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Monetary policy and inclusive social development in Africa: Evidence from instrumental variable quantile regressions

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***Abstract*---**This study investigates whether monetary policy, beyond its conventional objective of price stability, contributes to inclusive social development in Africa. The analysis is based on a panel of African countries covering the period 2010–2022. To ensure robust inference, three complementary econometric techniques are employed: a fixed-effects model to control for country-specific heterogeneity, a two-stage least squares (2SLS) estimator to address endogeneity issues, and an instrumental-variable quantile regression (IV-QR) approach to examine potential variations across different levels of inclusive development. The results reveal that monetary policy exerts a positive and causal effect on inclusive human development. Specifically, higher banking liquidity, greater monetary depth, and increased real interest rate stability significantly improve the Inequality-Adjusted Human Development Index (IHDI). The IV-QR estimates indicate that these effects remain relatively stable across the distribution of inclusive development, suggesting limited heterogeneity among African countries. Additional analyses further show that monetary policy contributes to reducing social and income inequalities while enhancing overall human well-being. These findings highlight the importance of monetary policy as a macroeconomic instrument for promoting inclusive development rather than solely maintaining price stability. Strengthening macroeconomic stability, improving liquidity management, and fostering financial deepening therefore emerge as key policy priorities for advancing inclusive human development in Africa.

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Introduction

African countries face the challenge of developing economic policies that can stimulate development while also ensuring that inequalities are taken into account in this socioeconomic progress. Among these, monetary policy is one of the important policy orientations for achieving inclusive development. It 'is a critical tool in the hands of central banks, aims to control the money supply and interest rates to ensure price stability and foster economic growth' (Abou et al., 2024). It involves measures taken by the central bank, such as setting interest rates and controlling the money supply'.

Monetary policy, although geared toward traditional macroeconomic objectives such as growth, price stability and reducing unemployment (Iddrisu et al., 2022), should also be designed as a strategic instrument for achieving inclusive human development. This adjusts average human development achievements by taking into account social and economic disparities (Foster et al., 2005). It therefore contributes to improving living conditions by reducing educational, health and economic inequalities in the context of socioeconomic progress.

However, it has been shown that monetary policy affects the rich and the poor at different levels, taking into account the average effect of macroeconomic changes (Kang et al., 2013). However, one of the main criteria for assessing a country's level of inclusive human development (Foster et al., 2005) is the inequality-adjusted human development index (IHDI). However, this approach appears to be ineffective because of the relatively large gap between the IHDI and HDI levels of African countries. For example, for our sample, the average IHDI for the period 2010–2022 is 0.356, whereas the HDI is 0.541. This means that there is significant inequality between individuals in terms of access to education, health and income levels, resulting in a loss of human development due to inequalities equivalent to an average of 0.185. Furthermore, Africa is considered one of the most unequal regions in the world (Odusola, 2017; Xu et al., 2021). In this context, monetary policy, while traditionally aimed at price stability and economic growth, must now be redefined as a strategic lever to promote human development that integrates inequalities and takes into account socioeconomic losses. Given the importance of monetary policy as a driver of inclusive development, this paper asks the following: To what extent can monetary policy decisions contribute to promoting inclusive human development?

The literature emphasizes the dynamic nature of monetary policy and its essential role in stabilizing economies and external sustainability (Iddrisu et al., 2025; Fielding, 2004). However, it does not explore the indirect impact of monetary policy on human development while taking into account socioeconomic losses. This aspect could help to explore the specific role of monetary policy in the long term in inclusive well-being. Indeed, monetary policy, while traditionally aimed at price stability and economic growth, must now be redefined as a strategic lever for

promoting inclusive human development. An approach aimed at stimulating not only growth but also ensuring that its fruits benefit the entire population, especially the most marginalized. Hence, the purpose of this paper is to analyze the transmission effects of monetary policy on inclusive human development in Africa.

Our study sheds new light on the contribution of monetary policy to inclusive human development in Africa and contributes to the literature at both the theoretical and empirical levels. First, unlike previous studies that emphasize the role of monetary factors in macroeconomic stabilization, our research goes further by taking into account the social aspects of progress while integrating the various disparities that lead to more inclusive human development. Empirically, we account for the endogeneity of inclusive development by using instrumental variable regressions and examining the effect across different intervals via quantile regression, which resolves potential issues of unobserved heterogeneity within our sample. We also study the specific effects of the main monetary policy indicators and synthesize them to obtain an overall effect that, taken together, significantly influences inclusive human development. Furthermore, we appreciate the differentiated effect of monetary policy on each dimension of inclusive human development, taking into account social inequalities, income inequality, and human development; these various analyses have thus far been conducted only separately in the literature. The joint analysis of these phenomena, which focuses on African countries that not only have a low level of human development globally but also a low level of inclusivity, constitutes a substantial contribution to the literature.

Following the introduction, the literature review is analyzed in the first section, followed by the methodological approach in the second section, and the third section presents and discusses the results before concluding this paper.

I. Literature review

Fiscal and monetary policy instruments are traditionally used either individually or in combination to achieve the same overall objective, which is to promote inclusive growth (Batool and Bhatti, 2021; Ahiadorme, 2022). However, Morosoli et al. (2024) find that monetary policy, characterized by low inflation, plays a more decisive role than fiscal policy in promoting inclusive development. Iddrisu et al. (2022), on the other hand, believe that effective monetary policy may not improve human development, even if its main objectives are achieved. According to them, policymakers should therefore ensure that the effectiveness of monetary policy is not limited to price stability but also considers the moderation of banking costs to promote human development.

Furthermore, a monetary policy aimed at stabilizing aggregate demand is likely to improve the living conditions of the poorest in the long term and, as a result, ensure inclusive human development (Romer and Romer, 1998). This extension of the objectives of a well-targeted monetary policy would be more effective in promoting development than simply stimulating economic growth, as advocated in traditional theory. It would therefore affect inflation and unemployment rates, which in turn influence household purchasing power, affect access to health and

education, facilitate access to credit for disadvantaged groups, and thus promote broader economic participation and, consequently, a reduction in inequalities or an improvement in inclusive human development (Chowdhury, 2019; Pérez-Moreno et al., 2025). These authors argue that socially inclusive and environmentally sustainable economic growth is a central public policy priority for most governments around the world, and they recommend orienting monetary policy toward more inclusive development, particularly human development that integrates marginalized groups.

The government therefore uses monetary policy instruments through the central bank to bring about socioeconomic change, which helps reduce social inequalities and considers marginalized groups in the assessment of human development. With regard to these instruments, some authors believe that the M2 and M3 money supply, interest rates, inflation rates and yield curves do not directly measure the effectiveness of monetary policy (Romer and Romer, 1998; Fielding, 2004; Uhlig, 2005; Galbraith et al., 2007; Nwoko et al., 2016). However, other authors consider reserve requirements, interest rates and the money supply to be instruments that can be used to activate transmission channels from the financial sector to the real sector, stabilize policies, promote financial inclusion, reduce social inequalities and support equitable growth (Modigliani et al., 1970; Amidu, 2006; Chiu et al., 2018; Ciccarelli et al., 2015). However, the empirical link between monetary policy and inclusive development has not been clearly demonstrated in some studies (Olakanmi & Olagunju, 2020; Ahiadorme, 2022; Ekomane, 2021; Romer and Romer, 1999).

Srithilat et al. (2017) analyze the impact of monetary policy on inclusive development via time series data covering the period 1989--2016 in Laos. Using unit root tests, Johansen cointegration and an error correction model, the authors highlight an inverse relationship between money supply, interest rates and inflation (used as indicators of monetary policy) and GDP per capita, a component of human development. However, monetary policy, as measured by the M3 money supply, significantly influences inclusive growth (Khabo and Harmse, 2005). Their study focused on South Africa for the period 1960--1997, applying the OLS method and the augmented Dickey–Fuller test.

Olakanmi and Olagunju (2020) determined the impact of monetary policy on inclusive growth in Nigeria via a multivariate regression model. By exploring the collected data, with the CPI as a proxy for inclusive growth and the exchange rate, interest rate and money supply as indicators of monetary policy, they find a positive and significant relationship between the money supply and inclusive growth. Indeed, a 1% increase in money supply increases individual well-being by 12%. In contrast, the exchange rate and interest rate have a negative and insignificant impact on per capita income. This implies the appropriate implementation of monetary policy measures (particularly money supply) to induce changes in the economy by improving citizens' well-being. Similarly, Ahiadorme (2022) assesses the role of monetary policy in inclusive growth by exploring a sample of 144 countries covering the period 2000--2018. The author uses the dynamic GMM approach and proves that, in the short and long term, a monetary policy aimed at low inflation and stable economic growth is likely to

permanently improve the inclusiveness of growth and the living conditions of the poor.

In addition to empirical investigations into the effect of monetary policy on inclusive economic growth, which is a factor in inclusive development, other studies have examined other components of inclusive development. Romer and Romer (1999), for example, analyze the short- and long-term effects of monetary policy on poverty and inequality. They use a simple regression on US time series data for short-term effects and cross-country panel data for long-term effects. Their study revealed that the results of short-term analysis contrast with those of long-term analysis. The decrease in interest rates resulting from expansionary monetary policy reduces poverty in the short term without having any obvious impact on income distribution. However, in the long term, expansionary monetary policy reduces the incomes of the poor and exacerbates inequality.

Unlike Romer and Romer (1999), Kang et al. (2013) overcome econometric problems and maintain the consistency of short- and long-term data to better understand the heterogeneous effects of monetary policy on the welfare of individual economic agents, poverty and income inequality. They use the interest rate as the key variable of monetary policy, as do central banks.

Furthermore, Ekomane (2021) identified the transmission channels through which monetary policy affects social welfare, as captured by the HDI, in Cameroon from 1990--2015. Using a conventional structural autoregressive methodology, he shows that the HDI responds significantly to monetary policy impulses with a two-year lag through the income-consumption channel and the credit-consumption channel. For Fielding (2004), changes in monetary policy instruments, particularly interest rates, have a greater impact on poor households than on rich households in the case of the WAEMU. Iddrisu et al. (2022) also examine the effect of monetary policy effectiveness on human development in Africa. The authors use both microbanking data from the BankScope database maintained by Fitch/IBCA/Bureau Van Dijk and macronational data with annual series covering a sample of 320 banks in 29 African countries over the period 2002–2013. They use fixed effects, random effects and instrumental variable regression methods, with an instrument on the basis that the effectiveness of monetary policy depends on the independence of the central bank. Their results suggest that effective monetary policy translates into high interest rates on bank loans and deposits, which tends to promote human development. However, the estimated net effects show that effective monetary policy does not, on balance, improve human development.

Morosoli et al. (2024) identify the economic policies and factors that promote inclusive development. They use the multidimensional inclusiveness index proposed by Dörffel and Schuhmann (2022) in a panel OLS regression framework with fixed effects (FE), as well as the generalized method of moments (GMM) estimates, which is based on a sample of 178 countries over the period 1980--2018. Their results reveal a robust association between monetary policy, as captured by inflation, financial development and trade openness, in both the short and long term. Low inflation and stable economic growth, i.e., the achievement of monetary policy objectives, are likely to bring about lasting

improvements in the inclusiveness of growth and the living conditions of the poorest, and thus in inclusive human development (Ahiadorme, 2022).

We note that the literature on monetary policy and human development shows mixed results, with a majority of studies agreeing that poorly targeted monetary policy may not improve the distribution of growth benefits. However, other research shows that monetary policies focused on inclusiveness can reduce inequalities and improve inclusive development. To date, this literature has focused on specific monetary policy variables related to inclusive growth, as well as on a few aspects contributing to well-being, such as poverty, inequality and human development. The instruments used do not always effectively assess the effectiveness of monetary policy. The empirical link between monetary and real variables requires the use of robust methods to correct for econometric inference problems. The scope of application remains limited in Africa, even though the challenge of the contribution of monetary policy to inclusive development is crucial, as fiscal policy alone cannot promote a high and inclusive level of human development. Furthermore, the quantile regression with instrumental variables methodology allows us to test the hypothesis that the effects of monetary policy vary according to levels of inclusive development, which is something that certain studies have not explored. In these respects, this paper makes a solid contribution, both theoretically and empirically, to the literature.

II. Methodology and Data

2.1. Econometric method

Empirical analysis of the effects of monetary policy on inclusive development can be carried out via the pooled OLS method. However, applying this method to panel data masks certain econometric problems related to the inability to correct for biases due to endogeneity and heterogeneity. Indeed, monetary policy, which influences bank reserves, the money supply and interest rates, can affect the IHDI by changing health and education conditions through its effect on economic growth. Furthermore, inclusive human development (reflected in inclusive economic growth and the consideration of inequalities in education and health) could, in turn, influence monetary policy decisions. However, the effects of financial variables are rarely homogeneous (Koenker, 2005, 2017; Chernozhukov & Hansen, 2006).

Furthermore, despite the variables included in our model, the probability of omitting other factors that could explain inclusive human development remains significant. Furthermore, as monetary policy is measured by bank liquidity, money supply and lending rates, as well as by a composite index of these three indicators that captures demand, supply and cost aspects, measurement errors are highly likely to occur. Thus, the monetary policy variable is potentially endogenous. It is therefore appropriate to use regression methods that address endogeneity.

For the regression technique, three estimators are used to test the effect of monetary policy on inclusive development. We use fixed effects (FEs) to control for unobserved heterogeneity that is invariant over time, then 2SLS with internal and external instruments, which allows us to control for endogeneity, and finally

quantile regression with instrumental variables (IVQRs), which allows us to capture heterogeneous effects along the conditional distribution of the IHDI while treating endogeneity. To control for endogeneity, we use internal instruments, namely, two-period lagged values of monetary policy variables. We then use external instruments corresponding to regional averages of monetary policy, referring to the technique developed by Mundlak (1978). These instruments ensure that the observed relationships are causal and not spurious. Finally, we combine quantile regression with instrumental variables introduced by Chernozhukov and Hansen (2005) to account for country heterogeneity in the model.

The smoothed instrumental variable quantile regression developed by Kaplan (2022) and Kaplan and Sun (2017), which is used in this paper, allows us to obtain relatively homogeneous subgroups and improves computational efficiency and statistical accuracy through smoothing. This method is robust to distribution assumptions and outliers, providing reliable and insensitive estimates (Hao and Naiman, 2007; Kudryavtsev, 2009). It also allows for the treatment of models with multiple endogenous variables and effectively manages issues of simultaneity and reverse causality (Oudanou et al., 2024; Ouedraogo, 2025). It is therefore better suited to testing the hypothesis of our study, which is that the effects of monetary policy may vary considerably depending on the different levels of inclusive development in Africa. We therefore use the basic quantile model of Chernozhukov and Hansen (2006), simplified as follows:

$$Y_{it} = Z_{1,it}\beta_1(\alpha) + Z_{2,it}\beta_2(\alpha) + W'_{it}\gamma(\alpha) + \varepsilon_{it}(\alpha) \quad (1)$$

where Y_{it} denotes the dependent variable for unit i at time t;
$Z_{1,it}$ and $Z_{2,it}$ are two potentially endogenous regressors;
W'_{it} is a vector of exogenous control variables;
$\beta_1(\alpha)$ and $\beta_2(\alpha)$ measure the causal marginal effects of X specific to the conditional quantile of Y.
$\varepsilon_{it}(\alpha)$ is an unobserved error term
On the basis of equation (1) and the literature, we specify our econometric model used in the instrumental variable quantile regression in equation (2):

$$IHDI_{it} = \beta_0 + \beta_1 BANKLIQRES_{it} + \beta_2 BROADMOGDP_{it} + \beta_3 REALINTRAT_{it} + \beta_4 HUCAP_{it} + \beta_5 GOVINVEST_{it} + \beta_6 CC_{it} + \beta_7 CPI_{it} + \beta_8 TNRR_{it} + \delta_i + \gamma_t + \varepsilon_{it} \quad (2)$$

where δ represents the unobserved effect specific to each country; γ denotes the time fixed effect; and ε signifies the error term.
However, we specify an alternative regression by combining our three indicators capturing monetary policy into a composite index as follows:

$$IHDI_{it} = \beta_0 + \beta_1 POMO_{it} + \beta_2 HUCAP_{it} + \beta_3 GOVINVEST_{it} + \beta_4 CC_{it} + \beta_5 CPI_{it} + \beta_6 TNRR_{it} + \delta_i + \gamma_t + \varepsilon_{it} \quad (3)$$

The new monetary policy variable is designed as a composite index, constructed via z score standardization of the three variables that make up monetary policy, followed by unweighted linear aggregation, in accordance with the methodological recommendations of Nardo et al. (2005), to test the robustness of our results.

2.2. Data and variables

As part of this study, we draw on data from various secondary sources. It is based on a panel of 43 African countries covering the period from 2010--2022. The

choice of sample is dictated by data availability. The variable relating to inclusive development is measured by the inequality-adjusted human development index (IHDI) to consider distributional inequalities in the dimensions of the HDI. According to Kovacevic (2010) and Alkire and Foster (2010), this indicator reflects the distribution of human development gains within the population and between the different dimensions, integrating inequalities into the quantification of human development. It is adequate for measuring inclusive development (Hicks, 1997; Foster et al., 2005; Casadio Tarabusi & Guarini, 2016). The IHDI also takes into account the extent of inequalities in each dimension of the HDI by updating their average value.

In this paper, inclusive development is explained by our independent variable of interest, which is monetary policy. According to the literature, the effect of monetary policy on inclusive development depends on how it is measured. Indeed, financial dynamics in terms of depth, activity, and size improve inclusive human development, whereas the inability of banks to transform mobilized deposits into credit for financial access negatively affects inclusive human development (Asongu & Nting, 2022; Asongu and Nwachukwu, 2015). Therefore, to measure the monetary policy variable in this paper, we use three indicators: a stock indicator, namely, bank liquidity; a supply indicator, which is the M2 money supply; and a credit cost indicator, measured by the real interest rate.

According to the literature, inclusive development is supposedly influenced by human capital, public investment, corruption control, the inflation rate, and natural resource rents. The definitions, sources, and descriptive statistics for all the variables are presented in Table (1).

Table 1: Descriptive Statistics

Variables	Obs	Mean	Std. Dev.	Min	Max	Definitions	Source
ihdi	559	.356	.099	.184	.633	Inequality-adjusted Human Development Index	United Nations Development Programme (UNDP, 2024)
bankliqres	559	21.6	16.494	2.259	94.82	Bank liquid reserves to bank assets ratio (%)	International Financial Statistics (International Monetary Fund, 2024)
broadmogdp	559	38.725	24.391	.023	110.54	Broad money (% of GDP)	International Financial Statistics (International Monetary Fund, 2024)
realintrat	416	7.602	9.654	-15.69	52.437	Real interest rate (%)	International Financial

Variables	Obs	Mean	Std. Dev.	Min	Max	Definitions	Source
							Statistics (International Monetary Fund, 2024)
hucap	468	1.94	.482	1.166	2.908	Human Capital Index	Penn World Table 10.02
govinvest	559	5.765	3.264	0	10	Government investment	World Development Indicators (World Bank, 2024)
cc	559	-.617	.602	-1.6	1.016	Control of Corruption: Estimate	Worldwide Governance Indicators (World Bank, 2024)
cpi	541	6.34	6.481	-4.295	36.907	Consumer price index (2010 = 100)	World Development Indicators (World Bank, 2024)
tnrr	516	10.007	8.684	.002	43.94	Total natural resources rents (% of GDP)	World Development Indicators (World Bank, 2024)

Source authors

To diagnose any potential multicollinearity issues upstream, we created the correlation matrix shown in Table 2 in the appendix. This reveals a lack of strong correlation between the regressors in our empirical model, as the coefficients do not exceed the critical threshold established by Kennedy (2008). For the author, the absolute value of the correlation coefficient between two regressors should not exceed 0.8. Graph 1 shows the relationship between monetary policy and inclusive development using the average level for countries. This finding indicates that an accumulation of liquidity, in the absence of an effective mechanism for transmitting credit at low cost to the real economy, can limit its impact and mitigate its distributive effects favorable to inclusive development. However, monetary policy appears to be more relevant to inclusive development when assessed multidimensionally rather than through isolated indicators.

III. Results

3.1. Baseline results

The results of the joint FE, DMC and instrumental variable quantile regression models, which examine the heterogeneity of monetary policy effects according to the level of human development adjusted for inequality, are presented in Table 2.

The IVQR coefficients are virtually constant between the 10% and 90% quantiles, indicating a lack of heterogeneity in terms of inclusive development among African countries.

Improved bank liquidity is associated with more inclusive human development. This can be explained by the fact that excess bank liquidity facilitates access to credit for financing social spending (education and health), regardless of human development levels. The stability of the coefficient across all quantiles indicates a structural and generalized effect. Indeed, improving the African banking system's ability to provide liquid resources benefits countries with low IHDI levels as well as those with medium or high IHDI levels. These results are consistent with the literature, which shows that financial stability indirectly promotes well-being (Casadio Tarabusi & Guarini, 2016).

Similarly, an increase in the money supply relative to GDP improves the IHDI, reflecting the role of monetary depth in stimulating inclusive economic activity. In this sense, monetary depth would promote investment by resolving liquidity constraints, which would stimulate inclusive socioeconomic activities. Furthermore, when the amount of money held by economic agents increases, it improves their transactions in the social sector, thereby contributing to strengthening inclusive human development. These results are consistent with those of Kang et al. (2013), who find that monetary policy, when it promotes bank liquidity, can reduce inequalities and promote more inclusive human development.

Control of the real interest rate is associated with an improvement in the IHDI, reflecting a decline in economic uncertainty. This can be explained by the fact that an improvement in the interest rate is predictive of greater monetary credibility, controlled inflation and more efficient capital allocation, macroeconomic conditions that indirectly promote inclusive human development. These results disagree with those of Ekomane (2021), who shows that the money supply and interest rates reduce GDP per capita, as well as with those of Khabo and Harmse (2005), who argue that the M3 money supply promotes inclusive growth.

Monetary policy, as measured by bank liquidity, monetary depth and real interest rate stability, has a positive and consistent effect on inclusive development. These monetary transmission mechanisms are more institutional than distributive, operating at the macroeconomic level rather than among specific groups, in a structural manner and independent of the level of inclusive development. As a result, monetary policy, through its real and financial transmission mechanisms, is not limited to macroeconomic stability but also influences the dimension of inclusive development. This extension of the role of monetary policy is thus an additional determinant of inclusive development.

Table 2: Estimation results with internal instruments

Variables	Dependent Variable: Inclusive social Development						
	FE	2SLS	Quantile instrumental variable regression				
			10%	25%	50%	75%	90%
Bank liquid reserves	0.000241***	0.000665**	0.000665***	0.000665***	0.000665***	0.000665***	0.000661***
	(6.89e-05)	(0.000269)	(0.000227)	(0.000227)	(0.000227)	(0.000227)	(0.000226)
Broad money	0.000556***	0.00244***	0.00244***	0.00244***	0.00244***	0.00244***	0.00244***
	(0.000143)	(0.000155)	(0.000108)	(0.000108)	(0.000108)	(0.000108)	(0.000108)
Real interest rate	0.000281*	0.000834***	0.000834***	0.000834***	0.000834***	0.000834***	0.000834***
	(0.000167)	(0.000193)	(0.000183)	(0.000183)	(0.000183)	(0.000183)	(0.000183)
Human Capital Index	0.101***	0.107***	0.107***	0.107***	0.107***	0.107***	0.107***
	(0.00889)	(0.00774)	(0.00711)	(0.00711)	(0.00711)	(0.00711)	(0.00746)
Government investment	-0.00106***	-0.00249***	-0.00249***	-0.00249***	-0.00249***	-0.00249***	-0.00249***
	(0.000385)	(0.000691)	(0.000677)	(0.000674)	(0.000674)	(0.000674)	(0.000684)
Control of Corruption	0.00560	0.0120***	0.0120***	0.0120***	0.0120***	0.0120***	0.0121***
	(0.00497)	(0.00415)	(0.00346)	(0.00346)	(0.00346)	(0.00346)	(0.00342)
Consumer price index	-4.31e-05	0.000260	0.000260	0.000260	0.000260	0.000260	0.000266
	(0.000201)	(0.000492)	(0.000373)	(0.000373)	(0.000373)	(0.000373)	(0.000369)
Total natural resources rents	-0.000477**	0.00151**	0.00151***	0.00151***	0.00151***	0.00151***	0.00154***
	(0.000230)	(0.000659)	(0.000442)	(0.000442)	(0.000442)	(0.000442)	(0.000491)
Constant	0.149***	0.0485***	-0.351***	-0.201***	0.0485***	0.299***	0.448***
	(0.0173)	(0.0140)	(0.0119)	(0.0119)	(0.0119)	(0.0119)	(0.0119)
Observations	336	278	278	278	278	278	278
R-squared	0.476	0.851					
Number of countries	29						
Under identification test (Kleibergen–Paap rk LM statistic)		32.663***					
Hansen J statistic (overidentification test of all instruments)		16.389***					

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

We have incorporated external instruments into the model. These are constructed from regional averages of monetary policy variables. The results presented in Table 3 confirm those obtained using only internal instruments in Table 2. This convergence of estimates reinforces the robustness and credibility of our empirical results.

Table 3: Estimation results with internal and external instruments

Dependent Variable: Inclusive social Development						
	2SLS	Regression quantile à variable instrumental				
Variables		10%	25%	50%	75%	90%
Bank liquid reserves	0.000635**	0.000635***	0.000635***	0.000635***	0.000635***	0.000632***
	(0.000265)	(0.000232)	(0.000232)	(0.000232)	(0.000232)	(0.000235)
Broad money	0.00245***	0.00245***	0.00245***	0.00245***	0.00245***	0.00245***
	(0.000154)	(0.000111)	(0.000111)	(0.000111)	(0.000111)	(0.000111)
Real interest rate	0.000868***	0.000868***	0.000868***	0.000868***	0.000868***	0.000867***
	(0.000188)	(0.000181)	(0.000181)	(0.000181)	(0.000181)	(0.000180)
Human Capital Index	0.107***	0.107***	0.107***	0.107***	0.107***	0.107***
	(0.00767)	(0.00704)	(0.00704)	(0.00704)	(0.00704)	(0.00735)
Government investment	-0.00251***	-0.00251***	-0.00251***	-0.00251***	-0.00251***	-0.00250***
	(0.000690)	(0.000676)	(0.000674)	(0.000674)	(0.000674)	(0.000683)
Control of Corruption	0.0118***	0.0118***	0.0118***	0.0118***	0.0118***	0.0119***
	(0.00415)	(0.00347)	(0.00347)	(0.00347)	(0.00347)	(0.00344)
Consumer price index	0.000286	0.000286	0.000286	0.000286	0.000286	0.000292
	(0.000490)	(0.000381)	(0.000380)	(0.000380)	(0.000380)	(0.000372)
Total natural resources rents	0.00153**	0.00153***	0.00153***	0.00153***	0.00153***	0.00156***
	(0.000657)	(0.000437)	(0.000437)	(0.000437)	(0.000437)	(0.000482)
Constant	0.0478***	-0.352***	-0.202***	0.0478***	0.298***	0.447***
	(0.0139)	(0.0114)	(0.0114)	(0.0114)	(0.0114)	(0.0114)
Observations	278	278	278	278	278	278
R-squared	0.851					
Underidentification test (Kleibergen–Paap rk LM statistic):	63.702***					
Hansen J statistic (overidentification test of all instruments):	40.177***					

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

The results of measuring monetary policy via a composite index constructed from our three basic indicators specified in equation (3) are presented in Table 4. These remain stable, robust, and statistically significant, which is consistent with those obtained from the disaggregated measures of the variables used to assess monetary policy.

Table 4: Estimation results when measuring monetary policy via a composite index and regressing with internal and external instruments

Variables	Dependent Variable: Inclusive social Development						
	FE	2SLS	Quantile instrumental variable regression				
			10%	25%	50%	75%	90%
Monetary policy	0.00298***	0.0174***	0.0173***	0.0174***	0.0174***	0.0174***	0.0174***
	(0.000574)	(0.00164)	(0.00158)	(0.00152)	(0.00152)	(0.00152)	(0.00154)
Human Capital Index	0.105***	0.118***	0.118***	0.118***	0.118***	0.118***	0.118***
	(0.00867)	(0.00857)	(0.00736)	(0.00714)	(0.00714)	(0.00714)	(0.00675)
Government investment	-0.000919**	-0.00281***	-0.00281***	-0.00281***	-0.00281***	-0.00281***	-0.00281***
	(0.000379)	(0.000822)	(0.000776)	(0.000796)	(0.000796)	(0.000796)	(0.000817)
Control of Corruption	0.00472	0.0313***	0.0313***	0.0313***	0.0313***	0.0313***	0.0313***
	(0.00487)	(0.00505)	(0.00350)	(0.00349)	(0.00349)	(0.00349)	(0.00369)
Consumer price index	-7.13e-05	-0.000915	-0.000924	-0.000915*	-0.000915*	-0.000915*	-0.000925
	(0.000192)	(0.000556)	(0.000595)	(0.000555)	(0.000555)	(0.000555)	(0.000568)
Total natural resources rents	-0.000551**	0.00195***	0.00193***	0.00195***	0.00195***	0.00195***	0.00202***
	(0.000220)	(0.000698)	(0.000619)	(0.000595)	(0.000595)	(0.000595)	(0.000619)
Constant	0.157***	0.0803***	-0.319***	-0.170***	0.0803***	0.330***	0.479***
	(0.0173)	(0.0153)	(0.0128)	(0.0123)	(0.0123)	(0.0123)	(0.0128)
Observations	336	278	278	278	278	278	278
R-squared	0.469	0.793					
Number of countries	29						
Under identification test (Kleibergen–Paap rk LM statistic)		81.834***					
Hansen J statistic (overidentification test of all instruments):		11.917***					

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

We tested the sensitivity of our results by incorporating additional control variables into our base model specified in equation (2). The results are presented in Table 5 and confirm those of the base model. According to Elistia and Syahzuni (2018) and Sarkodie and Adams (2020), individual wealth captured by "GDP per capita growth (annual %)" and access to electricity (% of population) are key determinants of inclusive development. We therefore add these values to our baseline model.

Table 5: Estimation results with the addition of control variables and regression with internal and external instruments

Variables	Dependent Variable: Inclusive social Development						
	FE	2SLS	Quantile instrumental variable regression				
			10%	25%	50%	75%	90%
Bank liquid reserves	0.000249***	0.000366	0.000366*	0.000366*	0.000366*	0.000366*	0.000359*
	(5.53e-05)	(0.000234)	(0.000206)	(0.000206)	(0.000206)	(0.000206)	(0.000208)
Broad money	0.000337***	0.00183***	0.00183***	0.00183***	0.00183***	0.00183***	0.00183***
	(0.000116)	(0.000171)	(0.000154)	(0.000154)	(0.000154)	(0.000154)	(0.000151)
Real interest rate	0.000364***	0.00122***	0.00122***	0.00122***	0.00122***	0.00122***	0.00122***
	(0.000135)	(0.000206)	(0.000210)	(0.000210)	(0.000210)	(0.000210)	(0.000209)
Human Capital Index	0.0483***	0.0937***	0.0937***	0.0937***	0.0937***	0.0937***	0.0941***
	(0.00822)	(0.00706)	(0.00571)	(0.00571)	(0.00571)	(0.00571)	(0.00599)
Government investment	-0.000559*	-0.00192***	-0.00192***	-0.00192***	-0.00192***	-0.00192***	-0.00191***
	(0.000313)	(0.000606)	(0.000660)	(0.000660)	(0.000660)	(0.000660)	(0.000661)
Control of Corruption	0.00555	0.0125***	0.0125***	0.0125***	0.0125***	0.0125***	0.0126***
	(0.00399)	(0.00360)	(0.00344)	(0.00344)	(0.00344)	(0.00344)	(0.00336)
Consumer price index	-6.82e-05	0.000584	0.000584*	0.000584*	0.000584*	0.000584*	0.000597**
	(0.000162)	(0.000417)	(0.000314)	(0.000314)	(0.000314)	(0.000314)	(0.000303)
Total natural resources rents	-0.000412**	0.00186***	0.00186***	0.00186***	0.00186***	0.00186***	0.00192***
	(0.000186)	(0.000626)	(0.000499)	(0.000499)	(0.000499)	(0.000499)	(0.000515)
GDP per capita growth	-8.88e-05	-1.38e-05	-1.38e-05	-1.38e-05	-1.38e-05	-1.38e-05	5.96e-06
	(0.000161)	(0.000519)	(0.000495)	(0.000495)	(0.000495)	(0.000495)	(0.000481)
Access to electricity	0.00122***	0.000851***	0.000851***	0.000851***	0.000851***	0.000851***	0.000852***
	(9.60e-05)	(0.000138)	(0.000146)	(0.000146)	(0.000146)	(0.000146)	(0.000146)
Constant	0.198***	0.0515***	-0.349***	-0.199***	0.0515***	0.301***	0.450***
	(0.0145)	(0.0135)	(0.0115)	(0.0115)	(0.0115)	(0.0115)	(0.0115)
Observations	336	278	278	278	278	278	278
R-squared	0.665	0.870					
Number of countries	29						
Under identification test (Kleibergen–Paap rk LM statistic):		52.240***					
Hansen J statistic (overidentification test of all instruments)		43.978***					

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

3.2. Results from alternative estimations

Tables A2, A3, and A4, presented in the appendix, summarize the estimates derived from monetary policy regressions on social inequality, income inequality, and human development, respectively. These results allow us to assess the differentiated effect of monetary policy on each dimension of inclusive development.

The estimates indicate that monetary policy contributes to reducing social and income inequality, thereby strengthening inclusive development, understood as a development process that takes these disparities into account. Furthermore, monetary policy has a positive effect on human development while reducing social and economic inequalities, thereby promoting more inclusive human development in African countries. These results reinforce the theoretical conception of inclusive development formulated by Alkire and Foster (2010).

Conclusion

This study examined the impact of distributive monetary policy on inclusive development in Africa over the period 2010–2022, employing complementary econometric approaches, including fixed-effects models, two-stage least squares, and instrumental variable quantile regression. The overall findings provide evidence of a positive, statistically significant, and robust effect of monetary policy on inclusive human development.

The results indicate that monetary policy operates primarily as a structural macroeconomic lever. Its influence is transmitted through systemic mechanisms particularly bank liquidity management, money supply dynamics, and real interest rate movements that contribute to improving overall socioeconomic conditions. However, the absence of differentiated effects across initial levels of inclusive development suggests that monetary policy does not automatically correct structural asymmetries between countries. While it strengthens the general macroeconomic environment, it does not, in itself, function as a targeted redistributive instrument.

The analysis of transmission channels shows that increased bank liquidity consistently supports inclusive development by enhancing financial intermediation and facilitating access to credit. Similarly, financial deepening—captured by the expansion of the money supply relative to GDP appears especially beneficial for economies with lower levels of human development, where financing constraints remain more acute. Moreover, the stabilization of real interest rates helps reduce macroeconomic uncertainty, improves the predictability of investment decisions, and promotes a more efficient allocation of resources toward social and productive sectors.

These findings call for a reassessment of the strategic orientation of monetary policy in the African context. Beyond price stability, monetary authorities would benefit from explicitly incorporating economic and social inclusion objectives into the design and implementation of their policy instruments, particularly with regard to liquidity management, credit regulation, and financial development. Nevertheless, the redistributive capacity of monetary policy remains limited in the

absence of coherent coordination with fiscal policy. Stronger policy coordination therefore appears essential to amplify the effects on inequality reduction and sustainable improvements in welfare.

Finally, this study faces certain limitations, notably, the limited availability of data on inclusive development and the absence of explicit modeling of monetary–fiscal policy interactions. Future research could further investigate institutional complementarities and assess the extent to which optimal coordination of macroeconomic policy instruments may strengthen inclusive development trajectories in Africa.

Author contributions
All the authors contributed to the design and development of the study. The methodology and analysis of the results were written by the first author. The introduction and literature review were written by the second author. All the authors have read and approved the final manuscript. All authors accept responsibility for all aspects of their work.

Conflict of interest statement
The authors present no conflicts of interest.

Data availability
The data that support the findings of this study are available from the corresponding author upon reasonable request.

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Appendix

Graph 1: Graph 1: Monetary Policy and Inclusive Development

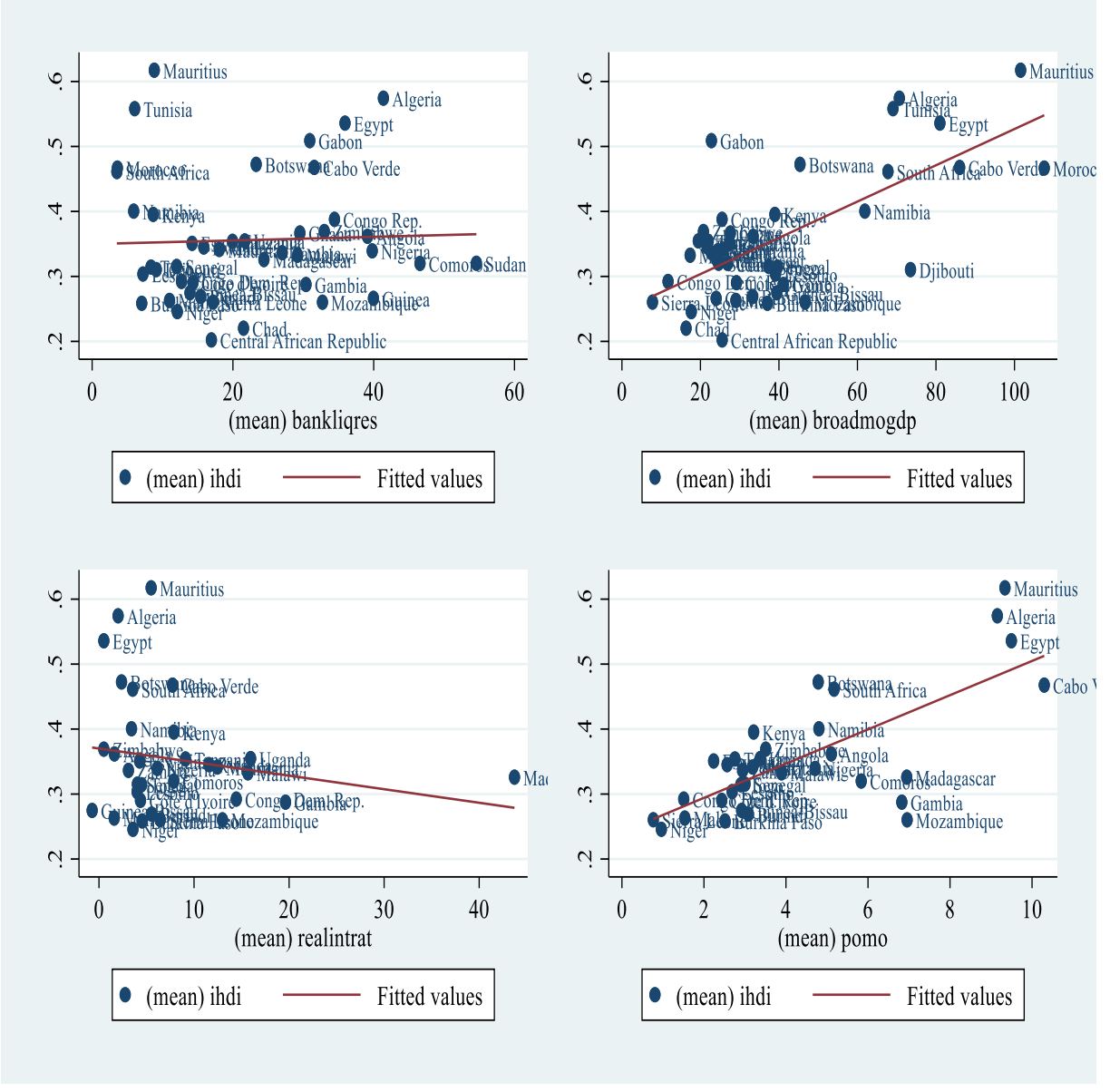

Table A1: Pairwise correlations

Variables	(ihdi)	(banklqres)	(broadmogdp)	(realintrat)	(hucap)	(govinvest)	(cc)	(cpi)	(tnrr)
ihdi	1.000								
banklqres	0.040	1.000							
broadmogdp	0.668***	-0.173***	1.000						
realintrat	-0.162***	0.046	-0.205***	1.000					
hucap	0.776***	0.043	0.351***	-0.184***	1.000				
govinvest	0.124***	-0.002	0.056	0.102**	0.140***	1.000			
cc	0.444***	-0.234***	0.468***	-0.103**	0.317***	-0.037	1.000		
cpi	-0.034	0.418***	-0.178***	-0.056	-0.027	0.092*	-0.183***	1.000	
tnrr	-0.098**	0.274***	-0.260***	-0.102**	-0.140***	0.074*	-0.382***	0.088**	1.000

*** p<0.01, ** p<0.05, * p<0.1

Table A2: Regression of monetary policy on social inequality

Dependent Variable: social inequality							
Variables	FE	2SLS	Quantile instrumental variable regression	social inequality	social inequality	social inequality	social inequality
			10%	25%	50%	75%	90%
monetary policy	-0.132**	-0.962***	-1.421***	-1.283***	-1.078***	-0.878***	-0.761***
	(0.0617)	(0.115)	(0.157)	(0.162)	(0.202)	(0.191)	(0.109)
Human Capital Index	-6.168***	-5.338***	-2.371***	-3.821**	-4.101***	-4.574***	-6.414***
	(0.931)	(0.612)	(0.780)	(1.514)	(0.884)	(0.846)	(0.367)
Government investment	0.173***	0.372***	0.404***	0.506***	0.374***	0.255**	0.417***
	(0.0407)	(0.0616)	(0.109)	(0.0843)	(0.0688)	(0.125)	(0.121)
Control of Corruption	-0.0453	0.142	0.701	0.948	0.341	0.363	0.0790
	(0.523)	(0.348)	(0.461)	(0.589)	(0.590)	(0.878)	(0.750)

Consumer price index	0.0123	0.0917**	0.195***	0.125**	0.0598	-0.0731	0.0120
	(0.0206)	(0.0370)	(0.0355)	(0.0559)	(0.0534)	(0.0607)	(0.0790)
Total natural resources rents	0.0588**	-0.00885	0.00606	0.0383	0.0568	0.118	0.0169
	(0.0236)	(0.0451)	(0.114)	(0.0672)	(0.0646)	(0.0777)	(0.0513)
Constant	44.81***	45.77***	36.20***	40.61***	43.62***	47.30***	52.01***
	(1.852)	(1.238)	(1.426)	(2.588)	(1.278)	(2.573)	(1.195)
Observations	336	278	278	278	278	278	278
R-squared	0.251	0.552					
Number of countries	29						

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

Table A3: Regression of monetary policy on income inequality

Dependent Variable: income inequality							
Variables	FE	2SLS	Quantile instrumental variable regression	social inequality	social inequality	social inequality	social inequality
			10%	25%	50%	75%	90%
Monetary policy	0.0291	-2.025***	-1.979***	-2.871***	-1.700	-0.829	-0.936*
	(0.154)	(0.361)	(0.355)	(0.594)	(1.415)	(0.638)	(0.551)
Human Capital Index	0.197	3.788**	0.543	7.265*	5.125	8.680***	4.311***
	(2.291)	(1.852)	(2.851)	(3.987)	(3.291)	(2.388)	(1.137)
Government investment	0.371***	0.604***	0.179	0.699**	0.694*	0.106	0.0818
	(0.100)	(0.232)	(0.403)	(0.297)	(0.384)	(0.483)	(0.198)
Control of Corruption	1.836	5.117***	9.748***	5.472***	4.134***	3.798	8.022***
	(1.287)	(1.109)	(2.964)	(1.816)	(1.348)	(2.477)	(0.864)
Consumer price index	0.108**	0.161	-0.142	0.0330	0.257*	0.382	0.140
	(0.0506)	(0.131)	(0.112)	(0.264)	(0.146)	(0.240)	(0.207)
Total natural resources rents	0.0772	0.0691	-0.436**	-0.0737	0.0624	0.189	0.490***
	(0.0581)	(0.142)	(0.208)	(0.275)	(0.230)	(0.165)	(0.171)
Constant	39.95***	41.92***	44.97***	33.38***	36.85***	34.95***	50.85***
	(4.568)	(3.425)	(3.978)	(6.891)	(6.222)	(7.310)	(2.021)
Observations	335	278	278	278	278	278	278
R-squared	0.069	0.203					
Number of countries	29						

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

Table A4: Regression of monetary policy on human development

Dependent Variable: human development							
Variables	FE	2SLS	Quantile instrumental variable regression				
			10%	25%	50%	75%	90%
Monetary policy	0.0109***	0.0560***	0.0558***	0.0560***	0.0560***	0.0560***	0.0556***
	(0.00227)	(0.00514)	(0.00477)	(0.00486)	(0.00486)	(0.00486)	(0.00478)
Human Capital	0.134***	0.141***	0.142***	0.141***	0.141***	0.141***	0.142***
	(0.00907)	(0.00786)	(0.00714)	(0.00717)	(0.00717)	(0.00717)	(0.00725)
Government investment	0.000675*	-0.000383	-0.000478	-0.000383	-0.000383	-0.000383	-0.000396
	(0.000396)	(0.000893)	(0.000964)	(0.000913)	(0.000913)	(0.000913)	(0.000915)
Control of Corruption	0.00916*	0.0469***	0.0468***	0.0469***	0.0469***	0.0469***	0.0470***
	(0.00510)	(0.00559)	(0.00564)	(0.00549)	(0.00549)	(0.00549)	(0.00606)
Consumer price index	0.000469**	-7.81e-05	-0.000278	-7.81e-05	-7.81e-05	-7.81e-05	-6.80e-05
	(0.000201)	(0.000645)	(0.000741)	(0.000707)	(0.000707)	(0.000707)	(0.000724)
Total natural resources rents	-0.000862***	0.00245***	0.00241***	0.00245***	0.00245***	0.00245***	0.00256***
	(0.000230)	(0.000710)	(0.000674)	(0.000627)	(0.000627)	(0.000627)	(0.000651)
Constant	0.292***	0.281***	-0.119***	0.0308*	0.281***	0.531***	0.678***
	(0.0184)	(0.0175)	(0.0161)	(0.0157)	(0.0157)	(0.0157)	(0.0179)
Observations	336	278	278	278	278	278	278
R-squared	0.545	0.831					
Number of countries	29						

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

Framework: Sample

Algeria, Angola, Botswana, Burundi, Burkina Faso, Cabo Verde, Central African Republic, Chad, Comoros, Congo Dem. Rep., Congo Rep., Côte d'Ivoire, Djibouti, Egypt, Eswatini, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Madagascar, Malawi, Mali, Mauritania, Mauritius, Morocco, Mozambique, Namibia, Niger, Nigeria, Rwanda, Senegal, Sierra Leone, South Africa, Sudan, Tanzania, Togo, Tunisia, Uganda, Zambia, Zimbabwe.