to estimate the propensity scores for beneficiary and non-beneficiary firms. Table 4 reports the Probit model estimates of marginal effects for various observables. The likelihood of receiving the Incentive (i.e. Corporate Income Tax exemption) positively and significantly depends on most of the economic activities considered, except for Trade, Teaching and Health Services, for which a negative and significant evidence is reported.

As for the geographic determinants, the localization in the Provinces of Alt-agracia, Azua, Districto Nacional, La Romana, Montecristi, Puetro Plada, Samana, San Cristobal, San Pedro de Macoris, Santo Domingo appears to be an important factor to receive the benefits, while a negative or not significant result is evidenced for the other provinces.

Finally, firms with a higher value of buildings and land are most likely to be affected by the treatment, while the Cost of Employee has a negative and significant effect.

Table 4: determinants of Corporate Income Tax

VARIABLES	Corporate Income Tax
ALTAGRACIA	0.354***(0.0566)
AZUA	0.213** (0.0948)
BAHORUCO	0.0749 (0.195)
BARAHONA	0.0446(0.0798)
DAJABON	0.00299 (0.221)
DISTRITO NACIONAL	0.190***(0.0519)
DUARTE	-0.0395 (0.0641)
EL SEYBO	-0.371***(0.104)
PESPAILLAT	-0.311***(0.0637)
HATO MAYOR	-0.00699(0.0955)
INDIPENDENCIA	0.155(0.193)
LA ROMANA	0.455***(0.0563)
LAVEGA	0.0288(0.0573)
MARIA TRINIDAD SANCHEZ	0.109(0.0770)
MONSEOR NOUEL	-0.107(0.0755)
MONTE PLATA	0.0110(0.148)
MONTECRISTI	0.505***(0.0873)
PERNADALES	0.200(0.271)
PERAVIA	0.00185(0.0733)
PUERTO PLATA	0.223***(0.0552)
SALCEDO	-0.264***(0.0867)
SAMANA	0.810***(0.0651)
SAN CRISTOBAL	0.247***(0.0563)
SAN JOSE DE OCOA	-0.265*(0.160)
SAN JUAN DE LAMAGUANA	-0.221***(0.0835)
SAN PEDRO DE MACORIS	0.222***(0.0607)
SANCHEZ RAMIREZ	-0.155*(0.0805)
SABTIAGO DE LOS CABALLEROS	0.0265 (0.0528)
SANTIAGO RODRIGUEZ	-0.189(0.142)
SANTO DOMINGO	0.185***(0.0523)
PUBLIC ADMINISTRATION	0.236(0.202)
RENTAL HOUSING	0.481***(0.0180)
TRADE	-0.0595***(0.0165)
COMMUNICATION	0.345***(0.0277)
CONSTRUCTION	0.237***(0.0194)
GRAIN CROP	0.0700(0.0765)
TRADITIONAL CROP	0.315***(0.0418)
ELETTRICITY, GASW, WATER	-0.0534(0.0450)
MINE AND QUARRIG	0.445***(0.0814)
LIVESTOCK, FORESTRY AND FISHERIES	0.254***(0.0404)
HOTEL, BAR , RESTAURANTS	0.340***(0.0251)
FINANCIAL INTERMEDIATION, INSURANCE	0.493***(0.0213)
MANUFACTURING	0.219***(0.0188)
OTHER SERVICES	0.249***(0.0175)
AGRICULTURE SERVICES	0.356***(0.0371)
TEACHING	-0.236***(0.0371)
HEALTH SERVICES	-0.286***(0.0282)
Capital Stock	3.58e-11 (5.39e-11)
Building	2.05e-10 ***(3.12e-11)
Employee's Cost	-1.17e-09 ***(1.32e-10)
Land's Ownership	1.24e-10 ***(4.64e-11)
Constant	-0.743 ***(0.0539)
Observations	152,357

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Types of Matching employed

The estimated scores are then used for matching the participating and non-participating firms. The techniques that have been used in the matching process are: Nearest Neighbor Matching (NNM) and Radius Matching (RM). The NNM consists of matching each treated firm with the control firms that have the closest propensity score. As usual, we apply this method through replacement, which means that a control unit can be a best match for more than one treated unit. However, there may be problems of poor matching if the propensity scores are too far from one another. So, before performing the matching, a common support region is defined. In the Radius Matching (RM) approach, a firm from the control group is chosen as a matching partner for a participant that lies within the specified radius in terms of propensity score. Table 5 reports the results related to NNM and RM for all the outcomes of interest and shows (for both the types of Matching employed) positive effects for most of the variables considered.

Table 5 Propensity Score Matching-Results

VARIABLES	Nearest Neighbor Matching	Radius Matching
Liquidity	**268.08 (493.24)**	**268.14 (493.21)**
Number of treated units	36,258	36,251
Number of untreated units	73,976	73,975
GFSAL	**17295.32 *(9416.60)**	**17295.32 *(9416.60)**
Number of treated units	15,724	15,724
Number of untreated units	34,802	34,802
ROS	**2.56 **(1.22)**	**2.56 **(1.22)**
Number of treated units	15,956	15,951
Number of untreated units	35,207	35,206
ROA	**22463.54 (22462.53)**	**22464.74 (22463.73)**
Number of treated units	37,513	37,515
Number of untreated units	76,747	76,747
STS	**2.23 *(1.32)**	**2.23 *(1.31)**
Number of treated units	20,393	20,293
Number of untreated units	37,216	37,216
Turnover	**19.02 ** (9.16)**	**19.03 **(9.16)**
Number of treated units	18,619	18,615
Number of untreated units	36,856	36,836

Notes: * Significant at 10 per cent; ** significant at 5 percent; *** significant at 1 percent. Standard errors are reported in parentheses.

Robustness and Balancing Test

This analysis also doublechecked the robustness of ATT estimations through different matching algorithms, obtaining positive confirmation that the ATT estimations are robust across them. Moreover, the Propensity score estimation warrants a balance in the distribution of independent variables in the two groups of firms (beneficiaries and not). Figure 1 and 2 show the distribution and common support for the propensity score estimation both for the NNM than the RM. All the treated and untreated firms were within the region of

common support, indicating that all treated firms have corresponding untreated firms.

Figure 1: Nearest Neighbor Matching (NNM)

Figure 1: Propensity score distribution and common support for Propensity Score Estimation-NNM

Figure 2: Radius Matching (RM)

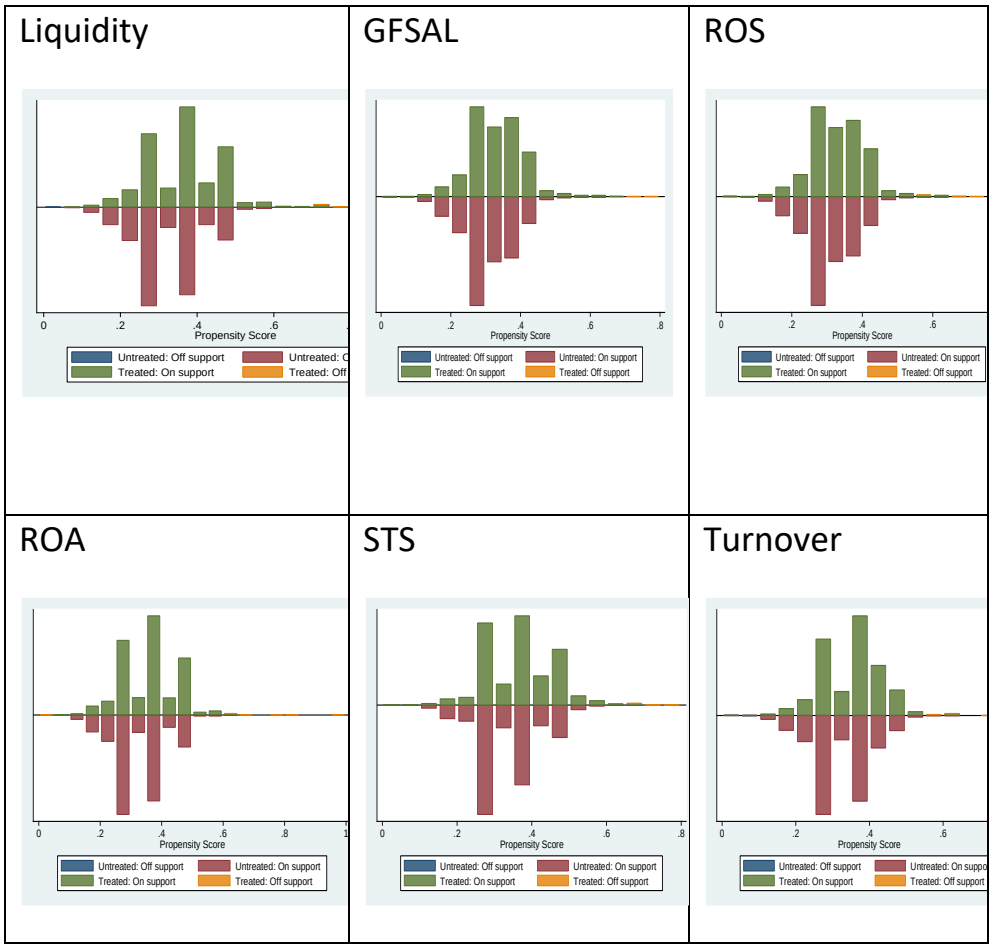


Figure 2: Propensity score distribution and common support for Propensity Score Estimation-RM

Matching Balancing Test

The conclusive results of this analysis (Table 6 and 7) indicate that there was a substantial reduction in both the mean and median bias as a result of the matching, which strengthens the robustness of the results.

Moreover, the results of the pseudo-R2 after the matching were all lower than before the matching, and for all the matching algorithms. This implies that

after the matching there are no systematic differences in the distribution of covariates between treated and control firms.

Also, the value of B, that is the absolute standardized difference of the means of the linear index of the propensity in the treated and (matched) non-treated group, and R, that is the ratio of treated to (matched) non-treated variances of the propensity score index are both within the Rubin's parameters.

Table 6: Balancing Test-Results-NNM

Outcomes	U and M	Ps-R2	Mean Bias	Med Bias	B	R
Liquidity	U	0.033	4.4	2.9	43.7*	1.07
	M	0.001	0.8	0.5	7.3	1.03
GFSAL	U	0.021	3.7	2.3	34.5*	0.89
	M	0.000	1.0	0.7	7.9	0.82
ROS	U	0.021	3.6	2.2	34.3*	0.90
	M	0.001	0.9	0.7	8.7	1.44
ROA	U	0.028	4.1	3.0	40.3*	0.90
	M	0.001	0.8	0.6	8.7	1.31
STS	U	0.027	4.0	2.7	39.2*	0.92
	M	0.002	0.5	0.5	9.1	1.36
Turnover	U	0.023	3.8	2.5	36.5*	0.89
	M	0.002	1.1	0.6	11.2	1.59

Notes: The table reports the Ps R2, that is the Pseudo R2 from Probit estimation of the conditional treatment probability (propensity score) on all the variables before and after matching, the mean and median bias as summary indicators of the distribution of the abs(bias),the Rubins' B (the absolute standardized difference of the means of the linear index of the propensity score in the treated and (matched) non-treated group) and the Rubin's R (the ratio of treated to (matched) non-treated variances of the propensity score index). Rubin (2001) recommends that B be less than 25 and that R be between 0.5 and 2 for the samples to be considered sufficiently balanced. An asterisk is displayed next to B and R for values that fall outside those limits.

Table 7: Balancing Test-Results-RM

Outcomes	U and M	Ps-R2	Mean Bias	Med Bias	B	R
Liquidity	U	0.033	4.4	2.9	43.7*	1.07
	M	0.001	0.8	0.5	7.3	1.03
GFSAL	U	0.021	3.7	2.3	34.5*	0.89
	M	0.000	1.0	0.7	7.9	0.82
ROS	U	0.021	3.6	2.2	34.3*	0.90
	M	0.001	0.9	0.7	8.7	1.52
ROA	U	0.028	4.1	3.0	40.6*	0.98
	M	0.001	0.8	0.6	8.7	1.31
STS	U	0.027	4.0	2.7	39.2*	0.92
	M	0.002	0.5	0.5	9.1	1.36
Turnover	U	0.023	3.8	2.5	36.5*	0.87
	M	0.002	1.1	0.7	11.2	1.56

Notes: The table reports the Ps R2, that is the Pseudo R2 from Probit estimation of the conditional treatment probability (propensity score) on all the variables before and after matching, the mean and median bias as summary indicators of the distribution of the abs(bias),the Rubins' B (the absolute standardized difference of the means of the linear index of the propensity score in the treated and (matched) non-treated group) and the Rubin's R (the ratio of treated to (matched) non-treated variances of the propensity score index). Rubin (2001) recommends that B be less than 25 and that R be between 0.5 and 2 for the samples to be considered sufficiently balanced. An asterisk is displayed next to B and R for values that fall outside those limits.

Policy Conclusions

This paper aims to evaluate the impact of CIT Incentives on firms' performance in the Dominican Republic, by applying a propensity score matching to a database provided by country authorities to the World Bank. The results provide clear and compelling evidence that firm receiving incentives outperform their peers on a wide range of financial metrics of interest. The estimations are robust to all the types of matching considered (Nearest Neighbor Matching and Radius Matching) and support the balancing test. In line with these results authorities should consider levelling the playing field by reducing or rationalizing CIT incentives. Firms located in SEZs tend to benefit most from fiscal incentives, and receive a full and permanent exemption from CIT.

As the analysis shows, the existing CIT exemptions regime directly affects the firm performance, with negative implications for competition, and thus the overall economic productivity. Reducing the asymmetry in the tax treatment between SEZ and non-SEZ firms could alleviate distortions as a first step toward phasing out the DR's dual production and export structure[26], although this may likely face strong opposition from vested interests. Increasing the neutrality of the tax system would also help fighting tax avoidance, thus having a positive effect on addressing informality.

[26] Cfr. Building a better future together in the Dominican Republic, World Bank, 2016

References/Bibliography

Chapter 1:

Armendáriz, B. & Morduch, J. (2010). *The economics of microfinance* (2nd ed.). Cambridge MA.: The MIT press.

Attanasio, O., Battistin, E. & Padula, M. (2010). *Inequality and Living Standards since 1980*. American Enterprise Institute for Public Policy Research Press. http://hdl.handle.net/10278/22684.

Banerjee, A., Duflo, E., Glennerster, R., & Kinnan, C. (2015). *The miracle of Microfinance? Evidence from a Randomized Evaluation.* American Economic Journal: Applied Economics, 7 (1), 22-53. http://dx.doi.org/10.1257/app.20130533.

Beck, T., Demirgűç-Kunt, A., & Levine, R. (2007). *Finance, Inequality and Poor: Cross Country Evidence*. Journal of Economic Growth, 12 (1), 27-49. http://doi.org/10.1007/s10887-007-9010-6.

Becker, A. & Woessmann, L. (2009). *Was Weber Wrong? A Human Capital Theory of Protestant Economic History*. The Quarterly Journal of Economics, 124 (2), 531-596. https://doi.org/10.1162/qjec.2009.124.2.531

Boonperm,J., Haughton, J., & Khandker, S. R. (2013). *Does the Village Fund matter in Thailand?Evaluating the impact on incomes and spending*. Journal of Asian Economies, 25, 3-16. http://dx.doi.org/10.1016/j.asieco.2013.01.001.

Burgess, R. & Pande, R. (2003). *Do rural banks matter? Evidence from the Indian social banking experiment*. The American Economic Review, 95 (3), 780-795. http://dx.doi.org/10.1257/0002828054201242

Ciang, T.T., Wang, G., , & Chien, N.D. (2015). *How Credit affects the poor household Expenditure? A case study of Vietnam.* Journal of Finance and Economics, 3 (1), 31-43. http://dx.doi.org/10.12735/jfe.v3i1p31

Diagne, A. & Zeller, M. (2001). *Access to Credit and its Impact on Welfare in Malawi. International Food Policy* Research Institute. Research Report, 116.

Desai, J., Johnson, K., & Tarozzi, A. (2015). *The Impacts of Microcredit: Evidence from Ethiopia*. American Economic Journal: Applied Economics, 7 (1), 54-89. http://dx.doi.org/10.1257/app.20130475

Honohan, P. (2004). Financial Development, Growth and Poverty: How Close Are the Links? (World Bank Policy Research Working Paper 3023). Washington, D.C.: The World Bank. http://hdl.handle.net/10986/14439

Honohan, P. & M. King (2012). *Cause and Effects Access: Cross-Country Evidence From the Finscope Survey*. IIIS Discussion paper No.339.

Kaboski, J.P. & Townsend, R.M. (2012). *The Impact of Credit on Village Economies.* American Economic, Journal: Applied Economics, 4 (2), 98–133. https://www.aeaweb.org/articles?id=10.1257/app.4.2.98

Karlan, D. & Zinman, J. (2010). *Expanding Credit Access: Using Randomized Supply Decisions to Estimate the Impacts*. Review of Financial Studies, 23 (1), 433-464. https://doi.org/10.1093/rfs/hhp092

Khandker, S.R. & Faruqee, R.R. (2003). *The Impact of Farm Credit in Pakistan*. Agricultural Economics, 28 (3), 197-213. http://dx.doi.org/10.1016/S0169-5150(03)00017-3

Khandker, S.R. (2005). *Microfinance and Poverty: Evidence Using Panel Data from Bangladesh.* The World Bank Economic Review, 19, 263-286. https://doi.org/10.1093/wber/lhi008

Mahjabeen, R. (2008). *Microfinance in Bangladesh: Impact on households, consumption and welfare*. Journal of Policy Modeling, 30 (6), 1083–1092. http://dx.doi.org/10.1016/j.jpolmod.2007.12.007

Mosley, P. & Hulme, D. (1998). *Microenterprice Finance: is there a conflict between Growth and Poverty Alleviation?*. World Development, 26 (5), 783-790. http://dx.doi.org/10.1016/S0305-750X(98)00021-7

Morduch, J. (1998). *Does microfinance really helps the poor? New evidence from Flagship programs in Bangladesh.* New York University. New York, NY: NYU Wagner.

Morduch, J. & Haley, B. (2002). *Analysis of the Effects of Microfinance on Poverty Reduction.* NYU Wagner Working Paper No. 1014. New York, NY: NYU Wagner.

Pitt, M. & Khandker, S.R. (1998).*The impact of group-based credit on poor households in Bangladesh: Does the gender of participants matter?* Journal of Political Economy, 106 (5), 958-996. http://dx.doi.org/10.1086/250037

Robinson, M.S. (2001). *The microfinance revolution: Sustainable finance for the poor* (Vol. 1). Washington, D.C.: The World Bank.

Notes

Note 1. See, e.g., Pitt and Khandker (1998), Robinson (2001); Morduch & Haley (2002); Khandker (2003); Mahjabeen (2008); Armendáriz & Morduch, (2010); Boonperm, Haughton, Khandker, (2013); and Kaboski and Townsend, (2012).

Note 2. Given the limitation of data it was no possible to distinguish between access to credit from banks or from other institutions.

Note 3. See, e.g., Pitt and Khandker (1998), and Kaboski and Townsend (2012).

Note 4. Cf. ONS 2013, « *Recensement général de la population* » http://www.ons.mr.

Note 5. ONS-ILO Joint Labor Survey, 2013.

Note 6. Mauritania Economic Update 2014, World Bank.

Note 7. World Bank, 2007.

Note 8. Cf. Mauritania Country Partnership Strategy, World Bank, 2013.

Note 9. World Bank. 2013.

Note 10. *Ibidem*.

Note 11. African Development Fund (2007). Mauritania Appraisal Report, PRECAMF.

Note 12. See also Attanasio, Battistin and Padula (2010) for a discussion.

Note 13. The value of consumption of household production, total spending on nondurable goods and food spending are equivalised considering per capita expenditure. Expenditures are measured in “milliers d'ouguiyas”.

Note 14. The analysis below was also performed by region. This is not reported in its entirety for reasons of brevity. Mauritania’s territory was divided into three macro zones, by clustering regions: Zone 1 (Nouakchott, Dakhlett Nouadibou) Zone 2 (Gorgol, Brakma, Traza, Guidimagha) and Zone 3 (Hodh Charghy, Hodh Gharby.Assaba, Adrar, Tagant, Tirs-Ezemour, Inchiri). The subdivision in zones reflects various structural characteristics at the

subnational level. Zone 1 represents the most populated and urbanized areas, some of the most productive and economically active in the country. Zone 2 corresponds roughly to the Senegal valley regions; these areas are structurally different from the Sahelian regions, as they rely more on agricultural activities and are significantly less sparsely populated than desert areas. Zone 3 is obtained as a residual. The analysis by macro areas showed that the zone 1 presented a positive effect of access to credit on education expenditure and poverty reduction. A negative effect on self-production was found for the other two macro areas.

Note 15. See also Pitt and Khandker (1998) for a discussion.

Note 16. Meaning, if the analysis is repeated by omitting some of the distances, the results do not change.

Note 17. An analogous approach was employed by Becker and Woessmann, (2009), who showed that Protestantism had a strong effect on literacy by using "Distance to Wittenberg" as an instrument for the share of Protestants in each county. They corroborate the identifying assumption by showing that distance to Wittenberg is indeed unrelated to a series of proxies for economic and educational development before 1517, including the pre-Luther placement of schools, universities, monasteries, and free imperial and Hanseatic cities.

Note 18. The analysis was computed between the two variables (separately).

Note 19. Computed from the main sample.

Chapter 2:

Alessandrini, Michele and Tullio Buccellato. 2009. "Natural Resources: A Blessing or a Curse? The Role of Inequality." Discussion Paper 98 2009(October).

Barbier, Edward B. 2014. "Account for Depreciation of Natural Capital." Nature 515:32–33.

Barbier, Edward B. 2015. "Wealth Inequality." Pp. 1–30 in Nature and Wealth, vol. 1, edited by Intergovernmental Panel on Climate Change. Cambridge: Palgrave Macmillan. Retrieved (http://ebooks.cambridge.org/ref/id/CBO9781107415324A009).

Barro, Robert J. and Jong Wha Lee. 2013. "A New Data Set of Educational Attainment in the World, 1950–2010." Journal of Development Economics 104:184–98. Retrieved (http://dx.doi.org/10.1016/j.jdeveco.2012.10.001).

Behzadan, Nazanin, Richard Chisik, Harun Onder, and Bill Battaile. 2017. "Does Inequality Drive the Dutch Disease? Theory and Evidence." Journal of International Economics 106:104–18. Retrieved (http://dx.doi.org/10.1016/j.jinteco.2017.02.003).

Brahmbhatt, M., O. Canuto, and E. Vostroknutova. 2010. "Dealing with Dutch Disease." World Bank's PREM Economic Premise series (16).

Brunnscheweiler, Christa N., and Bulte Erwin H. 2008. "The resource curse revisited and revised: A tale of paradoxes and red herrings." Journal of Environemntal Economics and Management 55 (2008) 248-264.

Bunte, Jonas. 2011. "Why Does the Severity of the Dutch Disease Vary across Countries ?" Pp. 1–29 in International Political Economy Society Conference Paper. Retrieved (https://ncgg.princeton.edu/IPES/2011/papers/S900_rm2.pdf).

Darvas, Zsolt. 2012. Real Effective Exchange Rates for 178 Countries: A New Database.

Dasgupta, Partha. 2010. "The Place of Nature in Economic Development." Pp. 4977–5046 in Handbook of Development Economics, vol. 5, Handbook of Development Economics. Elsevier. Retrieved March 23, 2016 (http://www.sciencedirect.com/science/article/pii/B9780444529442000124).

Fum, Ruikang Marcus and Roland Hodler. 2010. “Natural Resources and Income Inequality: The Role of Ethnic Divisions.” Economics Letters 107(3):360–63. Retrieved (http://dx.doi.org/10.1016/j.econlet.2010.03.008).

Furtado, Celso. 1968. "The Economic Growth of Brazil: A Survey from Colonial to Modern Times". University of California Press, Berkeley

Gylfason, Thorvaldur. 2001. “Nature, Power and Growth.” Scottish Journal of Political Economy 48(5):558–88. Retrieved (http://doi.wiley.com/10.1111/1467-9485.00215).

Gylfason, Thorvaldur and Gylfi Zoega. 2002. Inequality and Economic Growth: Do Natural Resources Matter ?

van der Ploeg, F. and S. Poelhekke. 2009. “Volatility and the Natural Resource Curse.” Oxford Economic Papers 61(4):727–60. Retrieved (https://academic.oup.com/oep/article-lookup/doi/10.1093/oep/gpp027).

Robinson, James A., Ragnar Torvik, and Thierry Verdier. 2006. “Political Foundations of the Resource Curse.” Journal of Development Economics 79(2):447–68. Retrieved (http://linkinghub.elsevier.com/retrieve/pii/S0304387806000137).

Sachs, Jeffrey D. and Andrew Warner. 1995. Natural Resource Abundance and Economic Growth. Cambridge, MA. Retrieved (http://www.nber.org/papers/w5398.pdf).

Sachs, Jeffrey D. and Andrew M. Warner. 1999. “The Big Push, Natural Resource Booms and Growth.” Journal of Development Economics 59(1):43–76. Retrieved (http://linkinghub.elsevier.com/retrieve/pii/S030438789900005X).

Sachs, Jeffrey D. and Andrew M. Warner. 2001. “The Curse of Natural Resources.” European Economic Review 45(4–6):827–38. Retrieved (http://linkinghub.elsevier.com/retrieve/pii/S0014292101001258).

Chapter 3:

Alvarez, R. and Crespi, G. and Cuevas, C. (2012), Public Programs, Innovation, and Firm Performance in Chile, Inter-American Development Bank.

Arnold, J., Mattoo, A., and Narciso, G., (2008), Services Inputs and Firm Productivity in Sub-Saharan Africa: Evidence from Firm-Level Data, Journal of African Economies, 17(4): 578-599.

Bora, B. (2002) Investment Distortions and the International Policy Architecture, World Trade Organisation, Working Paper, Geneva. Retrieved from https://core.ac.uk/download/files/35/272221.pdf Bureau of Economic and Business Affairs (2013), 2013 Investment Climate Statement – Cameroon, Retrieved from http://www.state.gov/e/eb/rls/othr/ics/2013/204615.htm.

Brodaty T., Crepon B., Fougre D. (2007), Les mthodes microconomtriques d'evaluation et leurs applications aux politiques actives de lemploi , Economie et Prvision, Vol.1, n177, pp.93-118.

Cleeve, E., (2008), How Effective Are Fiscal Incentives to Attract FDI to Sub-Saharan Africa? The Journal of Developing Areas, 42(1): 135-153.

Clarke, G. (2012), Manufacturing Firms in Africa: Some Stylized Facts about Wages and Productivity , In Dinh, H.T., and Clarke, G.R.G., (Eds.), Performance of Manufacturing Firms in Africa: An Empirical Analysis: 47-83, Washington: World Bank.

Caliendo M. and Kopeinig S. (2008), Some pratical guidance for the implementation of Propensity Score Matching , Journal of Economic Surveys, Vol.22, No.1, pp. 31-72

Czarnitzk, D., Hanel, P. and Rosa, J.M. (2011), Evaluating the Impact of RD Tax Credits on Innovation: A Microeconometric Study on Canadian Firms, Research Policy, Vol.40, No.2, pp. 217-229.

Duch N., Montolio S. and D and Mediavilla M. (2007), Evaluation the impact of public subsidies on a firm's performance: a quasi experimental approach , IEB.

Heckman, J., R. LaLonde, and J. Smith (1999, The Economics and Econometrics of Active Labor Market Programs , Handbook of Labor Economics Vol.III, ed. by O. Ashenfelter, and D. Card, pp. 18652097. Elsevier, Amsterdam.

Lee, J., (1996), Government Interventions and Productivity Growth, Journal of Economic Growth, 1(3): 391- 414.

Leuven, E., and B. Sianesi (2003, PSMATCH2: Stata Module to Perform Full Mahalanobis and Propensity Score Matching, Common Support Graphing, and Covariate Imbalance Testing ,Software, http://ideas.repec.org/c/boc/bocode/s432001.html.

Mayende, S., (2013), The Effects of Tax Incentives on Firm Performance: Evidence from Uganda, Journal of Politics and Law, 6(4): 95-107.

Ohaka, J., and Agundu, P.U., (2012), Tax Incentives for Industry Synergy in Nigeria: A Pragmatic Proprietary System Advocacy, African Research Review, 6(3): 42-58.

Porter, Michael E., and Mark R. Kramer (2011). Creating Shared Value. Harvard Business Review 89, nos. 1-2 (Jan–Feb 2011): 62–77

Rapuluchukwu, E. U., Belmondo, T.V. Ibukun, B. (2016), Incentives and Firms Productivity: Exploring Multidimensional Fiscal Incentives in a Developing Country, OCP Policy Center, Research paper.

Rosembaum P.R. Rubin D.B. (1983), The Central Role of the Propensity Score in Observational Studies for Causal Effects , Biometrika, 70(1), pp. 41-55.

Rosembaum P.R. (1985), Constructing a Control Group Using Multivariate Matched

Sampling Methods that Incorporate the Propensity Score , The American Statistican, 39, 3338.

Rubin D. (1977), Assignement to Treatment Group on the Basis of a Covariate, Journal of educational Statistics, Vol.2 (1).

Sianesi, B. (2004), An Evaluation of the Active Labour Market Programmes in Sweden, J The Review of Economics and Statistics, 86(1), 133155.

Smith, J.A. Todd, P.E.,(2005), Does matching overcome LaLondes critique of nonexperimental estimators? , Journal of Econometrics 125, pp. 305-353.

UNCTAD (2015), Broadening the Sources of Growth in Africa: The Role of Investment, Geneva: UNCTAD.