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IN MADAGASCAR, INFLATION HURTS

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ABSTRACT

The purpose of this study is to show that inflation adversely affects the economic performance of Madagascar. In this country, the inflationary environment is persistent. Through a first econometric estimation, it is proved that at some high level, inflation negatively impacts economic growth. Nonetheless, as suggested by many authors, the inflation-growth nexus is not linear. This case is verified for this country as we were able to determine an optimal level of inflation favorable to growth. In a second analysis, we show that an increase in inflation pushes individuals below the poverty line. The adoption of an inflation targeting regime seems to be unavoidable, to effectively and sustainably fight against inflation in Madagascar.

Résumé

Cette étude entend montrer que l'inflation affecte négativement la performance économique de Madagascar. Dans ce pays, l'environnement inflationniste est persistant. A travers une première estimation économétrique, nous sommes en mesure de prouver qu'à un certain niveau élevé, l'inflation impacte négativement la croissance économique. La relation entre ces deux grandeurs n'est toutefois pas linéaire, car nous avons pu déterminer un niveau optimal de l'inflation, propice à la croissance. Dans une seconde analyse, nous exposons qu'un accroissement de l'inflation fait basculer des individus en dessous du seuil de pauvreté monétaire. Le passage vers un régime de ciblage d'inflation semble être inéluctable, pour lutter de manière efficace et pérenne contre l'inflation à Madagascar.

KEYWORDS: *inflation, growth, poverty, inflation targeting, monetary policy*
***JEL classification**: E31, I32*

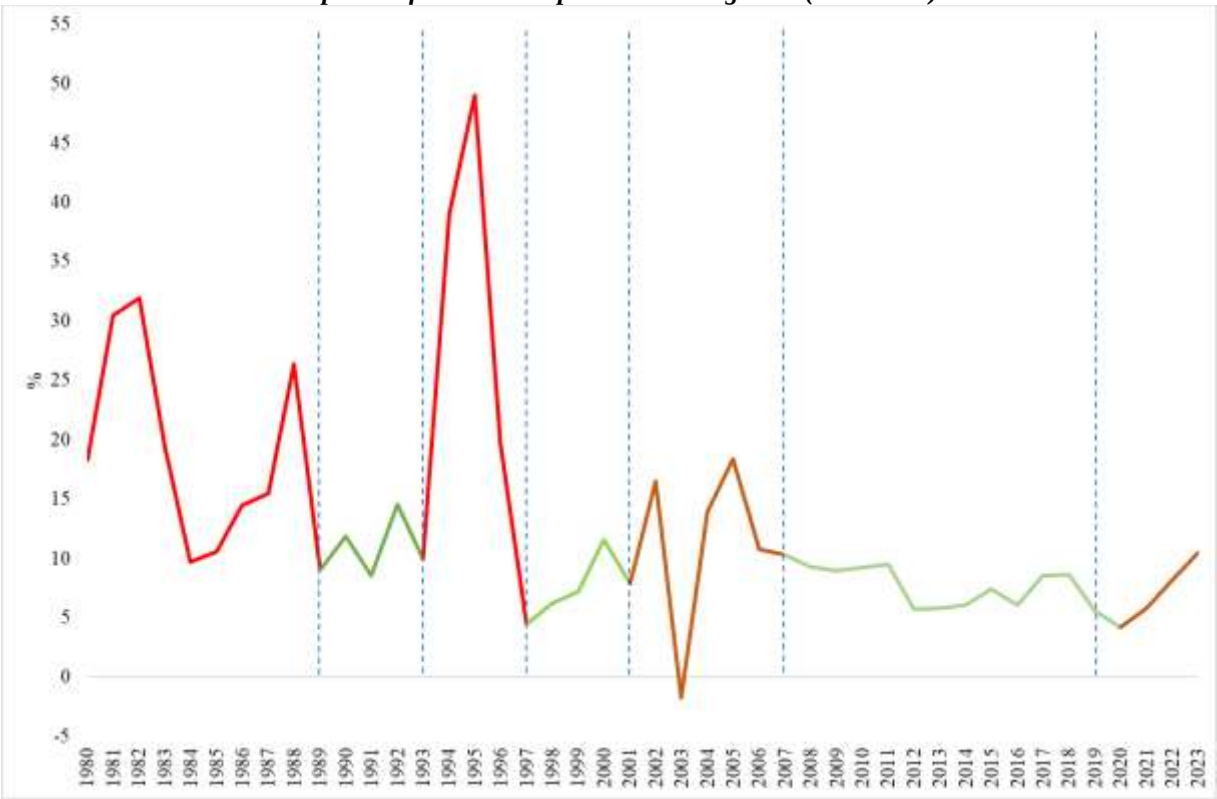
INTRODUCTION: *INFLATION DEVELOPMENT IN MADAGASCAR*

Madagascar has experienced a turbulent inflation history. Throughout the observation period (1980 to 2023), inflation recorded fluctuations of varying significance. Only during 2008-2020 did inflation experience relative stability. During this period, inflation averaged 7.6%, with a volatility of 1.6%. Outside this interval, inflation has been high and volatile like in the 80s. At that time, average inflation was 19.6% with volatility of 8.2%. There were also 3 years of high inflation during the 90s, from 1994 to 1996, when its average reached 35.9%, with a volatility of 14.9%. Between these two periods, inflation was relatively stable, but remained at a relatively high level.

The 80s' inflationary episode was linked to the severe shortage of basic goods. The lack in essential products has led to a general rise in prices. For the period 1994-1996, high inflation was associated in particular to the shock induced by the floating exchange rate regime adoption, one of the conditions imposed by international partners, within the economy's structural adjustment program. The depreciation of the national currency had an important impact on inflation. The other inflationary episodes were mainly caused by the repeated political crises in the country.

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Graph 1. Inflation development in Madagascar (1980-2023)



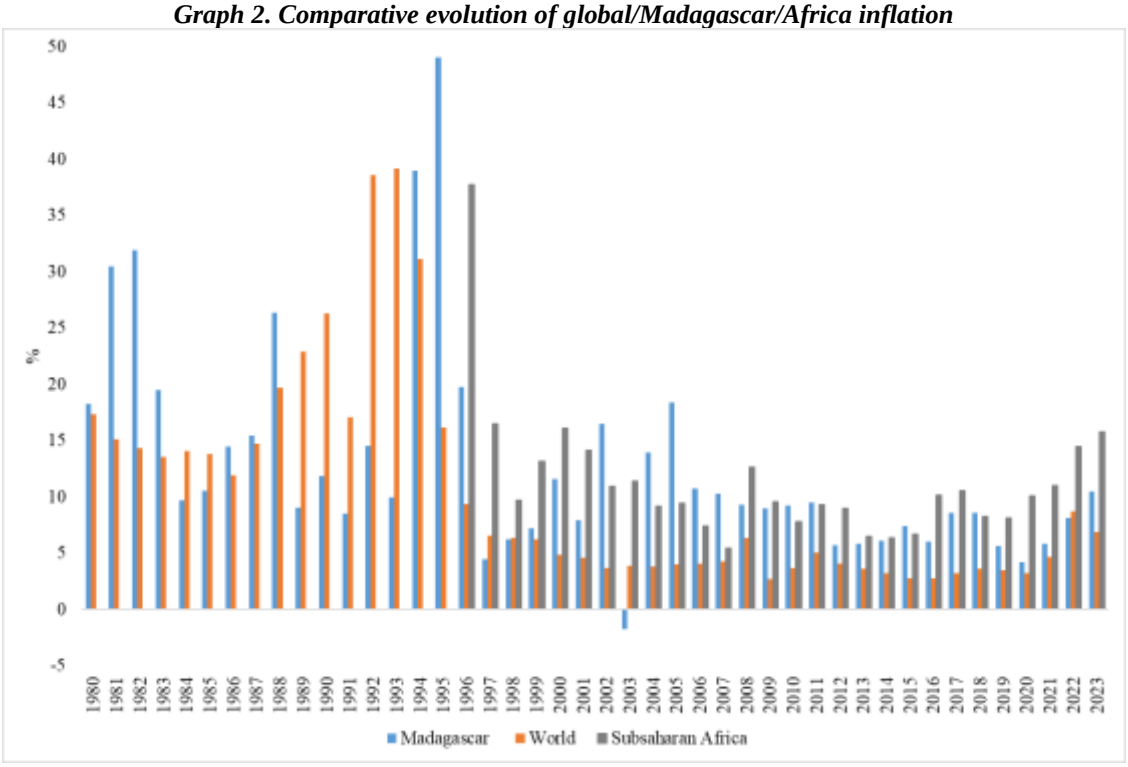
Source: data from World Economic Outlook, ed. April 2024

In the 80s and 90s, inflation in Madagascar and at the global level were comparable. This era was marked by high and volatile inflation around the world. From late 90s, coinciding with the beginning of inflation targeting practice in some countries, global inflation fell to a relatively low level, except during the financial crisis and the post-pandemic and Russia-Ukraine crises. The trajectory of inflation in Madagascar has not followed this global trend. Certainly, inflation has fallen compared to the 80s'figures, but its level has remained high, as evidenced by the graph below. The volatility of inflation in Madagascar is also demonstrated by this figure, in contrast to global inflation which has now experienced relative stability.

Nonetheless, inflation in Madagascar, even if at a high level, was generally lower than the African average during the observation period. According to the African Development Bank latest economic report, the inflation situation in Africa was different from the rest of the world in 2023. While many regions in the world experienced a disinflation process in 2023, inflation in Africa has increased, with an average of 17.8%, after 14.1% in 2022. According to this report, supply shocks in the agricultural sector, weaknesses of African currencies, as well as rising imported goods' prices, were indicated to be at the origin of this situation. It should also be noticed that Africa includes the fewest countries practicing the inflation-targeting monetary policy regime.

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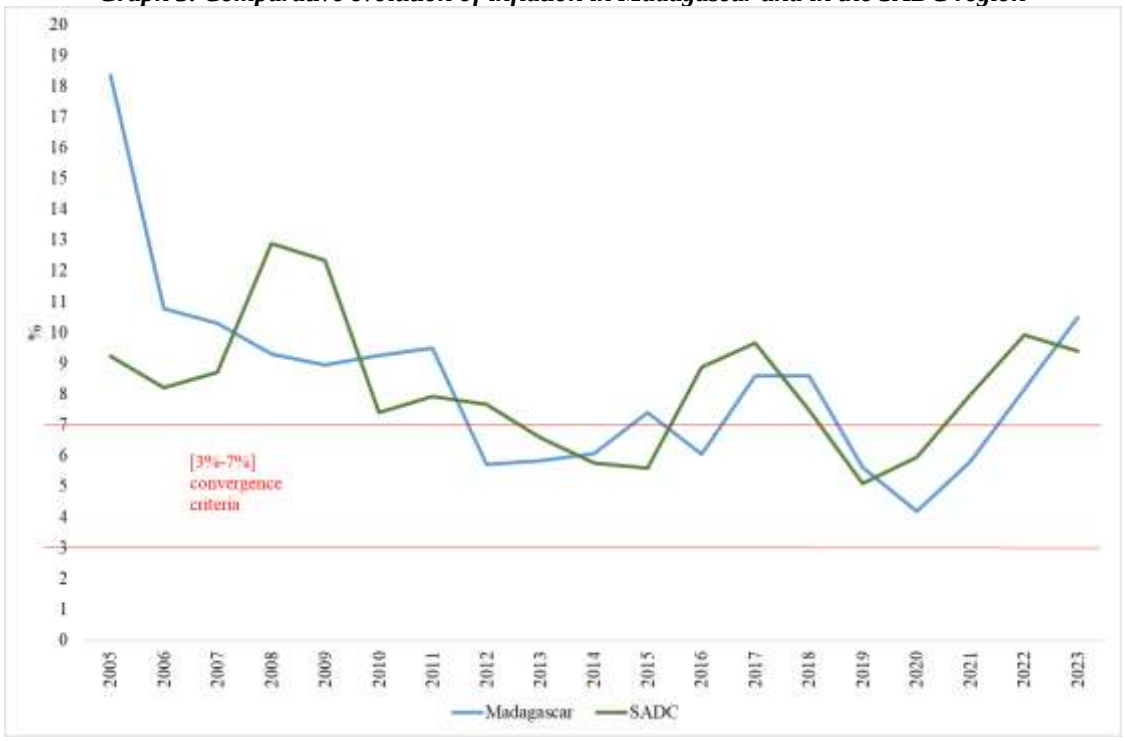
Graph 2. Comparative evolution of global/Madagascar/Africa inflation



Source : data from World Economic Outlook, ed. April 2024

Since Madagascar became part of the SADC[1], its inflation is almost in line with the region's average. However, the objective is not necessarily the alignment, but the compliance with the convergence criterion, represented by the red band in the following graph. According to this figure, the country's inflation has been outside the range most of the time.

Graph 3. Comparative evolution of inflation in Madagascar and in the SADC region



Source: data from World Economic Outlook, ed. April 2024

[1] *South African Development Community: Regional Economic Community composed of 16 countries from Southern Africa.*

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This succinct analysis of the recent history of inflation in Madagascar strengthens our conviction about the inflationary reality in this country. In the following section, we will try to prove that inflation affects the economic performance of this country.

Impacts of inflation on economic performance

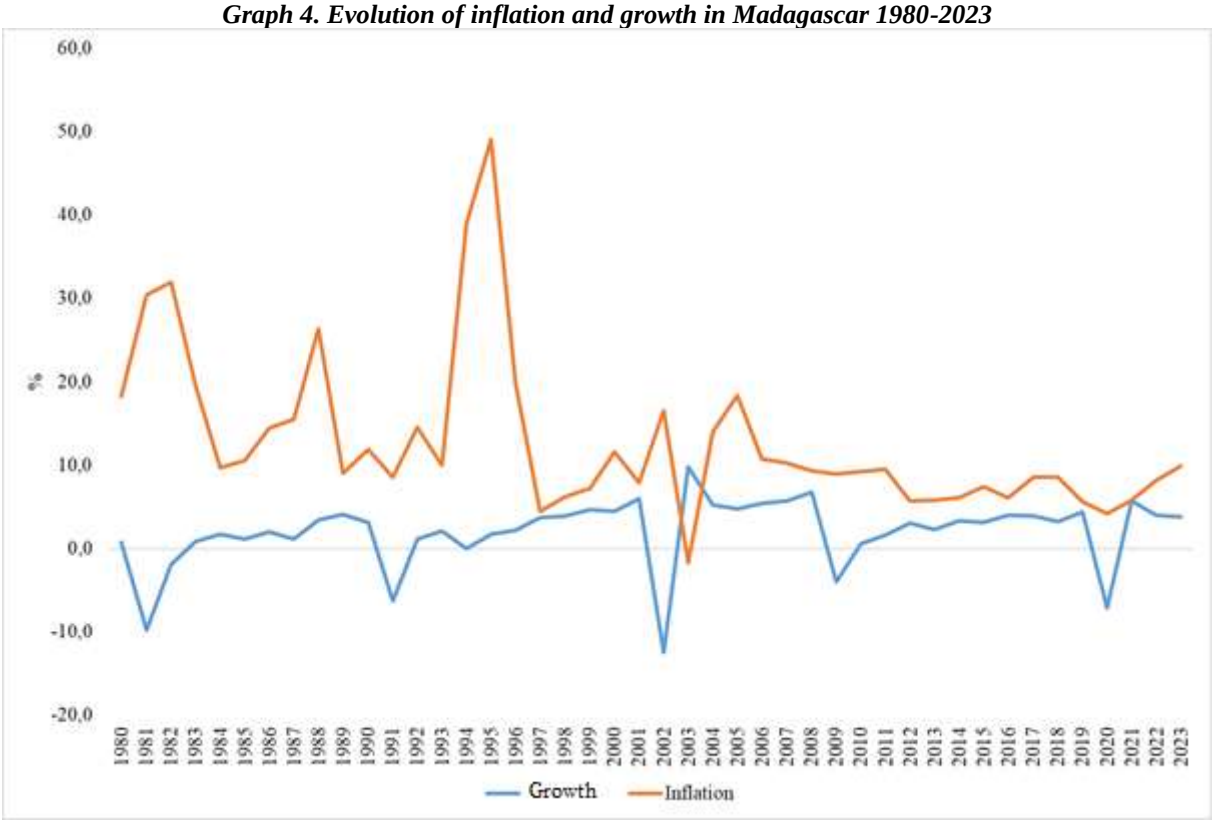
Following the descriptive analyzes on the inflation development in Madagascar, we will try to determine the harmful effects of this phenomenon on economic performance. First, we will attempt to show the negative impact of inflation on growth. Subsequently, we will demonstrate the consequence of inflation on poverty.

Inflation and growth nexus

In this section, we will try to determine the inflation-growth nexus for the case of Madagascar. Generally speaking, the literature suggests a negative relationship between these two variables (Fischer & Modigliani, 1978), (Fischer,1993), (Barro, 1995). In other words, inflation is detrimental to economic growth. However, these arguments contrast with the Keynesian thoughts, which argue a positive effect of inflation on growth. This theory is based on the Phillips curve (1958), which identified a decreasing relationship between inflation and unemployment, *i.e.*, high inflation leads to low unemployment. In turn, this latter positively affects growth (Grimes, 1991). For Mundell (1991), inflation is the consequence of the reduction in agents' net wealth. Thus, to restore this post-inflation wealth, agents are encouraged to save, lowering the interest rate, which in turn stimulates inflation.

In this paper, we assume the existence of a negative relationship between growth and inflation. First, we will check the existence of a long-term relationship between these two variables. Intuitively, the graph below displays us a certain symmetry between growth and inflation throughout the observation period.

Graph 4. Evolution of inflation and growth in Madagascar 1980-2023



Source: data from World Economic Outlook, ed. April 2024

Next, we will estimate a simple ordinary least squares model, liaising these two aggregates. The estimation results are given by the following table:

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Table1. Impact of inflation on growth for the case of Madagascar

	Dependent variable : growth			
	Coeff.	*Std. Err.*	*t-stat*	*Prob.*
Intercept	4.788051	0.484491	9.882647	0.0000
Inflation	-0.120980	0.030522	-3.963726	0.0003
Dum81	-10.90337	1.923285	-5.669138	0.0000
Dum91	-10.06088	1.849410	-5.440050	0.0000
Dum02	-15.20001	1.848794	-8.221580	0.0000
Dum09	-7.683798	1.848591	-4.156570	0.0002
Dum20	-11.41939	1.863190	-6.128945	0.0000
		R^2 = 0.840798		
		DW = 0.981182		
		Obs. : 44		

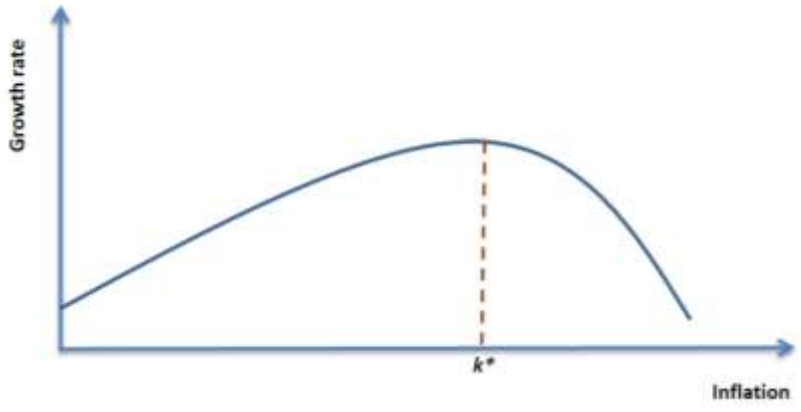
Source: Author's Calculation

This equation reveals the negative growth-inflation nexus for the case of Madagascar. This relation could be considered as a long-term one due to the fact that these two variables are stationary. It can be interpreted such as 1-point increase in inflation decreases growth by 0.13 point. The estimation includes 5 dummy variables correcting the effects of the crises that occurred in Madagascar, namely:

- *External payment default crisis in 1981;*
- *Political crises of 1991, 2002, 2009 ;*
- *Pandemic crisis of 2020.*

However, authors who defend the negativity of the inflation-growth nexus also argue that the relationship is not linear, *i.e.*, the relation is not negative in every way. For Gosh & Phillips (1998), "*moderate inflation can help to grease the economy*". Thus, there is some level of inflation which is favorable to growth. We attempt to determine this level for the case of Madagascar. For this purpose, we will use the pioneering study of Khan & Senhadji (2001). These authors carried out a panel-countries study, to test whether the relationship between inflation and growth is non-linear. They assumed that at a moderate level of inflation, the relationship between these two indicators can be positive, but at a high rate, inflation negatively affects growth. In this case, there should be an inflation threshold that splits these two situations. For Sattarov (2011), if this threshold exists, the relationship between inflation and growth is concave as illustrated by the graph below.

Graph 5. Inflation threshold



k : inflation threshold*
Source: Sattarov (2011), p. 12

This hypothesis will be tested for the case of Madagascar. However, for technical reasons linked to the availability of data, we will take only these two variables and leave the control variables used by Khan & Senhadji (2001). The model we are going to estimate is as follows:

$$dlog(y_t) = \mu + \gamma_1 \log(\pi_t) + \gamma_2 d_t^{\pi^*} [\log(\pi_t) - \log(\pi^*)] + \varepsilon_t$$

$$d_t^{\pi^*} = \begin{cases} 1 \; si \; \pi_t > \pi^* \\ 0 \; si \; \pi_t < \pi^* \end{cases} t = 1, \dots, T$$

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y_t : real GDP
π_t : average inflation rate at t
π^* : inflation threshold
$d_t^{\pi^*}$: dummy variable, taking the value of 1 when inflation is above the threshold, and 0 otherwise
ε_t : error term
The observation period extends from 1980 to 2023. To obtain the optimal inflation level, we carried out numerous OLS regressions, increasing the threshold by 1 point each time. The table below summarizes the estimation results.

Table 2. Determination of the optimal inflation level for the case of Madagascar

		Dependent variable: $dlog(y)$					
Explanatory variable	$\pi^* \leq 4$	π^* =5	π^* =6	π^* = 7	π^* = 10	π^* = 14	π^* =15
μ	No result	-0.33 *(-2.39)*	-0.13 *(-1.86)*	-0.05 *(-1.19)*	-0.002 *(-0.07)*	0.01 *(0.68)*	0.02 *(0.92)*
$\log(\pi)$		0.50 *(2.50)*	0.18 *(2.06)*	0.08 *(1.46)*	0.01 *(0.49)*	-0.004 *(-0.20)*	-0.08 *(-0.43)*
$\log(\pi) - \log(\pi^*)$		-0.53 *(-2.59)*	-0.21 *(-2.28)*	-0.12 *(-1.81)*	-0.05 *(-1.23)*	-0.03 *(-080)*	-0.02 *(-0.60)*
R^2		0.20	0.18	0.13	0.10	0.08	0.07
DW		1.39	1.46	1.55	1.61	1.60	1.60

Source : author's calculation
We have tried estimation with inflation thresholds less than or equal to 4%, but encountered near-singular cases. This can be easily explained because the minimum inflation in our series is 4.2%. Thus, if we set the threshold below 4%, the series of the difference between achieved inflation and the threshold does not differ from the inflation series. Nevertheless, this situation can be interpreted economically, that during our observation period, an inflation rate below 4% would not be able to support economic growth.

Next, we will determine the optimal level of inflation, as indicated by Gosh & Phillips (1998). We immediately see in the gray area in the above-table that with an inflation threshold of 5%, inflation positively affects growth with a statistically significant coefficient. Likewise, for a threshold of 6%, the coefficient remains positive and significant, but is reduced to 0.18, after 0.5 for the 5% threshold. We can understand that from the 7% threshold, the coefficient, even if it remained positive, is no longer statistically significant. At a level of 10%, the positive effect of inflation dissipates. Continuing the estimates, it is observed that from the 14% threshold, inflation begins to negatively affect growth, even if the coefficients are not statistically significant. At a certain very high level of inflation, the negative impact of inflation on growth becomes important and statistically significant. According to these results, the optimal level of inflation to support growth is a range of 5%-6% for the case of Madagascar.

Inflation and Monetary Poverty
Beyond its impact on growth, inflation is a rather concerning phenomenon as it produces undesirable effects. One of the striking consequences of inflation is its effect on poverty. Numerous studies have argued for the exacerbation of poverty by inflation. We will delve into these works in the following literature review.

LITERATURE REVIEW
The relationship between inflation and poverty is explained through various approaches. The pioneering study was conducted by Cardoso (1992), who constructed an indicator measuring the inflation tax, affecting notably the middle class. Individuals already living below the poverty line are impacted to a limited extent because they hold very little cash. However, savings of the segment of the population belonging to the middle class are eroded by inflation. The decrease in disposable income is considered as the primary transmission channel of inflation to poverty. The second channel is the decline in real wages, as nominal wages grow less rapidly than prices during periods of high inflation. Therefore, according to this author, inflation increases the number of the poor. Easterly & Fischer (2000) conducted a survey of 31,869 households in 38 countries and concluded that high inflation tends to increase poverty. Additionally, inflation disproportionately affects lower-income households by directly reducing the *per capita* income of this population segment. In this empirical study, they argued that a 20% increase in the inflation tax reduces real wages by 8 percentage points.

According to Agénor (1999), there are 3 factors explaining the vulnerability of the poor to inflation:
- The wages of the poor are often defined in nominal terms, and they do not benefit from indexation mechanisms. Thus, in case of high inflation, their real wages tend to depreciate;
- The poor are less protected against price increases as they lack financial assets and real assets;
- Their cash holdings are subject to the inflation tax.

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A pertinent empirical study that served as a major inspiration for our research is the investigation conducted by Chani, Pervaiz, Jan, Ali & Chaudary (2011). They explored the relationship between poverty, inflation, and economic growth for the case of Pakistan. Using a 5-variable ARDL model encompassing factors such as the percentage of the population below the poverty line, the consumer price index, GDP per capita in the national currency, investment, and the level of foreign trade openness, these authors established a robust relationship between inflation and poverty, both in the short and long term, for the period 1972 to 2008 for Pakistan.

In a similar way, Arshad, Sheikh, Akhtar & Mushtaq (2019) also estimated an ARDL model, once again for the case of Pakistan, but their analyses delved deeper. These authors used two price indices, namely the Consumer Price Index (CPI) and the Wholesale Price Index (WPI). They decomposed these two indicators to better understand the influences of their components on poverty. Additionally, they employed two poverty measures, namely the head count ratio and the poverty gap. As such, 6 disaggregated models were estimated over the period 1982-2015. In general, these authors found a positive relationship between poverty and inflation. They proposed 3 factors explaining this link, including the contraction of individuals' real incomes, the weak bargaining power of the poor, and the low, or even absence of, indexation system.

Jayashankar & Murphy (2023) explored a study akin to that of Easterly & Fischer (2000) and found almost similar results. Through a survey conducted on thousands of American households, these authors noted that low-income households are more adversely affected by inflation because they lack the flexibility to purchase cheaper goods, as they already consume them. They do not have the capacity to stockpile goods like affluent households. Poor households have very little cash to shield themselves against high inflation. Therefore, these authors underscored the importance of price stability, a role to be fulfilled by the Central Bank.

METHODOLOGY

In this study, we select ARDL modeling as econometric technique. This approach is commonly employed for time series unveiling at least one cointegration relationship. We opt for this method over a two-step Johansen-ECM (Error Correction Model) due to ARDL's advantage in combining variables with different orders of integration. Additionally, this model allows for distinguishing the effects of lags in the dependent variable and lags in the explanatory variables. It is also known to perform well with a limited number of observations. A 3-variable ARDL model is presented as follows :

$$y_t = c + \sum_{j=1}^{p} \gamma_j \, y_{t-j} + \sum_{k=0}^{p} \varphi_k x_{t-i} + \sum_{l=0}^{p} \vartheta_l z_{t-l} + \varepsilon_t$$

Regarding these variables, three aggregates are included in this model: monetary poverty, GDP per capita in USD, and the Consumer Price Index (CPI). Monetary poverty represents the percentage of the population living below the poverty line. Currently, the World Bank has updated the poverty line to $2.15 USD per day. The data is sourced from the WDI database[2]. For Madagascar, there are missing figures and we interpolated them using the Cubic Spline method. The other two variables were sourced from the IMF's WEO database. The observation period extends from 1980 to 2023.

By conducting Augmented Dickey-Fuller (ADF) tests for unit roots on the variables, we observe that GDP per capita and the Consumer Price Index (CPI) are not stationary in level. However, the interpolated monetary poverty variable is. This result may be surprising as in reality this variable should not be stationary, but similar cases exist in some studies. Thus, we have a combination of I(0) and I(1) variables, justifying the use of the ARDL model. The results of the unit root tests can be found in the appendix. We impose a maximum lag order of 6, and we let the Eviews© software automatically select the optimal ARDL model.

RESULTS

The first result confirms the presence of a cointegration relationship among the variables included in this model. In this regard, the F-statistic calculated from the bound testing approach to cointegration shows a fairly comfortable value of 15.5. The maximum threshold for a number of observations of 30 at 1% significance level is 9.4. Thus, it can be confirmed that there is at least one cointegration relationship between monetary poverty, inflation, and per capita growth for the case of Madagascar. In other words, there exists a long-term equilibrium among these 3 variables.

However, the speed of convergence towards this equilibrium is slow, as the error correction term, although negative, is only around -0.095. This means that any short-term deviation from the long-term equilibrium is corrected by barely 10% each year. In the case of Pakistan, the authors found a convergence speed of around 60%.

In the short term, monetary poverty is strongly explained by its past values. As mentioned earlier, the ARDL model allows for distinguishing the effects of lags on the dependent variable. There is a strong persistence of this explanatory variable up to 4 years. We are most interested in the long-term relationship, which is presented as follows:

[2] *https://databank.worldbank.org/source/world-development-indicators*

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$$POV_t = 7{,}1 - 0{,}041GDPPC_t + 0{,}121CPI_t + \varepsilon_t$$
(6,1) (-2,583) (2,038)

The signs correspond to expectations, as GDP per capita is negatively related to monetary poverty, in contrast to the CPI, whose relationship with monetary poverty is positive. Concretely, this result suggests that an increase in GDP per capita of $100 would reduce the percentage of the population living below the $2.15/day by 4.1 points. However, the long-term relationship suggests that a 10% increase in the CPI pushes 1.2% of the population below the poverty line.

CONCLUSION

This study attempted to show that inflation may hurt Madagascar's economic performance. At a certain level, inflation negatively affects economic growth. This hypothesis was proven through the long-term relationship, stipulating that an 1% increase in inflation leads to a 0.13% decrease in growth. However, as recommended in the literature, we also succeeded in proving that this relationship is not linear in this country. There is a certain level of inflation favorable to economic growth, that is a range [5-6%]. The 1% increase in inflation also pushes 0.12% of the population below the monetary poverty line. In this case, the fight against inflation should be a priority in this country. According to Federal Reserve Chair Jerome Powell (2022): *« Without price stability, the economy does not work for anyone. In particular, without price stability, we will not achieve a sustained period of strong labor market conditions that benefit all. The burdens of high inflation fall heaviest on those who are least able to bear them»*. Drastic measures should be implemented to reverse this trend and establish an environment of low and stable inflation. Migration to an inflation-targeting monetary policy regime is highly recommended.

Given the limitations this study, it should pave the way for future research. The use of an approximate measure of monetary poverty may be a major limitation in poverty studies for Madagascar. The results of estimation with a complete series of poverty, without resorting to interpolation, could have been different. Thus, the construction of comprehensive, robust, and reliable databases on poverty in Madagascar would provide significant added value to researchers and policymakers, especially for a country ranked among the least developed in the world. The same applies to data on the labor market, including employment and wages. It would also be interesting to conduct a study on the relationship between these two variables, decomposing the CPI as in Arshad and al. (2019), to observe the effects of price components on poverty in a country where food and energy prices are highly volatile compared to other products and services.

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