



Inflation and Economic Growth: Evidence from the Southern African Development Community

Manoel Bittencourt, René van Eyden and Monaheng Seleteng

ERSA working paper 405

January 2014

Economic Research Southern Africa (ERSA) is a research programme funded by the National Treasury of South Africa.

The views expressed are those of the author(s) and do not necessarily represent those of the funder, ERSA or the author's affiliated institution(s). ERSA shall not be liable to any person for inaccurate information or opinions contained herein.

Inflation and Economic Growth: Evidence from the Southern African Development Community*

Manoel Bittencourt[†] Reneé van Eyden[‡] Monaheng Seleteng[§]

December 31, 2013

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 prospective 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.

*We thank Alain Kabundi, Stephen Miller, an ERSA referee and seminar participants at Pretoria, ESSA 2011 in Stellenbosch and ERSA Financial Economics Workshop in Cape Town for comments. Financial support from ERSA is acknowledged.

[†]Department of Economics, University of Pretoria, Lynnwood Road, Pretoria 0002, RSA, Email: manoel.bittencourt@up.ac.za.

[‡]Department of Economics, University of Pretoria, Lynnwood Road, Pretoria 0002, RSA, Email: renee.vaneyden@up.ac.za.

[§]Department of Economics, University of Pretoria, Lynnwood Road, Pretoria 0002, RSA and Research Department, Central Bank of Lesotho, Maseru 100, Lesotho, E-mail: mseleteng@centralbank.org.ls.

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, and poor macroeconomic performance (in terms of economic activity and prosperity the late 1980s and early 1990s saw even negative growth rates). More recently though, the continent saw some economic structural adjustments and reforms taking place, 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). This community of countries includes the likes of Angola, Botswana, the Democratic Republic of the Congo (DRC), Lesotho, Madagascar, Mozambique, Mauritius, Malawi, Namibia, South Africa, Swaziland, Seychelles, Tanzania, Zambia and Zimbabwe, and it professes the importance of "regional integration, peace and security, democracy and development" as tools to eradicate poverty in the region. Specifically, we use data from all these fifteen SADC members between 1980 and 2009 and panel time-series analysis to study whether inflation played any role in generating growth and prosperity in the region.

Firstly, one would argue that some inflation can be conducive to growth via the Mundell-Tobin effect and its predicted shift from money holdings to financial assets that usually drive interest rates down and consequently might lead to an increase in economic activity. In other words, with higher inflation people tend to convert their money balances into financial assets

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 South Africa. All in all, it can be said that these conflicts were either related to the cold war, or natural resources.

which reduce interest rates and that can increase capital accumulation. Secondly, others would argue that inflation can be detrimental to growth because it might increase macroeconomic uncertainty and that usually leads to lower investment and consequently lower economic activity as well. All in all, the link between inflation and growth is not obvious and therefore deserves attention.

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.*, 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 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 been a robust macroeconomic determinant of growth in the region and also that its effect has been a negative one on growth, clearly 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 to be a device used by governments which are losing control of their own finances to fund themselves (Fischer (1993)). That process of generating easy money leads to higher inflation rates, with all their consequences on macroeconomic uncertainty, 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 to 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 policy. There 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. Therefore, it is important to better understand not only the causes, but also the consequences of macroeconomic management 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 via increased macroeconomic uncertainty.

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 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 1970-1999. 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, this non-exhaustive literature review suggests that high, or higher, inflation is detrimental to growth in large cross-sectional, time series, panel and panel time-series data samples. It outweighs the Mundell-Tobin effect by creating particular distortions, including increased macroeconomic uncertainty, which result in a shift to less productive activities and consequently reduced growth rates. Needless to say that 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 (Bruno and Easterly (1998)), 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, *i.e.*, higher inflation might lead to an increase in macroeconomic uncertainty, which in turn becomes detrimental to economic activity, Fischer (1993).

The control variables used are rather standard in the literature and include the ratio of the gross fixed capital formation to GDP (*INV*) from the World Bank, 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 in secondary education and this proxy for education is provided by the World Bank as well. 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 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 predicted 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 the 1980s saw stable inflation and some economic growth. Moreover, in the 1990s inflation saw a considerable increase which was matched by a decrease in growth rates³. Coincidentally enough, growth rates became positive again once inflation was brought under control 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

³It 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.

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.

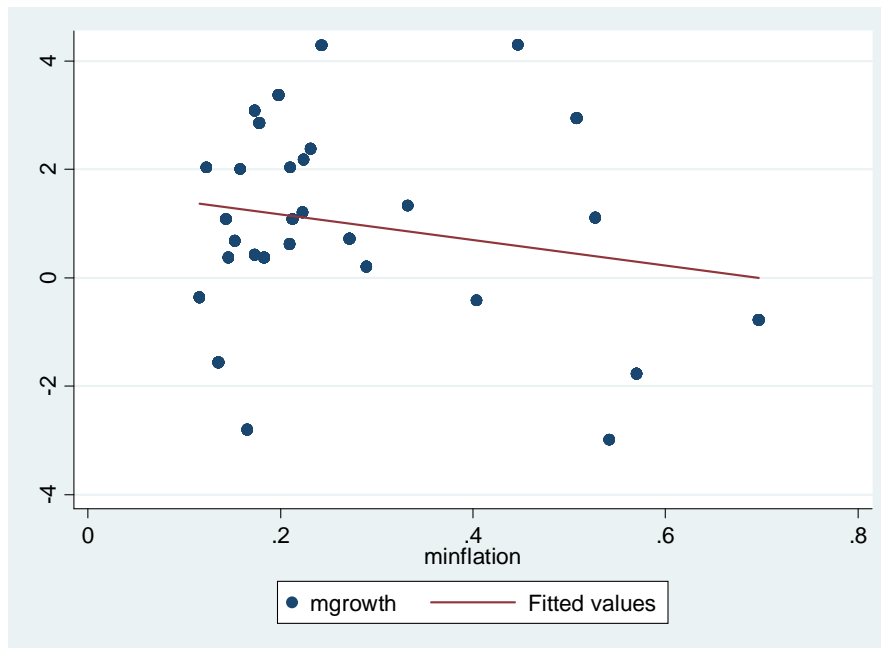


Figure 2: OLS Regression Line, Inflation and GDP per capita growth rates, SADC, 1980-2009. Sources: World Bank and IMF.

In a nutshell, this initial descriptive inspection of the data, with all the known caveats associated with descriptive analyses, 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 by the increased macroeconomic uncertainty caused by inflation in these SADC countries, which resulted in lower growth rates overall.

2.2 Empirical Strategy

Since we have a $T > N$ data set, ($T = 30$ and $N = 15$), 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 we can 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 individual effects which are nested in the error term might be correlated to the regressors), and heterogeneity of intercepts are dealt with by the one- and two-way Fixed Effects (FE) with robust standard errors estimator, which provides consistent estimates in dynamic models when $T \rightarrow \infty$, Smith and Fuertes (2008).

In addition, Judson and Owen (1999) argue that the issue of the Nickell bias in dynamic $T > N$ panels—of order $O(1/T)$, and which is caused because the FE transformed error term (which purges the country-specific effect) tends to be correlated with the lagged dependent variable—can be a problem even with $T = 30$. Therefore, we implement the bias approximation provided by Bruno (2005), which extends on Bun and Kiviet (2003), and that allows for an unbalanced panel to give "corrected" FE estimates. In this case, given the nature of our dataset, we use the Anderson and Hsiao option as our baseline consistent estimator.

Essentially, although these countries shared some political and economic transitions in their recent history, the FE estimator accounts 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 growth might generate 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)⁴.

We therefore estimate dynamic growth equations with different pooled estimators (the FE and FE-IV estimators), so that different econometric issues are dealt with and more reliable estimates provided⁵. The one-way FE estimated dynamic equation is therefore as follows,

$$\begin{aligned} GROW_{it} = & \alpha_i + \beta INFLAT_{it} + \gamma INV_{it} + \delta EDUC_{it} + \epsilon GOV_{it} \\ & + \varepsilon OPEN_{it} + \zeta M2_{it} + \eta POL_{it} + \theta GROW_{it-1} + v_{it} \quad (1) \end{aligned}$$

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 in secondary education, 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 Tables Two and Three we report the dynamic estimates of $INFLAT$ on $GROW$ using the one- and two-way FE estimator respectively. All $INFLAT$ estimates are negative and statistically significant

⁴In addition, Bond (2002) argues that GMM-type estimators are not an alternative under $T > N$ for the overfitting problem.

⁵For 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.

against *GROW*, which not only suggests that inflation is detrimental to economic growth, but also that, *e.g.*, the higher inflation rates of the 1990s contributed to distort the pace of overall economic activity in the region via increased macroeconomic uncertainty. For instance, the dynamic inflation estimates in columns (1), Tables Two and Three, indicate 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. Moreover, in columns six, both tables, we report the Bruno-corrected estimates using the complete specification and they are in line with the ones reported in columns five (*i.e.*, the Nickell bias is not of a significant size in regressions five). All in all, the Mundell-Tobin effect in the region is being offset by the macroeconomic uncertainty originating from higher rates of inflation, Fischer (1993).

The canonical variable investment *INV* (or capital accumulation), as predicted, presents positive and mostly 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 Spiegel (1994) and Krueger and Lindahl (2001).

In addition, it can be argued that growth in the SADC is still based on physical capital instead of human capital accumulation, or that because of low human capital an economy ends up without too much technology and consequently without the necessary skills in place, Eicher and García-Peñalosa (2001). In other words, education in African economies, because of non-monotonicities and low levels of development, might well not, as yet, play the expected positive role on growth. Furthermore, Galor (2005) argues that the first stage of the industrial revolution taking place in Britain in the 18th century was mostly based on physical capital and not necessarily on formal human capital accumulation. It is therefore plausible to assume, as predicted by the unified growth theory, that the SADC is going through the same sort of developmental process that more mature societies have already gone through, which justifies why human capital is still not playing its expected role on growth in the community.

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 wholly significant estimates at this stage.

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 mostly significant estimates on growth, Foster and Székely (2008). In addition, the variable for democracy is positive, but not entirely significant. Finally, the F^* tests indicate that there is evidence of country fixed effects.

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

GROW	FE (1)	FE (2)	FE (3)	FE (4)	FE (5)	LSDVC (6)
INFLAT	-1.54 (-4.48)	-1.83 (-6.52)	-2.08 (-6.46)	-2.80 (-4.90)	-2.97 (-5.21)	-2.92
INV	1.44 (2.93)	1.58 (3.89)	1.05 (2.58)	.607 (1.39)	.561 (1.40)	.563
EDUC	-.588 (-0.25)	-1.76 (-0.78)	-2.51 (-1.24)	-.851 (-0.43)	-2.49 (-1.05)	-2.58
GOV		-3.53 (-2.60)	-3.42 (-2.48)	-2.59 (-2.24)	-2.71 (-2.30)	-2.62
OPEN			2.71 (2.14)	2.30 (1.75)	1.85 (1.46)	1.84
M2				-1.65 (-2.17)	-1.48 (-1.93)	-1.41
POL					.654 (1.95)	.694
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 estimated equation is $GROW_{it} = \alpha_i + \beta INFLAT_{it} + \gamma INV_{it} + \delta EDUC_{it} + \epsilon GOV_{it} + \varepsilon OPEN_{it} + \zeta M2_{it} + \eta POL_{it} + \theta GROW_{it-1} + v_{it}$, 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. FE is the one-way Fixed Effects estimator and the LSDVC are the Bruno-corrected estimates.

Table 3: Two-way FE Estimates of Inflation on Economic Growth, 1980-2009.

GROW	FE (1)	FE (2)	FE (3)	FE (4)	FE (5)	LSDVC (6)
INFLAT	-1.57 (-5.33)	-1.77 (-4.56)	-1.91 (-4.60)	-2.52 (-4.02)	-2.73 (-4.46)	-2.69
INV	1.80 (4.17)	1.89 (5.04)	1.58 (3.16)	1.24 (2.55)	1.13 (2.28)	1.13
EDUC	-2.10 (-0.91)	-2.58 (-1.07)	-2.67 (-1.16)	-.875 (-0.35)	-2.37 (-0.85)	-2.53
GOV		-2.47 (-1.74)	-2.54 (-1.79)	-1.85 (-1.53)	-2.09 (-1.60)	-2.00
OPEN			1.57 (1.16)	.786 (0.47)	.649 (0.41)	.671
M2				-1.89 (-2.01)	-1.53 (-1.50)	-1.48
POL					.816 (1.58)	.835
GROW ₋₁	.194 (2.39)	.184 (2.12)	.176 (2.05)	.080 (0.92)	.049 (.093)	.087
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 estimated equation is $GROW_{it} = \alpha_i + \vartheta_t + \beta INFLAT_{it} + \gamma INV_{it} + \delta EDUC_{it} + \epsilon GOV_{it} + \varepsilon OPEN_{it} + \zeta M2_{it} + \eta POL_{it} + \theta GROW_{it-1} + v_{it}$, 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. FE is the two-way Fixed Effects estimator and the LSDVC are the Bruno-corrected estimates.

In Table Four we report the dynamic estimates of $INFLAT$ on $GROW$ using the FE-IV estimator which accounts for possible endogeneity. All $INFLAT$ estimates instrumented with the lagged inflation are negative and mostly statistically significant, Barro (1998). These instrumented dynamic inflation estimates 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, lending credence to the Solovian prediction on the role of capital accumulation in growth, Bond, Leblebicioğlu and Schiantarelli (2010). Education, once again, does not present clear-cut or significant estimates,

Krueger and Lindahl (2001). Furthermore, government consumption confirms its detrimental role on economic activity (via distortions coming from government expenditure, Barro (1991)), and trade openness confirms now its predicted positive role on economic growth as well (via an increase in flows of goods, people and knowledge, Wacziarg and Welch (2008)). The latter is in accordance to one of SADC's aims which is about increasing trade integration in the region.

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 (Foster and Székely (2008)), and democracy presents a positive and significant estimate on economic growth (via better constraints on the executive that tend to improve governance, Papaioannou and Siourounis (2008)). Needless to say that the latter bodes well with the objectives of the SADC as well, *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, 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 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. To say the least, low inflation rates are a necessary precondition for economic growth in the community, Fischer (1993), and Sirimaneetham and Temple (2009). Moreover, it can be argued that because we avoid the averages and make use of annual (high frequency) data, and inflation is a cyclical variable, we end up better capturing inflation's effect on economic activity in the region (Bruno and Easterly (1998)).

All in all, inflation in the SADC offset the prospective Mundell-Tobin effect via an increase in macroeconomic uncertainty which leads to reductions, in the much needed, economic activity. Ultimately, the above is potentially important in terms of economic welfare, say, reductions in economic growth

usually have a first- and second-order effect on the poor via higher unemployment, and subsequently increased poverty and inequality⁶.

The control variables also provide some interesting results. Firstly, investment presents positive and mostly significant estimates, which suggests that physical capital accumulation plays a role on growth in the region. Secondly, apart from the fact that physical capital seems to play a more important role than human capital in the community, perhaps $M2$ is 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. All in all, the results regarding investment and education seem to be in accordance to the unified growth theory prediction which suggests that the first stage of the industrial revolution (the post-Malthusian regime) was based on physical, instead of human, capital accumulation, Galor (2005).

In addition, 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, inflation proved to be a robust macroeconomic determinant of 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

⁶For instance, Easterly and Fischer (2001) suggest that the poor from 38 countries consider inflation to be a more pressing problem than the rich, and Bittencourt (2009) reports that the high rates of inflation seen in Brazil in 1983-1994 contributed to increase earnings inequality.

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 community 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 inflationary 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 historical 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 touch upon the issue of heterogeneity of intercepts and slopes 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} . We make use of the Mean

Group (MG) estimator, proposed by Pesaran and Smith (1995), which is essentially an average of all different time series in the panel⁷.

In essence, the estimates of inflation are all negative and statistically significant against growth, which confirms the FE and FE-IV estimates reported 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: 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 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.

References

- [1] Arellano, M. 2003. Panel data econometrics. Oxford University Press: Advanced texts in Econometrics.

⁷Another 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).

- [2] Barro, Robert J. 1998. *Determinants of Economic Growth: A Cross-country Empirical Study*. The MIT Press.
- [3] Barro, Robert J. 1995. Inflation and Economic Growth. In *NBER Working Paper Series*.
- [4] Barro, Robert J. 1991. Economic Growth in a Cross Section of Countries. *Quarterly Journal of Economics* 106 (2):407-443.
- [5] Benhabib, Jess, and Mark Spiegel. 1994. The role of human capital in economic development: evidence from aggregate cross-country data. *Journal of Monetary Economics*, 34: 143-173.
- [6] Berger, Daniel, Alejandro Corvalan, William Easterly, and Shanker Satyanath. 2013. Do superpower interventions have short and long term consequences for democracy? *Journal of Comparative Economics* 41:22-34.
- [7] Besley, Timothy J. and Torsten Persson. 2008. *The Incidence of Civil War: Theory and Evidence*. NBER Working Paper No. w14585.
- [8] Bittencourt, Manoel. 2012. Inflation and economic growth in Latin America: some panel time-series evidence. *Economic Modelling* 29:333-340.
- [9] Bittencourt, Manoel. 2009. Macroeconomic Performance and Inequality: Brazil, 1983-94. *The Developing Economies* 47 (1):30-52.
- [10] Bond, Stephen R. 2002. Dynamic Panel Data Models: A Guide to Micro Data Methods and Practice. *Portuguese Economic Journal* 1 (2):141-62.
- [11] Bond, Stephen, Asli Leblebicioğlu, and Fabio Schiantarelli. 2010. Capital Accumulation and Growth: a New Look at the Empirical Evidence. *Journal of Applied Econometrics* 25:1073-1099.
- [12] Bruno, Giovanni. 2005. Approximating the bias of the LSDV estimator for dynamic unbalanced panel data models. *Economic Letters* 87:361-366.
- [13] Bruno, Michael, and William Easterly. 1998. Inflation crises and long-run growth. *Journal of Monetary Economics* 41:3-26.

- [14] Bullard, James, and John W. Keating. 1995. The long-run relationship between inflation and output in postwar economies. *Journal of Monetary Economics* 36:477-496.
- [15] Bun, M.J.G. and Kiviet, J.F. 2003. On the diminishing returns of higher order terms in asymptotic expansion of bias. *Economics Letters* 79:145-152.
- [16] Clark, Todd E. 1997. Cross-country evidence on long-run growth and inflation. *Economic Inquiry* XXXV:70-81.
- [17] Durlauf, S. N., Johnson, P. A., and Temple, J. R. W. 2005. Growth econometrics. In P. Aghion and S. N. Durlauf (eds.) *Handbook of Economic Growth, Volume 1A*, North-Holland: Amsterdam.
- [18] Easterly, William, and Stanley Fischer. 2001. Inflation and the Poor. *Journal of Money, Credit and Banking* 33 (2):160-178.
- [19] Eicher, Theo, and Cecilia García-Peñalosa. 2001. Inequality and growth: the dual role of human capital in development. *Journal of Development Economics* 66:173-197.
- [20] Fischer, Stanley. 1993. The role of macroeconomic factors in growth. *Journal of Monetary Economics* 32:485-512.
- [21] Foster, James E., and Miguel Székely. 2008. Is economic growth good for the poor? Tracking low incomes using general means. *International Economic Review* 49 (4):1143-1172.
- [22] Galor, Oded. 2005. From Stagnation to Growth: Unified Growth Theory. In *Handbook of Economic Growth*, edited by P. Aghion and S. Durlauf. Amsterdam: Elsevier North-Holland.
- [23] Ghosh, Atish, and Steven Phillips. 1998. Warning: Inflation May Be Harmful to Your Growth. *IMF Staff Papers* 45 (4):672-710.
- [24] Gregorio, José De. 1993. Inflation, taxation, and long-run growth. *Journal of Monetary Economics* 31:271-298.
- [25] Judson, Ruth, and Ann Owen. 1999. Estimating dynamic panel data models: a guide for macroeconomists. *Economics Letters* 65:9-15.

- [26] Khan, Mohsin S., and Abdelhak S. Senhadji. 2001. Threshold Effects in the Relationship Between Inflation and Growth. *IMF Staff Papers* 48 (1):1-21.
- [27] Kocherlakota, Narayana. 1996. Inflation and growth - commentary. Review, Federal Reserve Bank of St. Louis May:170-172.
- [28] Krueger, Alan, and Mikael Lindahl. 2001. Education for Growth: Why and for Whom? *Journal of Economic Literature* 39:4.
- [29] Lee, Kevin, H. Pesaran, and R.P. Smith. 1998. Growth empirics: a panel data approach - a comment. *Quarterly Journal of Economics* 113:319-323.
- [30] Levine, Ross. 2005. Finance and Growth: Theory and Evidence. In *Handbook of Economic Growth*, edited by P. Aghion and S. Durlauf. Amsterdam: North-Holland.
- [31] Mankiw, N. Gregory, David Romer, and David Weil. 1992. A Contribution to the Empirics of Economic Growth. *The Quarterly Journal of Economics*, 107:2.
- [32] Papaioannou, Elias and Gregorios Siourounis. 2008. Democratisation and Growth. *Economic Journal*, 118:1520-1551.
- [33] Pesaran, M. Hashem, and Ron Smith. 1995. Estimating Long-Run Relationships from Dynamic Heterogeneous Panels. *Journal of Econometrics* 68 (1):79-113.
- [34] Phillips, P. and H. R. Moon. 1999. Linear Regression Limit Theory for Nonstationary Panel Data. *Econometrica* 67 (5):1057-1112.
- [35] Sarel, Michael. 1996. Nonlinear Effects of Inflation on Economic Growth. *IMF Staff Papers* 43 (1):199-215.
- [36] Seleteng, Monaheng, Manoel Bittencourt, and René van Eyden. 2013. Non-linearities in inflation–growth nexus in the SADC region: A panel smooth transition regression approach. *Economic Modelling* 30:149-156.
- [37] Sirimaneetham, Vatcharin, and Jonathan R. W. Temple. 2009. Macroeconomic Stability and the Distribution of Growth Rates. *World Bank Economic Review* 23 (3):443-479.

- [38] Smith, Ron, and Ana-Maria Fuertes. 2008. Panel Time-Series. In London: Centre for Microdata Methods and Practice. Institute for Fiscal Studies.
- [39] Wacziarg, Romain, and Karen Welch. 2008. Trade liberalisation and growth: new evidence. *World Bank Economic Review*, 22 (2):187-231.