Impacts of Official Development Assistance (ODA) on Basic Living Conditions in Madagascar

By

NY AINA IANJATINA, Andrianony

THESIS

Submitted to

KDI School of Public Policy and Management

In Partial Fulfillment of the Requirements

For the Degree of

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ABSTRACT

Impacts of Official Development Assistance (ODA) on Basic Living Conditions in Madagascar

Madagascar is classed among the poorest country in the world, ranked 208th out of 213 countries in terms of GDP per capita. The country is classed in the low-income category with a GDP per capita of 495.49 US dollar in 2020. It is estimated that 75% of people in Madagascar live on less than $1.90 per day. The country is weak and fragile in responding to economic, social or political shocks; that is the reason why external assistance is principally needed. In this context, this study conducts in-depth analysis on this area, to present the effects of external assistance (ODA) on basic living conditions of the population in terms of income, education, health and infrastructures. The results indicate a positive relationship between Oda and Income, Education and Infrastructures; nonetheless, there is a negative relationship between Oda and Crude Death Rate, controlling for main changes years in the data.

Keywords: Oda, Basic Living Conditions, Income, Education, Health, Infrastructures, Political crisis.

TABLE OF CONTENT

LIST OF TABLES

LIST OF GRAPHICS

INTRODUCTION

Madagascar is classed among the poorest country in the world. It is estimated that 75% of people in Madagascar live on less than $1.90 per day[1]. Living conditions in Madagascar remain difficult. Poor results in terms of infant mortality, school attendance, literacy and primary school completion rates, malnutrition, access to transport, electricity and drinking water are significant (World Bank, 2020)

Madagascar's human capital is one of the lowest in the world, the country is classed among the highest rates of chronic malnutrition, and nearly one in two children under five suffer from late growth. About 97% of 10-year-old Malagasy children cannot read. And 4 out of 10 children drop out of primary school. (World Bank, 2020)

The country is weak and fragile in responding to economic, social or political shocks; that is the reason why external assistance is principally needed.

Madagascar appears to be dependent on external aid, always listed as one of Heavily Indebted Poor Countries in the World (HIPC). According to OECD report in 2020, the economic and social dimensions; areas such as aid dependance, low performance in education sector, lack of basic living standard such as a huge level of food insecurity and lack of basic health services, resource dependance merit greater attention to improve Madagascar's performance.[2]

Recently, researchers in the field of development have turned their attention to the important issue of foreign aid to developing countries. The relationship between ODA and basic living conditions have been the subject of controversies. On one hand, many scholars

[1] WDI, World Bank
[2] OECD, “States of Fragility”, 2020

investigated the impact of development assistance on economic growth, education, health and infrastructure and their results were significant; they found that external assistance has positive impacts on basic living conditions (Hugon, 1973; Collier & Dollar, 2001,2002; Suphian & Kim, 2016; Eregha & Oziegbe, 2016; Sekanabo ,2016; Dakwa, 2018; Dand et al., 2020; Ben Saad, 2012; Poirier, 2020). On another hand; others research found a negative or no relationship between ODA and growth, education, health and infrastructures (Burnside & Dollar, 2000; Ferreira & Simoes, 2013; Easterley, 2017; Yiew & Lau, 2018; Ogieva & Okungbowa, 2018, Nwude et al., 2020).

Despite the growing number of research in the area of Official Development Assistance and its effect on economic development, there remains a gap in the literature empirically testing whether the recipient country likewise Madagascar can allocate aid efficiently. To the author's best knowledge, this is one of the first paper that formally examines empirically the effects of external aid on economic performance in the case of Madagascar.

This paper aims to find out whether external aid has a positive, negative or no impact on basic living conditions in Madagascar. The problem is that, despite the huge amount of ODA received, its basic living conditions in the areas of education, health and infrastructures do not seem to be improving. Aid might have positive impact but it is hindered by others variables. Hence, this paper attempts to answer the following research questions: What is the effect of aid on basic living conditions? Is aid having a positive/negative on the population's well-being? what are the main variables that influence the relationship between aid and income/education/health/infrastructures?

The methodology used in this study is quantitative research. Analyzing indicators such as Gdp per capita, school enrolment, crude death rate, access to electricity and flux of ODA received show possible relation between external intervention and living conditions of the local

population. This work paper tries to establish such relationship by applying an ARDL (Auto-Regressive Distributed Lagged) Model.

This work is organized as follows: the first part is focused on theoretical aspects by presenting pertinent literature review of the topic, the second part concerns an empirical approach by analyzing the data collected for further interpretations and recommendations.

PART I: LITERATURE REVIEW AND BACKGROUND OF THE STUDY

The first part conducts a literature review. The first section investigates the possible relations between ODA and economic growth, the second section analyzes different perception of scholars concerning the relation of ODA and education; the third section presents the link between aid and health. Laslty, the fourth section concerns aid and infrastructures.

I.1. Literature review

I.1.1. Aid and growth

The effectiveness of official development assistance (ODA) has been debated by development experts. As countless studies have attempted to discover the effects of aid on a country's growth.

1. Positive correlation between aid and growth

Many scholars studied about the link between ODA and economic growth. Hugon (1973); Collier & Dollar (2001,2002); Ben Saad (2012); Ferreira & Simoes (2013); Suphian & Kim (2016); Eregha & Oziegbe (2016); Sekanabo (2016); Dakwa (2018); Poirier (2021) argued that there is a positive correlation between ODA and economic growth.

Collier and Dollar (2001, 2002) have developed an aid allocation model whose objective is to maximize poverty reduction. Their model is based on two ideas: aid has a positive effect on growth in countries with good economic policies (Burnside and Dollar, 1997, 2000).

Suphian & Kim (2016) have devoted their work to analyzing the effectiveness of ODA in African countries, using data from East African Countries (1980-2014) and applying a ARDL

(Autoregressive Distributed Lag) model. The authors have suggested that the effectiveness of aid could not be seen in a short period. They found that in a long period, ODA has positive effects on East African countries; however, ODA seems to have negative effects on economic growth in Kenya and Uganda within a short period.

In addition to, Eregha & Oziegbe (2016) analyze the further impact of ODA by comparing regions in Africa. They studied data from Sub-Saharan Countries (1970-2013). Their main results show the effect was positive and significant for Southern, Central and Oil Exporting African countries controlling for macroeconomic policy environment.

Dakwa (2018) investigates the case of Rwanda after the genocide in 1994 and applied an OLS model. The author found that although foreign aid was not statistically significant, it becomes statistically significant controlling for governance indicators. Moreover, Desire (2016) also uses the case of Rwanda from 1995 to 2013 and concluded that ODA has a positive effect on growth only by controlling the policy environment in Rwanda.

2. No effect or negative correlation between aid and growth

Nevertheless, some researchers argue that aid has no effect or negative effect on economic growth.

Easterly (2007) noted that in poor countries such as Africa and Latin America, aid seems to be unproductive. It appears country's debts turn out not to be repayable which leads to an aid dependence afterwards. He concluded that aid should be accompanied by good policies to be effective.

Ferreira & Simoes (2013) compared 44 Sub-Saharan Africa and 31 Asian countries (1972-2007). Their results imply a negative relationship between aid and growth in both regions.

Variables such as institutional quality and financial development mainly influence their conclusion.

Yiew & Lau (2018) studied 95 countries (2005-2013), and used a POLS model. The authors found that FDI and the number of populations are more important determinants of GDP, implying that GDP is less likely dependent on ODA.

Burnside and Dollar (2000) did an empirical test of the effect of aid on the quality of economic policies. They estimate an economic policy equation based on the structural and political characteristics of countries. While the quality of economic policies seems to depend on the characteristics of the recipient countries, the aid variable has no effect. Eventually, donor governments and aid agencies realize that their different approaches and demands impose huge costs on developing countries, making aid less effective.

I.1.2. Aid and education

Education is one of the critical areas where external funding is allocated; thus, one important question is how to allocate ODA resources efficiently.

Experts like Suphian & Kim (2016) analyses data from East African Countries (1980-2014) and applied a ARDL (Autoregressive Distributed Lag) model. They concluded that in a long period, ODA has a positive effect on education in East African Countries because education is linked directly with economic growth.

Nonetheless, Ogieva & Okungbowa (2018) argued that ODA might have negative impacts on education, and supported their argument by using 14 African Countries (1974-2014) and a 2-gap model, concluding that the impact of ODA on educational development was significant but negative. This might be because the wrong or non-application of ODA to the sector it should be allocated.

I.1.3. Aid and health

Along with the education sector, health sector is a principal sector of a nation's wellbeing. COVID-19 has proven this fact. Developing countries mainly rely on external aid to finance the health sector. However, on one hand, some studies emphasize that aid has negative impacts on health; on the other hand, some state that aid is important for developing the health sector.

Gutema & Halemariam (2016) analyzed the impacts of Oda on health in Africa. They study data of 43 African countries (1990-2010) and applied a fixed effect, random effect, and first difference generalized method of moments estimator. Their result shows a strong positive effect of health development Assistance on health status.

Meanwhile, Nwude et al. (2020) conducted research on Oda, income and health outcomes in Africa. They studied a sample of Sub-African Countries (1999-2017) using GMM Model, and refuted the findings of Gutema & Halemariam (2016): aid has no effect on health sector. The result was also valid for non-sub-Saharan countries.

I.1.4. Aid and infrastructure

Table 1

Total aid (ODA) from DAC countries by sector, in Million US dollars

Year	2017	2018	2019
I. Social Infrastructure & Services	44345.96	45914.27	46501.92
II. Economic Infrastructure & Services	22327.7	21611.55	21729.21
III. Production Sectors	8965.37	7814.01	9015.51
V. Multi-Sector / Cross-Cutting	10287.7	9988.23	11370.22
VI. Commodity Aid / General Program Assistance	3765.57	2840.49	2327.12

VII. Action Relating to Debt	679.73	196.34	43.38
VIII. Humanitarian Aid	17368.74	14698.18	17852.25

Source : *OECD (2019),* https://stats.oecd.org/Index.aspx?DataSetCode=TABLE5

Table 1 demonstrates that a large amount of ODA is allocated to social and economic infrastructures.

Papers has been published to questioned the effectiveness of aid on basic economic infrastructures. Dand et al (2020) dealt with the impact of ODA in constructing road traffic infrastructure on Vietnam's economic growth, and suggested a positive correlation. Moreover, Japan Bank for International Cooperation (2008) in their report related aid effectiveness with infrastructure; through a comparative study of East Asia and Sub-Saharan Africa, they suggested the existence of a positive effect of aid in infrastructure in East Asia but a negative effect of aid in Sub Saharan Africa. They studied data from 8 countries and applied a quantitative study using institutional analysis of project cases and comparative analysis of project cases.

In summary, after reviewing the possible link between aid and basic living conditions, we can conclude that its effectiveness principally depends on good governance, good policy, a good macroeconomic environment and quality of institutions.

I.2. Background of the study

I.2.1. Map in the region: Madagascar's potentials and main challenges

Madagascar is classed as the 4th largest island in the World located in the South East of African region. It has a huge potential in terms of natural resources where the land is blessed with titanium, gold, nickel, petroleum, phosphorus, sapphire, cotton and other precious metals. Also the richness of fauna and flora attracts many tourists. Another great advantage of the country is

the population structure which has abundant labor force since almost half of its population is aged between 0 and 14 years.

Moreover, one particularity of the region is the weight of the agricultural sector, Madagascar's economy is based primarily on the primary sector which employs 80% of the active labor force and accounts for 33.6% of the GDP. The nations exports products are mainly vanilla, coffee, cloves and fishery products where the destination countries are especially the United States, France and China.[3]

However, despite its potential, Madagascar is one of the poorest countries in the World. As a matter of fact, it always appears in the list of Fragility States since OECD launched their report where the high fragility in the economic dimension is the most relevant. According to the OECD report of States Fragility in 2020, the high fragility in the economic dimension is mainly related to the following: aid dependence, low performance in education sector, lack of basic living standard such as a huge level of food insecurity and lack of basic health services, resource dependence that leads to economic volatility[4].

I.2.2. Donor contributions and ODA allocation per sector

According to OECD, "Official Development Assistance" is defined as aid provided by the Development Assistance Committee (DAC), non-DAC countries or multilateral institutions in order to promote economic development and to improve living conditions in developing countries.[5]

To develop its economy, Madagascar has to rely on external interventions. The context of external development assistance in Madagascar dates back to the late 1960s, when the country

[3] African Development Bank, “Madagascar Economic Outlook”, 2019
[4] OECD, “States of Fragility”, 2020
[5] http://www.odakorea.go.kr/ODAPage_2022/eng/cate01/L01_S01_01.jsp#:~:text=The%20OECD%20DAC%20defines%20ODA,main%20objective%20(meaning%20that%20aid

won independence from France but was too weak to stand on its own; as a result, international actors intervened. Likewise, many African countries, the World Bank and IMF introduced the "structural adjustment" to Madagascar, which was a loan to support economic recovery. Nevertheless, Madagascar ended up with huge debt, and began to be listed in the Heavily Indebted Poor Countries in the World (HIPC) since 1996.

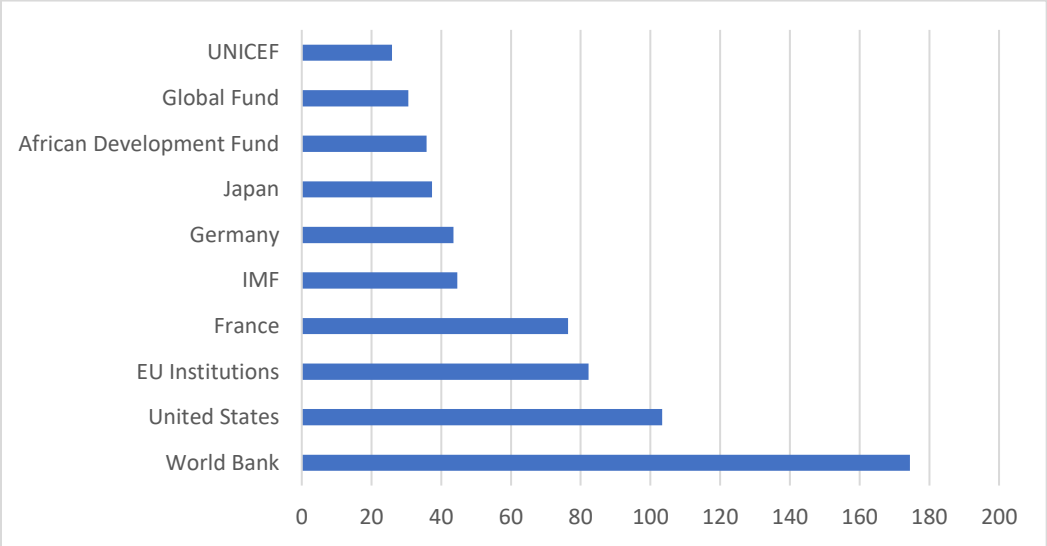
Since the country has limited resources, increasing the tax rate per GDP was still difficult because many citizens were poor and jobless; the informal sector is the source of income of more than the half of the population. Counting on FDI was still challenging since foreign investors weren't interested in investing in the country due to many obstacles such as corruption or poor business climate. Consequently, Madagascar began to depend on ODA, which accounted for some 40 percent of the State budget and 75 percent of State investments.[6]

It is important to note that Madagascar received more multilateral aid than bilateral. In regards to multilateral assistance, the World Bank via IDA (International Development Assistance) is the main contributor providing aid that accounted 519 US million dollars in 2019. In contrast bilateral assistance that was around 300 US million dollar within the same year where the principal donors are The United States followed by France.

[6] Aaron R., Rija S., "Madagascar: When the Aid Dries Up", Pulitzer Center,

Graphic 1

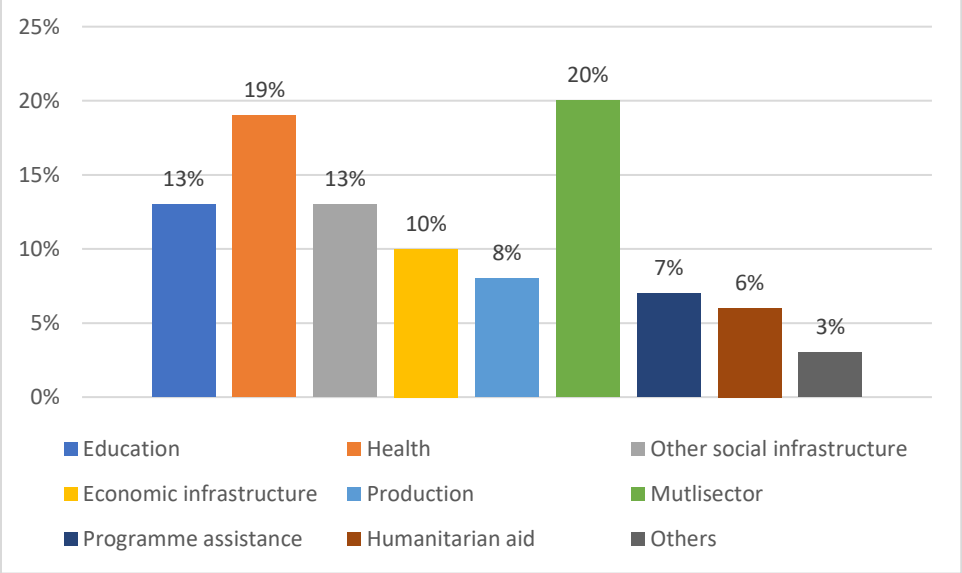
Top Ten Donors of Gross ODA for Madagascar, 2018-2019 average (in million USD)



Source: OECD (2019)

Graphic 2

Bilateral ODA by Sector for Madagascar, 2018-19 average



Source: OECD (2019)

Hence, ODA in Madagascar is principally allocated on service delivery such as health, water and sanitation, infrastructures since those are the most challenging sector for the country. The graphic above is showing that the share of health in ODA was about 19% followed by infrastructures 13%; education counted around 13% of the total amount of ODA.

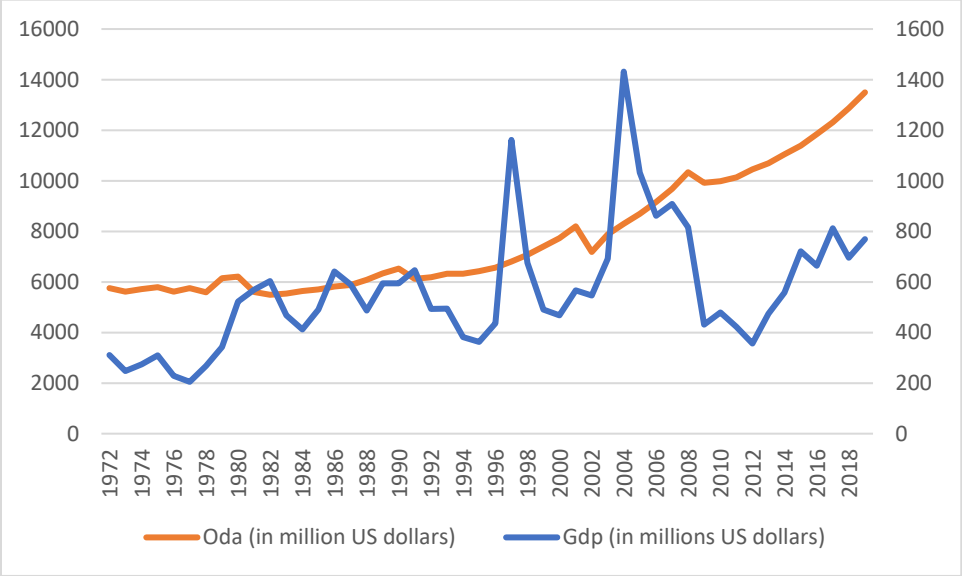
I.2.3. Evolution of ODA and basic living standards

1. ODA and national income

In 2021, Madagascar ranks fifth among countries that produce the least wealth per capita, with a GDP per capita of 531 dollars. According to the World Bank, 75% of Malagasy lived below the poverty line.

Graphic 3

Evolution of ODA received and GDP



Source: World Bank (2020)

The graphic above shows that in Madagascar, despite an increase in ODA especially in crisis times, national revenue is remaining stable. Structural adjustment Program was introduced in Madagascar in 1989; some conditionality of the aid was to float the national currency. In result,

the national currency suffered from devaluation. In order to stabilize the macroeconomic situation, more ODA was injected which caused the first large spike of the graphic in 1997.

The country underwent a political coup in 2002. The ambitious program of the new president 'Madagascar Action Plan' gained the support of International Organizations, funders was willing to support the national program. The flux of ODA received was its highest in 2004.

After crisis years, particularly political ones (1991-2002-2009), there seems to be a trend where Gross Domestic Product decreased meanwhile ODA increases. As explained above, this is mainly due to recover the macroeconomics' situation.

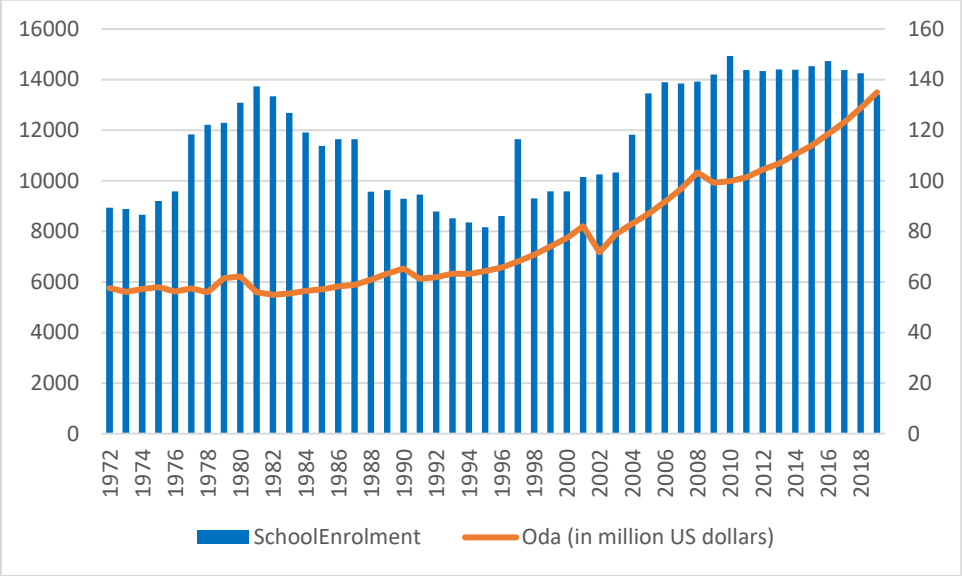
2. ODA and education

As one of the indicators of living conditions and human development; in 2019, Madagascar's HDI value was 0.528 putting the country in the low human development category. In the education sector, in 2018, the literacy rate among adults was 65%; in the health sector, chronic malnutrition affects 42% of children under 5, one of the highest rates in the world. The rate of access to electricity remains very low, with less than 35% of the population having access to water. Those examples show that the country is heavily sick and needs efficient solutions.[7]

[7] UNDP, « Human Development Report », 2019

Graphic 4

Evolution of ODA received and primary school enrolment rate



Source: World Bank (2020)

Concerning secondary and tertiary school enrolment, in 2018, 36% is the rate for secondary school enrolment and only 5% can access tertiary education.[8] Means years of schooling is far below the threshold of OECD, this latter is registered as 8 years. From 2000 to 2010, means years of schooling increase from 5.2 to 6.1 and remained stable until 2019.

3. ODA and health

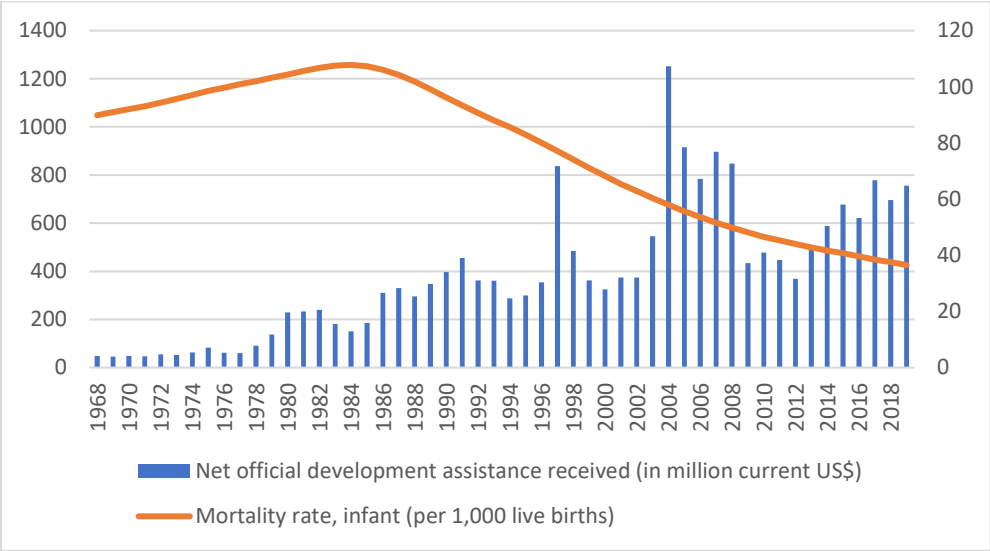
Even if Madagascar allocates a large portion of ODA in the health sector by giving priority to the most vulnerable populations: to not only women and children, but also to the inhabitants of the most remote areas; the health sector is still facing many difficulties which can explain principally by a low quality of the healthcare supply, unequally distribution over the territory, numerous barriers to access to healthcare, from a financial, geographic and cultural

[8] WDI World Bank

point of view, low level of public funding, insufficient management of the system. For instance, the infant mortality rate per 1,000 live births was 41 in 2014. [9]

Graphic 5

Evolution of ODA received and infant mortality rate



Source: World Bank (2020)

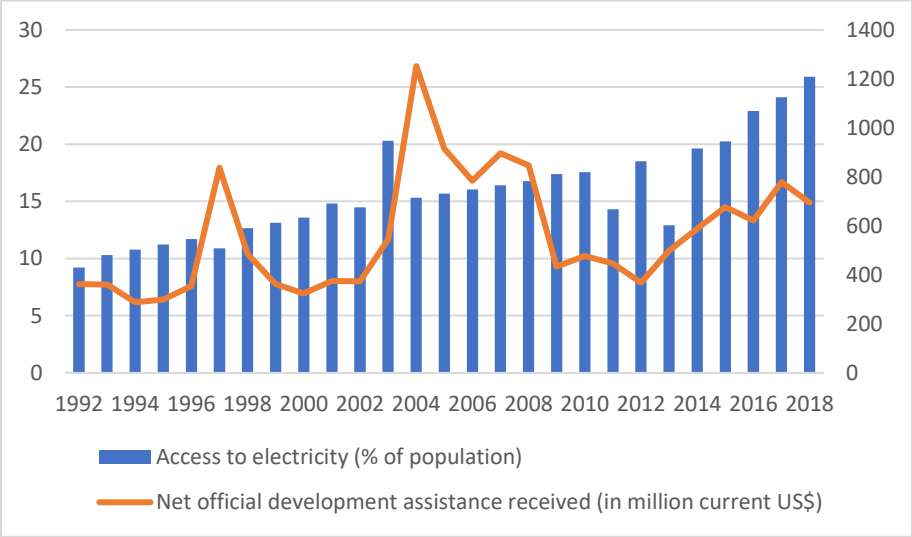
4. ODA and infrastructures

In Madagascar, less than 50% of its population enjoy basic drinking water services, while less than 20% of the population have access to electricity[10].

[9] World Development Indicators by World Bank
[10] World Development Indicators by World Bank

Graphic 6

Evolution of ODA received and access to electricity (% of population)



Source: World Bank (2020)

Electricity remains a luxury product. The population of many villages light theirs houses with candles or kerosene lamps. Access to electricity of the whole population around 15% has not changed for years. It is one of the poorest countries in terms of electricity coverage. Crisis years (2002, 2009) impacted a lot the basic living conditions. Not only GDP decreased, but also there is a huge decrease in purchasing power, households decided to switch to candles or petrol lamps. ILO (2011), stated that during the crisis times (2002 and 2009) 336,000 jobs destroyed, 90% vulnerable jobs, 91% of formal enterprises affected, drop of 51% of foreign direct investment, 11% drop in per capita income between 2008 and 2010, are the key figures that illustrate the direct effects of the domestic political crisis. The damage was immense and the consequences are disastrous both for the economy as a whole and for living conditions of the population.

PART II: EMPIRICAL ANALYSIS

II.1. Data collection

For the reliability of this research (Ekstedt et al., 2014), the data used come from pertinent sources; they are collected from the World Bank database. The scope of the data covers time series from 1972 to 2019.

Since the main objective of this study is to draw the relation between Official Development Assistance and basic living conditions, the data will include relevant indicators which can measure this relation, the details of the indicators are explained in the Table 2 and 3.

II.2. Methodology

Auto Regressive Distributed Lagged (ARDL) model can estimate the relationship between Oda and basic living conditions in Madagascar. ARDL is a standard least square regressions that include lags of both the dependent and independent variables (Greene, 2008).

II.3. Formulation

$$\boldsymbol{y_t} = \alpha + \sum_{j=1}^{p} \beta_j \, y_{t-1} + \sum_{j=0}^{r} \gamma_j \, x_{t-j} + \varepsilon_t$$

Basic living conditions such as Income, Education, Health and Infrastructures are measured respectively by Gdp per capita, School Enrolment, Crude Death Rate and Access to electricity for the urban population. Thus, we would like to estimate the 4 equations as follows:

(1) $\boldsymbol{lnGdp_t} = \alpha + \boldsymbol{lnGdp_{t-1}} + \sum_{j=0}^{1} \beta_j \, \boldsymbol{lnOda_{t-j}} + \sum_{j=0}^{1} \gamma_j \, dum1_{t-j} + \sum_{j=0}^{1} \lambda j \; dum1\_Gdp_{t-j} + \varepsilon_t$

(2) $\boldsymbol{lnSchoolEnrolment_t} = \alpha + \boldsymbol{lnSchoolEnrolment_{t-1}} + \sum_{j=0}^{1} \beta_j \boldsymbol{lnOda_{t-j}} + \sum_{j=0}^{1} \gamma_j\, dum2_{t-j} + \sum_{j=0}^{1} \lambda j\ dum2\_Educ_{t-j} + \varepsilon_t$

(3) $\boldsymbol{lnCrudeDeathRate_t} = \alpha + \boldsymbol{lnCrudeDeathRate_{t-1}} + \sum_{j=0}^{1} \beta_j \boldsymbol{lnOda_{t-j}} + \sum_{j=0}^{1} \gamma_j\, dum3_{t-j} + \sum_{j=0}^{1} \lambda j\ dum3\_Health_{t-j} + \varepsilon_t$

(4) $\boldsymbol{lnAccessElectricity_t} = \alpha + \boldsymbol{lnAccessElectricity_{t-1}} + \sum_{j=0}^{1} \beta_j \boldsymbol{lnOda_{t-j}} + \sum_{j=0}^{1} \gamma_j\, dum4_{t-j} + \sum_{j=0}^{1} \lambda j\ dum4\_Infra_{t-j} + \varepsilon_t$

Lagged 1 is used for all the variables after checking for the optimum lag in Stata. (varsoc command)

Moreover, the model has detected some structural time break i.e., the data changes at a point in time and the change can modify the mean or a change in the other parameters. We tested the structural break in Stata with the command "estat sbsingle". The years of the structural break are 1991 for the equation (1); 2005 for the equation (2); 2000 for the equation (3) and 2011 for the equation (4). Those years represent the years after political crisis. In order to deal with the structural break, dummy variables are included in each equation along with the interaction term of the dummy variable with the explanatory variable.

Table 2

Variables Description

Variables	Indicator	Definition
Gdp per capita	GDP per capita (constant 2015 US dollars)	Indicates the value of the GDP divided by the total number of population.
School Enrolment	School enrolment, primary (% gross)	Is the ratio of total primary education enrollment of the population regardless of age, to the population of the specific age group which corresponds the primary level of education.
Crude Death Rate	Death rate, crude (per 1,000 people)	Indicates the number of deaths within a year out of 1000 population.
Access to Electricity	Access to electricity (% of urban population)	Refers to the % of population living in the urban areas that have access to electricity.
Oda	Net official development assistance received (constant 2018 US$)	Aid provided by the Development Assistance Committee (DAC), non-DAC countries or multilateral institutions in order to promote economic development and to improve living conditions in developing countries

Source: World Bank. (n.d.). World Development Indicators. Metadata Glossary.

II.4. Summary statistics

Table 2 summarizes the characteristics of the variables. The outcomes are Gdp per capita, primary school enrolment, crude death rate, access to electricity. The independent variable is net Oda received, dummy variable for year the structural break and interaction between the dummy variables and Oda.

Table 3

Descriptive Statistics

Variables	Unit	Number of observations	Mean	Standard Deviation	Minimum	Maximum
lnOda	Constant 2018 US$, logged	48	20.06	0.41	19.13	21.08
lnGdp	Constant 2015 US$, logged	48	6.28	0.17	6.05	6.71
lnSchoolEnrolment	%, logged	48	4.73	0.19	4.40	5.00
lnCrudeDeathRate	per 1,000 people, logged	48	3.32	0.71	2.36	4.20
lnAccessElectricity	%, logged	28	3.98	0.22	3.64	4.37
dum1	dummy	48	0.60	0.49	0	1
dum2	dummy	48	0.31	0.46	0	1
dum3	dummy	48	0.41	0.49	0	1
dum4	dummy	48	0.18	0.39	0	1
dum1_Oda	Interaction term between dum1 and Oda	48	12.22	10.00	0	21.08
dum2_Oda	Interaction term between dum2 and Oda	48	6.33	9.49	0	20.75
dum3_Oda	Interaction term between dum3 and Oda	48	8.45	10.10	0	21.08
dum4_ Oda	Interaction term between dum4 and Oda	48	3.78	7.96	0	20.51

II.5. Model Assumptions

According the Gauss-Markov theorems; for the linear regression to be BLUE, some conditions should be satisfied (as cited in Wooldridge, 2019):

Assumption 1: Linearity

The first assumption assumes that $\{(x_{t1}, x_{t2,} \ldots\ldots\ldots, x_{tk,} y_t)$: t= 1, 2, …., n$\}$ observes the linear model $\boldsymbol{y}_{t=} \beta_1 + \beta_2 \boldsymbol{xt}_{,2} + \ldots\ldots + \beta_k \boldsymbol{x}_{t,k} + \boldsymbol{\varepsilon}_t$ where $\{ \boldsymbol{\varepsilon}_{t:}$ t = 1, 2, 3, ... , n$\}$ designate the disturbance or errors.

Assumption 2: No perfect Collinearity

This assumption postulates that there is no perfect combination of the explanatory variables, and the independent variables should not be constant.

Assumption 3: Zero Conditional Mean

E [ε_t| x] = 0 i.e., the estimated value of the error given x at all-time t is zero.

Assumption 4: Homoscedasticity

No explanatory variable will predict the variance of the error. Var (ε_t| x) = σ^2

Assumption 5: No serial correlation

Corr (ε_t, ε_s | x) = 0 for all time t and s. The noise at a different time are uncorrelated.

Assumption 6: Normality

The errors must be independent of the explanatory variables and should follow a normal distribution.

Therefore; the Gauss-Markov assumptions can be resumed and tested by:

- ✓ All data are stationary
- ✓ The error terms are homoscedastic
- ✓ There is no autocorrelation of errors, also called “White noise”

II.6. Methodology Justification

II.6.1. Stationarity

For the data to be stationary; the mean, variance should not vary over time and there should not be any seasonality. In others words, the overall behavior of the time-series data should stay constant. [11] (Wooldridge, 2019)

Stationarity of the variables can be tested by applying Augmented Dickey-Fuller Test also known as the "unit root test" on the variables. The null hypothesis is that to be stationary, the t-test should be more than the critical values in absolute value and p-value below the significance level suggests we shall reject the null hypothesis.

Table 4

Unit Root Test

		At Levels		At First Difference	
	Variables	t-test	p-value	t-test	p-value
Dependent Variables	lnGdp	-2.56	0.10	-5.10	0.00
	lnSchoolEnrolment	-1.55	0.50	-4.46	0.00
	lnCrudeDeathRate	-0.9	0.78	-4.77	0.00
	lnAccessElectricity	-0.79	0.82	-7.59	0.00
Independent Variables	lnOda	-2.86	0.04	-5.75	0.00
	dum1	-1.23	0.65	-4.74	0.00
	dum2	-0.63	0.86	-4.74	0.00
	dum3	-0.81	0.81	-4.74	0.00
	dum4	-0.42	0.90	-4.74	0.00
	dum1_ Oda	-1.21	0.66	-4.78	0.00
	dum2_ Oda	-0.64	0.86	-4.74	0.00
	dum3_ Oda	-0.79	0.82	-4.73	0.00
	dum4_ Oda	-0.33	0.92	-4.70	0.00

Note: **p<0.1; ** p<0.05; *** p<0.01*

Based on the table above, all of the variables are not stationary. In order to correct the variables to be stationary, the first difference transform will be applied. The difference transform helps to stabilize time-series data. It consists of taking the difference between t and its first past values.

[11] Reoccurring pattern at a fixed and known frequency based on a time of the year, week, or day

All of the variables are stationary after taking the first difference. Some of the pre-requisite before applying the ARDL model argues that if all the variables are stationary at first difference, then we can still use ARDL; in addition to, none of the variable should be stationary at second difference.

II.6.2. Homoscedasticity and Normality

A simple definition of homoscedasticity is when errors are constant throughout the sample. If the error is not homoscedastic, the standard error can be biased.

In order to test the homoscedasticity of the errors, Cameron and Trivedi (1990) can be applied. The null hypothesis states that if the p-value fall under the level of significance, the errors are heteroskedastic instead of homoscedastic.

The test adds Skewness and Kurtosis which can check for normality. Skewness tests the asymmetrical of the distribution curve and Kurtosis relates to the tails and peak of the distribution curve.

Table 5

Heteroscedasticity and normality test

	p-value
(1)	
Heteroskedasticity	0.74
Skewness	0.54
Kurtosis	0.24
(2)	
Heteroskedasticity	0.50
Skewness	0.30
Kurtosis	0.21
(3)	
Heteroskedasticity	0.07
Skewness	0.05
Kurtosis	0.86
(4)	
Heteroskedasticity	0.14
Skewness	0.58
Kurtosis	0.89

Note: *p<0.1; ** p<0.05; *** p<0.01*

As seen in the table above, p-value fall largely above the significance level; therefore, the errors are constant throughout the sample. Homoscedasticity and normality assumption are satisfied.

II.6.3. Serial Correlation

Serial correlation is when the errors at a given time t continues into the future times. Autocorrelation can be observed for several reasons: absence of an important variable; wrong model specification.

No auto-correlated error is a fundamental condition for the validity of a linear regression; it can be tested by Portmanteau test; the null hypothesis is that the p-value should be more than the significance level alpha of 0.05.

Table 6

Serial correlation test

	Portmanteau Q-stat	p-value
(1)	14.18	0.86
(2)	16.30	0.75
(3)	13.9	0.06
(4)	5.70	0.89

Note: *p<0.1; ** p<0.05; *** p<0.01*

Afterwards, we can conclude that the errors in the model are not correlated since the p-values appear to be more than 0.05; then, we do not reject the null hypothesis.

II.6.4. Cointegration

One of the popularities of the ARDL model is that it can include the existence of long-run relationship between two or more variables; in others words, cointegration. “Cointegration of nonstationary variables is equivalent to an error correction process, and the ARDL model has a re-parameterization in an error correction form” (Engle & Granger, 1987; Hassler & Wolters,

2006). A bounds testing aims to find out if the variables might have long run relationship or not (Pesaran et al. 2001).

For our 4 equations, the equation (1), (3) and (4) seem to have a cointegration; thus, it will take account of the error correction form.

Table 7

Bound Tests

k=3	0.1		0.05		0.025		0.01	
	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
F-value	2.72	3.77	3.23	4.35	3.69	4.89	4.29	5.61
H0: no levels relationship k: # of non-deterministic regressors in long-run relationship								
Equation (1) F=6.15 Equation (2) F= 2.96 Equation (3) F= 79.96 Equation (4) F= 9.60								

Source: Pesaran/Shin/Smith

II.6. Results

The results of this present work can be reflected in Table 8. Column (1) shows the effect of Oda on Gdp. Column (2) explains the effect of Oda on School Enrolment. Moreover, column (3) and (4) respectively demonstrate the impact of Oda on Death Crude Rate and access to electricity.

Column (1) (2) (3) and (4) show significant results at 99% significance level controlling for one lagged period of the dependent variable, the independent variables and the dummies. Adding the lagged dependent variable as a can control the effects of change over multiple periods (Fomby et al., 1984). Moreover, it also can capture OVB (Kennedy, 1992). The variable is expected to be significant, the results in the Table 8 can confirm where one lagged of the dependent variable impact the dependent variables at a time t.

Column (1) shows a negative interaction between Oda and Gdp per capita by 0.32 dollars in the long-run. By adding the structural break dummy, the coefficient turns out to be positive by 0.09 (=-0.32+0.36). We can say that before 1991, the link between Gdp and Oda is negative; however, if we capture the years after 1991, the coefficient becomes negative. As a tentative of explanation; in the 90s, Madagascar switched from a socialist regime into a liberal one. Structural adjustment was introduced in the late 80s. This change in the public management mainly influence the results since 1985 is one of the pics of Oda received. The more Oda the country received, the more its likely to improve the income.

Furthermore, column (2) is showing positive results. The link between Oda and School Enrolment is estimated to be 0.19 at a time t and 0.24 at a time t-1. If we add the structural break in 2005, there are additional effects by -0.21 at a time t and 0.26 at a time t-1. Thus, at a time t; before 2005, the relationship is positive by 0.19; after 2005, it becomes negative by -0.21. At a time t-1; before and after the year 2005, the connection between Oda and School Enrolment Rate is positive. The lagged positive effect might be attributed to a long result of the investment in education sector. Concerning the negative effect at a time t; regarding the education sector; aid allocated to education has steadily increased over time. However, when putted into the General State Budget, it has decreased over time (UNICEF, 2019). According to the last household survey by GPE (2014), the number of children of primary school age not attending school increased by 35% from 2005 and 2011. Household were unable to afford tuition fees resulting from severe cuts in public spending.

Column (3) reveals a negative interaction between Oda and Death Crude Rate even after adding the structural break 2000. The interaction is estimated to be -0.16 before 2000 and -0.02 after 2000. Speaking about the health sector, in partnership with the French Agency for Development, UNICEF and many others international organizations, especially in response to the lack of funding; several efforts and policy has been applied in this sector since the 3rd Republic (2000).

The last column (4) displays a positive association between Oda and access to electricity by 0.28 at a time t. Infrastructures remains always a priority for the country, not only Oda but also FDI and a large part of the government budget is allocated to infrastructures.

Table 8

Results

	Dependent Variables(Y)			
	lnGdp(t) *(1)*	*lnSchoolEnrolment(t)* *(2)*	*lnDeathCrudeRate(t)* *(3)*	*lnAccessElectricity(t)* *(4)*
Independent Variables(X)				
lnY(t-1)	-0.32***	0.84***	0.07***	-0.72***
	(0.07)	(0.06)	(0.00)	(0.13)
lnOda(t)	-0.27***	0.19***	-0.16***	0.28***
	(0.06)	(0.03)	(0.04)	(0.10)
lnOda(t-1)		0.24***		
		(0.03)		
dum(t)	-7.61***	4.8***	-1.98	2.51
	(1.88)	(1.66)	(1.40)	(4.23)
dum(t-1)		-5.58***		
		(1.61)		
dum_Oda(t)	0.36***	-0.21***	0.14***	-0.10
	(0.09)	(0.08)	(0.06)	(0.20)
dum_Oda(t-1)		0.26***		
		(0.07)		
Observations	47	47	47	27
R^2	0.36	0.93	0.99	0.69
Adjusted R^2	0.30	0.91	0.99	0.62

Note: **p<0.1; ** p<0.05; *** p<0.01*

Short and long-run relationship

The bounding test demonstrates that equations (1), (3) and (4) are cointegrated, i.e. that the model detects a long-run relationship between the variables of interest. Table 8, 9 and 10 show the long-run relationship between Oda and Gdp; Oda and Death Crude Rate; Oda and Access to Electricity. It is important to note that the results we had in table 7 for the equations (1), (3) and (4) reflects a correlation in the long run.

Table 10 states that Oda at a time (t-1) and access to electricity has a negative coefficient by -0.27 in the short run; however, in the long run, the effect is positive.

Table 9

Short and Run-Long Effects of Oda on Gdp

	Short Run Coefficients			Long Run Coefficients		
	Coefficient	Std.Error	t-Statistic	Coefficient	Std.Error	t-Statistic
lnOda (t)				-0.27	0.06	-4.00***
lnOda(t-1)						
dum1 (t)				-7.61	1.88	-4.04***
dum1 (t-1)						
dum1_Oda (t)				0.36	0.09	3.91***
dum1_Oda(t-1)						

Short and Run-Long Effects of Oda on Health

	Short Run Coefficients			Long Run Coefficients		
	Coefficient	Std.Error	t-Statistic	Coefficient	Std.Error	t-Statistic
lnOda (t)				-0.16	0.04	-3.99***
lnOda(t-1)						
dum3 (t)				-1.98	1.4	-1.41
dum3 (t-1)	1.83	0.01	98.91***			
dum3_Oda (t)				0.14	0.06	2.14***
dum3_Oda(t-1)						

Note: **p<0.1; ** p<0.05; *** p<0.01*

Short and Run-Long Effects of Oda on Electricity

	Short Run Coefficients			Long Run Coefficients		
	Coefficient	Std.Error	t-Statistic	Coefficient	Std.Error	t-Statistic
lnOda (t)				0.28	0.10	2.75***
lnOda(t-1)	-0.27	0.06	-3.88***			
dum4 (t)				2.51	4.23	0.59
dum4 (t-1)						
dum4_Oda (t)				-0.10	0.20	-0.19
dum4_Oda(t-1)						

Note: **p<0.1; ** p<0.05; *** p<0.01*

CONCLUSION AND LIMITATIONS

Understanding and engaging the potential impact of Oda on basic living conditions such as income, education, health and infrastructures has become a major discussion in recent years. However, much of the discussion especially for the case of Madagascar has been carried out in the absence of robust and comparable evidence about how the Oda actually impact basic needs of the population.

One objective of this article is to assert new empirical evidence around ways in which Oda can impact populations basic needs, using time series data from 1972-2019 and indicators such as Oda net received, School Enrolment, Crude Death Rate and Access to Electricity. The null hypothesis states that there is no relationship between Oda and basic living conditions.

This present paper presents that somehow, Oda has a positive relation with basic living conditions controlling for other explanatory variables. Regarding Oda and Income, before the structural break in 1991 (where the country began to receive a lot of Oda), the link between Gdp and Oda is negative; however, if we capture the years after 1991, the coefficient becomes negative, the more Oda the country received, the more its likely to improve the income. Hence, the link between Oda and School Enrolment is estimated to be 0.19 at a time t and 0.24 at a time t-1. If we add the structural break in 2005, there are additional effects by -0.21 at a time t and 0.26 at a time t-1. The lagged positive effect is attributed to a long result of the investment in education sector. Third, the results reveal a negative interaction between Oda and Death Crude Rate even after adding the structural break 2000. Afterward, there is a positive association between Oda and access to electricity by 0.28 at a time t and 0.27 at a time t-1.

A key finding of our work is that context matters when considering the possible impact of Oda on basic populations needs. Using the time framework, Oda and basic living conditions responds to crisis and the country needs times to heal after a shock.

Nevertheless, interpreting the results presents some limitations such as the limited number of observations especially for the variable “access to electricity”. Moreover, variables like trade openness, inflation, public expenses, country comparison might be omitted. Also, the model does not capture any information of the donor country dynamics. Capturing the crisis times with structural break might not be the optimal solution. And finally, in addition to all of the caveats and what have been studied in this paper; the estimators are unlikely to be completely causal, i.e, the link between the dependent and independent variables cannot be interpreted as a causal relation. These caveats limit the results of this study and they merit deeper analysis and further research.

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