EVALUATING THE GENERAL EQUILIBRIUM EFFECTS OF A WAGE SUBSIDY SCHEME FOR SOUTH AFRICA

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October 2002
TIPS Working Paper 3-2003

Abstract

The unemployment rate among semi- and unskilled workers in South Africa is over 50%. This high rate can be attributed to various factors, including political decisions of the past, educational inequalities, and poor economic growth. These factors have contributed to the structural unemployment problem in South Africa. The real cost of labour – and in particular that of semi- and unskilled workers – has also increased dramatically. This could be a further incentive for firms to hire fewer semi- and unskilled workers.

Investment in human capital is imperative, as this will increase the income earning potential through higher skilled employment. However, in the short run this may not be enough. A wage subsidy has been proposed as a further incentive for firms to employ more semi- and unskilled workers. This type of subsidy lowers the cost of employment to the firm while maintaining the wage of the worker. It is a tool that is equally useful in reducing unemployment and improving the distribution of income, particularly when semi- and unskilled workers are targeted.

The outcome of various wage subsidy experiments are analysed using a CGE model. This class of multisector model is useful for evaluating the impact of policy tools that can have economy-wide effects. The simulations suggest that employment can be raised quite significantly, with important benefits especially for poor households.

The cost of employment subsidies can be substantial, depending on the extent of the target group. However, it is argued that the benefit of increased employment justifies the cost. It is shown that although the negative indirect effects of raising funds for the scheme, either via an increased budget deficit or increased taxation, counteract the positive impact of an employment subsidy scheme, the net overall benefits are positive. All modelled household groups increase their income, while all industries are able to employ more workers than before.

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1. Introduction

The South African unemployment level is creeping towards the 40% mark[1], posing a serious threat to political and economic stability in South Africa. Many of the country's social problems such as poverty, crime, violence, loss of morale, social degradation, and political and economic instability can be linked to unemployment (Kingdon and Knight 2000). Although questions have been raised about the measurement of unemployment[2] in South Africa, the exact extent thereof is irrelevant: all agree that there is massive under-utilisation of human resources in the country (Lewis 2000).

The GEAR strategy (Republic of South Africa 1996) failed in its objectives of achieving high economic growth and job creation. Reasons for its failure range from institutional problems and misaligned government policies[3] to global market constraints[4] and the economy's inability to create jobs through growth.[5] In order to devise a workable solution, it is important to understand the nature of unemployment in South Africa.

Various factors have contributed to the unemployment problem in South Africa. The economy is characterised by a strong capital-bias in production (see Fallon and Pereira da Silva 1994), while past policies of discrimination and educational inequalities have contributed greatly to the structural unemployment problem in this country. While about 40% of workers can be classified as semi- or unskilled, firms are demanding more skilled and professional workers.[6] This is reflected in current unemployment figures: semi- and unskilled unemployment was 50.1% in 1999, compared to 16.2% of skilled labour and zero unemployment among highly skilled workers (Lewis 2001).

A further important cause of unemployment, and one that is more important in the context of this paper, is the sharp rise in real wages of particularly semi- and unskilled workers over the last two decades. Figure 1 below highlights this phenomenon. Relative to productivity

[1] Bhorat and Leibbrandt estimated the national unemployment rate at 32.6% of the work force in 1996, while Lewis (2001) estimated the 1999 unemployment rate at 36%, using the expanded definition of unemployment. This supports Mohr's (2000) evidence of an increasing unemployment rate. He found that the formal sector has shed 0.9% of its jobs during the period 1990 to 1996.

[2] Unemployment rates are calculated on the basis of the individuals' own perception of their employment status, thus introducing a large degree of subjectivity and possibly an overestimation of the true unemployment rate.

[3] Nattrass (2000) believes that GEAR's failure is a result of increased labour market regulation despite objectives of creating more flexibility in this market. Furthermore, high interest rates stifled growth and employment.

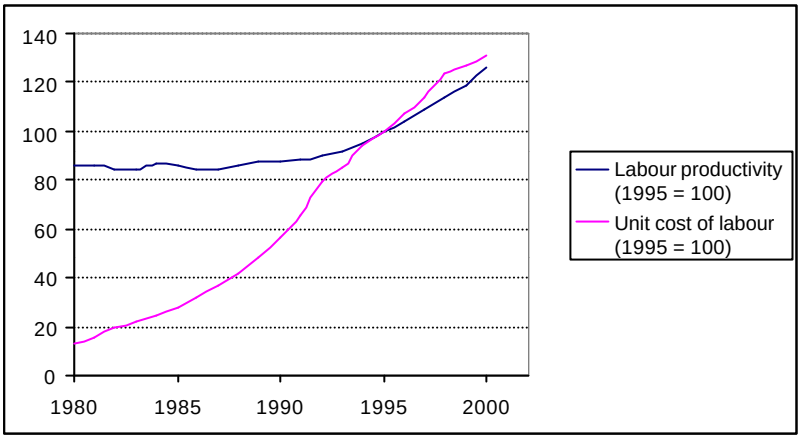
[4] Lewis (2000) believes that a small open economy like South Africa should not rely too heavily on economic growth as the solution to its problems. Such economies are too vulnerable to fluctuations in world markets, often rendering demand-side policies ineffective. South Africa's vulnerability in this regard became obvious during recent months.

[5] Samson (2000: 1) argues, "South Africa's recent experience with formal sector job losses raises serious questions about the notion that economic growth [is] sufficient to create jobs".

[6] Professional workers make up 14% of the economically active population and include legislators, senior officials, managers and professionals. Skilled workers (30%) consist of technicians, clerks, service workers, skilled agricultural and fishery workers and craft and related trade workers. Semi- and unskilled workers (40%) include plant and machine operators, assemblers and elementary occupations. Finally, 16% of workers are self-employed or employed in the informal sector. Informal workers have similar characteristics to semi- and unskilled workers (see Lewis 2000). Kingdon and Knight (2000) define informal workers as those not in regular employment, such as casual workers, domestic workers or self-employed persons.

increases, labour costs have increased sharply, especially during the 1980s. Lewis (2001) shows that these costs were probably driven by sharp real wage increases of semi- and unskilled workers. The 1999-level of wages of highly skilled workers was 90% of the 1970-level in real terms. Skilled wages were 10% higher in real terms. However, semi- and unskilled wages increased by a massive 150% in real terms over the same period. While unemployment among semi- and unskilled workers was below 10% in 1970, it had grown to over 50% in 1999.[7]

Figure 1. Unit labour cost and labour productivity: 1980 – 2000 (index, 1995=100)



Source: SARB Quarterly Bulletin (July 2001)

Rising real wages were not the only cause of rising labour costs. Nattrass (2000) argues that regulation in the labour market has impacted on employment levels by increasing the cost of employing labour. In a recent survey of 325 large South African manufacturing firms, managers indicated that, in response to new legislation, they hired fewer workers, substituted capital for labour when expanding, hired more temporary workers as opposed to permanent workers, and relied on sub-contracting (Chandra *et al*. 2001).

Lowering the real wage is arguably an infeasible solution to the problem[8], while a reversal of the recent trend of increased regulation in the labour market is unlikely. The focus should be on supply-side policies, since demand-side policies have proven to be ineffective in times of global uncertainty. Increased investment in education and training is important, as this will reduce the pool of unemployed semi- and unskilled workers in the long run. However, in the short run, alternative options should be explored. This paper will explore the option of employment (or wage) subsidies as one solution to the unemployment problem.

The effectiveness of employment subsidies stems from the fact that they impact directly on the labour market. Employment subsidy schemes have been used widely to address declining

[7] It must be noted that comparative figures such as these should be analysed with extreme caution. Prior to the 1990s, data from the former TBVC states were excluded from most official statistics. There is little doubt that the inclusion of data from these areas has had a significant on national employment statistics.

[8] Firstly, lowering wages is a politically sensitive issue, especially in the light of the evidence of the large number of households that can be classified as the working poor (see Bhorat and Leibbrandt 1996). Secondly, as Heintz and Bowles (1996) argue, it is possible to have unemployment in the long run since no *positive* wage rate exists that clears the market. Thirdly, some maintain that productivity may decline as a result of lower wages, either as a result of nutritional reasons or a lack of incentive – the so-called efficiency wage argument.

employment levels, both in developing and developed countries. Few researchers have explored the suitability of employment subsidy schemes for South Africa (see Heintz and Bowles (1996) and Lewis (2001)). However, there seems to be interest from policymakers and policy analysts to further investigate options. The implementation of a 'wage incentive scheme' was proposed by the National Government in the 2001 Budget Review. Draft legislation for this scheme was already released early in 2002. Provision has also been made for the wage incentive scheme to be extended to a wage subsidy scheme in the future.

This paper uses a Computable General Equilibrium (CGE) model for South Africa in order to analyse the economy-wide impact of an employment subsidy scheme. CGE models are employed extensively in policy analysis as they simulate a market economy and serve as a useful tool to analyse "cross-cutting issues" that have an economy-wide impact (Arndt and Lewis 2000: 4). Although partial equilibrium analysis is useful, general equilibrium analysis provides a more balanced overall picture. It provides a tool to analyse movements within markets, while it also captures the interactions between markets and economic agents. In the next section we explore the theoretical background to employment subsidies, while the model is explained in Section 3. The results of various simulations are compared in comparative static fashion and are discussed in Section 4. Section 5 draws general conclusions.

2. Theory of employment subsidies

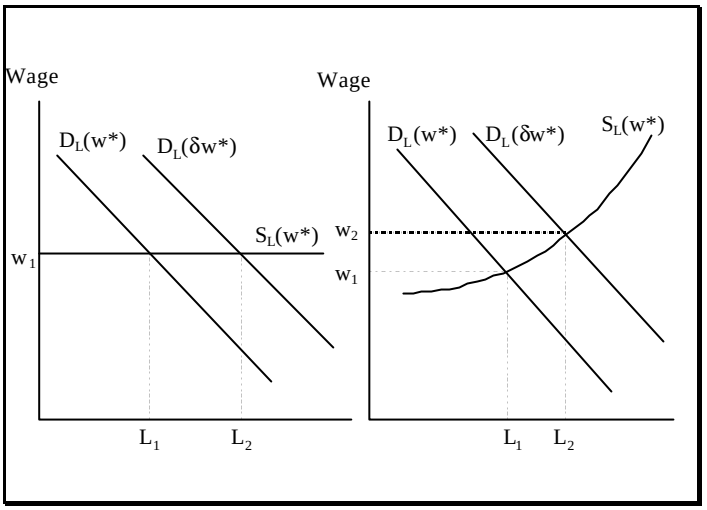
2.1 Overview

Employment subsidies aim at expanding employment by reducing the cost of labour to the employer. Typically the state subsidises the wage paid by the firm without lowering the wage received by the worker. This encourages higher labour absorption by firms, the direct employment effect of the subsidy (Heintz and Bowles 1996). Lewis (2001) describes a further direct effect, namely an accumulation effect. This occurs when lower labour costs raise expected profits and lead to increased capital investment. Employment is also induced indirectly. Since more workers are employed, household income increases, which in turn leads to an increase in consumption. At the same time, firms are able to lower prices, thus increasing the real spending power of households. Firms increase their output to satisfy higher consumption demand, and hence demand more labour indirectly. Employment subsidies therefore have various positive downstream effects, which render them useful to address a number of issues directly and indirectly, including poverty alleviation, income redistribution, and the stimulation of private investment and aggregate demand.

Standard producer theory can be used to show the impact of an employment subsidy on the employment level of the individual firm. The firm's short-run labour demand curve is given by the downward-sloping section of the marginal revenue product (MRP) curve that falls below and to the right of the average revenue product (ARP) curve. The firm hires labour at the point where the equilibrium wage, w^*, equals MRP. When the wage is reduced by a factor δ ($\delta < 1$), the firm increases employment up to the point where $\delta w^* = MRP$. The total subsidy cost incurred by government is equal to the new level of employment times the subsidy per workers $[w^*(1-\delta)]$. In a perfectly competitive environment, all firms receiving the subsidy increase their demand for labour and hence the aggregate labour demand curve shifts to the

right[9]. Katz (1998) uses a simple partial equilibrium analysis to show the impact of a wage subsidy in the labour market for unskilled workers. Consider Figure 2 below:

Figure 2. Labour demand analysis – market for unskilled workers



Source: Katz (1998)

This figure covers two scenarios. A supply-side constraint in the labour market would suggest a horizontal supply of labour curve and hence a fixed wage (left panel). A wage subsidy causes the demand for labour to shift to the right. As a result, total employment increases from L_1 to L_2, while the wage remains constant. The employer benefits from a lower wage and is able to use the extra 'income' from the subsidy to increase employment. This has a positive effect on overall poverty and unemployment. Aggregate households receive a higher total income since there are fewer unemployed household members. Furthermore, the expected wage of unemployed persons, defined as wage times the probability of finding work, increases as a result of the subsidy.

If the supply curve slopes upward (right-hand panel of Figure 2), the individual worker's wage will increase, thus counteracting the employment effect to some extent. The subsidy is shared between the worker and the firm. Under this scenario, both the wage elasticity of supply and demand for labour should be taken into account to evaluate the total employment effect of the wage subsidy. Generally, however, supply elasticities are higher for low-wage workers (Katz 1998). In South Africa this also tends to be the case, particularly because unemployment is much higher among low-skilled workers (Lewis 2001). This suggests that an employment subsidy scheme in South Africa would have a relatively larger impact on employment and a smaller impact on wages. For that reason, the CGE model used in this paper assumes an infinite wage elasticity of supply of semi- and unskilled workers at a fixed wage.

[9] An alternative scenario is one where workers receive the subsidy (as opposed to firms). In this case the supply of labour curve will shift to the right. A higher wage implies that the relative cost of leisure increases, thus encouraging individual workers to increase their supply of labour. This allows the aggregate labour supply curve to shift to the right. In theory, these two effects are similar (see further discussion in Section 2.3).

2.2 Targeted employment subsidies

Often employment subsidies are targeted at specific labour categories or industries. Targeting tends to be associated with trade-offs. The basic targeting principle is the following: the narrower the target group is defined, the more effective it will be in reaching the intended beneficiaries. Narrow targeting also lowers the actual cost of the subsidy, as fewer beneficiaries are involved. However, a downside of narrow targeting is the high administration cost and potential administrative complexities. Broad targeting is much easier to administer, but the actual subsidy cost becomes much higher. The rule of thumb here should be: when administrative capacity is low policymakers should opt for broader targeting. Furthermore, if unemployment and poverty is widespread, broader targeting may be required.

2.2.1 Targeting labour categories

In the light of declining employment and a shift in labour demand towards more skilled labour classes, there is a strong case for targeting a wage subsidy at semi- and unskilled workers. Unemployment rates are considerably higher among these workers. An employment subsidy will assist them in finding employment, gaining experience and increasing their employability. Once employed, the subsequent probability of entering unemployment decreases significantly, as demonstrated by Kingdon and Knight (2000). Semi- and unskilled workers make up about 40% of the South African labour market. Although the cost of targeting such a large group will be high, it is possible to reduce the cost by changing it to a marginal subsidy, i.e. one that is only applicable to additional workers employed rather than all workers. The analysis of a marginal subsidy would, however, require a dynamic framework that can deal with changes in employment from one period to another. The CGE simulations presented below are all based on a comparative static framework and hence we only explore a general subsidy targeted at semi- and unskilled workers.

2.2.2 Targeting industries

The targeting of industries may be necessary to reduce costs. There are various factors that the policymaker can take into account when selecting industries for targeting. Typically large, labour-intensive industries with relatively high employment elasticities of demand for labour are selected. The extent of backward and forward linkages may also play a role. These factors are briefly discussed below. Refer to Table 1, which lists some key statistics of various South African industries. These statistics may be useful in deciding which industries should be targeted.

- The *value-added structure*, which measures an industry's contribution to GDP, as well as the *employment structure*, which measures the relative size of the industry in terms of employment levels, may be used as an indication of the size of the industry or its employment capabilities. A specific industry may be extremely labour intensive, but if it is very small in absolute terms, it might not be sensible to target due to its insignificant impact on employment at a national level.

- The *capital-labour ratio* is a measure of the labour intensity of industries. An alternative measure is the *labour-output coefficient*, which measures the number of

workers per R1 million of output. Industries with high labour-output coefficients for semi- and unskilled labour are usually a sensible choice for targeting.

- The *wage elasticity of demand* for labour, also sometimes referred to as the employment elasticity, is perhaps the most important targeting criterion. The employment elasticity measures the responsiveness of employment to a change in the real wage. The employment effect of a wage subsidy will be higher in industries with high employment elasticities, and typically such industries are selected for targeting.

- *Employment multipliers* can be used to provide insight into the existence of backward and forward linkages between industries. Due to interdependence between industries, changes in one industry will have an impact on the employment levels of another industry. Industries with significant upstream or downstream employment effects may be suitable for targeting.

The modelling section describes the results of an employment subsidy with industry targeting in place. These results are discussed in Section 4.3.

Table 1. Identifying industries for targeting

Sectors	Value-added and factor use (CGE Model)			Capital-labour ratio			Sectoral labour/output coefficients (Workers/R million)		
	Value added structure	Employment structure (Unskilled)	Employment structure (Total)	Capital/ labour ratio	Professional labour	Skilled labour	Semi-skilled and unskilled labour	Informal labour	Total labour
Agriculture, forestry and fishing	5.6%	22.0%	9.7%	63.80	0.08	1.00	16.65	0.69	18.42
Mining and quarrying	6.2%	12.4%	6.3%	193.33	0.25	1.16	6.01	0.29	7.71
Food processing	3.5%	3.2%	2.3%	181.72	0.16	0.66	1.11	0.07	2.00
Textiles and apparel	1.0%	4.8%	2.5%	21.74	0.52	1.82	9.28	0.45	12.07
Leather goods and footwear	0.2%	0.8%	0.4%	25.56	0.27	0.63	6.61	0.29	7.79
Wood and furniture	0.7%	2.1%	1.2%	32.31	0.36	2.08	5.77	0.32	8.52
Paper and printing	1.7%	1.1%	1.1%	119.37	0.48	1.46	1.23	0.12	3.30
Petroleum products	0.8%	0.2%	0.2%	2544.12	0.15	0.25	0.30	0.03	0.72
Chemicals	2.2%	1.1%	1.0%	285.75	0.42	0.68	0.82	0.07	1.99
Rubber, glass, plastic, non-metal	3.2%	2.5%	1.6%	98.55	0.23	0.62	1.55	0.09	2.49
Basic metals	2.4%	3.3%	2.2%	744.54	0.22	0.66	1.19	0.08	2.14
Machinery and equipment	4.5%	2.8%	2.1%	70.77	0.55	1.30	2.62	0.17	4.64
Electricity, gas and water	3.3%	1.2%	1.0%	1321.11	0.37	0.56	1.38	0.56	2.87
Construction	3.1%	6.2%	6.2%	24.79	0.26	1.10	3.52	3.97	8.84
Trade	12.7%	5.0%	9.9%	90.82	0.75	3.37	1.37	1.36	6.85
Tourism	1.1%	0.9%	2.5%	30.09	1.12	9.27	1.80	0.47	12.66
Transport and storage	8.0%	3.4%	6.4%	500.20	0.18	1.30	0.66	2.43	4.57
Financial and business services	18.3%	0.3%	7.6%	574.72	0.70	2.32	0.14	1.12	4.28
Medical and health services	1.9%	0.1%	0.7%	171.61	1.08	1.08	0.10	0.45	2.71
Social and personal services	3.2%	19.3%	15.5%	4.89	3.36	5.40	23.43	15.36	47.55
General government and other producers	16.3%	7.4%	19.7%	168.40	6.53	8.09	2.51	0.37	17.50
TOTAL/AGGREGATE	**100.0%**	**100%**	**100%**	**174.34**	**1.01**	**2.25**	**2.95**	**1.21**	**7.42**

Source: Lewis, 2000

2.3 Payment options

A wage subsidy can be a calculated as a lump sum per worker or as a fixed percentage of the wage. The subsidy can be disbursed in the form of a direct cash subsidy or a tax credit towards future obligations. Typically tax credits are used, as these are easier to administer. The calculation and disbursement of the subsidy are not contentious issues in the literature. However, more time has been spent discussing whether the subsidy should be payable to the employer or the employee (see footnote 9). This is also at present an important issue in the development of South African policy.[10]

In theory there is no difference between a subsidy payable to the firm or the employee. In order to make comparisons between the two approaches, one has to assume that the supply curve for labour is upward sloping. If the subsidy is payable to the employer, the 'derived' demand for labour curve will shift to the right (see Figure 2 right-hand panel). The benefit of the subsidy is shared between the firm and the employee. Alternatively, if the subsidy is paid to workers, the aggregate labour supply curve will shift to the right, resulting in a new equilibrium where, as before, the benefit of the subsidy is shared between the employer and the employee. In both instances the worker earns more, the employer pays a lower wage, and employment is increased by the same margin.

Proponents of a supply-side approach argue that a subsidy payable to employers may fail due to two reasons. Firstly, firms receive immediate windfall gains without increasing employment if they receive a subsidy for all workers employed (Heintz and Bowles, 1996). This may induce them to maintain their existing labour force size, thus rendering the subsidy scheme ineffective. This can only be monitored by implementing some form of control which forces firms to increase their workforce by some minimum level before being eligible for a subsidy. Secondly, wages may increase as a result of the subsidy, even if a horizontal supply curve of labour is assumed. Wage setting in the market for semi- and unskilled workers is not entirely a market-driven process, with labour unions being important players in the collective bargaining process. Unions may counteract the employment generating impact by setting higher wages, justified on the grounds of arguments that firms' profits are being subsidised by the employment subsidy scheme. In the extreme case the new wage (w^L) consumes the entire subsidy, such that $\delta w^L = w^*$. The firm thus still pays the same wage as before, and no direct employment effect can be observed. The cost of the subsidy is a deadweight loss, as the objective of increased employment is not realised.

The debate surrounding the issue of who should receive the subsidy is an ongoing one. This paper will not contribute anything to the discussion. As mentioned before, the employment effect is exactly the same in theory, whether the subsidy is payable to the worker or the employer. Hence this paper will only model a subsidy payable to the employee.

2.4 Financing an employment subsidy

Phelps (1994: 58) argues that wage subsidies would require a large budgetary outlay, but that savings in welfare entitlements, unemployment benefits, crime fighting, and increased tax

[10] In the development of ideas and arguments contained in the section below, the author has benefited from discussions with officials in National Treasury.

revenue "might counterbalance the [impact on the] budget." An effective employment subsidy scheme would allow government to save on welfare outlays and generate more income and consumption tax due to the reduction in unemployment. Whether these savings would exceed the actual subsidy cost is uncertain. The fiscal cost of an employment subsidy scheme financed purely by government can be quite substantial if employment subsidies are broadly targeted. However, the trade-off between narrow and broad targeting with regard to actual subsidisation cost and administrative cost was highlighted before. Therefore the policy choice should depend on the circumstances.

One of the more conventional ways to fund employment subsidies is through a tax on capital (see Heintz and Bowles 1996). The rationale behind a capital asset tax is that, in addition to the factor price ratio distortion caused by the wage subsidy, it further increases the relative price of capital. This will complement the substitution process of labour for capital initiated by the employment subsidy. If the government is reluctant to tax all capital goods, it is possible to tax only certain goods – for example those capital goods that produce environmentally harmful emissions. This will limit the use of specific capital goods. Although a tax on capital assets reduces the burden on the budget and further contributes to the factor-price distortion of an employment subsidy, it could prove to be difficult to determine the value of the capital assets to be taxed. A capital tax may also be harmful to some of the high-growth capital-intensive sectors in South Africa, which could ultimately have a negative impact on the economy.

An alternative revenue-neutral financing option is an increase in income and profit tax rates. Higher household income tax rates will affect household consumption spending, especially for households in high income tax brackets. On the other hand, the beneficiaries of the employment subsidy scheme (e.g. semi- and unskilled workers) will increase consumption spending. If the net effect is a decrease in overall consumption, it could counteract the employment generating effect of the wage subsidy. Increased enterprise taxes will also counteract the impact of the wage subsidy on employment, while firms' investment levels may also be affected due to lower after-tax profits. A final financing option is deficit financing. Rather than raising capital or income tax rates, government can opt to finance the subsidy by borrowing funds on the capital market. This, however, may crowd out private investment. The net impact of a revenue-neutral (income and profit tax increase) and the deficit financing method are compared in the CGE model simulations.

2.5 Current South African programmes and proposals

In the 2001 national budget speech (Budget Review, Republic of South Africa 2001), government announced its intention to introduce a wage incentive scheme. The budget aimed at "addressing poverty through job creation and economic growth" through expenditure on infrastructure, human capacity development, and employment creation programmes. At the time it was proposed that SARS and National Treasury would investigate "economically and administratively efficient tax measures" that would:

- Encourage job creation by reducing the cost of hiring new workers and offering learnerships; and
- Encourage the formalisation of employment in the informal sector, as this would positive effects on other government programmes.

It was estimated at the time that the scheme would result in a revenue loss of about R600 million (Budget Review 2001). An inter-departmental task team was appointed to investigate options for a wage incentive scheme that would be appropriate for the South African circumstances. It was decided that as a first step government would implement a policy that would focus on additional tax allowances for employers who sign learnership agreements with workers. Draft legislation[11] was released in February 2002. The 2001 Budget Review proposed that the wage incentive schemes would be fully operational by October 2001. However, to date the legislation has not yet been finalised. Although the 2001 Budget made provision for an employment subsidy scheme as well, such a scheme has not yet been developed.

3. CGE Model: Methodology and Results

3.1 Overview

General equilibrium analysis can be attributed to Léon Walras (1934–1910), a French-born economist and founder of the Lausanne School of Economics in Switzerland. His book "Elements of Pure Economics" (1874) was "one of the first comprehensive mathematical analyses of general economic equilibrium" (Dixon 2000). General equilibrium analysis is concerned with finding a set of prices that clears all markets simultaneously. Understandably so, general equilibrium analysis can become very complicated, as choices of consumers and firms need to be co-ordinated across markets on an economy-wide basis (Estrin and Laidler 1995). The interdependence between economic agents is therefore a central theme in general equilibrium analysis.

Although Leontief's input-output analysis is "strictly speaking…not a form of general equilibrium analysis" (Chiang 1984: 116), it presents a useful starting point for more complex multisector models (such as CGE models) as they effectively capture sectoral (inter-industry) interdependence (Robinson 1989). However, interdependence is not only limited to the production side of the economy. Households, factors of production, the government sector, and the foreign sector act on market signals and also interact with each other. The aim of CGE models is to try and capture the interdependence of economic agents at a microeconomic level in a structural mathematical model that also takes various macroeconomic constraints into account.

In order to effectively capture interdependence and interrelationships, it is important to develop rich datasets. An important outflow of input-output tables was the development of social accounting matrices (SAMs). A SAM is a "comprehensive, economy-wide data framework" represented in the form of a square matrix (Löfgren *et al*. 2001). Each account is represented by a row and a column: the income side of each account appears along its row, while expenses are written in the columns. An important aspect of the SAM is that it captures resource flows between agents, i.e. it records transactions at a point in time. A SAM "can provide a comprehensive and consistent record of the interrelationships of an economy" (Reinert and Roland-Holst 1997: 95) while it provides an "excellent framework for exploring macroeconomic and multisectoral issues" (Robinson 1989: 887). SAMs usually consist of

[11] The draft legislation released in February 2002 was a proposed insertion into Act 58 of 1962 (section 12H) and entitled "Deduction in respect of learnership agreements".

multiple accounts for activities, commodities, factors, households, enterprises, government accounts, savings-investment accounts, and the rest of the world. An important feature of the SAM is compliance with the basic economic accounting principle, namely that for every income or receipt there is a corresponding expenditure outlay (Reinert and Roland-Holst 1997: 95).

3.2 The standard CGE model

The standard CGE model used here is a generic model that was initially developed by the International Food Policy Research Institute (IFPRI) (see Löfgren *et al*. 2001) and adapted for South Africa by Lewis (2001). The format of this standard CGE model is used extensively in developing countries. The model defines the relationships and sectoral independence between economic agents and is calibrated using the South African SAM for 1997.[12] The SAM forms the benchmark or base data of the model. Once the model is calibrated, policy shocks can be simulated. A new general equilibrium is calculated, and variables are compared with the base data in a comparative static fashion. Dynamic effects are not evaluated.

The actions and interactions of various agents are captured in the model. Activities (or producers) maximise profits subject to a nested production technology explained below. Households maximise utility subject to their budget constraints. Other agents include government and the rest of the world. The labour market is divided into capital and four classes of labour, namely professional, skilled, semi- and unskilled and informal labour (see footnote 6).

Once the model is calibrated, one has a structural model of the economy that can be used to analyse the impact of policy shocks at an economy-wide level. This model is "Walrasian and neoclassical in its truest form", but it is possible to incorporate certain "structural rigidities" (Robinson 1989: 894). Often in developing countries the assumptions of perfect competition and perfectly functioning markets have to make way for more realistic non-neoclassical behavioural assumptions, such as macro imbalances and institutional rigidities (see discussion on model closures below).

The model makes use of a "variety of substitution mechanisms" to model producers' and consumers' economic decision-making processes (Arndt and Lewis 2000: 5). The discussion below will focus on the production side of the model, which is characterised by the use of a two-tier or nested production technology (see Löfgren *et al*. 2001). At the top-level (or activity level), technology is defined by either a Leontief (default setting) or a CES production function.[13] The top-level function defines how the firm combines intermediate inputs and

[12] This SAM was developed by WEFA, a global economics consulting firm, and is based on the SARB's national statistics for 1997.

[13] The general form of the CES production function is the following (see Varian 1992):

$$y = [a_1 x_1^r + a_2 x_2^r]^{\frac{1}{r}}$$

In the function above, y denotes the output, a_1, a_2 and ρ are parameters and x_1 and x_2 are the two factors of production. The CES function is versatile in that it contains several other well-known production functions, depending on the choice of the function exponent (ρ). When ρ = 1 the CES function reduces to a simple linear isoquant, i.e. there is perfect substitutability between factors. The CES production function reduces to a

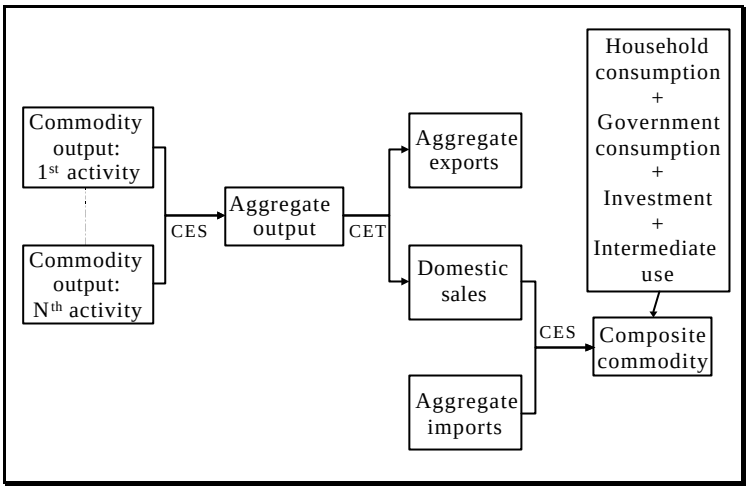
value added through the use of its own factors of production. At the second level, 'value added' is a CES function of the primary factors, capital and labour. This is a critical functional relationship in the model as it governs the substitution amongst the factors of production due to relative price changes. In case of a wage subsidy, the relative price of unskilled labour will decline and, as a result, one would expect higher demand for unskilled labour and lower demand for the other production factors. The 'aggregate intermediates' are either purchased on the domestic market or imported, with their proportions determined by a Leontief production function.

Figure 3 below summarises the flows of marketed commodities through the economy. The commodity outputs for the activities defined in the SAM are combined by a CES function to form aggregate output. Next, a constant elasticity of transformation (CET) function allocates aggregate output to the export market and the domestic market. The CET function behaves similar to the CES function, except that it is concave to the origin and the elasticity of substitution is negative. If the domestic price increases relatively to the export price of a commodity, firms will shift to the domestic market (see Lofgren 2001 for more details).

The composite supply function combines domestically supplied goods (from the CET function mentioned above) and imported goods into the total quantity of goods and services that is supplied in the domestic economy. This function is also defined by a CES function, and is called the Armington function, named after its originator. In equilibrium, domestic institutions consume the total domestic supply of the composite commodity. The sum of household consumption, government consumption, investments and firms' intermediate input consumption must equal total supply (including imported goods). The circular flow in the economy is apparent in Figure 3. Intermediate inputs are again taken up into the production process, value is added, and the final good is added to the aggregate output. Furthermore, institutions (such as households) earn income from factors (labour and capital). As more is produced, more factors are employed, thus raising factor income. This has a positive effect on the demand side. The aim of a general equilibrium model is to capture all these interactions, interrelationships and circular flows in the economy.

standard Cobb-Douglas production function as ρ approaches zero. This function is smooth and convex to the origin. Finally, the CES function can also reduce to the Leontief production function as ρ approaches $-\infty$. The Leontief production function is characterised by zero substitutability between factors and is L-shaped. Thus, the larger the absolute value of ρ, the lower the substitutability between factors of production.

Figure 3. Flows of marketed commodities



Source: Löfgren et al (2001)

The use of various CES functions as well as the CET function requires the selection of the elasticity of substitution (EOS) and elasticity of transformation (EOT) parameters. Although various econometricians have attempted to estimate values for these elasticity parameters, there seems to be no consistency in the results. The econometric measurement of the elasticities is very difficult, while structural inconsistencies between the econometric models used for estimation of these elasticities and the CGE model in which they are used or applied creates most of the controversy (McDaniel and Balistreri 2001). Frequently a value of one is assumed, reducing the CES to the standard Cobb-Douglas production function. The value of the Armington elasticity is especially a controversial issue. McDaniel and Balistreri (2001) demonstrated that CGE model results are often extremely sensitive to the choice of Armington elasticities, especially in international trade simulations. However, in the wage subsidy simulations performed in this study the Armington elasticity is not of great importance, mainly due to the limited impact of the subsidy on imports. A wage subsidy targeted at semi- and unskilled workers will mainly affect lower-income households, who typically have a lower propensity to import. Sensitivity analyses of various choices of the different elasticities of substitution were performed with a wage subsidy scenario. The model results were fairly robust. Table 2 summarises the elasticities used in the various CET and CES functions. These are the 'default' values as used in the Lewis CGE model.

Table 2. Model parameters of the CES and CET functions

Parameter*	**Description**	**Value of rho (ρ)*****
rhoa(A)	Value-added production function exponent.	0.75
rhoa2(A)	Top-level activity production function exponent.	0.5
rhoq(C)	Armington function exponent.	2**
rhot(C)	CET function exponent.	2**
elasac(C)	Output aggregation elasticity.	4

Notes:

* *The A or C indicates whether the parameter is defined over activities (A) or commodities (C).*

** *The parameters rhot and rhoq take on a value of 0.5 for all commodities classified as services.*

*** *The EOS (σ) is a linear transformation of the function exponent (ρ) (see footnote 13) as per the equation below. The transformation function for the EOT is similar, except for a positive sign before ρ:*

$$s = \frac{1}{1 - r}$$

3.3 Model closures and structural features

The model includes three macroeconomic balances: the government balance; the external balance; and the savings-investment balance. Model closures ensure that the macroeconomic constraints hold. When selecting closures, certain assumptions and structural features of the economy are taken into account.

Government budget: The government balance ensures that the budget deficit (negative savings) or surplus remains equal to the difference between government revenue and expenditure. The default closure is one with flexible government savings. Thus, an increase in the government expenditure (*ceteris paribus*) will increase the deficit. This is also sometimes referred to as deficit financing, i.e. any increase in expenditure is simply financed via an increase in government borrowings. Alternatively, a 'balanced budget' closure may be selected. Under this closure, taxes are allowed to vary in order to maintain the budget deficit of the base model. In the CGE model simulations, government expenditure on goods and services (excluding the cost of the subsidy) will be fixed. Government revenue may vary as tax receipts change, either due to changes in income or consumption or changes in average tax rates.

External balance: The external balance (balance of payments) ensures that the domestic value of foreign currency receipts match local currency outflows. This includes capital flows as well as trade flows. By default, a flexible exchange rate is the equilibrating variable, while foreign savings are assumed fixed. This seems to represent the preferred adjustment currently adopted by the SARB, in that a particular balance of payment to GDP ratio is targeted. As the trade balance changes, the exchange rate will adjust to maintain the balance. The alternative is a flexible level of foreign savings and a fixed exchange rate.

Savings-investment balance: The savings-investment balance must be maintained in equilibrium. To achieve this two options are available. An investment-driven model assumes that institutions (households, firms) change their marginal propensity to save (MPS) in order to meet target investment levels. The level of investment is therefore fixed. Alternatively, the model can be savings-driven, i.e. the MPS for households is fixed, while the level of investment in the economy is flexible. The level of savings is determined solely by household income, and changes in domestic saving thus feed into changes in investment levels. The latter option was selected in this model.

An important structural feature introduced in the model is the assumption of unemployment among semi- and unskilled workers. Although the model is based on a neo-classical microeconomic framework that assumes full employment, the model is fairly flexible in that certain structural rigidities can be incorporated. The factor market closure selected to model semi- and unskilled unemployment assumes a fixed wage and unlimited supply of labour at this wage. This implies that the wage elasticity of supply is infinite. All other sub-classes of labour (professional, skilled and informal workers) are fully employed at flexible wages.

The capital market closure is usually based on the assumption of full employment of this factor of production. Two full employment closure options exist: capital can either be fully mobile between sectors; or be activity-specific. Both these closures assume that the economy-

wide level of capital remains fixed. The more flexible approach of mobility between sectors is a slightly controversial one. It is usually applied if the model has a long-run focus where capital is allocated to its most efficient locations. This paper takes the short-run approach where firms (and by extension industries) are unable to adjust the level of capital stock employed in the production process. Capital is thus activity specific. This is often the preferred closure for the capital market because many types of capital stock are only employable in certain industries, and firms will employ the required type of capital irrespective of the relative price thereof.

A further structural feature was introduced in the mining sector. This constitutes a slight adaptation of the standard Lewis model. South Africa is usually regarded as a small open economy with no monopoly power in export markets. The world price of all commodities is fixed, and is also unaffected by changes in the supply (exports) of commodities. This is certainly a valid assumption for most South African commodities, but given South Africa's dominance in world mining products (especially diamonds, coal, gold and uranium ore), this assumption becomes too unrealistic. Thus, in contrast to the standard treatment of exporting industries, mining sector exports are modelled as a function of the relative price of world exports and foreign substitute goods. Initial simulations have shown that a failure to model mining in this fashion will result in overwhelmingly large increases in exports and employment in the mining sector, thus driving overall results. Formally, we introduce the following equation:

$$QE = \boldsymbol{j}\left(\frac{pwe}{pwse}\right)^{-e}$$

QE denotes the quantity of mining exports. The price of foreign substitute goods (*pwse*) is fixed by assumption, while the price of world exports (*pwe*) is variable. These variables, as well as the demand function constant ($\boldsymbol{j}$), are initialised during the calibration process. The parameter $\boldsymbol{e}$ is the elasticity of demand for exports. Similar to the other model elasticities, $\boldsymbol{e}$ also has to be estimated. Following McDonald (2002), this elasticity is assumed to be equal to two (2). The small country assumption is still applied to all other non-mining sectors.

4. Simulation set-up and results

A general wage subsidy reduces the wage paid by the firm, while maintaining the wage earned by the employee. This is modelled by lowering the wage rate in the firm's profit maximising equation (w* = MRP), but maintaining the wage level in the factor income equation (wage times quantity of labour employed). As discussed in Section 2.1, the direct effect of the lower wage is higher employment at the firm level. The profit-maximising firm will employ labour up to the point where the wage payable is equal to the marginal revenue product (MRP), where MRP is an indirect function of (*inter alia*) the quantity of labour. In production theory, the MRP represents the short-run labour demand curve of the firm. Thus, as the wage is reduced, the firm will hire more workers. As shown in Figure 2, the result is a shift in the aggregate demand for labour curve. The various direct and indirect effects of a wage subsidy scheme can be analysed using the standard CGE model.

Three wage subsidy simulations were performed. In all the simulations, government subsidises 10% of the wage of semi- and unskilled workers. Firms thus only pay 90% of the original wage, while workers still receive the original wage. The cost to government is calculated by multiplying the total level of semi- and unskilled employment by the subsidy per worker. This equals 10% of the total wage bill for semi- and unskilled workers. Essentially, this boils down to a government transfer to the employer. Employed individuals do not gain from the subsidy as they still earn the same wage as before. Unemployed workers may gain, if they get hired they will receive a full wage of which 10% is subsidised by government and firms pay the rest. As is shown below, the total cost (1997 prices) of a general non-targeted wage subsidy is around R9.2 billion, while a targeted wage subsidy will cost roughly R1.3 billion.[14,15]

1. In the first simulation the subsidy is applicable to all industries and financed via a budget deficit, i.e. the state borrows funds to pay for the subsidy.

2. The second simulation is similar to the first, except that the subsidy cost is now funded via an endogenous increase in direct taxes on institutions. Households thus pay a higher average income tax and firms pay higher profit taxes. This is the so-called balanced budget closure.

3. The third simulation replicates the second (i.e. a balanced budget approach is opted for), only this time with industry targeting in place. Four industries were targeted: (1) agriculture, forestry and fishing; (2) textiles and apparel; (3) leather goods and footwear; and (4) wood and furniture.

4.1 Simulation 1: 10% wage subsidy with deficit financing

This simulation models a scenario where government subsidises 10% of the wage of all semi- and unskilled workers employed in all industries. Government finances the scheme by increasing the budget deficit. As expected, the effect of the wage subsidy is an increase in semi- and unskilled employment in all sectors (Table 5). The employment impact ranges from a low of 2.8% in the construction industry to a high 11.1% in the medical and health services sector. Below we discuss some of the possible indirect employment effects that may be responsible for the poor performance in some industries. The economy-wide employment effect is an 8.7% increase in semi- and unskilled employment. The supply of all other classes of labour are fixed due to the full employment assumption. However, there is an increase in demand for these classes of labour, as reflected in a slight increase in their respective wage rates (0.74% for professional workers, 1.07% for skilled workers and 0.80% for informal workers). Therefore, while firms initially substitute semi- and unskilled workers for other labour classes due to a change in relative wages, the various indirect employment effects, some of which are discussed in more detail below, causes net demand for other labour types to increase at an economy-wide level. The other factor of production, capital, is fixed by assumption.

[14] This of course depends on the number of industries targeted, the size of these industries and the magnitude of each targeted industry's employment effect.

[15] The estimated costs are substantial, mainly because the subsidy rate of 10% is quite high. In the case of a 5% subsidy, the cost is reduced to about R4.4 billion, slightly less than half the cost of a 10% subsidy. Only the results of a 10% subsidy are discussed.

Output increases in most industries with the exception of the construction industry. The economy-wide increase in production is equal to 1.1%. This increase in production is mainly driven by a 2.3% growth in domestic consumption demand (Table 4). Due to lower production costs associated with the lower wage paid by the firm, domestic prices initially decline. This affects the export-domestic price ratio, causing firms to shift production towards the export market. At the same time, consumers demand more domestically produced goods due to a relative increase in the price of imports versus domestically produced goods. The joint effect of increased exports and lower imports leads to a positive effect on the balance of payments. Since foreign savings are fixed, the exchange rate appreciates by 1.2% to correct the imbalance on the foreign account. Although export supply increases, the value of exports as they appear in the GDP accounts actually declines due to the appreciation of the currency. Also, strong consumption demand counteracts the initial decline in prices, leading to a (negligible) 0.2% increase in the CPI (Table 4).

The significant employment effect of the wage subsidy has an important impact on household income levels. Since relatively poor households (often defined as the first four income deciles) derive most of their income from semi- and unskilled wages, these households benefit the most from the subsidy via the impact on employment levels. Although wages of semi- and unskilled workers remain constant, more individuals are employed in every representative household group (or decile), thus increasing the income of the group as a whole. High-income households also experience an increase in their incomes, mainly via the increase in wages of other labour classes from which they derive most of their income. Relatively speaking, the increase in the income of high-income households is slightly less than for low-income households (Table 6). The wage subsidy is therefore effective in reducing inequality by favouring poor households more than it favours the rich. The growth in consumption demand is mainly spurred by the increase in household income, with low-income households able to increase consumption slightly more (in relative terms) than high-income households.

The cost of living is unchanged for low-income households, but increases slightly for higher income households. As mentioned before, the large increase in consumption demand counterbalances the initial price decline brought about by lower production costs, and hence CPI actually increases marginally.

The government budget closure selected has various important indirect effects. In order to finance the subsidy, government has to increase its borrowings (or negative government savings) by R6.1 billion or 28.0% (Table 4). This translates into an increase in the deficit from 3.0% to 3.8% of GDP. Roughly 68% of the subsidy cost is financed via this deficit increase. The remainder of the R9.1 billion cost of the subsidy (1997 prices) is financed via increased tax receipts. Although the various direct and indirect tax rates remain unchanged in this simulation, the higher household income and consumption demand allows government to increase its revenue from direct taxes, consumption taxes and excise taxes. Overall government revenue increases by 1.7%.

The large increase in the budget deficit has an important impact on national savings. Despite small increases in enterprise and household savings, national savings decrease by 3.8% (Table 4). By assumption, investors can only draw or borrow funds for investment from the pool of savings. Due to this savings-investment closure selected, the level of investment is determined by the change in the level of savings, i.e. investment is 'savings-driven'. Therefore, when the

pool of savings in the economy decreases by 3.8%, investment also decreases by the same percentage.[16]

Investment is modelled as expenditure on goods and services in the economy. Thus, a decline in investment will affect the demand for goods and services. Typically industries that supply investment-type goods – such as the construction industry and the machinery and equipment industry – are hardest hit by sharp decreases in investment demand. The drop in demand has an adverse effect on employment (the so-called indirect employment effect of the wage subsidy) in all industries, but especially those that specialise in investment goods. However, the dominating effect remains the direct employment effect of the wage subsidy, as well as a positive indirect employment effect associated with the increase in private consumption.

Since the model is comparative static, the decline in investment does not affect the growth potential of the economy in the short run. GDP growth is measured at 0.8%. It is generally recognised that poor investment growth will have a detrimental effect on growth potential in future periods, i.e. a period not covered by this analysis. It is often argued that any policy that causes investment to decline should rather be avoided. The next simulation tries control the falling investment levels by allowing government to alter tax levels in an attempt to raise finances for the employment subsidy scheme. This is one way to avoid the impact of the large government deficit on investment levels. Although raising direct taxes has a negative impact on household consumption levels, some interesting comparisons to the deficit finance simulation can be made.

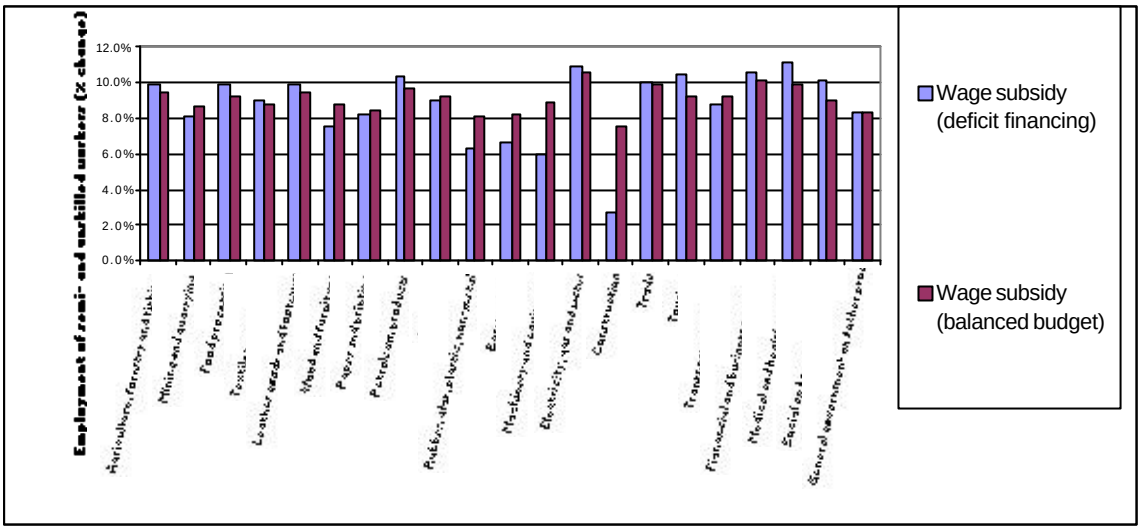
4.2 Simulation 2: 10% wage subsidy with balanced budget

The second simulation replicates the first, with the only difference being the introduction of a variable tax adjustment parameter and a change in the government budget closure. Income tax parameters for institutions (comprising of enterprises and households) are endogenously raised in the model to generate just enough additional government revenue to maintain the level of the budget deficit as in the base.

The employment impact across industries is very similar to the previous simulation (Table 5 and Figure 4). In response to the subsidy, all industries increase the number of semi- and unskilled workers employed. The 9.0% economy-wide increase in employment is slightly higher than under the deficit finance simulation. It is interesting to note that the employment effect is clearly higher in industries that typically supply investment goods, while service industries and those supplying 'normal' consumption goods have a slightly lower employment effect (Figure 4). As before, an increase in demand for the other fully employed classes of labour leads to a rise in their nominal wages. Output increases by 1.3%, which is also slightly higher than before. The same argument can be used to explain the appreciation of the currency: firms shift production towards the export market, while consumers substitute domestic goods for imported goods. The resulting appreciation of the currency is slightly less than before (0.8%). The value of exports (Table 4) increases by 0.8% despite the appreciation of the currency.

[16] Note that fixed investment declines by 4.0%, while the 'change of inventories' entry in the GDP table is 1.4%. The figure of -3.8% is a weighted average of these two numbers (see Table 4).

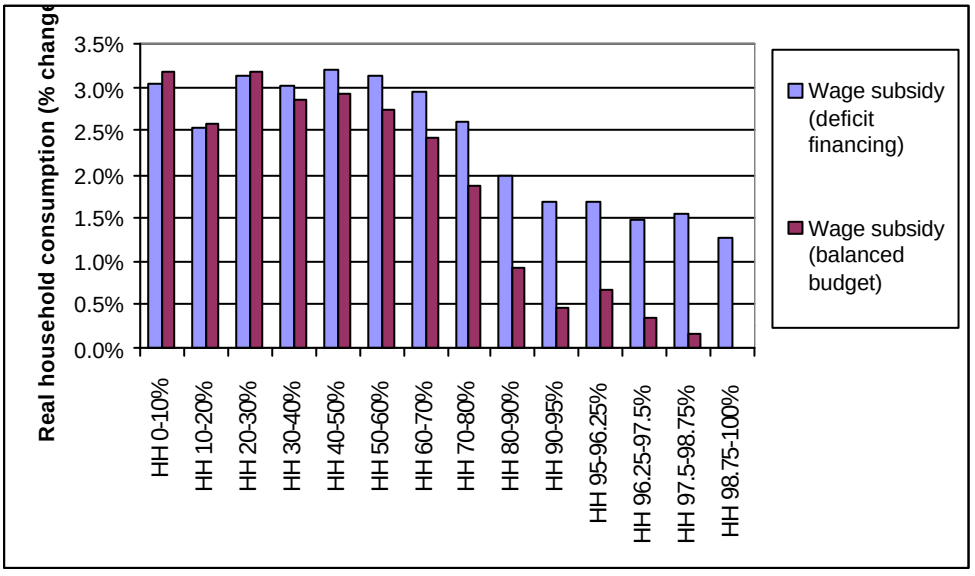
Figure 4. Employment effects of a 10% wage subsidy across different sectors



Source: CGE model

The increase in household income levels is also very similar to the previous simulation (Table 6). All households experience an increase in income, with lower-income households benefiting more from the subsidy. However, when comparing consumption levels, there are some clear differences compared to the previous simulation (Figure 5). Low-income households in the first three income deciles increase consumption, despite paying higher taxes. Low-income households pay very little income tax, and a small proportional change in their average tax rate does not affect their consumption patterns too much. In fact, the increase in consumption shows that the larger employment effect of this simulation certainly benefits low-income households. Higher income households are, however, worse off than under the previous scenario, with the impact of higher average income tax rates becoming progressively worse as one moves to higher income groups.

Figure 5. Real consumption changes across different household groups



Source: CGE model

Next we turn to the government account, the major difference between the two simulations (Table 4). By assumption, the budget deficit level of the base is maintained by making taxes endogenous. The subsidy cost of R9.2 billion is marginally higher than before, mainly due the larger employment effect of this simulation. In order to finance the subsidy, the direct tax rates on institutions need to be raised by 5.4%. As a result of this tax rate increase, as well as the 2.1% overall increase in real household income (Table 6), direct tax receipts increase by 7.4%. Increases in excise, import and consumption taxes also contribute to the higher government revenue. Government revenue receipts from all sources together increase by 5.1%. If indirect taxes had not increased, (endogenous) direct taxes would have had to increase more to balance the budget.

With an assumed fixed savings rate and higher income, household and enterprise savings are slightly higher, contributing to the 0.6% increase in national savings. This allows investment to increase by the same percentage via the savings-driven investment closure. Fixed investment increases by 0.6%, while the change in inventories is 1.6%. The impact of higher taxes is clear when comparing the growth in consumption demand, which now 'only' increases by 1.3%, compared to the 2.3% increase before. However, the shift towards investment made possible by increased savings contributes towards GDP, which increases by 0.9% in this simulation.

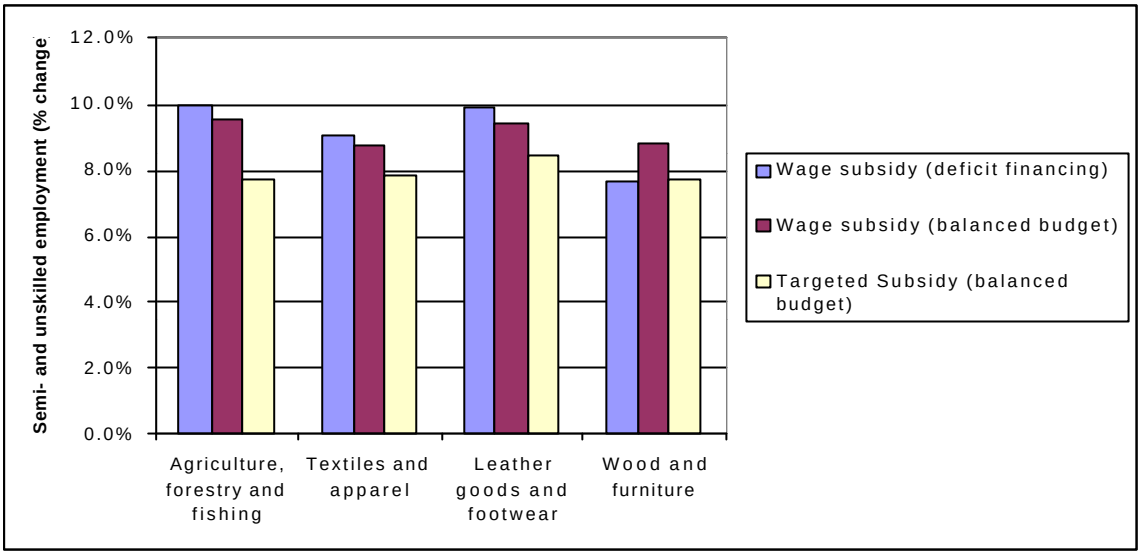
4.3 Simulation 3: Targeted 10% wage subsidy with balanced budget

As mentioned before, four industries were targeted in this simulation. The agriculture, forestry and fishing industry is the largest employer of unskilled workers. It also has a fairly low capital-labour ratio and a high labour-output coefficient for unskilled workers. The other targeted industries –textiles and apparel, leather goods and footwear, and wood and furniture – may not be very large in terms of their employment or value-added structures, but they have low capital-labour ratios and high labour-output coefficients. These factors make these industries suitable for targeting (see Table 1).[17] The simulation uses the same set of closure rules as that of simulation 2. Some comparisons with this 'non-targeted' simulation are made throughout the discussion below. As can be expected, the pattern of the results is very similar to that of the non-targeted simulation, although the changes are generally much smaller due to targeting. The targeted industries together employ roughly one-third of all semi- and unskilled workers in the economy.

Total semi- and unskilled employment increases by 2.4% (Table 4). Compared to the previous simulation, the increase in semi- and unskilled employment is smaller in all the targeted industries. This is due to the indirect employment effects that were lost because fewer industries were included in the wage subsidy scheme. By excluding certain industries, inter-industry employment multipliers are reduced. However, it is equally interesting to see that most of the other non-targeted industries still report increased employment levels, despite not receiving a subsidy. This is due to the multiplier effect in the economy as well as the indirect employment effect of increased investment and consumption. As expected, output growth is lower for all industries when the subsidy is targeted at a few select industries.

[17] Note that the selection of industries here was not necessarily done in any systematic way.

Figure 6. The employment effect of targeted and non-targeted simulations



Source: CGE model

Households are affected in a similar way as before, although the impact on income and consumption is much smaller. Low-income households are again favoured by the subsidy. As a result of the higher income levels, households and enterprises save more, with overall national savings increasing by 0.1%. This allows investment to increase by the same percentage. Private consumption increases by 0.2%, while exports and imports increase by 0.1% and 0.2% respectively. The growth in GDP is 0.2%.

Government revenue increases by 0.7%, with direct tax rates adjusted upwards by 0.7% to fund the subsidy cost of R1.3 billion (1997 prices). Just more than 87 000 jobs are created. Under the non-targeted scenario, the cost was R9.2 billion, while just over 324 000 jobs were created. Some interesting comparisons can be made. Consider Table 3 below: in the non-targeted scenario, the per capita subsidy cost was R2 328. When some selected industries were targeted, the per capita subsidy cost dropped significantly to R927. This difference is due to the fact that semi- and unskilled workers in the targeted industries earn a lower average wage than the average wage of all semi- and unskilled workers in all industries.[18] An alternative measure of the efficiency of the subsidy is the cost per job created (see Table 3). The cost per job created under the targeted scenario is almost half the cost of the non-targeted scenario. This is mainly due to the lower per capita cost. However, the targeted industries also have a higher wage elasticity of demand for labour, adding further to the greater efficiency of the targeted simulation via the larger direct employment effect. Therefore, although indirect employment effects were lower (due to smaller changes in investment and consumption), the overall efficiency is higher when industries are targeted.

[18] Wages of all semi- and unskilled workers are fixed by assumption, but provision is made in the standard CGE model for industry specific wages via the use of a so-called wage distortion parameter.

Table 3. Total subsidy cost and per capita subsidy cost

Wage subsidy with balanced budget, no targeting (Simulation 2)	
Number of semi- and unskilled workers in base	3,612,068
Total number of semi- and unskilled after subsidy	3,936,300
Jobs created	324,232
Total subsidy cost	R9.2 billion
Per capita subsidy cost	R 2,328
Cost per job created	R 28,259
Wage subsidy with balanced budget, targeting (Simulation 3)	
Total number of semi- and unskilled after subsidy	3,699,251
Jobs created	87,183
Number of semi- and unskilled workers in base (targeted industries)	1,072,043
Number of workers receiving subsidy (targeted industries)	1,393,900
Jobs created in 5 industries	83,300
Total subsidy cost	R1.3 billion
Per capita subsidy cost	R 927
Cost per job created	R 14,826

Source: own calculations

Table 4. Aggregate price data, savings-investments, government accounts, factor demand and GDP

	Actual figures				Percentage changes		
	Base	Wage subsidy (deficit financing)	Wage subsidy (balanced budget)	Targeted subsidy (balanced budget)	Wage subsidy (deficit financing)	Wage subsidy (balanced budget)	Targeted subsidy (balanced budget)
Aggregate Price Data							
Exchange rate (EXR)	1.00	0.99	0.99	1.00	-1.2%	-0.8%	-0.1%
Consumer prices (CPI)	1.00	1.00	1.00	1.00	0.2%	0.1%	0.0%
Domestic prices (DPI)	1.00	1.00	1.00	1.00	0.0%	0.0%	0.0%
Savings-Investment Components							
Savings	115,818	111,460	116,557	115,972	-3.8%	0.6%	0.1%
Household savings	6,883	7,025	6,942	6,895	2.1%	0.9%	0.2%
Enterprise savings	120,547	122,330	121,305	120,703	1.5%	0.6%	0.1%
Government savings	-22,039	-28,202	-22,039	-22,039	28.0%	0.0%	0.0%
Foreign savings	10,427	10,307	10,348	10,413	-1.2%	-0.8%	-0.1%
Investment	115,818	111,460	116,557	115,972	-3.8%	0.6%	0.1%
Household investment	8,461	8,125	8,512	8,473	-4.0%	0.6%	0.1%
Enterprise investment	89,714	86,150	90,250	89,845	-4.0%	0.6%	0.1%
Government investment	13,104	12,584	13,183	13,123	-4.0%	0.6%	0.1%
Stock changes	4,539	4,601	4,612	4,530	1.4%	1.6%	-0.2%
Investment adjustment factor	1.00	0.96	1.01	1.00	-4.0%	0.6%	0.1%

Table 4 continued…

	Actual figures				Percentage changes		
	Base	**Wage subsidy (deficit financing)**	**Wage subsidy (balanced budget)**	**Targeted subsidy (balanced budget)**	**Wage subsidy (deficit financing)**	**Wage subsidy (balanced budget)**	**Targeted subsidy (balanced budget)**
Government Accounts							
Total Budget Revenue	177,947	180,894	187,109	179,239	1.7%	5.1%	0.7%
Direct taxes	113,340	115,498	121,679	114,502	1.9%	7.4%	1.0%
Excise tax	9,103	9,120	9,166	9,094	0.2%	0.7%	-0.1%
Import tax	5,619	5,589	5,657	5,623	-0.5%	0.7%	0.1%
Consumption tax	53,224	53,988	53,922	53,355	1.4%	1.3%	0.2%
Transfer (from ROW)	-3,339	-3,300	-3,314	-3,335	-1.2%	-0.8%	-0.1%
Tax adjustment factor	1.000	1.000	1.054	1.007	0.0%	5.4%	0.7%
Total Budget Expenditure	199,986	218,206	218,311	202,571	9.1%	9.2%	1.3%
Government consumption expenditure	177,054	186,164	186,216	178,346	5.1%	5.2%	0.7%
Cost of subsidy	0	9,110	9,163	1,293			
Transfers	22,932	22,932	22,932	22,932	0.0%	0.0%	0.0%
Budget deficit (government dissaving)	-22,039	-28,202	-22,039	-22,039	28.0%	0.0%	0.0%
Budget deficit as % of GDP	3.0%	3.8%	3.0%	3.0%	27.0%	-0.8%	-0.2%

Table 4 continued…

	Actual figures				Percentage changes		
	Base	**Wage subsidy (deficit financing)**	**Wage subsidy (balanced budget)**	**Targeted subsidy (balanced budget)**	**Wage subsidy (deficit financing)**	**Wage subsidy (balanced budget)**	**Targeted subsidy (balanced budget)**
Factor Demand							
Capital stock	1,398,818	1,398,818	1,398,818	1,398,818	0.0%	0.0%	0.0%
Labour (thousands of workers)	9,098	9,414	9,422	9,185	3.5%	3.6%	1.0%
Labour - professional	1,237	1,237	1,237	1,237	0.0%	0.0%	0.0%
Labour - skilled	2,763	2,763	2,763	2,763	0.0%	0.0%	0.0%
Labour - unskilled	3,612	3,928	3,936	3,699	8.7%	9.0%	2.4%
Labour - informal	1,486	1,486	1,486	1,486	0.0%	0.0%	0.0%
Real GDP							
Private consumption	431,072	441,046	436,654	432,069	2.3%	1.3%	0.2%
Government consumption	177,054	177,054	177,054	177,054	0.0%	0.0%	0.0%
Fixed investment	111,279	106,859	111,944	111,442	-4.0%	0.6%	0.1%
Change in inventories	4,539	4,601	4,612	4,530	1.4%	1.6%	-0.2%
Exports	168,415	168,265	169,679	168,657	-0.1%	0.8%	0.1%
Imports	-160,716	-160,655	-162,039	-160,968	0.0%	0.8%	0.2%
Gross Domestic Product	731,643	737,170	737,906	732,785	0.8%	0.9%	0.2%

Source: own calculations

Table 5. Sectoral output and factor use: percentage changes

Sector	Wage subsidy (deficit financing)			Wage subsidy (balanced budget)			Targeted Subsidy (balanced budget)		
	Output	Employment unskilled labour	Total Employment	Output	Employment unskilled labour	Total Employment	Output	Employment unskilled labour	Total Employment
Agriculture, forestry and fishing	2.3%	10.0%	9.1%	2.1%	9.5%	8.6%	1.7%	7.7%	6.9%
Mining and quarrying	2.7%	8.2%	6.2%	2.9%	8.7%	6.7%	-0.1%	-0.2%	-0.2%
Food processing	2.2%	9.9%	5.9%	1.9%	9.2%	5.2%	0.6%	1.5%	1.4%
Textiles and apparel	4.6%	9.0%	7.0%	4.5%	8.8%	6.7%	4.1%	7.8%	5.9%
Leather goods and footwear	4.7%	9.9%	8.5%	4.6%	9.4%	8.1%	4.2%	8.5%	7.2%
Wood and furniture	2.8%	7.6%	4.7%	3.4%	8.8%	5.9%	3.0%	7.7%	5.0%
Paper and printing	0.8%	8.3%	2.8%	0.9%	8.5%	2.9%	0.1%	0.4%	0.2%
Petroleum products	1.1%	10.3%	5.0%	0.9%	9.7%	4.4%	0.0%	0.2%	0.1%
Chemicals	1.0%	9.0%	3.7%	1.1%	9.3%	4.0%	0.1%	0.3%	0.2%
Rubber, glass, plastic, non-metal	1.2%	6.3%	3.3%	1.8%	8.1%	5.0%	0.1%	0.3%	0.2%
Basic metals	1.2%	6.6%	3.1%	2.0%	8.2%	4.7%	-0.1%	-0.1%	-0.2%
Machinery and equipment	0.6%	5.9%	2.0%	2.4%	8.9%	4.8%	-0.2%	-0.2%	-0.2%
Electricity, gas and water	1.7%	10.9%	6.2%	1.6%	10.6%	5.8%	0.1%	0.3%	0.2%
Construction	-1.0%	2.8%	-2.1%	1.8%	7.6%	2.3%	0.1%	0.2%	0.1%
Trade	1.1%	10.0%	2.7%	1.1%	9.9%	2.6%	0.1%	0.4%	0.2%
Tourism	1.2%	10.5%	2.6%	0.6%	9.3%	1.5%	0.1%	0.3%	0.2%
Transport and storage	1.0%	8.8%	2.5%	1.1%	9.3%	2.4%	0.0%	0.1%	0.1%
Financial and business services	0.5%	10.6%	1.6%	0.3%	10.1%	1.0%	0.0%	0.3%	0.1%
Medical and health services	0.9%	11.1%	2.4%	0.4%	9.9%	1.2%	0.1%	0.3%	0.2%
Social and personal services	2.9%	10.1%	5.5%	1.9%	9.0%	4.4%	0.1%	0.2%	0.1%
General government and other producers	0.4%	8.3%	0.7%	0.4%	8.3%	0.7%	-0.1%	0.0%	-0.1%
TOTAL/AGGREGATE	**1.1%**	**8.7%**	**3.5%**	**1.3%**	**9.0%**	**3.6%**	**0.2%**	**2.4%**	**1.0%**

Source: own calculations

Table 6. Household consumption, cost of living and real income: percentage changes

Household percentiles	Wage subsidy (deficit financing)			Wage subsidy (balanced budget)			Targeted subsidy (balanced budget)		
	Real consumption	Cost of living	Real income	Real consumption	Cost of living	Real income	Real consumption	Cost of living	Real income
HH 0-10%	3.0%	0.0%	3.0%	3.2%	-0.1%	3.2%	0.7%	-0.2%	0.7%
HH 10-20%	2.5%	0.0%	2.5%	2.6%	-0.1%	2.7%	0.6%	-0.2%	0.6%
HH 20-30%	3.2%	0.0%	3.2%	3.2%	-0.1%	3.4%	0.7%	-0.2%	0.7%
HH 30-40%	3.0%	0.0%	3.0%	2.9%	-0.1%	3.2%	0.6%	-0.2%	0.6%
HH 40-50%	3.2%	0.1%	3.2%	2.9%	-0.1%	3.4%	0.6%	-0.2%	0.7%
HH 50-60%	3.1%	0.1%	3.1%	2.7%	-0.1%	3.3%	0.6%	-0.2%	0.6%
HH 60-70%	3.0%	0.1%	3.0%	2.4%	0.0%	3.1%	0.5%	-0.1%	0.6%
HH 70-80%	2.6%	0.1%	2.6%	1.9%	0.0%	2.7%	0.4%	-0.1%	0.5%
HH 80-90%	2.0%	0.1%	2.0%	0.9%	0.0%	2.0%	0.2%	0.0%	0.4%
HH 90-95%	1.7%	0.2%	1.7%	0.5%	0.1%	1.7%	0.1%	0.0%	0.3%
HH 95-96.25%	1.7%	0.2%	1.7%	0.7%	0.1%	1.8%	0.1%	0.0%	0.3%
HH 96.25-97.5%	1.5%	0.3%	1.5%	0.4%	0.2%	1.4%	0.1%	0.0%	0.2%
HH 97.5-98.75%	1.6%	0.2%	1.6%	0.2%	0.1%	1.4%	0.1%	0.0%	0.2%
HH 98.75-100%	1.3%	0.3%	1.3%	-0.2%	0.2%	0.7%	0.0%	0.0%	0.1%
TOTAL	**2.1%**	**0.2%**	**2.1%**	**1.2%**	**0.1%**	**2.1%**	**0.3%**	**-0.1%**	**0.4%**

Source: own calculations

5. Conclusions

Unemployment has reached extremely high levels during the last decade, especially among semi- and unskilled workers. It was argued that the negative social externalities associated with high unemployment are very costly to society and necessitates direct intervention in the labour market. Many factors have contributed to the structural unemployment problem, including political and economic decisions of the past, racial inequalities in education spending and the changing structure of labour demand in South Africa. Increasing labour costs, especially of semi- and unskilled workers, have also arguably contributed to rising unemployment levels.

Employment subsidies aim to increase employment levels directly by subsidising the wage paid by the employer. This will counteract the effect that increasing labour costs have on employment levels and encourage firms to hire more workers. The advantage of a wage subsidy over a wage decline is that workers still receive the same wage as before. Increased employment levels will impact directly on poverty, especially when semi- and unskilled workers are targeted. Apart from the direct employment effect of employment subsidies, various positive indirect effects also exist. Because of its wide-ranging effects, employment subsidies have been used internationally to address declining employment levels. The South African government also recently showed interest in this type of policy to address the rapidly increasing unemployment rate in this country. A wage incentive scheme that focuses on job training is currently being implemented. It is expected that this scheme will be extended to a pure employment subsidy scheme in the near future.

The standard CGE model used in this paper is useful for analysing the impact of policy tools that have wide-ranging effects. CGE models should be used with caution, as model assumptions regarding various market closures and elasticities can potentially have a significant effect on the results. Various sensitivity analyses provided some insight into this problem. In the end, a model structure was selected, which is believed to be an accurate representation of the South African economy in the longer run. A comparison of various simulations provided some interesting results. The following conclusions can be drawn:

Two non-targeted wage subsidy simulations had similar outcomes in terms of the effect on employment levels. In both instances, the direct employment effect of the wage subsidy was counteracted because of the need to raise revenue to fund the subsidy. A deficit finance option increased the budget deficit, leading to a decline in national savings. This will impact negatively on private fixed investment levels. The balanced budget option raised direct household and enterprise taxes endogenously to raise funds to cover the subsidy cost. This will impact negatively on household consumption levels, particularly among high-income households. In both simulations, either the decline in investment or the lower consumption growth counteracted the direct employment effect. The balanced budget scenario is marginally better on some accounts, such as employment, investment and GDP. Usually policies that hurt investment levels are not preferable. However, in terms of the job creation objective, the two simulations were so similar that either may be selected, depending on the preferences of the policymaker.

The targeted wage subsidy showed that effective targeting of labour-intensive industries would reduce the cost of the subsidy significantly. This will in turn also reduce the negative

impact of the higher tax rates (or the larger deficit in the case of deficit financing) on the indirect employment effects. The required increase in direct tax rates was very small and had a limited effect on consumption and employment. It is more efficient to target industries that are responsive to real wage changes and have lower average wages, as this reduces the per capita cost of the subsidy as well as the cost per job created, as was shown in Section 4.3. As progressively more industries are added to the target group, industries with higher average wages and lower wage elasticities of demand will eventually be included, thus reducing the effectiveness of the wage subsidy.

In conclusion, it is clear that under conditions of well-functioning labour markets, a wage subsidy scheme could have positive effects on employment and various other economic aggregates. Increased consumption, investment, income, savings and employment could contribute towards higher output and GDP. The method of financing as well as the scope of the subsidy can potentially have important indirect effects and should be considered carefully.

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