Anchoring Growth and Employment: The Interaction between Manufacturing and Services in South Africa

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Abstract

Manufacturing has been identified as a key marker for growth and employment driver in South Africa. Yet the sector itself is no longer a major source of employment creation internationally. Using cointegration, this paper assesses the relative importance of manufacturing and service sectors in achieving long term growth and employment objectives in South Africa. The study finds that both variables are positively related in both sectors of the economy in the long run. However, the elasticity of employment with respect to real output in the services sector appears to be greater than that of manufacturing. For every 1% increase in real output in the services sector, employment increases by 0.86% compared to 0.6% in the manufacturing sector. It suggests that future growth and employment potential of manufacturing requires a structural shift towards more value-adding and labour-intensive manufacturing sectors which are more pro-poor. While a more rapidly growing community, social and personal services, business services as well as wholesale and retail services sub sectors can unlock the future growth and employment potential of services.

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1 Introduction

South Africa has one of the highest unemployment rates, one of the lowest labour force participation rates, and exhibits one of the highest income inequality in the world. One in four South Africans in the labour force are currently unemployed. Of worrying also is that unemployment is highly concentrated among the youth, with 50 per cent of the youth remaining unemployed. In addition, labour force participation at 55 per cent is very low in international comparisons. The low share of individuals who are gainfully employed is one contributing factor to South Africa being one of the most unequal societies in the world as measured by the Gini coefficient, which is currently over 0.65. Episodes of elevated growth have not been sufficient to establish a declining trend in unemployment.

The New Development Plan (NDP), consistent with the New Growth Path (NGP) seeks to promote sustainable growth, employment and equity. It recognises that the needed large scale job creation requires tackling growth constraints. Meanwhile, in South Africa, manufacturing has been seen as key for development as well as employment driver. According to government's Industrial Policy Action Plan (IPAP), long term development needs to be underpinned by higher growth in production, led by the manufacturing sector.

Yet manufacturing itself is no longer a major source of employment creation internationally. There are three reasons for this provided in the literature. First is that final demand will increasingly shift to services as income grows, thereby raising the share of employment in service industries (Colin Clark, 1951). Second is that the shift will result in greater productivity growth and competitiveness (Baumol, 1967, 2001). The final explanation of the rising share of employment in the service sector focuses on the inter-industry division of labour; arguing that manufacturing industries increasingly outsource their service activities to firms specialized in the provision of such services.

Drawing on this, the interaction between manufacturing and services has serious implications for the country's industrial strategy, and would therefore need to be carefully explored. This paper investigates which sectors could make the greater contribution to future economic growth and employment in South Africa, identifying where the country can have greatest success in capturing high value opportunities based on its key strengths and capabilities. Cointegration analysis is used to estimate the long run relationship between output and employment for South African manufacturing and services sectors.

The rest of the paper is organised as follows. Section 2 sets out certain characteristics of South African manufacturing and service sectors and the ways in which both sectors have evolved in response to increased globalisation. Section 3 discusses the empirical specification. Section 4 presents the results. Finally, section 5 concludes.

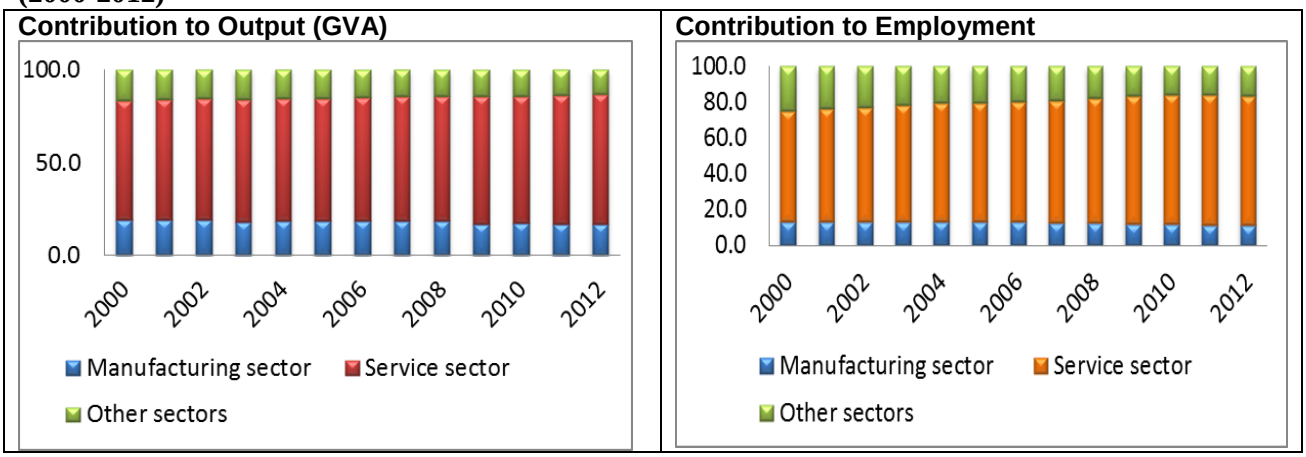
2 South African Manufacturing and Service Sectors: A Synopsis

This section provides some trends between real value-added output, employment, productivity and net export for South African manufacturing and service sectors. The goal is to gain some insights into possible growth and employment driving sector that may emerge from the data. It also offers some background information on the way in which both sectors have evolved in response to increased globalisation.

2.1 Output and employment

As with developed economies, there has been a marked shift in the structure of South African economy away from manufacturing towards services. This is illustrated in Figure 1. Over time, the shift has been driven by the more rapid growth of services sectors, rather than a contraction in manufacturing output.

Figure 1: GVA and Employment for South African Manufacturing and Service Sectors (2000-2012)



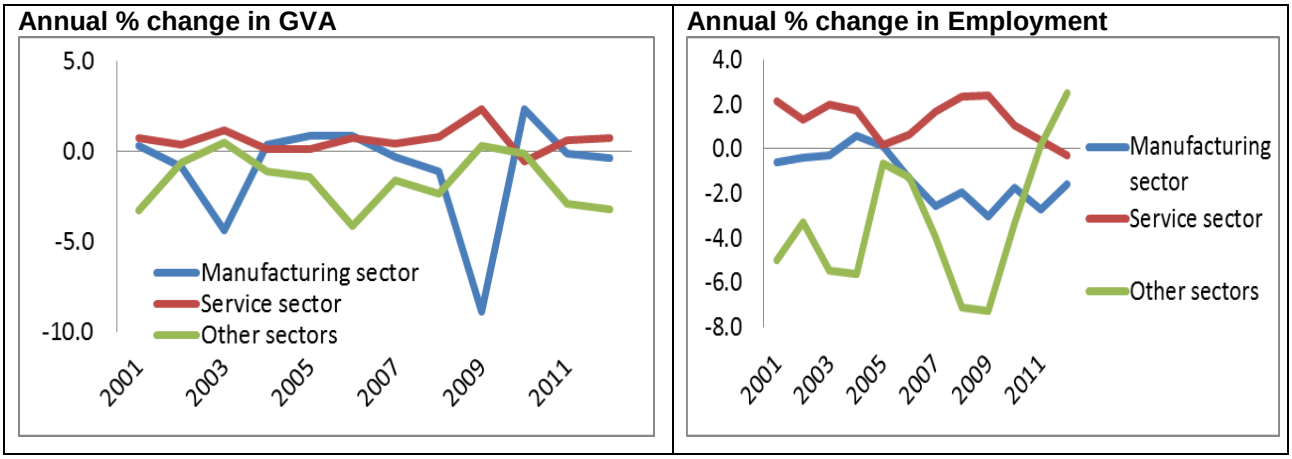


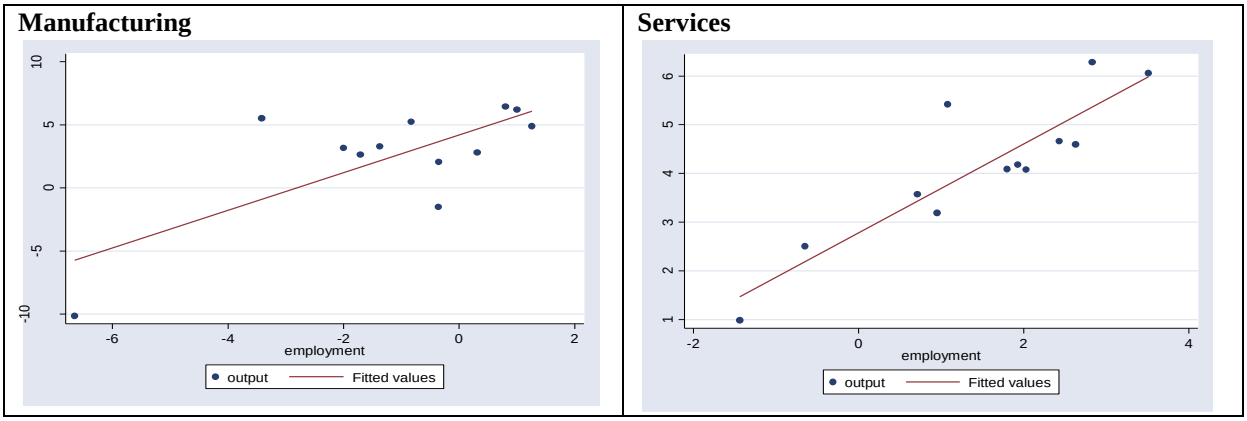
Table 1 provides a more detailed breakdown of the contribution of different sectors to the South African economy. Between 2000 and 2012, business services, community services and wholesale and retail trade accounted for about 50 per cent of the South African output and 60 per cent of total employment. By comparison manufacturing contributed 18 per cent and 13 per cent to total output and employment respectively.

Table 1: Contribution to the South African economy by sector (average, 2000-2012)

		Output (GVA)			Employment		
Sector	Sub-sector	Rb	% share	Change in share	Thous	% share	Change in share
Manufacturing sector	Basic chemicals	13.6	0.9	-2.3	20	0.2	-1.1
	Basic iron and steel	14.6	1.0	1.8	48	0.5	0.9
	Basic non-ferrous metals	9.4	0.6	-3.8	21	0.2	-0.3
	Machinery and equipment	13.5	0.9	2.4	108	1.1	1.5
	Food beverages and tobacco	45.7	3.1	-1.4	226	2.2	-1.8
	Electrical machinery and app.	7.3	0.5	-0.7	38	0.4	-0.6
	Furniture	3.1	0.2	0.7	41	0.4	-2.0
	Glass and glass products	2.0	0.1	0.0	12	0.1	-1.5
	Motor vehicles, parts and access	21.4	1.5	0.7	100	1.0	-2.1
	Paper and paper products	9.3	0.6	-1.7	27	0.3	2.3
	Textiles, clothing and leather	11.1	0.8	-1.8	140	1.4	-5.2
	Plastic products	8.3	0.6	-2.7	46	0.5	-2.7
	Other manufacturing	104.4	7.2	-0.8	441	4.4	-0.4
Service sector	Business services	207.2	14.2	1.8	1 439	14.2	3.2
	Community, social and personal serv	312.7	21.5	-0.6	3 168	31.4	1.2
	Finance and insurance	114.2	7.8	2.9	258	2.6	0.2
	Wholesale and retail trade	186.7	12.8	0.1	1 423	14.1	1.0
	Other services	158.3	10.9	1.0	560	5.5	-0.4
Other sectors	Other sectors	214.7	14.7	-1.7	1 987	19.7	-3.4
	Whole economy	**1 457**	**100.0**		**10 102**	**100.0**	

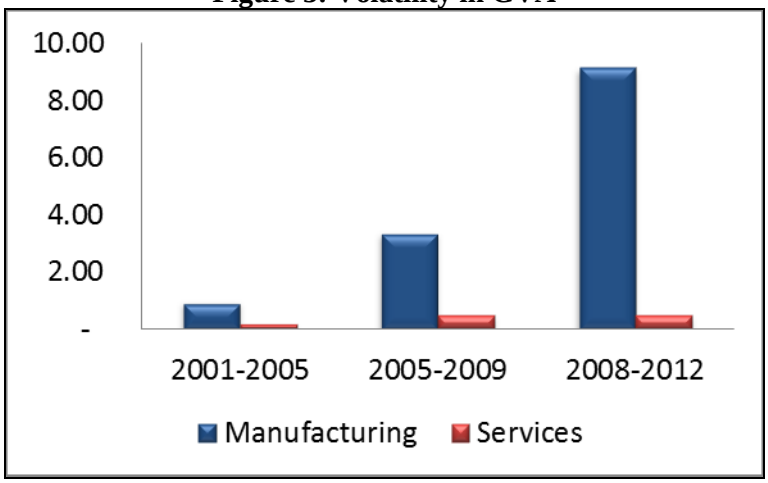
Although the manufacturing sector's contribution to growth and employment is low compared to services, Figure 2 shows that both sectors exhibited a strong positive correlation in both output and employment.

Figure 2: Correlation between output and employment (2001-2012)



Evidence suggests that pro-poor growth seems to coincide with low variability in output and vice-versa. Figure 3 presents the data for manufacturing and services, using a coefficient of variation.[3] Manufacturing output was highly volatile, compared to services. The volatility is traced to the nature of growth, which is led by commodity exports and the exogenously given prices. While the processes of globalisation introduced many opportunities to developing countries, it also made markets more vulnerable and introduced many economic shocks.

Figure 3: Volatility in GVA



2.2 Productivity

The two main measures of productivity commonly used are average labour productivity (ALP) and total factor productivity (TFP).[4] Figure 3 shows that in general, manufacturing

[3] The volatility is explained by the coefficient of variation in GVA growth, measured by standard deviation over mean (σ / μ).

[4] ALP is a measure of the value of output generated per employee or hour worked; whilst TFP is a measure of the additional value of output generated after accounting for changes in their raw inputs used (materials, capital, labour etc.). In principle TFP is a better measure of true productivity performance as it controls for a number of

have higher labour productivity than services (with notable exceptions of finance and insurance), particularly in basic chemicals, basic non-ferrous metals, and paper and paper products. Consistent with Figure 4, Figure 5 shows that the service sector lags behind manufacturing sector in total factor productivity, particularly in the recent period.

Figure 4: South Africa GVA per worker (2000-2012)

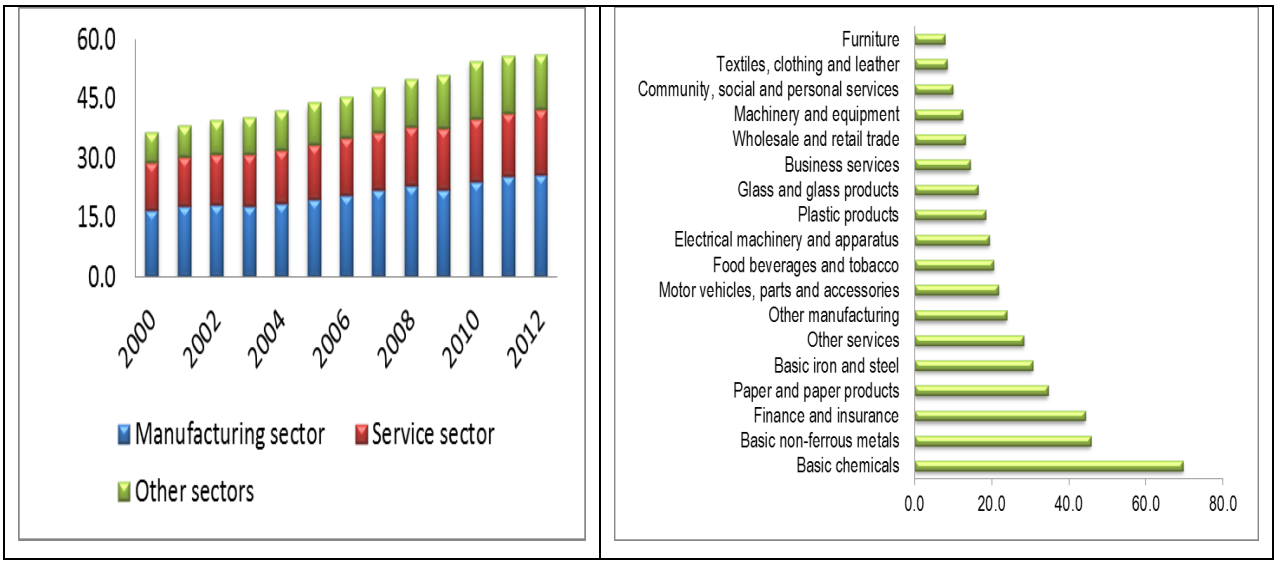
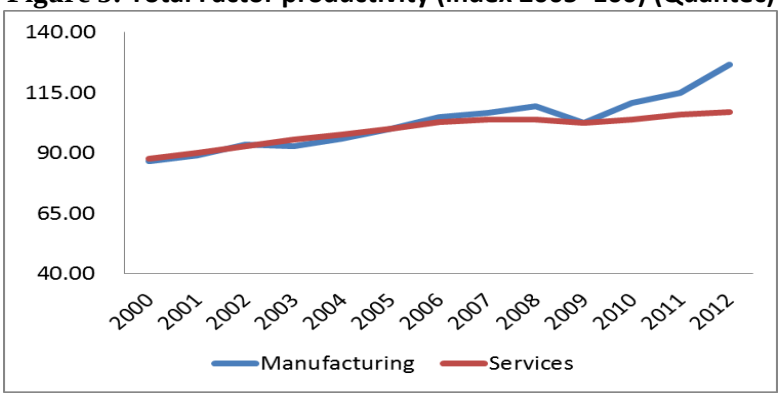


Figure 5: Total Factor productivity (index 2005=100) (Quantec)



2.3 Exports

The manufacturing sector accounts for around 53 per cent of South Africa exports, in particular basic iron and steel, motor vehicle parts and accessories, machinery and equipment and basic chemicals (Table 2). By comparison, services contribute just a 16 per cent to total exports, driven by wholesale and retail trade, as well as business services.

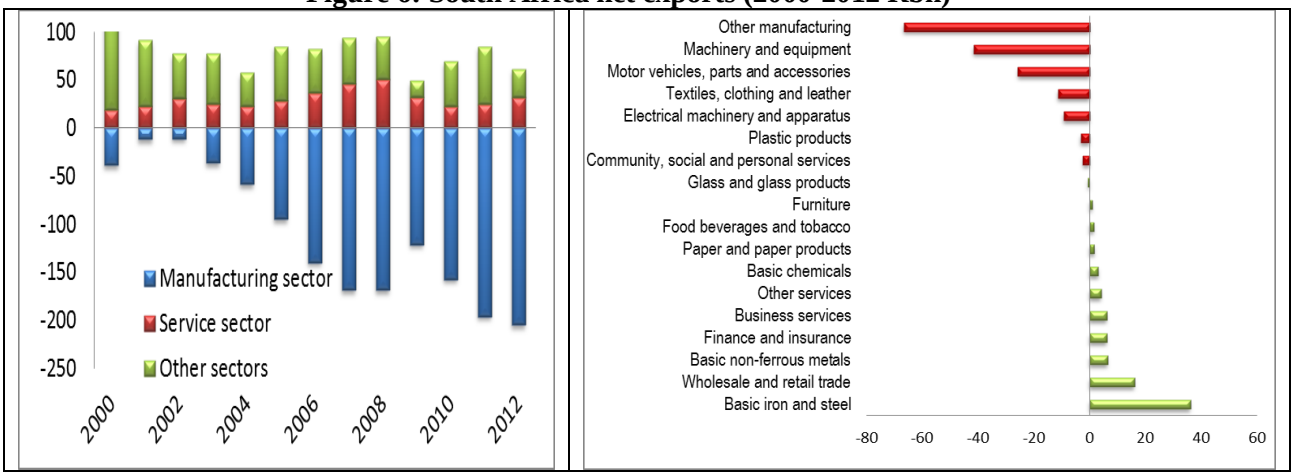
factors which also influence sector output, such as capital intensity. However, estimating TFP is difficult and the results are sensitive to the assumptions used.

Export values do not, of themselves, give a picture of the net contribution of exports from a particular sector to the economy. Figure 6 details the South Africa's largest net export sectors. It is striking that over the entire period under study net exports in services is larger than that of manufacturing (with the exceptions of basic iron and steel, basic non-ferrous metals, food, beverages and tobacco, furniture, and paper and paper products).

Table 2: South Africa Exports by Sector (average, 2000-2012)

Sector	Sub-sector	Output (GVA) Rb	% share
Manufacturing sector	Basic chemicals	22.4	5.2
	Basic iron and steel	42.7	10.0
	Basic non-ferrous metals	12.5	2.9
	Machinery and equipment	23.3	5.4
	Food beverages and tobacco	16.4	3.8
	Electrical machinery and app.	3.6	0.9
	Furniture	3.5	0.8
	Glass and glass products	0.7	0.2
	Motor vehicles, parts and access	35.5	8.3
	Paper and paper products	6.5	1.5
	Textiles, clothing and leather	5.1	1.2
	Plastic products	1.8	0.4
	Other manufacturing	51.7	12.1
Service sector	Business services	10.8	2.5
	Community, social and personal serv	3.3	0.8
	Finance and insurance	8.7	2.0
	Wholesale and retail trade	16.2	3.8
	Other services	32.9	7.7
Other sectors	Other sectors	130.18	30.4
	Whole economy	427.6	100.0

Figure 6: South Africa net exports (2000-2012 Rbn)



Looking at sector performance over time, the South Africa has consistently been a net exporter across all categories of services since 2000, with the exception of community, social and personal services.

3 The model and econometric framework

We use a reduced form of model of Kaldor's alternative specification of Verdoorn's Law in order to analyse the relationship between output and employment. Verdoorn's Law postulates that there exists a significant positive relationship between the growth rate of labour productivity and output growth. Verdoorn's Law and Kaldor's alternative version of Verdoorn's Law can be specified as follows:

$$p_{ti} = \beta_0 + \beta_1 y_{ti} \qquad \text{Verdoorn's Law (3.1)}$$

$$e_{ti} = \beta_0 + \beta_1 y_{ti} \qquad \text{Kaldor's version of Verdoon's Law (3.2)}$$

Where $p_{ti}, e_{ti}, \ y_{ti}$ are the growth rate of labour productivity, employment, and output respectively in sector i of the economy. Given that the focus of this study is to test the long run relationship between employment and output in the manufacturing and services sectors, we use Equation 3.2 in levels in our empirical estimations. Therefore, the long run relationship in levels can therefore be presented as follows:

$$E_t = \beta_0 + \beta_1 Y_t + \varepsilon_t \qquad (3.3)$$

Where $E_t, \ Y_t$ are the level of employment and output respectively while ε_t is the error term. All variables are in natural logarithmic form where the coefficient β_1 is interpreted as the elasticity of employment with respect to real output. According to Kaldor (1975), the sufficient condition for static and dynamic economies of scale such that there is a statistically significant relationship between employment and output growth, requires the estimated coefficient (β_1) to be statistically less than unity.

The long run relationship between the level of employment and real output is analysed based on the multivariate approach to cointegration analysis proposed by Johansen (1988 & 1995). Accordingly, Equation 3.3 above can be interpreted as a cointegrating relationship between employment and real output. The Johansen approach is based on a stable VAR model of lag length p and is represented as follows:

$$y_t = A_0 + A_1 y_{t-1} + A_2 y_{t-2} + \ldots + A_p y_{t-p} + u_t, \ t = 1,2.....T \qquad (3.4)$$

Where $y_t = (Y_t^i, E_t^i)$ *for i = manufacturing or services*, is a vector of endogenous variables; A_i (*for* $i = 1,2....p$) is a parameter matrix for the lagged endogenous variables, $u_t = (u_{1t}, u_{2t})'$ is a vector of error terms and is assumed to be a zero-mean independent white noise process with time-invariant, positive definite covariance matrix $E\left(u_t u_t^{'}\right) = \sum_u$ The vector A_0 represents deterministic terms (i.e. constant, a linear trend and/or dummy variables).

According to the Johansen approach to cointegration, the corresponding VECM for a given VAR in Equation 3.4 is given by:

$$\Delta y_t = \Gamma_0 + \Pi y_{t-p} + \Gamma_1 \Delta y_{t-1} + ... + \Gamma_{p-1} y_{t-p+1} + u_t \qquad (3.5)$$

Where $\Pi = -(I_2 - A_1 - .... - A_p)$ is a 2×2 impact matrix and

$\Gamma_1 = -(A_1 - I)$ and $\Gamma_2 = -(A_2 + \Gamma_1), \Gamma_3 = -(A_3 + \Gamma_2)...$

The impact matrix is given by $\Pi = \alpha\beta'$ where α is a vector of loading coefficients or the speed of adjustment parameters towards equilibrium and β is a vector of parameters in the cointegrating relationship.

If the matrix Π has row rank equal to zero, then there is no cointegration among the variables y_{it}. In particular, if the matrix Π has full rank then all linear combinations of y_{it} are stationary and Equation 3.5 would correspond to a VAR model in first differences with no cointegration. If however, the matrix Π is of reduced rank and the rank is not equal to zero ($r \neq 0$), then cointegration exists. As such, the number of cointegrating vectors depends on the row rank of the matrix Π.

This paper uses the two widely used likelihood ratio tests used to identify a number of cointegrating vectors as suggested by Johansen (1988), namely: the trace-test and the maximum eigen-value test, shown below:

$$\lambda_{trace}(r) = -T\sum_{i=t+1}^{n}\ln(1-\hat{\lambda}_i) \quad \text{.....: Trace test}$$

$$\lambda_{\max}(r, r+1) = -T\ln(1-(1-\hat{\lambda}_{r+1}) \quad \text{.....: Maximum eigenvalue test}$$

where $\hat{\lambda}_i$ is the estimated eigenvalue from the estimated Π matrix
T is the number of usable observations.

4 Empirical analysis

4.1 Data

We use quarterly South African data on employment and real output over the period 2000Q1-2013Q3, due to data availability on employment which is only available for this period. Data on manufacturing and services sector employment is sourced from Statistics South Africa. Seasonally adjusted real value added is used as a proxy for real output for manufacturing and services sector and is sourced from the South African Reserve Bank.

4.2 Unit root test

Before estimating a VAR model, it is important to check the order of integration of the variables. Accordingly, the augmented Dickey-Fuller (ADF) test (Dicky & Fuller, 1979) and the Kwiatkowski-Phillips-Schmidt and Shin (1992) unit root test (KPSS-test) were carried out in order to check the stationarity of the variables. The ADF-test, tests the null hypothesis that there is a unit root against the alternative of stationarity of time series that may have a constant, a deterministic linear time trend and seasonal dummy variables. On the other hand, the KPSS-test, tests the null hypothesis that variable is stationary (i.e. I (0)) against the alternative that it is non-stationary (i.e. I (1)).

In general, both the ADF and KPSS test indicate that all variables are non-stationary in levels and stationary in first differences, thus confirming that all the variables are integrated of order one (I(1))[5].

[5] Despite that the KPSS test indicate that employment is stationary at 5% and 10% significance level, we treat employment as non-stationary as per the ADF tests.

Table 3: Unit root tests

Variable	ADF		KPSS		Conclusion:
	t-statistic (constant)	**t-statistic (constant and trend)**	**t-statistic (constant)**	**t-statistic (constant and trend)**	
Y^m	-1.54	-2.38	0.80**	**0.15****	Non-stationary
ΔY^m	**-4.76***	**-4.77***	**0.12**	0.05	Stationary
Y^s	-1.61	-0.50	0.88**	0.18**	Non-stationary
ΔY^s	**-3.44***	**-3.79***	**0.30**	0.12	Stationary
E^m	-2.66	**-2.06**	**0.59****	**0.18****	Non-stationary
ΔE^m	**-5.71***	-5.85	**0.25**	0.05	Stationary
E^s	**-0.38**	-1.98	**0.86****	0.12	Non-stationary
ΔE^s	**-3.90***	-3.85	**0.058**	0.055	Stationary

Note: *ADF 5% Critical values of -2.91 (constant) and 3.50 (constant and trend) from MacKinnon (1994, Table 20.1). KPSS 5% critical value of 0.463 (constant) and 0.146(constant and trend) from Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1). *Rejection of null hypothesis at 5% significance level of ADF test. **rejects null at 5% significance level of KPSS test.* Δ indicates the first difference operator

4.3 Cointegration results

Given the all variables are nonstationary and integrated of the same order; it is possible to investigate short run and long run dynamics in VECM framework. To test for cointegration, two unrestricted bivariate VAR models which form basis for the VECMs are estimated separately for the manufacturing and services sector. We control for the recent global economic crisis by including a dummy variable corresponding to the financial crisis (2007Q1-2009Q4) in the estimated VAR models.

- **VAR lag length selection − Manufacturing sector:** In order to determine the optimal number of lags for a VAR (p), various lag order selection criteria is used based on a maximum lag order of $P_{\max} = 8$. The Akaike Information Criterion (AIC) and LR-test statistic, Hannan-Quinn (HQ) criterion, Final Prediction Error (FPE) suggest an optimal lag length of two while the Schwartz Information

Criterion (SIC) suggest a lag of one for the manufacturing sector VAR model. In order to induce well behaved error terms, a lag order of two is chosen. In particular the VAR (2) residuals satisfy the normality assumption, and do not show signs of autocorrelation and ARCH effects.

- **VAR lag length selection − Service sector:** Similarly, the Hannan-Quinn (HQ) criterion Schwartz Information Criterion (SIC), suggest an optimal lag length of two while the LR-test statistic, Akaike Information Criterion (AIC) and the Final Prediction Error (FPE) suggest a lag of five. In order to induce well behaved error terms, a lag order of five is chosen. In particular the VAR (5) residuals satisfy the normality assumption, and do not show signs of autocorrelation and ARCH effects.

Cointegration results are reported in Table 4 and 5, and are based on the Johansen's trace test and maximum eigen-value test.

Table 4: Johansen cointegration tests: Trace test

	Manufacturing			**Services**		
H_0	Trace statistic	Critical value	P-value	Trace statistics	Critical value	P-Value
$r = 0$	34.16	25.87	0.004	47.07	25.87	0.000
$r \leq 1$	**9.64***	**12.52**	**0.144**	**4.21***	**12.52**	**0.712**

Note: Critical values from Johansen (1995a, Table 15.4). * Significant at 5%.

Table 5: Johansen cointegration tests: Maximum eigen-value test

	Manufacturing			**Services**		
H_0	Max-Eigen statistic	Critical value	P-Value	Max-Eigen statistics	Critical value	P-Value
$r = 0$	24.51	19.39	0.008	42.86	19.39	0.000
$r = 1$	**9.64***	**12.52**	**0.144**	**4.21***	**12.52**	**0.712**

Note: Critical values from Johansen (1995a, Table 15.4). * Significant at 5%.

The estimated results of the parameters of the impact matrix $\Pi = \alpha\beta'$ are presented in Table 6 and Table 7 with t-statistics in parentheses where we have normalised the coefficient of employment to one. Table 6 presents results for the manufacturing sector while results for the services sector are presented in Table 7.

Table 6: Manufacturing - Cointegration vector and loading parameters for VECM with one lagged differences and cointerating rank r=1

	E^m	Y^m	t	Constant
$\hat{\beta}'$	1	-0.60 [–3.62]	0.0009 [1.90]	0.58
$\hat{\alpha}$	-0.58 [–5.27]			

Note: t-statistics in parentheses.

Table 7: Services - Cointegration vector and loading parameters for VECM with four lagged differences and cointerating rank r=1.

	E^s	Y^s	t	Constant
$\hat{\beta}'$	1	-0.86 [–2.87]	0.00003 [0.019]	3.40
$\hat{\alpha}$	-0.65 [–7.27]			

Note: t-statistics in parentheses.

The cointegrating vectors have been rearranged in order to get economic interpretation as follows:

Manufacturing: $E^m = 0.60Y^m - 0.0009t - 0.58 + ec_{t-1}$ (4.1)

Services: $E^s = 0.86Y^s - 0.000003t - 3.40 + ec_{t-1}$ (4.2)

Where ec_{t-1} represents the error correction term and is stationary. The results indicate that in the long run, employment and real output are positively related in both sectors. In particular, the long run elasticity of employment with respect to real output is significantly less than unity in both the manufacturing and service sector, suggesting that for every 1% increase in real output, employment must grow by less than 1% as suggested by Kaldor (1975). According to Kaldor's second law, the manufacturing sector exhibits static and dynamic economies of scale, however, our results suggest that Kaldor's second law also applies to the services sector. The result that the services sector also exhibits static and dynamic economies of scale is not unique to the South Africa economy. In their analysis of a sample of Indian states, Dasgupta and Singh (2005) find that Kaldor's first law also applies to the services sector. Our results indicate that the elasticity of employment with respect to real output in the

services sector is greater than that of manufacturing. For every 1% increase in real output, employment in the services sector will grow by 0.86% compared to 0.60% in the manufacturing sector. The estimated output-employment elasticity for the manufacturing sector compares fairly with results obtained by Bhorat (2009) but is however lower than the estimates obtained by Fedderke & Mariotti (2002) and Oosthuizen (2006), who estimate it at 0.86% for the period 1970-1997 and 0.76% for the years between 1995 and 2004, respectively.

The rate of adjustment in both sectors is negative and statistically significant. However, employment in the services sector adjusts at a faster rate (i.e. 0.65% per quarter) compared to the manufacturing sector (i.e. 0.58% per quarter). This further suggests that when employment is in disequilibrium due to external shocks, manufacturing employment will take longer to return to its equilibrium level. This is not surprising for the case of South Africa where employment in the manufacturing sector remains sluggish following the recent recession in 2009 while the services sector has somewhat remained resilient.

5 Conclusion

A sector based approach continues to have an important policy role as a tool in the government's industrial strategy. This paper assesses the relative importance of manufacturing and service sectors in achieving long term growth and employment objectives in South Africa. The results from the cointegration analysis show that in the long run, employment and real output are positively related in both manufacturing and service sectors. However, the elasticity of employment with respect to real output in the services sector appears to be greater than that of manufacturing.

South Africa's widened exposure to the rest of the world has not in itself induced the necessary structural changes in the economy to significantly alter the export basket beyond the range of products that reflect South Africa's static comparative advantage in mineral resources and commodities. In order to mitigate further aggravation in manufacturing account deficit and foster future growth and employment potential of manufacturing, a structural shift towards higher growth in more value adding and higher labour absorbing manufacturing sectors which are more pro-poor is required. At the same time, a more rapidly growing

community, social and personal services, business services as well as wholesale and retail services sub-sectors can unlock the future growth and employment potential of services.

The results point towards the direction of future enquiry to better understand the direct and indirect channels through which South African manufacturing growth can impact on economy-wide growth, and stimulate employment creation in the services sector.

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