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-RESEARCH ARTICLE-

THE RELATIONSHIP BETWEEN GOVERNMENT DEBT AND STATE-OWNED ENTERPRISES: AN EMPIRICAL ANALYSIS OF ESKOM

Lerato Nkosi

University of South Africa, Pretoria Campus

E-mail: nkosil@unisa.ac.za

Orcid ID: 0000-0002-9478-2714

─Abstract─

This study empirically investigates the relationship between government debt and Eskom debt using Eskom's financial statements and government debt data from 1985 – 2017. The paper uses a Vector Autoregression (VAR) model. Variance decomposition analysis shows large forecast error variances amongst all variables. The study finds that Eskom's increase in revenue is largely attributed to tariff increases and access to various funds rather than increases in sales. The study also shows that Eskom will continue to be illiquid and insolvent, thus fiscal consolidation or privatization are suggested as fiscal strategies.

Key Words: State Owned Enterprises; Eskom; government debt; VAR;

JEL Classification: H81, C87, H11, H63

1. INTRODUCTION

1.1. Background

State Owned Enterprises (SOEs) are firms established by government as vehicles of commercial and political objectives. These firms are usually located in industries such as electricity, infrastructure, banking and water supply. Eskom is both an SOE and monopoly in the South African Electricity Supply Industry and its supply chain includes electricity generation, transmission as well as distribution. (Eberhard 2004; Gigler & McMillan 2018:1). While SOEs play an instrumental role in economic development, they also suffer from several

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challenges such as lack of productivity, inefficiency and wasteful expenditure. Their biggest challenge is the fiscal risk that they impose on the government. This occurs mainly through state guaranteed loans where SOEs are given lax credit monitoring, face soft budget constraints and are able to increase their debt levels without fear of liquidation or bankruptcy (World Bank 2014; Yi-chong 2012: 128).

John Maynard Keynes (1936) believed that the accumulation of public debt should only be used for public capital expenditure and to stabilize the economy, which is also a form of decreasing unemployment. Tanzi (2016) supports this argument by noting that Keynes proposed that public borrowing should also have a short life span since its primary use is to stabilize the economy in the short run. Thus, Keynes did not advocate for public debt to be used for government consumption or transfers, be it for social spending or even public entities. This narrative resonates with Svaljek (1997) who adds that public borrowing should not be used for balancing current accounts, inflation control, the growth of private investments, or even maintaining credibility as a state. However, this is not the case in South Africa as the National Treasury (2018) conceded that total public debt largely consists of debt accumulated for current expenditure than capital expenditure.

According to Julies (2018), the combined financial position of public institutions has been weak with its government guarantee and exposure not only too high but increasing every financial year. Of all the public institutions, Eskom constitutes on average, 75 % of government guarantees and exposure (Julies 2018). This shows how much of a contingent liability Eskom is to the public purse. According to the Development Bank of South Africa (DBSA) (2012) Eskom has had access to funds through equity injections, government loans, the African Development Bank, export credit agencies, commercial paper and capital markets. Eskom's access to funds from capital markets also meant that they received R12,25 billion for the issuance of global bonds in 2010 and its oversubscription showed a strong global appetite for South African debt (Creamer 2011:1).

In a study comparing how the government and state-owned banks allocated credit to SOEs in China during 1980-1994, Cull and Xu (2002:533) found that direct government transfers were not significantly associated with profitability. Dewenter and Malatesta (2001: 320-321), using accounting numbers, conducted a large-sample cross-sectional comparison of SOEs and privately-owned corporations from 1975 – 1995. They found that SOEs are less profitable than private firms. Although the time period is old, the results are still comparable between private firms and SOEs today. Further challenges amongst SOEs are deteriorating fixed facilities, poor service quality, chronic revenue shortages, corporate governance and large outstanding debt levels (Kessides 2004: 2). There is little to no incentive for managers in SOEs to achieve full productivity. The remuneration of managers is independent of the organization's performance. Hence there is little incentive for sales maximisation; profit maximisation or even growth maximisation (Lypczynski, Wilson & Goodard 2013: 701). Ngwenya and Khumalo (2012) have found a negative relationship between CEO compensation and SOE performance and in 2011, they found that the salaries of Eskom's executives increased by 109%.

An important element of this study is the inclusion of financial ratio analysis in the empirical model. The study uses the current ratio and debt to assets ratio calculated from Eskom's financial statements from 1985 – 2017. According to Kumbirai and Webb (2010), financial ratio analysis is effective in distinguishing high performing companies. A current ratio measures the ability of a company to pay off its short-term debt without disturbing normal business operations (Walton and Earts 2009: 247). It is calculated as current assets with respect to current liabilities. The debt to assets ratio is a solvency ratio and is an indicator of stability and risk. A low current ratio of <1.5 implies that a company will not be able to pay off its short-term obligations even if it can liquidate all its current assets (Grains Research & Development Corporation 2013: 3). Conversely, a high current ratio of >1.5 implies that the company is highly liquid, which means that it would be able to pay off its short-term obligations by selling its current assets at a high value. Throughout the sample period, Eskom has been relatively illiquid never obtaining a current ratio that is >1.5.

A debt to asset ratio of less than 30% or 0.3 is desirable while a ratio higher than this shows that the company is in a weak financial position. The general state of Eskom is one of financial distress, so the data only confirms the details in the financial statements. Even though the debt to assets ratio trend has been generally downwards from 1985 -2017, it has still been on average, above 30%. Overall, Eskom is using debt financing for its operations, hence it has a debt to assets ratio which is close to 100%. This implies that if Eskom was not an SOE, it would have to declare bankruptcy or insolvency.

Much of the current literature on SOEs stems mainly from China due to their long rolling out of privatisation and corporatisation of their SOEs. Tian and Estrin (2007) conducted a study on Chinese publicly listed companies, one in which government has a significant share ownership. They used an Ordinary Least

Squares model (OLS) as well as an Arellano- Bond GMM regression. From the study they found that debt financing causes inefficiency in publicly listed Chinese companies. Cull and Xu (2002) also carried out a study on the behaviour of bureaucrats and state banks in allocating credit to Chinese state-owned enterprises with dated data from 1980-1994. Their findings indicated that bureaucracy was detrimental to the state banks' performance. The paper is organised in the following way: Section 2 will discuss the theoretical framework and methodology, Section 3 will outline the empirical analysis and Section 4 will conclude the study and provide recommendations.

2. THEORETICAL FRAMEWORK AND METHODOLOGY

2.1. Theoretical Framework

The theoretical framework of this study is based on the work of Keynes (1936), Tanzi (2016), Buchanan (2008), Svaljek (1997), and Hyman (2011) who view public debt from a positivist approach and support the narrative of borrowing only for stabilization purposes. Contrary to the views of Stiglitz (2015), Barro and Grilli (1994), Neck and Getzner (2001), and Ncube and Brixiova (2015), the study is of the view that the state must not engage in borrowing for fiscal stimulus packages, economic growth objectives or even transfers to SOEs as efforts of maintaining financial credibility. Borrowing should be used for capital expenditure which will benefit society in the long run in the form of employment and the creation of tangible structures (e.g infrastructure development) from this capital expenditure. Thus by extension, the study also refutes Barro's (1979) theory of the neutrality of debt, that changes to government spending do not have an effect on aggregate demand. If anything, these effects are very real and result in long term effects such as shifting the tax burden to future generations, decreasing the supply of loanable funds, and thus increasing interest rates for the average citizen. Brauninger (2005) also notes in the long run, the negative relationship between economic growth and public debt.

2.2. Methodology

This study has adopted the Vector Autoregressive (VAR) model. The choice of technique is based on its ability to explain movements in the current variables with its past values (Lutkepohl 2006). It does so by forecasting variance decomposition analyses and impulse response functions through a method called Cholesky Ordering (Harris 1995; Lutkepohl 2006; Lutkepohl & Poskitt 1991). The model is specified in log linear form and is expressed in the following way:

$$Ln\frac{GD}{GDP} = \beta_0 + \beta_1 LnEP + \beta_2 LnED + \beta_3 LnREV + \beta_4 LnSTAFF + \beta_5 LnCR + \beta_6\ LnDAR) \qquad (1.1)$$

Equation (1.1) stipulates that the dependent variable, government debt as a proportion of Gross Domestic Product (GDP) is a function of the electricity price, Eskom's debt, Eskom's revenue, its staff numbers, current ratio and debt to assets ratio.

2.3. Data Sources

The study used annual data from Eskom's Financial Statements during the period 1985 – 2017. The variables used from these statements are the electricity price, Eskom debt, revenue and staff. The current ratio and debt to assets ratio was calculated by the author utilising Eskom's financial statements. The data for GDP was sourced from Quantec (Easy Data)

3. EMPIRICAL ANALYSIS

3.1. Unit Root Testing

The study conducted unit root testing using the Augmented Dickey Fuller (ADF) test by Dickey and Fuller (1979) and the Phillips Peron (PP) test by Phillips & Perron (1988). The null hypothesis is non-stationarity, while the alternative hypothesis is stationarity. The study has conducted unit root tests across all three models, namely the intercept, trend and intercept and none. Testing at intercept indicates whether stationarity is present when there is a stochastic trend. This trend includes the progression of stochastic errors over time. It could also be said that this model tests stationarity when the data generating process does not forget its past errors. Testing at trend and intercept indicates whether stationarity is present when there is a deterministic trend. The inclusion of the trend and intercept when testing for stationarity often results in the series having a nonconstant mean. However it is still important to include the aforementioned models when testing for stationarity because their data generating processes could show stationarity and to ensure that the study is robust in its unit root testing. The last model, which tests for none, that is, no trend and intercept, is able to remove the deterministic and stochastic trend. This makes it is easy to see if the series will revert to a stationary white noise process.

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Table 1: Unit Root Tests at Levels and First Difference

Variable	Model	**ADF (Level)**		**PP**	
		Level	**First Difference**	**Level**	**First difference**
		t-statistic	**t-statistic**	**t-statistic**	**t-statistic**
GD/GDP	Trend & Intercept	-2.669	-2.413	-1.563	-2.12
	Intercept	-2.576	-2.442	-1.423	-2.212
	None	0.325	-2.384**	0.671	-2.127**
GD	Trend & Intercept	-2.944	-2.307	-1.938	-2.089
	Intercept	-1.180	-2.279	-1.434	-1.918
	None	1.386	-1.054	5.482	-0.990
GDP	Trend & Intercept	-1.493	-4.361***	-1.468	-4.374***
	Intercept	-7.608	-2.322	-7.608	-2.094
	None	1.575	-1.325	8.214	-1.585
ED/GD	Trend & Intercept	-1.600	-7.612***	-1.433	-7.651***
	Intercept	-2.281	-6.621***	-2.295	-6.537***
	None	0.441	-6.614***	0.503	-6.526***
ED	Trend & Intercept	-1.537	-8.206***	-1.204	-10.920***
	Intercept	1.5883	-7.528***	2.001	-7.528***
	None	3.441	-5.894***	3.886	-5.909***
EP	Trend & Intercept	-2.094	-2.551	-1.172	-2.586
	Intercept	0.4681	-2.378	0.3201	-2.509
	None	1.711	-1.698**	4.732	-1.702**

R/EP	Trend & Intercept	-2.606	-8.083***	-2.480	-14.819***
	Intercept	-1.999	-7.819***	-2.084	-7.919***
	None	1.712	-7.356***	1.750	-7.316***
REV	Trend & Intercept	-1.700	-5.042***	-2.018	-5.034***
	Intercept	-0.471	-5.130***	-0.488	-5.124***
	None	6.107	-1.792**	5.892	-3.000***
STAF	Trend & Intercept	0.764	-4.003***	1.469	-3.792**
	Intercept	-0.681	-2.320	-1.024	-2.218
	None	0.248	-2.453***	0.20	-2.392**
CR	Trend & Intercept	-3.090	-5.335***	-3.004	-7.982***
	Intercept	-2.964	-5.181***	-2.964	-7.531***
	None	3.020	-5.215***	-3.020	-7.532***
DAR	Trend & Intercept	-4.154	-5.991***	-4.144	-6.652***
	Intercept	-2.429	-6.15***	-2.563	-6.962***
	None	-1.494	-6.263***	-1.50	-7.078***

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Table 2: Unit Roots tests at Second Difference

Variable	Model	**ADF t-statistic**	**PP t-statistic**
GD	Trend & Intercept	-3.944**	-4.865***
	Intercept	-4.817**	-4.932***
	None	-4.886***	-5.003***

Source: Author's Computation from E-Views

* Statistically significant at a 10% level

** Statistically significant at a 5% level

*** Statistically significant at a 1% level

The unit root tests in Table 1 show that all variables are non-stationary at levels. The ADF and PP tests show that GDP is stationary at levels, when testing only the intercept. CR is also stationary at levels, only when the ADF test is performed with no intercept and no trend. DAR is also stationary when the PP test is performed only on the trend and intercept. Otherwise, all the variables are generally non-stationary at levels. The unit root tests also show that all variables are stationary at first difference. However, GD is still non-stationary at first difference. GD/GDP only shows stationarity when the ADF and PP test are performed with no trend and no intercept. GDP only shows stationarity when the ADF and PP tests are performed on the trend and intercept. EP is also stationary when the ADF and PP tests are performed with no trend and no intercept. STAFF is also stationary apart from when the ADF and PP tests are performed with an intercept. In table 2, GD is stationary only at second difference, therefore, it will not be considered in the study because it is I(2). Otherwise, all the variables are stationary at I(1)

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3.2. VAR model results

Table 3: Correlation Probability Matrix

Correlation Probability	GD/GDP	EP	REV	ED	STAF	CR	DAR
GD/GDP	1.000						
EP	0.470 (0.006) ***	1.000 ------					
REV	0.458 (0.007) ***	0.992 (0.000) ***	1.000 -------				
ED	0.344 (0.049) **	0.972 (0.000) ***	0.956 (0.000) ***	1.000 ……….			
STAF	-0.003 (0.987)	-0.032 (0.861)	-0.129 (0.475)	0.085 (0.637)	1.000 …		
CR	-0.110 (0.544)	0.398 (0.022) **	0.457 (0.008) ***	0.358 (0.004) ***	-0.512 (0.002) ***	1.000 ……….	
DAR	0.246 (0.167)	-0.442 (0.010) ***	-0.466 (0.006) **	-0.537 (0.001) ***	0.087 (0.629)	-0.297 (0.094) **	1.000

Source: Author's Computation from E-Views 9

*Where ( ) indicates p-values and *, **, ***, indicate statistical significance at the 10%, 5% and 1% level respectively*

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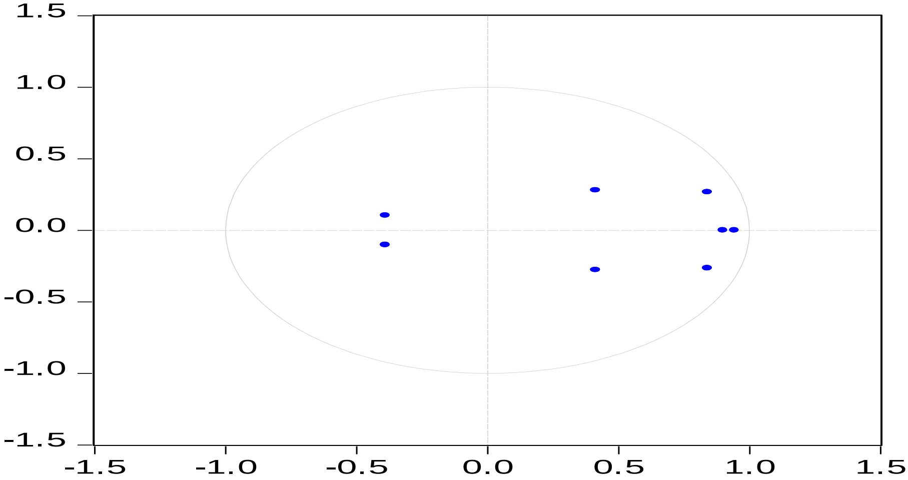
After conducting a correlation and probability matrix, STAFF, CR and DAR were all insignificant to GD/GDP so they were removed from the model. Thus, the new model is:

$$Ln\frac{GD}{GDP} = \beta_0 + \beta_1 LnEP + \beta_2 LnED + \beta_3 LnREV \quad (1.2)$$

3.2.1. VAR stability tests

Figure 1: Inverse Roots of Autoregressive Characteristic Polynomial



Source: Author's Computation from E-Views 9

Table 4: Inverse Roots of Autoregressive Characteristic Polynomial

Root	**Modulus**
0.945303	0.945303
0.900831	0.900831
0.841628 - 0.265675i	0.882565
0.841628 + 0.265675i	0.882565
0.414429 - 0.277926i	0.498993
0.414429 + 0.277926i	0.498993
-0.387862 - 0.103379i	0.401403
-0.387862 + 0.103379i	0.401403

Source: Author's Computation from E-Views 9

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For a simple data generating process, a characteristic root has to be between -1 and 1 to be stationary. This is also the required condition for the VAR to be stable. Figure 1 shows that this is the case because all the roots lie with the unit circle. Table 4 displays these roots in decimal form, where the characteristic root is still between -1 and 1. Thus the VAR is stable.

3.2.2. VAR Empirical Results

Table 5: Variance Decomposition Analysis

Shock Variable	**Period**	**Standard Error (S.E)**	**GD/GDP**	**EP**	**REV**	**ED**
GD/GDP	10	0.194563	80.08269	9.166241	6.705858	4.045210
EP	10	0.293011	32.92000	36.99010	22.71312	7.376777
REV	10	0.344344	26.70258	29.50995	42.66586	1.121607
ED	10	0.452629	30.33573	20.19991	20.37192	29.09244

Cholesky Ordering: GD/GDP EP REV ED

Source: Author's Computation from E-Views 9

In Table 5, variance decomposition analysis was performed up to the 10^{th} period to analyse what proportion of forecast error in each variable is explained by another.

GD/GDP: Up to 9,17% of the forecast error variance of government debt/GDP is explained by the electricity price. This implies that much of the price increases at Eskom involve NERSA approving price adjustment applications from Eskom, which are later overseen by government through equity injections for example. Revenue and Eskom Debt also explain some forecast error variance of government debt/GDP but to a far less extent with revenue explaining 6,7% and Eskom Debt explaining 4,05%.

EP: government debt/GDP explains 32,9% of the forecast error variance in the electricity price. This reiterates how the government has been increasing its own debt in order to appease price adjustment applications from Eskom. The fact that Eskom's revenue presents a 22,7% forecast error variance for the electricity price is another indication that revenues at Eskom are purely driven by the electricity price. Eskom's debt explains less of the forecasting error of the electricity at only 7,38%.

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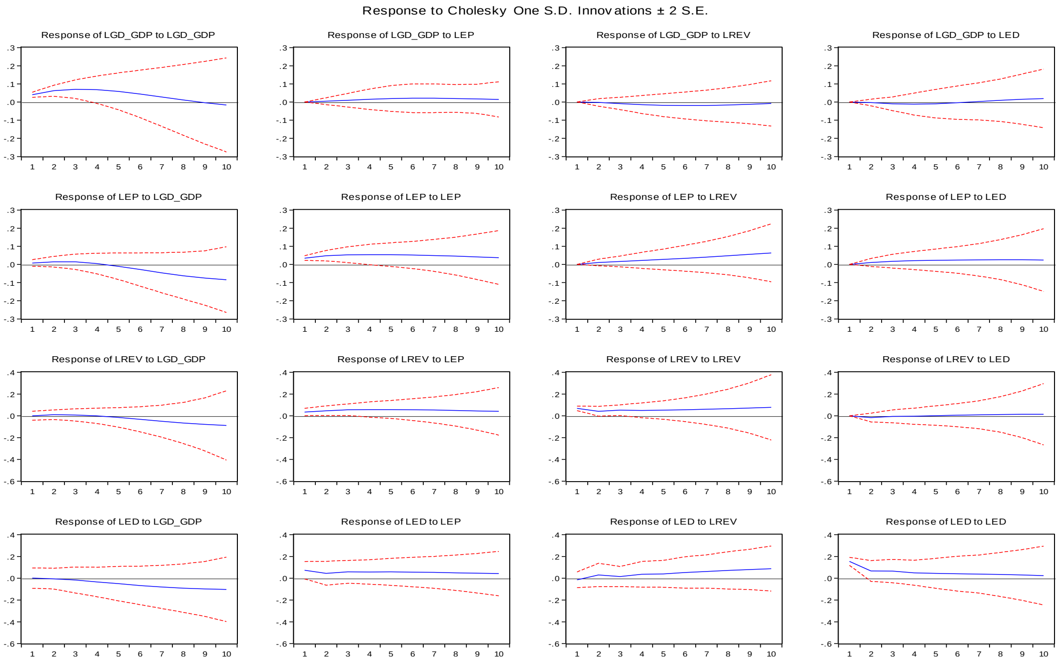
REV: The electricity price explains 29,51% of the forecast error variance in Eskom's revenue. This means that Eskom has not been making tangible revenue from the efficient sale of electricity. This means much of its revenue is increased by merely increasing electricity prices. This shows a great lack of productivity. Also, 26,7% of its revenue is explained by government debt/GDP, a further indication that government bail outs, state guaranteed loans and NERSA applications form a large percentage of Eskom's revenue. Eskom debt has a lower forecast variance of 1,14% which shows that it is not a significant influence on Eskom's revenue.

ED: The forecast error variance for Eskom Debt is explained by government debt/GDP and it is up to 30,34%. This means that that much of the debt incurred by government is from being the state guarantee of Eskom's debt. Eskom's revenue and electricity price explain a large portion of Eskom debt's forecast error variance at 20,37% and 20,2% respectively.

Figure 2: Impulse response functions



Source: Author's Computation from E-Views 9

Figure 2 shows impulse response functions. These functions show how other variables respond to a particular variable when it is initially shocked, and how

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these variables respond to the shock up to the 10th time period. The impulse response functions in figure 2 are similar to the variance decompositions analyses and so are their interpretations. The diagonal graphs from the top left to the bottom right indicate the impulse response functions of variables to themselves. All stationary time series are expected to mean reverting and thus converge to zero in the long run (Gujarati 2004, Lutkepohl 2006). This is the case with GD/GDP and ED, however the electricity price is far from the mean and does not appear to be mean reverting in the long run. This implies that the electricity price will continue to rise because Eskom will keep applying to NERSA for more tariff increases. Eskom's revenue is also reverting away from the mean of zero and is in fact increasing. This implies that in the long run, much of its revenues will continue to increase but most likely due to increases in the electricity price and not necessarily increases in sales.

4. CONCLUSION AND RECOMMENDATIONS

This study empirically investigated the relationship between government debt and Eskom debt using Eskom's financial statements and government debt data from 1985 – 2017. The study used a Vector Autoregression (VAR) model. Evidence from the VAR model showed that up to 9,17% of the forecast error variance of GD/GDP is explained by the electricity price. The model also showed that GD/GDP explains 32,9% of the forecast error variance in the electricity price. The same model showed that the electricity price explains 29,51% of the forecast error variance in Eskom's revenue. Also, 26,7% of its revenue is explained by government debt/GDP. The forecast error variance for ED is explained by GD/GDP and it is up to 30,34%. In summary, this model shows that the government has been increasing its own debt in order to appease price adjustment applications from Eskom. Also, revenues at Eskom are purely driven by the electricity price which means that no tangible revenue has been earned from the efficient sale of electricity. This shows a great lack of productivity and that much of its revenue is increased by raising electricity prices. Also, government bail outs, state guaranteed loans and NERSA applications form a large percentage of Eskom's revenue. As such, it is important for Eskom to increase its research and development (R&D) in experimental research to discover new and cheaper ways to generate electricity. A clear privatisation strategy is also suggested since President Ramaphosa alluded to this at this year's State of the Nation Address (SONA) by announcing the unbundling of Eskom into three business units, namely generation, transmission and distribution. Lastly, fiscal consolidation is also an avenue to explore especially if it is implemented as a fiscal squeeze.

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