

# The Dynamics of Goods and Services Inflation in South Africa: A VECM Approach<sup>1</sup>

- ❖ Central banks' primary responsibility has always been to protect the purchasing power of the currency by achieving and maintaining price stability. This has been achieved by assuming either an explicit or implicit inflation control target.
- ❖ For the South African Reserve Bank, the monetary goal is to keep the annual inflation rate, as measured by the headline CPI for all urban areas, within a target band of 3% to 6%. In trying to enhance the inflation debate, this paper investigates the dynamics of goods and services inflation in South Africa.
- ❖ Thus, the article models the relationship between goods and services inflation from 1980:1 to 2008:12 based on annual changes of the consumer price index (CPI) for metropolitan areas.
- ❖ The results indicate that for the period under consideration goods and services inflation have a unit root and are cointegrated series. Thus, the gap between the two series is mean reverting.
- ❖ These results form the basis for estimating a vector-error-correction model (VECM) that also helps in forecasting overall inflation for 2009.

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## International experience

- ❖ Worldwide, average inflation has dropped significantly over the past several decades.
- ❖ Goods inflation is normally well below services inflation
- ❖ Most industrialized countries (Euro zone, USA, Canada, Japan) have experienced rapid rise in prices of services than those of goods in the 1960s but the gap has widened in the latter years.
- ❖ So, growth in services prices outpaced growth in goods prices during periods when inflation was relatively high (1970s and 1980s) and also when inflation was relatively low (1960s and 1990s).
- ❖ The divergence in price movements has been persistent and independent of the level of inflation.
- ❖ Over a long period of time, changes in the prices of services relative to those of goods were positive, on average.
- ❖ Thus, the gap between the growth rates for the prices of goods and services components of the CPI should not be a cause of concern, since the gap appears to be independent of the trend in the development of the overall price level.
- ❖ That is, the widening gap is no worrisome as evidence shows that it is eventually reabsorbed.

## **Why have the prices of goods developed differently than the prices of Services?**

### ❖ Deterioration in the **accuracy of measured** services inflation

- Because production is not tangible in some sectors, it cannot easily be measured in quantifiable units (Maclean 1996).
- It is also difficult to measure quality improvements in the services sector as it depends on a number of factors (e.g. client's convenience).
- Methodologically consistent inflation data. Is CPI a better measure considering that historical data are not revised when measurement changes are introduced into current data.

### ❖ **Increase in productivity growth**

- There is more room for productivity growth in the production of goods than in labour-intensive services.
- As productivity increases in the goods sector, goods prices will decline relative to services prices.

### ❖ **Increased openness of trade**

- Since goods are more tangible than services, international trade is more focused on goods than on services.
- Thus, there is more competition in the goods market thereby limiting price increases in the goods sector than in services sector.

- If productivity in the country's goods sector is growing faster than it is in other countries, real exchange rate of the country will tend to appreciate.
  - Where a country benefits from productivity growth in the goods sector, a currency appreciation will exacerbate the gap in the growth of prices between the goods and services sectors.
- ❖ Growing demand for services
- Rising in demand for services in industrialized countries can be explained by various factors:
    - Aging population
    - Income effect is stronger than the price effect. Even expensive services will be insignificant as larger share of income continue to be devoted to leisure, education, personal services, insurance, financial services, etc.

# South Africa's Goods and Services inflation

Figure 1: Goods and Services Inflation

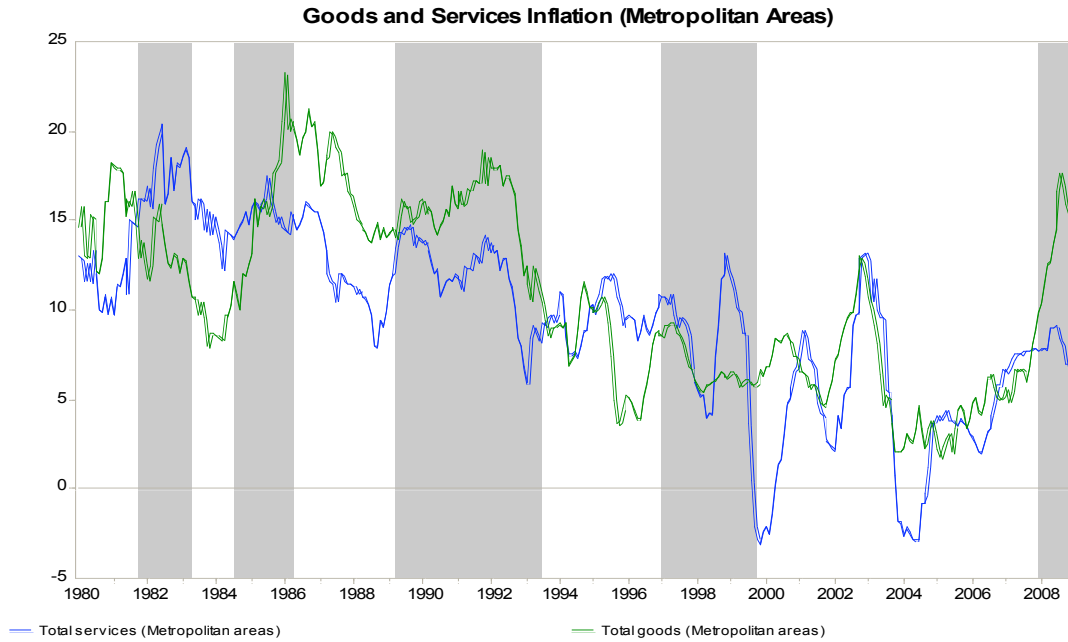
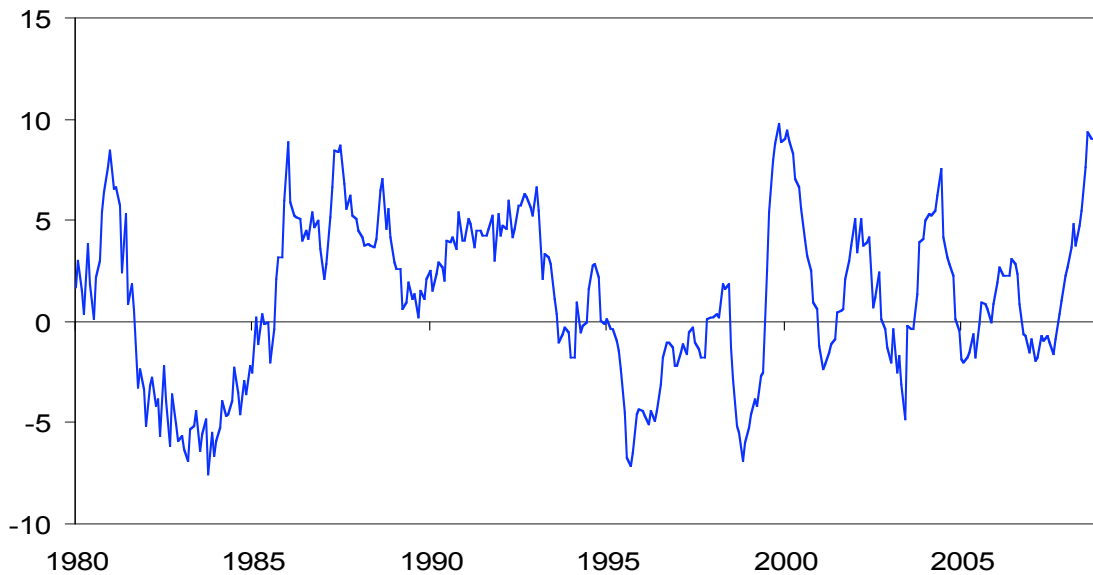
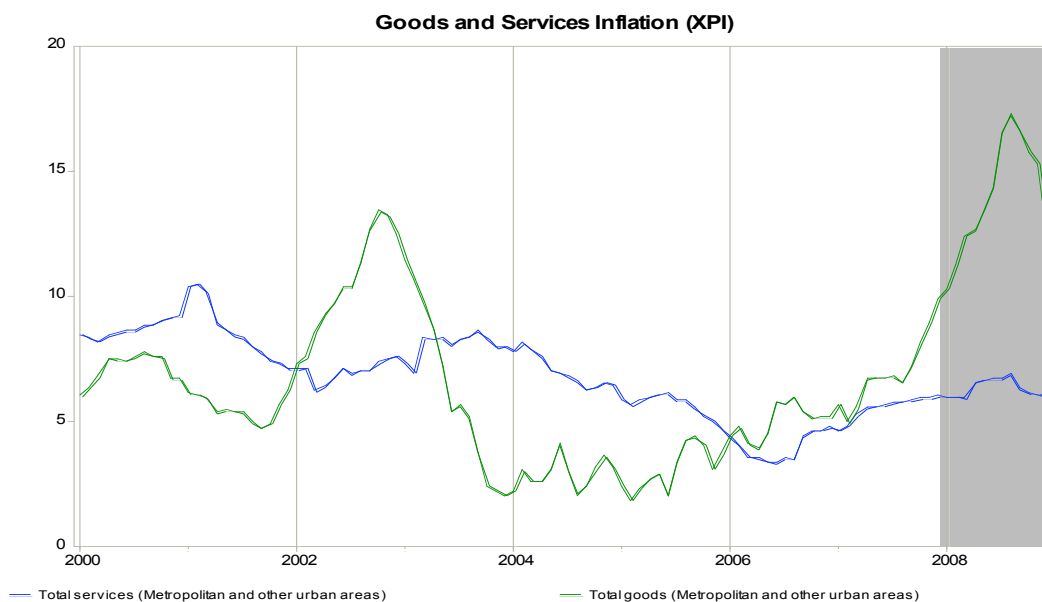
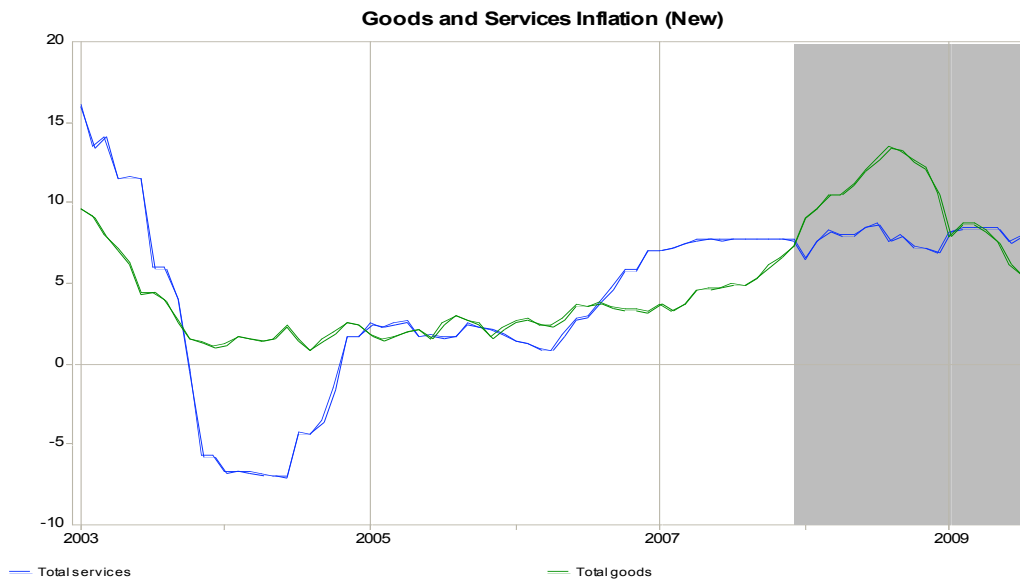


Figure 2: Gap between goods and services inflation



- Trend does not necessarily resemble that of the industrialized countries.
- Local goods and services inflation has been affected by price behaviour of other components such as interest rates and petrol prices.

**Figure 3: Goods and Services inflation**



**Table 1 Average annual change in Consumer price index**

	<b>CPI</b>	<b>Goods</b>	<b>Services</b>	<b>Services (XPI)</b>
<b>1980 - 2008</b>	14.6	13.9	15.0	
<b>1980 – 1990</b>	9.5	8.9	10.0	
<b>1990 – 2000</b>	6.0	4.9	6.9	
<b>2000 – 2008</b>	10.3	9.7	10.8	6.8

*Source: Statistics South Africa*

**Table 2 Annual changes in Consumer price index**

	<b>CPI</b>	<b>Goods</b>	<b>Services</b>	<b>Services (XPI)</b>
<b>1980</b>	13.6	11.5	14.6	
<b>1985</b>	16.3	15.8	16.5	
<b>1990</b>	14.3	12.2	15.4	
<b>1995</b>	8.7	10.8	7.5	
<b>2000</b>	5.3	2.4	7.9	8.7
<b>2005</b>	3.4	3.8	3.2	5.6
<b>2008</b>	11.5	8.0	14.2	6.3

*Source: Statistics South Africa*

## Stationarity and Cointegration tests

- ❖ Aim is to investigate the stationarity properties of goods and services inflation that relate to persistence in their movements.
- ❖ Consider the possibility that the series share a common stochastic trend and display a long-run equilibrium relationship.
- ❖ The empirical framework is consistent with the idea that goods and services inflation are linked through the effects of monetary policy.
- ❖ That is, although goods inflation and services inflation may experience permanent increases (decreases) due to episodes of expansionary (contractionary) monetary policy, the changes are of the same magnitude.

We apply the augmented Dickey-Fuller (1979) unit-root tests to individual inflation series based on the following regression:

$$\pi_t = \alpha + \rho\pi_{t-1} + \sum_i \delta_i \Delta\pi_{t-i} + \eta_t \quad (1)$$

Where  $\{\eta_t\}$  are mean-zero, serially uncorrelated innovations.

**Table 3: ADF Unit Root Tests for Stationarity**

$$\pi_t = \alpha + \rho\pi_{t-1} + \sum_i \delta_i \Delta\pi_{t-i} + \eta_t$$

Measure	$\pi^{Goods}$	$\pi^{Goods}$
Sample period	1981:5 – 2008:12	1981:4 – 2008:12
<b>ADF t*</b>	<b>-1.80</b>	<b>-1.14</b>
1% critical value	-3.44	-3.44
5% critical value	-2.86	-2.86
10% critical value	-2.57	-2.57
Lag length	12	11

$$\Delta\pi_t = \alpha + \rho\pi_{t-1} + \sum_i \delta_i \Delta^2\pi_{t-i} + \eta_t$$

Measure	$\pi^{Goods}$	$\pi^{Goods}$
Sample period	1981:5 – 2008:12	1981:4 – 2008:12
<b>ADF t*</b>	<b>-5.04</b>	<b>-7.03</b>
1% critical value	-3.44	-3.44
5% critical value	-2.86	-2.86
10% critical value	-2.57	-2.57
Lag length	12	11

The number of lagged first differences of inflation is selected using the Akaike Information Criterion (AIC).

- ❖ The thought of the existence of a long-run relationship between goods and services inflation lead to the application of cointegration to take advantage of the interpretations of the results.
- ❖ We apply to maximum-likelihood procedure presented by Johansen (1988, 1991). The testing procedure relies heavily on the relationship between the rank of a matrix and its characteristic roots.
- ❖ Johansen procedure can also be viewed as a multivariate generalization of the ADF test for unit root.
- ❖ That is, if goods and services inflation are cointegrated, deviations from the estimated long-run relationship should not be persistent.
- ❖ Thus, a linear combination  $\pi_t^{Services} - \alpha - \pi_t^{Goods}$  should produce a stationary error term.
- ❖ Johansen procedure and the corresponding test statistics entail identifying the number of cointegrating equations in a system of n variables.

**Table 4: Johansen Cointegration Rank Tests**

$$\pi_t^{Services} = \alpha + \beta \pi_t^{Goods} + \varepsilon_t$$

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.050314	22.78202	20.26184	0.0220
At most 1	0.014687	5.074854	9.164546	0.2753
		Max-Eigen Statistic		
None *	0.050314	17.70717	15.89210	0.0257
At most 1	0.014687	5.074854	9.164546	0.2753

- ❖ There exists a stable gap between goods and services inflation

## Gap between Goods and Services Inflation

- ❖ Since the gap exists, we can introduce an error-correction term that represents the short-run deviations of the gap from its long-run relationship. That is, we can now provide a broader characterization of the dynamic relationship between goods and services inflation.

The vector error-correction model for goods and services inflation is presented as:

$$\Delta\pi_t^{Goods} = \lambda_{10} (\pi_{t-1}^{Services} - \alpha - \beta\pi_{t-1}^{Goods}) + \sum_i \gamma_i^{11} \Delta\pi_{t-i}^{Goods} + \sum_i \gamma_i^{12} \Delta\pi_{t-i}^{Services} + \varepsilon_{1t}$$

$$\Delta\pi_t^{Services} = \lambda_{20} (\pi_{t-1}^{Services} - \alpha - \beta\pi_{t-1}^{Goods}) + \sum_i \gamma_i^{21} \Delta\pi_{t-i}^{Goods} + \sum_i \gamma_i^{22} \Delta\pi_{t-i}^{Services} + \varepsilon_{2t}$$

Where  $\varepsilon_{1t}$  and  $\varepsilon_{2t}$  are mean zero, serially uncorrelated random disturbance terms.

- ❖ VECM incorporates a role of the gap between goods inflation and services inflation.
- ❖ Goods inflation and services inflation change in response to random shocks ( $\varepsilon_{1t}$  and  $\varepsilon_{2t}$ ) and to the term  $\pi_t^{Services} - \alpha - \pi_t^{Goods}$  that represents previous period's deviation from long-run equilibrium.
- ❖ Ceteris paribus, if the error-correction term equal zero, there would be no need for either inflation series to adjust from its current level.
- ❖ Error-correction term also allows analysis of the behaviour of the gap between goods and services inflation over some historical episodes.

**Table 5: VECM for Goods and Services Inflation (1980:4 – 2008:12)**

Equation	RHS Variables						
$\Delta\pi^{Goods}$	$\alpha$	$\beta$	$\lambda_{10}$	$\gamma_1^{11}$	$\gamma_2^{11}$	$\gamma_1^{12}$	$\gamma_1^{12}$
$R^2 = 0.028$	1.803	-1.337**	-0.005**	0.122**	0.017	0.086*	-0.035
	(3.107)	(0.287)	(0.010)	(0.055)	(0.056)	(0.049)	(0.048)
$\Delta\pi^{Services}$	$\alpha$	$\beta$	$\lambda_{20}$	$\gamma_1^{21}$	$\gamma_2^{21}$	$\gamma_1^{22}$	$\gamma_2^{22}$
$R^2 = 0.111$	1.803	-1.337**	0.038**	0.171**	0.035	0.094*	0.180**
	(3.107)	(0.287)	(0.012)	(0.060)	(0.061)	(0.053)	(0.052)

*\*\* , \* denotes rejection of the hypothesis at 5 and 10 per cent, respectively*

- ❖ Error-correction term is statistically significant in each equation.
- ❖ The coefficients of the error-correction term are of opposite signs, which offer clear insight into the adjustment process for each inflation series.
- ❖ That is, a value of the gap above (below) its long-run equilibrium in one quarter will produce upward (downward) pressure on goods inflation and downward (upward) pressure on services inflation in the subsequent quarters.
- ❖ There is evidence to suggest that services inflation responds to changes in goods inflation in the previous quarter and its own changes during the previous two quarters.
- ❖ Goods inflation responds to changes on its own and services inflation in the previous quarter.

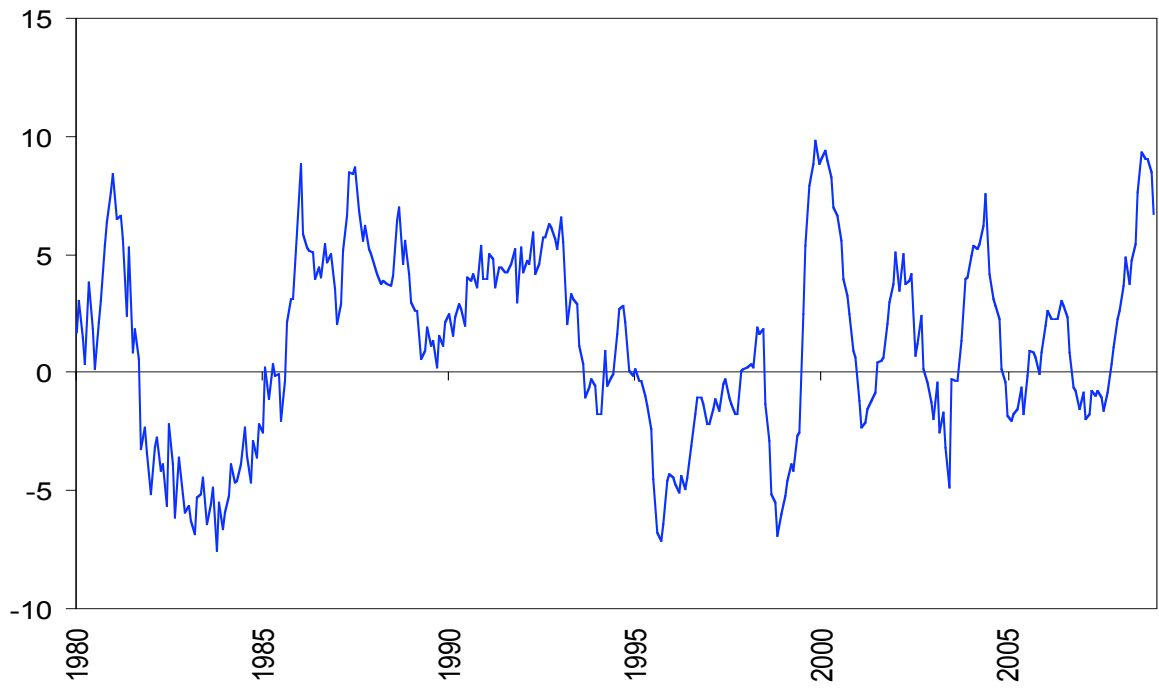
**Figure: Estimated gap between goods and services inflation (1980:4 – 2008:12)**

- ❖ Chart plot the estimated gap between goods and services inflation

$$\pi_t^{Services} - \hat{\beta}\pi_t^{Goods}$$

- ❖ The behaviour of the estimated correspond to measured gap between goods and services inflation.

**Thank you!**



**Figure: Residual plot**

