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Inflation determinants within EAC countries, pp. 21-40

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"Inflation Determinants within EAC Countries"

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1. INTRODUCTION

1. 1. INTRODUCTORY CONSIDERATIONS

The management of inflation at a low stable level is crucial to the macroeconomic convergence and to the wellbeing improvement in each regional grouping, and it, therefore, constitutes an important precondition for successful monetary integration.

The agreed macroeconomic convergence criteria for the EAC for the period from 2007 to 2015 include a primary criterion of an annual average inflation not exceeding 5% and a secondary criterion of achievement and maintenance of stable real exchange rate. Ingram (1969), Haberler (1970), Tower and Willett (1970), and Bayoumi and Ostry (1997), among others, argue that similarity in policy attitude and inflation convergence is an important precondition for a monetary union to succeed.

The re-established and enlarged East African Community (EAC) is an ambitious regional integration initiative that is aimed at a full economic and political integration within the area. It is now composed of 5 countries (Burundi, Kenya, Rwanda, Tanzania and Uganda) and since the 1st of July 2010, the EAC states have embarked on a common market stage.

From there, the EAC States members are working closely to establish a Common Currency within a Monetary Union which is expected to be established by 2012 as scheduled in the EAC Treaty. This is mostly and frequently, if not always, perceived as the most advanced stage in the regional integration process. At this stage, it principally required to have convergence of inflation. Efficient conduct of monetary policy in

a currency union does require amongst other things that partner states have similar business cycles, inflation convergence and strong economic ties (Ssozi John M. M., 2009).

Buigut Steven (2011) argues that macroeconomic convergence of member countries, mainly exhibited in similarity of inflation and interest rates amongst other indicators, is crucial and necessary to ensure a single monetary policy is optimal for all the union members, and to ensure the sustainability of a monetary union over the long run.

The fundamental question that constitutes the problem stating of this research is: how convergent/divergent are the inflationary trends within East African Community countries? Therefore, this paper seeks to respond to the issue of inflationary trends convergence within the EAC region.

1.2. General and specific objectives of the Study

The purpose of this paper is to investigate the convergence trends of inflationary pressures within the East African Community (EAC) as it aspires to become a common currency by 2012.
The specific goals of this research are:

- to estimate and study the main determinants of inflation within EAC region,
- to find out the convergence of recent inflationary trends within the EAC countries.

1.3. Methodology

We employ two approaches for this purpose:

1. First, we use descriptive statistics of the data to analyze the evolution of the most recent inflation trends within the EAC region.
2. Second and finally, we test the relative contribution of the main macroeconomic factors (the economic growth, the money-velocity, the exchanges rates trends, the lending interest rates) in determining the level of inflation within EAC area using panel

data analysis through a comparison of fixed and random effects models.

The methodology steps followed in this study consist of a desk study or literature review, data collection and clearing, econometric modelling and results interpretation.
Data collection is being carried from the EAC Secretariat Publications (EAC Database, EAC Facts and Figures, EAC trade report) UNCTAD CD-ROM, the World Bank Development Indicators CD-ROM, the International and Financial Statistics of IMF, EAC Central Banks Reports and Publications, etc...
The paper is shedding theoretical and empirical light on these matters of fact using advanced econometric analyses. The softwares used are: Word for typing, Excel for spreadsheet and descriptive analyses, and Eviews 6 for the econometric analyses.

2. THEORETICAL BACKGROUND ON INFLATION DETERMINANTS

A lot of models of inflation do exist, and we have classified all of them in three main categories:
a) Pure monetarist theories stating that inflation is always and everywhere a monetary phenomenon (Friedman, 1991). In this sense, causes of inflation are seen to derive from excess monetary growth.
b) Excess demand theories. These theories strengthen on inflation induced by demand pressures in the goods market.
c) Theories based on the transmission mechanism of import prices in foreign currency terms into general domestic inflation and, inflation attributable to exchange rate depreciation.

In other words, the possible explanations of inflation are:

- **Supply or cost-push pressures:** wages, currency depreciation
- **Demand-pull factors:** monetary expansion to finance fiscal deficits, large non-sterilized capital inflows
- **Structural changes or rigidities:** price deregulations, relative price changes

Various authors have used one or another of these theories categories, or a combined version model of these three components of inflation theories.

Using cointegration and error-correction models, Domac I. and Elbirt C. (1998) argue that the roots of Albanian inflation are rather conventional. According to them, the Albanian inflation is positively associated with money growth and exchange rates but it is negatively linked to real income.

Brada and Kutan (1999) working with data on the Czech Republic, Hungary and Poland concluded that import price changes play the most important role in explaining inflation dynamics, while nominal wage growth and money supply are quantitatively unimportant.

Golinelli R. and Orsi R. (2002) analyzed the determinants of the inflation rate in the Czech Republic, Hungary and Poland and they found that the exchange rate is the main long term factor influencing domestic prices, and can be seen to be the common inflation-adjusting mechanism utilized in all three countries.

Nikolic M. (2000) estimated the determinants of Russian inflation in a single equation framework and he concluded that money growth is a core determinant of Russian inflation.

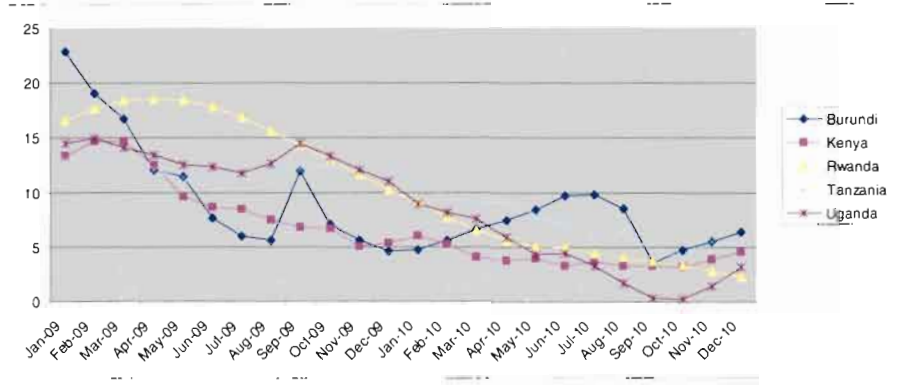
Botrić and Cota (2006) working on Croatian economy found that terms of trade and balance of payments shocks have the strongest impact on prices; Croatia being a small open economy with high import dependency and uncompetitive economic structure.

3. CONVERGENCE OF RECENT INFLATION TRENDS IN EAC

It is known that a strategic management of inflation at a low and stable level is crucial for a monetary union to succeed and it should be regarded at as a pre-requisite for a monetary union to be put in place. In this section, we analyze how successful has been the monetary policy in keeping the inflation rates at lower levels (one digit inflation) within EAC members. Using data on inflation statistics , we

have drawn the attention towards the monthly inflation trends of 2009 and 2009, and we also analyzed the food items weights in the CPI basket for each EAC member in order to assess the contribution of food prices increase in the CPI inflation.

Figure 1 : Monthly inflation rates in EAC for 2009 and 2010



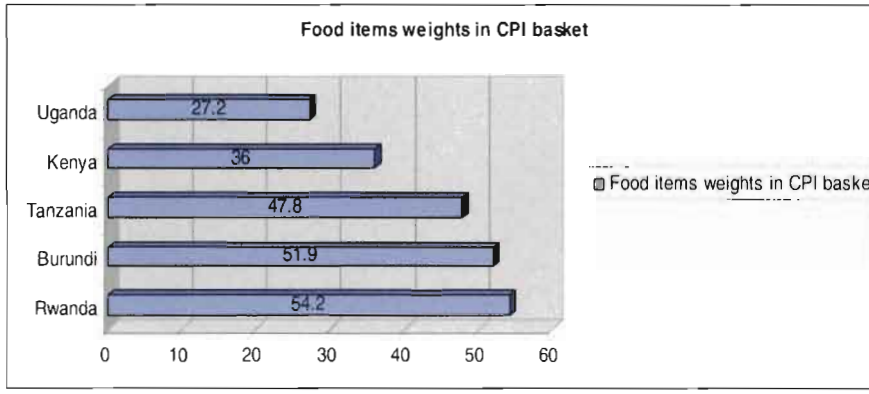
Source : Data compiled from IMF Economic Outlook (2011)

Amongst other factors, the global commodity price spikes of 2008 which drove up food prices as well as fuel prices explain the high inflation rates in the EAC. It interesting to note that in January 2009, all the five EAC members started with a monthly inflation rate of two digits and they all ended the year 2010 with a monthly inflation rate of less than 6.4%. Kenya, Tanzania and Uganda continued to experience a gradual decline in monthly inflation rates since the early beginning of the year 2009 whereas in the last quarter of 2010, they started exhibiting a slight upswing in their monthly inflation rates. At this stage, Rwanda has been the best performer in terms of a sustained, rigorous and continuous decline in inflation rates. Burundi has been the outlier for the EAC region because its headline inflation has been the most unstable and it came up being the highest in the last quarter of 2010, being at 6.3% in December 2010.

The figures supplied by IMF reveal that prices of December 2010 were at their highest level since September 2008. At the world level, a rapidly growing global population (about to reach 8 billions) is demanding ever-increasing amounts of food. And on the supply side, natural disasters, rain shortages, droughts, etc... have caused supply-

side prices spikes with long-lasting effects, and this increase in prices is mainly due to high prices in food. Therefore, countries which have a high food component of their consumption bundle or basket will necessary suffer more from the evolution of the international markets.

Figure 2: Food items weights in CPI basket in EAC for 2010



Source: Data compiled from IMF Economic Outlook (2011)

When we analyze the importance of food items in the consumption price index basket within the EAC region, we find out that any rise in food prices on the international markets or on the regional markets will result in a more generalized inflation. It is worth mentioning that CPI baskets with high weights for food items tend to be likely more responsive to rises in global food prices, and this is suggestive of a causal relationship from global food prices and inflation in the EAC region. The two most recent members and most fragile economies in the EAC, Burundi (51.9%) and Rwanda (54.2%) have the highest relative weight of food items in the CPI basket as it goes beyond 50%. Amongst the three original members and strong economies of EAC (namely, Kenya, Tanzania, Uganda), Uganda has the lowest computed weight of food items in the CPI basket (this is only 27.2%), followed by Kenya (36%) and Tanzania (47.8%).

Global fuel prices have had an important negative effect on the functioning of the economy, and this has translated in transport costs rise and manufacturing costs rise as well. When a rise in oil prices occurs, it may result in both short-run and long-run effects on

inflation. In the short-run, rising fuel prices push up CPI and create an upward spiral in prices and wages. In the long-run, increased oil prices will negatively affect disposable incomes and global economic growth. These second-round effects will necessary result in inflationary pressures.

4. DATA DESCRIPTION AND ESTIMATION RESULTS

The data (all variables in levels) used in this paper are characterized by these following facts:

- Periodicity: annual data
- Sample period: 1990 – 2009.
- Sources: IMF, World Bank, EAC Facts and Figures, Central Banks, National Institutes of Statistics
- 5 Countries of EAC: Burundi, Kenya, Rwanda, Tanzania and Uganda

- INFL? = Inflation rates of Consumer Price Index
- PIB? = Gross Domestic Product (GDP)
- SAVINGS? = Savings amounts, in dollars ($)
- M2? = broad money (M2)
- M2VELOCITY? = M2 – money velocity
- LENDRATES = Lending rates in the banking sector
- EXRATES? = nominal exchange rate (LCU/1USD)

Table 1: Summary statistics of the data used in the regression

	PIB	SAVINGS	M2	INFL	EXRATES	LENDRATES?	M2VELOCITY?
Mean	7.21E+09	-1.47E+09	2.05E+09	12.68574	654.6717	17.93988	4.978354
Median	5.40E+09	2.20E+08	9.12E+08	9.401692	547.3000	17.05000	4.867460
Maximum	3.00E+10	3.82E+09	1.35E+10	48.20000	2030.500	42.83333	13.16383
Minimum	5.95E+08	-2.04E+11	1.41E+08	-2.405932	22.91480	0.000000	2.177726
Std. Dev.	6.76E+09	2.08E+10	2.69E+09	10.63727	558.5093	8.487289	2.056174
Skewness	1.327813	-9.672763	2.259004	1.402383	0.729932	0.153905	1.095067
Kurtosis	4.521666	94.71553	8.644219	4.711258	2.490939	4.325344	5.086929
Jarque-Bera	39.03257	35510.03	217.7900	44.97964	9.959773	7.482275	38.13314
Probability	0.000000	0.000000	0.000000	0.000000	0.006875	0.023727	0.000000
Sum	7.21E+11	-1.43E+11	2.05E+11	1268.574	65467.17	1740.168	497.8354
Sum Sq. Dev.	4.52E+21	4.15E+22	7.18E+20	11202.00	30881330	6915.272	418.5572
Observations	100	97	100	100	100	97	100
Cross sections	5	5	5	5	5	5	5

Source: Author's own computation from collected data

The variables are normally and identically distributed and they also have symmetric distribution across countries and across time.

Table 2: Cointegration tests analysis

Pedroni Residual Cointegration Test					
Series: ***INFL PIB M2VELOCITY EXRATES LENDRATES***					
Date: 09/26/11 Time: 21:18					
Sample: 1990 2010					
Included observations: 21					
Cross-sections included: 5					
Null Hypothesis: No cointegration					
Trend assumption: No deterministic trend					
Lag selection: fixed at 1					
Newey-West bandwidth selection with Bartlett kernel					
Alternative hypothesis: common AR coefs. (within-dimension)					
				Weighted	
		Statistic	***Prob.***	***Statistic***	***Prob.***
Panel PP-Statistic		***-5.081838***	***0.0000***	***-4.756149***	***0.0000***
Panel ADF-Statistic		***-3.093590***	***0.0010***	***-2.822235***	***0.0024***
Alternative hypothesis: individual AR coefs. (between-dimension)					
		Statistic	***Prob.***		
Group PP-Statistic		***-10.78962***	***0.0000***		
Group ADF-Statistic		***-4.567539***	***0.0000***		
Cross section specific results					
Phillips-Peron results (non-parametric)					
Cross ID	AR(1)	Variance	HAC	Bandwidth	Obs
_BU	-0.250	43.24280	4.804783	18.00	19
_KE	0.187	91.44989	69.05458	4.00	19
_RW	-0.057	14.90903	14.44650	2.00	15
_TZ	-0.039	8.313192	3.360321	18.00	19
_UG	-0.540	20.60925	11.78604	5.00	19

Augmented Dickey-Fuller results (parametric)					
Cross ID	AR(1)	Variance	Lag	Max lag	Obs
_BU	-0.852	35.96421	1	--	18
_KE	-0.067	87.88468	1	--	18
_RW	-0.102	12.71989	1	--	13
_TZ	-0.606	5.729895	1	--	18
_UG	-1.017	19.00906	1	--	18

Source: Author's own computation from collected data using Eviews 6

According to these results, we see that the range of data of this flow of variables exhibit a strong cointegration relationship. The results are obtained from a Phillips and Perron test and a Dickey-Fuller Augmented test. These results imply that we can estimate a long-run dynamic model of inflation using these panel-cointegrated variables.

The fixed effects model

A fixed effects model has been run under Eviews 6, and the main results obtained are summarized in the table 3 hereafter produced.

Table 3: Fixed effects model

Dependent Variable: INFL
Method: Pooled Least Squares (Fixed effects model)
Date: 09/27/11 Time: 15:28
Sample (adjusted): 1990 2009
Included observations: 20 after adjustments
Cross-sections included: 5
Total pool (balanced) observations: 100

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	37.37736	8.218122	4.548163	0.0000
PIB	***-5.46E-10***	***2.29E-10***	***-2.388105***	***0.0190***
M2VELOCITY	***-2.062986***	***1.109122***	***-1.860017***	***0.0661***
EXRATES	***-0.016018***	***0.004726***	***-3.388995***	***0.0010***
Fixed Effects (Cross)				
_BU--C	-5.002689			
_KE--C	-8.611713			
_RW--C	-4.694986			
_TZ--C	4.959616			
_UG--C	13.34977			

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.237509	Mean dependent var	12.68574
Adjusted R-squared	0.179493	S.D. dependent var	10.63727
S.E. of regression	9.635432	Akaike info criterion	7.445390
Sum squared resid	8541.422	Schwarz criterion	7.653803
Log likelihood	-364.2695	Hannan-Quinn criter.	7.529738
F-statistic	***4.093882***	Durbin-Watson stat	1.130636
Prob(F-statistic)	***0.000593***		

Source: Author's own computation from collected data using Eviews 6

After many iterations of econometrics estimation, the fixed effects model we use here reveal that the main inflation determinants in the EAC are as follows:

Inflation depends negatively on economic size captured by the gross domestic product (GDP): the higher and stronger the economic activity within the countries, the less will be the inflation rate in this

area. The estimated coefficient (with a negative sign, indicating a negative effect on inflation levels) reveals to be statistically significant individually with only 1.90% of type I error probability. The expected sign is confirmed by the estimated coefficient.

As expected, inflation depends negatively on broad-money velocity: the higher the velocity of broad money within EAC countries, the less will be the inflation rate in this area. This may be seen in the sense that velocity improves with the economic activity boosting. The estimated coefficient (with a negative sign, indicating a negative effect on inflation levels) reveals to be statistically significant individually with only 6.61% of type I error probability. The expected sign is confirmed by the estimated coefficient.

Contrary to the expected sign, inflation depends negatively on exchange rate: the higher the exchange rate (the more depreciated the local currency) in EAC countries, the less will be the inflation rates in this area. This may be understood in the sense that local currency depreciation is not yet so strong to positively impact on inflation rates on one side; and the local production may become more competitive on international markets thanks to depreciation on the other side. The estimated coefficient (with a negative sign, indicating a negative effect on inflation levels) reveals to be statistically significant individually with only 0.10% of type I error probability. The expected sign was not confirmed by the estimated coefficient even though the latter is strongly significant.

Regarding the overall significance, although it is not strongly validated by the r-squared adjusted or not adjusted (less than 50% in both cases), it is supported by the Fisher-test statistic which is significantly in favour of overall significance (with a 0,0593% probability of committing the type I error).

The random effects model

A random effects model has been run under Eviews 6, and the main results obtained are exhibited in the table 4 hereafter summarized.

Table 4: Random effects model

Dependent Variable: INFL?
Method: Pooled EGLS (Cross-section random effects)
Date: 09/27/11 Time: 15:25
Sample (adjusted): 1990 2009
Included observations: 20 after adjustments
Cross-sections included: 5
Total pool (balanced) observations: 100
Wansbeek and Kapteyn estimator of component variances

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	29.66192	7.311654	4.056800	0.0001
PIB	***-5.51E-10***	***2.18E-10***	***-2.523334***	***0.0133***
M2VELOCITY	***-1.100072***	***0.883069***	***-1.245738***	***0.2159***
EXRATES	***-0.011502***	***0.003566***	***-3.225628***	***0.0017***
Random Effects (Cross)				
_BU--C	-4.149336			
_KE--C	-3.413335			
_RW--C	-4.300791			
_TZ--C	4.523720			
_UG--C	7.339742			

Effects Specification	S.D.	Rho
Cross-section random	7.769274	0.3940
Idiosyncratic random	9.635432	0.6060

Weighted Statistics			
R-squared	0.189188	Mean dependent var	3.390026
Adjusted R-squared	0.163850	S.D. dependent var	10.49111
S.E. of regression	9.593202	Sum squared resid	8834.835
F-statistic	***7.466596***	Durbin-Watson stat	1.100792
Prob(F-statistic)	***0.000152***		

Unweighted Statistics			
R-squared	-0.022677	Mean dependent var	12.68574
Sum squared resid	11456.03	Durbin-Watson stat	0.848925

Source: Author's own computation from collected data using Eviews 6

When considering random effects modelling, after many iterations of econometrics estimation, the results show up that inflation trends in the EAC mainly depend:

Inflation depends negatively on economic size captured by the gross domestic product (GDP): the higher and stronger the economic activity within the countries, the less will be the inflation rate in this area. The estimated coefficient (with a negative sign, indicating a negative effect on inflation levels) reveals to be statistically significant individually with only 1.33% of type I error probability. The expected sign is confirmed by the estimated coefficient.

As expected, when velocity of money increases, meaning the economic activity growth has also improved, inflation rates will tend to decrease. Therefore, inflation is negatively correlated with money-velocity. In our results, inflation depends negatively on broad-money velocity: the higher the velocity of broad money within EAC countries, the less will be the inflation rate in this area. The estimated coefficient (with a negative sign, indicating a negative effect on inflation levels) reveals to be statistically not significant individually with about 21.59% of type I error probability. The expected sign is confirmed by the estimated coefficient although not significant.

Contrary to the expected sign, inflation depends negatively on exchange rate: the higher the exchange rate (the more depreciated the local currency) in EAC countries, the less will be the inflation rates in this area. The estimated coefficient (with a negative sign, indicating a negative effect on inflation levels) reveals to be statistically significant individually with only 0.17% of type I error probability. The expected sign was not confirmed by the estimated coefficient although strongly significant.

The overall significance is supported by the Fisher-test statistic which is significantly in favour of overall significance (with a 0,0152% probability of committing the type I error).

Fixed versus Random Effects: the Hausman Test Application

When we consider discriminating between random and fixed effects, we apply the well-known Hausman test as configured in the Eviews 6 software. The results are in favour of fixed effects modelling rather than random effects model. As the computed probability of committing type I error (0,80%) is lesser than any usual level (1%, 5% or 10%).

Table 5: Results of Hausman Test: Random against Fixed effects
Correlated Random Effects - Hausman Test
Pool: POOLEACINFLATIONDET
Test cross-section random effects

Test Summary	*Chi-Sq. Statistic*	*Chi-Sq. d.f.*	*Prob.*
Cross-section random	***11.840448***	***3***	***0.0080***

Cross-section random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
PIB	-0.000000	-0.000000	0.000000	0.1276
M2VELOCITY	-2.062986	-0.121320	0.919558	0.0429
EXRATES	-0.016018	-0.006204	0.000019	0.0238

Cross-section random effects test equation:
Dependent Variable: INFL
Method: Panel Least Squares
Date: 09/27/11 Time: 15:30
Sample (adjusted): 1990 2009
Included observations: 20 after adjustments
Cross-sections included: 5
Total pool (balanced) observations: 100

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	37.37736	8.218122	4.548163	0.0000
PIB	-5.46E-10	2.29E-10	-2.388105	0.0190
M2VELOCITY	-2.062986	1.109122	-1.860017	0.0661
EXRATES	-0.016018	0.004726	-3.388995	0.0010

Effects Specification			
Cross-section fixed (dummy variables)			
R-squared	0.237509	Mean dependent var	12.68574
Adjusted R-squared	0.179493	S.D. dependent var	10.63727
S.E. of regression	9.635432	Akaike info criterion	7.445390
Sum squared resid	8541.422	Schwarz criterion	7.653803
Log likelihood	-364.2695	Hannan-Quinn criter.	7.529738
F-statistic	4.093882	Durbin-Watson stat	1.130636
Prob(F-statistic)	0.000593		

Source: Author's own computation from collected data using Eviews 6

In conclusion, we consider that within the EAC member countries, inflation determinants are mainly the economic size measured by the GDP (with expected negative sign), the money-velocity for broad money (with expected negative sign) and the exchange rate (with unexpected negative sign). Moreover, the fixed effects are proven (through the Hausman test) to be the best and most robust estimators for modelling EAC inflation determinants.

5. CONCLUDING REMARKS

EAC countries have been performing some good records in inflation management as they started in 2009 with a two-digit inflation rate and end up with a one-digit inflation rate by the end of 2010. The most important factors in driving inflation are the relative price adjustments (from food prices, from oil prices, etc...) and the high volatility of inflation. At this regard, Rwanda has been the most improving economy in EAC. And Burundi is the most unstable and less improving economy.

We have concluded that EAC inflation determinants are mainly:

- the economic size measured by the GDP (with negative effects), the more we produce in EAC, the less the inflation rates;
- the money-velocity for broad money (with negative effects also),
- the exchange rate (with negative sign). The significant and negative coefficient on the variable of the nominal exchange rate implies that the appreciation of the local currency in this 1990-2009 period has contributed to reducing inflation.

Policy implications and recommendation which I have drawn from these analyses can be summarized in the following formulations:

- The EAC members should mainly concentrate on production diversification and oil prices shocks mitigation;
- Inflation targeting policies should be considered more seriously in EAC countries;
- Economic growth and wealth creation should be set as priorities of the integration process as their proxies' variable revealed to be strong and statistically significant.

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