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Inflation and Economic Growth in the SADC: Some Panel Time-Series Evidence*

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Abstract

In this paper we investigate the role of inflation rates in determining economic growth in fifteen sub-Saharan African countries, which are all members of the Southern African Development Community (SADC), between 1980 and 2009. The results, based on panel time-series data and analysis, suggest that inflation has had a detrimental effect to growth in the region. All in all, we highlight not only the fact that inflation has offset the Mundell-Tobin effect and consequently reduced, the much needed, economic activity in the region, but also the importance of an institutional framework conducive to a stable macroeconomic environment as a precondition for development and prosperity in the community.

Keywords: Inflation, Growth, SADC.

JEL Classification: E31, O11, O42, O55.

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1 Introduction

The African continent has been known for its rather recent political independence from European colonial powers (mostly in the 1960s, but not only)¹, political regime changes during the cold war (with some countries sidelining with the former Soviet Union and others with the United States, Berger, Corvalan, Easterly and Satyanath (2013)), civil and military conflicts (which tend to be associated with the importance of natural resources, Besley and Persson (2008))², poor macroeconomic performance (in terms of economic activity and prosperity the early 1980s and 1990s saw even negative growth rates), and more recently, some economic structural adjustments and reforms, not to mention political stability, that have generally been matched by better economic performance overall.

Taking the above eventful background into account, we investigate the role of inflation rates in determining economic growth in the Southern African Development Community (SADC). Specifically, we use data from all fifteen SADC members between 1980 and 2009 and panel time-series analysis to study whether inflation played any role (either via the Mundell-Tobin effect and its predicted shift from money holdings to financial assets that—firstly, usually drive interest rates down and, secondly, might lead to an increase in economic activity—or alternatively via higher macroeconomic uncertainty and volatility that usually leads to lower economic activity), in generating growth and prosperity in the SADC.

Interestingly enough, although these SADC countries differ in terms of economic and institutional development (*e.g.*, with Botswana, Mauritius and South Africa being more developed than most of the other countries in the region), they also share common factors, *i.e.*, as mentioned, most of them went through particular economic and political structural changes from the 1960s onwards. Therefore, we pay special attention to these fifteen countries which are part of a "club", or umbrella, that professes the importance of

¹For instance, Zimbabwe gained independence from the UK in 1980, and Angola and Mozambique gained independence from Portugal in 1975.

²For example, the Democratic Republic of the Congo saw military conflict between 1996 and 2003, while the Angolan civil war dragged from 1975 until 2002. In addition, Mozambique's sixteen years of civil conflict came to an end in 1992, while the South African Border War, of which the start dates back to the late 1960s was resolved in 1994 with the institution of democratic institutions in the latter. All in all, these conflicts were either related to the cold war, or natural resources.

regional integration, democracy and economic growth and development as tools to eradicate poverty in the region.

The empirical results suggest that, during the period investigated, inflation has not only been the main macroeconomic determinant of growth in the region, but also that its effect has been a negative one on growth (offsetting the Mundell-Tobin effect). It is therefore fair to say that the lack of certain economic institutions (*de jure* and *de facto* central-bank independence and a credible fiscal authority), combined with political instability, facilitated the process of generating easy money which some would argue leads to higher inflation rates, with all their consequences on economic activity, growth and welfare in general.

In addition, the importance of acquiring a better understanding of the role of inflation on growth is not only because we recently have had a protracted hyperinflationary event in Zimbabwe, with all its detrimental consequences on economic activity, but also because there is an ongoing debate in countries like South Africa about the role, legitimacy and efficacy of independent central banks in conducting monetary policy³. Therefore, it is important to better understand not only the causes, but also the consequences of macroeconomic mismanagement to economic activity.

The literature on inflation and growth has a long, and enduring, tradition in Economics. Firstly, De Gregorio (1993) presents evidence using a panel of twelve Latin American countries during the 1950-1985 period, to suggest that inflation is detrimental to economic growth (or that economic agents in general shift to activities which are "not the engines of sustained growth"). Moreover, Fischer (1993) presents international cross-sectional and panel data evidence for the period 1961-1988 to suggest that inflation indeed outweighs the Mundell-Tobin effect, or that inflation reduces the capital stock in the economy.

Furthermore, Barro (1995 and 1998) makes use of international data covering the period 1960-1990 and cross-sectional analysis to suggest that the high-inflation countries in his sample drive the negative effects of inflation on growth, or that "households are thought to perform poorly when inflation is high". In addition, Bullard and Keating (1995) make use of annual time-series data and VAR analysis to reach a similar conclusion, *i.e.*, that in the

³There is also a related debate on whether the South African Reserve Bank should aim at low interest rates until unemployment rates reach a particular level.

high-inflation country in their sample, inflation negatively affects growth, or that the Mundell-Tobin effect is offset by the macroeconomic uncertainty coming from inflation.

Moreover, Clark (1997) uses a panel of eighty five countries between 1960 and 1985 to confirm the above (that economic agents "devote productive resources to dealing with inflation"). Furthermore, Bruno and Easterly (1998) suggest that there is no long-run relationship between inflation and growth in cross-sectional analysis. Nevertheless, they suggest, using a non-parametric approach and data covering the period 1961-1994, that there is a negative relationship between inflation and growth when inflation reaches their proposed 40% threshold.

Following from the latter, Sarel (1996), Gosh and Phillips (1998), Khan and Senhadji (2001), and Seleteng, Bittencourt and van Eyden (2013) confirm, with different samples of countries, the above negative relationship between inflation and growth once inflation reaches particular thresholds. Moreover, Sirimaneetham and Temple (2009) make use of an index for macroeconomic instability and Bayesian Model Averaging to suggest that macroeconomic stability is a necessary condition for economic growth in a panel of 70 developing countries during the period 1970 and 1999. Finally, Bittencourt (2012) uses a sample of Latin American countries between 1970 and 2007, and panel time-series analysis, to report that inflation, once again, presents detrimental effects to economic activity.

In essence, the literature suggests that high, or higher, inflation is detrimental to growth in large cross-sectional, panel and panel time-series data samples (it outweighs the Mundell-Tobin effect by creating particular distortions, including increased volatility and uncertainty, which results in a shift to less productive activities and consequently reduced growth rates), and in a continent like Africa—which suffers from chronic poverty—high inflation and erratic growth certainly display negative effects on overall economic welfare.

Hence, it is fair to say that this paper is a natural development of the previous literature on the subject, we conduct a case study—as suggested by Fischer (1993)—of an important "club" of African countries that attempts to pinpoint in more detail the effects of macroeconomic performance on economic activity. We do that by avoiding the averaging, which can masquerade the detrimental effects of inflation, and by making use of annual data, and

also by taking advantage of panel time-series analysis, all in an attempt to better capture the role of inflation on growth. Therefore, we are able to provide—to the best of our knowledge, for the first time—informative estimates so that our knowledge in a very idiosyncratic, and also diverse within, southern Africa is deepened.

The remainder of the paper is as follows: the next section describes the data and the empirical strategy used, and then reports and discusses the results obtained. Section Three concludes the paper, it summarises the work, and then it suggests some policy implications and also possible future work.

2 Empirical Analysis

2.1 A Brief Look at the Data

The dataset used covers the period between 1980 and 2009, and fifteen sub-Saharan African countries, which are all members of the SADC, namely Angola, Botswana, the Democratic Republic of the Congo, Lesotho, Madagascar, Mozambique, Mauritius, Malawi, Namibia, South Africa, Swaziland, Seychelles, Tanzania, Zambia and Zimbabwe ($T = 30$ and $N = 15$). To briefly illustrate the importance of these countries in the regional context, these fifteen countries accounted for approximately 52% of the total GDP in sub-Saharan Africa in 2009.

The growth rates of the real gross domestic products per capita ($GROW$) are taken from the World Bank's World Development Indicators and the data on inflation rates ($INFLAT$), with its usual log transformation $\ln(1 + INFLAT/100)$, come from the same source and also from the International Monetary Fund's World Economic Outlook (IMF WEO). As discussed in the brief literature review above, it is fair to expect a negative relationship between inflation and growth in the region.

The control variables used are rather standard in the literature and include the ratio of the gross fixed capital formation to GDP (INV), a canonical Solow growth determinant and it is expected that investment positively affects growth, Bond, Leblebicioğlu and Schiantarelli (2010). Furthermore, we include a variable accounting for the role of education, ($EDUC$), which is defined as the number of teachers per 100 pupils and this proxy is provided by the World Bank. In this case we expect a positive effect of education on

growth, Mankiw, Romer and Weil (1992).

In addition, we include a proxy for government, the ratio of final government consumption expenditure to GDP (*GOV*), which comes from the World Bank and IMF files. It is predicted that high government consumption tends to be detrimental to growth, Barro (1991). Moreover, we include a measure of trade openness, (*OPEN*), which comes from the World Bank files as well. It is expected that more open societies, in terms of trade, tend to grow faster, Wacziarg and Welch (2008).

We also use a baseline measure of financial development, the ratio of the liquid liabilities to GDP (*M2*), from the World Bank files and it is expected that wider access to finance increases economic activity, Levine (2005). Finally, we account for democracy by using the normalised, so that it ranges from zero to one, polity variable (*POL*) from the Polity IV files. It is expected in this case that more democratic societies tend to grow faster, Papaioannou and Siourounis (2008).

In essence, Durlauf, Johnson, and Temple (2005) in their extensive chapter in the Handbook of Economic Growth list different groups of variables that, in one way or another, have already been regressed against growth, which include proxies for inflation, investment, education, government, trade openness, financial development and democracy. Given data availability, we attempt to represent all these groups without unnecessary duplications in our empirical specifications later on in the analysis.

To illustrate, in Figure One we plot the averaged-data on inflation rates and GDP per capita growth rates in all fifteen countries in our sample, and what we can see is that, in particular during the 1990s, inflation saw a considerable increase which was matched by a decrease in growth rates⁴. Coincidentally enough, growth rates became positive again once inflation was brought under control towards the end of the 1990s. In this case it is plausible to speculate that if a twenty-year average, between 1980 and 2000, had been taken, we would not be able to see any negative effect of inflation on economic activity in the region, or to put it another way, the high inflation and low growth rates of the 1990s would be cancelled out by the low inflation and higher growth of the end of the 1990s, Bruno and Easterly (1998).

⁴It is perhaps worth mentioning that those high inflation rates in the 1990s do not include the Zimbabwean hyperinflation which starts more towards the end of the 1990s .

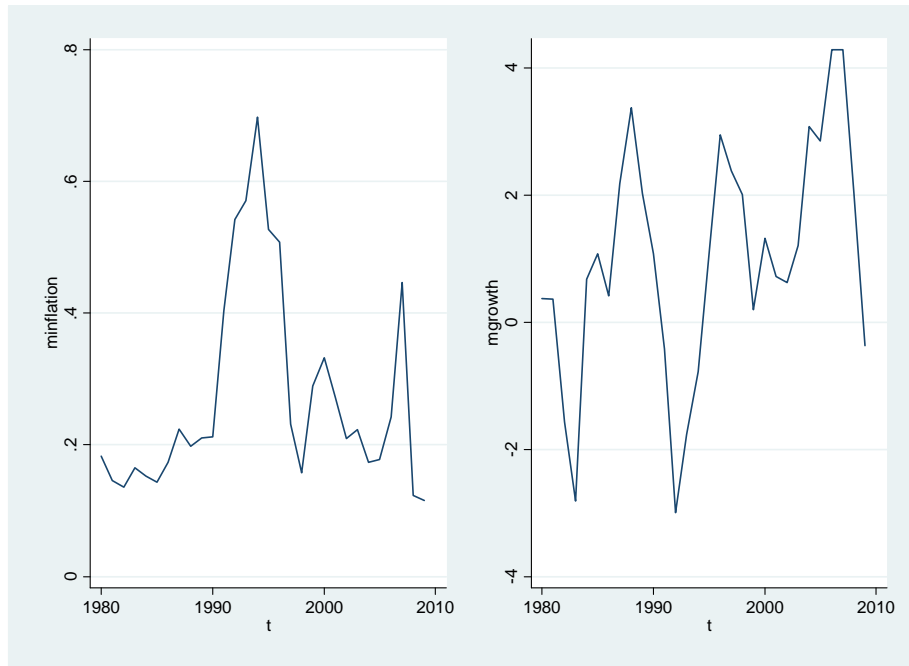


Figure 1: Inflation and GDP per capita growth rates, SADC, 1980-2009. Sources: World Bank and IMF.

Moreover, in Table One we present the correlation matrix of the variables used, and inflation and growth present a negative and statistically significant correlation to each other, Fischer (1993). The control variables present, for most of the time, the expected signs (investment, for being a canonical Solow growth determinant, is positively correlated to growth, Bond, Leblebicioğlu and Schiantarelli (2010), as well as trade openness, Wacziarg and Welch (2008), and democracy, Papaioannou and Siourounis (2008)).

Education is positively correlated to economic growth, however, not statistically significant, and the measure of financial development is also positively correlated to growth, however not significant either. Finally, government consumption presents a positive and significant correlation to economic activity, which somehow goes against the prediction that governments tend to be detrimental to economic activity, Barro (1991).

Table 1: The Correlation Matrix: SADC, 1980-2009.

| | GROW | INFLAT | INV | EDUC | GOV | OPEN | M2 | POL |
|--------|--------|--------|-------|-------|-------|-------|-------|-----|
| GROW | 1 | | | | | | | |
| INFLAT | -0.32* | 1 | | | | | | |
| INV | 0.33* | -0.35* | 1 | | | | | |
| EDUC | 0.05 | 0.02 | 0.14* | 1 | | | | |
| GOV | 0.13* | -0.14* | 0.40* | 0.24* | 1 | | | |
| OPEN | 0.26* | -0.10* | 0.47* | 0.45* | 0.49* | 1 | | |
| M2 | 0.08 | -0.33* | 0.34* | 0.02 | 0.33* | 0.37* | 1 | |
| POL | 0.20* | -0.09 | 0.24* | 0.17* | 0.06 | 0.21* | 0.32* | 1 |

Sources: World Bank, IMF and Polity IV. * represents significance at the 5% level.

Furthermore, in Figure Two we plot the OLS regression line between inflation and per capita growth in all fifteen SADC countries, and the relationship is negative and statistically significant, which indicates that there is an economic relationship between these two variables in the panel.

In a nutshell, this initial descriptive inspection of the data, with all its known caveats, suggests that there is a negative relationship between higher inflation rates and economic growth (*e.g.*, the data plots show the sharp decline in income, particularly during the 1990s when inflation rates were higher, the statistical correlation between inflation and growth is negative and significant, and the OLS regression line indicates a significant negative economic relationship between inflation and growth rates in the region).

Therefore, it can be plausibly said at this stage that the Mundell-Tobin effect was outweighed (or that there was an increase in macroeconomic volatility or a shift to less productive activities) by the macroeconomic uncertainty caused by inflation in these SADC countries, which resulted in lower growth rates overall.

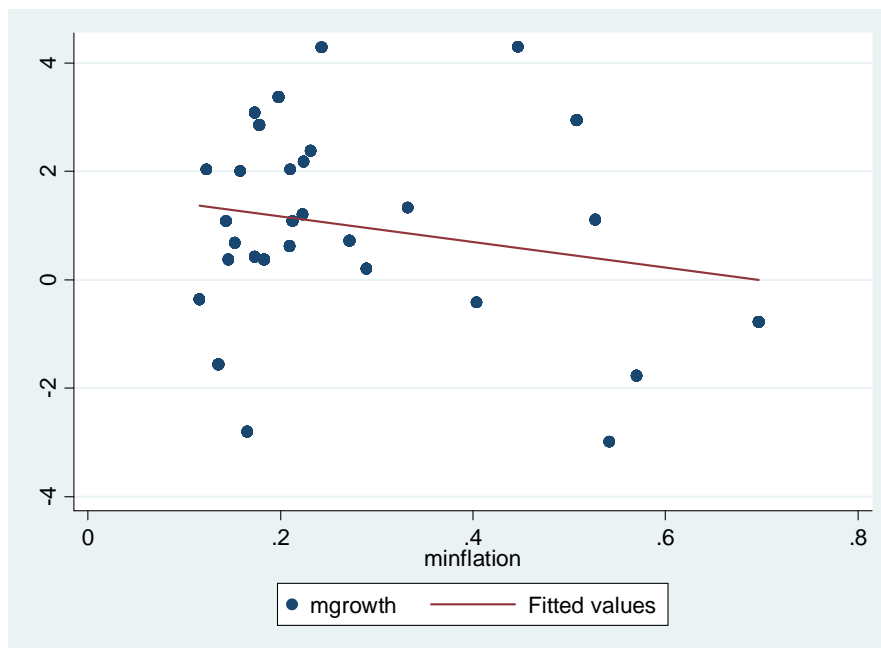


Figure 2: OLS Regression Line, Inflation and GDP per capita growth rates, SADC, 1980-2009. Sources: World Bank and IMF.

2.2 Empirical Strategy

Since we have a $T > N$ data set, the empirical strategy used is based on panel time-series analysis. This is interesting in itself because panel time-series allows us not only to deal with important econometric issues in relatively thin panels—heterogeneity and endogeneity biases—but also to specifically further our knowledge of sub-Saharan Africa without having to incur in the usual removal of African countries from large cross-sectional or panel data analyses. With panel time-series we can specifically analyse the SADC case, with all its idiosyncrasies and differences within, without treating it either as an outlier or as a dummy, and therefore get a clearer picture of the region.

Firstly, although some of the variables are either ratios or indices, and therefore bounded within closed intervals, we also evoke Phillips and Moon (1999) and their result which suggests that the issue of spurious regressions is much less of a problem in panels because of the averaging taking place in panel estimators, which reduces the prospective noise.

Secondly, the issue of statistical endogeneity (the unobserved individ-

ual effects which are nested in the error term might be correlated to the regressors), and heterogeneity of intercepts are dealt with by the two-way Fixed Effects (FE) with robust standard errors estimator, which provides consistent estimates in dynamic models when $T \rightarrow \infty$, indeed our case here⁵.

Thirdly, heterogeneity bias in dynamic $T > N$ panels—which is caused because, with wrongly assumed homogeneity of the slopes, the disturbance term is serially correlated and the explanatory variables x_s are not independent of the lagged dependent variable y_{t-1} —is dealt with by the Mean Group (MG) estimator, proposed by Pesaran and Smith (1995), which is essentially an average of all different time series in the panel⁶.

Essentially, although these countries shared some political and economic transitions in their recent history, these two pooled estimators, FE and MG, account for important econometric issues in dynamic $T > N$ panels, statistical endogeneity and heterogeneity biases, or for the fact that some of these countries do indeed present different levels of economic development (*e.g.*, South Africa is known to be relatively more developed than most countries in the region), and also for particular changes that happened during the period investigated here (*e.g.*, the end of the cold war in the 1990s, the end of the Apartheid regime in South Africa, *etc.*).

Furthermore, some would argue that there is reverse causality, or economic endogeneity, present (or that higher growth might generate lower inflation and not the inverse, Kocherlakota (1996)). We therefore use the Fixed Effects with Instrumental Variables (FE-IV) two-stage Least Squares estimator, and we follow Barro (1995 and 1998) and make use of the first lag of inflation ($E(x_{it-1}v_{it}) = 0$) as a baseline identifying instrument for contemporaneous inflation. The estimates provided by the FE-IV estimator are asymptotically consistent and efficient as $T \rightarrow \infty$, and it retains the time series consistency even if the instrument set is only predetermined, Arellano (2003)⁷.

We therefore estimate dynamic growth equations with different pooled estimators (the FE, MG and FE-IV estimators), so that different econo-

⁵Moreover, the issue of the Nickell bias is less of a problem here because when $T \rightarrow \infty$ the bias tends to zero, *i.e.*, Judson and Owen (1999) argue that when $T = 30$ the FE estimator provides the best alternative in dynamic thin panels.

⁶Another alternative would be the Random Coefficients (RC) estimator, however when $T \rightarrow \infty$ the difference between the MG and RC goes to zero, Smith and Fuertes (2008).

⁷In addition, Bond (2002) argues that GMM-type estimators are not an alternative under $T > N$ for the overfitting problem.

metric issues are dealt with and more reliable estimates provided⁸. The estimated heterogeneous dynamic equation is therefore as follows,

$$\begin{aligned}
GROW_{it} = & \alpha_i + \beta_i INFLAT_{it} + \gamma_i INV_{it} + \delta_i EDUC_{it} + \epsilon_i GOV_{it} \\
& + \varepsilon_i OPEN_{it} + \zeta_i M2_{it} + \eta_i POL_{it} + \theta_i GROW_{it-1} + v_{it} \quad (1)
\end{aligned}$$

in which $GROW$ are the growth rates of the per capita GDPs, $INFLAT$ are the inflation rates, INV is the share of gross fixed capital formation to GDP, $EDUC$ is the number of teachers per 100 pupils, GOV is the share of final government consumption to GDP, $OPEN$ is a measure of economic openness, $M2$ is the share of the liquid liabilities to GDP and POL is the political regime variable which proxies for democracy.

2.3 Results and Discussion

In this section we run baseline dynamic growth regressions with inflation, investment and human capital on the RHS, and then we include the other control variables in a step-wise fashion for robustness sake.

Firstly, in Table Two we report the dynamic estimates of $INFLAT$ on $GROW$ using the two-way FE estimator. All $INFLAT$ estimates are negative and statistically significant against $GROW$, which not only suggests that inflation is detrimental to economic growth, but also that the higher inflation rates of the 1990s certainly contributed to distort the pace of overall economic activity in the region. For instance, the dynamic inflation estimate in column (1) indicates that an increase by 1 percentage point in the inflation rate leads to a decline by 1.5 percentage points in the annual growth rate.

The canonical variable investment INV (or capital accumulation), as predicted, presents positive and significant effects on $GROW$, Bond, Leblebicioğlu and Schiantarelli (2010). On the other hand, the proxy $EDUC$ for education does not present significant estimates against growth. This non-result of education is somehow expected, since the growth literature, for all sorts of reasons—*e.g.*, measurement error—has not been able to find conclusive evidence for the role of education on economic growth, Benhabib and

⁸For a more thorough discussion about panel time-series analysis in general, see Smith and Fuertes (2008) or Lee, Pesaran and Smith (1998) for a treatment more applied to growth analysis.

Spiegel (1994) and Krueger and Lindahl (2001).

About the other control variables, the proxy for government consumption presents negative and mostly significant estimates on growth, which confirms that government consumption tends to be detrimental to economic activity because of particular inefficiencies associated with government spending and also perverse economic incentives associated with government activities, Barro (1991). The variable proxying for trade openness presents positive but not significant estimates.

Furthermore, the liquid liabilities (or financial depth), $M2$, perhaps because of informational asymmetries and lack of experience by the smaller entrepreneurs in terms of how to make better use of finance, present negative and not entirely significant estimates on growth. In addition, the variable for democracy is positive, but not significant. Finally, the F^* tests indicate that there is evidence of country fixed effects.

Table 2: Two-way FE Estimates of Inflation on Economic Growth, 1980-2009.

| GROW | FE (1) | FE (2) | FE (3) | FE (4) | FE (5) |
|--------------------|---------------|---------------|---------------|---------------|---------------|
| INFLAT | -1.57 (-5.33) | -1.77 (-4.56) | -1.91 (-4.60) | -2.52 (-4.02) | -2.73 (-4.46) |
| INV | 1.80 (4.17) | 1.89 (5.04) | 1.58 (3.16) | 1.24 (2.55) | 1.13 (2.28) |
| EDUC | -2.10 (-0.91) | -2.58 (-1.07) | -2.67 (-1.16) | -.875 (-0.35) | -2.37 (-0.85) |
| GOV | | -2.47 (-1.74) | -2.54 (-1.79) | -1.85 (-1.53) | -2.09 (-1.60) |
| OPEN | | | 1.57 (1.16) | .786 (0.47) | .649 (0.41) |
| M2 | | | | -1.89 (-2.01) | -1.53 (-1.50) |
| POL | | | | | .816 (1.58) |
| GROW ₋₁ | .194 (2.39) | .184 (2.12) | .176 (2.05) | .080 (0.92) | .049 (.093) |
| F test | 4.58 | 4.73 | 4.67 | 3.88 | 4.06 |
| F* test (p) | 1.99 (0.01) | 2.51 (0.00) | 2.31 (0.00) | 4.15 (0.00) | 3.99 (0.00) |
| R ² | 0.32 | 0.25 | 0.30 | 0.20 | 0.21 |

T-ratios in parentheses. Number of observations: $NT = 450$. The basic estimated equation is $GROW_{it} = \alpha_i + \vartheta_t + \beta_i INFLAT_{it} + \gamma_i INV_{it} + \delta_i EDUC_{it} + \epsilon_i GOV_{it} + \varepsilon_i OPEN_{it} + \zeta_i M2_{it} + \eta_i POL_{it} + \theta_i GROW_{it-1} + v_{it}$, in which $GROW$ is the growth rate of the real GDP per capita, $INFLAT$ is the inflation rate, INV is the gross fixed capital formation ratio to GDP, $EDUC$ is the number of teachers per 100 pupils, GOV is the government's consumption share to GDP, $OPEN$ is a measure of economic openness, $M2$ is the liquid liabilities ratio to GDP, and POL is a proxy for

political regime characteristics. FE is the two-way Fixed Effects estimator.

In Table Three we report the dynamic estimates of inflation on economic growth, but now we make use of the MG estimator which accounts for heterogeneity of intercepts and slopes as well. All inflation estimates are negative and mostly significant against growth, suggesting once again that higher inflation rates are detrimental to economic activity, or that the Mundell-Tobin effect is being offset by the macroeconomic uncertainty originating from higher rates of inflation, Fischer (1993).

In addition, investment is not entirely significant this time and education maintains its inconclusive results. About the other control variables, government consumption keeps its negative and significant estimates, which indicates that too much government activity, in terms of (conspicuous) consumption, does not lead to higher productivity, or economic growth, Barro (1991). Furthermore, the proxy for trade openness now displays positive and mostly significant estimates, suggesting that more open societies can indeed grow faster via increased flows of goods, people and ideas, Wacziarg and Welch (2008). This result regarding openness is important because an important objective of the SADC is to achieve regional integration, or trade openness, combined with economic growth and development.

Moreover, the proxy for financial development presents negative estimates, somehow confirming the fact that in developing countries there are informational asymmetries in terms of making good use of short-run finance (proxied here by the liquid liabilities) by smaller entrepreneurs which end up not generating economic activity. In addition, the variable accounting for democracy is positive and significant, Papaioannou and Siourounis (2008). This result regarding democracy indicates that the enhanced checks and balances coming from democracy might improve efficiency and governance, and therefore lead to higher economic activity.

Table 3: MG Estimates of Inflation on Economic Growth, 1980-2009.

| GROW | MG (1) | MG (2) | MG (3) | MG (4) | MG (5) |
|--------------------|----------------|----------------|----------------|----------------|----------------|
| INFLAT | -14.14 (-2.13) | -13.46 (-1.95) | -12.36 (-1.58) | -18.35 (-2.27) | -14.59 (-2.09) |
| INV | 2.14 (2.37) | 2.70 (2.48) | 1.01 (0.79) | 1.62 (1.26) | 1.26 (0.86) |
| EDUC | -6.18 (-0.72) | -13.41 (-1.14) | -3.72 (-0.86) | 2.43 (0.39) | 4.51 (0.53) |
| GOV | | -9.39 (-4.58) | -9.14 (-4.03) | -7.96 (-3.54) | -6.47 (-2.33) |
| OPEN | | | 4.78 (2.05) | 5.50 (2.48) | 4.62 (1.76) |
| M2 | | | | -5.31 (-1.80) | -6.28 (-1.93) |
| POL | | | | | 20.41 (2.13) |
| GROW ₋₁ | .126 (1.81) | .087 (1.20) | .076 (1.02) | -.011 (-0.13) | -.072 (-0.83) |
| Wald test | 12.70 | 35.31 | 19.93 | 53.75 | 21.49 |

T-ratios in parentheses. Number of observations: $NT = 450$. The basic estimated equation is $GROW_{it} = \alpha_i + \beta_i INFLAT_{it} + \gamma_i INV_{it} + \delta_i EDUC_{it} + \epsilon_i GOV_{it} + \varepsilon_i OPEN_{it} + \zeta_i M2_{it} + \eta_i POL_{it} + \theta_i GROW_{it-1} + v_{it}$, in which $GROW$ is the growth rate of the real GDP per capita, $INFLAT$ is the inflation rate, INV is the gross fixed capital formation ratio to GDP, $EDUC$ is the number of teachers per 100 pupils, GOV is the government's consumption share to GDP, $OPEN$ is a measure of economic openness, $M2$ is the liquid liabilities ratio to GDP, and POL is a proxy for political regime characteristics. MG is the Mean Group estimator.

In Table Four we report the dynamic estimates of $INFLAT$ on $GROW$ using the FE-IV estimator which account for possible endogeneity. All $INFLAT$ estimates instrumented with the lagged inflation are negative and mostly statistically significant. These instrumented dynamic inflation estimates strongly confirm the results reported above, clearly indicating that higher inflation rates are detrimental to economic growth in the SADC region. For instance, using specification in column (3), an increase by 1 percentage point in the inflation rate leads to a decline by 1.5 percentage points in the annual growth rate.

About the controls, the variable investment is positive and mostly significant, somehow confirming the Solovian prediction on the role of capital accumulation in growth. Education, once again, does not present clear-cut estimates. Furthermore, government consumption confirms its detrimental role on economic activity (via distortions coming from government expenditure), and trade openness confirms its positive role on economic growth as

well (via an increase in flows of goods, people and knowledge).

In addition, the financial development variable $M2$ keeps its negative and significant estimates against growth, suggesting the existence of informational asymmetries in terms of access to short-term finance by small entrepreneurs, and democracy presents a positive and significant estimate on economic growth (via better constraints on the executive that tend to improve governance). Needless to say that the latter bodes well with the objectives of the SADC, *i.e.*, democracy and economic growth.

Moreover, the F^* test indicates, for most of the time, the presence of regional fixed effects, and in the first-stage regressions (available on request) the identifying instrument for inflation, lagged inflation, is positive and statistically significant and the F test for overall significance indicates that we can reject the null as well in the first-stage regressions, which minimise the issue of weak instruments.

Table 4: FE-IV Estimates of Inflation on Economic Growth, 1980-2009.

| GROW | FE-IV (1) | FE-IV (2) | FE-IV (3) | FE-IV (4) | FE-IV (5) |
|--------------------|---------------|---------------|---------------|---------------|---------------|
| INFLAT | -1.03 (-1.58) | -1.27 (-1.94) | -1.54 (-2.30) | -3.22 (-4.15) | -3.55 (-4.54) |
| INV | 1.51 (2.48) | 1.64 (2.75) | 1.15 (1.83) | .507 (0.75) | .416 (0.61) |
| EDUC | -.683 (-0.31) | -1.79 (-0.81) | -2.49 (-1.13) | -.808 (-0.38) | -2.52 (-1.12) |
| GOV | | -3.33 (-3.54) | -3.25 (-3.49) | -2.60 (-2.85) | -2.73 (-2.98) |
| OPEN | | | 2.49 (2.52) | 2.38 (2.24) | 1.94 (1.82) |
| M2 | | | | -1.68 (-2.73) | -1.51 (-2.40) |
| POL | | | | | .690 (2.03) |
| GROW ₋₁ | .279 (5.35) | .258 (4.96) | .235 (4.44) | .107 (1.92) | .072 (1.25) |
| F* test (p) | 1.51 (0.10) | 2.37 (0.00) | 2.13 (0.00) | 3.99 (0.00) | 3.72 (0.00) |
| R ² | 0.25 | 0.14 | 0.22 | 0.15 | 0.14 |

T-ratios in parentheses. Number of observations: $NT = 450$. The basic estimated equation is $GROW_{it} = \alpha_i + \beta INFLAT_{it} + \gamma INV_{it} + \delta EDUC_{it} + \epsilon GOV_{it} + \epsilon OPEN_{it} + \zeta M2_{it} + \eta POL_{it} + \theta GROW_{it-1} + v_{it}$, in which $GROW$ is the growth rate of the real GDP per capita, $INFLAT$ is the inflation rate, INV is the gross fixed capital formation ratio to GDP, $EDUC$ is the number of teachers per 100 pupils, GOV is the government's consumption share to GDP, $OPEN$ is a measure of economic openness, $M2$ is the liquid liabilities ratio to GDP, and POL is a proxy for political regime characteristics. The identifying instrument is the first lag of inflation.

FE-IV is the Fixed Effects with Instrumental Variables estimator.

In a nutshell, the estimates reported above indicate that the inflation rates robustly presented detrimental effects to economic growth in those SADC countries between 1980 and 2009. It is also worth highlighting that the only cyclical and structural variable presenting clear-cut effects on growth is, in fact, inflation, which suggests that macroeconomic performance is an important driving force behind economic activity in the region. To say the least, low inflation rates are a necessary precondition for economic growth in the community, Fischer (1993) and Sirimaneetham and Temple (2009). All in all, inflation in the SADC offset the prospective Mundell-Tobin effect via an increase in macroeconomic uncertainty which lead to reductions, in the much needed, economic activity.

Ultimately, the above is potentially important in terms of economic welfare, reductions in economic growth usually have a first- and second-order effect on the poor via higher unemployment, and subsequently increased poverty.

The control variables also provide some interesting results. For instance, although education is not significant against growth, perhaps $M2$ is, in fact, picking up the importance of a certain degree of education in order to make good use of short-run finance, so that those resources could be used, usually by smaller entrepreneurs, to fund productive activities. The proxy for government size, which is negative and mostly significant, is suggestive of the importance of a better allocation of government expenditure, so that government consumption can be better channelled to more productive activities. Finally, the variables openness and democracy present positive and mostly significant estimates against growth, and these estimates bode well with the objectives of the SADC, *i.e.*, of achieving regional integration and democracy combined with economic prosperity.

3 Concluding Observations

Using a dataset covering the period between 1980 and 2009, in this paper we investigated the role of inflation rates in determining economic growth in a panel of sub-Saharan African countries that are all members of the SADC. The results, based on panel time-series analysis, suggest that inflation was indeed detrimental to growth in the region.

More specifically, amongst the cyclical and structural variables used in the analysis, inflation proved to be the only one presenting clear-cut effects against growth, which highlights its central role in determining economic activity in the region. Moreover, these detrimental effects to economic activity outweighed the Mundell-Tobin effect (or alternatively speaking, inflation has increased macroeconomic uncertainty or induced agents to shift to less productive activities).

The quality of the evidence presented is, to a certain extent, boosted because we avoid the averages and take advantage of panel time-series analysis, which deals with important empirical issues, such as heterogeneity bias in dynamic panels and endogeneity in relatively thin panels. Essentially, this analysis is important because it allows us to specifically study the SADC region, instead of treating the region either as a dummy or as an outlier to be removed from the sample. Therefore, the analysis conducted here represents a step forward in terms of achieving insightful estimates, and in improving our knowledge on the subject in sub-Saharan Africa.

Regarding future work, the issue of spatial dependence and spillovers (plausibly coming from the largest economy in the region, South Africa) is an interesting, and of practical importance, subject that deserves some attention and could complement the present study.

To conclude, the SADC experience is informative because it exemplifies the importance of a variable that requires particular economic institutions, such as independent and well-staffed central banks conducting sound monetary policy and credible fiscal authorities, to be in place. Moreover, in times of a crisis affecting a number of countries worldwide, it is important to keep in mind that (low) inflation in the SADC is a precondition for economic activity, and also that high inflation affects, in one way or another, mostly the welfare of the poor. Therefore, the importance of independent economic institutions in providing the necessary conditions for growth and the lessons of past macroeconomic mismanagement episodes and their effects on economic activity must be not only learned and well understood, but also kept in the minds of policy makers and other stakeholders, so that the mistakes of the past are not repeated again.

A Appendix

In this appendix, for robustness sake, we provide the one-way FE estimates. In essence, the estimates of inflation are all negative and statistically significant against growth. In addition, these estimates are similar in size to the ones reported in Table Two above. The control variables also follow the pattern reported above, *e.g.*, with government consumption proving to have a detrimental effect to productive activities, and openness and democracy keeping their positive effects on economic growth.

Table 5: One-way FE Estimates of Inflation on Economic Growth, 1980-2009.

| GROW | FE (1) | FE (2) | FE (3) | FE (4) | FE (5) |
|--------------------|---------------|---------------|---------------|---------------|---------------|
| INFLAT | -1.54 (-4.48) | -1.83 (-6.52) | -2.08 (-6.46) | -2.80 (-4.90) | -2.97 (-5.21) |
| INV | 1.44 (2.93) | 1.58 (3.89) | 1.05 (2.58) | .607 (1.39) | .561 (1.40) |
| EDUC | -.588 (-0.25) | -1.76 (-0.78) | -2.51 (-1.24) | -.851 (-0.43) | -2.49 (-1.05) |
| GOV | | -3.53 (-2.60) | -3.42 (-2.48) | -2.59 (-2.24) | -2.71 (-2.30) |
| OPEN | | | 2.71 (2.14) | 2.30 (1.75) | 1.85 (1.46) |
| M2 | | | | -1.65 (-2.17) | -1.48 (-1.93) |
| POL | | | | | .654 (1.95) |
| GROW ₋₁ | .262 (3.09) | .238 (2.68) | .215 (2.44) | .121 (1.32) | .093 (0.93) |
| F test | 18.76 | 211.40 | 67.53 | 57.72 | 57.31 |
| F* test (p) | 1.63 (0.06) | 2.66 (0.00) | 2.48 (0.00) | 4.00 (0.00) | 3.68 (0.00) |
| R ² | 0.24 | 0.14 | 0.22 | 0.15 | 0.15 |

T-ratios in parentheses. Number of observations: $NT = 450$. The basic estimated equation is $GROW_{it} = \alpha_i + \beta_i INFLAT_{it} + \gamma_i INV_{it} + \delta_i EDUC_{it} + \epsilon_i GOV_{it} + \varepsilon_i OPEN_{it} + \zeta_i M2_{it} + \eta_i POL_{it} + \theta_i GROW_{it-1} + v_{it}$, in which $GROW$ is the growth rate of the real GDP per capita, $INFLAT$ is the inflation rate, INV is the gross fixed capital formation ratio to GDP, $EDUC$ is the number of teachers per 100 pupils, GOV is the government's consumption share to GDP, $OPEN$ is a measure of economic openness, $M2$ is the liquid liabilities ratio to GDP, and POL is a proxy for political regime characteristics. FE is the one-way Fixed Effects estimator.

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