

# Labour Market Effects of Public Employment

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## **Abstract**

This paper investigates the effects of private sector productivity and public sector wage shocks on a calibrated South Africa's labour market. This is achieved using a DSGE model with two sectors of a labour market composed of skilled and unskilled individuals to study how the difference in bargaining power, and in production efficiency between public and private sectors impact the responsiveness of variables.

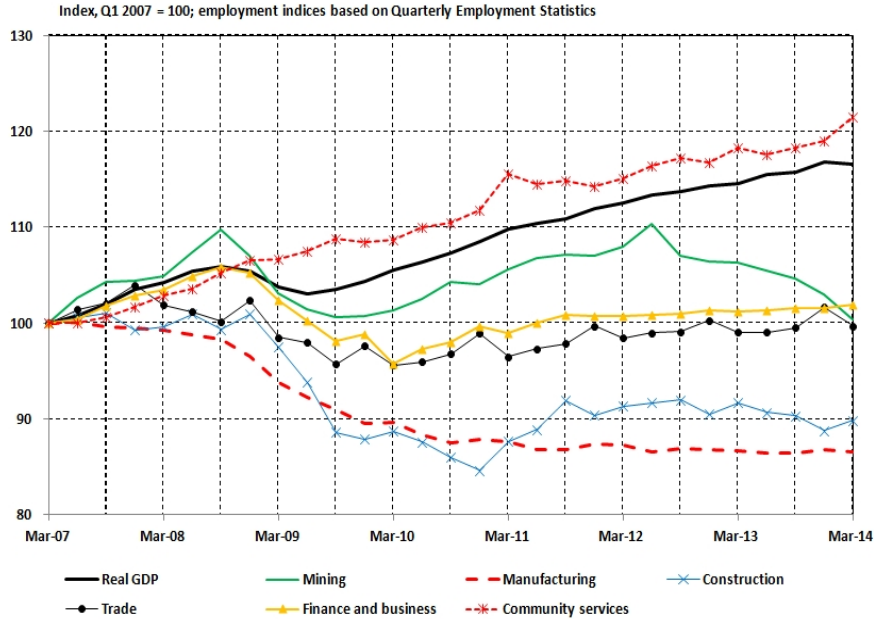
The findings show that an increase in private sector productivity produces more desirable results with an increase in employment for both skilled and unskilled workers which translates into a decrease in overall unemployment. Public sector wage shock on the other hand mainly crowds out private skilled labour which the firms react to by substituting it with unskilled workers. Ultimately, the increase in public wages raises overall unemployment as supplementary skilled unemployed individuals queue for public jobs. Altogether, the effects are more pronounced when the bargaining power of unskilled workers is raised. Also, when production efficiency is lower in the public sector compared to the private, a public wage shock leads to more skilled individuals queueing for public sector jobs. Finally, public wage premium generates an incentive for private sector workers to demand higher wages, which contributes to the presence of wage rigidities and labour shedding in the private sector during recessions.

# 1 Introduction

The end of the Apartheid era in South Africa signaled the beginning of the implementation of the new government's policies with a primal focus on significantly reducing inequalities inherited from the previous regime. These drastic measures had two main impacts on labour market dynamics regarding public employment. First of all, the government embarked into reforms that had the principal objective of recruiting individuals from previously disadvantaged groups. As a result, the public sector expanded rapidly to become in 1994 the largest single entity to absorb formal employment in South Africa; with public employment accounting for 14.2 percent of total employment (Hassen and Altman, 2010). Secondly the public sector preponderantly hired skilled individuals which turned the sector rather predominantly skilled workers intensive. Given these premises, this paper raises two questions. How do these two particular features of public employment affect overall labour market dynamics in South Africa? Moreover, could the fact that the public sector is for the most part skilled workers intensive, and the existence of the public wage premium contribute partly in explaining the rigidities in private sector wages in the economy?

Two decades after 1994, the public sector in South Africa continued its expansion and in 2014, 17.5 percent of all employees worked in the public sector. This number is in line with various OECD countries where the percentage of workers in the public sector ranges from 10 to 30 percent of total employment (Gomes, 2013). Evidence from after the 2008 financial crisis in the US shows that the number of individuals seeking jobs in the public sector increased in recent years mainly for two reasons. First, more individuals turned to the public sector where the salaries were higher as private sector wages significantly dropped in the aftermath of the crisis. Second, as the rate of job destruction was increasing in the private sector, government institutions continued to hire. The graph below shows a comparative performance of selected industrial sectors regarding employment and the real GDP in South Africa between 2007 and 2014.

Figure 1: Industrial sectors employment performance and real GDP



Source: Stats SA - Youth employment, unemployment, skills and economic growth, 1994-2014

Note that the employment figures in this graph are from the formal economy only. The most striking feature of this picture is that in the aftermath of the 2008 financial crisis, the employment growth has been well below the real GDP growth in most sectors. Only the community, social and personal services sector, which is predominantly constituted of public sector firms, experienced higher growth in jobs with respect to the real GDP. Private sector firms performance on the other hand is dramatic and worse relative to the public sector. Indeed focusing on the manufacturing industry, it is reported that the sector employed 13 percent less workers in 2014 compared to the figure in 1994. The quarterly labour force survey data in South Africa further emphasizes that since the fourth quarter of 2008, private sector employment has decreased by 4.5 percent whereas public sector employment has risen by 11.1 percent. Two reasons may explain this behaviour. First, wages in the private sector have fallen while public wages have been on a steady rise. Second, more jobs are now available in the public compared to the private sector as reported by Duncan (2013) - 314 000 jobs added in the public sector against 268 000 in the private sector. In particular, the public sector is more attractive with better working conditions, therefore resulting in a crowding out effect on private sector employment.

This paper uses a DSGE model with search and matching frictions in two sectors com-

posed of skilled and unskilled workers to primarily analyze the labour market effects of a positive public sector wage shock in a calibrated model to reflect South Africa's economy. The impact of an increase in productivity in the private sector is also assessed for comparison purposes. The findings show that a private sector productivity shock produces more desirable results with a decrease in overall unemployment, a surge in employment for both skilled and unskilled workers and an overall increase in the private sector production. The public sector wage shock on the other hand mainly crowds out skilled private sector employment which is substituted with cheaper unskilled labour, as skilled workers move to the public sector. In all cases, the effects are more pronounced the higher the bargaining power of unskilled workers. Furthermore, when productivity is low in the public sector compared to the private, a public wage shock leads to more skilled individuals queueing for public sector jobs.

Public wage premium as a source of private employment crowding out for starters raises the issue of the gap between private and public sector wages. This issue has been addressed in the South African literature by a couple of studies including Woolard (2002), Bosch (2006), Kerr and Teal (2012) and more recently by Kwenda and Ntuli (2015). In particular, Kwenda and Ntuli (2015) argue that the public sector is able to attract workers with better endowments. Furthermore, in an attempt to pursue wage equality, South Africa's government faces a major setback in terms of the forgone opportunity to pursue competitive or profit based wage setting procedures as it is the case for private firms. Consequently, the public sector ends up paying more than the private in a consistent basis. Such a high public wage bill has a significant blow regarding labour market efficiency and overall economic performance.

At an international level, the following studies essentially conclude that the public sector has a non negligible negative impact on private sector employment: Holmlund & Linden (1993), Calmford and Lang (1995), Finn (1988), Algan *et al* (2002), and Gomes (2013). Gomes (2013) for instance finds that raising wages in the public sector turns the sector more appealing and workers have an incentive to move from private sector jobs. Further, he argues that the government faces some sort of dilemma. In essence, by offering high wages, the government induces too many unemployed to queue for public jobs, ultimately

raising unemployment. On the other hand, if the wages are too low, the government faces recruitment problems. Gomes (2013) goes on to argue that there is an urgent need of designing an optimal policy as the government's wage policy plays a key role in attaining the efficient allocation. Basically, over the business cycle, it is optimal to have procyclical public sector wages. Thus, public sector wages should closely follow the evolution of wages in the private sector. Failure to do so may lead to an undesirable and highly volatile unemployment.

The South African case in general relative to international standards, is peculiar for the following two reasons. First off, there is an important dynamic of unskilled individuals in the labour market that is crucial to take into account. Second, the considerable collective bargaining power of unions in wage settlement is the other important concept to consider in this analysis. The first point has been discussed by Canova and Ravn (1998) to a certain extent as they analyze the macroeconomic effects of German unification. However, the workers (skilled and low skilled) are not employed by the government in their model. The issue of a unionized labour market has also been tackled by Ehrenberg and Schwarz (1986), Borland (1999) and Ardagna (2007) amongst others. These papers however do not separate between skilled and unskilled agents.

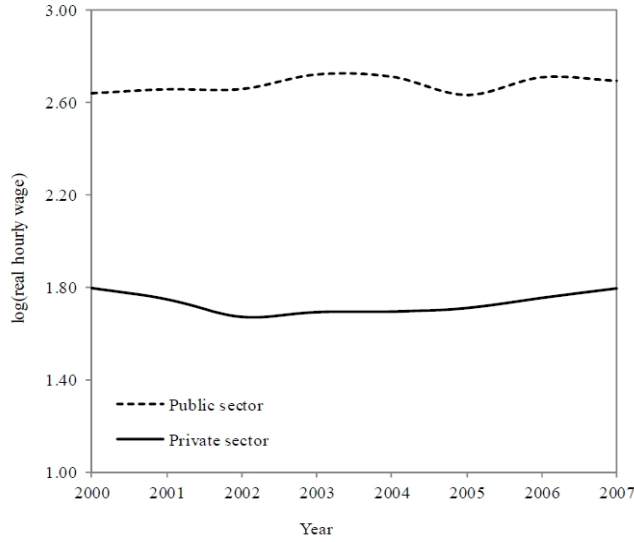
The rest of the paper is organized as follows. The second section discusses the development in the South African public sector regarding its expansion in terms of employment. It also covers a brief discussion on public wage premium and the theoretical effects of public employment. Section 3 lays down the model based on a framework first introduced by Gomes (2013). First in this section, a brief overview of the assumptions that depart from the original framework are discussed which therefore allows for the application of the model in the South African context. The model is then parameterized in section 4 to match the South African economy as much as possible. Section 5 discusses the impulse responses while an exploration of optimal policy responses and the contributing role of public wage premium in explaining wage rigidities are covered in section 6. Section 7 concludes.

## 2 Public employment effects: theory and stylized facts

As mentioned in the introduction, an intensive recruitment program by the new government targeting previously disadvantaged groups occurred in South Africa at the end of the Apartheid regime, which inevitably resulted in a drastic expansion of the public sector. The fact that this recruitment preponderant focus was on skilled workers shaped the labour market. Therefore the demand for low skilled workers in the public sector decreased dramatically, hence contributing in part to the structural nature of the unemployment in South Africa. Hassen and Altman (2010) give an overview of the public sector between 1994 and 2009. They mainly argue that since 1994, the public sector has been the single entity to absorb formal employment the most. The authors report that public employment accounted for 14.2 percent of total employment before it significantly declined in 2006 to about 10 percent. However between 2007 and 2008, the share of general government to total employment rose to reach 13.5 percent. Recent statistics from the quarterly labour force survey reveal that in the aftermath of the 2008 financial crisis, the public sector acted as the principal creator of jobs when private sector firms performed below par. Thus, in 2014 public sector employment accounted for 17.5 percent of total jobs in South Africa, therefore surpassing its highest recorded level in 1994. Contrary to the events of 1994, most jobs created after the 2008 financial crisis were in favour of low and medium skilled workers, with a relatively smaller share for skilled individuals. Although this is the case, the public sector remains predominantly skilled workers intensive.

Bhorat *et al* (2015) outline that 45 percent of all public sector employees fall into the top three occupational categories that require a certain level of skills set. Skilled individuals in the private sector on the other hand account for a smaller 26 percent. These findings are similar to that of Hassen and Altman (2010) and Kwenda and Ntuli (2015). The latter argue that the difference of skills between the two sectors explain for the sectoral wage gap, with wages significantly higher in the public than in the private sector as they show in the figure below.

Figure 2: Sector wage gap



Source: Kwenda and Ntuli (2015)

Although the figure above clearly indicates that wages in the public sector are higher than in the private sector in South Africa, the public wage premium issue is essentially a worldwide phenomenon. For instance, a direct comparison of wages between public and private sectors in selected Europe countries shows that government employees earn about 15 percent more than private sector workers. This wage gap is explained by the fact that public and private sectors are different in the kind of jobs they offer and the type of workers they hire. Furthermore, the two sectors differ in terms of job stability and income progression, two highly influential factors to take into account in individuals career choices (Postel-Vinay, 2015). Although South Africa may relate to European and US cases, the dynamics resulted from the large skill gap between workers may certainly influence the economy's performance.

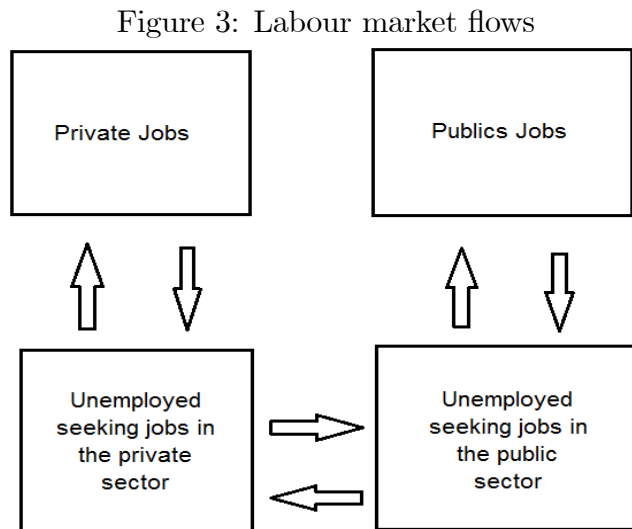
The theory suggests that if private employment and labour force remain constant, an additional public job would result directly in a reduction of unemployment. However, public employment can also affect unemployment indirectly by essentially crowding out private employment through a couple of channels.

First of all, the goods produced by the two sectors can be substitutes. As it turns out, the crowding out effect of public jobs on private employment increases with the degree of substitutability between public and private production. Typically, one would expect that



public employment is accountable for the fall in private jobs in countries where public sector jobs are more attractive. Furthermore, creating new jobs in the public sector increases the expected gains of the unemployed individuals. This in turn applies upward pressure on wages in the private sector which eventually decreases employment in the sector as pointed out by Holmlund and Linden (1993). Moreover, Algan *et al* (2002) argue that the cost of public jobs mainly implies an increase in public expenditure or public expenditure switching. This consequently may result in a reduction of the after tax profitability of firms for the former and that of public investment or infrastructure building for the latter. These reductions may eventually lead to a negative impact on productivity in the private sector, manifested by a fall in labour demand.

The figure below depicts labour market flows between public and private employment as reported by Algan *et al* (2002).



In economies with a relatively small proportion of low skilled individuals, the unemployed can afford to choose which sector they intend to direct their search into. Their decision fundamentally depends on the favourability of economic conditions prevailing in the economy. For instance, if wages are higher in the public sector, the share of unemployed individuals seeking jobs in state owned firms may rise. On the other hand, an improvement in technology in the private sector may result in firms posting more vacancies, therefore making the sector more attractive.

The scenario where there is a significant skill gap amongst workers is the main issue this paper focuses on. The next section lays down the model taking into account the dynamics generated by the presence of workers skill gap.

### 3 Model

#### 3.1 General assumptions

The proposed study is based on a simple and very comprehensive framework originally introduced by Gomes (2013). However in this section, certain assumptions are made to accommodate the framework to South African peculiar features. Consequently, the model in this study departs from the original framework on three main points. The first assumption is that there are two sets of workers based on their skills level. Second, for simplicity, the public sector exclusively hires skilled workers. Finally, this study emphasizes on the role played by the level of workers' bargaining power. Each points are discussed further in the next few paragraphs. Scanning through the literature, no work of such a nature has been conducted in the South African scene at this stage.

Regarding the first point, the labour market consists of skilled and low skilled individuals. The importance of this differentiation arises from the fact that South Africa displays a shortage of crucial skilled individuals while the unskilled workers are abundant. Therefore, it would be flawed to fully rely on the original model simply because doing so would not reflect one of the distinctive features of the South African labour market. The table below reports skill groups as categorized by Statistics South Africa, which include the skilled, the semi-skilled, and the low-skilled.

Table 1: Composition of employment by skilled level

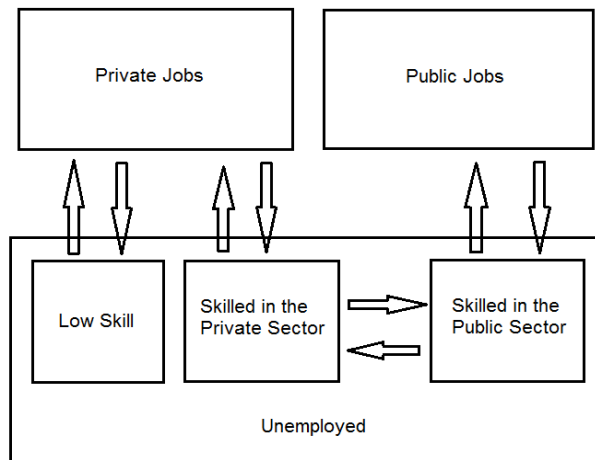
Skills level	Occupation	1994 (%of total)	2014 (% of total)	Change
Skilled	Manager, Professional	20.6%	25.2%	+4.6%
Semi-skilled	Clerk, Sales & Services	47%	46.6%	-0.8%
low-skilled	Elementary, Domestic worker	32.4%	28.5%	-3.9%

Source: The quarterly labour force survey

Although the proportion of skilled workers has improved in the past two decades, the growth rate remains noticeably sluggish. In addition, the amount of low skill individuals in the labour force slightly decreased but in 2014, it is still quantitatively massive relative to skilled individuals. This evidently has further implications in terms of labour market flows. The general consensus is that public sector jobs require a certain level of education and skill set. Private sector firms on the other hand may be forced to turn to cheap labour in their quest for profit maximization, depending on the suitability of economic conditions.

These facts are the basis of the second important assumption of the proposed study which is, for simplicity reasons, the public sector exclusively hires skilled workers whereby private firms may decide to recruit all types of workers. This assumption allows to depict labour market flows as implied by this paper. Accounting for skill gap dynamics alters the labour market flows described by Algan *et al* (2002) in the previous section.

Figure 4: Labour market with skill gap dynamics



Low skilled individuals cannot afford to direct their search in a sector other than the private unless improvement in their skills set. This assumption has various implications in terms of the functioning of the labour market and in particular, it may explain for the existential wage gap between low and skilled workers. Often referred to as the skilled wage premium, it is basically the equivalent of the public wage premium since the public sector is mainly skilled workers intensive. Given the scarcity of skilled individuals, they are more likely to demand higher wages relative to low skilled workers. Consequently, keeping in mind that public sector firms provide better endowments, they are in a better position to

attract skilled labour, especially during periods of recessions. Moreover, the increase in the demand for skilled workers since 1994, which almost matched the decline in low skilled workers demand over the past few decades, further motivates our question to investigate the labour market effects of a public wage increase.

The final point that diverges from the original model of Gomes (2013) regards the level of bargaining power of workers. Indeed, a distinct interest in the role played by the bargaining power of workers in this study is taken into account. Wages in the private and public sectors are determined by collective bargaining of workers that are all represented by trade unions. It is reported that the unions power in South Africa when it comes to wage settlement with firms is relatively and significantly high, especially for low skilled workers (Schultz & Mwabu, 1998). As a result, wages are not very responsive to labour market conditions as unions are labelled too powerful for the country's level of income. Indeed, consistent evidence in the private sector reveals that during recession, adjustments are done through considerable job shedding rather than wage cuts that would allow the market to clear. This therefore provides motivation to take into account various levels of bargaining power to assess its impact on the dynamics of the model.

### 3.2 General Setting

The model is a dynamic stochastic general equilibrium framework which accounts for public and private sectors as first illustrated by Gomes (2013). Rigidities enter the labour market in the form of search and matching frictions.

The labour force constitutes of many individuals  $j \in [0, 1]$  that are either skilled or unskilled ( $n \in [s, u]$ ). They are either unemployed ( $u_t$ ), skilled and employed by private sector firms ( $l_{s,t}^p$ ), skilled and employed in public sector ( $l_{s,t}^g$ ), or unskilled and employed by private sector firms ( $l_{u,t}^p$ ). Therefore the government only employs skilled workers:

$$1 = l_{s,t}^p + l_{u,t}^p + l_{s,t}^g + u_t \tag{1}$$

$l_t$  is the total level of employment. Search and matching frictions present in the labour market prevent some of the unemployed individuals from finding jobs. Employment (skilled

and unskilled) in both sectors evolves according to the number of new matches  $m_{n,t}^i$  ( $i \in [g, p]$ ) and the separation rates. Jobs are destroyed each period at a constant rate  $\lambda_n^i$ . Therefore:

$$l_{n,t+1}^i = (1 - \lambda_n^i)l_{n,t}^i + m_{n,t}^i \quad (2)$$

New matches are determined by the following Cobb-Douglas matching function:

$$m_{n,t}^i = \mu_n^i (u_{n,t}^i)^{\eta_n^i} (v_{n,t}^i)^{1-\eta_n^i} \quad (3)$$

The skilled individuals amongst the unemployed can afford to choose in which sector they wish to concentrate their search ( $u_{s,t}^i$ ). The unemployed individuals with low skills are however restricted from doing so, given the assumption that public sector firms will only hire individuals with skills.  $v_{n,t}^i$  denotes the vacancies in each sector for both sets of individuals,  $\eta_{n,t}^i$  is the matching elasticity with respect to unemployment, while  $\mu_{s,t}^i$  represents the matching efficiency. It is important at this stage to define a variable that captures the fraction of unemployed individuals with skills seeking public sector jobs which can be specified by:

$$s_t = \frac{u_{s,t}^g}{u_{s,t}}$$

Next the probabilities of vacancies being filled ( $q_{n,t}^i$ ), the job finding rates conditional on searching in a particular sector which is only specific to skilled individuals ( $p_{s,t}^i$ ), and the unconditional job finding rates ( $f_{n,t}^i$ ), are defined such that they all depend on matching functions.

$$q_{n,t}^i = \frac{m_{n,t}^i}{v_{n,t}^i}, \quad p_{s,t}^i = \frac{m_{s,t}^i}{u_{s,t}^i}, \quad f_{n,t}^i = \frac{m_{n,t}^i}{u_t}$$

### 3.3 Households

The representative household is assumed to live infinitely and consume both private consumption and public goods. Even though workers with low skills are not hired by gov-

ernment owned firms, they still consume public goods given that they are free. There is also a utility of unemployment with sensitivity parameter bigger in size for the low skilled individuals. This utility captures leisure and home production.

$$E_t \sum_{t=0}^{\infty} \beta^t [u(c_t, g_t) + v(u_t)] \quad (4)$$

where  $\beta \in (0, 1)$  is the discount factor. The budget constraint is given by:

$$c_t + B_{n,t} = (1 - r_{n,t-1})B_{n,t-1} + w_{n,t}^p l_{n,t}^p + w_{s,t}^g l_{s,t}^g + \Pi_{n,t} \quad (5)$$

where  $r_{n,t-1}$  is the real interest rate from period  $t-1$ ,  $B_{n,t}$  are the holdings of one period bonds.  $w_{n,t}^i l_{n,t}^i$  is the total wage income from household members of skills set  $n$  working in sector  $i$  at time  $t$ .  $\Pi_{n,t}$  denotes the lumps sum taxes that finance the government's wage bill as well as possible transfers from private sector firms. There are no unemployment benefits.

## 3.4 Workers

### 3.4.1 Skilled Workers

Each household's skilled member's value depends on their current state. Therefore the value of being employed in a particular sector is given by:

$$W_{s,t}^i = w_{s,t}^i + E_t \beta_{s,t,t+1} [(1 - \lambda_s^i W_{s,t}^i + \lambda_s^i U_{s,t+1}^i)] \quad (6)$$

where  $\beta_{s,t,t+k} = \beta^k \frac{u_{n,c}(c_{t+k}, g_{t+k})}{u_{n,c}(c_t, g_t)}$  is the stochastic discount factor. Essentially, the value of being employed for a skilled worker in a particular sector is a function of the current wage and the continuation value of the job, which in turns depends on the separation rate. Similarly, the value of being unemployed is given by:

$$U_{s,t}^i = \frac{v_{s,u}(u_t)}{u_{s,c}(c_t, g_t)} + E_t \beta_{s,t,t+1} [p_{s,t}^i W_{s,t+1}^i + (1 - p_{s,t}^i) U_{t+1}] \quad (7)$$

The above implies that the value of being unemployed for a skilled individual searching

in a particular sector depends in essence on the probability of finding a job and the value of working in that sector. If the optimality assumption holds, then movements between the two sectors guarantee no additional gain for searching in one sector *vis-a-vis* the other.

$$U_{s,t}^p = U_{s,t}^g = U_{s,t} \quad (8)$$

This assumption allows to implicitly determine the share of the unemployed skilled individuals seeking jobs in each sector:

$$\frac{m_{s,t}^p E_t \beta_{s,t,t+1} [W_{s,t+1}^p - U_{s,t+1}]}{(1 - s_t)} = \frac{m_{s,t}^g E_t \beta_{s,t,t+1} [W_{s,t+1}^g - U_{s,t+1}]}{s_t} \quad (9)$$

An increase in the value of employment in the public sector which can be driven by either wage increases or a separation rate decrease, will raise  $s_t$  until there is no extra gain from searching in that sector. Also, wages in the public sector play an important role in the determination of the share of the unemployed seeking jobs in government institutions.

### 3.4.2 Low skilled workers

Similar to the skilled individuals, the unskilled also have a certain value depending on whether they are employed or unemployed.

$$W_{u,t}^p = w_{u,t}^p + E_t \beta_{u,t,t+1} [(1 - \lambda_u^p W_{u,t}^p + \lambda_u^p U_{u,t+1}^p)] \quad (10)$$

where  $\beta_{u,t,t+k} = \beta^k \frac{u_{u,c}(c_{t+k}, g_{t+k})}{u_{u,c}(c_t, g_t)}$ .

$$U_{u,t}^p = \frac{v_{u,u}(u_t)}{u_{u,c}(c_t, g_t)} + E_t \beta_{u,t,t+1} [f_{u,t}^p W_{u,t+1}^p + (1 - f_{u,t}^p) U_{u,t+1}^p] \quad (11)$$

## 3.5 Private sector firms

The representative firm hires both skilled and unskilled labour to produce private consumption goods. Following Gomes (2013), private firms use a linear production function without capital and with part of the resources produced that have to be used for posting vacancies:

$$y_t = a_t^p (l_{s,t}^p)^\alpha (l_{u,t}^p)^{(1-\alpha)} - (\zeta_s^p v_{s,t}^p + \zeta_u^p v_{u,t}^p) \quad (12)$$

$\zeta_n^i$  denotes the cost of posting vacancies. At time  $t$ , the level of employment is predetermined with the firm only able to control the number of vacancies it can post. The value of opening a vacancy is thus given by:

$$V_{n,t}^p = E_t \beta_{n,t,t+1} [q_{n,t}^p J_{n,t+1}^p + (1 - q_{n,t}^p) V_{n,t}^p] - \zeta_n^p \quad (13)$$

where  $J_{n,t}^p$  is the value of a job for the firm defined as:

$$J_{n,t}^p = a_t^p - w_{n,t}^p + E_t \beta_{n,t,t+1} [(1 - \lambda_n^p) J_{n,t+1}^p] \quad (14)$$

Assuming free entry guarantees that the value of posting a vacancy is 0 ( $V_{n,t}^p = 0$ ). Combining the two equations above therefore gives:

$$\frac{\zeta_n^p}{q_{n,t}^p} = E_t \beta_{n,t,t+1} \left[ a_{t+1}^p - w_{n,t+1}^p + (1 - \lambda_n^p) \frac{\zeta_n^p}{q_{n,t+1}^p} \right] \quad (15)$$

This condition simply emphasizes that the expected cost of hiring a worker must equal its expected return. The benefit of hiring an extra worker is the discounted value of the expected difference between the worker's marginal productivity and his/her wage, plus the continuation value, knowing that with a probability  $\lambda_n^p$  the match is destroyed.

The private sector wages are subject to the outcome of a Nash bargaining between workers and firms with the following as sharing rule:

$$(1 - b_n)(W_{n,t}^p - U_t) = b_n J_{n,t}^p \quad (16)$$

with  $b_n$  being the workers' bargaining power.

### 3.6 Government

The government produces public goods using a linear technology on skilled labour exclusively. Contrary to private consumption goods, government goods are non-rival and are



supplied to the representative household for free. The production function is given by:

$$g_t = a_t^g l_{s,t}^g - \varsigma^g v_{s,t}^g \quad (17)$$

Finally, the government collects lump sum taxes to finance its wage bill:

$$\tau_t = w_{s,t}^g l_{s,t}^g \quad (18)$$

## 4 Calibration

Following Gomes (2013), the CES utility function and the linear function for unemployment take the following forms:

$$u_n(c_t, g_t) = \frac{1}{\gamma} \ln [c_{n,t}^\gamma + \xi g_{n,t}^\gamma]; \nu_n(u_t) = \chi_n u_t \quad (19)$$

The model is calibrated to match the South African economy as much as possible. However, some of the parameters deemed unnecessary to change are taken from Gomes (2013).

The disutility of working is higher for unskilled workers ( $\chi_u = 0.6$ ) than that of the skilled ( $\chi_s = 0.46$ ). The discount factor takes the usual  $\beta = 0.9$  value and the productivity levels in the private sector and public sector are fixed respectively to  $A^g = 1$  and  $A^p = 1$ . Private firms sensitivity with respect to skilled labour is set to the high value of  $\alpha = 0.7$ . Kerr *et al* (2013) conducted an analysis of the dynamics of jobs creation and destruction in South Africa's labour market. The findings show that smaller businesses tend to have higher job creation and destruction rates compared to bigger ones. In essence, enterprises of about 20 workers have jobs creation and destruction rates respectively of about 10.1 percent and 14.3 percent. Meanwhile bigger firms of above 5000 employees have respective job creation and destruction rates of about 6.7 percent and 4.0 percent. This provides ground to make the following assumptions. First off, big firms tend to hire more skilled labour, therefore the separation rate for skilled workers in private firms is set at  $\lambda_s^p = 4$  percent. Further, it is commonly observed that the separation rates in the public sector

are slightly lower than in the private sector. Evidence from the 2008 financial crisis shows for instance that when the manufacturing sector in South Africa suffered a significant loss in employment, the public sector was not as much affected. Hence, the separation rate for public firms is set to a lower value of  $\lambda_s^g = 3$  percent. The separation rate for unskilled individuals is set as high as  $\lambda_u^p = 14$  percent.

Gomes (2013) finds by observing data in the United Kingdom that the cost of posting vacancies in the public sector is slightly lower than the one in the private sector. There is no incentive to diverge from that. Therefore, the cost of posting vacancies for skilled labour in the private sector are fixed at  $\zeta_s^p = 2$  and  $\zeta_s^g = 1.1$  in the public sector while unskilled labour is cheaper which leads to  $\zeta_u^p = 0.9$ .

The lack of data availability for South Africa does not permit an estimation of matching elasticities with respect to unemployment and vacancies. Findings from Gomes (2013) suggest however that vacancies are more important determinants of matches in the private sector. Therefore, for the skilled individuals in the private sector  $\eta_s^p = 0.5$  and for unskilled individuals,  $\eta_u^p = 0.3$ , whereas in the public sector  $\eta_s^g = 0.2$ . Also, the matching efficiency is higher for the skilled than it is for the unskilled individuals. Thus:  $a_s^p = 1.9$ ,  $a_u^p = 1$ ,  $a_s^g = 1.7$ .

Calibrating the wage bargaining power plays a pivotal role in this analysis. First, the baseline values for both skilled and unskilled workers are set at the same level of  $b_s = b_u = 0.5$ . Later it is assumed that skilled workers have a higher bargaining power ( $b_s = 0.7$ ) while it remains the same for the unskilled ( $b_u = 0.5$ ). The final scenario involves a high bargaining power for unskilled workers ( $b_u = 0.7$ ) as the value for the skilled ones holds to the original  $b_s = 0.5$ .

The empirical evidence concerning the elasticity of substitution between private and public consumption is inconclusive. Therefore the elasticity of substitution is assumed to equal 1, which implies a calibrated value for  $\gamma = 0$ .

The steady state unemployment rate is set at  $u = 23$  percent segmented such that  $u_s = 3$  percent are skilled (having completed at least the tertiary level) and  $u_u = 20$  percent are unskilled. Breaking it down further,  $u_s^g = 1$  percent direct their search in the public sector while the remaining  $u_s^p = 2$  percent are seeking jobs in the private sector. This

allows us to calculate the share of skilled individuals looking for jobs in the public sector.  $s = \frac{u_s^g}{u_s} = 0.33$ . As discussed much earlier the quarterly labour force survey in 2014 reports 25.2 percent of total employment are skilled, the semi-skilled accounts for 46.2 percent, and the low-skilled share is 28.5 percent. In light of this evidence, the skilled labour force (unemployed included) is set slightly higher at  $l_s^p + l_s^g + u_s = 30$  percent of the total labour force. Grouping semi-skilled and low-skilled together shows that the unskilled account for  $l_u^p + u_u = 70$  percent of the total labour force.

The complete table of the model parameterization is available in the appendix.

## 5 Impulse response functions

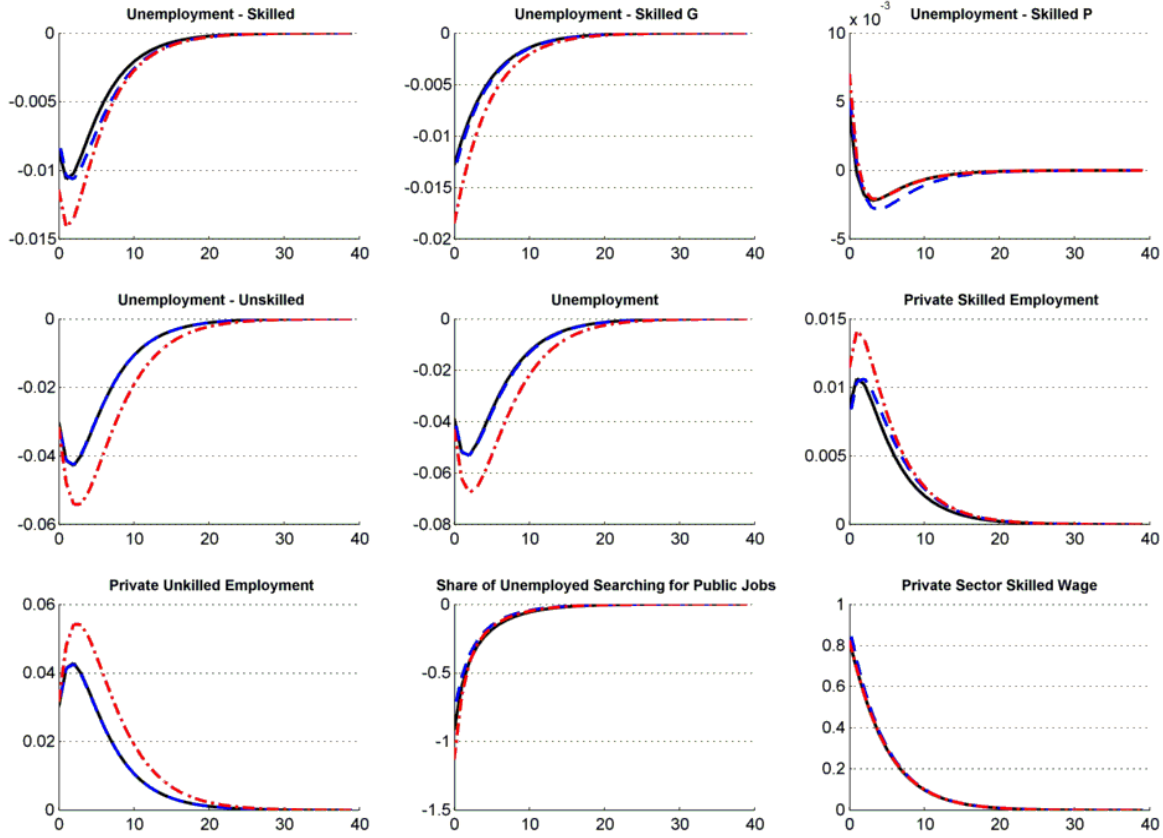
This section investigates the effects of private sector productivity and public sector wage shocks. Two cases are discussed below. First of all, different levels of bargaining power between skilled and unskilled workers are assumed to assess the impact of such a differentiation in the responses. Second, the productivity in the private sector is set higher than in the public sector. Each shock is an AR(1) process with an autocorrelation coefficient of 0.8. The figures below depict the responses of selected variables to a magnitude of 1 percent shock. The time line is set to be in quarters.

### 5.1 Effects of different levels of bargaining power

The effects of a positive private sector productivity shock for the most part are in line with prior expectations. Overall, the responses are about the same for the baseline calibration and the scenario with high bargaining power for skilled workers. However, the effects are quantitatively higher when the bargaining power of unskilled workers is greater. An increase in private sector productivity leads to a rise in employment in that sector for both the skilled and the unskilled individuals. This results in a fall in unemployment of 4 percent, with persistence increasing with the level of bargaining power for the unskilled. Dissecting the effects of unemployment between skilled and unskilled individuals shows that in both cases unemployment decreases and it appears that for the skilled unemployed, individuals direct their search more toward private sector jobs as the number of unemployed seeking

public employment decreases. While wages in the private sector for both skilled (figure 3) and unskilled (figure 4) workers increase, the effects on public wages are quantitatively and significantly small to be reported.

Figure 5: Private Sector Productivity Shock Part 1

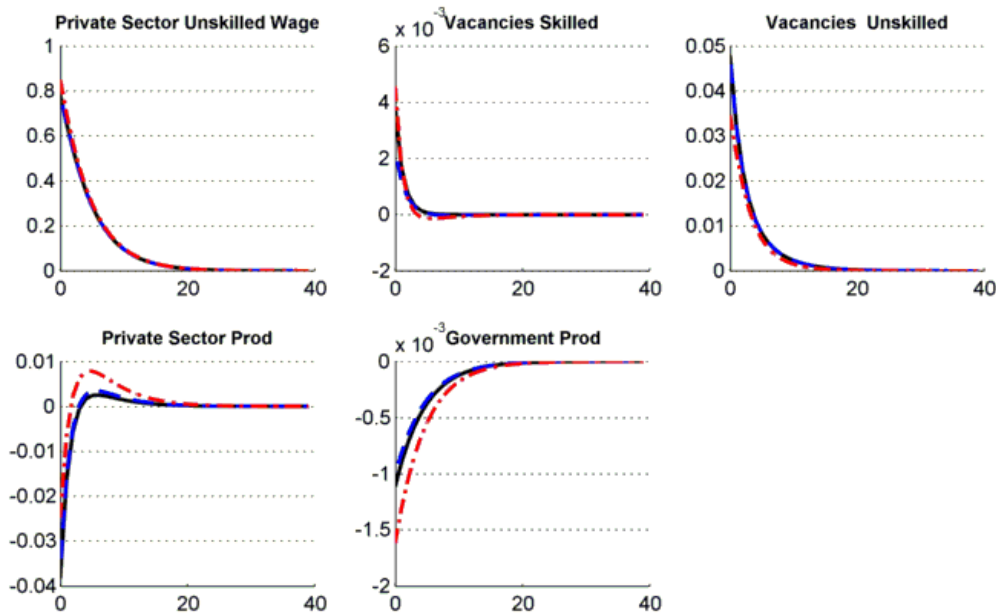


Note: solid line ( $b_s = b_u = 0.5$ ); dashed line ( $b_s = 0.7; b_u = 0.5$ ); chain line ( $b_s = 0.5; b_u = 0.7$ )

As vacancies increase for skilled and unskilled (the former smaller in magnitude than the latter), private sector production decreases. The level of bargaining power is the defining factor in the response of private sector production. First of all, when the bargaining power of unskilled workers is high, the decrease is the smallest - about 2 percent on impact. Second, private sector production then rapidly increases in the next few quarters to reach a peak of 1 percent. The following is a tentative explanation to why this is the case. Note that the responses of vacancies for the skilled are roughly the same regardless of the level of bargaining power. For the unskilled on the other hand, firms post less vacancies the higher their bargaining power. As initially mentioned, posting vacancies comes at a cost

of production to firms, which implies that the cost of hiring an unskilled worker decreased while that of skilled workers remained unchanged. This therefore leads to a lesser decrease in production when the bargaining power of unskilled workers is inflated, keeping in mind that private sector employment for both skilled and unskilled workers are on the rise as well.

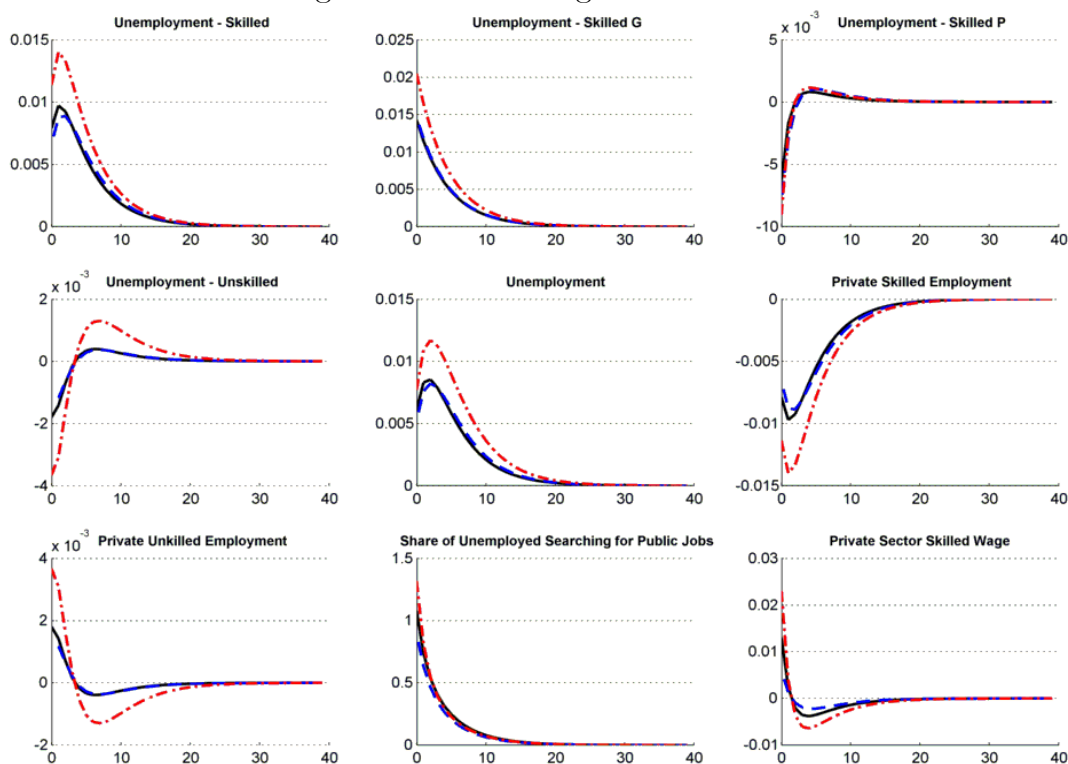
Figure 6 : Private Sector Productivity Shock Part 2



Note: solid line ( $b_s = b_u = 0.5$ ); dashed line ( $b_s = 0.7; b_u = 0.5$ ); chain line ( $b_s = 0.5; b_u = 0.7$ )

Similar to the private sector productivity shock effects, responses for a positive public wage shock are more pronounced the higher the bargaining power of unskilled workers altogether, while they are relatively the same for the baseline calibration and for higher skilled workers bargaining power. An increase in the public sector wage crowds out private sector skilled employment by about 0.6 percent for the baseline calibration and the high skilled workers bargaining power as shown in the figure below. This decrease in private sector skilled employment is significantly pronounced when for an increased bargaining power of unskilled workers. All in all, the crowding out effect leads to more skilled unemployed individuals to seek public jobs as they become more attractive. Consequently, fewer vacancies for skilled workers are posted in the private sector, ultimately resulting in a rise in unemployment amongst the skilled individuals.

Figure 7 : Public Wage Shock Part 1



Note: solid line ( $b_s = b_u = 0.5$ ); dashed line ( $b_s = 0.7; b_u = 0.5$ ); chain line ( $b_s = 0.5; b_u = 0.7$ )

The probability of matching vacancies in the private sector falls since both the number of vacancies posted and that of new matches decrease at the same time. This in turn reduces the overall job finding rate for skilled individuals. In the public sector, the surge in wages has a negative effect on the number of vacancies posted (figure 6) but because the number of new matches remains constant, the probability of matching vacancies already available increases.

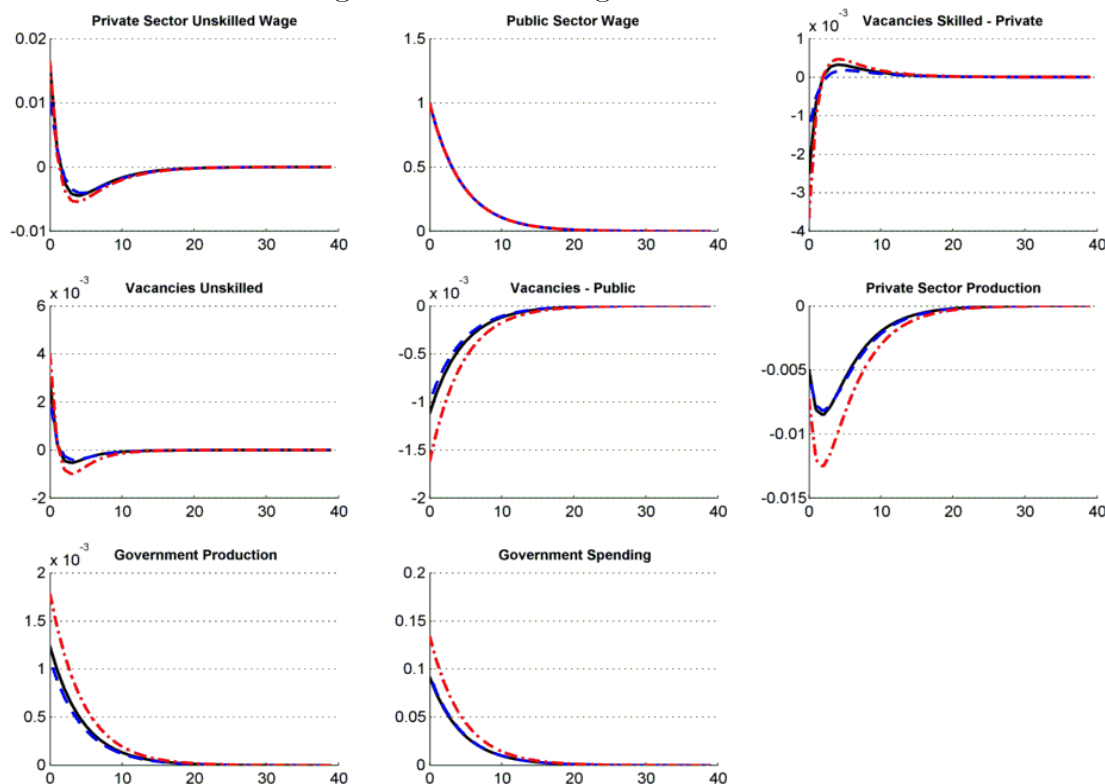
The public sector wage increase has a ripple effect on skilled workers wage in the private sector, with amplitude higher when unskilled workers bargaining power is increased. However, this rise is shortly lived and is followed by a decrease a few quarters later on until return to the steady state value about 20 quarters later.

The shock causes private sector employment amongst the unskilled to increase. The reason behind this increase is perhaps that private firms appears to substitute skilled labour with more affordable unskilled one, given that skilled workers are more likely to move to the public sector where better wages are offered. However, the probability of matching

the vacancies available amongst the unskilled falls. This is due to the fact that the shock incentivizes private sector firms to increase the number of vacancies for unskilled labour in a greater proportion relative to the rise in the number of new matches. Nevertheless, the probability of finding a job for the unskilled rises.

Wage for the unskilled rises, albeit slightly and for a short period of time. The unemployment response amongst the unskilled is relatively worse the more power in wage bargaining they have, as it fluctuates more. Taking the whole picture into consideration, this increase in unskilled unemployment coupled with more individuals queuing for public jobs are reflected in the overall unemployment as it rises, reaching a peak slightly above 1 percent. Private consumption goods production decreases given the crowding out effect of skilled workers that evidently contribute for a bigger proportion of the production. Consequently, government goods production rises as well as government expenditure.

Figure 8 : Public Wage Shock Part 2



Note: solid line ( $b_s = b_u = 0.5$ ); dashed line ( $b_s = 0.7; b_u = 0.5$ ); chain line ( $b_s = 0.5; b_u = 0.7$ )

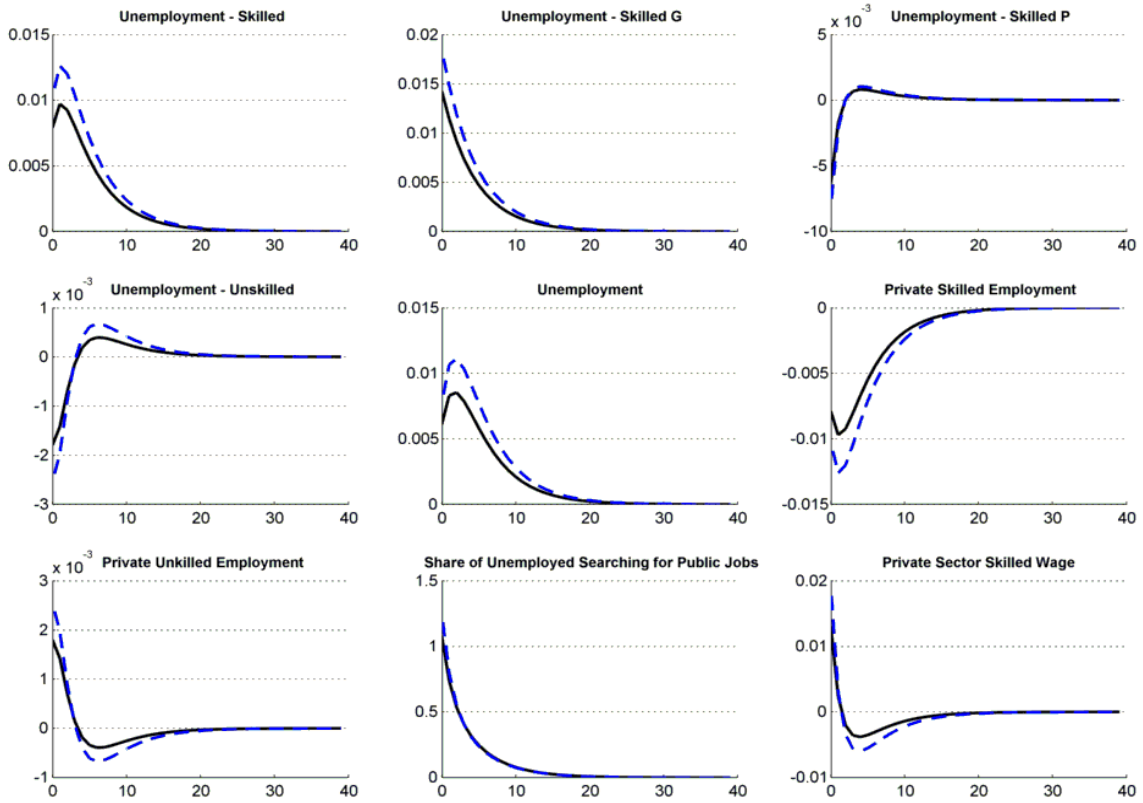
## 5.2 Difference of productivity between private and public sectors

This section focuses on the effects of a public sector wage increase when the private sector is assumed to have more productive efficiency than the public sector. Productivity tend to be a more important factor to private firms in their profit maximization problem, while the public sector pursues a different agenda. Two scenarios are therefore compared. The baseline scenario where  $A^p = A^g = 1$ , and a setup with the productivity in the private sector fixed at  $A^p = 1$  while the one in the public sector is cut by half  $A^g = 0.5$ .

Overall the results show that skilled individuals tend to look for jobs in a sector with better endowments and less production efficiency. The same crowding out effects as before can be observed here as well but the effects are now more pronounced in the private sector when the productivity in the public sector is lower. Further, the unemployed individuals that are skilled direct their searches more towards the public sector while the response for those looking for private sector jobs remains relatively the same under both scenarios. However, because private employment decreases even further when public sector productivity is lower, unemployment amongst the skilled rises. This in turn is reflected by the increase in the overall unemployment rate.



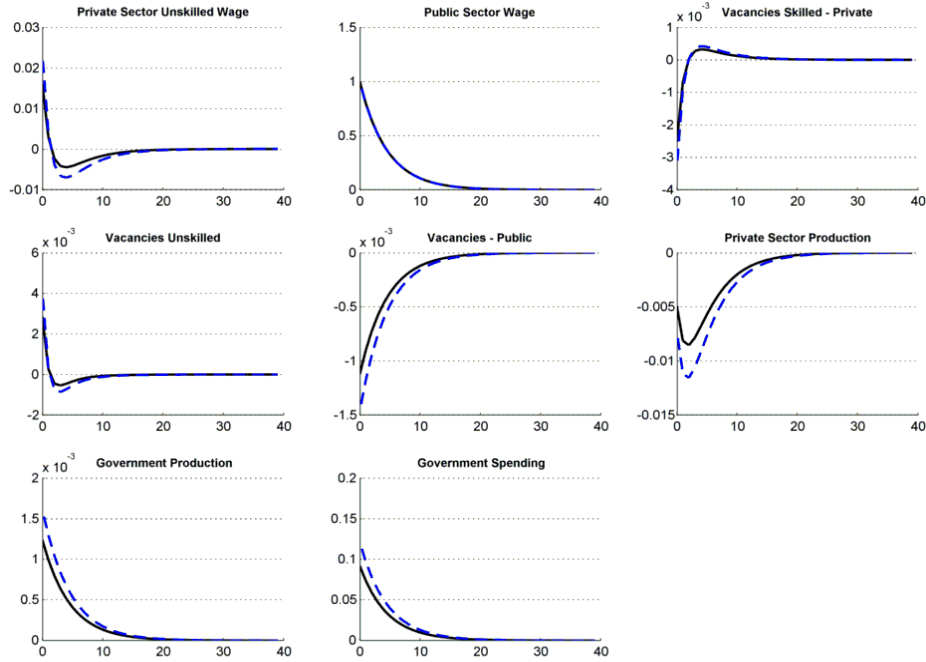
Figure 9: Public Wage Shock Part 1



Note: solid line ( $A^p = A^g = 1$ ); dashed line ( $A^p = 1; A^g = 0.5$ )

Vacancies posted in the public sector are in decline as observed in the figure below. Essentially, since the number of people seeking public jobs is on the rise, the available vacancies posted in that sector get matched fairly rapidly, therefore implying a high probability of matching available vacancies for public firms, and a higher probability of finding jobs for skilled individuals in the public sector.

Figure 10: Public Wage Shock Part 2



Note: solid line ( $A^p = A^g = 1$ ); dashed line ( $A^p = 1; A^g = 0.5$ )

## 6 Analysis of the results and optimal policy response

Whether this study accounts for different levels of workers bargaining power or for a difference of production efficiency between public and private sectors, one result remains unchanged, *i.e.* an increase in public wages crowds out private skilled employment, and it appears a substitution for unskilled workers is taking place. In turns, this typically generates undesirable fluctuations in overall unemployment. The skilled workers wage premium, which in this case is the equivalent of the public wage premium, therefore has for the most part negative effects on labour market dynamics overall. One point that has not been discussed thus far is the contribution of the public wage premium to explaining wage rigidities in the private sector.

Most of the literature in South Africa suggest that wages in the private sector has a weak response to labour market conditions. In particular, increases in private sector wages are often correlated with significant job shedding by private firms. The public wage premium plays a contributing role in the following way. An increase in public wages, as found in the

previous section, often spills over to private sector wages. This can occur through various channels. For instance, through the trade unions channel, higher wages for public servants intuitively incentivize private sector workers to demand an increase in salaries, regardless of the economy's position in the business cycle. Since private firms main objective is profit maximization, compliance to such demands during recession periods inevitably leads to job shedding. This is most likely to happen in economies with high level of trade unions bargaining power. An optimal policy response is thus required. This optimal policy could well be a combination of monetary and fiscal policies. For instance, the perverse effects of wages rigidities could be offset through optimal monetary policy if trade unions are concerned about the penalizing cost of employment which will result from wage increases. This section focuses more on the optimal fiscal response.

It is important to mention first that the immediate response to overcome the negative effects of an increase in public wage in the South African context would be to improve workers skills. This point has been covered extensively in the South African literature. However, this policy response alone will not subdue the crowding out effects of private employment. Indeed, if workers search is random, the sector with better endowment will always be the most attractive. In the case the most attractive sector is the public sector, a public wage premium will induce too many unemployed individuals to queue for public jobs, which will eventually end up raising overall unemployment. Consequently, it is important to design a sound policy response.

Gomes (2013) suggests a procyclical public wage policy over the business cycle. Therefore, governments should closely follow the evolution of wages in the private sector. In particular, public wages should be reduced in periods of recession and increased in periods of expansion; since individuals tend to excessively queue for public jobs during recessions whereas they apply significantly less for them during booms. However, government policy should adopt a countercyclical vacancies stance. During recessions, private firms display lower productivity. It is therefore optimal for the government to hire more in order to absorb the unused labour force. It is on the other hand, not optimal for the government to post more vacancies when the jobs offered are not productive.

This is particularly important in the South African context given the shortage of skilled

workers in the economy. A procyclical wage policy could prevent the exodus of skilled workers to the public sector or worse, for jobs abroad as it has been the case in the past few years. However, it is worth noting that, although optimal, the implementation of such a policy may turn out difficult to achieve. For instance, cutting wages in the public sector during periods of recession may prove difficult to accomplish, especially under severe political pressures. On the other hand, this policy in an economy dealing with the setbacks of falling commodity prices will most likely generate the desired results.

## 7 Conclusion

The public sector in South Africa has been expanding since the end of the Apartheid regime to become in recent years the single entity to absorb formal employment the most. The sector is for the most part skilled workers intensive, and given the existential large skill gap amongst workers in the economy, a public wage premium may have non negligible repercussions in terms of private sector employment and wage responsiveness to market conditions. Given such premises, this paper uses a DSGE model with two sectors composed of skilled and unskilled workers to primarily investigate the effects a positive public sector wage shock on a calibrated South African labour market. This is done by assuming different levels of collective bargaining power and a difference of production efficiency between private and public sectors.

The findings suggest that an increase in private sector productivity produces more desirable results as opposed to a rise in public sector wages. Indeed, the productivity shock essentially raises employment for skilled and unskilled workers, reduces overall unemployment and augments wages in the private sector. On the other hand, a public sector wage shock mainly crowds out employment in the private sector as skilled workers move to the public sector where the wages have increased. The decrease in skilled employment in the private sector is matched by an increase in unskilled labour, therefore suggesting that a substitution effect is taking place. Furthermore, an increase in public sector wages results in more unemployed individuals queueing for public jobs given the attractive benefits, which ultimately increases overall unemployment. All in all, the effects are more pronounced

when the level of collective bargaining power for unskilled workers is high.

It is however important to interpret these results cautiously. Although an increase in public sector investment, which may or may not be reflected by an increase in public sector wages, seems to worsen the overall labour market performance, by doing so the public sector may as well offer access to good health, better education and transport, etc. It is therefore important to take into account a number of parameters in an attempt to design an optimal public wage policy. Gomes (2013) suggests that such a policy should allow for public wages to be procyclical. In other words, public wages should follow closely the evolution of wages in the private sector in an attempt to avoid a highly volatile unemployment.

There are a couple of limitations about this study which suggest that the work could be improved upon. For starters, it would have been ideal to estimate the model using South African data which could not be achieved given the crucial lack of it. Finally, one could expand the model by incorporating unskilled labour in the public sector as well, in an attempt to make the model more 'realistic'.

## 8 Appendix A

### PARAMETER VALUES

Table 1A: Skilled workers

Parameter	Description	Value
$\chi_s$	Disutility of working	0.46
$\eta_s^p$	Private sector matching elasticity w.r.t. unemployment	0.5
$\eta_s^g$	Public sector matching elasticity w.r.t. unemployment	0.2
$\lambda_s^p$	Separation rate - Private sector	0.04
$\lambda_s^g$	Separation rate - Public sector	0.03
$a_s^p$	Matching efficiency - Private sector	1.96
$a_s^g$	Matching efficiency - Public sector	1.7
$c_s^p$	Private sector cost of posting vacancies	2
$c^g$	Public sector cost of posting a vacancy	1.1
$b_s$	Bargaining power	0.5

Table 2A: Low skilled workers

Parameter	Description	Value
$\chi_u$	Disutility of working	0.6
$\eta_u^p$	Matching elasticity w.r.t. unemployment	0.3
$\lambda_u^p$	Separation rate	0.14
$a_u^p$	Matching efficiency - Private sector	1
$c_u^p$	Private sector cost of posting vacancies	0.9
$b_u$	Bargaining power	0.5

Table 3A: Common parameters

Parameter	Description	Value
$\beta$	Discount factor	0.99
$\iota$	Fritch elasticity of labour	0
$\alpha$	Private firm production elasticity w.r.t. skilled labour	0.7
$A^p$	Private sector productivity	1
$A^g$	Public sector productivity	1
$\gamma$	Elasticity of substitution	0
$\xi$	Weight of public consumption	0.18
$b$	Bargaining power	0.5
$\rho$	Shock persistence	0.8

Table 4A: Steady state

Parameter	Description	Value
$u$	unemployment	0.23
$u_s$	Fraction of skilled unemployed	0.03
$u_u$	Fraction of unskilled unemployed	0.2
$l_s^g$	Public sector employment	0.1
$s_s$	Share of skilled seeking public jobs	0.33

# 9 Appendix B

## ADDITIONAL IMPULSE RESPONSES

Difference of productivity between private and public sectors

Figure 1B: Productivity shock Part 1

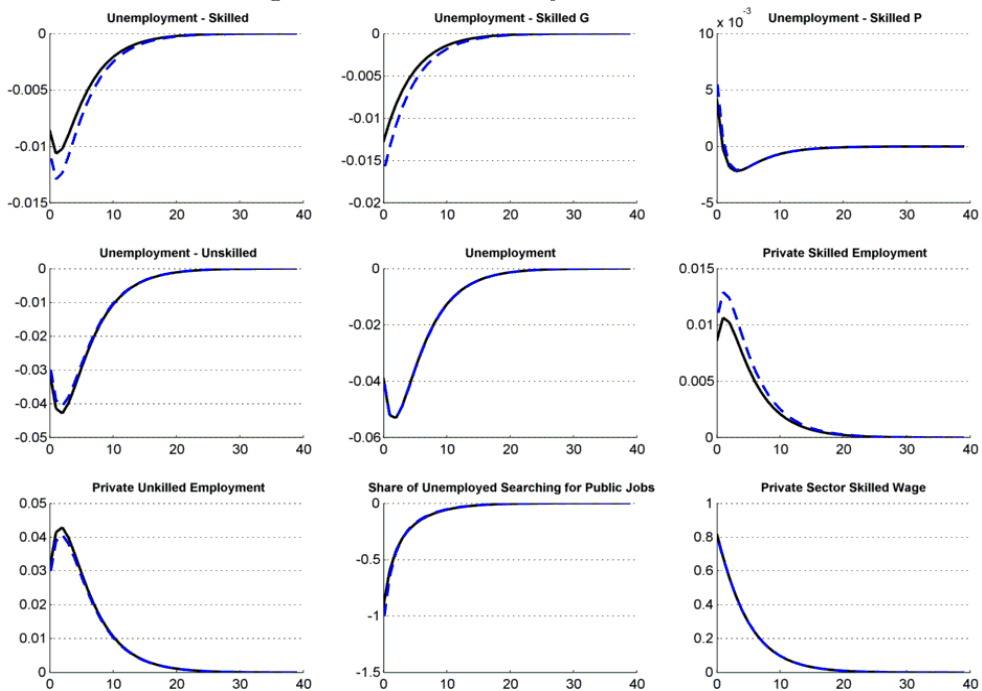
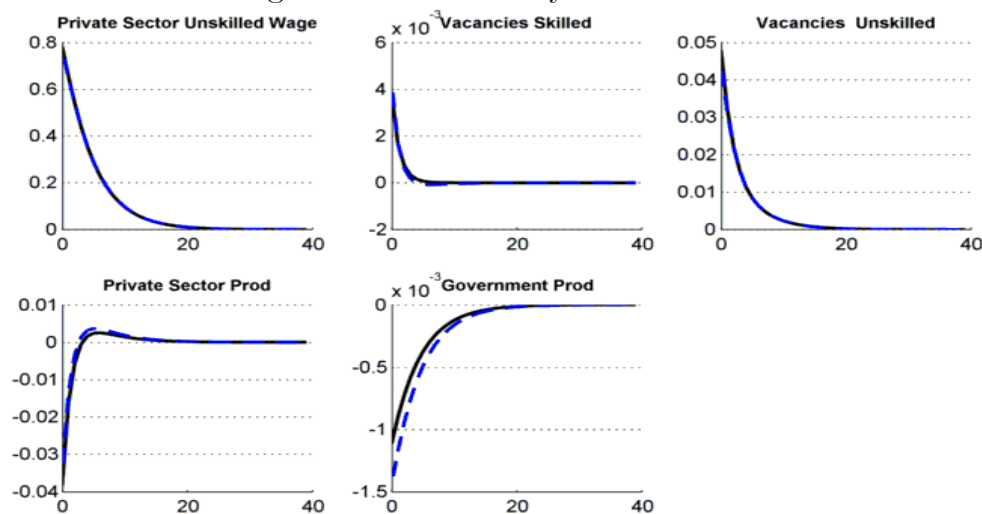


Figure 2B: Productivity shock Part 2



Note: solid line ( $A^p = A^g = 1$ ); dashed line ( $A^p = 1; A^g = 0.5$ )



## References

- [1] Algan, Y., Cahuc, P., Zylberberg, A., Jörn-Steffen, P. & Verdier, T. 2002. Public employment and labor Policy, Vol. 17, No. 34, 7-65.
- [2] Ardagna, S. 2007. Fiscal policy in unionized labor markets. *Journal of Economic Dynamics and Control*. 31(5), 1498-1534.
- [3] Bosch, A. 2006. Determinants of public and private-sector wages in South Africa. Research Department, South African Reserve Bank.
- [4] Bhorat, H., Naidoo, K., Oosthuizen, M. & Pillay, K. 2015. Demographic, employment, and wage trends in South Africa. UNU-WIDER Working Paper. 2015/141.
- [5] Calmford, L & Lang H. 1995. Macroeconomic effects of active labour market programs in a union wage-setting model. *Economic Journal*, 105, 601-619.
- [6] Canova, F. & Ravn, M.O. 1998. The macroeconomic effects of German unification: real adjustments and the welfare state. *Review of Economics Dynamics*. 3, 423-460 (2000). [Online] Available from: [www.idealibrary.com](http://www.idealibrary.com).
- [7] Duncan, J. 2013. Employment trends: A hard look at the numbers. [Online] Available from: <http://www.moneyweb.co.za/archive/employment-trends-a-hard-look-at-the-numbers/> [Accessed on 2016-03-13].
- [8] Ehrenberg, R. & Schwarz, J. 1986. Public sector labour markets, in Ashenfelter, O & Layard, R. (eds.) *Handbook of Labour Economics*, Amsterdam North Holland/Elsevier Science Publisher, Vol. 2, Chapter 22, pp. 1219-1267.
- [9] Finn, M . 1998. Cyclical effects of government's employment and goods purchases. *International Economic Review*, 39(3), 635 -657.
- [10] Gomes, P. 2013. Fiscal policy and the labour market: the effects of public sector employment and wages. Institute for the Study of Labor, IZA Discussion Paper No. 5321.

- [11] Gregory, R. & Borland, J. 1999. Recent developments in public sector labour markets, in Ashenfelter, O. & Card, D. (eds.) *Handbook of Labour Economics*, Amsterdam: North Holland/Elsevier Science Publisher Vol. 3c, Chapter 48, pp. 3573-3660.
- [12] Hassen, E-K. & Altman, M. 2010. Public service employment and the job creation in South Africa. *Human Sciences Research Council*.
- [13] Holmlund, B. & Linden, J. 1993. Job matching, temporary public employment and equilibrium unemployment. *Journal of Public Economics*, 51, 329-343.
- [14] Kerr, A. & Teal, F. 2012. Determinants of wage inequalities: panel data evidence from South Africa. Institute for the Study of Labor, IZA Discussion Paper No. 6534.
- [15] Kerr, A., Wittenberg, M. & Arrow, J. 2013. Job creation and destruction in South Africa. Southern Africa Labour and Development Research Unit. Working Paper Series, 92.
- [16] Kwenda, P. & Ntuli, M. 2015. A detailed decomposition analysis of the public-private sector wage gap in South Africa. Institute for the Study of Labor, IZA Discussion Paper No. 9271.
- [17] Postel-Vinay, F. 2015. Does it pay to be a public-sector employee? Institute for the Study of Labor.
- [18] Statistics South Africa. 2014. Youth employment, unemployment, skills and economic growth, 1994-2014. Stats SA [Online] Available from: [www.statssa.gov.za](http://www.statssa.gov.za).
- [19] Schultz, T.P. & Mwabu, G. 1998. Labour Unions and the distribution of wages and employment in South Africa. *Industrial Labour Relation Review* 51:680-703.
- [20] Woolard, I. 2002. A comparison of wage levels and wage inequality in the public and private sectors, 1995 and 2000. Development Policy Research Unit, Working Paper 02/62.