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Threshold Effect of Government Consumption on Employment: Evidence from African Countries

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Abstract

This paper uses a Panel Threshold model to evaluate the relationship between Government Consumption and employment. The model is applied to a Panel of 41 African countries over the period 1980 to 2014.The results show that there is a threshold effect in the relationship between Government Consumption and employment. Indeed, Government Consumption has a positive effect on employment when it is lower than 20.43% of Gross Domestic Product. But, above it does not impact employment. This study gives information for targeting fiscal policy in link with labor market performance and show that policy advices that are based on linear approaches may be misleading.

Key-words: Employment, Government Consumption, Threshold regression, Panel data

1. Introduction

Government consumption is often considered as unproductive (e.g., see Barro and Lee, 1994; Rodrick, 1997) because it promotes bureaucracy and favors interest (e.g., see Rodrick, 1997). Government consumption is however important for policy redistribution in particular public employment creation (e.g., see Alesina et al, 1999; Mattos and França, 2011). But, some studies show that Government consumption does not improve employment. While others show because of an impact on aggregate demand, Government consumption can stimulate the overall employment level and reduce unemployment. These contradictory results can be due to the nature of the relationship between employment and government consumption. Such consideration has been investigated by Asimakopoulos and Karavias (2015) for the relationship between Government size and growth. For developing and developed countries, results rejected the linear relationship and corroborate the existence of an inverted 'U-shaped' curve relationship also known as the BARS curve (e.g., see Barro, 1990; Armay, 1995; Rahn and Fox, 1996; and Scully, 1995). They find an optimal threshold level of government size of 18.04%. Below this threshold government size increases growth and above it decreases growth.

In this paper we try to investigate this question for the relationship between Government consumption and employment. We thus compare the results of a Panel linear model and a Panel Threshold (PTR thereafter) non dynamic model to investigate whether the results are sensitive to the model specification. The models are applied to data from 41 African countries that cover the period 1980-2014. We find that the linear model corroborates the results of previous studies that report no effect of Government consumption on employment. However the test for the existence of a linear relationship is strongly rejected in favor of a single threshold effect model. We find a positive relationship between Government consumption and employment below a threshold of 20.43% of GDP, while there is no impact beyond. The rest of the paper is organized as follows: In section 2 we give a brief literature review about the relationship between government consumption and growth and government consumption and employment. Section 3 describes the methodology and section 4 the data. In section 5 we report the econometric results. Section 6 concludes the paper.

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2. Related Literature Review

There is much work on the impact of Government consumption on growth, but there is not enough work on the relationship between Government consumption and employment. Some studies conclude that Government consumption expenditure has no impact or has a negative impact on growth (e.g., see Landau, 1983; Grier and Tullock, 1989; Barro and Lee, 1994), while others show that Government spending on consumption has a positive effect on growth (e.g., see Gali et al., 2004). Government consumption can have a negative impact on growth when it favors activities that are substitutable for private activities. But Government consumption may also affect positively growth if it increases private consumption (e.g., see Gali et al.,2004). Kweka and Morrisey (2000) found for Tanzania during the period 1965-1996 a negative impact of public investment on growth while public consumption impacted positively private consumption and growth. The positive impact of public spending on private consumption has also been corroborated by Bouakez and Rebei (2003).

Government spending also has an impact on the level of employment. As variations in public investment or consumption expenditure often result in recruitment or dismissal of workers. Rodrick (1997) showed with data from OECD countries, East-Asia, Latin America and Sub-Saharan Africa countries, that public consumption spending leads to an increase in public employment. Fatas and Mihov (1998) using a VAR approach applied to U.S data showed a positive impact of an increase in government spending on private output. They also found a persistent rise in all the components of consumption and an increase in overall employment. Brückner and Pappa (2011) used a structural VAR approach applied to OECD countries. They found that Government expenditures increase employment and labor participation rate, but also increase unemployment rate. Matsumae and Hasumi (2016) used a DSGE model applied to Japanese data. They found a positive impact of Government consumption on investment and unemployment. However by increasing the aggregate demand, Government consumption can reduce unemployment. Abrams (1999) with US data found a positive correlation between government outlays as percent of GDP and the unemployment rate.

The impact of government spending on employment also depends on the relationship between the private and public sectors. If the public sector and the private sector compete with each other, there can be a crowding-out effect which can influence the overall level of employment. Demeas and Kontolemis (1999) have developed a model in which government and the private sector compete for employment. They apply the model to data from Greece. They find that a rise in government wages leads to higher wages in the private sector and an increase in unemployment. They also find that public employment does not improve total employment. For Malley and Moutos (1998), public spending leads to an increase in the level of employment that can influence labor-market flows. If the labor supply is elastic to the real wage rate, an increase in public employment will have no crowding-out effect on private employment. On the other hand, if the labor supply is inelastic to the wage rate, a rise in public employment may crowd out private employment. They find that in Sweden, over the period 1964-1994, the increase in public employment has resulted in a fall in the level of private employment. This finding is corroborated by Algan et al. (2002) who showed for OECD countries from 1960 to 2000, that on average, 100 jobs created in the public sector destroyed about 150 private sector jobs. They add that this crowding out effect is significant in countries where public sector activities are highly substitutable to those of the private sector.

Another idea resides in the composition of the Government Consumption. Since the conclusion may differ if the Government consumption is oriented towards Goods and services or employment expenditures. Cavallo (2005) applied to U.S data a neoclassical model augmented for the inclusion of government employment, to compare the dynamic effect of government expenditures on goods and services and the government expenditure on employment. He finds that when government expenditure consists of consumption of goods, fiscal shocks reduce consumption since this leads to a reduction of the real wage. However, when government expenditures consists of employment, a fiscal shock leads to an increase in real wage, a decrease in private output and employment, but an increase in private consumption.

The above studies analyzed the impact of Government spending on employment without taking into account the possibility of a non- linear relationship between the variables. Yet, this question is important for employment policy concern. For example Beard et al. (2011) analyzed the impact of public expenditure and private investment on private employment using a threshold model. They find that public spending has no impact on private employment in times of crisis, but in a period of expansion it impacts positively employment. In this study we use annual data from a panel of 41 African countries over the period 1980-2014.

We compare the estimation from a panel linear model and that of a Panel Threshold Regression Model. Our results support the idea that the relationship between government consumption and employment is non-linear.

3. Econometric Methodology

3.1 The Empirical model

We assume following Mouheli (2007) that labor demand is a function of capital stock, the production level and the technology efficiency,

$$L_{it} = F\left(Y_{it}, K_{it}, A_{it}\right)(1)$$

Empirically we express the labor demand function in the log-linear form as follows,

$$\ln L_{it} = \alpha_0 + \alpha_1 \ln Y_{it} + \alpha_2 \ln K_{it} + \alpha_3 \ln A_{it} + \varepsilon_{it}(2)$$

We hypothesize that productive efficiency is determined by Government expenditures for example on education, health (e.g., see Irmen and Kuehnel, 2008) and innovation acquired *via* trade openness (e.g., see Licandro and Ruiz, 2010). We thus consider that the efficiency technology parameter varies with export ratio and Government expenditure ratio.

$$A_{it} = e^{\delta_0 + \delta_1 (X/Y)_{it} + \delta_2 (G/Y)_{it}}(3)$$

Equation 2 then becomes after some developments,

$$\ln L_{it} = \theta_0 + \theta_1 \ln Y_{it} + \theta_2 \ln K_{it} + \theta_3 (X/Y)_{it} + \theta_4 (G/Y)_{it} + \eta_i + \varepsilon_{it}(4)$$

This linear model can be modified to take into account a threshold effect in the relationship between Government size and labor demand. We thus use the non-dynamic panel Threshold Model (There after PTR) developed by Hansen (1999). This model can be generalized for *r* Thresholds and *r+1* regimes (e.g., see, Hansen, 1999) but we present here aPTR model with one Threshold (r=1) and two regimes as follows:

$$\ln L_{it} = \theta_0 + \theta_1 \ln Y_{it} + \theta_2 \ln K_{it} + \theta_3 \left(\frac{X}{Y}\right)_{it} + \theta_4 \left(\frac{G}{Y}\right)_{it} I(q_{it} < \gamma) + \theta_5 \left(\frac{G}{Y}\right)_{it} I(q_{it} \geq \gamma) + \eta_i + \varepsilon_{it}(5)$$

Where, $i = 1, \cdots, N$; $t = 1, \cdots, T$; N and T are the individual and time dimensions respectively of the panel; Y_{it} is the real GDP which measures production level, K_{it} is the stock of capital, $(X/Y)_{it}$ is the export ratio. $(G/Y)_{it}$ is the Government expenditures ratio, q_{it} is the threshold variable and ln the natural logarithm. I is an indicator variable that takes the value 1 if the condition inside the parenthesis is filled, γ is the threshold parameter that separates the equation into two regimes with the respective coefficients θ_4 and θ_5. The η_i parameter is the individual effect and ε_{it} is an error term independent and identically distributed with zero mean and finite variance. If we choose to proxy the stock of capital by the investment ratio I/Y, Equation 5 becomes:

$$\ln L_{it} = \theta_0 + \theta_1 \ln Y_{it} + \theta_2 \left(\frac{I}{Y}\right)_{it} + \theta_3 \left(\frac{X}{Y}\right)_{it} + \theta_4 \left(\frac{G}{Y}\right)_{it} I(q_{it} < \gamma) + \theta_5 \left(\frac{G}{Y}\right)_{it} I(q_{it} \geq \gamma) + \eta_i + \varepsilon_{it}(6)$$

3.2. Estimation Procedure

The PTR methodology follows several steps. First it is advisable to eliminate the individual effects by removing individual-specific means and then apply the least squares procedure. To estimate the values of the threshold parameters, we can define a range of potential values of q_{it} within which to seek γ. But it is advisable to opt for a rather narrow interval of values $\left(\gamma, \hat{\gamma}\right)$ representing the quantiles of q_{it}. This interval being defined for each potential value, Equation 6 is estimated and the optimal estimator of γ parameter is the value that minimizes the sum of squared residuals,

$$\hat{\gamma} = \arg\min_{\gamma} S_1(\gamma) \tag{7}$$

The second step is to test for the existence of the threshold effect. This test is based on $H_0 : \theta_4 = \theta_5$ (linear model) vs. $H_a : \theta_4 \neq \theta_5$ (threshold model). To test this hypothesis, the following F statistic is used,

$$F_1 = \frac{S_0 - S_1(\hat{\gamma}_1)}{\hat{\sigma}^2} \tag{8}$$

where $\hat{\sigma}^2 = \frac{1}{n(T-1)} S_1(\hat{\gamma}_1)$, S_0 represents the sum of squares of the residuals obtained from the regression under the null hypothesis and $S_1(\hat{\gamma}_1)$, the sum of squared residuals of the regression under the alternative hypothesis.

Under the null hypothesis the threshold γ is not identified. In addition, F_1 has a non-standard distribution. Thus, Hansen (1999) suggests to use a bootstrap procedure to simulate the critical values of F needed to test the threshold effect hypothesis.

4. The Data

The data used in this paper come from the Penn World Table 9.0 elaborated by Feenstra et al. (2015). These data are annual and consist of 41 African countries: Benin, Guinea-Bissau, Burkina Faso, Equatorial Guinea, Botswana, Kenya, Central African Republic, Liberia, Côte d'Ivoire, Madagascar, Cameroon, Mali, DR of the Congo, Mozambique, Congo, Mauritania, Cabo Verde, Mauritius, Djibouti, Malawi, Ethiopia, Namibia, Gabon, Niger, Ghana, Nigeria, Guinea, Rwanda, Gambia, Sudan, (Former), Senegal, Sierra Leone, Swaziland, Chad, Togo, UR of Tanzania: Mainland, Uganda, South Africa, Zambia, Zimbabwe.
The data cover the period from 1980 to 2014. Table 1 shows the descriptive statistics of the variables.

Table 1: Descriptive statistics

Variable	Definition	Observation	Mean	Std. Dev.	Min	Max
L	Number of persons engaged (in millions)	1,435	5.227	7.791	0.050	56.821
lnL	Logarithm of number of persons engaged (in millions)	1,435	0.729	1.504	-2.998	4.040
Y	Real GDP at chained PPPs in mil. 2011 US Dollar	1,435	35975.82	95025.51	151.360	989291.5
lnY	Logarithm of Real GDP at chained PPPs in mil. 2011 US Dollar	1,435	9.381	1.387	5.020	13.805
$\frac{G}{Y}$	Share of Government consumption at current PPPs	1,435	0.195	0.122	0.017	0.954
$\frac{I}{Y}$	Share of Gross Capital Formation at current PPPs	1,435	0.161	0.107	0.006	0.889
$\frac{X}{Y}$	Share of merchandise export at current PPPs	1,435	0.172	0.183	0.003	1.270

Source: Feenstra et al. (2015).

We can see that the minimum government consumption expenditure is 1.7% of GDP and the maximum is 95.4%. On average, during the period, Government Consumption was about 19.5% of GDP. Table 2 presents the stochastic properties of the data by using unit root tests.

Table 2: First and second Generation Panel unit root tests

	LLC		IPS		Peasaran CD-test	CIPS**	
	No Trend	Trend	No Trend	Trend		No Trend	Trend
LnL	-1.272	-6.081[a]	9.896	-2.601[a]	160.70 [a] (0.949)	-2.194[b]	-2.294 [a]
lnY	4.440	-1.837[b]	9.579	-0.05	114.94 [a] (0.678)	-2.133[b]	-2.485
I/Y	1.213	-5.778[a]	1.698	-4.301[a]	40.30 [a] (0.238)	-2.420 [a]	-2.898 [a]
X/Y	-2.144[a]	-3.694[a]	-4.738[a]	-5.051[a]	17.06 [a] (0.101)	-2.741 [a]	-2.940 [a]
G/Y	-4.771[a]	-2.530[a]	-2.039[a]	0.396	31.55 [a] (0.186)	-1.995	-2.933 [a]

** Note: CIPS test developed with the command xtcips of stata with 5 maximum lags and 2 lags for Breusch-Godfrey test; ( ) estimated coefficient correlation $\hat{\rho}$. ([b]) significant at 5% level;([a])significant at 1%.

Three types of unit root tests are developed. The Levin, Lee and Chu(LLC) (2002), the ImPeasaran and Shin (IPS)(2003) and the Peasaran (2007) test. The first two approaches are first generation panel unit root tests that assume cross-section independence. However this hypothesis is restrictive and unrealistic for macro series and leads to size distortions and low power (Hurlin and Migon, 2007).We thus add the third method, the Peasaran CIPS test, which is a second generation panel unit root test. The Peasaran CIPS test is a Dickey Fuller regression augmented with the cross-section average of lagged levels and first differences of the individual series. This procedure assumes one or more common unobserved factors produce cross-country dependence.

Before implementing this method we first check for the presence of cross-section independency by using the Peasaran (2004) CD statistic.

The results show that for all the variables the first generation unit root test rejects the unit root hypothesis except for variable $\ln Y$ for which the IPS test is not significant. However the CD test strongly rejects the assumption of cross-section independence for all the series. We therefore turn to the CIPS panel unit root test. This procedure concludes to stationarity of all the series. We can consequently develop our Threshold Regression.

5. Estimation Results

In this section we first analyze the relationship between Government Consumption and Employment with a linear model and second with a Threshold Regression Model as developed by Hansen (1999). The results show that the specification of the model plays an important role in understanding the link between the two variables.

5.1. Government consumption and employment: The linear Model

Table 3 reports the results of the Panel linear coefficients. We present the coefficients along with the OLS and the robust standard errors. Following the robust standard result, we see that Export ratio, and Government Consumption ratio does not impact the employment level. The coefficients of these two variables are not significantly different from zero. However, real GDP and Investment ratio have a significant and positive impact on employment. The coefficient of real GDP is significant at 1% level, while that of Investment ratio is significant at 5% level. The results confirm the view that Government Consumption fails to increase employment and is thus unproductive.

Table 3: Regression estimates: Panel Linear Fixed-effect model

Regressor (Dependent Variable: $\ln L_{it}$)	Coefficient	OLS S.E	Robust S.E
Const.	-2.396	0.102[a]	0.693 [a]
$\ln Y_{it}$	0.332	0.110[a]	0.074 [a]
$\left(\frac{I}{Y}\right)_{it}$	0.541	0.077[a]	0.239 [b]
$\left(\frac{X}{Y}\right)_{it}$	-0.148	0.060[b]	0.248
$\left(\frac{G}{Y}\right)_{it}$	-2.71	0.056[a]	0.257
N	1,435		
R^2 Within	0.517		
R^2 Between	0.657		
R^2 Overall	0.598		

([b]) significant at 5% level; ([a]) significant at 1%.

We now turn to the Threshold Regression Model to ascertain this result. The procedure behind this approach is to see whether the aforementioned result is not due to a misspecification of the model which does not take into account threshold effect.

5.2 Government consumption and employment: The Panel Threshold Model

The procedure here is to test first the threshold effect, estimate the threshold value and then estimate the coefficients of the PTR model. Regarding the threshold variable q_{it}, there may be two candidates: the variable G/Y or the lagged G/Y. Following Fouquau (2012), we discriminate between the two variables by selecting the variable that yields the lower Residual sum of squares (RSS) and that strongly rejects the linearity hypothesis.

Table 4: Selection of the threshold variable and linearity test

	$q_{it} = \left(\frac{G}{Y}\right)_{it}$	$q_{it} = \left(\frac{G}{Y}\right)_{it-1}$
One Regime		
RSS	54.962	49.585
F1	130.17	140.24
p-value	0.000	0.000
Two Regimes		
RSS	53.884	49.139
F2	27.99	23.40
p-value	0.240	0.240
Three Regimes		
RSS	52.911	48.605
F3	25.75	14.96
p-value	0.940	0.960

For the two q_{it}variables, the search for the threshold was part of a quantile range from 5% to 95% and the number of replications for bootstrapping was set to 300. The results are given in table 4. The F test statistic along with the bootstrap *p* value show that for the two candidates of threshold, there is strong evidence of rejection of linear regression and the existence of a single threshold in the regression. Moreover, the lagged G/Y variable is the best candidate because it has the lower RSS and the Highest F statistic. We thus consider this variable for the rest of the analysis and consider a two regime Threshold Model.The point estimate of the threshold and the 95% and 99% confidence intervals are given in Table 5. The point estimate is 0.2043; so the optimal Government consumption ratio is 20.43%.

Table 5 Threshold estimates

	Estimate	95% confidence interval	99% confidence interval
$\hat{\gamma}$	0.2043	[0.2020, 0.2049]	[0.1986, 0.2049]

Table 6 reports the number of countries which falls into the two regimes. We can notice that from 1981 to 1987, the majority of the countries (between 23 and 29 over 41)were in the high regime. After 1987, the number of countries in high regime each year decrease. It falls between 6 and 19 over 41. The first period correspond to the period of economic crisis experienced by the majority of African countries who undertook Structural Adjustment Programs (SAP). In the 90's these countries were engaged in the stabilization phase of SAP which led to government spending reduction.

Table 6: Number of countries in each regime by year

Year	$q_{it} \geq \hat{\gamma}$	$q_{it} < \hat{\gamma}$	N countries
1981	27	14	41
1982	28	13	41
1983	28	13	41
1984	29	12	41
1985	28	13	41
1986	29	12	41
1987	28	13	41
1988	23	18	41
1989	19	22	41
1990	18	23	41
1991	14	27	41
1992	13	28	41
1993	13	28	41
1994	12	29	41
1995	12	29	41
1996	10	31	41
1997	6	35	41
1998	6	35	41
1999	10	31	41
2000	7	34	41
2001	7	34	41
2002	7	34	41
2003	7	34	41
2004	9	32	41
2005	9	32	41
2006	10	31	41
2007	9	32	41
2008	8	33	41
2009	9	32	41
2010	10	31	41
2011	8	33	41
2012	8	33	41
2013	9	32	41
2014	9	32	41
Total	520	915	1,435

The estimated coefficients of the regression along with the standard errors are reported in table 7. Two types of standard errors are displayed. The OLS one and the robust standard one which corrects for heteroskedasticity. Results show that the investment ratio coefficient is significant at the 1% level. This coefficient has a positive sign indicating that investment is an engine of employment creation. A 1% increase in the investment ratio induces a 0.58 percentage increase in labor demand. The economic activity is also a major determinant of labor demand. The coefficient of the variable ln$Y$ is significant and positive. When the economy grows by one percent, labor demand increases by around 0.31 percent. However, export ratio does not impact the labor demand. The coefficient is negative but insignificantly different from zero.

Table 7: Regression estimates: Threshold model

Regressor (Dependent Variable: $\ln L_{it}$)	Coefficient	OLS S.E	Robust S.E
Const.	-2.331	0.097[a]	0.624 [a]
$\ln Y_{it}$	0.308	0.010[a]	0.068 [a]
$\left(\frac{I}{Y}\right)_{it}$	0.581	0.072[a]	0.581 [a]
$\left(\frac{X}{Y}\right)_{it}$	-0.076	0.058	-0.076
$\left(\frac{G}{Y}\right)_{it} I\left(q_{it} < 0.2043\right)$	1.124	0.124[a]	0.495[b]
$\left(\frac{G}{Y}\right)_{it} I\left(q_{it} \geq 0.2043\right)$	0.029	0.057	0.258
N	1,435		
R^2 Within	0.563		
R^2 Between	0.609		
R^2 Overall	0.549		

([b]) significant at 5% level;([a])significant at 1%.

We now turn to the impact of Government consumption ratio on labor demand. We observe that the coefficient relative to the high regime of Government consumption ratio is not significant. However, the coefficient of the low regime is significant at 5% and positive. This indicates that below 20.43% of GDP, Government consumption increases employment. A 1% increase in Government consumption, as a share of GDP, leads to an increase in employment by 1.12%. However above a threshold of 20.43% Government consumption fails to impact employment. One of the reasons may be that below the threshold, Government consumption does not reduce private employment. But above, it crowds-out private employment. This result suggests that expansionary fiscal policy that increases Government consumption has severe impacts on employment if Government consumption is higher than 20.43% of GDP. The results contrast with those studies that conclude to an unproductive effect of Government Consumption on employment. It also mitigates the results suggesting a positive impact of Government consumption since it indicates a limit above which the impact on employment becomes insignificant.

6. Final Remarks

The objective of this paper was to investigate the relationship between Government consumption and employment. We use data from a panel of 41 African countries over the period 1980-2014 and a methodology based on a Panel Threshold Regression. We find that there is a threshold effect in the relationship between Government consumption ratio and employment. The optimal Government Consumption ratio is of 20.43%.The majority of countries Government consumption ratio was above this optimal value during the 1981-1987 period. But after 1987, the majority of the countries were in the low regimes of Government consumption. Estimation of the Panel Threshold coefficients suggests that below the optimal value, Government Consumption has a positive and significant impact on employment. However beyond the optimal value, Government consumption ratio does not impact employment.The results indicate that in African countries, below a certain threshold, increasing Government Consumption may be favorable for employment promotion. In contrast above this threshold, increasing Government consumption will not be effective for employment promotion. The results show that not taking into account the nonlinear nature of the relationship between Government consumption and employment may cause misleading policy advices. The optimal value estimated in our study can help in targeting government consumption ratio in African countries and can be useful for assessing the link between fiscal policy and labor market performance.

Moreover, to get more relevant information we need to address this relationship by identifying the impact of the composition of Governments consumption expenditures on employment. This question is not analyzed in this study because of lack of data. So it will be useful to make such investigation for further study.

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