treasury
Department of Treasury
FREE STATE PROVINCE

Exploring the Impact of Provincial Expenditure on EPWP on Economic Growth and Labour Dynamics: ARIMA & VAR Modelling Approach

Oyeyinka Omoshoro-Jones (Snr. Econometrician)

A presentation prepared for FSPT-EAD Annual Economic Research Workshop, OR TAMBO Building, Bloemfontein
07 April 2016

EAD Staff Working paper series, No.6

Presented in the 7th Annual PSEF Conference, Bela-Bela, Limpopo, 27 November, 2015

Presentation Layout

treasury
Department of Treasury
FREE STATE PROVINCE

- Synoptic Review of Literature
- Theoretical and Empirical Evidence
- Furtive glance on the economic - and labour market – performance in SA.
- Research Motivation, Contribution, Aim and Question
- Empirical Results (findings) and Discussion
- Putting it altogether - Policy Recommendation

Synoptic Review of Literature

- Theoretically, the interrelationship between economic growth, poverty incidence and unemployment can be explored via 3 channels, viz:
  - ⇨ Direct (job creation and positive income shock) and indirect (TFP and aggregate demand);
  - ⇨ Macro (aggregate economy) and micro (sector) levels, and
  - ⇨ Supply and demand channel – using labour as an intermediary input and/or complementary input.
- Mostly in developing countries: unemployment rate and level of education are inversely related, this is evident in South Africa (cf. StatsSA, 2014), whereas, poverty and education are inversely correlated (cf. Islam, 2004)
- Empirics and theory indicates intensive investment in human capital (training and skill development) is a key channel for high economic growth to benefit the unemployed and/or working age poor (see, e.g., McCutcheon, 2009; McCord and Meth, 2007; McCord and Seventer, 2004; McCord, 2001, 2002)
- Similar to other developing countries in SSA, unemployment rate in SA is acutely high and structural in nature due to lack of appropriate skills and employment opportunities (see McCutheon, 2014, Meth, 2011; Triegaardt, 2009; McCord et al., 2004a amongst others).

Theoretical & Empirical Evidence

treasury
Department of Treasury
FREE STATE PROVINCE

- In theory, an increase in public investment spending on (infrastructure projects) induces a stimulatory effect on economic growth via 2 main channels, viz:
  - ⇨ Direct – high demand for labour as ouput/production increases. Sizeable supply of labour to firms, in effect, lower unemployment rates and raises household income spent on produced goods.
  - ⇨ Indirect – Innovation and technology spillover accompanying a surge in productivity growth indirectly raise total factor productivity (TFP), which in turn, boost growth.

- Concrete empirical evidence confirmed positive effects of high public infrastructure investment on:
  - ⇨ GDP growth (cf. Ashaeur, 1989 for US; Canning, 1999, Calderón and Servén 2008 for ASEAN countries; Jong-A-Pin and de Haan, 2008 for OECD countries)
  - ⇨ TFP growth (cf. Pereira and Andraz, 2013; Fedderke and Garlick, 2008 and Romp and de Haan, 2005)

- Other findings shows that high public spending on infrastructure reduce poverty incidence (cf. Estache et.al, 2013; World Bank, 2006) and improve income distribution (cf. Chong and Calderón, 2001; Calderón and Servén, 2004) . Recent by Seneviratne and Sun (2013) reported similar findings for ASEAN-5 countries (Indonesia, Malyasia, Phillipines, Thailand and Vietnam)

- Fedderke et al. (2008; 2006) found out that high infrastructure investment in South Africa leads to growth in TFP, income and aggregate demand

How does the labour market looks like?

treasury
Department of Treasury
FREE STATE PROVINCE

	Unemployment rate (narrow definition)	Expanded Unemployment rate	Labour force Participation rate	Labour market absorption ratio
South Africa	24.5	33.8	58.5	44.2
Province				
Western Cape	19.4	22	68.4	55.1
Northern Cape	25.8	38.9	54.5	40.4
Eastern Cape	27.4	40.3	47.2	24.2
Free State	**29.8**	**36.3**	**62.7**	**40**
KwaZulu-Natal	20.5	36.8	47.2	37.5
Mpumalanga	25.7	39.4	57.8	42.9
Limpopo	19.8	38.6	45.6	36.5
Gauteng	27.6	30.2	72.9	52.8
North West	23.9	38.9	72.9	52.8

- High unemployment rate, acute poverty incidence and growing inequality gap (both income and skill)
- Shrinking fiscal space to finance the expanding social protection system.

...The unemployed poor is exposed to idiosyncratic shocks & needs risk coping mechanism and **sustainable safety net** to cope with covariate shocks.

...The only possible way through public employment programmes

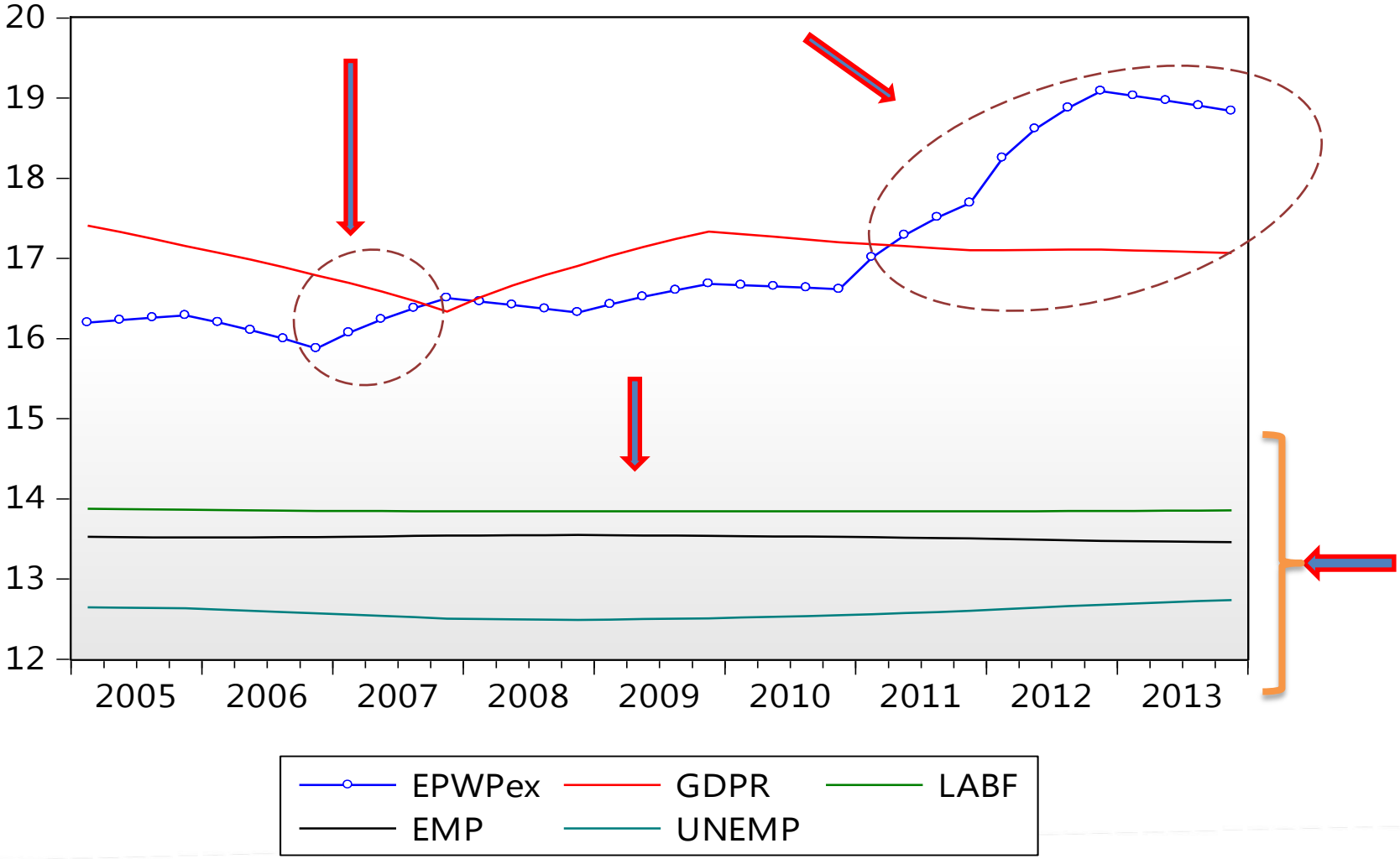
How does the economy looks like?

treasury
Department of Treasury
FREE STATE PROVINCE

- **Adverse trade shocks** through trade linkages with BRICs – China rebalancing – affects commodity prices and weaken exports
- **Interest rate shock** (normalization path in US) putting upward pressure on market rates (repo rate), induce **inflationary pressure** (CP1=7%) & **high borrowing cost.**
- **Terms of trade and exchange rate shocks** causing high volatility in domestic currency
- **Widening fiscal deficit** (4.2 percent) of GDP – Unsustainable!!
- **High debt-GDP** ratio at 45.9 percent (World Bank, 2014).
- **Massive infrastructure bottleneck** (domestic endogenous shocks)
- **Economic growth bordering on recession** - currently at 0.6%

Motivation for Research (i)

treasury
Department of Treasury
FREE STATE PROVINCE



Motivation for Research & Contribution to extant literature

treasury
Department of Treasury
FREE STATE PROVINCE

- What is the impact of an archetype public works programme (EPWP) on economic growth and labour market performance?

- Why is unemployment, employment and labour force participation rate irresponsive to an increased public spending on (or expanding) EPWP?

- Can the negative relationship between GDP and high public spending on EPWP be explained?

- Aim to fill the empirical research gap in extant literature on PWP. E.g. Holmes et al. (2013), Martin et al. (2001), Bertcherman et al. (2004) and McCord (2008) - questioned the efficacy of evaluation studies on the true benefits of PWP.

- To the best of our knowledge, this is the first study to attempt this objective using multivariate econometric model at international and national level.

Research Questions

treasury
Department of Treasury
FREE STATE PROVINCE

Specifically, this paper seek to answer the following questions:

- Why is output growth and the labour market irresponsive to high public spending on expanded public works programmes in the Free State?
- Is there any long-run and/or short-run relationship between high public spending on EPWP initiatives, economic growth, and labour market indicators?
- If any, what is the direction of causality between high public spending on EPWP initiatives, economic growth, and labour market indicators?
- What are the probable cause or binding constraints undermining the employment generating and poverty reducing effect of an upscaled EPWP schemes in the Free State province?

Methodological Approach

- Employed a estimated a higher order seasonal ARIMA-OLS model, unrestricted VAR, Johansen-Julieus cointegration and Granger Causality tests to :
  - Examine the *dynamic feedback* between high public spending on EPWP, provincial economic growth, labour force participation rate, employment and unemployment rate (as selected variables),
  - Identify *long-run and short-run association* between the selected variables, and also, determine the existence of causal link among the selected variables, and
  - Determine the *response of* economic growth and labour market performance indicators (labour force participation rate, employment and unemployment rate) to EPWP's innovations.

Data sources and Transformation

Variables	Source	Transformation
EPWP[1]	National Treasury – FS Department of Public Works, Vote 9	Linear interpolation[2]
Real regional-GDP (R-GDP)	IHS Global Insight	$rgdp=\left(\frac{GDP\text{-}R}{infl}\right)$
Real regional-GVA (R-GVA)	IHS Global Insight	$rgdp=\left(\frac{GVA\text{-}R}{infl}\right)$
Labour Force (LABF)	IHS Global Insight	
Inflation	Statistics South Africa	
CPI	Statistics South Africa	y-o-y growth of cpi
Unemployment rate	IHS Global Insight	
Inflation Rate		$infl=\frac{(cpi-cpi(-1))}{cpi(-1)}*100$

Data Treatment

- Converted annual data to quarterly data using Linear interpolation method. Sample period: 2005Q1 – 2013Q4
- All Quarterly data are seasonally adjusted using X-12 ARIMA programme in Eviews under the additive option.
- All quarterly data are log-transformed and adjusted to real variables

METHODOLOGY

Theory-Based Postulations

treasury
Department of Treasury
FREE STATE PROVINCE

Hypothesized mathematical equation:

$$\log EPWP_{ex} = f(\log GDPR, \log LABF, \log UNEMP, \log EMP) \quad \text{Eq.1}$$

We can expand Eq.1, as an auxiliary multivariate regression model computed as:

$$\ln EPWP_{\exp} = \beta_0 + \beta_1 \ln x_1 + \beta_2 \ln x_2 + \beta_3 \ln x_3 + \beta_4 \ln x_4 + \varepsilon_t \quad \text{Eq.2}$$

Variables	Expected Coefficient Signs	Rationale
GDPR	-ve or +ve	High capital accumulation via creation of useful public asset (e.g. road net work) Access to labour intensive jobs with wages, increase consumption spending , in turn, raise productivity, directly affect growth income gain and effective demand generated via multiplier effect in the local economy Negative: low labour intensity of infrastructure projects, the low nature of skills acquired, excessive public investment on infrastructure projects crowding out of private sector employment (i.e. job destruction) sector, in effect, dampening the labour productivity needed for GDP growth.
LABF	+ve	Short term increase labour participation rate The unemployed poor are drawn into productive and renumerative work
UNEMP	-ve	Crowding out effect of public sector jobs on private sector employment, high job substitutability associated with generous rents in the public sector, high job rationing owed to excessive demand for EPWP jobs
EMP	+ve and -ve	As a result of transitory rise in labour force participation rate created by access to temporary productive work in the public sector, labour market constraints is expected to ease somewhat, leading to a slight improvement in employment rate, nonetheless, in the short run, with no lasting impact on the labour market and/or the real economy.

Optimal lag selection

treasury
Department of Treasury
FREE STATE PROVINCE

Table 1: Lag Order Selection Criteria

Sample: 2005Q1 2013Q4

No. of observations: 32

Lag	LogL	LR	FPE	AIC	SC	HQ
1	407.9427	NA	2.71e-16*	-24.49642*	-23.76355*	-24.25349*
2	410.5513	3.912880	6.51e-16	-23.65946	-22.19372	-23.17361
3	416.7826	7.789160	1.34e-15	-23.04891	-20.85031	-22.32014

** indicates lag order selected by the criterion*

LR: sequential modified LR test statistic (each test at 5% level)

FPE: Final prediction error

AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

Any Long run relationship?
- Johansen & Juselius Cointegration Test

treasury
Department of Treasury
FREE STATE PROVINCE

$$LR_{\max}\left(\frac{r}{n+1}\right) = -T * \log(1-\hat{j})$$

$$LR_{tr}\left(\frac{r}{n}\right) = -T * \sum_{i=r+1}^{n} \log(1-\hat{j}_i)$$

Trace Test			Maximum Eingenvalue Tests		
Null hyp	Trace Statistic	Critical Value 95%	Null hyp	Max-Eigen Statistics	Critical Value 95%
$r = 0$	31.974 [0.614]	47.856§	$r = 0$	14.819 [0.762]	27.584§
$r \leq 1$	17.156 [0.629]	29.797§	$r \leq 1$	11.280 [0.619]	21.131§
$r \leq 2$	5.876 [0.710]	15.494§	$r \leq 2$	5.448 [0.685]	14.265§
$r \leq 3$	0.428 [0.513]	3.841§	$r \leq 3$	0.428 [0.513]	3.841§

Note, Eigenvalue for both the unrestricted cointegration rank test for Trace and Maximum Eigenvalue are: 0.362, 0.289, 0.152, 0.013 for $r = 0,\ r \leq 1,\ r \leq 2$ *and* $r \leq 3$

§Fail to reject null hypothesis, numbers in [ ] denotes p-values.

Setting up the ARIMA Model

- Used Box-Jenkins technique to select a parsimonious model

$$\text{AR(1), AR(2), SAR(4)} \Rightarrow \left(1-\rho_1 L-\rho_2 L^2\right)\left(1-\theta L^4\right)u_t=\varepsilon_t \qquad \text{Eq.3}$$

$$\text{Error process of AR(1), AR(2), SAR(4)} \Rightarrow u_t=\rho_1 u_{t-1}+\rho_2 u_{t-2}+\theta_{t-4}+\varepsilon_t \qquad \text{Eq.3.1}$$

$$\textit{Whereas}\ \text{the MA(1)} \Rightarrow \left(\beta_1\varphi_t\right)+u_t \qquad \text{Eq.4}$$

$$\text{And, the lag opeartor of the MA(1)} \Rightarrow u_t=(1+\varphi_1 L)(1+\omega L^4)\varepsilon_t \qquad \text{Eq.4.1}$$

$$\text{The error process of MA(1)} \Rightarrow u_t=\varepsilon_t+\varphi_1\varepsilon_{t-1}+\omega\varphi_{t-4} \qquad \text{Eq.4.2}$$

Setting up the VAR model

$$\mathrm{D}X_t = \mathrm{G}_1 \mathrm{D}X_{t-1} + \mathrm{D}X_{t-2} + \ldots + \mathrm{G}_{k-1}\mathrm{D}X_{t-h} + \mathrm{P}\,\mathrm{D}X_{t-k} + f + e_t \qquad \text{Eq.5}$$

where X_t is a $k+1$ vector of series integrated order one, $I(1)$variables of $\mathrm{G}_1,\ldots,\mathrm{G}_{k-1}$, while P denotes $k \times k$ matricesof unknown parameters and contains information about the cointegration relationships.

In a simple VAR system: $y_t = b_0 + b_1 Z_t + b_2 Z_t + b_3 Z_t + b_4 Z_t + e_t$ Eq.6

$$(1-L)\begin{bmatrix} \mathrm{D}EPWP_{ex} \\ \mathrm{D}GDP \\ \mathrm{D}LABF \\ \mathrm{D}UENMP \\ \mathrm{D}EMP \end{bmatrix} = \begin{bmatrix} a_1 & d_1 \\ a_2 & d_2 \\ a_3 & d_3 \\ a_4 & d_3 \end{bmatrix} \begin{pmatrix} 1 \\ e_{t-1} \end{pmatrix} + \sum_{t=1}^{n} (1-L) \begin{bmatrix} b_{11i} & b_{12i} & b_{13i} & b_{14} \\ b_{21i} & b_{22i} & b_{23i} & b_{24} \\ b_{31i} & b_{32i} & b_{33i} & b_{34} \\ b_{41i} & b_{42i} & b_{43i} & b_{44} \end{bmatrix} \begin{bmatrix} \mathrm{D}EPWP_{ex,t-i} \\ \mathrm{D}GDP_{t-i} \\ \mathrm{D}LABF_{t-i} \\ \mathrm{D}UENMP_{t-i} \\ \mathrm{D}EMP_{t-i} \end{bmatrix} + \begin{bmatrix} e_{1it} \\ e_{2it} \\ e_{3it} \\ e_{4it} \end{bmatrix} \qquad \text{Eq.6.1}$$

❖THE MULTIVARIATE MODELS,

- ARIMA-OLS FITTED
- VAR
- Dynamic Feedback Test (Johansen Cointegration, Granger Causality & Wald)

❖EMPIRICAL RESULT & DISCUSSION

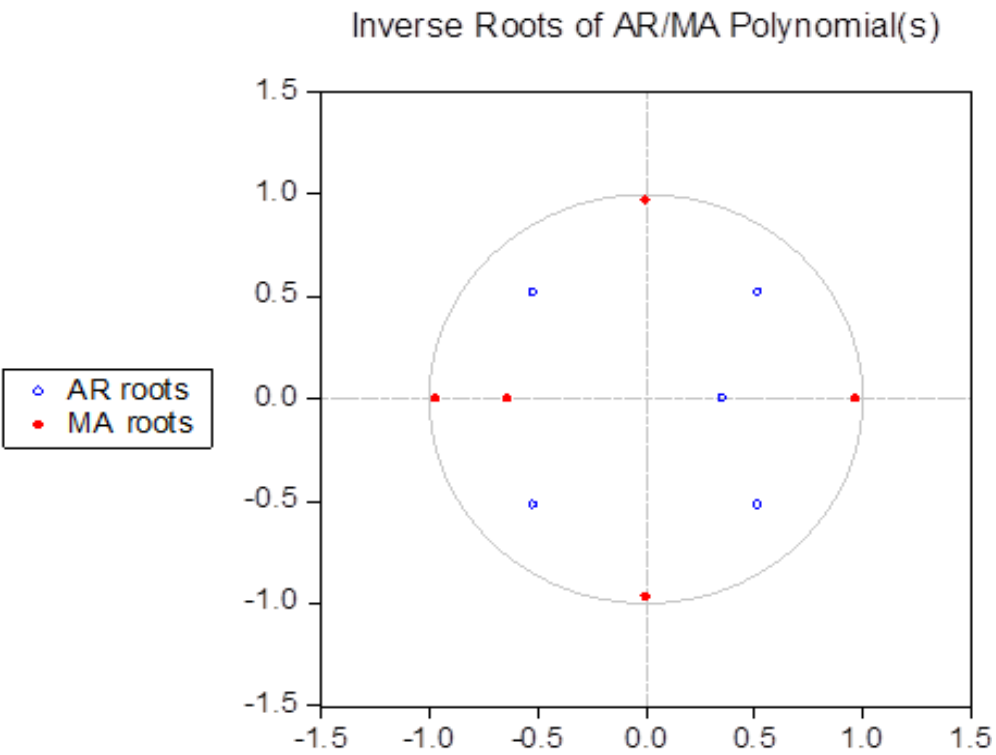
Post estimation
Diagnostic Tests Result for the Computed Seasonal ARIMA-OLS Model

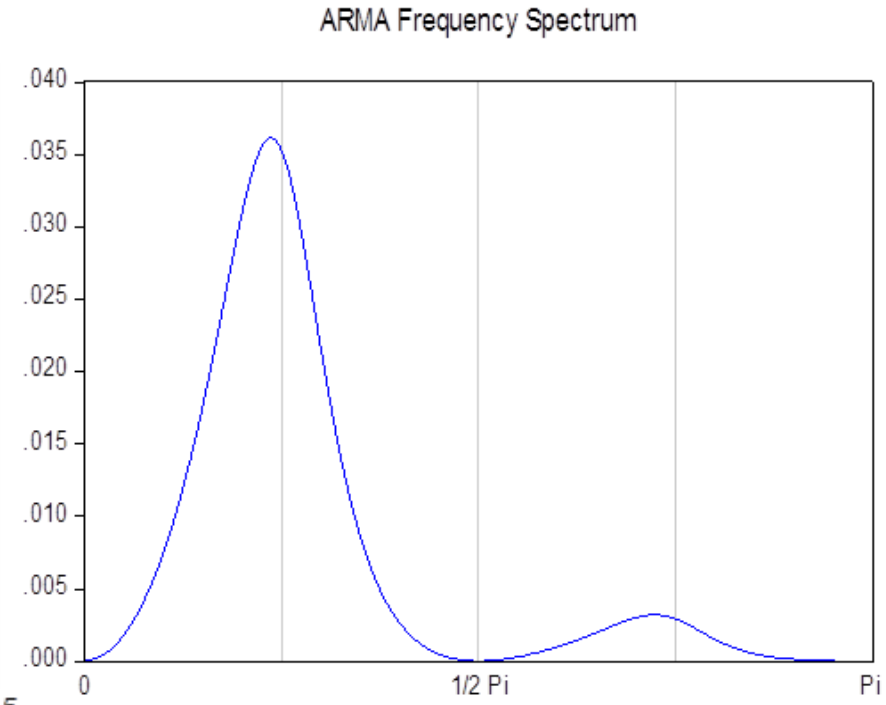
treasury
Department of Treasury
FREE STATE PROVINCE

Name of Test	Ho = Null hypothesis	Conclusion
Misspecification/ Stability test:		
ARMA Structure Roots Tests	ARIMA is invertible and (covariance stationary)	ARMA model is invertible and stationary
	ARMA is explosive, AR and MA roots lies outside the unit circle	AR and MA roots are inside the unit circle. No imaginary AR or MA roots.

Residual Tests	Ho = Null hypothesis	Test Statistic	*p-value*
Ljung-Box Q	No 16th order autocorrelation in residual	$LB_Q(16)=12.449$	0.132
Ljung-Box Q^2	No 16th order autocorrelation in residual	$LB_Q(16)=10.087$	0.08
Breusch-Godfrey	No 2nd order autocorrelation in residual	$nR^2(2)=6.586$	0.159
Gelsjer test	No 2nd order autocorrelation in residual	$nR^2(2)=4.309$	0.365
ARCH-LM	No 2nd order autoregressive conditional heteroscedacity	$nR^2(2)=0.414$	0.519
JB normality Test	Residual are normally distributed	0.373	0.829

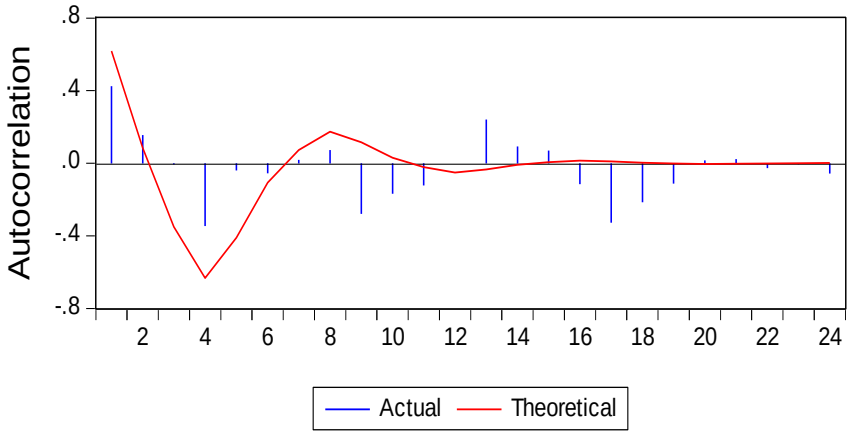
Stationarity (covariance) and Invertibility of ARIMA Model - Roots Structure

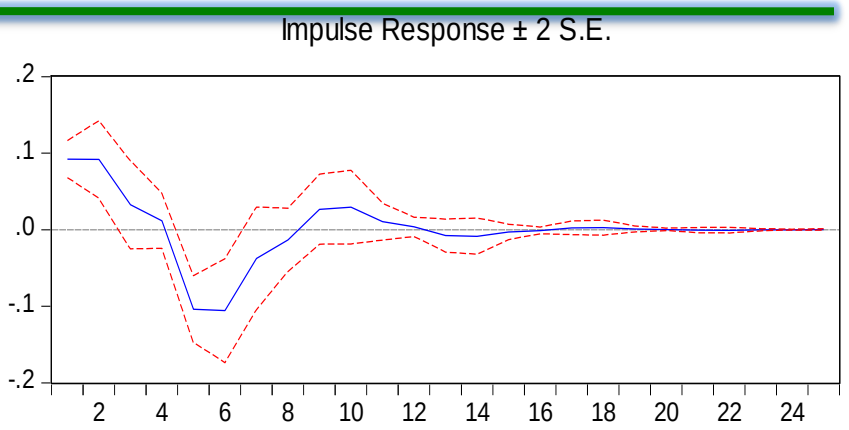


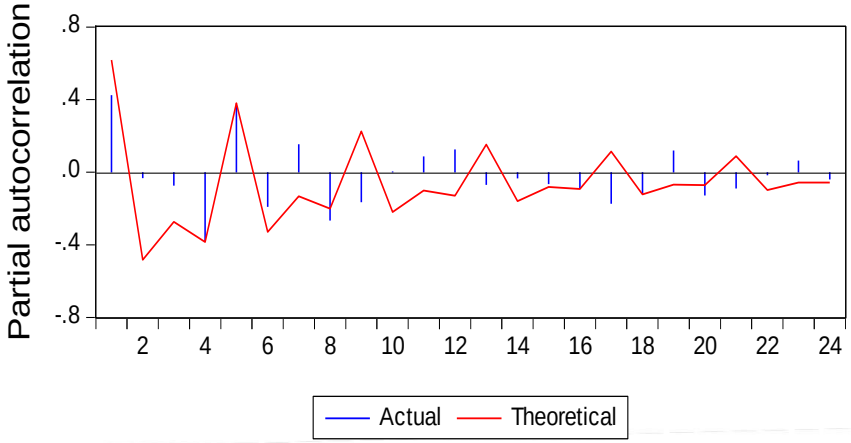


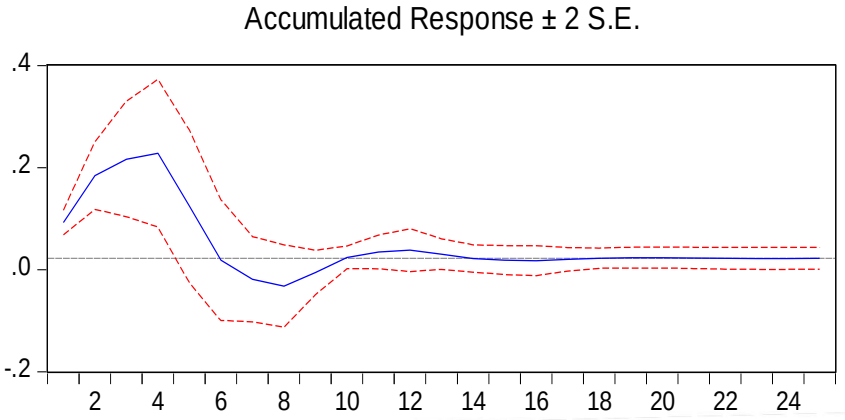
Stationarity of ARIMA model

ACF and PACF of Residuals & Convergence of innovations to asymptote IRF









Regression Output of the Seasonal ARIMA-OLS

treasury
Department of Treasury
FREE STATE PROVINCE

Dependent Variable: D(LEPWPEX)
Method: Least Squares
Sample (adjusted): 2006Q4 2013Q4
Included observations: 29 after adjustments
Convergence achieved after 37 iterations
MA Backcast: 2005Q3 2006Q3

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LRGDP,2)	-0.551414	0.223012	-2.472573	0.0225
D(LLABF,2)	1314.736	244.7916	5.370838	0.0000
D(LEMP,2)	-884.3797	174.6359	-5.064133	0.0001
D(LUNEMP,2)	-308.1022	63.48784	-4.852933	0.0001
C	0.023734	0.020120	1.179672	0.2520
AR(1)	0.354244	0.241028	1.469723	0.1572
SAR(4)	-0.291041	0.166636	-1.746566	0.0961
MA(1)	0.638889	0.176217	3.625580	0.0017
SMA(4)	-0.877789	0.041309	-21.24915	0.0000

R-squared	0.778421	Mean dependent var	0.097931
Adjusted R-squared	0.689789	S.D. dependent var	0.165740
S.E. of regression	0.092311	Akaike info criterion	-1.678175
Sum squared resid	0.170427	Schwarz criterion	-1.253842
Log likelihood	33.33353	Hannan-Quinn criter.	-1.545279
F-statistic	8.782655	Durbin-Watson stat	2.095754
Prob(F-statistic)	0.000042		

Inverted AR Roots	.52-.52i -.52+.52i	.52+.52i	.35	-.52+.52i
Inverted MA Roots	.97	.00-.97i		

Equation of the Estimated ARIMA-OLS Model

treasury
Department of Treasury
FREE STATE PROVINCE

$$\left.\begin{aligned}\Delta EPWP_{ex} = {} & \underset{\substack{(0.25)\\[0.02]}}{0.023} - \underset{\substack{(0.02)\\[0.22]}}{0.55} * \Delta(lrgdp-(2)) + \underset{\substack{(0.00)\\[244.79]}}{1314.74} * \Delta(llabf-(2)) - \underset{\substack{(0.00)\\[174.63]}}{888.37} * \Delta(lemp-(2)) \\ & - \underset{\substack{(0.00)\\[63.48]}}{308.10} * \Delta(lunemp-(2)) + u_t\end{aligned}\right\}$$

$$(1+0.35L)\left(1-0.29L^4\right)u_t = (1+0.63L)\left(1-0.877L^4\right)\}$$

- *where*, DW=2.09 AdjR^2 = 0.68 R^2=0.77, SE=0.09
- S.E = [ ] in parenthesis, p-values = ( ) in parenthesis, **p<0.05 (highly significant)

What does the ARIMA model Tells us?

treasury
Department of Treasury
FREE STATE PROVINCE

- All empirical results are strongly statistically significant suggesting that a high public spending on expanded public works programme at provincial level (taken as a large government size), induce a:

  → Negative impact on domestic economic growth,

  → Positive correlation with labour force participation rates, as such, high public spending tends to absorb unemployment poor into the labour market to engage in productive work,

  → Negative impact on employment rate, and

  → Has a reducing effect on unemployment.

All our results are consistent with findings in the literature.

Evidence supporting the ARIMA-OLS results?

treasury
Department of Treasury
FREE STATE PROVINCE

- Possible rationale for the negative correlation between high spending on public employment programmes could be attributed to a forceful crowding out of private sector, labour productivity, and destruction of jobs in the private sectors due to high public spending on EPWP to create employment opportunities (Behar and Mok, 2015; Stepayan et al. 2015; Aysu et al. 2011; Algan et al. 2002; Boeri et al. 2000; Holmund, 1997; Calmfor et al. 2005)

- An increased in temporary jobs in the public sector accompanied by a higher rents paid to workers, which in turn triggers an strong job substitution and misallocation of labour inputs, and

- Other factors could be low nature of skills acquired by beneficiaries of public works programme that hamper the employability of beneficiaries in the mainstream labour market (McCoord and Farrington, 2008), intense job rationing associated with excessive demand for EPWP jobs (McCutheon and Parkins, 2009),

- Low labour intensity of implemented projects (Omoshoro-Jones, 2014; McCord and Meth, 2007)

Regression Output of VAR Model

treasury
Department of Treasury
FREE STATE PROVINCE

Vector Autoregression Estimates
Sample (adjusted): 2005Q3 2013Q4
Included observations: 34 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	D(LEPWPEX)	D(LRGDP)	D(LLABF)	D(LUNEMP)
D(LEPWPEX(-1))	0.644796	0.061940	0.000176	0.004440
	(0.15656)	(0.06419)	(0.00072)	(0.00452)
	[4.11853]	[0.96498]	[0.24574]	[0.98270]
D(LRGDP(-1))	-0.095726	0.731182	-0.001083	0.001925
	(0.30971)	(0.12698)	(0.00142)	(0.00894)
	[-0.30908]	[5.75832]	[-0.76365]	[0.21539]
D(LLABF(-1))	-7.582661	11.69390	0.900320	0.701522
	(17.4562)	(7.15683)	(0.07996)	(0.50372)
	[-0.43438]	[1.63395]	[11.2592]	[1.39268]
D(LUNEMP(-1))	1.808499	-1.691643	0.005266	0.882960
	(2.66564)	(1.09288)	(0.01221)	(0.07692)
	[0.67845]	[-1.54787]	[0.43127]	[11.4789]

Equation of the Estimated VAR model.

$$\Delta \ln EPWP_{ex} = 0.64 * \Delta \ln epwp_{ex}(-1) - 0.09 * \Delta \ln rgdp(-1) - 7.58 * \Delta \ln labf(-1) + 1.80 * \Delta \ln unemp(-1) + \varepsilon_t$$

In terms of impact of changes in EPWPex on lagged terms for economic growth and labour market performance indicators, indicates

- Induce positive effect on its own lagged terms
- Exert negative effect on lagged GDPR and LABF variable.
- Has a positive effect on lagged UNEMP variable

Post estimation
Diagnostic Test on the VAR model (stationarity of error terms)

treasury
Department of Treasury
FREE STATE PROVINCE

Name of Test	Ho	Test Statistic	P value	Inference
Normality Tests Jacque-Bera (joint test)	Residuals are multivariate normal	379.93	0.000	Accept null
Skewness	Residuals are multivariate normal	82.510	0.000	Accept null
Kurtosis	Residuals are multivariate normal	297.427	0.000	Accept null
Residual Test: Portmanteau Test for autocorrelations	No 2nd order serial correlation in residuals	7.548	0.951	Accept null
Heteroscedasticity test (White Test) – joint test	No heteroskedacity	nR^2 (No cross terms) =108.68	0.018	Accept null
Serial correlation LM	No 2nd order serial correlation in residuals	4.500	0.997	Accept null

Granger Causality Test
Identifying the Direction of Causality –
Any dynamic causal relationship?

treasury
Department of Treasury
FREE STATE PROVINCE

Null Hypothesis	χ^2	*p*-value	Decision
RGDP does not granger cause EPWPex	0.096	0.757	Accept null hypothesis
LABF does not granger cause EPWPex	0.189	0.664	Accept null hypothesis
UNEMP does not granger cause EPWPex	0.460	0.497	Accept null hypothesis
EPWPex does not granger cause RGDP	0.931	0.334	Accept null hypothesis
LABF does not granger cause RGDP	2.669	0.102	Accept null hypothesis
UNEMP does not granger cause RGDP	2.396	0.121	Accept null hypothesis
EPWPex does not granger cause LABF	0.060	0.806	Accept null hypothesis
RGDP does not granger cause LABF	0.583	0.445	Accept null hypothesis
UNEMP does not granger cause LABF	0.186	0.666	Accept null hypothesis
EPWPex does not granger cause UNEMP	0.966	0.325	Accept null hypothesis
RGDP does not granger cause UNEMP	0.046	0.829	Accept null hypothesis
LABF does not granger cause UNEMP	1.939	0.163	Accept null hypothesis

Testing significance of coefficients in the VAR model (Rho test) - Any joint significant influence for **dynamic short run feedback**

System: SYS03_ROBUSTVAR_FMODEL
Estimation Method: Least Squares
Sample: 2005Q3 2013Q4
Included observations: 34
Total system (balanced) observations 136

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.644796	0.156560	4.118534	0.0001
C(2)	-0.095726	0.309713	-0.309080	0.7578
C(3)	-7.582661	17.45621	-0.434382	0.6648
C(4)	1.808499	2.665644	0.678447	0.4988
C(5)	0.061940	0.064188	0.964983	0.3365
C(6)	0.731182	0.126978	5.758319	0.0000
C(7)	11.69390	7.156831	1.633949	0.1049
C(8)	-1.691643	1.092881	-1.547874	0.1243
C(9)	0.000176	0.000717	0.245739	0.8063
C(10)	-0.001083	0.001419	-0.763651	0.4466
C(11)	0.900320	0.079963	11.25925	0.0000
C(12)	0.005266	0.012211	0.431272	0.6670
C(13)	0.004440	0.004518	0.982700	0.3277
C(14)	0.001925	0.008937	0.215391	0.8298
C(15)	0.701522	0.503721	1.392679	0.1663
C(16)	0.882960	0.076921	11.47886	0.0000
Determinant residual covariance		8.86E-17		

WALD Test: Coefficient Test for (F-Test) Joint Significance Hypothesis

Any Short-run relationship?

treasury
Department of Treasury
FREE STATE PROVINCE

$$H_o : \beta_1 = \beta_2 = \beta_3 = \beta_4 = 0$$

System: SYS03_ROBUSTVAR_FMODEL

Test Statistic	Value	df	Probability
Chi-square	0.539057	3	0.9102

Null Hypothesis: C(2)=C(3)=C(4)=0
Null Hypothesis Summary:

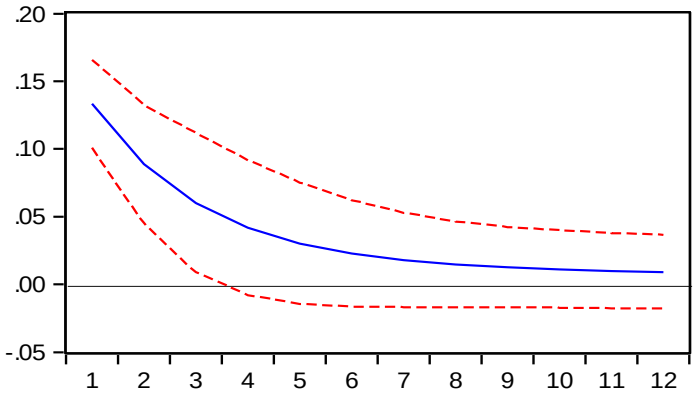
Normalized Restriction (= 0)	Value	Std. Err.
C(2)	-0.095726	0.309713
C(3)	-7.582661	17.45621
C(4)	1.808499	2.665644

Restrictions are linear in coefficients.

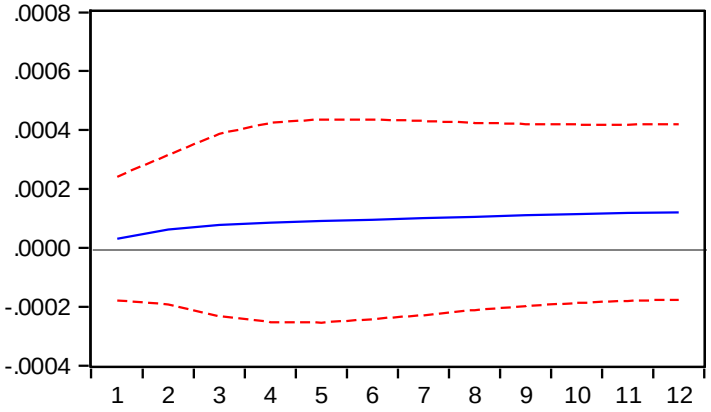
Impulse Response Function of VAR
Impact of one-time innovation to EPWP (positive fiscal shock)

treasury
Department of Treasury
FREE STATE PROVINCE

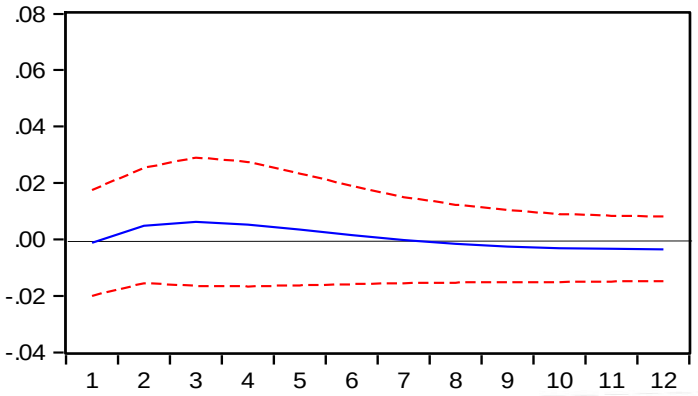
Response of D(LEPWPEX) to D(LEPWPEX)



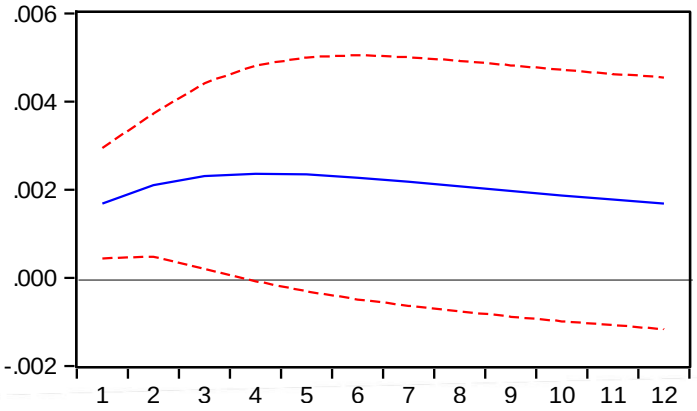
Response of D(LLABF) to D(LEPWPEX)



Response of D(LRGDP) to D(LEPWPEX)



Response of D(LUNEMP) to D(LEPWPEX)



What does the IRF results Tell us?

treasury
Department of Treasury
FREE STATE PROVINCE

IRF results shows varying degree of economic growth and labour market variables to innovation affecting public spending on EPWP.

- both labour participation react positively to a one-time positive fiscal shock on EPWP initiatives, in contrast, the impact of similar shock on the **provincial-GDP is negligible in the short run, i.e. only lasted 3 quarters, and turns negative** after the 7th quarter.

- **Unemployment rate appear to be irresponsive** to a one-time positive fiscal shock on EPWP on impact, nonetheless, in the short-run, the reducing effect of a positive shock to EPWP expenditure merely produce a slight decline in unemployment rate in the 6th quarter.

- Notably, this inference, confirmed earlier findings of negative effect of high public spending on economic growth and negligible impact on labour market performance discussed in the literature review.

- In SA, for South Africa, the negligible impact of temporary public employment programmes on economic growth, unemployment rate and poverty incidence have been widely documented in few evaluation studies assessing the expanded public works porgrammes.

Evidence supporting the IRF results?

treasury
Department of Treasury
FREE STATE PROVINCE

- Response of the provincial GDPR to a one-time fiscal shock to EPWP is not surprising. For empirical support, see Omoshoro-Jones (2014) - apart from short-duration of implemented projects (lasted 3 to 4 months) - insufficient to acquire tangible skill enhancing training / work experience to gain employment in the highly skilled mainstream labour market;

- Pervasive low labour-intensity that characterized most of (if not all) the infrastructure-linked EPWP schemes in Free State, does not support employment-intensive growth, human capital accumulation and creation of productive public assets require to (indirectly) stimulate an employment intensive growth.

- other contributing factors - large size of public sector in the local economy - crowding out of private sector investment and weak participation in the domestic economy.

- The crowding out of private sector by the public sector (through large government size) effectively emasculate the main driver (i.e. source) of job creation and output productivity.

Variance Decomposition Result for VAR Model

treasury
Department of Treasury
FREE STATE PROVINCE

Variance Decomposition of D(LEPWPEX):

Period	S.E.	D(LEPWPEX)	D(LRGDP)	D(LLABF)	D(LUNEMP)
1	0.133261	100.0000	0.000000	0.000000	0.000000
2	0.160326	99.80680	0.022537	0.072554	0.098104
3	0.171567	99.45305	0.033158	0.210112	0.303675
4	0.176991	99.02203	0.031766	0.369138	0.577063
5	0.179956	98.57615	0.036311	0.512388	0.875150
6	0.181779	98.15424	0.061155	0.619776	1.164833
7	0.183019	97.77586	0.109956	0.687543	1.426638
8	0.183930	97.44742	0.177891	0.722194	1.652498
9	0.184635	97.16737	0.256489	0.734331	1.841807
10	0.185202	96.93017	0.337438	0.734452	1.997938
11	0.185670	96.72878	0.414487	0.730879	2.125849
12	0.186063	96.55625	0.483885	0.729175	2.230693

What does the Variance Decomposition Result Tell us?

treasury
Department of Treasury
FREE STATE PROVINCE

- Even though, the explanatory power of the three endogenous variables to explain the variation in EPWPex improved in the 2nd quarter, still their **explanatory power is severely low,**

- In the 12th quarter only 0.48% of GDP-R, 0.72% of LABF and 2.12% respectively can explain the variation of EPWPex**.**

- This inference reinforced the previous results of no long-run or short-run relationship, and causal link (feedback effect) between high public spending on EPWP schemes, economic growth and labour market performance in the Free State

Putting it altogether …Some Policy Recommendation

treasury
Department of Treasury
FREE STATE PROVINCE

- Imperative to re-design framework to include an extensive training to ensure adequate skill development
- Consolidate EPWP projects since proliferation of small projects (especially infrastructure) diminish the positive externalities of economies of scale
- Focus on expanding EPWP schemes to deep rural area where poverty and unemployment is acutely high.
- Re-align strategy provincial policies to facilitate a vibrant private sector participation via public private partnerships (PPP) and establishment of SMMEs, to enhance job creation and encourage self employment
- Incorporate a new EPWP initiative that focus on re-vitalising the waning agricultural sector improve the labour absorption rate in the economy.
- Focus on routine infrastructure (road) upgrade and maintenance via EPWP schemes – more labour intensive, rather than construction of new infrastructure assets which are usually accompanied by high financial costs
- Consider extending the length of EPWP projects to 12 months - improve human capital accumulation, and close skill inequality gap
- Link the current EPWP and its operational framework to other poverty and employment creating policy in FS, e.g. FSGDS

treasury
Department of Treasury
FREE STATE PROVINCE

THANK YOU

QUESTION SESSION…

Oyeyinka Omoshoro-Jones

Snr. Econometrician

Modeling and Forecasting Sub-Directorate,
Economic Analysis Directorate,
Free State Provincial Treasury

Email: yinkaoj@treasury.fs.gov.za / economicpa@treasury.fs.gov.za

Phone: 051 430 4065 / 051 430 2691

[1] Ghadile G.G., and **Omoshoro-Jones, O.S** (2016). "Evaluating Poverty and Inequality Nexus: *A Quantitative Analysis*". Economic Analysis Directorate Staff Research Paper No. 6, Free State Provincial Treasury. Bloemfontein

[2] Omoshoro-Jones, O.S (2015). "Exploring the Impact of Provincial Expenditure on Expanded Public Works Programme on Economic Growth and Labour Dynamics in the Free State Province: *ARIMA and VAR Modelling Approach*", Economic Analysis Staff Working Paper No. 5, Free State Provincial Treasury, Bloemfontein. *A paper presented at the 7th Annual Public Sector Economists' Forum (PSEF),Forever Resort, Warmbath,* 25th – 27th Nov. 2015, Limpopo.

[3] Omoshoro-Jones, O.S (2014). "Disentangling Expanded Public Works Programme's Performance: *Any Impact on Job Creation, Poverty and Skill Development in Free State?* Economic Analysis Directorate Staff Research Paper No.5, Free State Provincial Treasury. Bloemfontein. *A paper presented at the 7th Annual Public Sector Economists' Forum (PSEF),Forever Resort, Warmbath,* 25th – 27th Nov. 2015, Limpopo.

[4] Omoshoro-Jones, O.S (2013). "Government Expenditure And Infrastructure: *An Empirical Survey and Assessment of the Impact of Infrastructure Investment on Free State Province.*" Economic Analysis Directorate Staff Research Paper No.4, Free State Provincial Treasury. Bloemfontein.

[5] Mashibini, G.G., Mokalanyane, N.D., and **Omoshoro-Jones, O.S** (2013), *"Evaluating Fiscal Multiplier Effects on the Free State Economy: A Social Accounting Matrix Approach."* Economic Analysis Directorate Staff Research Paper No. 3, Free State Provincial Treasury. Bloemfontein. *A paper presented at the 5th Annual Public Sector Economists' Forum (PSEF), Cradle of Humankind Conference Centre*, Maropeng, Magaliesburg, 27th – 29th Nov. 2013, Gauteng.

[6] Omoshoro-Jones, O.S (2012). "Evaluating Fiscal Transfers to Provinces and Local Governments: *An Empirical Analysis of Conditional Grants Allocation*", Economic Analysis Directorate Staff Research Paper No. 2, Free State Provincial Treasury. *A paper presented at the 4th Annual Public Sector Economist Forum, Golden Gate Hotel, Highland National Park), 28th – 30th November 2012.*

[7] Omoshoro-Jones, O.S., and Moses, I.J (2011). "Nationalizing Mines in South Africa: *A Critical Review of Proposed Models, Prospective Challenges and Socio-Economic Impacts".* Economic Analysis Directorate Staff Research Paper No. 1, Free State Provincial Treasury. *A paper presented at the 3rd Annual Public Sector Economist Forum*, Protea Kruger Gate Hotel, Mpumalanga, 28 – 31 November, 2011. *An earlier version was presented at the Free State Provincial Executive Council & Provincial Working Committee conference(chaired by the FS Premier) on 1st October, 2011 held at Phillip Sanders, Bloemfontein, Free State.*