EFFECT OF TRILEMMA INDEX ON FINANCIAL INSTITUTION DEVELOPMENT: EVIDENCE FROM AFRICA

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A B S T R A C T

Our main concern is which choice among the trilemma index affects financial institution development in developing countries. This study advances the empirical method to study the trilemma index and financial institution development in Africa. Using Ordinary Least Squares, Two Stages Least Squares and two steps system Generalized Method of Moments (GMM) techniques estimator with a dataset covering a number of 44 African countries over an extended period of time of 30 years, we indicate that monetary independence and financial market openness policies are the best indexes that significantly affect positively financial institution development in Africa. The main reason for this is that majority of African countries do not have well developed financial institutions, and they do not have the capacity to control exchange rate stability. The endogeneity tests are consistent with the findings.

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1. INTRODUCTION

In the modern world, given the growth of trade in goods and services and the fast pace of financial innovation, it is possible that capital controls can often be escaped (Jebeniani and Trabelsi,2022). In addition, capital controls introduce numerous distortions. Hence, there are few countries with an effective system of capital controls[1]. Lacking effective control on the free movement of capital, the impossible trinity asserts that a country must choose between reducing currency volatility and running a stabilizing monetary policy (Aizenman, Chinn and Ito, 2017). The point is that you cannot have it all: A country must pick two out of three. It can fix its exchange rate without emasculating its central bank, but only by maintaining controls on capital flows; it can leave capital movement free but retain monetary autonomy, but only by letting the exchange rate fluctuate; or it can choose to leave capital free and stabilize the currency, but only by abandoning any ability to adjust interest rates to fight inflation or recession. The combination of the three policies, fixed exchange rate, free capital flow, and independent monetary policy

[1]Kevin Gallagher (2010-03-01). "Capital controls back in IMF toolkit". The Guardian. Retrieved 2010-05-24.

is known to cause financial crisis[2].

In particular, the East Asian crisis (1997–1998) is widely known as a large-scale financial crisis caused by the combination of the three policies which violate the impossible trinity (Garnaut, 1999). The East Asian countries were taking a fixed exchange rate, promoting the free movement of capital, and making independent monetary policy at the same time. First, because of the de facto dollar peg, foreign investors could invest in Asian countries without the risk of exchange rate fluctuation. Second, the free flow of capital kept foreign investment uninhibited. Third, the short-term interest rates of Asian countries were higher than the short-term interest rate of the United States from 1990–1999 (Patnaik and Shah, 2010). For these reasons, many foreign investors invested enormous amounts of money in Asian countries and reaped huge profits. While the Asian countries' trade balance was favorable, the investment was pro-cyclical for the countries. But when the Asian countries' trade balance shifted, investors quickly retrieved their money, triggering the Asian crisis. Since many short-term debt obligations were denoted in US dollars, debts grew substantially, and many businesses had to shut down and declare bankruptcy. The disorderly collapse of fixed exchange rate regimes in Asia was anticipated in (Obstfeldand Kenneth, 1995) who showed that empirically almost no fixed exchange rate regime had survived five years once the capital account was opened. The more increase of the share of foreign currency in a competitive market, the more increase in entrepreneur's debt shares of government debt to foster their economic activities, and hence high GDP ratio (Gertler, Gilchrist and Natalucci, 2007), but most importantly, the foreign currency must not dominate the local currency in the market in terms of the exchange rate to allow the development of the domestic bond market and take over capital controls duties as far as corporate debt is concerned.

Many emerging markets seek to gain low inflation and economic stability by pegging currency against the dollar. It is a way for investors to gain confidence in investing and prevent inflationary pressures. However, once a developing economy pegs its currency against the dollar, it will need to give up freedom of capital or autonomous monetary policy. Referring to Gong, Mab and Chen(2022) the widened differences in the money supply and interest rates tend to weaken exchange rate dependence, but the differences in output and inflation have no explanatory power for exchange rate dependence. However, once a country has an exchange rate peg, interest rates will be set to achieve exchange rate target and not primarily for economic growth. It could mean that an emerging economy needs to increase interest rates, even in a downturn to keep the currency at its peg. If a developing economy wanted to keep exchange rate peg and cut interest rates, it would need to prevent capital leaving the economy through capital controls (Amewu, Junior, and Amenyitor, 2022). In practice, most fixed exchange rates rarely last. Countries invariably agree to devalue the currency if needed.

The trilemma index or impossible trinity is effectively a dilemma between capital mobility and independent monetary policy (Rey, 2015).There is a difficulty of controlling capital in developing economies, especially African countries[3]. In theory, a government may wish to impose capital controls, but in practice, investors and individuals may seek ways around it. Also, once government imposts capital controls, it may discourage investment and decrease confidence. At certain times, keeping the value of the exchange rate fixed can causes costs – if the fixed exchange rate is overvalued. If the exchange rate is overvalued and the currency falling below its target zone, then the government will be forced to intervene – through increasing interest rates and/or buying currency (Gong, Maband Chen,2022).

However, although this will keep the exchange rate within its target zone, there will be trade-off. Higher interest rates will lead to increased cost of borrowing and lower investment and economic growth. The overvalued exchange rates will make exports more expensive and cause relatively lower demand for exports. The formal model underlying the hypothesis is the uncovered interest rate parity condition which states that in absence of a risk premium, arbitrage will ensure that the depreciation or appreciation of a country's currency vis-à-vis another will be equal to the nominal interest rate differential between them. This in turn implies that the pegging country has no ability to set its nominal interest rate independently,

[2] The Mexican peso crisis (1994–1995), the Asian financial crisis (1997–1998), and the Argentinean financial collapse (2001–2002) are often cited as examples (Patnaik and Shah, 2010).
[3]Capital Accounts: Liberalize or Not? (imf.org)

and hence no independent monetary policy (André,Caraianiand Gupta,2022). The only way then that the country could have both a fixed exchange rate and an independent monetary policy is if it can prevent arbitrage in the foreign exchange rate market from taking place in institutes capital controls on international transactions (Aizenman, 2017). While one version of the impossible trinity is focused on the extreme case with a perfectly fixed exchange rate and a perfectly open capital account, a country has absolutely no autonomous monetary policy – the real world has thrown up repeated examples where the capital controls are loosened, resulting in greater exchange rate rigidity and less monetary-policy autonomy.

Economists Burd and Wyplosz (2005) say that the nation adopts an expansionary monetary policy to try to stimulate its domestic economy. This involves an increase of the monetary supply, and a fall of the domestically available interest rate. Because the internationally available interest rate adjusted for foreign exchange differences has not changed, market participants are able to make a profit by borrowing in the country's currency and then lending abroad. With no capital control, the trade will involve selling the borrowed currency on the foreign exchange market to acquire foreign currency to invest abroad – and this tends to cause the price of the nation's currency to drop due to the sudden extra supply (Boughton, 2003). Because the nation has a fixed exchange rate, it must defend its currency and will sell its reserves to buy its currency back. However, unless the monetary policy is changed back, the international markets will invariably continue until the government's foreign exchange reserves are exhausted, thereby causing the currency to devalue, thus breaking one of the three goals, and enriching market players at the expense of the government that tried to break the impossible trinity (Burdaand Wyplosz, 2005).

Many macroeconomics empirical studies have done in this area. Gong, Mab and Chen (2022) shows that exchange rate stability is important for portfolio optimization and risk management. Elsayeda, Naifar and Nasreene (2022) indicate monetary authorities react significantly to negative or positive shocks to financial stability, but they react differently in the short or long term. Other studies also find the positive effect of openness, for instance, Baltagi, Demetriades and Law (2009) indicate that all types of openness are statistically significant determinants of banking sector development. Cantaha, Brafu-Insaidoo,Wiafe and Adamsa (2018) show that an open economy attracts Foreign Direct Investment (FDI). Estrada, Park and Ramayandi (2015) shows that there a strong importance of financial openness on financial development. Catherine (2013) shows the significant relation between trade openness, market size and foreign direct investment (FDI) in fast emerging countries.

Several empirical studies use trade openness as the ratio of total trade to GDP, and represent a convenient variable routinely used for cross-country studies on a variety of issues. However, the effects that the crude measure captures remain ambiguous, making it difficult to interpret the empirical results. The impossible trinity (also known as the Trilemma) is a trilemma in international economics which states that it is impossible to have interest rate stability, monetary policy independent and financial markets openness at the same time. Using both macro-finance and macro-economic data from 44 African countries, we indicate that the combination of monetary policy independence and financial markets openness is the best choice in Africa. Any other combinations with exchange rate stability converges to the negative impacts. We contribute to the financial economic literature by indicating the best combination of trilemma index that should be used in Africa to support financial institution's development. To control for endogeneity issues, we use both two stages least square (2SLS) and System Generalized Methods of Moments (system GMM). Using both 2SLS and GMM, our results are still consistent.

2. PROBLEM STATEMENT AND THE RESEARCH QUESTIONS

There has been a concerted debate on the sensitivity of trilemma index to the economic and financial activities. One strand of literature by Aizenman, Chinn, and Ito (2008) indicate that in macroeconomic management, policy makers must face a trade-off of choosing two, not all, of the three policy choices: monetary independence, exchange rate stability, and financial openness. This is the famous hypothesis in international finance called the trilemma or the impossible trinity. History has shown that different international financial systems haven attempted to achieve combinations of two out of the three policy goals (Aizenman, 2017; Aizenman,Chinn,and Ito,2017). They also indicate that monitory policy, exchange, and interest rates to be sensitive to global financial shocks. Jebeniani and Trabelsi (2022) reveal that in the context of fixed and intermediate exchange rate regimes, an expansionary monetary

policy is an effective tool to stabilize exchange rate fluctuations and mitigate overvaluation in developing countries. Deng and Fang (2022) indicate that firms are less responsive in terms of investment to expansionary monetary shocks and the effect of monetary policy on aggregate investment depends on the distribution of debt maturity. Even if we have some studies related to exchange rate, monitory policy, and financial openness in Africa, we need more studies which should indicate the best indexes that should be used to promote financial institutions development in Africa. However, more specifically, our interest in this study is to show how trilemma index influences financial institutions development in Africa. We filled this gap in literature using the following research questions:

1. How the choice of trilemma index affects financial institutions development in Africa?
2. How the choice of trilemma index affects financial institutions depth in Africa?
3. How the choice of trilemma index affects financial institutions access in Africa?
4. How the choice of trilemma index affects financial institutions efficiency in Africa?

3. THEORITICAL REVIEW AND CONCETUAL FRAMEWORK

In this section we focus on the main theory and concept that we use in this study. We explain in detail the trilemma index.

The concept of impossible trinity or trilemma index

The concept of impossible trinity or trilemma index was developed independently by both John Marcus Fleming in 1962 and Robert Alexander Mundell in different articles between 1960 and 1963 (Aizenman, Chinn, and Ito, 2008).In 1997, Maurice and Taylor brought the trilemma index or impossible trinity into widespread use within economics. Economists Burd and Wyplosz (2005) provide an illustration of what can happen if a nation tries to pursue all three goals at once. It is a hypothesis based on the interest rate parity condition and empirical studies have proved that any country attempting to achieve the impossible trinity, is bound to fail.

The idea of the impossible trinity went from theoretical curiosity to becoming the foundation of open economy macroeconomics in the 1997, by which time capital controls had broken down in many countries, and conflicts were visible between pegged exchange rates and monetary policy autonomy. The policy trilemma refers to the trade-offs a government faces when managing international monetary policy (Agrippinoand Nenova,2022).

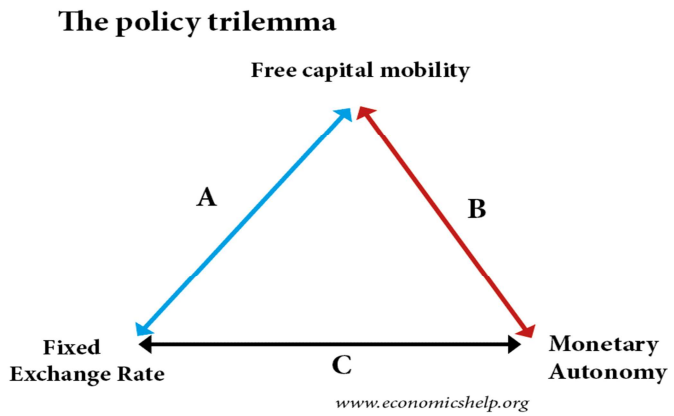
Countries which wish to promote growth would cut interest rates, but lower interest rates would cause hot money flows out of the economy and lead to a fall in the exchange rate. If the government wishes to have a fixed exchange rate but also change interest rates according to its own preferences, it will need to control the outflow of money. For example, suppose country wishes to keep her exchange rate fixed but it wished to cut interest rates to boost growth. In this case, there is downward pressure on the currency. Investors wish to sell the country currency and buy dollars(Mundell,1963). However, if the country prevents the country buying dollars and moving currency out of the country, then it can artificially keep the value of currency high.

The extent of monetary independence is measured as the reciprocal of the annual correlation between the monthly interest rates of the home country and the base country. The base country is defined as the country that a home country's monetary policy is most closely linked with as in Shambaugh (2004).By construction, the maximum value is 1, and the minimum value is 0. Higher values of the index mean more monetary policy independence. To measure exchange rate stability, annual standard deviations of the monthly exchange rate between the home country and the base country are calculated and the index is normalized between 0 and 1.

For the measure of financial openness, we use the index of capital account openness, or KAOPEN, by Chinn and Ito (2006, 2008). KAOPEN is based on information regarding restrictions in the International Monetary Fund's Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER). Specifically, KAOPEN is the first standardized principal component of the variables that indicate the presence of multiple exchange rates, restrictions on current account transactions, on capital account transactions, and the requirement of the surrender of export proceeds. The Chinn-Ito index is normalized between zero and one. Higher values of this index indicate that a country is more open to cross-border

capital transactions (Aizenman, Chinn, and Ito, 2008; Aizenman,Chinn, and Ito, 2017).

Figure 1: Trilemma Index or impossible trinity



Source: (Aizenman,Chinn, and Ito, 2017)[4]

This simple diagram suggests that a government must choose between: A = Fixed exchange rate + free capital mobility; B = Free capital mobility + monetary autonomy; C = Fixed Exchange rate + monetary autonomy.

4. EMPIRICAL REVIEW

Exchange rates

A puzzling feature of international price data is that real exchange rates are much more volatile than macroeconomic fundamentals. Yepezand Dzikpe (2022)empirically disaggregate international prices into their component parts to examine the key sources of high real exchange rate volatility with emphasis on Emerging Market Economies (EMEs). They document that relative tradeable goods prices account for most of the observed volatility world commodity prices explain about 30% of real exchange rate fluctuations. Jebenianiand Trabelsi (2022) explores the relationship between real exchange rate (RER) misalignments and economic fundamentals with respect to the exchange rate regime choice. Their empirical findings, based on nonlinear specifications and impulse response functions of Panel Vector Auto Regression (PVAR) estimations, reveal that for developing countries, and during the expansion and peak phases of the business cycle, the floating exchange rate regime may be used as a policy tool to contain the pressure in the exchange rate, and so limit overvaluation.

Gong,Mab and Chen (2022) indicate that exchange rate dependence enables investors to improve their portfolio performance. Aquilante and Masolo (2022) find that adverse pandemic news at the country level cause an immediate, statistically significant, depreciation of the domestic currency vis-à-vis a basket of trade-weighted currencies. This effect is more pronounced for free-floating economies. Amewu, Juniorand Amenyitor (2022) reveal that the dynamics of co-movement or interconnectedness of exchange rate and Ghana Stock Exchange composite index has evolved over time and across frequencies. Nusair and Olson (2022) find that rising and falling stock prices have significant long-run effects on exchange rates.

Monetary policy

Monetary instruments are more effective in the presence of a fiscal rule, based on commodity revenues. Ghiaiea,Tabarraei and Tavakolian (2022) show that with a persistent external shock, multiple currency practices (MCPs) could be effective at best in the short-run, while the aggregate welfare in the long-run can be diminished. According to Armstrong, Glaeser and Kepler (2022) the balance sheet channel of monetary policy predicts that the quality of firms' accounting reports plays a role in transmitting monetary policy by affecting information asymmetries between firms and capital providers i.e accounting quality moderates firms' equity market response and future investment sensitivity to unexpected changes in monetary policy. Monetary policies propagate internationally through trade and risk-taking. Spillovers of

[4]The Trilemma Indexes (pdx.edu)

the unconventional policies of the central banks to international asset prices are equivalent to a very large extent (Agrippino and Nenova (2022).

Monetary policy is the main tool of stock prices changes (André, Caraiani and Gupta, 2022). Debt maturity heterogeneity determines firm-level investment responses to monetary policy shocks. The effect of monetary policy on aggregate investment, therefore, depends on the distribution of debt maturity (Deng and Fang, 2022).Despite the econometric advances of the last 30 years, the effects of monetary policy stance during the boom and busts of the stock market are not clearly defined. Contractionary monetary policy enhances stock market volatility, but the importance of monetary policy shocks in explaining volatility evolves across different regimes and is relative to supply shocks (Plakandaras, Gupta, Balcilar and Ji, 2022). Monetary policy is more effective when financial intermediaries have a higher equity share in their total assets. The impulse responses of real variables to a given monetary policy shock also have larger magnitudes when financial intermediaries have a lower leverage (Zehao,2022).The financial intermediary leverage is counter-cyclical, explaining why monetary policy is less effective during recessions as found in the literature. Elsayeda,Naifarand Nasreene (2022)indicate that monetary authorities' response to the deviation of inflation from their target level, output gap, or exchange rate movement differ in magnitude, sign, and significance across the countries.

Financial openness

All types of openness are statistically significant determinants of banking sector development. The marginal effects of trade or financial openness are negatively related to the degree of financial or trade openness, indicating that relatively closed economies stand to benefit most from opening their trade and/or capital accounts. Although these economies may be able to accomplish more by taking steps to open both their trade and capital accounts, opening one without the other could still generate gains in terms of banking sector development (Baltagi,Demetriades and Law,2009). There is a linkage between country risk and the openness of an economy. The presence of country risk poses a problem for the smooth operation of international credit markets.

According to Aizenman (1987), a rise in country risk is associated with more frequent defaults and consequently with a lower level of investment. The resultant drop in investment is larger in activities with greater reliance on international trade. The nature of country risk in the presence of equity finance. Swapping nominal debt with equities may have useful consequences for reducing country risk, but it cannot eliminate the fundamental problems associated with international credit. Trade openness is an important determinant of Foreign Direct Investment (FDI) inflows into Sub-Saharan Africa (Cantaha,Brafu-Insaidoo,Wiafeb and Adamsa,2018). An efficient financial system is an indispensable ingredient of economic growth. It consists primarily of banks and capital markets, which channel savings into investments and other productive activities that contribute to economic growth and augment the economy's productive capacity (Estrada, Parkand Ramayandi,2015).

The scientific literature usually emphasizes the positive effects of trade and highlights its role in the ability to attract foreign capital however, the attraction can vary from country to country and sector to sector(Fazekas,2016).Catherine (2013) indicates that market size, interest rate and infrastructure quality are critical factors that determine FDI inflows for this group of emerging countries. According to Fujii (2019)fully integrated economies within a country, trade openness is approximately half as variable as it is for segmented diverse countries around the world. The information it conveys is better characterized as the extent of the economic remoteness and idiosyncratic distribution of sectoral production. The cross-country variation of trade openness derives more from the variability in GDP than trade. Gürişand Gözgör (2015) indicate that the external trade openness process attracts multinational companies and lead to further important steps in foreign direct investments (FDI). Gräbner, Heimberger, Kapeller and Springholz (2020) confirm that different openness measures contribute to economic growth due to financial institutions development. The above empirical studies on monetary policy independence, exchange rate stability and financial market openness motivate the researcher to study the effect of trilemma index on the financial institutions development in developing countries, especially in Africa.

5. DATA AND METHODOLOGY

The number of countries and time frame used in this study depend on the availability of data on trilemma

index and financial development databases. We collect data from 44 African countries over the period of 1990–2019 i.e30 years of time frame. The main sources of our data are trilemma dataset [5] ,IMF, world bank. The World Economic Outlook (WEO) is also a key to the country specific variables. The independent variables are the trilemma indexes that quantify the degree of achievement along the three dimensions of thetrilemma hypothesis: monetary independence, exchange rate stability, and financial openness. These indexes are first introduced by (Aizenman,Chinn,and Ito,2008). The dependent variables are the financial institutions development indicators as indicated in Figure 1 and in the footnotes[6][7]. The control variables are the natural log of GDP, GDP per capital, inflation, domestic credit to private sector by banks (% of GDP), nonbank financial institutions' assets to GDP (%), and GDP growth (annual %).

We practice Ordinary Least Square (OLS), instrumental variable Two Stages Least Squares (2SLS) and Generalized Method of Moments (GMM) estimators country-year panel data set of 44 African countries over the period of 1990–2019. The OLS model is given below:

$$\text{Fiancial Instutions Development} = \alpha + \beta\text{Trilemma index} + \theta Y_{i,t} + u_{it} + \text{Country FE} + \text{Year FE} \quad (1)$$

$$\text{Fiancial Instutions Depth} = \alpha + \beta\text{Trilemma index} + \theta Y_{i,t} + u_{it} + \text{Country FE} + \text{Year FE} \quad (2)$$

$$\text{Fiancial Instutions Access} = \alpha + \beta\text{Trilemma index} + \theta Y_{i,t} + u_{it} + \text{Country FE} + \text{Year FE} \quad (3)$$

$$\text{Fiancial Instutions Efficiency} = \alpha + \beta\text{Trilemma index} + \theta Y_{i,t} + u_{it} + \text{Country FE} + \text{Year FE} \quad (4)$$

Where α is intercept and β is a slope.Y_{it} is a vector of macroeconomic control variables for i^{th} country at year t, and u_{it} is an error term, country FE is country fixed effect and Year FE is year fixed effect.

We also use panel data Generalized Method of Moments (GMM) estimator to alleviate endogeneity concerns. This estimator was introduced by Holtz-Eakin et al. (1988) and Arellano and Bond (1991), and further developed in a series of papers including Arellano and Bover (1995) and Blundell and Bond (1998). They potentially improve on ordinary least squares (OLS) or traditional fixed effects estimates in at least Yone of three important ways. First, unlike OLS estimation, it allows us to include firm-fixed effects to account for (fixed) unobservable heterogeneity. Second, unlike traditional fixed-effects estimates, it allows current governance to be influenced by previous realizations of, or shocks to, past performance. Third, unlike either OLS or traditional fixed-effects estimates, a key insight of the dynamic panel GMM estimator is that if the underlying economic process itself is dynamic, in our case, if current trilemma index values is related to past financial development, then it may be possible to use some combination of variables from the country's history as valid instruments for current trilemma index to account for simultaneity. Thus, an important aspect of our methodology is that it relies on a set of "internal" instruments contained within the panel itself i.e past values of trilemma index and financial development are used as instruments for current realizations of trilemma index, and it eliminates the need for external instruments.

It is well known that empirical research in finance is complicated by the endogenous relation that exists between the control forces. Jensen (1993) broadly classifies these control forces as capital markets, the regulatory system, product and factor markets, and internal governance. To obtain consistent and unbiased estimates, under the assumption that unobserved heterogeneity exists but is fixed or time-invariant, we estimate the relationship between our variables using a dynamic GMM panel estimator. GMM helps us to exploit the dynamic relationships inherent in our explanatory variables. Assume the linear regression model with an endogenous regress or$Y = X^{/}\beta + u$, where Y and u re Nx1 vectors; β is Kx1 vector of unknown parameters; X is a NxK matrix of explanatory variables. Because of the Assumption of the endogeneity, we need to assume a matrix Z that is NxL, where L>K. The Z matrix is assumed to comprise a set of variables or a set of valid instruments that are highly correlated with X but orthogonal to u i.e. not correlated with the error term. To apply GMM, the number of cross-sections or groups N must be > than time span T. The instruments, Z must be exogenous, $E(Z^{/}u) = 0$. The number of

[5]The Trilemma Indexes (pdx.edu)
[6]Financial Development - Story - IMF Data
[7] https://www.worldbank.org/en/publication/gfdr/data/financial-structure-database

instruments, Z<= number of groups N. We use the first lags of our independent variables as the instruments. Both instrumental variables two Stages Least Square (2SLS) and system GMM are applied in this research[8].

6. SUMMARY STATISTICS AND DATA DISTRIBUTION

In this section we present the summary statistics and data distribution of the sample. The summary statistics table focuses on the mean, standard deviation, P25, P75, median, minimum, maximum and the total number of observation N.

Table 1: Data Distribution

Country Code	Years	min year	max year
AGO	30	1990	2019
BDI	30	1990	2019
BEN	30	1990	2019
BFA	30	1990	2019
BWA	30	1990	2019
CAF	30	1990	2019
CIV	30	1990	2019
CMR	30	1990	2019
COD	30	1990	2019
COG	30	1990	2019
COM	30	1990	2019
CPV	30	1990	2019
ERI	30	1990	2019
ETH	30	1990	2019
GAB	30	1990	2019
GHA	30	1990	2019
GIN	30	1990	2019
GMB	30	1990	2019
GNB	30	1990	2019
GNQ	30	1990	2019
KEN	30	1990	2019
LBR	30	1990	2019
LSO	30	1990	2019
MDG	30	1990	2019
MLI	30	1990	2019
MOZ	30	1990	2019
MUS	30	1990	2019
MWI	30	1990	2019
NAM	30	1990	2019
NER	30	1990	2019
NGA	30	1990	2019
RWA	30	1990	2019
SEN	30	1990	2019
SLE	30	1990	2019
SSD	30	1990	2019
STP	12	1991	2019
SWZ	30	1990	2019
SYC	30	1990	2019
TCD	30	1990	2019
TGO	30	1990	2019

[8]Two Stage Least Squares, the Gateway to Econometrics - Life on the Margin (chris-lavoie.com)

TZA	30	1990	2019
UGA	30	1990	2019
ZAF	30	1990	2019
ZMB	30	1990	2019

Table 1 presents data distribution of our sample. It indicates the list of 44 country codes, number of years, the minimum year and maximum year. We miss some African countries like Zimbabwe due to data missing from trilemma and financial development index databases. The data distribution for country code "STP" is 12 years and not 30 years as the rest of the sample.

Figure 2: Mean of Financial Institution Development In Africa(FI)

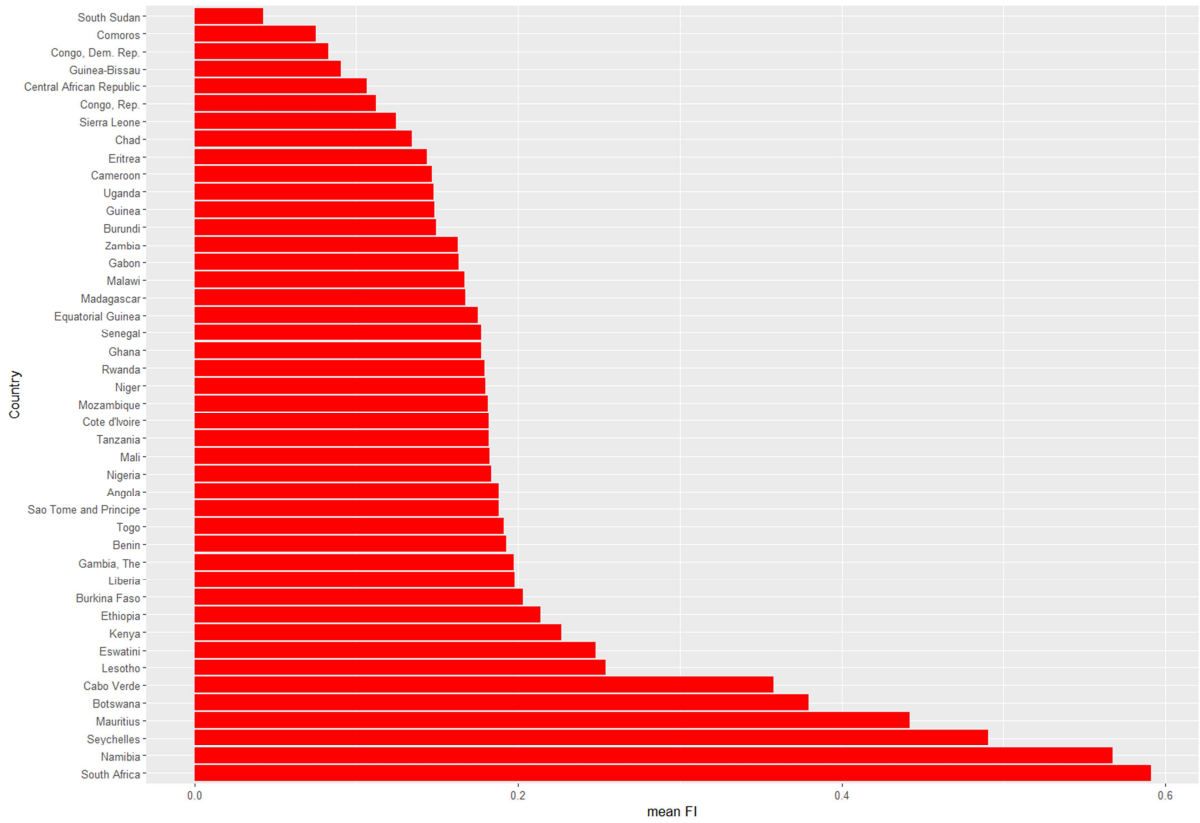


Figure 2 presents the mean of Financial Institutions development(FI) in Africa for 44 countries that we use in our sample.

Figure3: Trilemma index in Africa

Figure 3 present the mean of trilemma index in Africa from 1990 to 2019. The ers stands for exchange rate index, ka-op stands for country financial market openness and mi_index stands for monetary independence policy index.

Table 2 presents summary statistics of the dependent, independent and control variables. The dependent variables in this study are FI stands for financial institutions, FID stands for financial institutions depth, FIA stands for financial institutions access and, FIE stands for financial institutions efficiency.

The independent variables are exchange rate stability, monetary policy independence, and financial markets openness. The control variables are inflation, unemployment rate, FDI_gdp stands for foreign direct investment as a percentage of GDP, Bank credit to PS_gdp stands for bank credit to private sector as a percentage of GDP, Bank assets_gdp stands for total bank assets a percentage of GDP, and GDP growth annual.

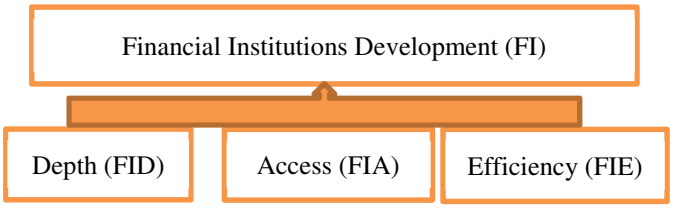
The financial institutions' index(FI) is an aggregate of financial institutions depth index (FID), financial institutions access index (FIA) and financial institutions efficiency index (FIE).Financial institutions depth index(FID) compiles data on bank credit to the private sector in per cent of GDP, pension fund assets to GDP, mutual fund assets to GDP, insurance premiums- life and non-life to GDP. Financial institutions access index (FIA) compiles data on bank branches per 100,000 adults and ATMs per 100,000 adults. Financial institutions efficiency index (FIE) compiles data on the banking sector's net interest margin, lending-deposit spread, non-interest income to total income, overhead costs to total assets, return on assets and return on equity. Both trilemma and financial development indexes take the value between 0 and 1.

Table 2: Summary Statistics

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	mean	sd	p25	p50	p75	Min	max	N
Inflation	16.7347	52.8003	2.09607	6.51484	13.3252	-15.4237	466.407	1,258
Unemployment rate	7.81875	7.50236	2.92000	4.52000	9.43000	0.56000	33.2900	1,201
FDI_gdp	3.60560	5.99062	0.54000	1.97000	4.36000	-3.75000	39.4600	1,242
Bank credit to PS_gdp	16.2813	15.2686	6.79000	12.0050	19.2950	0.91000	78.2300	1,224
Bankassets_gdp	24.9854	31.9868	9.65000	15.6000	26.1800	1.59000	232.580	1,135
GDPgrowth annual	4.08236	4.74975	1.92121	4.22793	6.33369	-10.7934	20.7158	1,252
Exchange rate stability	0.64095	0.35033	0.30699	0.67876	1	0.031324	1	1,166
Monetary policy independence	0.45887	0.17994	0.35261	0.48263	0.58523	1.4130e-03	0.86328	1,014
Financial markets openness	0.29867	0.29032	0.16496	0.16496	0.41654	0	1	1,111
FI	0.20698	0.12798	0.14298	0.17786	0.22395	0	0.68545	1,302
FID	0.10383	0.15729	0.028477	0.053846	0.094576	0	0.80275	1,302
FIA	0.081440	0.12496	0.012799	0.035154	0.084664	0	0.63005	1,302
FIE	0.50194	0.17251	0.40778	0.52784	0.62280	0	0.83518	1,302
LnGDP	22.4150	1.50164	21.3051	22.4002	23.2871	19.2642	26.6321	1,255

The mean of financial institutions (FI) is 0.21, the mean of financial institutions depth (FID) is 0.10, the mean of financial institutions access (FIA) is 0.08 and, the mean of financial institutions efficiency (FIE) is 0.5. The highest mean on financial institutions development index is 0.5 of financial institutions efficiency, while the lowest is financial institutions access. This implies that the access to financial institutions in Africa is a big challenge and this is among of our motivation to carry out this study. The exchange rate stability mean is 0.64, the monetary policy independence mean is 0.46 and the financial markets openness mean 0.30.

Figure 4: Financial Institutions Development Index Pyramid



Source: IMF staff, based on Čihákand et al. (2012)

7. EMPIRICAL RESULTS AND DISCUSSION

This section provides empirical evidence on the relationship between the trilemma index (exchange rate stability, monetary policy independence and financial market openness),and the financial institutions development index(financial institution access, financial institutions depth and financial institution efficiency). This section also contains endogeneity tests where we use both 2SLS and system GMM estimator.

In this Table 3, we report the relationship between financial market openness and financial institutions development. The response variables or dependent variablesare Financial Institution Depth(FID), Financial Institution access (FIA), and Financial Institution Efficiency (FIE). The explanatory variable or independent variable is financial market openness. Other variables are defined in section of summary statistics. For the results from Column (1)-(3), we control for year and country fixed effect, while for (4)-(6), we do not control for year and country fixed effect. The level. "*", "**" and "***" denote significance at the 10%, 5%, and 1% level, respectively.

Table 2: Financial market openness and financial institutions development index

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	FID Index	FIA Index	FIE Index	FID Index	FIA Index	FIE Index
Financial market openness	**0.0320*** (5.858)**	**0.00473 (0.836)**	**0.0563** (2.251)**	**0.0283*** (5.325)**	**0.00473 (0.836)**	**0.0563** (2.251)**
Unemployment rate	-0.00217*** (-4.484)	-0.00225*** (-4.496)	-0.0161*** (-7.271)	-0.00248*** (-5.198)	-0.00225*** (-4.496)	-0.0161*** (-7.271)
LnGDP	-0.0123*** (-4.861)	-0.00504* (-1.925)	-0.000883 (-0.0764)	0.000513 (0.406)	-0.00504* (-1.925)	-0.000883 (-0.0764)
GDP_growth_annual	7.01e-05 (0.391)	-0.000299 (-1.608)	0.000532 (0.648)	0.000292* (1.682)	-0.000299 (-1.608)	0.000532 (0.648)
Inflation	0.000189*** (7.908)	-4.08e-05* (-1.651)	-0.000102 (-0.934)	0.000182*** (7.692)	-4.08e-05* (-1.651)	-0.000102 (-0.934)
FDI percentof GDP	-0.000141 (-0.899)	-0.000619*** (-3.815)	0.000321 (0.447)	0.000141 (0.939)	-0.000619*** (-3.815)	0.000321 (0.447)
Bank credit to the ps_gdp	0.00259*** (9.960)	0.000667** (2.472)	-0.00218* (-1.826)	0.00275*** (10.83)	0.000667** (2.472)	-0.00218* (-1.826)
Bank assets percent of GDP	0.000541*** (3.122)	0.000866*** (4.819)	0.00173** (2.184)	0.000680*** (4.011)	0.000866*** (4.819)	0.00173** (2.184)
Constant	0.321***	0.145**	0.597**	0.0462	0.145**	0.597**
	(5.775)	(2.516)	(2.351)	(1.640)	(2.516)	(2.351)
Observations	959	959	959	959	959	959
R-squared	0.515	0.607	0.114	0.486	0.607	0.114
Country FE	YES	YES	YES	NO	NO	NO
Year FE	YES	YES	YES	NO	NO	NO

t-statistics in parentheses

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

The idea of financial market openness is related to, but distinct from, the idea of financial development. As a financial system develops and becomes more sophisticated, it often opens up to foreign capital and becomes more closely integrated with foreign financial systems. A country can also experience financial development while maintaining a relatively closed financial system. Financial openness can have significant positive effects on financial development. For instance, the participation of foreign institutional investors can benefit underdeveloped African markets. Our finding is consistent with Baltagi,Demetriades and Law (2009) in that economies take steps to open both their trade and capital accounts could still generate gains in terms of banking sector development.

The result in Table 4 indicates the relationship between exchange rate stability and financial institutions development. The response variables or dependent variables are Financial Institution Depth (FID), Financial Institution access (FIA), and Financial Institution Efficiency (FIE). The explanatory variable or independent variable is exchange rate stability. Other variables are defined in section of summary statistics. For the results from Column (1)-(3), we control for year and country fixed effect, while for (4)-(6), we do not control for year and country fixed effect. The level. "*", "**" and "***" denote significance at the 10%, 5%, and 1% level, respectively.

Table 4: Exchange rate stability and financial institutions Development index

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	FID Index	FIA Index	FIE Index	FID Index	FIA Index	FIE Index
Exchange rate stability	**-0.0145*** **	**-0.0153*** **	**-0.0796*** **	**-0.0147*** **	**-0.0153*** **	**-0.0796*** **
	(-2.654)	(-3.062)	(-3.699)	(-2.684)	(-3.062)	(-3.699)
Unemployment rate	-0.00223***	-0.00214***	-0.0167***	-0.00221***	-0.00214***	-0.0167***
	(-4.094)	(-4.300)	(-7.775)	(-4.070)	(-4.300)	(-7.775)
LnGDP	-0.00876***	-0.00381	0.00599	0.000613	-0.00381	0.00599
	(-3.032)	(-1.441)	(0.527)	(0.419)	(-1.441)	(0.527)
GDP_growth_annual	5.47e-05	-0.000259	0.000981	0.000371*	-0.000259	0.000981
	(0.264)	(-1.367)	(1.203)	(1.847)	(-1.367)	(1.203)
Inflation	0.000189***	-4.60e-05*	-0.000171	0.000178***	-4.60e-05*	-0.000171
	(6.814)	(-1.812)	(-1.567)	(6.480)	(-1.812)	(-1.567)
FDI percentof GDP	-0.000144	-0.000603***	0.000361	0.000105	-0.000603***	0.000361
	(-0.797)	(-3.666)	(0.510)	(0.609)	(-3.666)	(0.510)
Bank credit to the ps_gdp	0.00350***	0.00105***	-0.00192*	0.00343***	0.00105***	-0.00192*
	(12.87)	(4.231)	(-1.793)	(12.82)	(4.231)	(-1.793)
Bank assets percent of GDP	0.000533***	0.000754***	0.00189***	0.000628***	0.000754***	0.00189***
	(2.947)	(4.564)	(2.656)	(3.552)	(4.564)	(2.656)
Constant	0.239***	0.121**	0.504**	0.0509	0.121**	0.504**
	(3.767)	(2.092)	(2.019)	(1.575)	(2.092)	(2.019)
Observations	965	965	965	965	965	965
R-squared	0.490	0.607	0.123	0.461	0.607	0.123
Country FE	YES	YES	YES	NO	NO	NO
Year FE	YES	YES	YES	NO	NO	NO

t-statistics in parentheses

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

The exchange rate may cause shocks to asset quality, including recession, which can cause insolvency among borrowers, adversely affecting their ability to repay. It may also be the main reason for trade movements' adverse terms, which will similarly undermine creditor solvency. This confirms the findings

of (Juniorand Amenyitor, 2022; Nusair and Olson 2022) who reveal that the exchange rate stability may be a significant contribution to the markets. Furthermore, the exchange rate may create unpredictable monetary policies, which may decrease borrowers 'financial capacity to repay by raising interest rates and the cost of borrowing. In addition, the exchange rate may influence the factors affecting bank funding, including expected depreciation which will reduce the demand for domestic currency deposits. And then, the availability of domestic credit will affect world interest rates which affect the ability of banks to borrow abroad.

The result in Table 5 indicates the relationship between monetary policy independence and financial institutions development. The response variables or dependent variables are Financial Institution Depth (FID), Financial Institution access (FIA), and Financial Institution Efficiency (FIE). The explanatory variable or independent variable is monetary policy independence. Other variables are defined in the section of summary statistics. For the results from Columns (1)-(3), we control for year and country fixed effect, while for (4)-(6), we do not control for year and country fixed effect. The level. "*", "**" and "***" denote significance at the 10%, 5%, and 1% level, respectively.

Table 3: Monetary policy independence and financial institution development index

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	FID Index	FIA Index	FIE Index	FID Index	FIA Index	FIE Index
Monetary policy independence	**-0.000506**	**-0.00129**	**-0.0302**	**-3.43e-05**	**-0.00129**	**-0.0302**
	(-0.0761)	(-0.213)	(-1.194)	(-0.00536)	(-0.213)	(-1.194)
Unemployment rate	-0.00221***	-0.00212***	-0.0169***	-0.00220***	-0.00212***	-0.0169***
	(-3.849)	(-4.068)	(-7.776)	(-3.855)	(-4.068)	(-7.776)
LnGDP	-0.0101***	-0.00612**	-0.00909	0.000235	-0.00612**	-0.00909
	(-3.254)	(-2.172)	(-0.771)	(0.151)	(-2.172)	(-0.771)
GDP_growth _annual	4.51e-05	-0.000329	0.000254	0.000399*	-0.000329	0.000254
	(0.202)	(-1.625)	(0.300)	(1.853)	(-1.625)	(0.300)
Inflation	0.000205***	-2.75e-05	-0.000115	0.000195***	-2.75e-05	-0.000115
	(7.206)	(-1.063)	(-1.067)	(6.890)	(-1.063)	(-1.067)
FDI percentof GDP	-0.000165	-0.000660***	0.000190	9.97e-05	-0.000660***	0.000190
	(-0.865)	(-3.824)	(0.263)	(0.548)	(-3.824)	(0.263)
Bank credit to the ps_gdp	0.00369***	0.000918***	-0.00256**	0.00359***	0.000918***	-0.00256**
	(11.03)	(3.024)	(-2.016)	(10.96)	(3.024)	(-2.016)
Bank assets percent of GDP	0.000483**	0.000911***	0.00229***	0.000599***	0.000911***	0.00229***
	(2.157)	(4.487)	(2.689)	(2.697)	(4.487)	(2.689)
Constant	0.260***	0.164***	0.793***	0.0526	0.164***	0.793***
	(3.793)	(2.639)	(3.049)	(1.520)	(2.639)	(3.049)
Observations	893	893	893	893	893	893
R-squared	0.486	0.611	0.136	0.452	0.611	0.136
Numberof code1	37	37	37	37	37	37
Country FE	YES	YES	YES	NO	NO	NO
Year FE	YES	YES	YES	NO	NO	NO

t-statistics in parentheses

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

The financial system is crucial to monetary policy because monetary policy targeted at certain macroeconomic variables is essentially a financial process, with the financial system as the interface linking central bank policies and the real economy through the monetary transmission mechanism. Given that monetary policy works mainly through its influence on the financial system, any economic development that affects the structure or conditions of the financial system will potentially exert influence on the transmission mechanism. The results of Ma and Lin (2016) show that monetary policy affects significantly and negatively financial development from the international perspective study, indicating that the effectiveness of monetary policy declines as the financial system becomes more developed. They also, confirm that the effect of monetary policy on output decreases more with financial development in developing economies. Our result are consistent with their findings, even if it is negative but not significant.

In this Table we interact monetary policy independence and financial market openness. And then, we report the relationship between the interaction of the mentioned variables and financial institutions development index. The response variables or dependent variables are Financial Institution Depth (FID), Financial Institution access (FIA), and Financial Institution Efficiency (FIE). The explanatory variable or independent variable is interaction of monetary policy independence and financial openness (mi_index_ka_open). Other variables are defined in section of summary statistics. For the results from Column (1)-(3), we control for year and country fixed effect, while for (4)-(6), we do not control for year and country fixed effect. The level. "*", "**" and "***" denote significance at the 10%, 5%, and 1% level, respectively.

Table 4: Interaction of monetary policy independence (MI) and financial openness

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	FID Index	FIA Index	FIE Index	FID Index	FIA Index	FIE Index
mi_index_ka_open	**0.0306*** (3.424)**	-0.00353 (-0.388)	0.0646* (1.663)	**0.0284*** (3.234)**	-0.00353 (-0.388)	0.0646* (1.663)
Unemployment rate	-0.00232*** (-4.556)	-0.00226*** (-4.348)	-0.0161*** (-7.272)	-0.00258*** (-5.113)	-0.00226*** (-4.348)	-0.0161*** (-7.272)
LnGDP	-0.0125*** (-4.581)	-0.00631** (-2.264)	-0.0131 (-1.099)	0.000189 (0.139)	-0.00631** (-2.264)	-0.0131 (-1.099)
GDP_growth _annual	9.63e-05 (0.491)	-0.000284 (-1.419)	0.000121 (0.142)	0.000364* (1.928)	-0.000284 (-1.419)	0.000121 (0.142)
Inflation	0.000192*** (7.629)	-3.81e-05 (-1.488)	-0.000115 (-1.056)	0.000184*** (7.423)	-3.81e-05 (-1.488)	-0.000115 (-1.056)
FDI percentof GDP	-0.000172 (-1.032)	-0.000656*** (-3.863)	0.000145 (0.200)	0.000125 (0.784)	-0.000656*** (-3.863)	0.000145 (0.200)
Bank credit to the ps_gdp	0.00276*** (9.201)	0.000676** (2.216)	-0.00309** (-2.375)	0.00286*** (9.872)	0.000676** (2.216)	-0.00309** (-2.375)
Bank assets percent of GDP	0.000589*** (3.013)	0.000917*** (4.604)	0.00246*** (2.892)	0.000726*** (3.761)	0.000917*** (4.604)	0.00246*** (2.892)
Constant	0.331*** (5.478)	0.175*** (2.847)	0.857*** (3.262)	0.0604** (1.997)	0.175*** (2.847)	0.857*** (3.262)
Observations	886	886	886	886	886	886
R-squared	0.500	0.613	0.137	0.470	0.613	0.137
Numberof code1	37	37	37	37	37	37
Country FE	YES	YES	YES	NO	NO	NO
Year FE	YES	YES	YES	NO	NO	NO

t-statistics in parentheses

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

A good relationship between the financial institutions and the foreign investors is essential for monetary policy and the financial system to function efficiently. Financial market openness contributes to monetary policy functioning better. It will be easier to communicate that the interest rate decisions are aimed at achieving low and stable inflation. Monetary policy authorities in emerging markets face the "trilemma" of attempting to achieve monetary independence, exchange rate stability, and financial market integration simultaneously. They may have ceded some control over local monetary policy and financial market openness to benefit from integration. Our paper finds that local monetary policy independence and financial openness affect positively financial institution development in Africa.

In Table 7 we interact financial market openness and exchange rate stability Index. And then, we report the relationship between the interaction of the mentioned variables and financial institutions development index. The response variables or dependent variables are Financial Institution Depth(FID), Financial Institution access (FIA), and Financial Institution Efficiency (FIE). The explanatory variable or independent variable is interaction of financial market openness and exchange rate stability index (ka_open_ers). Other variables are defined in section of summary statistics. For the results from Column (1)-(3), we control for year and country fixed effect, while for (4)-(6), we do not control for year and country fixed effect. The level. "*", "**" and "***" denote significance at the 10%, 5%, and 1% level, respectively.

Table 5: Interaction of financial market openness and exchange rate stability Index

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	FID Index	FIA Index	FIE Index	FID Index	FIA Index	FIE Index
ka_open_ers	**-0.0379*** (-4.268)**	0.00458 (0.501)	-0.0299 (-0.742)	**-0.0255*** (2.962)**	0.00458 (0.501)	-0.0299 (-0.742)
Unemployment rate	-0.00246*** (-5.082)	-0.00230*** (-4.628)	-0.0171*** (-7.791)	-0.00272*** (-5.665)	-0.00230*** (-4.628)	-0.0171*** (-7.791)
LnGDP	-0.0120*** (-4.696)	-0.00501* (-1.904)	0.00376 (0.324)	0.000635 (0.495)	-0.00501* (-1.904)	0.00376 (0.324)
GDP_growth _annual	3.99e-05 (0.220)	-0.000301 (-1.610)	0.000656 (0.796)	0.000303* (1.725)	-0.000301 (-1.610)	0.000656 (0.796)
Inflation	0.000192*** (7.949)	-4.05e-05 (-1.636)	-0.000108 (-0.985)	0.000181*** (7.589)	-4.05e-05 (-1.636)	-0.000108 (-0.985)
FDI percentof GDP	-0.000175 (-1.099)	-0.000625*** (-3.832)	0.000408 (0.566)	0.000126 (0.831)	-0.000625*** (-3.832)	0.000408 (0.566)
Bank credit to the ps_gdp	0.00280*** (10.76)	0.000697*** (2.612)	-0.00167 (-1.418)	0.00289*** (11.34)	0.000697*** (2.612)	-0.00167 (-1.418)
Bank assets percent of GDP	0.000508*** (2.887)	0.000862*** (4.763)	0.00184** (2.309)	0.000654*** (3.797)	0.000862*** (4.763)	0.00184** (2.309)
Constant	0.317*** (5.626)	0.145** (2.500)	0.511** (2.001)	0.0480* (1.676)	0.145** (2.500)	0.511** (2.001)
Observations	956	956	956	956	956	956
R-squared	0.506	0.607	0.110	0.476	0.607	0.110
Numberof code1	38	38	38	38	38	38
Country FE	YES	YES	YES	NO	NO	NO
Year FE	YES	YES	YES	NO	NO	NO

t-statistics in parentheses

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

The relationship between trade openness and the exchange rate stability is that when the real effective exchange rate appreciates, domestic products become more expensive for the rest of the world, and therefore their demand decreases resulting to a slump in exports. Our results show a robust negative effect of the combination of financial market openness and exchange rate stability on financial institutions development in Africa.So this is consistent withthe empirical analysis of Gantman and Dabós (2018)which finds that trade openness helps weaken the effects of volatile fluctuations, and in contrast, financial openness amplifies shocks to the exchange rate.

The result in Table 8 indicates the relationship between the interaction of Exchange rate stability and monetary independence (mi_index_ers) and financial institutions development. The response variables or dependent variables are Financial Institution Depth (FID), Financial Institution access (FIA), and Financial Institution Efficiency (FIE). The explanatory variable or independent variable is mi_index_ers. Other variables are defined in section of summary statistics. For the results from Column (1)-(3), we control for year and country fixed effect, while for (4)-(6), we do not control for year and country fixed effect. The level. "*", "**" and "***" denote significance at the 10%, 5%, and 1% level, respectively.

Table 6: Interaction of Exchange rate stability and monetary independence

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	FID Index	FIA Index	FIE Index	FID Index	FIA Index	FIE Index
mi_index_ers	**-0.00608**	**-0.00352**	**-0.0720****	**-0.00342**	**-0.00352**	**-0.0720****
	(-0.763)	(-0.487)	(-2.389)	(-0.453)	(-0.487)	(-2.389)
Unemployment rate	-0.00223***	-0.00210***	-0.0168***	-0.00221***	-0.00210***	-0.0168***
	(-3.888)	(-4.051)	(-7.753)	(-3.880)	(-4.051)	(-7.753)
LnGDP	-0.00986***	-0.00597**	-0.00673	0.000388	-0.00597**	-0.00673
	(-3.170)	(-2.116)	(-0.572)	(0.244)	(-2.116)	(-0.572)
GDP_growth _annual	5.78e-05	-0.000314	0.000470	0.000409*	-0.000314	0.000470
	(0.258)	(-1.545)	(0.555)	(1.889)	(-1.545)	(0.555)
Inflation	0.000203***	-2.91e-05	-0.000144	0.000194***	-2.91e-05	-0.000144
	(7.093)	(-1.119)	(-1.331)	(6.811)	(-1.119)	(-1.331)
FDI percentof GDP	-0.000165	-0.000657***	0.000224	9.99e-05	-0.000657***	0.000224
	(-0.865)	(-3.802)	(0.311)	(0.549)	(-3.802)	(0.311)
Bank credit to the ps_gdp	0.00369***	0.000919***	-0.00262**	0.00359***	0.000919***	-0.00262**
	(11.06)	(3.035)	(-2.080)	(10.96)	(3.035)	(-2.080)
Bank assets percent of GDP	0.000475**	0.000903***	0.00219***	0.000594***	0.000903***	0.00219***
	(2.126)	(4.456)	(2.597)	(2.685)	(4.456)	(2.597)
Constant	0.256***	0.161***	0.747***	0.0504	0.161***	0.747***
	(3.737)	(2.589)	(2.881)	(1.439)	(2.589)	(2.881)
Observations	892	892	892	892	892	892
R-squared	0.487	0.611	0.140	0.452	0.611	0.140
Numberof code1	37	37	37	37	37	37
Country FE	YES	YES	YES	NO	NO	NO
Year FE	YES	YES	YES	NO	NO	NO

t-statistics in parentheses

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

The choice or combination of a monetary and exchange rate policy framework is one of the most crucial decisions that economic policymakers and, ultimately, politicians, in many cases, are called upon to make. Our study indicates that the combination of the above two policies negatively affects the financial institutions' development in Africa. The choice is far-reaching for several reasons. First, the policy framework has widespread implications for all economic agents. Second, it affects key macroeconomic outcomes such as inflation, competitiveness, and responsiveness to economic shocks. Third, policy frameworks rarely undergo fundamental change, although they may evolve. And fourth, different frameworks have different institutional requirements. In many African countries, the discussion of monetary policy choices is outlined around the transition from monetary aggregate targeting to inflation targeting with a flexible exchange rate. This is a good and critical debate, and such a transition may well be beneficial. However, these ideas are only a part of the range of monetary policy options available, encompassing a range of exchange rate policy stability.

In this Table, we test the effect of the trilemma index on financial institutions development using the overall index of financial institutions development. The response variables or dependent variables are Financial Institution Depth (FID), Financial Institution access (FIA), and Financial Institution Efficiency (FIE). The explanatory variable or independent variable are mi_index_ers,ka_open_ers and mi_index_ka_open. Where mi_index_ers stands for the interaction of exchange rate stability and monetary independence. ka_open_ers stands for the interaction of financial market openness and exchange rate stability index. mi_index_ka_open stands for the interaction of monetary policy independence and financial openness. Other variables are defined in section of summary statistics. For the results from Column (1)-(3), we control for year and country fixed effect, while for (4)-(6), we do not control for year and country fixed effect. The level. "*", "**" and "***" denote significance at the 10%, 5%, and 1% level, respectively.

Table 7: Trilemma index and financial institution development

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	FI Index	FI Index	FI Index	FI Index	FI Index	FI Index
mi_index_ers	**-0.0222** **(-2.352)**			**-0.0150*** **(-1.662)**		
Unemployment rate	- 0.00624*** (-9.211)	- 0.00617*** (-9.175)	- 0.00648*** (-9.778)	- 0.00661*** (-9.698)	- 0.00677*** (-10.07)	- 0.00693*** (-10.56)
LnGDP	-0.00787** (-2.135)	-0.0108*** (-2.988)	-0.00581* (-1.653)	0.00924*** (4.852)	0.00820*** (4.513)	0.00843*** (4.806)
GDP_growth_annual	1.64e-05 (0.0619)	-4.45e-05 (-0.172)	5.88e-05 (0.236)	0.000439* (1.694)	0.000329 (1.307)	0.000341 (1.417)
Inflation	3.57e-05 (1.053)	3.44e-05 (1.038)	3.53e-05 (1.067)	4.51e-05 (1.325)	4.33e-05 (1.306)	4.16e-05 (1.273)
FDI percentof GDP	-0.000279 (-1.240)	-0.000303 (-1.377)	-0.000226 (-1.038)	0.000131 (0.601)	0.000133 (0.628)	8.48e-05 (0.409)
Bank credit to the ps_gdp	0.00131*** (3.323)	0.000693* (1.753)	0.00107*** (2.995)	0.00154*** (3.922)	0.00107*** (2.762)	0.00132*** (3.780)
Bank assets percent of GDP	0.00114*** (4.324)	0.00127*** (4.909)	0.00105*** (4.348)	0.00135*** (5.107)	0.00147*** (5.720)	0.00125*** (5.325)
mi_index_ka_open		**0.0290** **(2.463)**			**0.0260** **(2.220)**	
ka_open_ers			**0.0121** **(0.996)**			**0.000642** **(0.0544)**

Constant	0.357*** (4.394)	0.423*** (5.306)	0.317*** (4.109)	-0.00459 (-0.110)	0.0168 (0.416)	0.0132 (0.336)
Observations	892	886	956	892	886	956
R-squared	0.445	0.438	0.405	0.395	0.391	0.372
Country FE	YES	YES	YES	NO	NO	NO
Year FE	YES	YES	YES	NO	NO	NO

t-statistics in parentheses

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

The high level of monetary policy independence may help to reduce the inflation rate, while the exchange rate stability and capital account openness is associated with a higher growth rate and a more significant output gap (Jefferis, 2012). We may suggest that the constraints imagined in theory are somewhat unclear in practice, leading to many intermediate solutions in developing economies. We indicate that the combination of monetary and exchange rate policies significantly affects negatively the overall financial institution development. In contrast, the combination of monetary policy independence and country openness significantly affects the financial institution's development. Our results is still robust to the result in the previous tables.

8. ENDOGENEITY ISSUES

Endogeneity occurs when an explanatory variable is present within your regression model correlated to the error term. Therefore, trilemma indexes should be linked to other variables like interest rate, external government debt, etc. Unfortunately, this violates classical assumption number three, which states no correlation between any of the explanatory variables and the error term. The most important challenge confronting studies in empirical finance is endogeneity. The endogeneity leads to biased and inconsistent parameter estimates that make reliable inference virtually impossible[9].

Table 8: Instrumental Variables/ Two stages Least Squares and GMM Results

In this Table, we test the effect of the trilemma index on financial institutions development using the also the overall index of financial institutions development. The response variables or dependent variables are Financial Institution development (FI). The explanatory variable or independent variable are mi_index_ers,ka_open_ers and mi_index_ka_open. Where mi_index_ers stands for the interaction of exchange rate stability and monetary independence. ka_open_ers stands for the interaction of financial market openness and exchange rate stability index. mi_index_ka_open stands for the interaction of monetary policy independence and financial market openness. Other variables are defined in section of summary statistics. For the results from Column (1)-(3), we test for endogeneity using two stages least square, while for (4)-(6), we test for endogeneity using two stage system GMM. We control for both year and country fixed effect. The level. "*", "**" and "***" denote significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	IV-2SLS	IV-2SLS	IV-2SLS	System GMM	System GMM	System GMM
mi_index_ers	**-0.0660*** (-3.331)**			**-0.151*** (-0.566)**		
Unemployment rate	- 0.00640*** (-9.896)	- 0.00615*** (-9.513)	-0.00653*** (-10.14)	-0.0445 (-1.577)	0.000791 (0.127)	-0.0725** (-2.658)
LnGDP	-0.00677* (-1.885)	-0.0105*** (-3.021)	-0.00598* (-1.735)	-0.0666 (-0.259)	-0.0217 (-0.283)	0.0279 (0.570)
GDP_growth_annual	8.98e-05 (0.351)	-0.000123 (-0.499)	4.58e-05 (0.191)	-0.000986 (-0.431)	-0.00199 (-1.138)	-0.000227 (-0.141)

[9]Two Stage Least Squares, the Gateway to Econometrics - Life on the Margin (chris-lavoie.com)

Inflation	-2.15e-05 (-0.614)	-1.25e-06 (-0.0372)	3.59e-05 (1.131)	-5.58e-05 (-0.287)	-2.80e-05 (-0.201)	0.000141 (1.422)
FDI percentof GDP	-0.000264 (-1.228)	-0.000287 (-1.369)	-0.000234 (-1.116)	-0.00230 (-1.073)	-0.00185 (-0.662)	-0.00218* (-1.968)
Bank credit to the ps_gdp	0.000896** (2.356)	0.000561 (1.481)	0.000964*** (2.664)	0.00891 (0.216)	0.00436 (0.854)	0.0228** (2.397)
Bank assets percent of GDP	0.00113*** (4.477)	0.00131*** (5.319)	0.00107*** (4.396)	0.00109 (0.125)	0.00117 (0.508)	0.00536** (2.117)
mi_index_ka_open		**0.0359**** **(2.441)**			**0.0903**** **(2.181)**	
ka_open_ers			-0.0224 (-1.175)			-0.200 (-1.423)
Constant	0.433*** (4.788)	0.501*** (5.650)	0.390*** (4.425)	1.836 (0.303)	0.692 (0.421)	-0.0323 (-0.0290)
Observations	879	874	951	879	874	951
R-squared	0.942	0.945	0.939			
Cragg-Donald Wald	208.8	105.6	538.03			
Stock-Yogo10%	16.38	16.38	16.38			
Control variables	YES	YES	YES	YES	YES	YES
Country FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Adj R2	0.937	0.940	0.934			
Hansen Test (p-value)				1	1	1
Arellano-Bond test (p-value AR2)				0.499	0.838	0.552

z-statistics in parentheses

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

We find the significant and positive effect of the interaction of monetary policy independence and financial openness on the overall financial institutions development using IV-2SLS and two stage system GMM. In contrast, we find the significant and negative effect of the interaction of exchange rate stability and monetary independence on the overall financial institutions development using the same methods.

9. CONCLUSION

Our main concern is which choice among the trilemma index affects financial development in developing countries. However, the number of studies that have explored this question empirically is still relatively limited and the results seem to be mixed. In this context, this paper adds to the literature by providing new evidence on the relationship between the effectiveness of the monetary policy, exchange rate stability, financial market openness and financial development. This study advances the empirical method to study trilemma index and financial institution development. Using Ordinary Least Squares, Two Stages Least Squares and two steps system Generalized Method of Moments (GMM) techniques estimator and a dataset covering 44 African countries over an extended period of 30 years, we indicate that monetary independent policy and financial openness are the best indexes to combine in Africa. The main reason of this is that majority of African countries do not have well developed financial institutions and they do not have capacity to control exchange rate stability. The main explanation of our findings is that if the government set a fixed exchange rate and allow the free movement of capital, then they will need to change interest rates according to outside pressures. It means, in a recession, the country could not cut interest rates because if she does, the currency would fall in value. If the government wished to purse monetary autonomy and it allowed free mobility of capital, it would need to allow a floating exchange rate. For example, if the government is worried about inflation, it could increase interest rates. These

higher interest rates would cause appreciation in the currency(Ma and Lin (2016).

While this study shows that there is no positive relationship between exchange rate stability and financial institutions development, it confirms that the monetary independent policy and financial openness are better policies on African financial institutions.

When foreign monetary disturbances are important, a flexible rate provides useful insulation, but when such disturbances originate at home, exchange rate stability allows them to be shared with the rest of the world and disciplines domestic policymakers. This logic applies directly to the stability of the financial institution system. When changes in global monetary and financial conditions are an important source of disturbances to the financial institutions system, as has repeatedly been the case, exchange rate flexibility can help to insulate the financial institutions from shocks to their funding and investments and give the authorities the opportunity to act as lenders of last resort. Thus, where lack of domestic monetary discipline is the problem, pegged rates retain obvious appeal. But countries adopting pegged rates, for this or other reasons, must take care to tailor financial arrangements affecting their financial systems to accommodate this additional constraint.

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