



NATIONAL BANK OF RWANDA

ECONOMIC REVIEW

N° 005

May 2012

NATIONAL BANK OF RWANDA



FOREWORD

In this fifth edition of National Bank of Rwanda's Economic Review are published two papers as well as the monetary policy and financial stability statement by the Governor which is essentially a mid-term review of the implementation of the monetary and financial sector development program of the year 2011, presented on 9th February 2012.

The two papers analyze the fundamentals of the National Bank of Rwanda's monetary policy framework namely the stability of money multiplier and Inflation modelling in Rwanda.

The National Bank of Rwanda assumes no responsibility for the views expressed by the authors of the two papers. Reprinting of any figures or statements contained herein is permitted on condition that proper citation and/or referencing is given to the National Bank of Rwanda's Economic Review.

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MONETARY POLICY AND FINANCIAL STABILITY STATEMENT, FEBRUARY 2012

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Governor of National Bank of Rwanda

ASSESING THE STABILITY OF MONEY MULTIPLIER IN RWANDA

Dr. Thomas Kigabo RUSUHUZWA and Mrs. Joy Irankunda

MODELLING INFLATION IN RWANDA

Mr. Gichondo Mukiza Ananias and Mr. Kimenyi Valens

MONETARY POLICY AND FINANCIAL STABILITY STATEMENT

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EXECUTIVE SUMMARY

In 2011, Rwanda's economy evolved in a challenging international and regional economic environment. The world economy was marked by high oil and food prices, a sovereign debt crisis in the Euro zone and a debt ceiling crisis in the USA, while in the East Africa sub-region, inflationary pressures have been increasing at a very high pace, never recorded in the last decade.

In the EAC region, inflation continued to rise in 2011 mainly owing to the increase in oil and food prices. In December 2011, on annual basis, inflation hit 27.0 percent in Uganda, 18.9 percent in Kenya from respectively 3.1 percent and 4.5 percent in December 2010. During the same period, headline inflation reached 19.8 percent in Tanzania and 14.9 percent in Burundi from 5.6 percent and 4.9 percent in December 2010 respectively.

Similarly, inflation in Rwanda has been increasing as well but maintained at moderate levels. The annual headline inflation reached 8.3 percent in December 2011 from 0.23 percent in December 2010. Moderate inflation has been achieved due mainly to good harvest that kept domestic food markets stable, a relatively stable exchange rate, as well as well coordinated Government policies to mitigate the exogenous inflationary pressures.

Despite the challenging international and regional economic environment, Rwanda managed to sustain dynamic economic activities in 2011, recording high performance in all sectors. Real GDP growth is estimated at 8.8 percent higher than 7.0 percent initially projected and 7.5 percent achieved in 2010. This growth was driven by agriculture sector (+8.2 percent) reflecting the impact of ongoing Government reforms and favorable climatic conditions. It was also pushed by the industry sector (+15.1 percent) and services sector (+8.5 percent) both boosted by significant improvement in credit market conditions.

The dynamism in the Rwandan economic activities was also marked by a strong improvement in the external sector. The export sector in 2011 continued to perform better, sustained by traditional exports; where formal exports of goods covered 23.8 percent of imports in 2011, from 18.3 percent in the previous year, as a result of more rapid increase in exports. Indeed, exports value increased by 52.8 percent against 17.3 percent for imports.

Rwanda has ended the year 2011 with a positive balance of payments, estimated at USD 120.13 million, continuing the trend observed during the past years. Positive balance of payments resulted from a significant increase in official and private capital inflows which counterbalanced the significant structural current account deficit.

Regarding the developments in the monetary Sector, broad money supply recorded an annual increase of 26.7 percent by end 2011, driven mainly by the credit to the private sector (+28.4 percent). The increase in monetary aggregates has been significantly higher than initially projected, in line with the increase in money demand associated to higher-than-projected economic growth.

Regarding the perspectives in 2012, the BNR monetary and exchange rate policy will remain prudent enough to continue limiting the impact of likely persistent regional inflationary pressures. By end 2012, the monetary program projects a Reserve Money increase of 17 percent, in line with nominal GDP growth and allowing for some moderate increase in the monetization of the economy. The real GDP is projected to increase by 7.6 percent while end 2012 headline inflation is projected at 7.5 percent.

The exchange rate is expected to remain market driven, while the BNR will continue to intervene on forex market only to smoothen the exchange rate volatility.

Financial sector stability has been sound and stable in 2011. The banking sector demonstrated positive stance with an increase in the balance sheet of 24.5 percent. The sector has been profitable, liquid and well capitalized to sustain growth but also resilient to external shocks as a result of strengthened legal, regulatory and supervisory framework. For instance, the Capital Adequacy Ratio (CAR) increased to 27.2 percent in 2011 from 24.4 percent 2010. This is well above the minimum required Capital Adequacy ratio of 15%, which shows the stability of the financial sector.

The microfinance sector recorded a positive performance with the continued expansion of its balance sheet, realizing 12.1 percent annual growth. The introduction of UMURENGE SACCOs enhanced the growth of this sector. In the year under review, UMURENGE SACCOs contributed 37.6 percent of the sector's total assets. Additionally, the SACCOs played a significant role in expanding financial inclusion. By end December 2011, UMURENGE SACCOs registered deposits and gross loans amounting to RWF 22.5 billion and RWF 4.7 billion respectively.

During the year under review, the insurance sector performance improved progressively. The total assets of the Rwandan insurance sector as at December 31, 2011, increased by 12.1%, reaching RWF 143.7 billion compared to RWF 128.21 billion as at December 31, 2010. The Gross premiums also increased, as well as the net profit, due to a better performance of the Rwandan economy. The liquidity position of the insurers is also satisfactory. This good performance is a reflection of the impact of the supervisory reforms undertaken in the last three years. Major developments are related to prudent underwritings, investments and improved professionalism.

The pension sector assets (excluding private pension schemes) continued to grow with a positive trend reaching RWF 189.39 billion in 2011 from RWF 166.78 billion in 2010; indicating an increase of 14 percent on annual basis. Positive prospects are expected after the enactment of the new pension law that will give rise to the establishment of private pension schemes.

Briefly, financial sector as a whole was stable; a factor that was also confirmed by the Financial Sector Assessment program (FSAP) conducted by both the IMF and World Bank experts in the first quarter 2011. Going forward, the BNR is committed to continue fostering competition, efficiency and growth of the financial sector. In addition, ensuring that cost effective services are provided, and promoting financial inclusion as a critical success factor to poverty reduction, are two important items on the BNR agenda.

I. OVERVIEW OF ECONOMIC ENVIRONMENT IN 2011

I.1 GLOBAL ECONOMY

I.1.1 Economic growth and outlook

After an increase of 5.2 percent in 2010, the global economic activity decelerated to 3.8 percent in 2011 and is expected to further decelerate to 3.3 percent in 2012 due to the mixed adverse developments across countries including Tsunami and earthquake in Japan, renewed concerns about the debt crisis in Europe and USA and political unrest in the Arab countries whose effects dampened oil supply.

According to the IMF, real GDP growth in developed countries was estimated at 1.6 percent in 2011 and 1.2 percent in 2012 after 3.2 percent increase in 2010. In the USA, it fell to 1.8 percent in 2011 on the lessening of the policy stimulus effect and is expected to remain unchanged at 1.8 percent in 2012 after 3.0 percent in 2010. In the Euro Area, real GDP growth decelerated to 1.6 percent in 2011 against 1.9 percent in 2010. In 2012, the Euro Area economic growth is expected to slide to -0.5 percent as some countries took rigorous fiscal consolidation and austerity measures. In Japan, the economy declined by 0.9 percent in 2011 after 4.4 percent in 2010 due to a sharp appreciation of the yen and following the earthquake. The Japanese economy is expected to recover by 1.7 percent in 2012 helped by the recovery in both output and domestic spending, and on improvement in business confidence.

In the emerging and developing economies, real GDP growth is estimated at 6.2 percent in 2011 after 7.3 percent recorded in 2010, while projected to slow down to 5.4 percent in 2012. This slowdown is due to capacity constraints, policy tightening and slowing foreign and domestic demand. In developing Asia, economic activity remained solid. China's real GDP growth is estimated at 9.2 percent in 2011 against 10.4 percent in 2010 and projected to decelerate to 8.2 percent in 2012 as a result of a tightened monetary policy and the low contribution from exports.

For the African continent, economic growth is estimated at 5 percent in 2011 up from 4.7 percent recorded in 2010.

Furthermore, in line with this trend, economic growth in Sub-Saharan Africa is estimated at 4.9 percent in 2011 from 5.3 percent in 2010. However, in 2012, economic growth is projected to rebound at 5.5 percent on account of economic activities supported by favorable prices of export commodities, large scale infrastructure development, improvement in services and industries, good performance of agriculture and improved economic policies.

I.1.2 INFLATION

The world inflation increased from 2.6 percent in 2010 to 3.5 percent in 2011 due to low economic recovery. In 2011, it stood at 2.7 percent in advanced economies and at 7.2 percent in emerging and developing countries after 1.6 percent and 6.1 percent respectively in 2010. In 2012, inflation is projected to draw back to 1.6 percent in developed economies and to 6.2 percent in emerging and developing countries. Headline inflation reached 3.0 percent and 2.7 percent respectively in the USA and the EURO area from 1.6 percent in both economies in 2010. Inflationary pressures have been more pronounced in emerging economies on accommodative monetary policy and associated to high economic recovery.

In the EAC countries, inflation continued to rise throughout 2011 caused by high oil and food prices and the drought in the horn of Africa. In December 2011, annual headline inflation stood at 27.0 percent in Uganda, 19.8 percent in Tanzania, 18.9 percent in Kenya, 14.9 percent in Burundi and 8.3 percent in Rwanda from respectively 3.1 percent, 5.6 percent, 4.5 percent, 4.9 percent and 0.2 percent in December 2010.

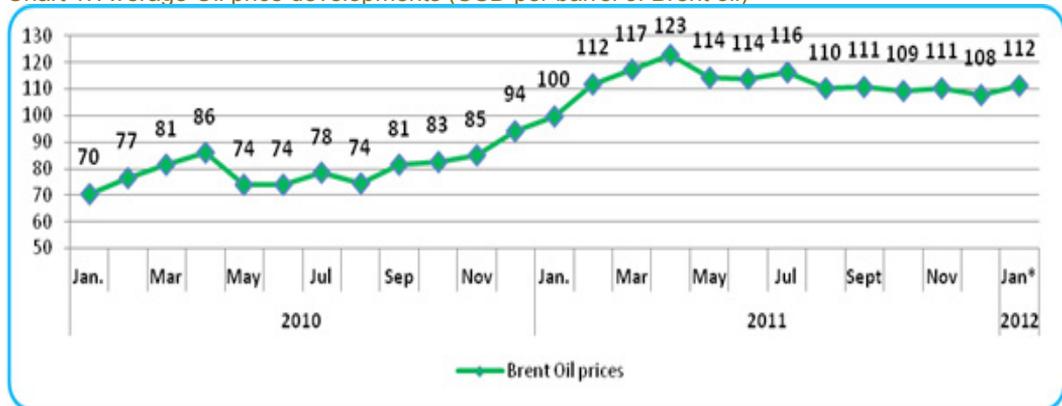
Table 1: Annual inflation in EAC countries in percent

	2010	2011				
	Dec.	Mar.	Jun.	Sept.	Nov.	Dec.
Uganda	3.1	11.1	15.8	28.3	29.0	27.0
Kenya	4.5	9.2	14.5	17.3	19.7	18.9
Tanzania	5.6	8.0	10.9	16.8	19.2	19.8
Burundi	4.9	5.7	8.6	11.7	16.4	14.9
Rwanda	0.2	4.1	5.8	6.6	7.4	8.3

Source: Central Banks' websites

With regard to commodity prices, in 2011 oil prices continued their strong rebound during the first half of the year due to the unrest in oil-producing countries but also following the high demand in emerging economies. According to IMF estimates in January 2012, crude oil average price rose by 31.9% to USD 104.23 in 2011 after 27.9 percent increase in the previous year. In the medium term, oil prices are expected to slow down with futures contracts for December 2013 trading at USD 103.6 per barrel (ECB Bulletin, January 2012).

Chart 1: Average Oil price developments (USD per barrel of Brent oil)



Source: BNR, Monetary Policy and Economic Analysis Department

During the last quarter of 2011, non-energy prices recorded strong declines on improved supply conditions but also commodity prices were affected by concerns about the debt crisis and their impact on the global demand. In aggregate terms, the price index for non-energy commodities denominated in US dollars was 14.8 percent lower at the end December 2011 than at the beginning of the year (ECB bulletin, January 2012).

However, in terms of annual average, prices for non-energy primary commodities increased by 17.7 percent in 2011 compared to 26.3 percent recorded in 2010. In this regard, Coffee prices on international market rose by 38.3 percent on average while tea prices (Mombasa Auction) gained 6.2 percent.

1.1.3 Financial Markets

Financial markets in developed countries have been in turmoil following the debt crisis in USA and Europe. As one of the serious consequences of this crisis, after the downgrading of the USA credit rating in August 2011 from AAA to AA+ over Congress' handling of the federal debt, Standard & Poor's revised down France's credit rating from AAA to AA and lowered eight other euro zone countries' credit ratings. Further still, on Friday January 13, 2012, Fitch downgraded the sovereign

credit ratings of Belgium, Cyprus, Italy, Slovenia and Spain, indicating that there was a 50 percent chance of further cuts in the next two years on concerns about worsening European economic outlook. Therefore, these countries will have to cut their spending, their deficits and improve their competitiveness to ensure the return to growth. In addition, the European Financial Stability Fund (EFSF) was downgraded from AAA to AA+. This indicates that the continent's debt crisis would take time to be resolved since the policy packages that have been set by European policymakers are found insufficient to fully address ongoing financial concerns in the Euro zone

With regard to interest rates developments in 2011, money market interest rates remained low to give a boost to the economic activity. Central banks' policy rate remained unchanged or slightly fluctuating in most of developed countries. It varied between 0 and 0.25 percent in the USA and around 0.1 percent and 0.5 percent respectively in Japan and UK while in the Euro Area the ECB rate was revised four times in 2011. From 1.0 percent it went up to 1.25 percent in April, 1.50 percent in July, came back to 1.25 percent in November, before it was finally revised to 1.0 percent in December, 2011.

Three months deposit rates have been increasing standing at 0.58 percent after 0.30 percent in the USA, 1.36 percent after 1.01 percent in the Euro Area, 0.20 percent after 0.19 percent in Japan respectively in 2011 and 2010. Ten year government bond rates were lower in all the three developed economic zones reflecting both the concerns about the sovereign debt crisis and the uncertainty about the global economic outlook. They stood at 1.88 percent after 3.30 percent in the USA, 1.83 percent after 2.96 percent in the Euro Area and 0.99 percent against 1.13 percent in Japan respectively in 2011 and 2010.

As regards the exchange rates in 2011, the US dollar extended its appreciation against the Euro by 3.0 percent after 6.3 percent and the GBP by 0.6 percent after 3.7 percent while it strongly depreciated against the Yen by 8.1 percent after 18.5 percent in 2011 and 2010 respectively. The main drivers were changes in the perception of the sustainability of public finances in some countries of the Euro zone and in the United States as well as the movements in the yield differentials between the two economies. The Japanese Yen was regarded as a "safe haven" currency amid market volatility.

1.2 NATIONAL ECONOMIC PERFORMANCE

1.2.1 Economic growth

Rwanda's economy continued to demonstrate resilience to regional and global shocks due to the country's stable macroeconomic framework resulting from important economic reforms and more coordinated macroeconomic policy management.

In 2011, the Rwanda's economy is estimated to grow by 8.8 percent which is higher than 7.0 percent initially projected and 7.5 percent achieved in 2010. This growth is significantly higher than the expected average growth of 5.2 percent for Sub-Saharan countries. This high growth was driven by good performance in all economic sectors in which agriculture grew by (+8.2 percent), significant recovery in the services by (7.2 percent) and industry sector growth by (15 percent).

Table 2: Real GDP Growth, in percentage

	2006	2007	2008	2009	2010	2011 est.
GDP	9.2	7.7	11.5	6.1	7.5	8.8
Agriculture	2.8	2.7	6.4	7.7	4.9	8.2
Food Crop	1.4	4.0	6.2	9.4	4.9	9.0
Industry	11.7	9.1	15.1	1.4	8.4	15.0
Mining	-13.8	42.8	-15.7	-17.9	-10.8	15.5
Manufacturing	13.4	0.8	5.6	3.0	9.3	6.8
Construction	13.1	15.0	28.2	1.4	8.8	22.3
Services	13.3	12.3	14.7	5.9	9.6	7.2
Wholesale and Retail	18.2	14.8	19.4	4.0	8.4	4.9
Transport & Communi- cation	22.5	15.0	23.8	9.2	8.7	5.6
Finance	9.5	11.6	1.8	-4.1	23.6	10.3
Activities non elsewhere classified	7.8	4.5	12.0	9.4	5.1	10.3

Source: MINECOFIN, Macroeconomic Policy Unit

a. Agriculture sector

The good performance recorded in agriculture over the past three years has been sustained during the year 2011 as a result of ongoing investments under the crop intensification program (CIP). The programme has focused on facilitating access to fertilizers and selected seeds, land use consolidation and increase in irrigation.

Harvests for 2011 seasons A and B performed better (10.4 percent) than the harvest recorded in the same seasons of the previous year (9.5 percent). The production of tradable coffee decreased by 7.5 percent in 2011 from 19.32 to 17.87 thousand tons, mainly due to the low production of green coffee during the first semester 2011 compared to the first semester 2010. Tea production increased by 10.2 percent, from 19.89 thousand tons in 2010 to 21.90 thousand tons in 2011.

b. Non-agriculture activities

Concerning non agricultural activities, both industry and services recorded significant improvement in 2011 compared to the previous year. The industry sector's value addition grew by 15.0 percent led by construction (+22.3 percent), mining (+15.5 percent) and manufacturing industries (+6.8 percent). The construction sector was boosted by major infrastructure projects, as well as commercial, administrative and residential buildings. The performance in manufacturing industry was driven by beverages and tobacco (+14.0 percent) and food processing (+4.9 percent). The strong performance recorded by the mining sector is mainly stimulated by higher prices for minerals on international markets.

In the services sector, business climate significantly improved particularly in finance and insurance sector which have recorded the highest increase (10.3 percent) followed by transport and communication (5.6 percent) and the wholesale and retail trade (4.9 percent).

I.2.2 External sector

a. External trade

With regard to formal external trade in 2011, exports value increased by 52.8 percent compared to 2010, while its volume rose by 48.4 percent. Imports value rose by 17.3 percent while its volume increased by 12.1 percent. Exports covered 23.8 percent of imports from 18.3 percent in 2010 as a result of a more rapid increase in exports. This coverage becomes 27.4 percent when including cross border trade and is estimated at 43.0 percent when services are included.

Exports

In 2011, driven by minerals and export crops, Rwandan exports recorded strong performances increasing both in value and volume by 52.8 percent and 48.4 percent respectively between 2010 and 2011. However, exports in Rwanda are still less diversified and dominated by traditional export products such as coffee, tea and minerals, which represented 74.8 percent of total export earnings in 2011. The value of major mineral exports was USD 151.4 million representing 39.1 percent of total export earnings, while coffee and tea amounted to USD 138.5 million, representing 35.7 percent.

Coffee exports performed poorly, falling by 14.5 percent in volume. However, due to a significant increase of 55.5 percent in prices following higher demand as production in some countries declined, the coffee exports value increased by 33 percent amounting to USD 74.6 million in 2011 from USD 56.1 million realized the previous year. Tea exports have continued to perform well as both the value and volume increased by 10.2 percent and 14.2 percent respectively.

Table 3: Export developments (Value in million of USD, Volume in thousands of tons)

	2009		2010		2011		% change	
	Volume	Value	Volume	Value	Volume	Value	Volume	Value
EXPORTS	103.1	191.0	113.1	253.7	167.8	387.7	48.4	52.8
Coffee	15.0	37.3	18.2	56.1	15.6	74.6	-14.5	33.0
Tea	18.7	48.2	21.5	55.7	23.7	63.9	10.2	14.7
Tin	4.3	28.6	3.9	42.2	7.0	96.8	79.4	129.4
Coltan	0.9	20.2	0.7	18.5	0.9	38.6	18.9	108.8
Wolfram	0.9	5.8	0.8	7.1	1.0	16.0	19.3	125.7
Hides and Skins	1.8	2.0	3.7	3.7	6.2	7.6	66.7	103.4
Pyrethrum	0.0	0.6	0.0	1.4	0.0	4.5	196.7	220.9
Re-exports	4.1	20.6	7.4	35.9	20.4	37.3	174.0	3.8
Other export products	57.5	27.7	56.7	33.0	93.1	48.4	64.2	46.4

Source: BNR, Statistics Department

The exports in the mining sector have recorded a significant improvement in 2011 compared to the previous year mainly driven by the overall increase in international prices of the major minerals exported by Rwanda, namely tin, coltan and wolfram.

Their total value and volume increased by 123.4 percent and 61.9 percent respectively. The prices of all minerals have significantly increased, by 89.2 percent for wolfram, 75.6 percent for coltan and 27.8 percent for tin.

Re-export products slightly rose by 3.8 percent in value while increasing highly by 174.0 percent in volume, on account of petroleum products which represented 84 percent of total volume of re-exports in 2011. Their volume increased more than 5 times in 2011 compared to 2010. However, this strong increase was not reflected in total value as the impact of petroleum products was offset by a fall in other re-exported products, especially minerals. Indeed, Rwanda re-exports include mainly tin, coltan, wolfram, other minerals, petroleum products, machines and engines, vehicles and others.

Other export products composed among others by live animals, vegetables, fruits, cereals, milling products and beverages increased by 46.4 percent in value and 64.2 percent in volume.

Table 4: Export shares by destination in percent of volume

	2006	2007	2008	2009	2010	2011
EUROPE	47.3	26.0	24.4	19.0	20.0	13.5
EAC	42.1	51.9	52.4	58.8	56.0	54.4
OTHER AFRICA COUNTRIES	2.4	15.2	18.3	18.3	18.9	26.1
ASIA	5.9	5.1	4.5	3.2	3.6	2.9
AMERICA	2.3	1.7	0.3	0.7	1.5	0.9
OCEANIA	0.0	0.0	0.0	0.0	0.0	0.1
TOTAL	100	100	100	100	100	100

Source: BNR, Statistics Department

Regarding the geographic destination of exports, in recent years, Rwanda has experienced more diversification in terms of its export destination, with the share to Europe declining. The share of exports to Europe has decreased from 47.3 percent of total exported volume in 2006 to 13.5 percent in 2011. In the same period, the share of exports to EAC countries increased from 42.1 percent to 54.4 percent while the share of exports to other African countries increased from 2.4 percent to 26.1 percent. The shares of exports to Asia and America decreased from 5.9 percent and 2.3 percent to 2.9 percent and 0.86 percent respectively. However, these numbers have to be treated with caution.

Indeed, the final destinations of tea exported to EAC (representing over 60 percent of the total value exports to EAC countries) are Europe (UK), Asia (Pakistan, Afghanistan, Yemen and Saud Arabia) and African countries (Egypt and Sudan).

Imports

Dominated by intermediary goods representing 46 percent of the total volume of imports, followed by consumer goods (34 percent), Energy and Lubricants (16.5 percent) and capital goods (4 percent), imports of goods increased both in value and volume respectively by 17.3 percent and 12.1 percent in 2011. The significant increase in volume of intermediary reflects good performance in industry and services sectors.

In 2011, importation of intermediary goods increased by 23.1 percent in value, while their volume rose by 26.5 percent. This performance is attributed to construction materials which rose by 15.5 percent in value and by 24.2 percent in volume. The main products are cement and other similar products as well as metallic construction materials which respectively increased by 22.0 percent and 28.6 percent in value. The imported cement represented 75 percent of domestic consumption, showing the existing gap between the local demand for cement and the domestic production capacity. For the industrial products, their value rose by 41.1 percent while their volume increased by 38.0 percent.

Dominated by machines, devices and tools, capital goods account for 24 percent of the total value imports, and rose by 9.8 percent and 17.3 percent in value and volume respectively. Transport materials show an increase both in value and volume with growth rates of 39.7 percent and 69.9 percent respectively, while machines, devices and tools declined by 5.5 percent in value, and by 0.8 percent in volume.

Table 5: Imports Developments (Value CIF in million of USD, Volume in thousands of tons)

	2009		2010		2011		Percent change	
	volume	Value	Volume	Value	Volume	Value	Volume	Value
TOTAL IMPORTS	1010.4	1246.9	1188.88	1389.36	1333.19	1629.7	12.1	17.3
Consumer goods	359.3	364.0	468.5	439.01	453.1	478.0	-3.3	8.9
Capital goods	53.1	372.4	43.08	357.56	50.5	392.4	17.3	9.7
Intermediary goods	408.7	332.5	481.6	381.96	609.1	470.2	26.5	23.1
Energy and lubricants	189.3	178.0	195.7	210.83	220.49	289.1	12.7	37.1

Source: BNR, Statistics Department

Consumer goods dominated by food and health care products (pharmaceutical and perfumes) increased by 8.9 percent in value while the volume declined by 3.3 percent. This decline in volume is attributed to foods products which declined by 8 percent due partly to good performance in domestic food production. Imports of energy and lubricants of which about 96 percent is fuel, rose by 12.7 percent in volume while their value increased by 37.1 percent mainly due to the high cost of petroleum products.

b. Trade with EAC countries

Rwanda's total trade with EAC partner states has significantly expanded in both exports and imports. Since 2006 the total trade value with EAC recorded more than a double increase from USD 278.2 in 2010 to USD 755.5 million in 2011, mainly driven by imports.

Table 6: Trade flow of Rwanda within EAC bloc (USD million)

	2006	2007	2008	2009	2010	2011
Exports to EAC	36.51	45.03	46.25	47.34	54.16	80.70
Imports from EAC	241.73	316.17	461.10	449.65	513.35	674.65
Trade balance	-205.22	-271.14	-414.85	-402.31	-459.19	-593.95

Source: BNR, Statistics Department

c. Informal Cross-border trade

With regard to the informal cross-border trade which is becoming quite significant in the Rwandan external trade, total exports in 2011 amounted to USD 71.51 million from USD 51.7 million in 2010 and account for about 18 percent of formal exports. Informal imports rose by 14.24 percent from USD 20.57 to USD 23.50 million, leading to improvement in Rwanda's positive trade balance with neighboring countries. Informal cross border exports and imports are dominated by crop products and live animals and the main trading partners are DRC and Uganda. More than 78% of these exports are destined to DRC.

Table 7: Rwanda informal cross border trade (in USD millions)

	2010					2011				
	Q1	Q2	Q3	Q4	Total	Q1	Q2	Q3	Q4	Total
Exports	12.56	12.10	12.43	14.64	51.74	13.51	17.46	17.46	21	69.43
Imports	4.70	4.80	5.61	5.47	20.57	4.41	8.09	8.09	5.13	25.72
Trade balance	7.86	7.29	6.83	9.18	31.16	9.10	9.37	9.37	15.87	43.71

Source: BNR, Statistics Department

d. Overall Balance of Payments:

Continuing the trend observed in previous years, Rwanda has ended 2011 with a positive balance of payments standing at USD 120.13 million from 72.01 million in 2010, leading to a buildup of official reserves at the BNR. This comfortable external position resulted from a significant increase of official and private capital inflows which continued to offset the structural current account deficit mainly coming from a huge trade deficit, estimated at USD 1194.3 million.

Table 8: Net Current Transfers (in USD millions)

	2007	2008	2009	2010	2011 est.	Change (%)
Current transfers (net)	461.32	518.57	604.02	657.36	880.57	34.0
Current private transfers (net)	98.82	72.61	79.71	90.68	133.31	47.0
Remittances from Diaspora	69.48	31.07	53.09	65.07	110.17	69.3
Private transfers for churches and associations	29.34	41.54	26.62	25.61	23.14	-9.6
Current officials transfers (net)	362.5	445.96	524.31	566.68	747.25	31.9
Current support net	259.27	339.76	415.84	479.52	628.39	31.0
Humanitarian aid	107.11	110.32	115.84	100.52	107.03	6.5
Social security benefits	-	-	-	-	22.19	
Contribution to internat.organ	-3.88	-4.12	-7.36	-13.36	-10.36	-22.5

Source: BNR, Statistics Department

With regard to capital and financial accounts balance, it increased in 2011 compared to 2010, mainly attributed to high public external debt disbursement, increasing from USD 61.71 million to USD 138.9 million, and to FDI and portfolio inflows increasing from USD 63.71 million to USD 137.50 million. By end 2011, official reserves are estimated at 7.7 months of goods imports from 7.0 months of goods imports in 2010.

Table 9: Estimate BOP 2011 summary (in USD millions)

	2007	2008	2009	2010	2011 Est.
Trade balance	-404.4	-613.1	-762.1	-786.7	-1101.2
Services and income (net)	-140.4	-135.7	-214.5	-292.1	-242.54
Current account balance	-83.45	-230.2	-372.5	-421.4	-463.15
Capital and Financial account balance	196.7	316.1	433.55	499.36	682.5
Overall balance	110.6	58.01	57.05	72.07	234.54

Source: BNR, Statistics Department

II. MONETARY SECTOR DEVELOPMENTS IN 2011

II.1 INFLATION

Inflation in Rwanda has been increasing over the year 2011 but was maintained at moderate levels despite global and regional high inflationary pressures. In December 2011, headline inflation reached 8.3 percent on annual basis, from 6.6 percent in September, 5.8 percent in June and 4.1 percent in March. In terms of annual average, it has increased to 5.6 percent in December 2011 from 2.3 percent in December 2010. Inflation has been contained at moderate levels mainly due to the improved food production, efficient management of the monetary policy, a stable exchange rate which limited the pass-through of imported inflation to domestic market and a good coordination of fiscal and monetary policies.

Table 10: Inflation by origin and category (percentage change in CPI, base 2009:100)

	Weights	2010	2011			
		Dec.	Mar.	Jun.	Sept.	Dec.
Annual average headline inflation	10 000	2.3	2.2	2.5	3.7	5.6
Overall inflation, year on year	10 000	0.2	4.1	5.8	6.6	8.3
<i>Local Goods</i>	7947	-0.1	3.9	5.1	5.7	8.3
<i>Imported Goods</i>	2053	1.5	5.1	8.7	10.7	8.6
<i>Fresh Food Products</i>	1403	-1.1	10.7	6.5	-4.3	8.3
<i>Energy</i>	767	3.6	5.0	5.0	7.3	9.3
Underlying inflation	7829	0.2	2.8	5.8	9.0	8.3
Annual average underlying inflation	7829	1.5	1.4	1.9	3.7	5.7

Source: BNR, Statistics Department

The underlying inflation which excludes fresh foods and energy from the overall CPI, reached 8.3 percent in December on annual basis, from 8.95 percent in September, 5.77 percent in June and 2.78 percent in March. On annual average, underlying inflation increased to 5.7 percent in December from 1.5 percent in December 2010.

II.2 MONETARY AND EXCHANGE RATE POLICY

In 2011, the National Bank of Rwanda has been implementing a prudent monetary policy to avoid risks of exacerbation of inflationary pressures while continuing to support the financing of the economy. In response to rising inflation and persistent uncertainties in international and regional environment, the BNR Monetary Policy Committee raised the Central Bank policy rate twice from 6.0 percent to 6.5 percent in October and 7.0 percent in November. Previously, the policy rate was kept unchanged at 6.0 percent since November 2010. In addition to further build and shape market expectations, the BNR continued to enhance its communication strategy by exchanging information with all stakeholders, with a particular focus on financial institutions and the business community.

With regard to exchange rate policy, the BNR continued to maintain a flexible exchange rate regime and only intervened on the domestic foreign exchange market by selling foreign exchange to banks to smoothen the RWF exchange rate volatility.

During the whole year 2011, the Rwanda franc remained quite stable; depreciating only by 1.6 percent against the US dollar, the most used foreign currency in transactions with the rest of the world.

II.3 MONETARY AGGREGATES AND LIQUIDITY CONDITIONS

II.3.1 Money supply and demand

During the year 2011, development in key monetary aggregates was in line with the dynamics in economic activities. The broad money (M3) increased by 26.7 percent against 19.6 percent initially projected and 17.0 percent achieved in 2010. The growth of M3 was driven by the increase of Net Foreign Assets (NFA) by 29.4 percent and that of Net Domestic Assets (12.8 percent). At the same time, the domestic credit was driven by the credit to private sector which increased by 28.4 percent in 2011 from 11.1 percent recorded in 2010.

Table 11: Monetary aggregates developments (in RWF billion, at end period)

	2009	2010	2011				Change (%)	
			Mar.	June	Sep.	Dec.	2010/ 2009	2011/ 2010
Net Foreign Asset	442.9	518.9	464.4	485.3	520.0	671.2	17.2	29.4
Net domestic assets	81.6	97.0	161.5	227.3	201.8	109.4	18.9	12.8
Domestic credit	217.0	268.2	323.4	400.9	379.3	287.9	23.6	7.3
Central Government net	-141.3	-131.3	-98.6	-48.2	-114.6	-223.6	7.1	-70.3
Public Enterprises	3.0	3.2	1.1	2.6	4.4	2.8	6.7	-12.5
Private sector	357.3	397.1	421.3	447.0	490.3	509.8	11.2	28.4
Other items net	-135.5	-171.2	-161.4	-173.5	-177.5	-178.5	26.4	-4.3
Broad money M3	526.6	615.9	626.4	712.6	721.8	780.6	17.0	26.7
Currency in circulation	77.0	90.5	83.9	101.5	93.4	102.8	17.5	13.6
Deposits	447.5	525.4	542.5	611.1	628.4	678.0	17.4	29.0

Source: BNR, Statistics Department

In 2011, total new authorized loans by commercial banks and BRD stood at RWF 336.0 billion in 2011 from RWF 262.0 billion authorized during the year 2010, that is an increase of 28.0 percent

against 32.0 percent a year ago. In terms of loans distribution by economic activities, commerce, restaurant and hotels have the highest share (36.7 percent), followed by public works and building (24.7 percent). It is worth to highlight that the new authorized loans to the agriculture sector has continued to increase from RWF 5.1 billion in 2010 to RWF 11.9 billion in 2011.

Table 12: New loans authorized by commercial banks and BRD (in RWF billion)

	2009	2010	2011				
			Q1	Q2	Q3	Q4	Total
AGRICULTURE, ANIMAL, HUSBANDARY&FISHING	3.7	5.1	3.8	2.0	4.2	1.9	11.9
MINING INDUSTRIES	0.1	0.1	0.0	0.0	0.0	0.0	0.0
MANUFACTURING INDUSTRIES	20.1	26.8	2.5	7.8	3.4	5.0	18.7
ENERGY AND WATER	3.2	1.4	0.0	0.1	0.0	0.4	0.6
PUBLIC WORKS AND BUILDING & INDUSTRY	36.7	45.1	14.3	20.7	26.7	21.4	83.1
COMMERCE, RESTAURANT & HOTELS	73.0	111.8	20.8	29.5	35.5	37.6	123.4
TRANSPORT, WAREHOUSING & COMMUNICATIONS	31.9	22.7	2.6	3.2	7.6	4.7	18.2
O.F.I, INSURANCES AND OTHER NON FINANCIAL SERVICES	7.5	8.5	7.0	1.3	8.2	2.7	19.2
SERVICES PROVIDED TO THE COMMUNITY	4.7	9.8	1.6	2.2	1.3	4.5	9.6
ACTIVITIES NOT CLASSIFIED ELSEWHERE	17.6	30.9	8.3	10.1	14.7	18.4	51.5
TOTAL	198.4	262	60.9	76.9	101.4	96.6	336

Source: BNR, Financial Stability Directorate

Regarding the money demand in 2011, deposits in the banking system have increased by 29.0 percent from 17.4 percent in 2010 while the currency in circulation increased by 13.6 percent. This upward trend was backed by strong economic activities, supported by government spending and the increase in credit to the private sector.

II.3.2 Banking system liquidity conditions

The liquidity in the banking system has been improving continuously throughout 2011 following the recovery of the economy in 2010, as evidenced by the level of liquid assets which have been expanding considerably. To regulate this liquidity, REPO (Repurchase Agreement Operations) operations were used more frequently to absorb the excess liquidity due to its flexibility in terms of investment maturity and its role to steer the markets rates.

Commercial banks' outstanding investments in REPO amounted to RWF 85.0 billion by end 2011 compared to RWF 60.6 million by end December 2010. The Central Bank has also been issuing debt securities to sterilize excess liquidity and to finance short term Government treasury needs. The outstanding T-Bills by end December 2011 amounted to 76 billion RWF against 56 Billion in 2010. Going forward, the BNR will continue to manage liquidity by issuing T-Bills and availing at the

same time the securities needed to promote interbank market. The Central Bank is also developing other instruments that would help in the implementation of the Monetary Policy.

Within the framework of developing the capital market, BNR issued Government Treasury Bonds and by end 2011, the total Bonds listed on Rwanda Stock Exchange amounted to RWF 15 billion.

II.4 INTEREST RATES DEVELOPMENTS

Developments in money market interest rates have been consistent with the change in the banking system liquidity, significantly influenced by the level of the reserve money targets. Repo rates were stable around the central bank rate during the first 3 quarters of the year 2011 due to tight reserve money targets.

Table 13: Interest rates (in percentage)

	2010	2011											
	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
BNR Policy Rates													
Key Repo Rate	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.50	7.00	7.00
Discount Rate	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.50	11.00	11.00
Money Market													
Repo rate	5.47	5.95	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.37	6.62	6.53
Refinancing Facility Rate	8.83	-	-	8.40	-	-	-	-	-	-	-	-	-
Treasury Bills Rate	7.32	7.14	7.02	7.22	7.11	7.11	6.78	6.80	6.74	6.71	7.21	7.82	7.62
Commercial Banks													
Interbank Rate	6.84	6.71	6.74	6.74	6.86	6.86	7.00	6.93	6.87	6.93	7.36	7.48	8.08
Deposit Rate	7.10	7.51	7.50	7.49	8.65	7.93	8.03	7.22	7.67	7.70	7.36	7.97	n.a
Lending Rate	16.94	15.63	16.90	16.59	16.59	16.89	16.97	16.58	16.98	17.01	17.04	16.48	16.73

Source: BNR, Statistics Department

However, from October, Repo rates have been fluctuating as a result of the adjustment of reserve money targets to respond to higher economic activities and the increase in the

policy rate. Thus, the average repo rate moved to 6.53 in December from 6.0 percent in September while the average t-bill rate increased to 7.62 from 6.71 percent and interbank rate rose to 8.08 percent from 6.93 percent during the same period.

With regard to market rates, commercial banks deposit interest rates slightly went up to 7.17 percent in November 2011 from 6.84 percent in December 2010 while lending rates have been fluctuating between 17.04 percent and 15.63 percent.

II.5 EXCHANGE RATE AND FOREX MARKET

II.5.1 Exchange rate developments

In 2011, the Rwandan franc remained stable, depreciating only by 1.6 percent against the US dollar, trading between RWF 594.45 end-December 2010 and 604.14 end-December 2011. This stability was explained by the sufficient capacity of the banking system to respond to high demand for forex. It also depreciated by 1.5 percent vis-à-vis GBP, while it was quite stable against EUR with an appreciation of 0.4 percent.

However, against other EAC currencies, RWF appreciated by 2.0 percent, 5.8 percent, 3.9 percent and 2.2 percent versus Kenyan shilling, Tanzanian shilling, Ugandan shilling and Burundi franc respectively. This appreciation against regional currencies has been one of the key factors that limited the pass-through of higher regional inflation to domestic market, as Rwanda remains a net importer.

Chart 2: Real effective exchange rate as on November 2011



Source: Monetary policy and economic analysis department

Therefore, the Real Effective Exchange Rate (REER) appreciated by 0.93 percent between December 2010 and December 2011. This REER appreciation was consistent with the trend of Rwandan Franc against regional currencies.

II.5.2 Foreign Exchange Market Developments

Over the year 2011, domestic foreign exchange market activity has been boosted by a substantial increase both in resources and expenditures by 24.1 percent and 24.0 percent reaching the total amounts of USD 4.67 billion and 4.52 billion respectively.

To this end, it is important to highlight that the private sector's demand for forex maintained the pace as they increased by 43.3 percent for imports of goods and 12.5 percent for transfers. At the same time Government spending in forex increased by 11.7 percent. Furthermore, to respond to the overall increasing demand for forex, the BNR sold USD 327.8 million in 2011 against USD 232.7 million to commercial banks in 2010, while on the other side, operations on FOREX interbank market recorded USD 86.4 million in 2011 against USD 44.7 million recorded in 2010 which indicates that forex interbank market has been more active in 2011 than in 2010.

Table 14: Revenue and expenditure in Forex (In USD millions)

	2009	2010	2011	% Change 2011/10
Resources	3303.7	3767.2	4674.2	24.1
BNR	976.8	1049.2	1323.6	26.1
Of Which Budget Support	409.6	466.0	625.3	34.2
Bank deposits	175.4	225.8	280.8	24.4
Government Projects	199.9	290.0	307.8	6.1
Commercial Banks	1952.5	2276.7	2876.8	26.4
Of which Exports receipts	198.3	249.0	329.5	32.3
Receipts on services	250.8	222.3	304.4	36.9
Private transfers received	1275.3	1572.4	1915.1	21.8
Purchases forex from BNR	228.1	232.9	327.8	40.7
Forex Bureaus	374.5	441.3	473.8	7.4
Forex Bureaus purchases from the public	225.5	282.1	303.8	7.7
Forex Bureaus purchases from commercial banks	148.9	159.2	170.0	6.8
Expenditure	3170.5	3644.8	4517.8	24.0
BNR	836.7	979.2	1086.8	11.0
Of which Government Spending (including debt pymnt)	845.2	989.9	1105.5	11.7
Non Banking Clients	107.5	117.7	105.9	-10.1
Sales to banks (interbank market)	228.3	232.9	327.8	40.8
Commercial Banks	1934.0	2215.6	2923.4	31.9
Imports of goods	1025.4	1227.6	1758.5	43.3
Imports of services	361.6	354.6	463.2	30.6
Private transfers paid	398.0	472.4	531.6	12.5
Sales to Forex Bureaus	148.9	161.0	170.0	5.6
Forex Bureaus	399.7	450.0	507.7	12.8
Sales to public	399.7	450.0	507.7	12.8

Source: BNR, Financial Market Department

II.6 CAPITAL MARKET DEVELOPMENTS

Within the framework of further developing the Capital Market in Rwanda, a law regulating Collective Investment Schemes in Rwanda (Law N°40/2011 of 20/09/2011) was published and the Trust Law will be published soon as it is currently under discussion in Parliament.

Transactions at the Secondary Market for Treasury Bonds were very minimal. The turnover only recorded RWF 500 million as the security holders (over 90 percent are commercial banks) preferred to keep them till maturity. This trend will change this year with new measures to be taken by the BNR in terms of security allocation. On equity market, Bank of Kigali listed its shares on the RSE market

on September 1st, 2011 following a successful Initial Public Offer (IPO) which was oversubscribed by 276 percent. Bank of Kigali's IPO attracted 6,721 applicants compared to 3,939 applicants for BRALIRWA and this shows the increasing interest in public to invest in the capital market. Since September 1st, 2011 to the end of 2011, the equity market recorded a turnover of more than RWF 12.7 billion from about 14.5 million BRALIRWA shares and 61.4 million BK shares traded in 1,038 transactions.

In August 2011, BNR launched a Central Securities Depository (CSD) System and all transactions have been successfully settled through a paperless system and the settlement period has been reduced from T+5 to T+2.

III. PAYMENT SYSTEM MODERNIZATION

In 2011, BNR and stakeholders continued to work together to modernize Rwanda payment systems, ensuring that they are efficient and reliable. The main development was the implementation of the Rwanda Integrated Payment Processing System (RIPPS) and the introduction of new payment instruments by the banks.

III.1 RWANDA INTEGRATED PAYMENTS PROCESSING SYSTEM

RIPPS has been put in place to reduce time lag in payments and notably to mitigate systemic risk in the financial system of Rwanda. All its components were implemented in 2011. These are the Automated Transfer System (ATS) and the Central Securities Depository (CSD). The ATS is operational since February 2011 and comprises the Real Time Gross Settlement system (RTGS) function for large value and time critical payments and the Automated Clearing House (ACH) which provides clearing and netting facilities for a range of low value electronic instruments including direct debits, direct credits and cheques. The ATS has 16 participants including 14 banks, RSwitch and BNR. On the other hand, the CSD is operational since July 2011 and has 20 participants namely banks, brokers and Rwanda Stock Exchange. Currently, the CSD holds both debt securities and equities. On the debt side, the CSD handles Treasury Bills and Treasury Bonds. On the equity side, the CSD handles BRALIRWA and Bank of Kigali shares.

Table 15: Transactions settled through RIPPS.

	ATS					CSD	
	RTGS		ACH				
	Customers transactions	Interbank transactions	Cheques	Credit transfer (batches)	Total	N/A	
Total Messages	270,768	24,120	32,103	69,410	396,401		
Volume of instructions	270,768	24,120	296,595	730,599	1,322,082	1,569	
Value (millions RWFs)	977,286	4,179,446	750,217	446,206	6,353,155	Shares traded	Turnover
						75,700	12,726

Source: BNR, Payment System Department

Most of the participants are implementing full straight-through processing (STP); the only issue for ATS (Automated Transfer System) concerns the participants whose interfaces are not yet installed or stable; hence obliged to post transactions manually.

III.2 CARD- BASED PAYMENT SYSTEM

Regarding the card based payment system, the banks continued to issue payment cards and RSwitch (former SIMTEL) as a common platform ensures that the infrastructure is interoperable. On one hand, RSwitch continued to issue proprietary cards to banks. On the other hand, several initiatives are being taken by banks in order to provide electronic banking services to their clients. More effort has been put on improving ATMs up time which increased from 58 percent in January 2011 to 85 percent in December 2011. The ATMs transactions have increased significantly as well.

Table 16: Evolution of card based payments

Instruments	2010	2011
Number of Automated Teller Machines (ATMs)	84	167
Number of Point of Sale (POS) terminals	99	227
Number of debit cards	41,377	208,767
Number of credit cards	172	526
Number of prepaid cards	0	3,270
Number of transactions		
Debit cards	393,088	1,933,811
Credit cards	20,036	42,545
Transactions on POS		38,440
Value settled (Rwandan francs millions)		
Debit cards	26,983	117,838
Credit cards	2,897	4,698
Balance on prepaid cards		73
Transactions on POS		6,438

Source: BNR, Payment System Department

Additionally, concerted effort was put on the interoperability of the ATMs. Thus, most of all ATMs are interoperable except EQUITY Bank ATMs, the new comer to the market. Regarding international acquiring, 43 ATMs and 202 POS are accepting VISA cards. Some banks are working with different international Payment Card Service Providers to ensure all international cards are accepted on Rwanda payment terminal.

III.3 MOBILE PAYMENT AND MONEY TRANSFER SERVICES

In 2011 TIGO RWANDA joined MTN Rwanda to provide mobile payment services and was fully licensed to operate the "TIGO Cash." In the domain of remittances, three companies have been licensed as money transfer service providers, bringing the total number of companies to twelve. One local Remittance Service Provider (Virunga Express, Ltd) started to operate international remittances as well. Moreover, several banks offer mobile banking services to their clients, though on an intra-bank basis.

Table 17: Mobile financial service development Jan – Nov 2011

	Agents/branches	Subscribers	Number of Transactions	Value (Million RWF)
Mobile Payments	1,387	639,673	697,497	7,955
Mobile Banking	215	155,986	527,300	5,215

Source: BNR, Payment System Department

IV. FINANCIAL SECTOR STABILITY IN 2011

One of the National Bank of Rwanda's (BNR) core mission is ensuring stability and growth of the financial system. In the period under review (2011), BNR continued to employ radical reforms to ensure that the financial system (mainly composed of the banking, microfinance and non-banking financial institutions) is robust and strong to stimulate the economic growth. The reforms included: establishment of appropriate market infrastructure (efficient legal and regulatory framework, supervisory tools, modern payment systems and the private credit reference bureau).

The data discussed in the subsequent paragraphs demonstrates the stability and positive outlook of the system. Additionally, the outcome of the IMF/World Bank, Financial Sector Assessment Mission (FSAP) conducted in February 2011 substantiates that Rwanda's financial system is sound and stable and able to mitigate systemic risks.

IV.1 FINANCIAL SOUNDNESS

IV.1.1 Banking Sector

The banking sector continues to dominate Rwanda's financial sector, controlling over 73 percent of the total assets. Currently, Rwanda's banking sector is composed of nine (9) commercial banks, one (1) development bank which merged with the mortgage financing bank during the year 2011, three (3) microfinance banks (Urwego Opportunity Bank, UNGUKA Bank Ltd and AGASEKE Bank Ltd) and one (1) cooperative bank (Zigama CSS); all supervised under the banking law.

The banking sector's (commercial banks and specialized banks) balance sheet outlook was remarkable with an annual total asset growth of 24.5 percent from RWF 869.8 billion in December 2010 to RWF 1,083.3 billion in December 2011. The increase of the asset base was mainly attributable to new entrants (one commercial bank and the two MFIs that upgraded to microfinance banks). The breakdown of the total assets for commercial banks and other specialized banks indicated that commercial banks had the largest share, that is, 82.4 percent of the total banking sector assets.

The main drivers of the banking sector asset base in December 2011 (RWF 1,083.3 billion) included; loans and advances (53.8 percent), placements in local banks and other financial institutions (11.9 percent), placements in foreign banks (9.8 percent) and investments in both government securities and others (6.8 percent). The banking institutions' participation in resources mobilization and reallocation to the private sector was positive. Commercial banks controlled 90.9 percent and 77.9 percent respectively of the total sector deposits and gross loans. During the year under review, 88.1 percent of deposits financed the credit to private sector and ultimately impacting the banking sector asset size.

Results from the macro-prudential assessments and stress testing indicate that the banking sector is well capitalized, profitable, improved asset quality and with strong liquidity. In the period under review the capitalization levels as measured by total capital to risk weighted assets stood at 27.2 percent compared to 24.4 percent realized in December 2010 and the ratio is well above the regulatory capital of 15 percent. Through close supervision and monitoring of banks, the quality of assets improved significantly as measured by the Non-performing loans to total gross loans (NPL ratio).

The NPL ratio reduced to 8.0 percent in December 2011 compared to 10.8 percent in December 2010. In absolute figures, the NPL stood at RWF 50.5 billion in December 2011 against RWF 54.8 billion in December 2010. The banking sector also proved to have sufficient income to grow with market demands and to build capital buffers for safety nets purposes in the year under review. The sector's profitability (net profit after tax) increased by 42.4 percent, that is, RWF 22.8 billion in December 2011 compared to RWF 16.0 billion in December 2010. Similarly, the sector's return on assets and equity stood at 2.2 percent and 10.6 percent respectively in December 2011 compared to 2.0 percent and 11.2 percent in December 2010. The sector's liquidity position over its obligation stood at 19.6 percent liquid assets to short term liabilities in December 2011 compared to 16.2 percent realized in December 2010.

Table 18: Key consolidated performance indicators, in percent

Indicators	2010	2011			
	Dec.	March	June	Sept.	Dec.
Solvency ratio (total capital)	24.4	25.6	24.4	25.7	27.2
NPLs / Gross Loans	10.8	10.2	9.2	9.3	8.0
NPLS net/Gross loans	9.3	8.7	7.5	7.3	7.0
Provisions / NPLs	50.6	46.9	49.5	49.4	50.8
Earning Assets / Total Assets	79.5	80.8	80.5	71.2	77.2
Large Exposures / Gross Loans	13.1	14.7	10.2	10.1	9.8
Return on Average Assets	2.0	2.7	2.89	2.3	2.2
Return on Average Equity	11.2	14.4	15.17	11.9	10.6
Cost of deposits	2.7	2.5	2.4	2.4	2.4
Liquid assets/total deposits	58.2	51.7	55.9	49.3	45.3
Forex exposure/core capital	5.0	5.4	4.8	3.0	6.6

Source: BNR, Banking Supervision Department

With continuous and improved adjustment of risk based supervision by BNR, improved regulation and compliance with corporate governance by the market players will further strengthen the financial stability in the country. This will go hand in hand with the implementation of good macroeconomic policies.

IV.1.2 Microfinance Sector

The microfinance sector is comprised of microfinance institutions and SACCOs. As at end December 2011, the sector registered total deposits of RWF 46.5 billion and total gross loans of RWF 42.5 billion.

The total assets of the microfinance sector (UMURENGE SACCOs excluded) increased by 12.1 percent from December 31, 2010 to December 31, 2011, that is, from RWF 43.0 billion to RWF 48.2 billion. Gross loans and deposits increased by 17.0 percent and 4.3 percent, moving from RWF 32.3 billion to RWF 37.8 billion and from RWF 23.0 billion to RWF 24 billion, respectively for the same period. The sector continued to register good performance despite the upgrading of the two (2) microfinance institutions (UNGUKA IMF, S.A and CFE AGASEKE, SA) from the microfinance sector to the micrifinance bank status.

By end December 2011, UMURENGE SACCOs registered deposits and gross loans amounting to RWF 22.5 billion and RWF 4.7 billion respectively.

Table 19: MFIs Consolidated financial performance indicators, UMURENGE SACCOs excluded (in RWF billion)

	31-Dec-10	31-Dec-11	% Change
Total Assets	43.0	48.2	12.1
Cash and Cash Equivalent	8.5	8.8	3.5
Gross Loans (Before Provisions)	32.3	37.8	17.0
Non Performing Loans	3.6	4.2	16.7
Provisions	1.8	2.9	61.1
Loans (Net of Provisions)	30.5	34.9	14.4
Deposits	23.0	24.0	4.3
Equity	14.9	15.3	3.4
Non Performing Loans rate, in percent	11.0	11.3	2.7
Liquidity ratio, in percent	55.5	56.9	2.5
Capital adequacy (Solvency), in percent	34.5	31.7	-8.1

Source: BNR, Microfinance Supervision Department

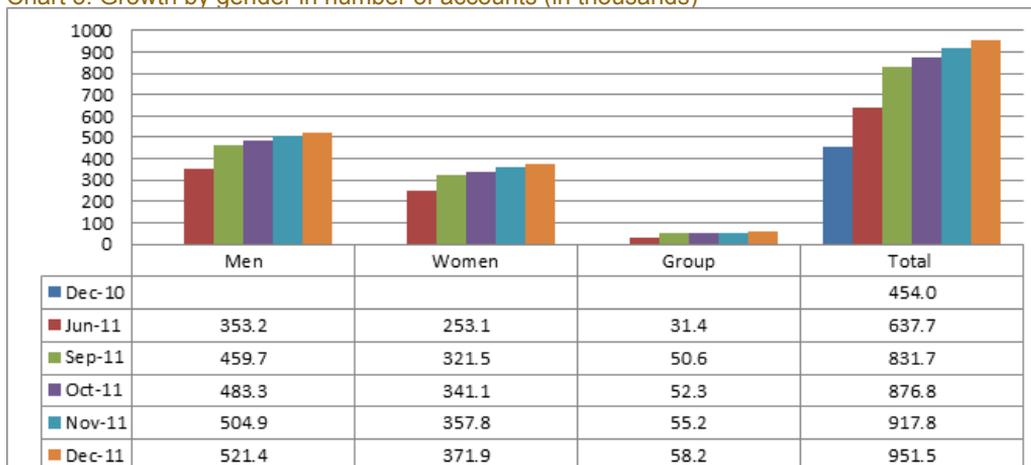
Financial soundness indicators of the microfinance sector indicated a slight deterioration measured in terms of capital adequacy and NPLs ratios, while a slight improvement is observed in liquidity ratio. The capital adequacy ratio decreased from 34.5 percent to 31.7 percent while NPLs ratio increased from 11 percent to 11.3 percent from 2010 to 2011. Compared to the minimum prudential norms of 15 percent and 30 percent, the capital adequacy and liquidity ratios stood at 31.7 percent and 56.9 percent respectively. The NPL ratio remained high compared to the generally acceptable limit of 5 percent in microfinance best practice.

Table 20: Consolidated financial performance indicators of UMURENGE SACCOs (in RWF billion)

	Jun-11	Sep-11	Oct-11	Nov-11	Dec-11
Total Assets	19.89	25.27	26.86	28.76	29.02
Total Liquid Assets	17.58	20.14	22.29	23.60	23.22
Gross loans	1.66	3.36	3.75	4.19	4.72
Provisions	0.13	0.11	0.14	0.13	0.11
Net Loans	1.52	3.25	3.60	4.05	4.60
NPLs	0.26	0.24	0.32	0.31	0.26
Total Deposits	15.15	19.47	21.10	22.88	22.50
Total Equity	3.41	3.81	4.11	4.34	4.70
NPL Ratio	16.0	7.3	8.8	7.5	5.6
Liquidity ratio, in percent	116.1	103.4	105.6	103.2	103.2
Capital Adequacy Ratio , in percent	17.2	15.1	15.3	15.1	16.1

Source: BNR, Microfinance Supervision Department

Chart 3: Growth by gender in number of accounts (in thousands)



Source: BNR, Microfinance Supervision Department

Both banks and MFIs play a key role in financing all segments of the economy with the financing of SMEs in particular. Both sectors have recorded an upward trend for the last five years from 2006 to 2010. There is no doubt that financing to SMEs done in 2011 is much higher compared to 2010.

Table 21: Financing of SMEs by banks and MFIs

Sector	2006	2007	2008	2009	2010
Banks	45,234,156	67,620,359	77,200,670	108,733,789	108,015,099
MFIs	624,962	830,897	815,038	2,732,746	3,470,400

Source: BNR, Financial Stability Directorate

IV.1.3 Non Bank Financial Institutions (NBFIS)

The non-bank financial institutions under the supervision of National Bank of Rwanda are composed of insurance and pension sectors. The National Bank of Rwanda is mandated to regulate and supervise these institutions in order to protect the interest of pensioners and policy holders by ensuring that these institutions are financially sound and stable.

Insurance sector

The insurance sector is composed of eight insurers of which six are private and two public Insurers (RSSB, former RAMA and MMI), five insurance brokers, 102 insurance agents and four loss adjusters. The insurance sector in Rwanda is developing as depicted by insurance penetration which is about 2.3 percent though still less than the 10 percent for middle income economies.

During the year under review, the insurance sector performance improved progressively. The total assets of the Rwandan insurance sector as at December 31, 2011 reached RWF 143.7 billion compared to RWF 128.21 billion as at December 31, 2010. The Gross premiums increased as well as the net profit due to the boom in the Rwandan economy. The liquidity position of the insurers is also satisfactory. The return on assets and returns on equity continue to improve as most of the insurers continue to invest prudently.

Table 22: Financial soundness indicators for the insurance sector in RFW billions

Indicators	2010		2011	
	Sept.	Dec.	Sept. 2011	Dec. (est.)
Total assets	118.9	128.2	138.2	143.7
Total capital	69.9	85.0	88.7	94.9
Total gross premiums	40.4	50.0	45.1	60.2
Underwriting profit	6.2	7.1	8.9	11.9
Total net profit	13.5	16.0	16.1	21.4
Claims ratio in percent	45.9	44.0	41.1	41.9
Combined ratio in percent	73.5	81.0	77.3	78.0
Current ratio (percent)	208.1	272.0	240.5	242.9
Return on equity ratio(ROE) in percent	19.4	17.0	18.2	18.5
Return on assets ratio(ROA) in percent	15.2	11.0	11.6	11.8

Source: BNR, Non Bank Financial Institution Supervision Department

Pension sector

The Pension Sector is comprised of the National Social Security Fund (NSSF/CSR), which merged with RAMA to form Rwanda Social Security Board (RSSB) and about 40 private pension schemes.

The National Social Security Fund covers largely salaried workers representing 8 percent of the working population in Rwanda. The pension coverage is still low compared to middle income economies' coverage of at least 25 percent.

The pension sector assets (excluding private pension schemes) continued to grow with a positive trend reaching RWF 189.39 billion in 2011 from RWF 166.78 billion in 2010, indicating a 14 percent increase; as shown in the table below:

Table 23: Pension sector assets and contributions (RWF billion)

Indicators	2007	2008	June 2009*	End June 2010	End June 2011 (prov.)	% change
Total assets	112.98	129.04	142.38	166.78	189.39	14
Total Contributions	18.96	23.25	9.3	28.23	35.84	27

Source: BNR, Non Bank Financial Institution Supervision Department

* Means data for sixth months period

IV.2 REGULATORY FRAMEWORK AND SUPERVISION

IV.2.1 Banking Sector

In the year 2011, the BNR continued to improve its supervisory roles by conducting off site surveillance and onsite inspection. During the year, nine onsite inspections were conducted against seven carried out in 2010.

The BNR continued to reinforce the supervisory legal framework to accommodate new market developments such as agent banking, mobile banking among others, all aiming to widen financial access. Banks have expressed interest in these new innovations and so far three banks have been licensed to offer agent banking, while almost all banks do mobile banking. In addition to encouraging product innovations and network expansion, one new regional bank (Equity Bank) started its operation in the third quarter of 2011. Licensing new entrants aims at increasing competition, innovation, efficiency and growth while fostering reasonable prices within the banking sector.

The BNR continued to implement the banking law by putting in place new regulations; fifteen regulations were published in the Official Gazette and two were drafted in 2011.

Fourteen new forex bureaus were licensed in the year under review, recording a total of 131 forex bureaus. The BNR issued a new regulation on the operation of forex bureaus with the aim of streamlining the business and to ensure adherence to best practices in the sector.

Through rigorous surveillance and close monitoring of NPLs in the banking sector, asset quality significantly improved and the NPL ratio decreased from 10.8 percent end December 2010 to 8.0 percent recorded end December 2011.

A feasibility study on Deposit Insurance fund for banks and MFIs was completed, and the draft laws on the establishment of the Fund were prepared.

IV.2.2 Microfinance Sector

During 2011, off-site and on-site inspections were performed on regular basis. The microfinance supervision activity mainly concentrated on the licensing of SACCOs established in line with UMURENGE SACCO Program where 414 SACCOs out of 416 received authorization to grant loans and 139 were fully licensed against 56 authorized to grant loans and 4 fully licensed in 2010. By 31st January 2012, 220 SACCOs were fully licensed.

Regarding the supervision and monitoring of SACCOs, a Technical Control Unit (a team of 2 inspectors) was put in place in each district and became operational since May 2011. Their mandate was extended to all MFIs and SACCOs in the 4th quarter of 2011.

The consolidation process of small SACCOs into viable SACCOs is ongoing. In this regard, some SACCOs were merged either with UMURENGE SACCOs or their respective networks.

The "SACCOs sustainability study" is ongoing to determine adequate organizational structure and supervisory approach of the SACCOs. The consultant is working on the financial model of the proposed cooperative bank structure.

In line with the recovery of NPLs, a committee in charge of assisting the recovery was set up at district level and the ministerial instruction governing its organization was published in the Official Gazette no. 33 of 15th August, 2011.

IV.2.3 Non-Bank Financial Institutions

During the period under review BNR accomplished a number of activities relating to strengthening the legal framework and conducting inspections for Non-Bank Financial institutions. Activities accomplished included Regulations to implement the Insurance law especially that related to mergers and acquisition that were finalized and published in the official Gazette. Regulations to implement the pension law were also drafted while waiting for the pension law enactment. In addition, composite insurers were required to expedite the separation of life and non-life insurance businesses, meet minimum capital and solvency requirements and observe corporate governance standards as envisaged in the provisions of the insurance legal framework.

IV.3 ACCESS TO FINANCE

During the year 2011, actions to facilitate access to banking services were performed through expansion of banks' branch networks and the introduction of Automated Teller Machines (ATMs). In the same year, the number of bank branches and outlet networks was 683 countrywide, supplemented by 170 ATMs from 84 in 2010

The positive impact of extending services to clients was realized whereby the number of accounts opened increased by 14.4 percent from 1.77 million accounts to 2.03 million accounts in the banking sector.

In line with the promotion of financial inclusion, Access to Finance Forums (AFF) were launched in all districts and are now in operation. AFF is a platform where local authorities, commercial banks, MFIs, SACCOs and other financial institutions, the Technical Control Unit of SACCOs and development partners meet and discuss the constraints relating to access to finance both on demand and supply side and work out solutions. Issues discussed in AFF include the problem of financial exclusion, SMEs financing and the rationale for strategic linkages with commercial banks, MFIs and SACCOs and the possible mutual benefits.

Under the National SME development policy, Business Development Fund (BDF) was assigned two main objectives: Access to Finance and Capacity building for MSMEs.

BNR exercises close follow up of the BDF strategy implementation aiming to ensure that its programs and services are effectively delivered to beneficiaries; especially the youth and women through participant financial institutions including SACCOs.

BDF currently manages 5 funds namely: SME Guarantee Fund; Agriculture Guarantee Fund; Rural Investment Facility; Women Guarantee Fund and Retrenched Civil Servants Guarantee Fund.

These funds are mainly managed through comprehensive agreements with the participant financing institutions. BDF has strong Government and stakeholder support which has been demonstrated by the GoR's willingness and actual transfer of funds to the tune of RWF 9.3 billion to BDF detailed as in the table below:

Table 24: Government transfers to BDF (In RWF)

Fund	Amount
Agricultural Guarantee Fund	911,340,000
Retrenched Civil Servants Fund	511,295,000
Women Guarantee Fund	122,625,000
SME Guarantee Fund	3,700,000,000
Rural Investment Facility II	4,090,724,758
Total	9,335,984,758

Review of the BDF Guarantee Scheme

Following the consolidation of all Government guarantee and refinancing facilities in the Business Development Fund (BDF), the Fund reviewed the scheme and altered its key features with an aim to make the facilities more attractive to the lending institutions and to encourage increased utilization of the guarantees.

In this regard the changes introduced include, the paradigm shift to provide guarantee risk coverage for both investment assets and working capital (working capital cover ranges between 30-50%), introduction of loan portfolio coverage (a participating financial institution is offered a “guarantee line”, i.e. the institution will be free to accept projects to the tune of that amount without submitting individual application to BDF for every single project), the move from a uniform guarantee risk coverage percentage to a wider range that considers loan risk profiles (for women and the youth coverage varies between 50-75%), the trigger point for claims which was revised to when a loan becomes non performing with a limited recovery period (currently, 90 days) and an integrated fund management framework was set up from the pre-existing single funds. These alterations were all designed to compel lending institutions to embrace the facilities and focus more on SMEs as the target borrowers.

IV. 4 CREDIT INFORMATION SYSTEM

The coming of the private credit reference bureau (CRB Africa) to supplement the public credit reference bureau managed within the BNR in order to gather quality credit information for the purposes of minimizing credit moral hazards and adverse selections has started to pay off. All financial institutions have signed memorandum of understanding with CRB Africa and have started to provide data to CRB Africa. Similarly, banks have begun to use CRB Africa data in client credit analysis.

During the period under review, the BNR achieved the following: ensuring that all mandatory participants provide data to CRB Africa and use credit reports issued by the bureau. According to CRB Africa report, from December 2010 to December 2011, the usage (that is, institutions that use credit information from CRB database) of credit report by the mandatory participants increased by 88.6 percent; from 848 usage in December 2010 to 7,498 usage in December 2011. All commercial banks are CRB Africa participants. MFIs and SACCOs participation also improved significantly from 14 institutions in 2010 to 32 in 2011.

The insurance companies started sharing information with CRB Africa in October 2011 and by end December information on 6,003 policy accounts was submitted. In addition to mandatory participants (financial institutions), voluntary participants such as the utility companies (telecoms & EWSA) have registered to share credit information.

Consequently, the reforms in the credit reference bureau significantly improved Rwanda's position on the “getting credit” indicator of doing business from the 32nd to 8th position out of 183 countries (World Bank Doing Business report, 2011).

V. MONETARY AND EXCHANGE RATE POLICY ORIENTATION AND FINANCIAL SECTOR REFORMS IN 2012

V.1 MONETARY AND EXCHANGE RATE POLICY IN 2012

V.1.1 Monetary Policy Stance

The major objective of BNR in 2012 will be the consolidation of its achievements in 2011 and sustaining macroeconomic and financial stability despite the global risks that still persist. These include sovereign debt the Euro zone, debt ceiling crisis in the USA and the risk of inflationary pressures due to the expected international high oil prices. The current crisis in the euro zone and in US is likely to negatively impact Low Income Countries including Rwanda through different channels such as the slowdown in global demand for their exports, the reduction in Foreign Direct Investment and the slowdown in tourism and remittances.

However, the stable macro-economic framework, the existing coordination between different stakeholders in charge of economic management as well as the good perspectives in the Rwanda's economy are likely to limit the above mentioned risks.

Thus, BNR monetary policy will remain prudent to contain the impact of persistent risk of inflationary exogenous shocks and continue to support the Government prospects of economic growth by at least 7.6 percent. To this end, the reserve money as the anchor of BNR monetary policy has been programmed to increase by 17 percent in 2012 lower than its increase (20.5 percent) in 2011. The broad money is also projected to grow by 17.0 percent by end 2012, less than its growth (26.7 percent) in 2011. Boosted by new comers in the sector, namely Equity Bank (one of the biggest regional banks), Unguka and Agaseke, 2 big microfinance banks, the banking system will continue to support the economic growth by an increase of 16.6 percent in credit to the private sector but much lower than 28.4 percent realized in 2011. As a result, the headline inflation is projected at 7.5 percent end December 2012.

The BNR will also continue to use all available monetary policy instruments, including the policy rate, to ensure that real interest rates in the economy remain positive to further support domestic savings mobilization and the financial sector deepening.

To further build and shape market expectations, the BNR will continue to enhance its communication strategy by creating an interactive platform of exchanging information with all stakeholders, with a particular focus on financial institutions and the business community. In addition, the communication will focus on educating the public about the ongoing financial deepening reforms such as credit information reporting activities, the Umurenge SACCO program, capital market development and payment systems modernization.

V.1.2 Exchange rate policy orientation

With regard to the exchange rate policy orientation in 2012, the BNR remains committed to maintaining a market driven exchange rate. The BNR will continue to only intervene from time to time on forex market to smoothen the exchange rate volatility. The Bank will also continue to ensure that the exchange rate policy remains supportive of external sector competitiveness and prospects for export diversification.

V.2 FINANCIAL SECTOR REFORMS IN 2012

V.2.1 Financial sector soundness and access to finance

Going forward, the BNR will continue to enforce stability and the soundness of the sector by performing various activities including; streamlining the legal, regulatory and supervisory framework for the supervised institutions, close monitoring of strategies to reduce the level of NPLs in lending institutions, encouraging Financial Institutions to report and to use credit information, reinforcing of supervision tools for financial institutions, improving communication strategy, enhancing further access to financial services up country as well as network risk management, encouraging customer

care within the financial sector, ensuring that all forex bureaus submit financial returns on quarterly basis, close monitoring forex bureaux for efficiency and finalizing the draft laws on the deposit insurance scheme for banks and microfinance institutions.

The National Bank of Rwanda will continue to ensure improved quality and coverage of credit information sharing with voluntary participants to include retail traders (supermarkets) as well as other credit granting institutions.

The National Bank of Rwanda plans to carry out a public awareness campaign to sensitize consumers, participants and policy makers on the role of credit information sharing and consumer rights. BNR is committed to ensure that the required regulations to implement the Law No.16/2010 on Credit information system in Rwanda are in place.

During 2012, a special emphasis will be put on actions aimed at completing the licensing of SACCOs established in line with UMURENGE SACCO Program by March 2012, as well as their monitoring and supervision.

BNR will continue to strengthen the supervision of SACCOs and MFIs by conducting off-site and on-site inspections, and following up their NPLs recovery through the recovery committees set up at district level. The liquidation of failed MFIs will be completed by end 2012

The consolidation of SACCOs as well as the establishment of Deposit Insurance Fund will be part of the priorities for 2012.

Regarding access to finance, the key actions to be undertaken include monitoring Access to Finance Forum (AFF) activities; embarking on a financial awareness campaign while working with stakeholders on a financial literacy and consumer protection baselines and the, FinScope survey 2012 prior to the elaboration of a National Financial Literacy and Consumer Protection Strategies and a National Financial Inclusion Policy.

The Bank will ensure that the legal infrastructure for Non-bank financial institutions is further strengthened which will be done by finalizing the draft insurance contract and mandatory insurance laws. BNR will support the Ministry of Finance and Economic Planning and the parliamentary committee to fast-track the review of the draft pension law which is in parliament. BNR will also ensure that all the remaining insurance and pension regulations are finalized and published in the Official Gazette.

These cover liquidation and dissolution of insurance business, licensing pension service providers and operating standards of the pension schemes. Furthermore, BNR will continue conducting off-site surveillance and on-site inspections to ensure the soundness of Non-Bank Financial Institutions. BNR will strengthen further partnerships with sister regulatory bodies in the region and internationally aiming at promoting professionalism and information sharing as one of the 2012 priorities.

V.2.2 Capital Market development

The Government of Rwanda is keen on the development of domestic financial market. Plans are underway to increase the number of tradable securities as well as extending their maturities in order to avail more opportunities for long term investments. Before the end of the fiscal year 2011-2012, two bonds will be issued. These include a seven year Bond which will be issued end February 2012 and a specific Bond for the Diaspora community which will be issued by end June 2012.

The Central Bank together with the Capital Market Authority and other stakeholders have put in place new strategies to enhance the development of the financial market in Rwanda. These strategies include, among others:

- Financial awareness campaign to educate the public on investment and other financial issues through TV and Radio programs, newspapers, social media networks, road-shows, training, seminars and workshops,
- New products on the market to increase the number and types of securities listed on the market,

- The process of procuring an Electronic Trading Platform at the Rwanda Stock Exchange (RSE) whose go-live date is targeted to June 2012.
- Financing the development of the guidelines to support the issue of municipal bonds, commercial papers and infrastructure bonds,
- Putting in place regulations for Small and Medium Enterprises wishing to raise long-term capital through the capital market.

V.2.3 Payment system modernization

To promote the use of electronic settlement and payment systems, by end of 2012, the Rwanda Integrated Payments Processing System (RIPPS) will be connected to EAPS (East African payment Systems) and to the COMESA REPSS (Regional Payments and Settlements System), which will facilitate regional trade. Cheque truncation system will be implemented. In addition, the Intraday Liquidity Facility (ILF) will be established in RIPPS. Unlike the current practice whereby all visa transactions are settled in foreign currency, The Visa National Net Settlement System that facilitate domestic transactions to be settled in local currency will be implemented and the Central Bank will be the settlement agent.

Regarding payment cards, efforts are being made to increase the number of payment cards and terminals. International cards like Visa, Master Card, American Express, China Union Pay (CUP), Diners Club, and others will be accepted on local ATMs and POS while local cards will be accepted at POS as well.

An important partnership between Visa inc. and the Government of Rwanda was signed in November 2011 aiming at developing localized payment solutions to extend access to financial services to local and international consumers throughout the country. This partnership covers 3 areas:

- Lay the Foundations for Electronic Payments – Install the basic infrastructure requirements to enable country-wide use of electronic payments, including: (1) facilitating the widespread issuance and acceptance of payment cards; and (2) localizing clearing and settlement services.
- Promote Electronic Payments Innovation – Enable Rwanda to take advantage of mobile phone technologies to reach Rwandans who are under-served by traditional payments infrastructure.
- Capacity Building – Develop training programs and facilitates knowledge-transfer in order to ensure the long-term sustainability of financial systems throughout the country.

ASSESSING THE STABILITY OF THE MONEY MULTIPLIER

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Abstract

Our objective in this paper is to analyze the stability of the money multiplier from January 2001 to December 2011.

The results of our analysis show that there is evidence that the M3 multiplier is stable over the long run. However, this stability of the multiplier itself masks offsetting trends in the principal components. The cash ratio has exhibited a steady downward trend over time but this trend has been offset by a rise in bank's excess reserve ratio. The net effect, therefore, has been an upward trend in the multiplier.

Over the short run, the multiplier is not constant but responds inversely to movements in reserve money in such way that the negative correlation between base money and the multiplier attenuates the impact of changes in base money on broad money. In addition, whilst the multiplier itself is not strongly seasonal, its key components are. Finally, we have shown how standard models can be employed to develop a reasonably accurate forecast of the future path of the multiplier and its components.

I. INTRODUCTION

The National Bank of Rwanda (BNR) conducts its monetary policy under monetary targeting framework using the broad monetary aggregate (M3) as an intermediate target to achieve the objective of price stability. In this framework, the transmission mechanism of monetary policy sets out from the quantity of monetary base (B) as an operating target and moves towards inflation through the money supply (M3). The base money is the main policy variable which is influenced by BNR using different policy instruments. BNR monitors growth in B and its deviations from its target are corrected through market interventions using Open Market Operations to regulate the liquidity in the banking system.

The process of BNR's monetary policy formulation sets a target of M3 growth in line with targets of inflation and economic growth and an estimated money demand in the economy. The overall objective is to keep money supply close to its estimated demand level because significant excess or shortfall may both lead to important deviations in outcomes of inflation and economic growth compared to their targets. This framework is based on two strong assumptions: a strong and reliable relationship between M_3 and inflation, and the controllability of M3 by BNR. This paper focuses on the latter condition. The control of M_3 by BNR requires a strong relationship between M_3 and the monetary base. In practice, the target on monetary base is set and must be compatible with an estimated level of money supply, given a stable money multiplier (k). The relationship between the three variables is $M_3 = kB$. From this relationship it appears that the more stable and predictable will the money multiplier be, the more it will be easy for BNR to estimate the behavior of money supply.

The objective of this paper is to discuss the stability and predictability of money multiplier in Rwanda, using monthly data covering the period January 2001 to December 2011. This paper updates the existing one (BNR economic review, no 3) and uses the agreed methodology between the EAC central banks to support the current process of harmonization of their monetary policy frameworks.

The rest of the paper is organized as follows. In section 2 the multiplier theoretical model is derived. In section 3 we present the empirical methodology used in the analysis before presenting main findings in section 3. The last section concludes by proposing some policy recommendations.

II. THEORETICAL FRAMEWORK OF THE MONEY MULTIPLIER

The M_3 money multiplier, denoted K_3 , is defined as the ratio of the money supply (M3) to base money (B).

$$K_3 = \frac{M_3}{B} = \frac{D + F + C}{C + R} \quad (1)$$

Where B is base money, consisting of currency in circulation out the banking system (C) plus bank reserves with the Central bank (R), including cash in vault in banks.

M3 consists of currency in circulation out the banking system (C), domestic currency deposits, both demand and time and savings deposits, aggregated and denoted by D, and foreign currency deposits (where \bar{F} is the nominal exchange rate, \bar{F} foreign currency deposits and F foreign deposits expressed in RWF).

In practice, total reserves can be partitioned between required reserves (RR), as defined by the Central bank, and the excess (E) held over this requirement. The money multiplier becomes:

$$K_3 = \frac{M_3}{B} = \frac{D + F + C}{C + RR + E} \quad (2)$$

The reserve requirement is also portioned between reserve requirement in foreign currency and reserve requirement in domestic currency:

$$RR = r^d D + r^f F \quad (3)$$

Where r^d and r^f are reserve requirement or statutory reserve requirement ratios defined as percentage of total deposits D and F respectively. Because foreign and domestic deposits attract the same reserve requirement in Rwanda, $r^d = r^f = r$ therefore

$$RR = rD + rF = r(D + F) \quad (4)$$

The money multiplier becomes:

$$K_3 = \frac{D + F + C}{C + r(D + F) + E} \quad (5)$$

Dividing through by D, the money multiplier can be expressed in terms of four ratios.

$$K_3 = \frac{1 + f + c}{c + r(1 + f) + e} \quad (6)$$

The first two ratios: $c = \frac{C}{D}$ and $f = \frac{F}{D}$ describe private sector portfolio behavior, between cash and deposits and between foreign and domestic deposits respectively;

r is a policy measure by central bank, and

$e = \frac{E}{D}$ reflects the banks 'discretionary portfolio behavior.

III. METHODOLOGY

In the multiplier model, the level of the money multiplier does not matter so much but rather its movements over time. In this paper, we analyze the money multiplier stability by testing its stationarity and determine the long run relationship between M3 and B using Johansen (1988) and Johansen and Juselius (1999) multivariate cointegration and error correction modelling technique.

If K_3 is stationary, then M_3 and B are either stationary or cointegrated with (1,-1) as cointegrating vector, because $k_3 = m_3 - b$ ¹

Before testing the stability of the money multiplier, we first analyze the long-run trend, the cyclical movement around the trend and the seasonal component of the reserve money and its components. This will help to assess the short run changes in K3.

IV. EMPIRICAL RESULTS

IV.1 Analysis of trends

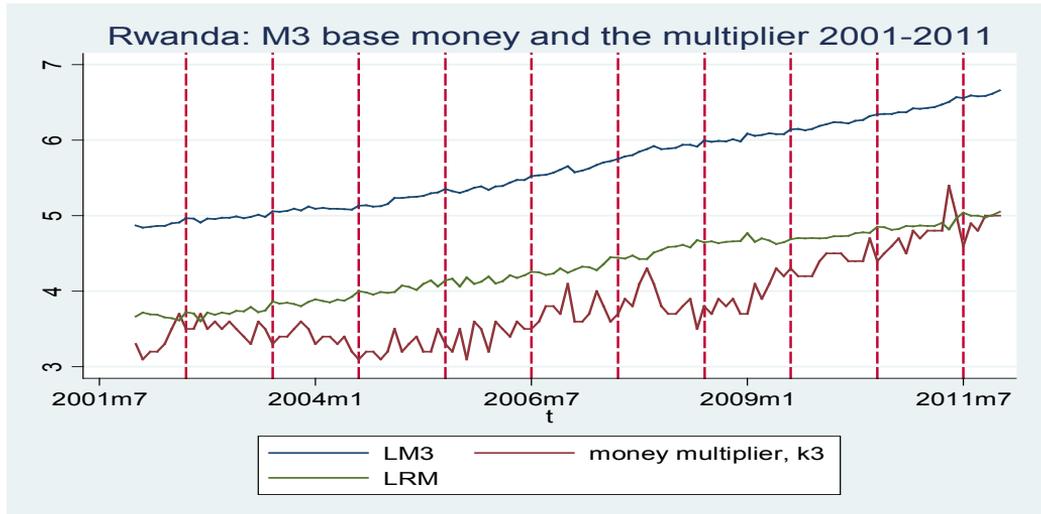
Any time series variable can be decomposed into three components: the long -run trend, the cyclical movement around the trend and the seasonal component which is the within-year movement relative to the trend cycle. In this section we analyze the proprieties of the M3 multiplier and its components starting with analysis of their trend characteristics, followed by an examination of their seasonal pattern and short -run or cyclical movements.

Although the money multiplier (k3) has significant month to month movement, it has an overall upward trend with a significant decline between 2008 and 2009 due to the liquidity crunch faced by the banking system in Rwanda as the impact of the financial crisis in the second half of 2008. This drop is associated with an increase of 1.7% in cash ratio between 2008 and 2009 from a decline of 0.5% in 2007 before dropping to 2.7% in 2009. Between December 2001 and December 2011, the monthly change of K3 ranged between -17.8% and 11.8% with a standard deviation of 5.6%.

The broad aggregate M3 and the reserve money RM follow the same trend in the long- run, which is an indication of the long run relationship between the two variables. In addition, the following graph shows that M3, RM and K3 are not stationary.

¹ The small letter is the logarithm of the corresponding aggregate.

Figure1: Money, Base money and the multiplier



We analyze the long-run trends in the money multiplier and its components by regressing the log of the multiplier (and components) on a linear trend and seasonal dummy variables. The regression equation is stated as follows:

$$\ln(x) = \alpha + \beta \cdot t + \sum_{i=1}^{11} \gamma_i S_i \quad (7)$$

Where:

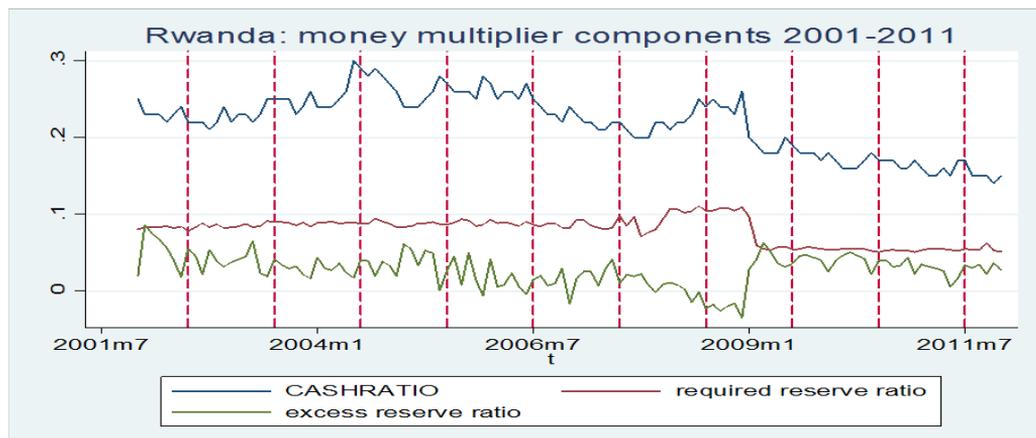
x : denotes the multiplier and its components,

t : the time trend and

S_i : monthly seasonal dummy variables, $i=1,2,\dots,11$.

Figure 2 shows that the cash ratio (c) dropped sharply since the last quarter of 2004 following the development of the banking system and the confidence of the population in the system as well as the greater formalization of the economy including the wider use of direct payment of salaries into bank accounts. The currency in circulation increased by 1.3% on average between January 2001 and December 2011, less than 1.6% increase in total deposit. These increases are respectively 1.3% and 2.0% between the last quarter of 2004 and end December 2011.

Fig 2: M3 multiplier components



The results of the regression (table 1) show that this ratio presents an overall long-run trend decline of 0.004% per month. Since 2004 to second quarter of 2008, Rwanda banking sector has consistently experienced an important excess of liquidity as a result of an increase in public spending, especially owing to increases in aids inflows. During that period, the Central Bank monetary policy was mainly focused on managing the excess liquidity which was quite permanent in the banking system.

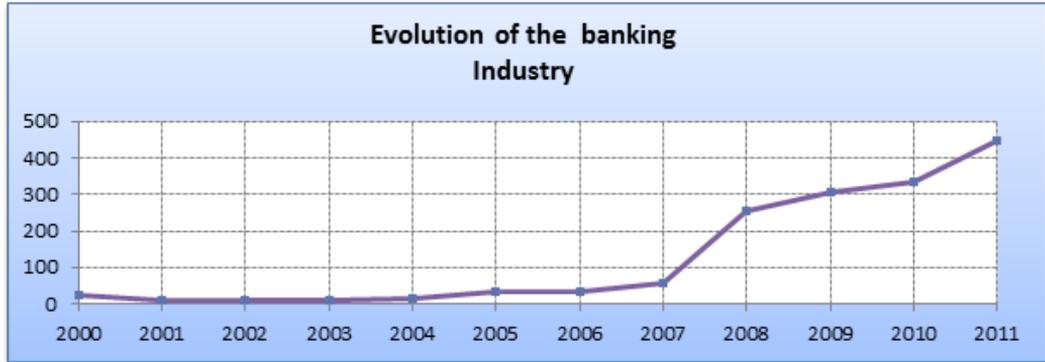
However following a strong credit distribution in 2007 and 2008 at a time when deposits growth was slowing down for many reasons, a deposit-credit mismatch was observed since June 2008 and the banking liquidity declined since then in such a way that in January 2009, NBR was obliged to inject liquidity in the system for the first time since 2004. Other measures were taken as the reduction of reserve requirement ratio from 8% to 5% and the decision of not automatically rolling over all short term government T-bills maturing in 2009.

Table 1: estimated long-run trend in M3 multiplier and components

December 2001 to December 2011			
Component	Trend per month	Probability	R-squared
M3 multiplier	0.00%	0.0	0.77
Cash ratio	-0.004%	0.0	0.61
Required Reserves	0.01%	0.0	0.42
Excess Reserves	0.11%	0.0	0.34

Given the current speed of both ATMs and mobile phone based financial services as well as the rapid increase in banking sector expansion across the country, the observed downward trend in the cash ratio may be expected to accelerate in future.

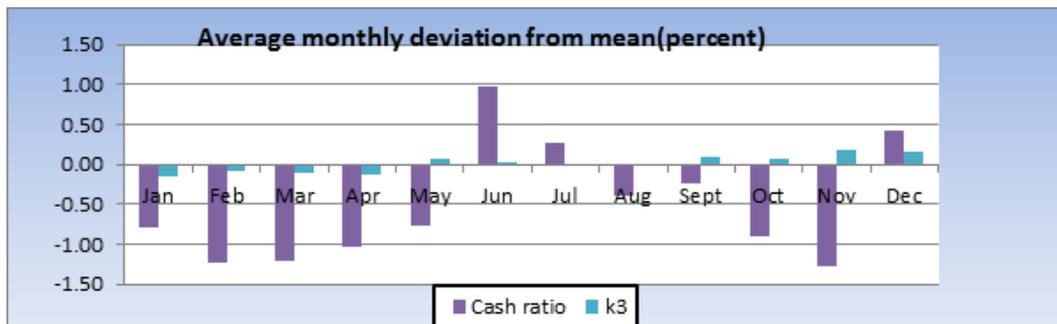
Fig 3: Banking sector expansion: Number of branches and sub branches



IV.2 SEASONAL PATTERNS

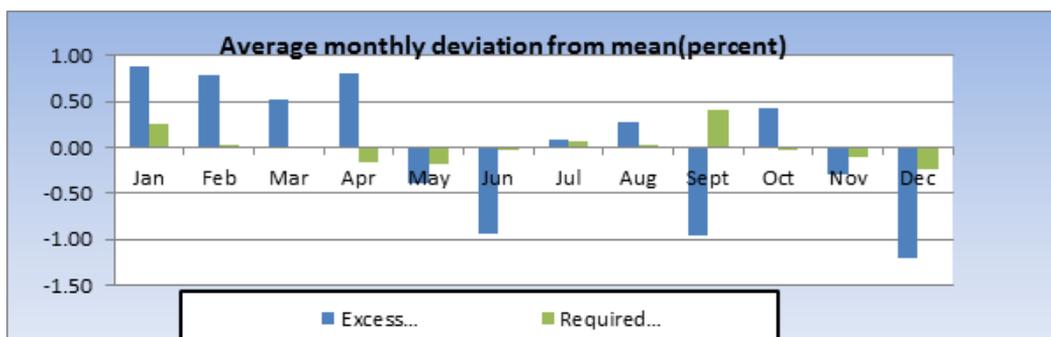
The multiplier itself does not exhibit a strong seasonality but its two behavioral components, the cash ratio and the excess reserve ratio do. Figures 4a and 4b plot the mean percentage monthly deviations of the M3 multiplier and its components from their long-run trend. The cash ratio exhibits a seasonal pattern through the year which is consistent with the coffee campaign, the festive season in December and the schools opening in January. However the cash ratio drops below its average for the rest of the months.

Figure 4a: Seasonal patterns in M2 multiplier and cash ratio



The excess reserves exhibit a seasonal pattern in June, September and December. This reflects the BNR's behavior concerning IMF programmed benchmark dates (end quarter) when the Bank mops up excess liquidity. These operations are however reversed immediately after the benchmark dates have lapsed. This situation is associated to the under estimation of the money demand in the monetary program during the periods this seasonal pattern is observed.

Figure 4b: Seasonal patterns in reserve requirements and excess reserves



IV.3 Test of the stability of M3 money multiplier

In this section, we analyze the behavior of existing relationship between the broad monetary aggregate M3 and the reserve money (B). Before testing the behavior of long run relationship between the two variables in Rwanda, we analyze their short run interactions. To this end, we compute the variance of the growth in m_3 from the following relationship:

$$Var(\hat{m}_3) = Var(\hat{k}_3) + Var(\hat{b}) + 2Cov(\hat{k}_3, \hat{b}) \quad (8)$$

As seen in table below, the covariance between base money and multiplier is approximately the same order of magnitude as the individual variances. This implies that the correlation coefficient between the base money and the multiplier is approximately -1 suggesting that the multiplier accommodates changes in base money.

Table 2: the stability of M3 money multiplier, Jan 2002 to December 2011

	Average monthly growth rates			Average monthly variances and covariances			
	M3*	RM*	K3*	Vark3*	VarRM*	varM3*	cov(k3*,RM*)
Jan02 -Dec 11	1.49%	1.15%	0.34%	0.023	0.164	0.293	- 0.002
Jan02-Dec 02	0.83%	0.74%	0.09%	0.004	0.002	0.002	- 0.004
Jan03-Dec 04	1.08%	1.04%	0.04%	0.002	0.007	0.004	- 0.002
Jan05-Dec 07	1.91%	1.40%	0.51%	0.007	0.017	0.039	- 0.004
Jan08-Dec 09	1.22%	0.86%	0.36%	0.004	0.003	0.009	- 0.002
Jan10-Dec 11	1.87%	1.36%	0.50%	0.003	0.009	0.017	- 0.001

To understand how this works, we analyze the contribution of individual component to the overall movement in the money multiplier k_3 , using the following relationships:

$$\frac{\partial m_3}{\partial c} = \frac{(\tau + x - 1)}{(\tau + x + c)^2} p_1 \quad \text{and} \quad \frac{\partial m_3}{\partial \tau} = \frac{(c - 1)}{(\tau + x + c)^2} p_1 \quad (9)$$

Table 3 below shows that the correlation between movements in the components (c, x, τ) and the multiplier is exactly as the algebra predicts (previous relationships). In addition the pair wise correlations indicate that required and excess reserves are positively correlated, indicating that attempts to eliminate the latter by raising the former may be counterproductive, at least in the short run.

Table 3: The contribution of components to movements in the M3 multiplier Dec 2001 to June 2011

	Levels		Contribution of components	Pair-wise correlations				
	mean	Std	coeff (t-stat)	R-sq	m	c	rr	er
K3	4.36	0.46			1.000			
c	0.21	0.04	-11.22 (0.0)	0.64	-0.75	1.000		
Rrratio	0.08	0.01	-21.3 (0.0)	0.35	-0.56	0.74	1.000	
er	0.003	0.02	-9.82 (-0.0)	0.14	-0.33	-0.10	-0.27	1.000

Notes: [1] coefficients derived from a linear pairwise regression of the multiplier on the relevant ratio, controlling for a constant and 11 monthly seasonal dummy variables. Probabilities are in parentheses.

The analysis of some descriptive statistics shows that on average, over the long-run, the growth in M3 is principally determined by the growth in reserve money as the average month-to-month percentage change in the multiplier is approximately zero as shown in table 2 giving the percent-

age changes for monetary aggregate (\hat{m}), the multiplier (\hat{k}) and reserve money (\hat{b}) over different periods. Numbers are computed from the equation $\Delta m(\%) = \Delta k(\%) + \Delta b(\%)$. Derived from $m = k + b$,

This long-run relationship between broad monetary aggregate M3 and reserve money can be assessed using the cointegration approach. The Augmented Dickey fuller tests for non stationarity show that M3, B and K3 are I(1) as indicated in the table 2, in appendix. The Johansen cointegration test indicates 1 cointegration relationship between M3 and Reserve money. The cointegrating vector is not statistically different from (1, -1). The corresponding LR test indicates that data support this restriction: $\chi^2(1) = 0.78, prob = 0.38$. This result is a strong support for the existence of long-run proportionality between the money base and M3.

Table 4: The long-run relationship between base money and M3

Johansen Rank test			Cointegrating Vector	
H0:Rank	Trace test	5%CV		
r=0	17.1	15.49	LogM3	1
r=1	0.02	3.84	Logrm	-1.20
				(0.03)

Trace test indicates 1 cointegration equation at the 0.05 level.

Another important element is the direction of causality between M3 and B in implementing a reserve

money targeting monetary framework. The main issue here is to ensure that the growth rate of B is not an endogenous variable in such a way that causality runs from money supply to monetary base. This is the case for example when the monetary base is essentially influenced by currency to deposit ratio and the private sector portfolio decisions. Using the Granger causality test we find that there is one way causality running from the reserve money to the broad monetary aggregate M3 at 5%.

Table 5 :Granger causality test between M3 and RM

Null Hypothesis:	Obs	Statistic	Prob.
LRM does not Granger Cause LM	118	4.57	0.20
LM does not Granger Cause LRM		8.01	0.04

IV.4 Forecast performance

In this section we examine the ability of alternative models to forecast the short-run evolution of the M3 multiplier and its components using univariate forecasting models rather than structural models. Specifically we compare forecasting from simple trend-extrapolation methods and ARIMA-based models.

The suite of models is estimated on actual data from December 2001 to December 2009. We then compare the forecast performance of each model over the period from January 2010 to the end of 2011. In each case we examine the comparative performance of one-step-ahead forecast accuracy (although this comparison could be extended to h-step ahead forecasts as well) using standard root mean square forecast error (RMFSE) and mean absolute forecast error (MAFE) indicators.

Model 1: A Benchmark: the 'pure' random walk

The simplest benchmark model takes the form

$$\Delta m_t = \varepsilon_t \quad (8)$$

or, equivalently,

$$m_t = m_{t-1} + \varepsilon_t \quad (9)$$

M is the money multiplier

This 'random walk' model is a useful benchmark as it provides an estimate of the average unconditional forecast error for the month-to-month change in the multiplier. To take into account the strong seasonality in the process by calculating month-to-month forecast of the multiplier or of its components, we introduce random walk models with seasonal dummy variables. Using these models, the forecast of the month-on-month change in the multiplier or its components in period t+1 is conditional on information up to and including t plus the estimated seasonal component for month t+1.

Model 2: random walk with seasonal dummy variables

This model simply adds to the pure random walk a vector of deterministic seasonal dummy variables.

$$\Delta m_t = \alpha + \sum_{i=1}^{11} \gamma_i S_i + \varepsilon_t \quad (10)$$

Where S_i is a vector of seasonal dummy variables.

Model 3: local linear trend

Our first alternative model is of the form:

$$m_t = \alpha + \beta \cdot t + \sum_{i=1}^{11} \gamma_i S_i + \varepsilon_t \quad (11)$$

This model is estimated on a rolling 12, 24, or 36 month window. Thus the one-period ahead forecast (for $t+1$) is computed from a model estimated over the data for the previous one- two- or three years, up to and including time t . As in equation (10) this forecast is conditional on a vector of estimated seasonal dummy variables.

Models 4 and 5: ARIMA and Seasonal ARIMA models

The random-walk model is a special case of a more general class of autoregressive integrated moving average (ARIMA) models. The general form of these models is

$$\Delta^d m_t = \alpha + \sum_{i=1}^p \mu_i \Delta^d m_{t-i} + \varepsilon_t + \sum_{i=1}^q \theta_i \varepsilon_{t-i} + \sum_{i=1}^{11} \gamma_i S_i \quad (12)$$

Where d denotes the degree of integration (i.e. the number of unit roots in the time series), p the degree of autocorrelation and q the moving average order of the error term. The equation (9) is described as an ARIMA (p,d,q) specification. Using the lag operator, L , the equation (12) becomes:

$$\Delta^d m_t (1 - \mu_1 L - \mu_2 L^2 - \dots - \mu_p L^p) = \alpha + \varepsilon_t (1 + \theta_1 L + \theta_2 L^2 + \dots + \theta_p L^q) + \sum_{i=1}^{11} \gamma_i S_i \quad (13)$$

where $L^n x_t = x_{t-n}$.

Equation (12) and (13) allow for a deterministic set of seasonal dummy variables. An alternative approach involves directly estimating the seasonal effects in the data using a Seasonal ARIMA model of the form

$$\Delta^d m_t (1 - \mu_1 L - \dots - \mu_p L^p) (1 - \varphi L^{12}) = \alpha + \varepsilon_t (1 + \theta_1 L + \theta_2 L^2 + \dots + \theta_p L^q) (1 - \omega L^{12}) \quad (14)$$

where $(1 - \varphi L^{12})$ and $(1 - \omega L^{12})$ are the seasonal differences for the AR and MA components of the process.

Estimation of ARIMA models

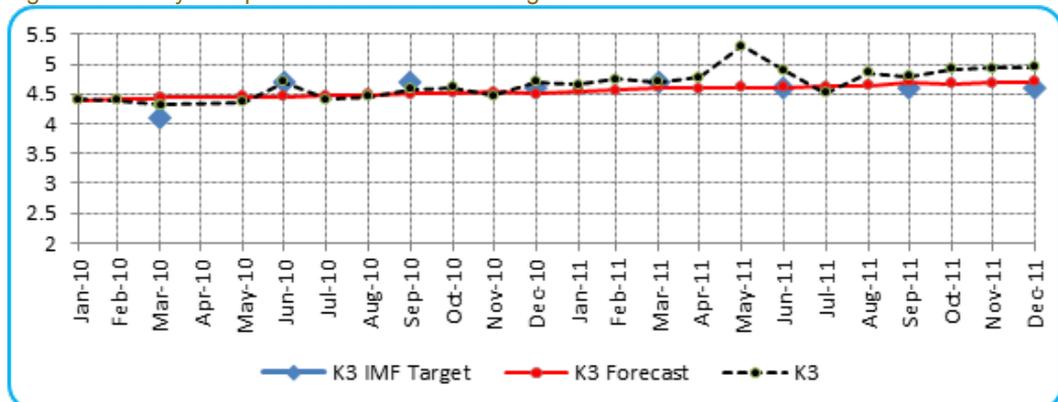
The selection of the optimal ARIMA structure (i.e. the 'best fitting' combination of the order of integration, d, and the AR and MA components, p and q) for any given time series and sample period is done using different criteria. The first step typically entails the order of integration of a given time series. The multiplier is not stationary at level which allows us to set d=1. To select the AR and MA components we proceed in two steps. We first examine the autocorrelation function (ACF) and partial autocorrelation functions (PACF) for the multiplier to identify the maximum AR and MA lengths. Then, we estimate all possible combinations within these limits and use standard selection criteria to identify the 'best' ARMA specification.

The ACF and PACF have the convenient property that for an AR(p) process the PACF goes to zero after lag p while for an MA(q) process the ACF goes to zero after q lags. Hence by examining the two functions together we can make an informed guess as to the maximum ARMA structure in the data. Results on identification of ARMA (p,q) models are not reported here.

Table 6 : Comparative Forecast Performance

Description	M3 multiplier		Cash ratio		Excess Reserve Ratio	
	RMSFE % per month	MAFE % per month	RMSFE % per month	MAFE % per month	RMSFE % per month	MAFE % per month
Pure Random Walk	0.21	0.16	0.01	0.01	0.03	0.03
Random Walk with seasonal	0.28	0.23	0.02	0.01	0.01	0.01
Local Linear Trend (12 month window)	1.93	1.64	0.05	0.02	0.03	0.03
Local Linear Trend (24 month window)	1.73	1.39	0.06	0.03	0.03	0.03
Local Linear Trend (36 month window)	1.51	1.10	0.05	0.06	0.03	0.03
ARIMA(2,1,0) with seasonal dummies	0.21	0.17	0.007	0.005	0.01	0.009
SARIMA(2,1,2,12)	0.39	0.32	0.02	0.01	0.02	0.02
IMF Forecast errors[1] less than 6 month horizon						

Fig 5: M3 money multiplier forecasts and IMF targets



SUMMARY AND CONCLUSION

Our objective in this paper was to analyze the evolution of the money multiplier over time. First we examined the historical evidence on money multiplier in Rwanda and its principal components considering three frequencies: the long-run trend; the within-year seasonal pattern; and the short-run or cyclical pattern. This provides the basis for understanding how key structural developments in the economy have influenced the central policy link between the intermediate target (the broad money supply) and its operational target (the reserve money). The second step was to develop a framework for forecasting the money multiplier in Rwanda.

The results of our analysis show that there is strong evidence that the M3 multiplier is stable over the long run and on average there is long-run proportionality between the money base and M3. In addition, using the Granger causality test we find that there is one way causality running from the reserve money to the broad monetary aggregate M3 at 5%.

However, the stability of the multiplier itself masks offsetting trends in the principal components. The cash ratio has exhibited a steady downward trend over time and is expected to continue with the same trend reflecting long-run structural and technological developments in Rwanda. This trend has been offset by a rise in bank's excess reserve ratio. The net effect, therefore, has been an upward trend in the multiplier.

Over the short run, the multiplier is not constant but responds inversely to movements in reserve money in such way that the negative correlation between base money and the multiplier attenuates the impact of changes in base money on broad money. In addition, whilst the multiplier itself is not strongly seasonal, its key components are. The strong within-year movements in the cash ratio reflects the strong seasonality of demand in the rural economy, while movements in banks' excess reserve ratio appears to have been driven by BNR's approach to conducting monetary policy in the context of IMF program. Finally, we have shown how standard models can be employed to develop a reasonably accurate forecast of the future path of the multiplier and its components.

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APPENDIX

Table 1: VAR Lag Order Selection

Lag	LogL	LR	FPE	AIC	SC	HQ
0	75.08952	NA	0.000929	-1.305170	-1.256625	-1.285474
1	431.0004	692.7550	1.73e-06	-7.589292	-7.443658	-7.530204
2	441.5219	20.10372	1.54e-06	-7.705749	-7.463026	-7.607268
3	454.5989	24.51930*	1.31e-06*	-7.867837*	-7.528025*	-7.729965*
4	457.1062	4.611619	1.35e-06	-7.841182	-7.404280	-7.663917
5	459.1036	3.602445	1.40e-06	-7.805421	-7.271430	-7.588764
6	461.9433	5.020312	1.43e-06	-7.784703	-7.153623	-7.528653
7	462.4064	0.801997	1.52e-06	-7.721542	-6.993373	-7.426101
8	467.8403	9.218316	1.49e-06	-7.747148	-6.921890	-7.412315

* indicates lag order selected by the criterion

FPE: Final prediction error;

AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

Table 2: ADF test of non stationarity

Variables	Number of lags	Level ADF statistics	First difference ADF statistics
Log(m3)	1	1.06	-14.6*
Log(B)	2	0.23	-13.6*
K3	2	-0.054	-12.97

MODELLING INFLATION IN RWANDA

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Abstract

In this study we employ a VAR Model to study inflation process in Rwanda. The main objectives of this study being; assessing the main drivers of inflation and the magnitude and duration of price changes arising from macroeconomic and international environment shocks. The model uses quarterly observations on CPI, GDP, exchange rate, and international oil price. The co-integration approach is employed to investigate the long-run relationship; and the vector error correction method (VECM) to investigate short term dynamics. Findings herein show a significant long-run relationship between inflation and the hypothesized determinants in this study with a 31% speed of adjustment to restore long-run equilibrium every quarter. Co-integration results contend that economic growth work to reduce inflation while money supply (M_3), exchange rate depreciation, international oil price work to increase inflation. In the short-run, lagged inflation proves to be the only significant variable explaining inflation. This confirms the relevancy of ARMA model used by BNR in short-term inflation forecasting. The impulse response function revealed that a shock on international oil price would have immediate expansionary impact on prices that would last for six months. Finally, an innovation on M_3 has expansionary impact on prices although the impact is not significant.

I. INTRODUCTION

Inflation is considered to be a major economic problem in transition economies and thus one of the fundamental objectives of sound macroeconomic policy is to maintain price stability at full-employment economic growth. The negative consequences of inflation are well known. Inflation can result in a decrease in the purchasing power of the national currency leading to the aggravation of social conditions and living standards (Lipsey et al. 1982). High prices can also lead to uncertainty making domestic and foreign investors reluctant to invest in the economy. In an open economy, the cost of inflation is even higher, inflated prices worsen the country's terms of trade by making domestic goods expensive on regional and world markets making it increasingly difficult to compete in world trade and hence causing a poor trade balance.

Stable prices allow market participants, both domestic and foreign, to make informed decisions and adjust their decisions about spending, saving and investing in welfare enhancing ways. Thus, it is necessary to maintain price stability through controlling its channels or sources that are responsible for inflationary impulse.

Given BNR's primary objective of price stability, the ability to predict the process of price adjustments is essential. From a policy perspective, an understanding of the interactions and transmission process between the main macroeconomic variables and prices serves to guide the process of policy formulation and implementation. In understanding and predicting inflation, it is necessary to understand the importance of shocks and their underlying processes. Critical elements of these are the persistent components such as external shocks, monetary shocks, and production shocks. This paper uses a VAR model to study how inflation responds to changes in various macroeconomic aggregates and other economic indicators in Rwanda

The rest of the paper is structured as follows: the second section gives a brief theoretical and empirical literature review on inflation. The third section entails an overview of past inflation behavior in Rwanda. Section four includes a theoretical demonstration of the VAR model and co-integration techniques used in this study. Section five summarizes unit root tests, co-integration, VECM results and impulse response functions. Section six attempts to use VAR model to forecast inflation. Finally, section seven highlights policy implications and conclusions.

II. REVIEW OF RELEVANT LITERATURE

2.1. Theories of Inflation determinants

The study about the causes of inflation has probably given rise to one of the most significant macroeconomic debates in the field of economics. The debates differ in their hypotheses, mainly due to a range of conventional views about the appropriate measure to control inflation and also due to the disparity between developed and developing countries.

In economic theory, causes of the rise in the general price level are essentially explained from two broad perspectives: demand-pull factors due to an increase in demand and cost-push factors due to an increase in the costs of factors of production. The causes of demand-pull inflation are related to excess demand resulting from the components of aggregate demand, namely, private consumption, investment, government expenditure and net exports (Golam M., 2006). Any factor that causes an

exogenous increase in any of these components will create excess demand. However, there exists a debate among economists about what actually triggers demand-pull inflation.

Monetarists argue that inflation is essentially a monetary phenomenon. Assuming that economic agents are rational, increases in the money supply leads to proportionate price increases, leaving the real money balances and out-put unchanged. They argue that money is a close substitute for real assets (such as houses and land,) and financial assets (such as bank deposits, treasury bills, bonds) and that any extra cash balances realised from increased money supply will be spent on those assets rather than held as idle money balances. This situation will give rise to excess demand for assets, which will cause prices to rise, thereby ultimately leading to increased inflation. Hence the monetarists model the mechanisms by which monetary policy affects inflation and how they can be used to control price inflation. This means that the rate of growth of the money stock is often exogenous hence inflation can result from increases in the money supply in excess of the desired real money (Mame.A, 2007)

Structuralists emphasize the role of supply-side constraints as a cause of monetary growth and hence a source of inflation. According to these structural models, inflation is often driven by bottlenecks in the real economy. This issue is mostly at hand in developing countries where food supply is relatively inelastic: This creates occasional excess demand that arise mainly from an increase in non-agricultural incomes that cannot be absorbed quickly to avoid price increases. Likewise, if there are restrictions on food imports in the economy, domestic supply shocks coming from droughts tend to lead to food shortages and price increases. Similarly, adjustments in wages in the labor market tend to influence inflation. If wages are indexed and monetary policy is accommodative, an initial increase in prices will lead to wage adjustments to compensate for the lost real income, reinforcing inflation inertia (Mame .A, 2007).

In developed countries, supply shocks are generally identified as the rise in world oil prices and increases in wage settlements that push up the costs of production. In contrast, along with higher oil prices and wages, factors such as a currency devaluation or depreciation, interest rate increase, indirect taxation or removal of subsidies are referred to as sources of cost push inflation in developing countries (Golam M. 2006).

Taslim (1982) pointed out two aspects of inflation in an open economy. One is the transmission of trading partner's inflation to the domestic economy and another is the impact of changes in the relative price of exports and imports, known as the terms of trade effect. An increase in the interest rate causes a rise in the cost of borrowing, which ultimately affects prices of the final goods. Natural calamities such as a drought or a flood as well as political instability can also create supply shocks in developing economies and, as a result, may cause inflation.

Other scholars argue that inflation is both a monetary, as well as cost-push-driven phenomenon .Durevall and Njuguna, (2001) postulate inflation in the context of purchasing power parity (PPP) type of theoretical framework. In this framework, inflation is postulated as a positive function of prices of traded goods (PT); prices of non-traded goods (PN); and controlled or regulated prices e.g. utility tariffs (PC). In this context, inflation is determined according to absolute PPP, in which prices for non-traded goods are approximated by excess supply of real money balances, prices of traded goods are approximated by prices of imported goods, and other cost-push measures are approximated by unit-labour costs (wages).

The role of inflationary expectations is also important in explaining inflationary process in a given period. If workers expect a rise in the inflation rate, they will demand higher nominal wage to keep their real wage stable. Once people come to expect high rates of inflation, the expectation alone will generate further inflation without any change in the existing labour market conditions (Taslim, 1982). In general, if there is a lack of confidence in monetary policy, inflationary expectations are likely to be self-fulfilling.

2.2. Empirical Literature on inflation determinants

There is a considerable body of empirical studies on inflation. These have adopted a variety of approaches when examining the causes of inflation. Some of these studies have attempted to estimate the causes of inflation from a structuralism and monetarist perspective. Chhibber et al (1989) developed a detailed econometric model for Zimbabwe, which includes both monetary and structural factors of inflation. The study shows that nominal monetary growth, foreign prices, exchange and interest rates, unit labour costs and real income are the determinants of inflation in that country.

Liu and Adedeji (2000) and Ubide (1997), are noted to have clear ideas about the determinants of inflation in developing countries. These studies stress money supply as the major source of inflation in the respective economies. For example, while explaining inflation in Iran, Liu and Adedeji (2000) found that an excess money supply generates an increase in the rate of inflation. The study also found a permanent rise in real income as an inflation reducing factor in the long-run through increasing the real demand for money. Even though, the study of Ubide (1997) had a similar result with regards to money supply, it stresses, basically, the combination of monetary policy with seasonal behaviour of agricultural production and a collection of irregular events corresponding to agro-climate conditions as the explanation for Mozambique's inflation pattern.

A study by Mame.A (2007), investigated the determinants of inflation in Mali. The study used a mixed monetarist-structural model and cointegration methods. An Error correction model was also used to find the short-run determinants of Mali's inflation. The study finds out that Mali's inflation is driven by monetary and external factors in both the short and long-run. It was observed that disequilibrium in the monetary market had lasting deflationary effects and disequilibrium in the tradable goods market had deflationary effects. More specifically, the study found out that increases in real income, exchange rate, and the deposit interest rate had a short-term inflationary impact but a rise in the discount rate was found to be lowering inflation. On the supply side, supply side constraints appeared to have inflationary impacts. Specifically an increase in average national rainfall substantially showed up to decrease inflation one quarter and two quarters later. Hence this study recommends policies to reduce food shortages and improve food security in Mali as an effective way to lowering inflation.

On the other hand, in investigating the relationship between money, prices, output and exchange rate in Bangladesh during the period 1974-92, Chowdhury et al. (1995) find that the inflationary process in Bangladesh cannot be explained exclusively by the monetarist or the structuralist factors. The paper noted that monetary shocks have a strong, but relatively short-run, impact on inflation, and therefore suggested that tight money may put a short-term dampening effect on inflation and help stabilize the foreign trade sector, but may also cause a slowdown in the economy. Using cointegration techniques, error correction models and, Akhtaruzzaman (2005) attempted to identify the variables that are believed to generate inflation in Bangladesh during the period 1973-2002. The paper observes that inflation is negatively related with real income. In addition, both the level and rate of the devaluation of exchange rate, growth of money supply and deposit interest rate have

statistically significant role in explaining the inflationary process in Bangladesh.

Elbadawi's (1990) research on inflation in Uganda revealed that rapid monetary expansion and the depreciation of the parallel exchange rate were the principal determinants of inflation in Uganda and generally supported the findings of Ghana by Chhibber and Shafik (1990) and Sowa and Kwakye (1991) that the influence of the official exchange rate was insignificant.

Tegene (1989) departed from the common application of an econometric model, and used Granger - causality tests in order to investigate the role of domestic money supply on inflation in six African countries. Evidence indicated a uni-directional causality from monetary growth to inflation in the sample countries. A similar analytical methodology was employed by Canetti and Greene (1991) on ten African countries during 1978-89, and the results are similar to that of Tegene (1989) that monetary growth (and the nominal exchange rate) had a significant causal influence on inflation. These findings also support the issue of the exogeneity of the money supply.

Adopting a VAR model to study inflation in Ghana, Mathew Kofi (2007) identified exchange rate, foreign prices and Terms of Trade as determinants of inflation in the long-run. This study hence failed to find evidence for the influence of excess money supply on inflation (in the long-run). In the short-run, inflation inertia, exchange rate, money growth and treasury bill rate were found to be important determinants of inflation.

In Tanzania, the results showed that inflation was more of a monetary phenomenon than a structural phenomenon i.e. Money supply measured by M2 was found to be highly significant compared to exchange rate and out-put effects (Samuel A. 2001). Lastly, Kihangire D. on the Ugandan case confirmed that inflation was more of monetary phenomenon than structural.

With regard to the above theoretical and empirical literature on inflation and for a broad analysis of inflation determinants in Rwanda, this study adopts a model that combines both structural and monetary factors that were found determining inflation. The study hypothesized that inflation in Rwanda is influenced by; money aggregate (M3), nominal exchange rate, GDP, oil price.

III. THE SCOPE AND NATURE OF INFLATION IN RWANDA

This section provides an analysis of trends in inflation since January 2004 to June 2010, with an emphasis on the major drivers of inflationary developments during this period. It is important to underscore that, since 1995, the National Bank of Rwanda (BNR) pursued a monetary targeting regime with broad money supply M_3 as a nominal anchor to achieve the objective of controlling inflation without any prejudice to growth. Specifically, the National Bank of Rwanda's definition of price stability is to maintain inflation at a single digit.

The official inflation rate in Rwanda is established through the Consumer Price Index (CPI), which can be explained in terms of a basket of goods and services consumed by the typical household. The CPI which measures price movements in this 'fixed' basket is monitored on a monthly basis by the National Institute of Statistics of Rwanda (NISR). The CPI weighting scheme which indicates the relative importance of each individual item covered in the 'fixed' basket of goods and services has been progressively constructed. It indicates the share of household spending on different items.

3.1 Composition and Structure of the Consumer Price Index

Since the expenditure pattern of consumers change over-time, the composition and structure of basket of goods and services for computing CPI in Rwanda has seen some changes. With some items gaining more weight and others reducing in weight. Comparing the weights of items in periods 2000/2001 and 2005/2006, the composition and weight of the basket of goods and services that determines inflation has seen some remarkable changes. The apparent dominance of the weight of food and beverage prices in the CPI basket has remained large. This situation lends credence to the key role of agriculture in price formation in the country. Consequently, factors affecting food prices dominate movements in the CPI. These factors include mainly agro climatic conditions, domestic inputs, and import prices, with rainfall playing a crucial role.

Table 1: Weights for Twelve COICOP Divisions – All Urban Index

COICOP DIVISION	Description	Weights 2000/2001	Weights 2005/2006
1	Food & Non Alcoholic Beverages	3709	3538
2	Alcoholic Beverages & Tobacco	221	240
3	Clothing & Footwear	500	377
4	Housing, Water, Fuel & Power	1579	2204
5	Furniture, Household Equipment & Household Maintenance	764	457
6	Health	708	163
7	Transportation	987	1189
8	Communication	37	288
9	Recreation & Entertainment	206	256
10	Education	432	331
11	Restaurants & Hotels	273	558
12	Miscellaneous Goods & Services	584	400
	Total	10,000	10,000

Source: NISR, 2006

3.2 Contributions of item categories to inflation

The contribution of an item to inflation is determined by the interaction between its share in total expenditure and the change in its price index for the period over which inflation is calculated. Precisely, it is the product of the item-category inflation rate and the item-category weight, with the weight being the updated relative importance where the all-items category weight is normalized to 100. A category with a high relative importance and whose price index has changed substantially in a given period is expected to make a relatively large percentage-point contribution to overall average inflation. Identification of the item categories that drive overall inflation and group-specific inflation is thus the focus of this section.

Evident from table 2 below, showing the distribution of category specific inflation and the weight of each category in the total basket of goods, the contribution of item specific inflation to overall inflation index has been at different levels with some items being major contributors to overall inflation

and others being minor. Food remains an outstanding inflationary item with a standard deviation in its own innovation of 8.9 and the highest weight of 35.38% followed by Housing, water, electricity and fuels with a standard deviation of 6.4 in own innovation and a weight of 22.04%.

Less inflationary items include; Health, recreation and culture, Education and clothing and footwear. Prices of these items have proven stable as expressed by the low standard deviation in their prices and the lower weights they hold in the Rwandan consumption expenditure patterns as revealed by the 2005 Rwanda Integrated household survey.

Table 2: Identification of Main potential contributors to overall average inflation

	Item	Min	Max	SD	Weight
01	Food and non-alcoholic beverages	-3.4	30.9	8.9	3 538
02	Alcoholic beverages and tobacco	1.1	35.5	9.6	240
03	Clothing and footwear	-2.3	7.2	2.4	377
04	Housing, water, electricity, gas and other fuels	-1.1	23.6	7.7	2 204
05	Furnishing, household equipment and routine household maintenance	-2.5	24.5	7.8	457
06	Health	-1.8	16.1	5.4	163
07	Transport	-2.3	29.5	6.9	1 189
08	Communication	-15.2	24.5	11.1	288
09	Recreation and culture	-5.9	8.0	3.5	256
10	Education	0.0	25.7	6.0	331
11	Restaurants and hotels	-2.9	34.1	8.4	558
12	Miscellaneous goods and services	-4.0	10.7	3.5	400
	General Index	1.9	22.3	5.1	10 000

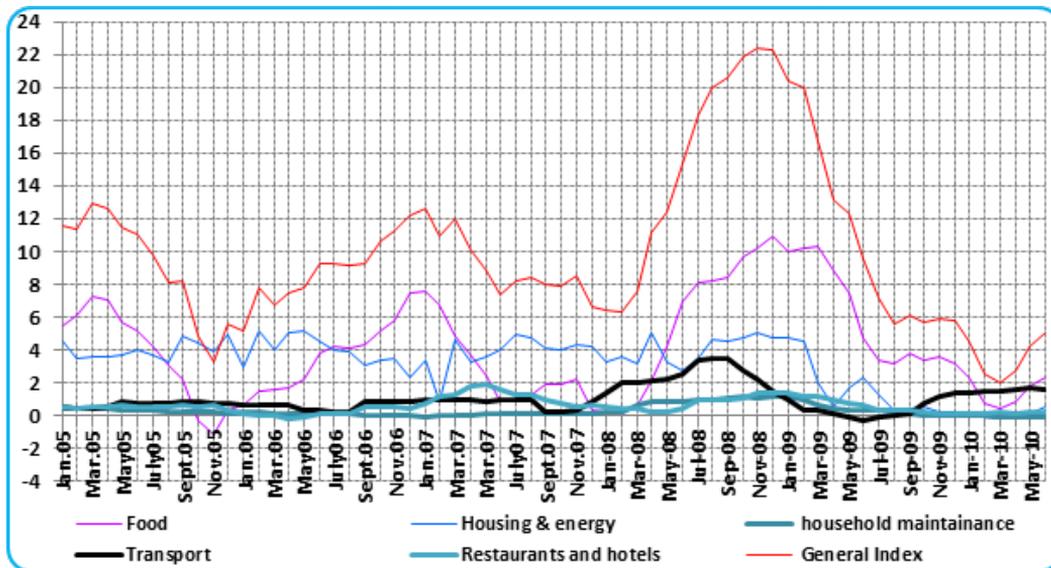
Although the table above gives some information on the item specific contribution to overall inflation index, it doesn't clearly show the exact estimate of category by category contribution to annual inflation. To obtain the percentage contribution of each category to overall inflation, we multiply the inflation rate of that category by its weight of that category and then plot the results as shown in figure 1 below.

The contribution of categories of items such as "Food and non-alcoholic beverage" and "Housing, water, electricity, gas and other fuels" to overall inflation level in the country continue to be dominant as clearly demonstrated in figure 1 below. It is clear that the cyclical pattern of overall inflation follows the trend of these two items' contribution to overall inflation.

The cyclical pattern depicted in figure 1 below shows three major inflation peaks notably; March 2005, January 2007 and finally November 2008. In all the inflation peaks identified in the period of study, food prices were the leading contributor. In fact, an increasing rate of the contribution of food prices to overall inflation can be observed; in the first peak of March 2005 the contribution of food was 7.2% out of 12.9% annual inflation, in January 2007 it was 7.6% out of 12.6% annual inflation and finally in November 2008 it became 10.2% out of 22.3 annual inflation rate. This increasing trend in the contribution of food to overall inflation points out the increasing elasticity of domestic prices to supply shocks in the economy.

In addition to food, energy and housing prices have contributed immensely to Rwandan inflation. Occasionally, this item has even triggered inflation hikes more than food. Evident in figure 1 below, the last three quarters of 2007 was characterized by low and stable food prices that contained Rwandan overall inflation to single digit throughout the year. In this period of time, the contribution of Housing and energy prices to overall inflation was significantly greater than any other item.

Figure 1: Contribution of Item Categories to Overall Annual Inflation (January 2005-June 2010)



Source: BNR, Research Department

3.3 Developments in Headline and Underlying Inflation (2004-2010)

There are two important measures of inflation computed by BNR and the Rwanda National Institute of Statistics. One measure is the year to year headline inflation which is defined as the percentage change in the national consumer price Index. The other measure of inflation is the underlying inflation rate which is defined as the rate of inflation excluding changes in fresh foods and energy prices.

Headline inflation rates can be volatile, often because of substantial movements in commodity or food prices. Such volatility in a key price index can make it difficult for policymakers to accurately judge the underlying state of, and prospects for, inflation. In this respect, the central bank of Rwanda in conjunction with the Institute of statistics have found it important to compute core inflation rates - excluding more volatile price changes namely; fresh foods and oil .

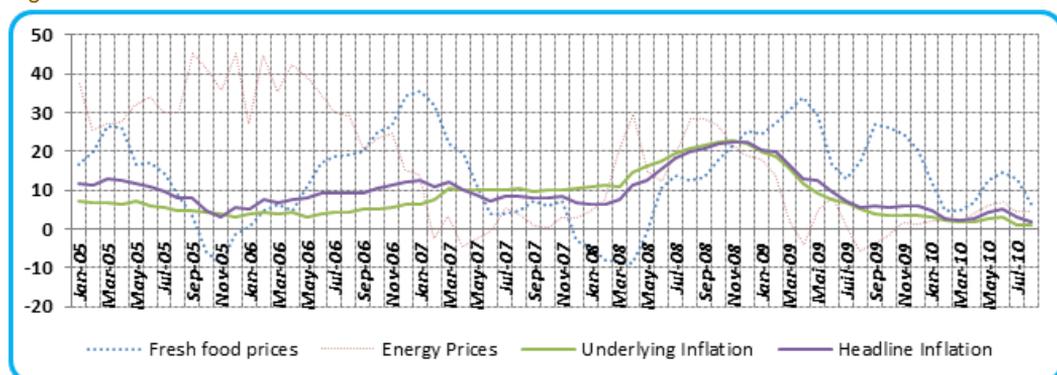
The economic argument for excluding these components from the calculation of headline inflation rates is that they are the ones most likely to be subject to disruptions in supply, as opposed to reflecting aggregate demand. In this case, and provided that the stance of monetary policy has not changed, the influence of such large, one-off price changes (either positive or negative) will fade over time. Hence, excluding them provides a better picture of existing underlying inflation pressures for monetary policy formulation.

Figure 2 shows a co-movement of Headline and underlying inflation in the period 2005-2009. It is visible that in the first two years of the period under review, that is 2005 and 2006, headline inflation was higher than underlying inflation. From the second quarter of 2007 throughout 2008, underlying

inflation rose more than headline inflation mainly because of lower international oil prices experienced in 2007 and good agricultural produce registered in 2008. The good agricultural performance of 2008 and the stable exchange rate worked to neutralize higher international commodity prices and oil prices that prevailed in 2008. The pass-through impact of oil prices to other commodity prices explains further why underlying inflation may have been over and above headline inflation in some periods under review.

The divergence between core and headline inflation also imply that seasonal bottlenecks in fresh food production coupled with patterns in international oil prices explain trends of Rwandan inflation than money supply. This indeed confirms other studies' empirical findings that inflation in developing countries is a structural phenomenon other than monetary phenomenon; the latter is indeed more relevant in developed countries.

Figure 2: Trends in Headline and Core Inflation



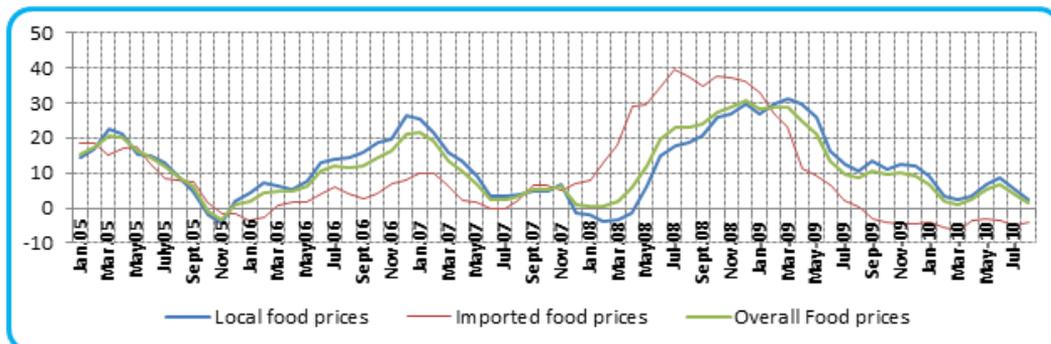
Source: BNR, Research Department

3.3.1 IMPORTED Vs LOCAL INFLATION

In assessing the nature and source of inflation patterns, it is imperative to distinguish between inflation originating from imported items and inflation on locally produced goods and services. Assuming a stable money supply in the economy, prices on imported goods are mainly affected by the exchange rate, oil prices (transport costs for a land locked country like Rwanda) and international commodity prices. Prices on locally produced goods normally stem from domestic supply. To categorise inflation by source, figure 3 attempts to show how imported and locally produced food prices have evolved since 2005.

Evident from the figure below, throughout 2008, imported food prices were escalating reaching a maximum increase of 40% in July 2008. This was geared by high global food prices that averaged 43 percent increase, as per IMF estimates and higher oil prices that reached \$147 per barrel in July 2008 (IIE, 2009). Rwanda producing much of its food and a good agricultural harvest of 2008 helped to mitigate the would have been food prices corresponding to global trends. Since 2009 to-date, imported food prices have been persistently falling reflecting global trends of falling global food prices and a stable Rwandan exchange rate.

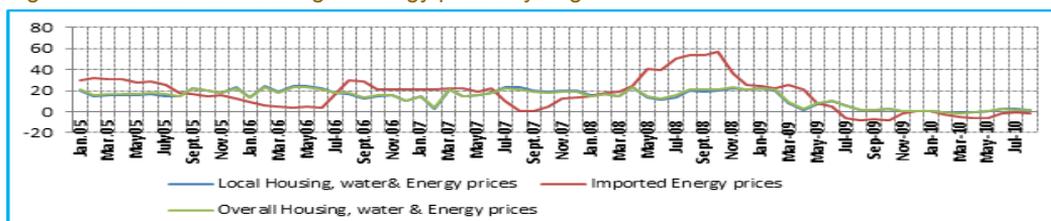
Figure 3: Variation in Food prices by Origin



Source: BNR, Research Department

The figure below displays a comparative view on how domestic and imported energy prices have evolved since 2005. The observed imported energy price surge in 2008 was mainly a reflection of a global oil price bubble where oil prices rose from \$92 a barrel in January 2008 to cross the \$140 a barrel mark in June and finally hitting a record high of \$147 a barrel on July 11, 2008 (11E, 2009). However since January 2009, imported energy prices have been gradually decreasing.

Figure 4: Variation of Housing & Energy prices by origin



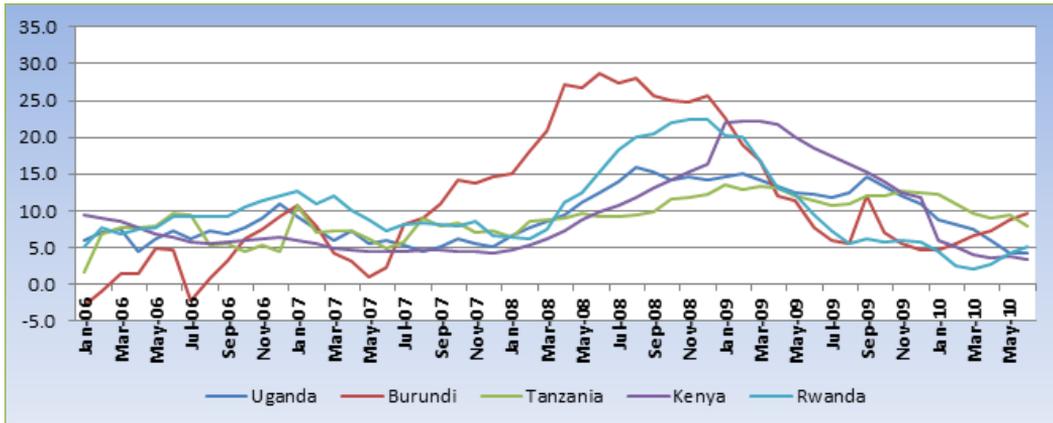
Source: BNR, Research Department

3.3.2 Benchmarking Rwandan Inflation rates to EAC rates

The Inflation target of 5% being one of the macroeconomic convergence criteria for EAC monetary union, there has been tangible achievement among all member states to meet that goal as demonstrated by overwhelmingly falling inflation rates since 2009 to-date. In a twelve month period i.e from the third quarter of 2006 to the third quarter 2007, Rwanda faced higher inflation pressures than any other member countries. However, after July 2007, Rwandan inflation fell to catch the levels of other EAC countries. Symmetric patterns in regional inflation can be observed throughout the period under review, particularly inflation taking similar trends in all countries albeit various degrees of variation.

In December 2008, inflation rate in Rwanda reached a maximum of 22.3%. Nonetheless, higher inflation was a common phenomenon in all EAC countries with Burundi the most affected with inflation rate of 25.66% in December 2008. In fact throughout 2008, inflation was high across all sub-Saharan Africa. For EAC countries as a group, annual headline inflation rose from 4 percent at the end of 2006 to 12 percent by mid-2008 (IMF, 2008). Meanwhile, measured by the U.S. dollar-denominated World Economic Outlook (WEO) indices, world prices for food in 2008 increased by about half and for fuel about two-thirds since January 2006. Therefore, higher global commodity prices and fuel prices were the primary factors behind inflation pressures experienced by all EAC countries in 2008.

Figure 5: Annual Inflation Developments in EAC member states



Source: BNR, Research Department

IV. EMPIRICAL METHODOLOGY

4.1 VAR Model Approach

Economic theories show that many variables do affect inflation, and are in turn affected by inflation. Thus, it is possible to identify a small set of economic variables which appear more correlated with inflation in Rwanda and as such may then be useful in forecasting future inflation. The Vector Autoregressive (VAR) approach provides a convenient means of accomplishing this, as it relies on the causal and feedback relation amongst variables. Forecasts from VAR models are quite flexible because they can be made conditional on the potential future paths of specified variables in the model.

When Sims (1980) first advocated for the use of a VAR in economics, it was in response to the prevailing orthodoxy that all economic models should be structural models, i.e., that they should include identifying restrictions. Instead, he argued for the use of an unrestricted VAR with no distinction being made in the model between endogenous and exogenous variables. The aim was to free-up econometric modelling from the constraints applied by economic theory and, in effect, to 'let the data speak' for themselves.

A p^{th} order Vector Autoregression (denoted as a VAR(p)) for N variables is defined as a set of equations where each variable depends on p lags of all N variables included in the model.

A VAR(p) is written as

$$Y_t = c + A_1 Y_{t-1} + A_2 Y_{t-2} + \dots + A_p Y_{t-p} + \varepsilon_t \quad (1)$$

where Y_t is the data matrix containing the N variables in the VAR. The matrices A_1 to A_p represent N x N matrices of coefficient on each lag of Y_t , c denotes the N x 1 vector of constants and $\varepsilon_t = (\varepsilon_{1t}, \dots, \varepsilon_{nt})'$ is an unobservable n-dimensional error process.

A VAR is said to be stationary if its mean and variance are constant over time

$$E(Y_t) = \mu$$

$$E(Y'_{t,Y_t}) = \Omega$$

Equation (1) can be written compactly as

$$Y^i = X_i + \varepsilon_i$$

Where $X = \{c_i, Y_{it-1}, Y_{it-2}, \dots, Y_{it-p}\}$

In other words, the VAR model can be written as;

$$\begin{pmatrix} Y^1 \\ Y^2 \\ \cdot \\ Y^i \end{pmatrix} = \begin{pmatrix} X & 0 & \cdot & 0 \\ 0 & X & \cdot & 0 \\ \cdot & \cdot & \cdot & \cdot \\ 0 & 0 & \cdot & X \end{pmatrix} \begin{pmatrix} A^1 \\ A^2 \\ \cdot \\ A^i \end{pmatrix} + \begin{pmatrix} \varepsilon^1 \\ \varepsilon^2 \\ \cdot \\ \varepsilon^i \end{pmatrix} \quad (2)$$

The coefficients of VAR model in equation (1) can be estimated using OLS for each equation of the VAR. This is in-turn equivalent to estimating each A_i in equation (2).

$$\hat{A}_i = (X'X^{-1})(X'Y^i)$$

4.2 Long-run equilibrium: Cointegration Analysis

The cointegration and Vector Error correction approach is good in assessing the long-run and short-run relationship between two or more time series. Individual economic variables may fluctuate violently but their linear combination may be tied together by economic forces and thus may fluctuate only moderately. To study the long-run relationship of variables under this study, we follow the Johansen procedure as demonstrated below;

Consider a VAR (vector autoregression) of order p:

$$y_t = \sum_{i=1}^p A_i y_{t-i} + Bx_t + \varepsilon_t \quad (3)$$

Where y_t is a k-vector of non-stationary I(1) variables, x_t is a d-vector of deterministic variables such as trend and constant, while ε_t is a k-vector of innovations. Equation (3) can be written as:

$$\Delta y_t = \Pi y_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta y_{t-i} + Bx_t + \varepsilon_t \quad (4)$$

Where $\Pi = \sum_{i=1}^p A_i - 1$, $\Gamma_i = - \sum_{j=i+1}^p A_j$

The number of cointegrating relations among the components of the vector y_t is represented by the rank of Π . If Π has rank $r < k$, then there exist $k \times r$ matrices, α and β each with rank r such that

$$\Pi = \alpha \beta' \text{ and } \beta y_t \sim I(0).$$

So, r is also called the cointegrating ranks, β is the cointegrating vector, and the components of α are the adjustment parameters. Johansen's method is to estimate the matrix Π based on an unrestricted VAR and to test the number of non-zero eigenvalues of Π (which equals r) applying trace or maximum eigenvalue statistics.

Cointegrated non-stationary variables require the inclusion of a vector of cointegrating residuals (adjustment matrix) in the VAR with differenced variables. This is known as a vector error correction model (VECM). This is necessary as the Granger representation theorem notes that cointegrated variables are related through an error correction mechanism.

In summary, we use a VAR model to study inflation in Rwanda. But we first assess the order of integration of variables, then assess cointegration among the variables (Long-run relationship) and short-run adjustments to retain the long-run equilibrium. Finally we analyze the dynamic relationship between inflation and hypothesized determinants (This is done by view of the impulse response functions and variance decompositions).

4.3 Variable selection and Model

From a literature survey, inflation is caused by both monetary and structural factors. In this study, we take a hybrid of both monetary and structural factors. As summarized in equation 5 below, the variables used are the logs of; CPI, GDP (captures structural factors), Nominal exchange rate, International oil price (captures imported inflation) and M_3 which (captures the monetary policy stance). Equation 5 below gives a composite of the variables used to model inflation in Rwanda. Other similar studies elsewhere included interest rates, but considering the previous studies on monetary policy transmission mechanism in Rwanda and preliminary tests done in this study, this variable was found irrelevant and hence dropped in this study.

$$CPI_t = f(M3, GDP, Exrate, lop, Inf_{t-1}) \quad (5)$$

Equation 6 below outlines the Equation of interest among the five VAR model systems equations.

$$CPI_t = \delta_0 + \sum_{i=1}^{k-1} \delta_{1i} CPI_{t-i} + \sum_{i=0}^k \delta_{2i} M3_{t-i} + \sum_{i=0}^k \delta_{5i} Exrate_{t-i} + \sum_{i=0}^k \delta_{6i} op_{t-i} + \sum_{i=0}^k \delta_{7i} gdp_{t-1} \quad (6)$$

Economic theory postulates that; an increase in money supply, exchange rate and oil price is expected to generate inflationary pressure; hence their coefficients were expected to have positive signs. On the other hand, coefficient for GDP was expected to possess negative signs. It is expected that a high inflationary rate for the previous period may be built into negotiations and thus result in an inflationary spiral. Therefore the sign for the coefficient of the lagged inflation was expected to be positive.

V. RESULTS

5.1: Data and Stationarity Test

The study used quarterly data. The time series data used ranged from 1997-2009. All data was subjected to unit root tests to detect the integration order of each series. We used ADF and PP tests methods. Eventually, by combining the ADF and PP procedure, it is likely to provide more clear-cut conclusion with regard to the order of integration for all of the series. Table 3 summarizes the outcome of the ADF and PP tests on all five variables in this study. The null hypothesis tested is that the variable under investigation has a unit root against the alternative that it does not. On level, the null hypothesis that each variable has a unit root cannot be rejected by both ADF and PP tests. However, after applying the first difference, both ADF and PP tests reject the null hypothesis. Hence implying that all variables used in this study are integrated of the same order which is order one I(1).

Table 3: Unit root test results

Variable	ADF Test			PP Test		
	Level	1 st difference	I(d)	Level	1 st difference	I(d)
LCP	-2.185	-5.148*	I(1)	-1.061	-5.669*	I(1)
LGDP	-2.703	-2.927**	I(1)	-1.393	-2.927**	I(1)
LM3	-1.849	-9.118*	I(1)	-1.686	-9.026*	I(1)
LEXRATE	-1.981	-2.369**	I(1)	-1.7980	-2.315**	I(1)
LIOP	-3.757	-5.553*	I(1)	-3.192	-5.157*	I(1)

(*) and (**) denote statistically significant at 1% and 5% significance levels respectively.

Given the fact that all series under ADF and PP stationary test are I(1), we proceed with integration identification between the variables to identify the level of co-integration using the Johansen-Juselius technique which is part of the VECM approach.

5.2: Cointegration results

A lag length of 1 was selected by help of information criteria like, AIC, SC, HQ. As per results in the table 4 below, Trace statistics indicate two cointegrating equation at 5% significance level. While the Maximum Eigen statistic show one cointegrating equation. Since the null hypothesis of $r = 1$ is marginally rejected under the trace test, it is reasonable to conclude that there is one clear cointegrating equation.

Table 4: Johansen co-integration results

Hypothesized		0.05	Trace	0.05
No.CE(s)	Max-Eigen statistic	Critical Value	Statistic	Critical Value
$r = 0$	35.24068**	33.87687	84.43874*	69.81889
$r = 1$	24.76154	27.58434	49.19807**	47.85613
$r = 2$	13.22210	21.13162	24.43653	29.79707
$r = 3$	9.384114	14.26460	11.21443	15.49471
$r = 4$	1.830316	3.841466	1.830316	3.841466

(*) & (**) Denotes statistically significant at 1% and 5% respectively

Many studies have used normalized co-integrating coefficients to interpret the long-run elasticity of dependent and its independent variables. Annex 7 provides details of the estimated normalized co-integrating coefficients of this study or the long-run relationship between the five variables used in the study.

The signs of all parameters of the long-run cointegrating relations are as expected, the magnitude of coefficients is reasonable and highly significant. In particular, the long-run equation in table 5 below means that a 1% increase in GDP would reduce inflation by 1.04%. This result conforms to economic theory that as GDP (or out-put) increases, excess demand reduces and prices fall. Similarly, a 10% depreciation of the Rwandan franc would provoke a 4.47% increase in prices. This result clarifies a positive relationship between depreciation of Rwandan francs and domestic prices. A 10% increase in M_3 would increase prices by 4.36%. Finally, a 10% increase in international oil prices would increase domestic prices by 0.4%. Evident in the long-run coefficients, GDP explains inflation more than any other variable, followed by Exchange rate and Money supply.

Table 5: Normalized cointegrating coefficients –Long-run Dynamics (standard error in parentheses)

CPI	GDP	EXRATE	M_3	IOP
1.000000	-1.047365	0.447228	0.435625	0.048938
(SE)	(0.09254)	(0.03537)	(0.09369)	(0.02447)
[t-value]	[-11.3183]	[12.6455]	[4.64982]	[2.00021]

5.3 Short-run dynamics: a vector error correction (VECM) model

Once the existence of co-integration test has been proved, the coefficients of the short-run relationship can be estimated using VECM approaches. Basically the VECM estimation is usually used to estimate the short-run dynamic relation between variables. In this study, a lag length of 1 was selected according to the minimum value of AIC. VECM results are given in table 6.

Table 6: Vector error correction estimates (Short-run dynamics)

Δ CPI	Constant	ect_{t-1}	Δcpi_{t-1}	ΔGDP_{t-1}	$\Delta Exrate_{t-1}$	$\Delta M3_{t-1}$	ΔIOP_{t-1}
	-0.02127	-0.318321*	0.55885*	0.714382	-0.120135	0.061441	0.017226
(SE)	(0.0082)	(0.11007)	(0.1372)	(0.13716)	(0.18521)	(0.07123)	(0.01900)
[t-value]	[-2.603]	[-2.89188]	[4.074]	[3.6521]	[-0.64864]	[0.86260]	[0.90648]

The error correction term coefficient shows the speed of adjustment of prices to return to equilibrium. This coefficient is statistically significant and with a negative sign. The VECM estimation result of this study indicates ect_{t-1} term with a negative sign of -0.31; and significant at 5%. The ect_{t-1} coefficient value indicates 31% of speed of adjustment to restore equilibrium condition in the long-run. This means that each quarter 31% of the errors will be corrected. Which ultimately means that for any shock, in around 10 months the long-run equilibrium would be re-established.

In the short-run, only lagged inflation has the expected sign that is significant. This highlights the prevalence of inflation inertia in Rwanda (i.e. inflation being explained by its previous values). This finding also confirms the relevance of ARMA model currently used in BNR's monthly and quarterly

inflation forecasting. Unexpectedly, GDP has a positive and significant sign in the short-run. The main reason for this may probably be unavailability of quarterly GDP data which propelled a disaggregation of annual GDP data to quarterly frequency to be able to use it in this study. Monetary policy variable (M3) has a positive but non-significant coefficient which confirms to economic theory that monetary policy does not affect prices in the short-run (because economic theory postulates that prices are sticky in the short-run) but instead affects out-put. In fact M3 proves in this study to affect prices in the long-run than in short-run. International Oil price and exchange rate poses non-significant coefficients.

5.4. Diagnostic Statistics of the model

We employed some important diagnostic test to prove the quality and stability of the model. The study has passed the Breusch-Godfred serial correlation test and Heteroskedasticity tests. Hence there is no evidence of serial correlation or heteroskedasticity problems in this model. The Jarque-Berra normality test confirms that the errors are normally distributed (see annex 1 to 5).

DIAGNOSTIC TESTS

Breusch-Godfrey Serial Correlation LM test	
White Heteroskedasticity test	359.21 [0.011]
Jarque-Bera Normality test	15.34 [0.120]
R-squared	0.98

5.5. Granger Causality Test (Causation Analysis)

After identifying the cointegration vector and VECM (showing the long-run and short-run relationship between inflation and its hypothesized determinants in this study), there is need to determine how these variables drive each other. To depict the causation among these variables, we use the granger causality test. From the granger causality results in the table 7 below, we observe that any changes in GDP would predict or cause changes in domestic prices with feedback impacts (i.e. the direction is bi-directional meaning that GDP causes CPI and CPI also Causes GDP. Exchange rate doesn't seem to cause CPI although CPI causes or predicts Exchange rate. Money supply (M_3) seems to cause CPI but CPI does not provoke and increase in M_3 . Finally, international Oil prices significantly predicts CPI.

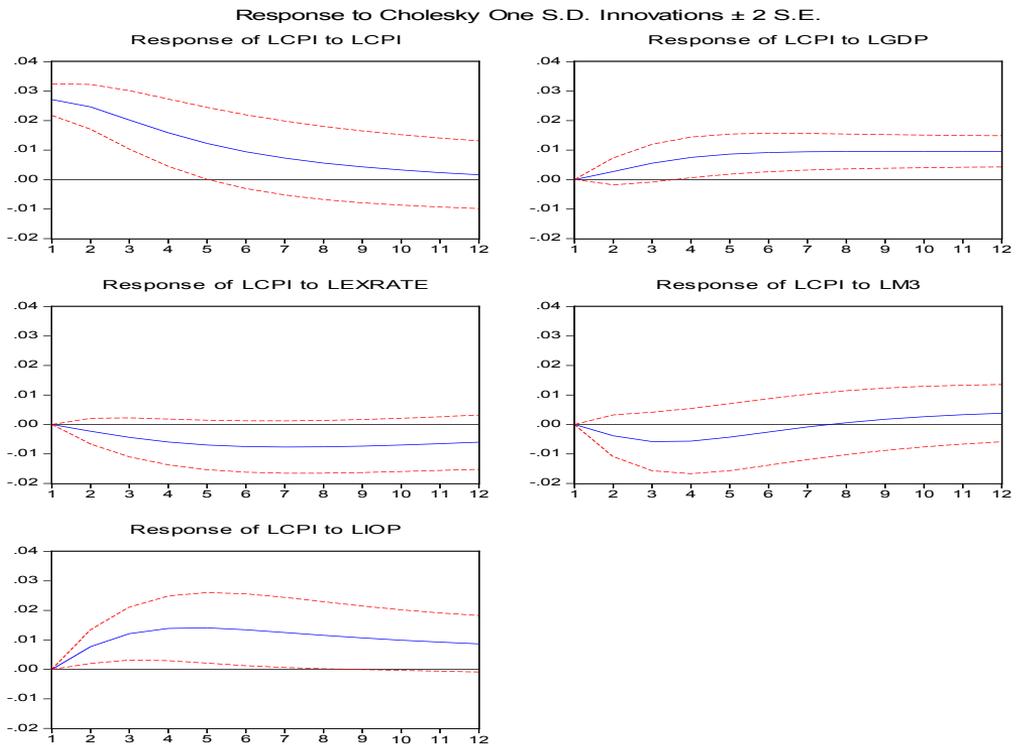
Table 7: Granger Causality Test

	<i>F-statistic</i>	<i>Probability</i>
GDP→CPI	F(4.41938)	0.0408
CPI→GDP	F(4.46733)	0.0398
EXRATE→CPI	F(2.00890)	0.1628
CPI→EXRATE	F(7.69983)	0.0078
M3→CPI	F(4.39056)	0.0414
CPI→M3	F(0.35516)	0.5540
LIOP→CPI	F(15.1631)	0.0003
CPI→LIOP	F(0.18801)	0.6665

5.6. Impulse response

The dynamic property of the model is tested using impulse response function and variance decomposition. Figure 6 below shows the response of the inflation rate measured by CPI to a one unit shock to the exchange rate, Money supply (M_3), International oil price, GDP, and inflation lag . The X axis gives the time horizon or the duration of the shock whilst the Y-axis gives the direction and intensity of the impulse or the percent variation in the dependent variable away from its base line level. The impulse responses of inflation due to a shock on international oil price meet a priori expectations in terms of the direction and significance level. A shock on international oil prices has immediate inflationary pressures that die out after six months. The graph below also depicts that a shock on M_3 (Money supply) would pose expansionary effects on inflation (positive response but not significant).

Figure 6: Impulse response functions between CPI inflation rate and selected variables



Variance Decomposition

Table 8 shows the variance decomposition. The statistics indicate the percentage contribution of innovations in each of the variables in the system to the variance of the CPI. The results show that shocks to the CPI itself and international oil price accounts for most of the variability in the CPI.

Table 8: Variance Decomposition of CPI (%)

Period	S.E.	LNCPI	LNEXRATE	LNGDPE	LNIOP	LN3
1	0.028778	84.66630	0.843299	13.87996	0.073483	0.536961
2	0.039685	77.50976	0.640088	14.87237	6.521492	0.456292
3	0.047764	68.78886	0.533871	15.10109	14.86754	0.708643
4	0.054086	60.91183	0.482995	15.06542	22.67453	0.865233
5	0.059067	54.40658	0.463628	14.96768	29.27526	0.886864
6	0.063009	49.21247	0.461194	14.87604	34.62009	0.830207
7	0.066157	45.12851	0.465746	14.80719	38.84207	0.756480
8	0.068711	41.94542	0.470343	14.76022	42.11493	0.709087
9	0.070827	39.47964	0.470660	14.72959	44.60823	0.711873
10	0.072620	37.57917	0.464872	14.70972	46.47307	0.773175

Cholesky ordering : LNIOP LNEXRATE LN3 LNGDPE LNCPI

VI. INFLATION FORECAST BY VAR MODEL

Vector Autoregressive (VAR) models provide a convenient and powerful tool for forecasting because each variable included in the VAR is endogenous i.e has an equation. The VAR, therefore, is able to forecast each variable included without requiring additional information. It is why the VAR models have been widely used to forecast inflation as they offer a good framework to forecast inflation taking into consideration different macroeconomic variables which intuitively contain information about inflation such as money aggregates, exchange rates and out output. After estimating a VAR model, e-views allows easily forecasting out of sample by using different specified VAR models.

For the moment we are only interested with the equation in which CPI is a function of Output proxied by GDP, nominal exchange rate, money supply (M_3) and international oil price. After making such an equation and solving it by choosing a simulation type and a solution sample, we forecast our independent variable (Log CPI). Since CPI forecasts are expressed in logarithm, we solve the logarithm equation to obtain CPI forecasts. The table below gives headline inflation forecasting in 2010 based on the VAR Model.

Table 9: Inflation forecasting

Period		Log CPI	CPI	Headline Inflation
2010	Q1	4.66	105.91	6.2
	Q2	4.68	107.87	8.0
	Q3	4.70	109.92	8.2
	Q4	4.72	112.10	7.7

The forecasts in table 9 above are consistent with the ARMA Model forecasts using data up to December 2009 which projected inflation to move around 7% in the last quarter of 2010. From these results, one wouldn't rule out the accuracy of the VAR model in forecasting inflation since throughout 2010 inflation has been abnormally reducing. Since we use dynamic forecasting, incorporating

the actual inflation figures for 2010 will improve the VAR model predictive power for 2011. In short, ruling out the 2010 data, the two models (ARMA & VAR) give almost similar results. Unlike in the ARMA model where monthly inflation data can be obtained, VAR model is not more practical to forecast inflation because we can't get data on all the variables used herein hence we can't obtain monthly forecasts.

VII. CONCLUSION AND POLICY IMPLICATION

The findings of this study include some useful results for policy purposes. Results prove a long-run relationship between inflation and its hypothesized determinants. Economic growth is a key inflation reducing factor. This is actually evidenced by prior descriptive assessment of inflation in Rwanda that showed a close link between inflation and agricultural harvest. However inflation in Rwanda has got monetary origin also as per the long-run co-integration results. Indeed monetary expansion would induce price increases in the long-run. This result is in conformity with economic theory that monetary policy impacts prices in the long-run rather than short-run. From a policy perspective this calls for BNR to continue taking appropriate policy measures to control money supply.

Furthermore, Exchange rate depreciation and International oil price have expansionary impacts on inflation. This result is consistent with historical trends observed in Rwanda e.g in 2008 when domestic prices responded to hikes in world oil prices increases. Rwanda has registered a stable exchange rate and as a net importing country, such a policy should continue prevailing to counteract imported inflation. In the short-run, only international oil prices explain inflation.

The dynamic property of the VAR model captured by impulse response functions and variance decomposition show that a shock on international oil price has got immediate impacts that can last for six months, and most of the innovations in CPI is explained by its self (highlighting the inflation inertia) and international oil prices. A shock on M3 portraying monetary policy stance has an expansionary inflation impacts although non-significant. Policy wise, BNR should monitor trends and perspectives in international commodity prices and pursue appropriate policy. In this regard, in conjunction with stakeholder ministries like MINECOM measures to mitigate a path-through of international oil prices should be adopted.

In terms of forecasting quality, the VAR model used in this paper is consistent with the ARMA Model forecasts mostly when the 2010 inflation data is not put into consideration. In the beginning of 2010, by use of ARMA Model, inflation was projected to move around 7% at the end of 2010 which is similar to VAR forecasts contained in this paper. However, taking into consideration inflation data up to October 2010, ARMA Model projects inflation to be around 1%.

This points out a unique inflation trend in 2010 that needs a thorough assessment of the reasons behind observed unusual low inflation in 2010. Finally the VAR model used in this study contain some limitations mostly concentrating on the frequency of data. Quarterly GDP data used herein is a disaggregated annual data which may cause some bias in terms of estimation and forecasting. Before a timely quarterly GDP is computed in Rwanda, ARMA model will serve as the best alternative to forecast short-term inflation. However a VAR model will supplement in empirically assessing the determinants of Inflation.

APPENDICES

Appendix 1: Lag length determination (VAR lag order selection criteria)

Endogenous variables: LCPI LGDP LEXRATE LM3 LIOP						
Exogenous variables: C						
Date: 11/11/10 Time: 14:36						
Sample: 1997Q1 2009Q4						
Included observations: 46						
Lag	LogL	LR	FPE	AIC	SC	HQ
0	163.4714	NA	7.00e-10	-6.890059	-6.691294	-6.815600
1	497.2705	580.5202	1.04e-15	-20.31611	-19.12351*	-19.86935
2	537.8000	61.67540	5.52e-16	-20.99130	-18.80489	-20.17226
3	556.5553	24.46339	8.03e-16	-20.71979	-17.53955	-19.52846
4	597.2609	44.24520	5.02e-16	-21.40265	-17.22857	-19.83901
5	670.1439	63.37660*	9.23e-17*	-23.48452	-18.31662	-21.54859
6	706.3124	23.58810	1.13e-16	-23.97010*	-17.80838	-21.66188*

Appendix 2 : VAR Residual Normality Tests

Component	Skewness	Chi-sq	df	Prob.
1	0.098549	0.082552	1	0.7739
2	-0.244131	0.506598	1	0.4766
3	0.320524	0.873251	1	0.3501
4	0.141393	0.169933	1	0.6802
5	-0.935073	7.432079	1	0.0064
Joint		9.064412	5	0.1065

Component	Kurtosis	Chi-sq	df	Prob.
1	2.213071	1.315923	1	0.2513
2	3.521686	0.578333	1	0.4470
3	2.018484	2.047171	1	0.1525
4	2.050932	1.914050	1	0.1665
5	3.444651	0.420143	1	0.5169
Joint		6.275619	5	0.2803

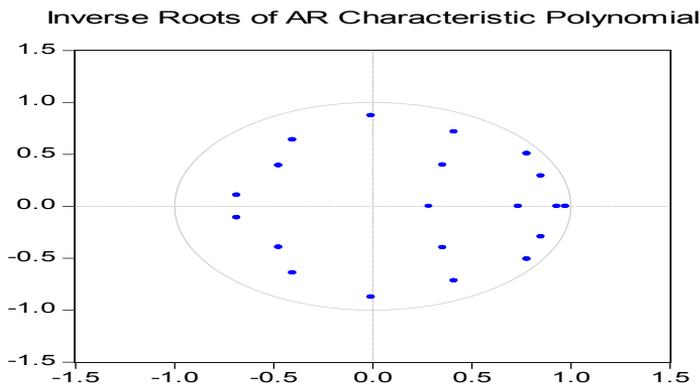
Component	Jarque-Bera	df	Prob.
1	1.398474	2	0.4970
2	1.084931	2	0.5813
3	2.920422	2	0.2322
4	2.083983	2	0.3528
5	7.852222	2	0.0197
Joint	15.34003	10	0.1201

Appendix 3: VAR Residual Serial Correlation LM Tests

Null Hypothesis: no serial correlation at lag order h		
Date: 11/11/10 Time: 14:42		
Sample: 1997Q1 2009Q4		
Included observations: 51		
Lags	LM-Stat	Prob
1	63.91876	0.0000
2	46.80568	0.0052
3	22.93398	0.5814
4	26.18782	0.3976
5	47.57026	0.0042
6	44.98507	0.0084
7	43.81709	0.0114
8	40.05777	0.0288
9	40.69382	0.0247
10	28.12098	0.3023
11	23.08168	0.5728
12	35.08492	0.0867

Probs from chi-square with 25 df.

Appendix 4: Stability Test



Appendix 5: VAR Residual Heteroskedasticity Tests: Includes Cross Terms

Sample: 1997Q1 2009Q4		
Included observations: 51		
Joint test:		
Chi-sq	df	Prob.
359.2185	300	0.0107

Appendix 6: Vector Autoregression Estimates

Sample (adjusted): 1997Q2 2009Q4					
Included observations: 51 after adjustments					
Standard errors in () & t-statistics in []					
	LCPI	LGDP	LEXRATE	LM3	LIOP
LCPI(-1)	0.860770 (0.10434) [8.24939]	0.081184 (0.05199) [1.56159]	-0.162790 (0.06096) [-2.67063]	-0.321498 (0.15730) [-2.04385]	-1.456725 (0.59362) [-2.45396]
LGDP(-1)	0.127753 (0.11609) [1.10050]	0.864565 (0.05784) [14.9478]	0.108029 (0.06782) [1.59299]	0.618556 (0.17500) [3.53456]	1.097898 (0.66043) [1.66240]
LEXRATE(-1)	-0.050863 (0.05227) [-0.97311]	0.070413 (0.02604) [2.70376]	0.937792 (0.03053) [30.7126]	-0.081923 (0.07880) [-1.03969]	-0.320482 (0.29736) [-1.07775]
LM3(-1)	-0.090120 (0.08021) [-1.12355]	0.060875 (0.03996) [1.52324]	-0.032148 (0.04686) [-0.68608]	0.518897 (0.12092) [4.29131]	-0.073100 (0.45633) [-0.16019]
LIOP(-1)	0.057251 (0.01753) [3.26513]	0.027287 (0.00874) [3.12344]	0.000653 (0.01024) [0.06373]	0.063219 (0.02643) [2.39167]	0.713601 (0.09975) [7.15367]
C	0.449699 (0.36902) [1.21863]	-0.379477 (0.18386) [-2.06394]	0.621304 (0.21558) [2.88208]	0.652831 (0.55630) [1.17351]	3.203844 (2.09940) [1.52607]
R-squared	0.988084	0.999417	0.995192	0.995241	0.939064
Adj. R-squared	0.986761	0.999352	0.994658	0.994713	0.932293
Sum sq. resids	0.037268	0.009251	0.012718	0.084695	1.206205
S.E. equation	0.028778	0.014338	0.016812	0.043383	0.163721
F-statistic	746.3165	15417.57	1862.852	1882.334	138.6951
Log likelihood	111.7813	147.3116	139.1960	90.84765	23.11497
Akaike AIC	-4.148287	-5.541630	-5.223372	-3.327359	-0.671175
Schwarz SC	-3.921014	-5.314357	-4.996099	-3.100085	-0.443902
Mean dependent	4.130608	5.637418	6.141465	5.182419	3.499397
S.D. dependent	0.250106	0.563162	0.230008	0.596631	0.629198
Determinant resid covariance (dof adj.)		1.44E-15			
Determinant resid covariance		7.70E-16			
Log likelihood		525.5895			
Akaike information criterion		-19.43488			
Schwarz criterion		-18.29851			

Appendix 7: Cointegration test

Series: LCPI LGDP LEXRATE LM3 LIOP					
Lags interval (in first differences): 1 to 1					
Unrestricted Cointegration Rank Test (Trace)					
Hypothesized		Trace	0.05		
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**	
None *	0.505799	84.43874	69.81889	0.0022	
At most 1 *	0.390570	49.19807	47.85613	0.0372	
At most 2	0.232366	24.43653	29.79707	0.1826	
At most 3	0.171122	11.21443	15.49471	0.1987	
At most 4	0.035944	1.830316	3.841466	0.1761	
Trace test indicates 2 cointegrating eqn(s) at the 0.05 level					
* denotes rejection of the hypothesis at the 0.05 level					
**MacKinnon-Haug-Michelis (1999) p-values					
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)					
Hypothesized		Max-Eigen	0.05		
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**	
None *	0.505799	35.24068	33.87687	0.0342	
At most 1	0.390570	24.76154	27.58434	0.1103	
At most 2	0.232366	13.22210	21.13162	0.4320	
At most 3	0.171122	9.384114	14.26460	0.2556	
At most 4	0.035944	1.830316	3.841466	0.1761	
Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level					
* denotes rejection of the hypothesis at the 0.05 level					
**MacKinnon-Haug-Michelis (1999) p-values					
Unrestricted Cointegrating Coefficients (normalized by b*S11*b=l):					
LCPI	LGDP	LEXRATE	LM3	LIOP	
35.01134	-36.66967	15.65806	15.25182	1.713401	
-9.187578	-2.862070	1.760068	8.512851	-1.968197	
-6.875785	1.990774	-3.108728	-2.331365	4.792378	
1.034507	-18.05482	-2.658581	18.36136	-1.927399	
-0.549887	-1.456927	4.844455	-1.971041	0.395821	

Appendix 7: Cointegration test

Series: LCPI LGDP LEXRATE LM3 LIOP					
Lags interval (in first differences): 1 to 1					
Unrestricted Adjustment Coefficients (alpha):					
D(LCPI)	-0.009092	0.006079	0.004898	-0.000997	-0.002248
D(LGDP)	0.002730	0.005882	0.000958	0.001683	0.000879
D(LEXRATE)	-0.002813	-0.001104	0.003836	0.003010	0.001129
D(LM3)	-0.003117	0.004050	0.003204	-0.015050	0.002883
D(LIOP)	-0.056934	0.057890	-0.050583	0.000160	0.007202
1 Cointegrating Equation(s):		Log likeli- hood	548.7577		
Normalized cointegrating coefficients (standard error in parentheses)					
LCPI	LGDP	LEXRATE	LM3	LIOP	
1.000000	-1.047365	0.447228	0.435625	0.048938	
	(0.09254)	(0.03537)	(0.09369)	(0.02447)	

Appendix 8: Vector Error Correction Estimates

Error Correction:	D(LCPI)	D(LGDP)	D(LEXRATE)	D(LM3)	D(LIOP)
CointEq1	-0.318321 (0.11007) [-2.89188]	0.095581 (0.06269) [1.52456]	-0.098500 (0.06809) [-1.44663]	-0.109148 (0.21691) [-0.50320]	-1.993352 (0.83062) [-2.39984]
D(LCPI(-1))	0.558858 (0.13716) [4.07440]	0.091956 (0.07812) [1.17707]	0.017178 (0.08485) [0.20246]	0.084414 (0.27029) [0.31231]	1.114374 (1.03503) [1.07666]
D(LGDP(-1))	0.714382 (0.19561) [3.65214]	0.507743 (0.11141) [4.55744]	0.000681 (0.12100) [0.00563]	0.423658 (0.38545) [1.09912]	-0.611475 (1.47604) [-0.41427]
D(LEXRATE(-1))	-0.120135 (0.18521) [-0.64864]	-0.048202 (0.10549) [-0.45694]	0.616377 (0.11457) [5.38010]	-0.250677 (0.36496) [-0.68686]	-2.237655 (1.39759) [-1.60109]
D(LM3(-1))	0.061441 (0.07123) [0.86260]	-0.022335 (0.04057) [-0.55055]	-0.020130 (0.04406) [-0.45689]	-0.312898 (0.14036) [-2.22930]	0.202966 (0.53748) [0.37762]
D(LIOP(-1))	0.017226 (0.01900) [0.90648]	0.025337 (0.01082) [2.34082]	0.001946 (0.01176) [0.16556]	0.108061 (0.03745) [2.88566]	0.157928 (0.14340) [1.10130]
C	-0.021269 (0.00817) [-2.60305]	0.016452 (0.00465) [3.53518]	0.005199 (0.00505) [1.02868]	0.031059 (0.01610) [1.92903]	0.049654 (0.06166) [0.80533]
R-squared	0.523265	0.625867	0.553990	0.281931	0.218447
Adj. R-squared	0.456744	0.573663	0.491756	0.181735	0.109393
Sum sq. resids	0.021252	0.006894	0.008132	0.082521	1.210103
S.E. equation	0.022231	0.012662	0.013752	0.043807	0.167756
F-statistic	7.866150	11.98875	8.901722	2.813805	2.003108
Log likelihood	123.1367	151.2812	147.1535	89.22120	22.08601
Akaike AIC	-4.645468	-5.771246	-5.606139	-3.288848	-0.603440
Schwarz SC	-4.377785	-5.503563	-5.338456	-3.021165	-0.335757
Mean dependent	0.014178	0.035186	0.012463	0.035514	0.028831
S.D. dependent	0.030162	0.019392	0.019289	0.048429	0.177760
Determinant resid covariance (dof adj.)		4.29E-16			
Determinant resid covariance		2.02E-16			
Log likelihood		548.7577			
Akaike information criterion		-20.35031			
Schwarz criterion		-18.82069			

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