Minimum Wages, Employment and Household Poverty: Investigating the Impact of Sectoral Determinations

March 2008

Development Policy Research Unit

Table of Contents

List of Figures

List of Tables

Executive Summary

South African minimum wages are stipulated in several sectoral determinations published by the Department of Labour. The aim of minimum wages is to redistribute earnings and lift the working poor out of poverty by raising wages of workers in designated occupation categories or economic sectors. The downside of mandated wage increases is that they may cause employment levels to decline. The extent of the employment loss depends on the responsiveness of employment levels to wage changes or the wage elasticity of demand for labour. Higher wages also impact on the rest of the economy by raising production costs and hence consumer prices. Such inflation erodes income gains associated with minimum wages, while causing aggregate demand levels in the economy to decline. There is no easy answer to the question about the impact of minimum wages on poverty; the overall outcome depends on the level of the minimum wage relative to market wages, the wage elasticity, the poverty line and the type of income sharing that takes place at the household level.

This study explores these possible effects of minimum wages under a variety of assumptions about how the economy functions. Sectoral determinations covering retail and wholesale trade workers, domestic workers, farm and forestry workers, taxi operators, security workers, hospitality sector workers and contract cleaners are included in the analysis. Two modelling approaches are used. The first is a partial equilibrium analysis, which focuses on income and poverty effects at a micro (survey) level and uses micro-simulation techniques to identify potential gainers and losers of a minimum wage policy. The second is a general equilibrium approach that loses some of the specificity of the partial equilibrium model, but considers all indirect economic effects such as price increases and indirect demand effects. Simulations in both these models are based on the actual minimum wage shocks introduced in South Africa during the last six years.

The study finds that the poverty effects of minimum wages are generally small but positive. The partial equilibrium model shows, however, that the decline in poverty is statistically insignificant at high wage elasticity levels when employment losses are large and therefore offset gains from higher wages. When accounting for indirect effects in the general equilibrium model, the poverty-reducing effect of minimum wages is statistically insignificant at all wage elasticity levels. This important result suggests that when firms are unable to reduce employment levels of minimum wage workers due to substitutability constraints (low wage elasticities) they tend to raise prices, which offset gains. Alternatively, when wage elasticities are high, prices do not rise by as much, but higher employment losses are observed (as in the partial equilibrium model). The statistical insignificance of the poverty results also relates to the fact that the poor are largely removed from the labour market due to low participation rates and high unemployment rates, which means that labour market policies such as minimum wages only affect the poor to a limited extent. In addition to this, poor households tend to be larger in size than non-poor household, implying that more family members in poor households are dependent on the wages of employed members. Any income gain in a poor household is shared among many family members, thus reducing per capita gains.

1. Introduction

Since 2002 various sectoral determinations have came into force in South Africa. They set general conditions for employment, most important of which are a variety of minimum wage levels for workers in several economic sectors. These include retail and wholesale trade workers, domestic workers, farm workers, forestry workers, taxi operators, security guards, hospitality staff and contract cleaners. Based on data from the Labour Force Survey (LFS) of September 2000, which was conducted prior to any of the minimum wages being enacted, it is estimated that all the sectoral determinations combined would eventually cover about one-third of formal and informal sector workers in South Africa. Over half of these workers that would eventually be covered my minimum wages reportedly earned less than what the stipulated minimum wage would eventually be (converted to 2000 prices) and were therefore set to benefit from the policy if their employers complied.

The introduction of minimum wages in an economy with high unemployment rates may seem a bold policy option for addressing low incomes and poverty among working adults. Most economists tend to agree that employment is affected negatively by mandated wage increases. This belief is substantiated by robust evidence of downward-sloping labour demand curves in South Africa's economic sectors. Theoretically speaking the extent of the employment loss depends on the wage elasticity of labour demand, defined as the responsiveness of employment levels to changes in wages. Estimates of the South African wage elasticity usually range from -0.5 to -0.7 for the economy as a whole and in the longer run[1], which means that for a 10 per cent rise in wages, employment levels are expected to fall by between 5 and 7 per cent. The employment effect also depends on the level of the minimum wage relative to market wages, with some arguing that moderate increases in wages are unlikely to affect employment levels in any significant way as employers may be able to mitigate cost increases in ways other than reducing employment levels.

Minimum wages are a popular way of addressing poverty associated with low wages. As long as employment losses can be minimised, minimum wages represent a simple way of transferring funds to the (working) poor without having the need of increasing government spending. The socio-economic arguments in favour of minimum wages are also well established. Minimum wages aim to redistribute earnings to low paid workers and to lift the working poor out of poverty. In South Africa, wages at the lower end of the skill spectrum are very low, contributing to the immense inequalities in the distribution of income in this country. In one of the earlier studies of the post-apartheid era, Bhorat and Leibbrandt (1996) estimated what they term a low-earnings line, defined as the wage required to enable an average household to escape poverty, taking into account average employment and unemployment rates in households. They estimate that just under half of the labour force (including broadly defined unemployed) earned less than the low-earnings line. Of these, the unemployed made up half this

1 Short run elasticities are generally smaller since it takes some time for the full effect of a wage increase to work through the labour market.

group and the working poor the other half. In a more recent study, Pollin et al argue that despite the large increases in relative wages of low-skilled workers seen in South Africa in the last few decades, African workers still only earn a wage that is "*modestly above a reasonable poverty line*" (2006:27). These wages are then often shared among large families, thus causing the entire family to be in poverty, despite being attached to the labour market. Poverty is therefore not only a phenomenon among the unemployed part of the labour force, as is often postulated. For this reason minimum wages may be an important way to reduce poverty among the working poor and their families.

The efficiency wage argument is also sometimes offered as a justification for minimum wages. The theory was initially developed to explain why some firms pay above-equilibrium wages and why then, as a result, unemployment may sometimes persist in the long run. In a perfectly competitive environment with full employment a worker who is fired for shirking on the job will immediately be rehired again. However, when efficiency wages are paid the worker has an incentive not to shirk, since, in the presence of unemployment, the worker may run the risk of not finding a job again (Shapiro and Stiglitz, 1984). In effect, therefore, the opportunity cost of being fired is raised by efficiency wages. Efficiency wages therefore cause worker productivity levels to increase, while they minimise labour turnover and enable firms to attract better quality workers. By the same token minimum wages may thus ultimately increase labour productivity among minimum wage earners. In fact, if productivity levels rise by enough, the unit cost of production may even decline despite the introduction of minimum wages.

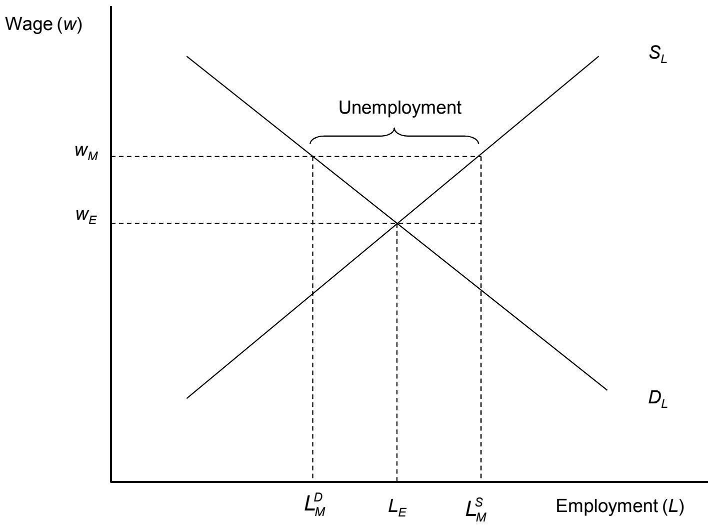
This paper investigates the impacts of minimum wages on employment, wage earnings and poverty at the household level both in a theoretical framework and in an applied modelling framework based on South African data. Section 2 reviews the theory and literature, while section 3 provides a detailed analysis of the possible linkages between minimum wages, employment, household incomes and poverty. Section 4 present results from two types of models used to evaluate the possible impacts of minimum wages. The first is a so-called partial equilibrium model that considers the labour market in isolation from the rest of the economy, although some links are drawn between the labour market and households. This simple model allows us to evaluate how labour market changes affect household incomes and hence poverty at the household level. The second is a general equilibrium model that, in addition to the factor market-household linkages, considers all the other linkages and feedback effects in the economy. Section 5 draws general conclusions.

2. Theoretical Considerations

2.1. The Impact of Minimum Wages on the Labour Market

Standard neo-classical textbooks usually adopt a simple partial equilibrium approach to analysing the impact of minimum wages. Supply and demand diagrams are used to illustrate how the factor market reaches full-employment (L_E) equilibrium at the market clearing or equilibrium wage (w_E). As shown in Figure 1, the introduction of a minimum wage (w_M) set above the market clearing wage will lead to employment losses among covered workers due to the fact that labour supply exceeds labour demand at this higher wage level. This leads to unemployment equal to $L_M^S - L_M^D$. This is called a partial factor market analysis or partial equilibrium model because it only considers supply of and demand for a single factor of production, in the case of Figure 1, labour.

Figure 1: Demand and Supply of Labour and the Impact of a Minimum Wage



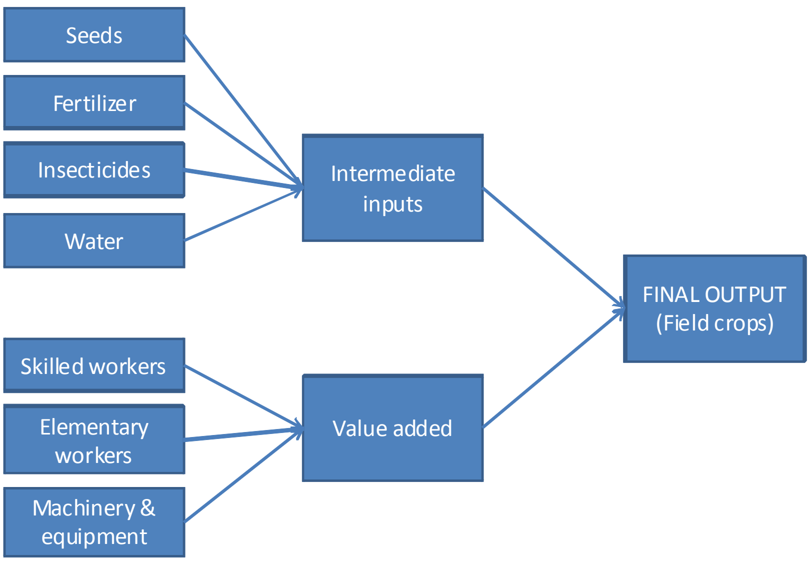
In order to study the effects of minimum wages it is necessary to predict how large the disemployment effect would be. The wage elasticity (denoted by η_L, and also called the partial own-price elasticity of demand for labour) is defined as the percentage change in employment ($\%\Delta L$) for a given percentage change in the wage ($\%\Delta w$). Although in practice advanced econometric techniques are used to estimate wage elasticities (see section 2.3), the wage elasticity for the particular disemployment effect shown in Figure 1 (i.e. a drop in employment from L_E to L_M^D) can be calculated as follows:

$$\eta_L = \frac{\%\Delta w}{\%\Delta L} = \frac{\left(\frac{w_M - w_E}{w_E} * \frac{100}{1}\right)}{\left(\frac{L_M^D - L_E}{L_E} * \frac{100}{1}\right)} \quad [1]$$

Once the wage elasticity is known it is possible to calculate the disemployment effect associated with a specific change in the wage by simply reorganising equation [1], i.e. $\%\Delta L = \eta_L.\%\Delta w$.

A partial equilibrium analysis only concentrates on a single market and ignores the effects that changes in one market can have on other markets. In reality firms employ a variety of different types of factors of production, including capital, land and (possibly) various different types of labour. The decline in employment in response to higher wages stems from the fact that firms are able to choose between different production technologies. A production technology defines the technical relationship between inputs and outputs. Thus, in the agricultural sector for example, firms produce output (say field crops) by employing a combination of capital (machinery and equipment) and labour (skilled agricultural workers and farm hands/elementary workers). The combined contribution of these factors of production is called value added, since these factors are said to add value to intermediate inputs. Intermediate inputs include commodities or services such as seeds, fertilizer, insecticides and water that are purchased as part of the production process. By combining intermediate inputs with primary factors of production, final output is produced. These input-output relationships are shown diagrammatically in Figure 2 below.

Figure 2: An Example of a Simple Input-Output Production Technology for Agriculture



The fundamental assumption in microeconomic production theory is that producers can choose between various combinations of factors of production in order to produce a unit of output. This principle holds especially in the value added component of the production function shown in Figure 2. For example, agricultural producers can decide to produce a unit of output using a more capital-intensive production technique, thus employing relatively more machinery and equipment and fewer labourers per unit of output. It may also be possible to follow a high-skilled intensive production strategy, i.e. by employing relatively more skilled agricultural workers and fewer elementary workers. The choices made by employers are ultimately driven by relative factor costs, where factor costs refer to wages (in the case of labour) and interest or rent (in the case of capital stock).

In some sector it may be harder to substitute between different types of factors of production than in other sectors. Consider for example the construction of a skyscraper. It would be technically infeasible to substitute a 100 foot crane for construction workers. In the agricultural sector, however, it may be possible to replace a tractor with a number of workers (efficiency issues aside). In economic models the ease with which producers can substitute between different factors of production is determined by the elasticity of substitution, which is simply a parameter in a mathematical production function. A low elasticity of substitution indicates a low degree of substitutability between the primary factors and vice versa.

Returning now to our hypothetical production structure for the agricultural sector in Figure 2, suppose a minimum wages increases the wage of elementary workers relative to skilled wages and the cost of capital. Given the production choices available to the producer it is now likely that the producer will employ fewer elementary workers (assuming their productivity levels remain unchanged) and more skilled workers and/or capital stock per unit of output. The extent of the substitution effect depends on the elasticity of substitution, and hence the extent of the disemployment effect among elementary workers (minimum wage earners) also depends on this parameter. This extended model also illustrates how a minimum wage for elementary workers may affect other factors of production as well. General equilibrium models tend to adopt this approach to analysing the impact of economic shocks.

The employment effect in a partial equilibrium model depends on the wage elasticity, while it depends on the elasticity of substitution in a general equilibrium model. It follows that these two parameters have to be related to one another in some way. In the equation [2] below the elasticity of substitution is represented by σ and the wage elasticity by η_L (as before):

$$\eta_L = -(1-\tau)\sigma < 0 \quad \text{where} \quad \tau = \frac{w.L}{P.Q} \qquad [2]$$

In this expression the symbol τ represents labour's share in the value of output. This share is calculated as the ratio of the wage bill ($w.L$) to total revenue ($P.Q$), where P represents the price of the underlying goods produced by the firm. As τ becomes very small, the wage elasticity and elasticity of substitution are very similar. In models where factor accounts are highly disaggregated (rather than just the two types of labour, elementary workers and skilled workers, as is the case in our hypothetical production function shown in Figure 2) τ will automatically become small.

The factor market as a whole still only represents a part of the economy. In order to be a complete and consistent representation of the entire economy, general equilibrium analyses have to capture one further important dimension, namely the secondary demand response of households or consumers in response to changes in prices and/or income levels. When wages rise, production costs are likely to increase. Firms partly mitigate such cost increases by reducing employment levels of the relatively more expensive factor production as explained. However, the extent to which firms can substitute between alternative factors of production depends on the degree of substitutability, which may be low in some industries and higher in others. In cases where the elasticity of substitution is low, firms are forced to pass more of the cost increase on to consumers in the form of higher commodity prices. Hamermesh (1993) shows that in a competitive market a 1 per cent rise in wages will cause consumer prices to rise by labour's share of revenue (τ). In a competitive market where all firms face the same wage increase, the price increase will be across the board, and hence given a downward-sloping demand curve in the commodity market, demand will fall and hence output will decline.

This effect is due to the fact that output levels in a perfectly competitive environment are driven by demand levels; hence demand for labour is also called derived demand. The total wage elasticity (represented by η_L' in equation [3] below), which also takes into account downstream commodity price and demand effects, is defined as follows (note η_P is the demand elasticity for the product):

$$\eta_L' = -(1-\tau)\sigma - \tau.\eta_P \qquad [3]$$

The term $\tau.\eta_P$ reflects Marshall's second law of derived demand, and shows that labour demand is less elastic when demand for the product is less elastic.

Minimum wages also impact on the spending capacity of households. Thus, another feedback effect that is captured in a general equilibrium framework is the change in consumption due to changes in disposable income. In partial equilibrium analyses the commodity market impacts on derived demand are usually ignored. In a general equilibrium context, however, these feedback effects are considered explicitly, albeit it typically in the context of a more complex multi-product environment rather than a single commodity partial framework as we show later on.

2.2. Minimum Wages and Poverty

The goal of the minimum wage legislation is to redistribute earnings to low paid workers and thus lift the working poor out of poverty (Freeman, 1996). South Africa's large numbers of working poor and the elements of labour market discrimination inherited from the past are strong arguments in support of minimum wages in this country. As with most economic shocks, however, minimum wage policies may create winners and losers, the latter being those that potentially lose their jobs.

Poverty is often measured using the Foster-Greer-Thorbecke (FGT) poverty measure (P_α). in its simplest sense 'income poverty analysis' involves indentifying those individuals that earn less than some poverty line (z), which represents the income level needed to ensure that an individual can achieve an acceptable or minimum standard of living. In the formula for P_α below, the symbol y_i is the income or expenditure level of individual i, n is the total population size and α the poverty aversion parameter.

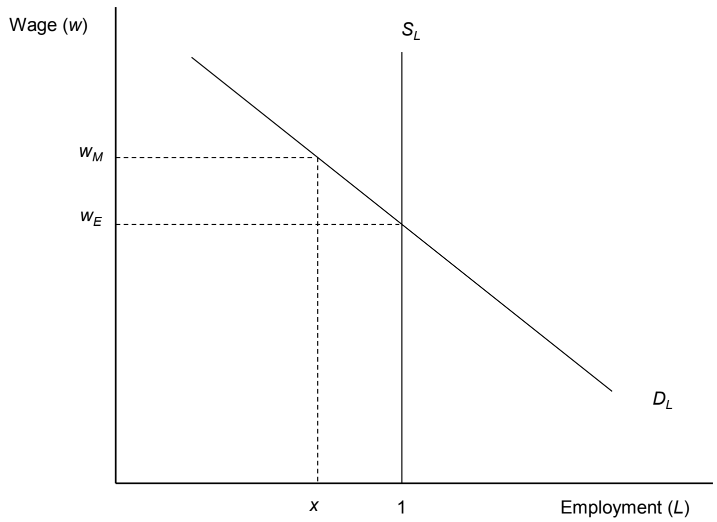
$$P_\alpha = \frac{1}{n}\sum_{i=1}^{q}\left(\frac{z-y_i}{z}\right)^\alpha \quad [4]$$

When $\alpha = 0$ (P_0) the formula is reduced to the simple poverty headcount ratio, i.e. the fraction of people below the poverty line. This measure is completely insensitive to the depth of poverty, but given its simplicity it is a measure most often quoted in poverty studies. For values of α greater than 0, the index is sensitive to the depth of poverty, indicating a greater aversion to poverty. Most often values of 1 and 2 are used, with P_1 and P_2 representing the 'poverty gap' (or depth of poverty) and the 'poverty gap squared' (or severity of poverty).

In their analysis of minimum wages and poverty, Fields and Kanbur (2007) develop a theoretical model outlining the complex relationship between minimum wages and poverty (as measured by the FGT index) under different assumptions. This model considers the entire economy, but given the model assumptions it is in essence a partial equilibrium model. The starting point of the Fields-Kanbur model is the assumption that the minimum wage legislation applies and is enforced in all sectors of the economy equally. The model further assumes that there is a single homogenous type of labour that is supplied by workers and demanded by firms, with no labour force entry or exit. The entire population in their model participates in the labour market, i.e. everyone is either employed or unemployed. Any person who is unemployed earns zero income, except in the income sharing model where the unemployed share in the income earned by the employed. The model shows that the poverty effects of minimum wages depend on four parameters, namely (1) the degree of poverty aversion (α in the FGT equation), (2) the wage-employment elasticity (η_L), (3) the ratio of the minimum wage to the poverty line (w_M/z), and (4) the extent to and/or the way in which income sharing takes place in the economy.

In contrast to the labour market model shown previously in Figure 1, the supply curve (in this case normalised to 1 and representing the entire population) is vertical in the Fields-Kanbur model given the assumption that the supply response is independent from the wage level (Figure 3). The level of labour demanded is a function of the wage rate and is represented by the downward-sloping labour demand curve, D_L. Full-employment is obtained at the equilibrium wage is w_E. At the minimum wage ($w_M > w_E$) employment declines to x and the number of unemployed is $(1 – x)$.

Figure 3: Minimum Wage Effects on Employment in a Competitive Labour Market



Source: Adapted from Fields and Kanbur (2007)

In the basic scenario the impact of the minimum wage on the poverty headcount depends on where the minimum wage is set relative to the poverty line, z. If the aim of the minimum wage legislation is to raise the working poor out of poverty and the minimum wage is set above the poverty line, it means that all those who work are out of poverty, but the unemployed (who earn zero) are in poverty. Thus for $0 < z \leq w_M$, the poverty headcount is simply $1 – x$, i.e. the share of unemployed.[2]

If, however, the minimum wage is set below the poverty line, i.e. $0 < w_M < z$, the population will consist of x poor people who receive the minimum wage and $1 - x$ poor people who are unemployed and earn zero. This means the entire population is poor, and hence $P_0 = 1$. The results are somewhat more

2 Using the formula for P_α it can be shown that when the minimum wage is above the poverty line and the poor are only those who are unemployed and earn zero, $P_\alpha = \frac{1}{n}\sum_{i=1}^{q}\left(\frac{z-0}{z}\right)^\alpha = q/n = 1 - x$. This result is independent of the value of α. Since the population is normalized to 1 the share of unemployed is also the number of unemployed.

complex for P_1 and P_2.[3] Basically, as Field and Kanbur (2007) show, there is a poverty trade-off between the working poor and non-working poor as the minimum wage is raised, with the parameters of the trade-off determined by the wage elasticity of demand. For example, when $\alpha = 1$, poverty increases if the wage elasticity of demand for labour is greater than 1 and decreases if wage elasticity of demand for labour is less than 1.

These predicted outcomes are for a very simplistic model where the unemployed earn no income. A more plausible scenario is one where the unemployed share in the income of employed members of society, either formally via some form of state-sanctioned unemployment insurance or informally within communities or families. The Fields-Kanbur model considers outcomes under a *social sharing* model and a *family sharing* model.

In the social sharing model employed persons are 'taxed' or they 'donate' a certain share of their income to the 'community cooking pot' from which all the unemployed partake. The impact on the poverty headcount depends now on a variety of factors. The level of the minimum wage with respect to the poverty line will determine whether only the unemployed or all people will be poor (as before). The extent of unemployment depends on the wage elasticity, and this now also determines how many employed people are left to make contributions to the community cooking pot. The tax rate payable by wage earners will also impact on poverty, either among the employed (if the resulting net wage is less than the poverty line) or the unemployed (a higher tax share means the unemployment insurance payments are higher).

In the family sharing model the entire population lives in two-person households, and each household therefore has either none, one or two employed members. The model assumes perfect income sharing within the household, i.e. household income is pooled and then shared equally between the two members. The per capita income is therefore w_M in households with two employed persons, $\frac{1}{2}w_M$ in households with one employed persons, and zero in the households with no employed persons. A further assumption is that each individual faces the exact same probability of becoming unemployed when a minimum wage is introduced.[4] Once again the outcome in terms of poverty is complex. The wage elasticity will determine how many people become unemployed. The higher the elasticity, the larger the number of households with no employed members will be. These households are always poor. The level of the minimum wage with respect to the poverty line is also important, and whether it is above the minimum wage (entire population is poor), between w_M and $\frac{1}{2}w_M$ or between $\frac{1}{2}w_M$ and 0 will further determine whether households with one or two working members are poor or not.

3 When the wage is set below the poverty line $P_\alpha = (1-x) + x\left(\frac{z - w_M}{z}\right)^\alpha$.

4 Each individual therefore has an unemployment probability of $1 - x$. Given normalisation of the population, it can be shown that there will x^2 households with two employed members, $2x(1 - x)$ households with one employed member and $(1 - x)^2$ households with no employed persons.

Labour market economists would often reject minimum wages outright, arguing that they cause unemployment, and if unemployment is equated with poverty, minimum wages will cause poverty to increase. Trade unions, on the other hand, would argue that higher wages raise the incomes of the working poor, and even if minimum wage earners are not poor, higher wages may improve income sharing between the employed and the (poor) unemployed, thus ultimately reducing poverty (Fields and Kanbur, 2007). The Fields-Kanbur model is important in bringing across the notion that both these views of the labour market are too simplistic, and no simple answer exists to the question about minimum wages and poverty. Field and Kanbur (2007:146) note "*not only does the truth lie somewhere in between*" the views of labour economists and trade unions, but as they illustrate in their paper "*it can be characterised precisely in terms of empirically observable parameters*".

2.3. Wage Elasticity Estimates for South Africa

High and persistent unemployment in South Africa poses a serious threat to economic and social stability in South Africa and has sparked widespread debate and analysis of the issue. Various factors have contributed to rising unemployment levels during the latter half of the 1990s. Most often cited are structural changes that have taken place in the economy during the last few decades. In particular, production has shifted away from primary production sectors towards relatively capital and skill intensive secondary and tertiary sectors (Bhorat and Oosthuizen, 2005). Technological gains in production processes, brought about by pressure to remain globally competitive, have further increased demand for high-skilled workers relative to low-skilled workers. These factors have led economists to concur that unemployment is partly a structural problem, which can be explained as a mismatch between the type of labour that is highly in demand but scarce (skilled and high skilled) and the type of labour that is in excess supply (semi- and unskilled).

However, many analysts have also sought to explain growing unemployment as a function of changes in relative factor costs. Edwards (2001) argues that the subsidisation of capital during the 1980s and early 1990s has had a negative impact on labour demand, and especially demand for low-skilled workers.[5] Increased regulation of the labour market since 1994 has also raised the non-wage cost of employment (Nattrass, 2000), creating further pressure on employment levels. Even the efficiency wage argument could be offered as a reason for persistent unemployment in the country. Unfortunately South African wage income data spanning long periods of time are somewhat suspect, given poor record keeping during apartheid, the incorporation of the homelands into the national statistics during the 1990s, and the large proportion of the economy that operates in the informal sector. Nevertheless, both Lewis (2001) and Pollin et al. (2006) cautiously present evidence suggesting that wages of low-skilled workers have risen relative to those of skilled or high-skilled

5 In fact, increased capital intensity may have actually benefited high-skilled workers relative to low-skilled workers due to complementarity effects; as capital intensity rises, more high-skilled workers are required to operate new capital equipment (see Bhorat and Hodge, 1999)

workers during the last few decades, which, at least in terms of economic theories, would partly explain the substitution of low-skilled workers for high-skilled workers that has been observed.

The estimation of wage elasticities is one way of exploring the trade-off between wages and employment levels. Econometric techniques used in such estimations allow for the control of external factors that may have affected employment levels during the period of observation, while also controlling for structural shifts and growth in output over the period. Estimates of the national average wage elasticity for South Africa usually range from -0.5 to -0.7 (see for example Fallon and Lucas, 1998, Fedderke and Mariotti, 2002, Heintz and Bowles, 1996). This means that for a 10 per cent rise in wages employment levels are expected to fall by between 5 and 7 per cent.

The study by Fallon and Lucas (1998) produced some of the most widely cited sets of wage-employment elasticities for South Africa. Their method involves estimating various labour demand equations assuming a so-called constant elasticity of substitution production function, and, on the basis of these, they derive a set of long run wage elasticities by economic sector for black employees. Capital stock levels are assumed exogenous while employment levels of white workers are endogenous in the model (see Table 16 in the appendix, section 7.1.3). Their results show a high degree of variation between sectors. The mining sector has a fairly low elasticity of -0.15. In contrast, and "*not unexpectedly*", services has a much higher elasticity (-0.95), while the average for the manufacturing sector is about -1.0 (Fallon and Lucas, 1998:11).[6] The authors admit that the estimate for the manufacturing sector is perhaps too high, driven by very high estimates in at least two of the manufacturing sectors, as is quite evident from Table 16. Fallon and Lucas also estimate a national average elasticity of -0.71. This national wage elasticity is a weighted mean estimate of all the sectoral wage elasticities.

In response to these estimates, Pollin et al (2006) note that just six years prior to this Fallon also produced employment elasticities, only this time coming up with a national weighted average of -0.28. While their later estimate is perhaps, as argued by Fallon and Lucas, more in line with those of other countries, Pollin et al (2006: 26) write:

> *"…the large shift in their own estimate underscores the difficulties in providing generalisations on this matter, given the remarkable historical and institutional changes that South Africa has undergone in the past 30 years – as well as the inadequacy of data on employment under the apartheid regime."*

6 The Hicks-Marshall laws of derived demand suggest that a number of factors influence the own-price elasticity of labour demand an industry. The wage elasticity will be high if (1) the price elasticity of demand for the product produced in that industry is high, (2) when other factors of production are easily substituted for that category of labour, (3) when the supply of other factors is highly elastic (production costs are unlikely to increase too much as demand for other factors increase), and (4) when labour costs of the particular category of labour make up a large share of total costs. All these laws pertain to scale and substitution effects associated with a change in relative factor costs.

A further level of concern relating to the reliability and hence the usefulness wage elasticity estimates relates to Fallon and Lucas's reporting of so-called impact elasticities (see Table 16), defined as the wage elasticity over a one-year period.[7] This is reported as -0.16 for the economy as a whole, which suggests that it would take over 4½ years for the full (long run) effect of a wage increase or decrease to work its way through the economy. Pollin et al note that many other exogenous shocks would impact on the economy over such a long period, making the effectiveness of wage changes as a policy tool to affect employment levels highly uncertain.

In another South African study Fields et al. (2000) calculated elasticties for the South African private sector. They also find significant variation in elasticities between different sectors. At a national level they come up with estimates of -0.35 for the period 1990-93 and -0.53 for the period 1994-98. On the basis of these (statistically significant) estimates they argue that the elasticity has increased over time, although their estimates are still somewhat lower than those obtained by Fallon and Lucas (1998). Fedderke and Marriotti (2002) analysed manufacturing sector data and found the average elasticity to be between -0.5 and -0.55, which is slightly higher than Fields et al.'s (2000) estimate for the manufacturing sector of -0.45 (1994-98).

The estimation of wage elasticities is clearly sensitive to the period of analysis. Hamermesh (1993) suggests that wage elasticity estimates are sensitive to the way in which economic data is aggregated to form larger sectoral groupings or labour groups.[8] Most studies, however, tend to confirm that a negative relationship does in fact exist between wages and employment levels. The South African studies cited above further seem to concur that the wage elasticity is inelastic, which means that for a 1 per cent rise in the wage, employment will decline by less than 1 per cent. These estimated values are also not unreasonably high when compared against wage elasticity estimates for other developing countries.

There are, however, some that challenge the notion of a trade-off between wages and employment levels. Findings of a number of studies conducted by Card and Krueger (1995:393) in the United States all show that both wages and employment levels improved after the introduction of minimum wages in various sectors, suggesting "*a reorientation of policy discussions away from the efficiency*

7 The long run is seen to be about three years.

8 Hamermesh (1993) affords the wage elasticity estimation problem some attention, and in particular writes about the problem of aggregation. This problem has two dimensions. Firstly, it concerns the estimation of elasticities at a sectoral level and how to aggregate these to obtain meaningful estimates for the economy as a whole. Typically elasticities are estimated using a labour demand function of the form $\ln L_i = \alpha - \sigma \ln w_i + \ln Q_i$ where the subscript *i* represents each sector, while *L* and *Q* represent employment and output respectively. Often sectoral data is highly disaggregated, and hence aggregation may be required. Aggregating across sectors/labour yields an equation of the form $\ln\left(\sum_i L_i\right) = \alpha' - \sigma' \ln\left(\sum_i w_i\right) + b.\ln \sum_i Q_i$. Hamermesh argues that there is no reason to expect that $\sigma' = \sigma$ or that *b* = 1.

The second dimension of the aggregation problem concerns the grouping of labour, i.e. the choice about how labour should be aggregated to form representative groups to be included in the estimation models. No two workers are perfectly substitutable, yet when workers are grouped through linearly adding up employment levels of a particular group and using the average wage of the group in the estimation, the assumption is effectively that workers within a group are perfectly substitutable or homogeneous. Mathematically this implies that the elasticity of substitution between workers *i* and *j* within a group tends to infinity ($\sigma_{ij} \rightarrow \infty$). While this is a common problem in microeconomic analyses where representative groups are used, it is nevertheless important as it affects estimation results.

aspects of the minimum wage and toward distribution issues".[9] Given the disagreement around the true nature of the wage-employment relationship we consider a wide range of wage elasticities in the partial and general equilibrium models employed, including (in the partial equilibrium model at least) a wage elasticity of zero which allows for a scenarios where there is no employment response to minimum wages.

3. Data Analysis

3.1. Data and Modelling Approaches

There are a number of sectoral determinations currently in force in South Africa. Sectoral determinations are published on the Department of Labour website[10]. These documents contain information about the eligibility criteria for minimum wages. The sector of employment, occupation or skill level and the region of employment are generally the main factors determining whether a person is eligible, while this also determines the level of the minimum wage for which an eligible person qualifies. Generally minimum wages are higher in urban areas in order to compensate for higher transport and living costs. Up to five geographical areas are specified in each of the sectoral determinations, usually representing regions with different degrees of urbanisation.

The Labour Force Survey of September 2000 (LFS 2000:2), which is merged with the Income and Expenditure Survey of 2000 (IES 2000), is used as the main data source in this study. This merged dataset is referenced as IES/LFS 2000 in the remainder of this paper. The IES/LFS 2000 is used to identify workers that would be eligible for minimum wages once the sectoral determinations come into force.

In this study we focus on eight sectoral determinations, namely the (1) retail sector, (2) domestic workers, (3) farm workers, (4) forestry workers, (5) taxi operators, (6) security personnel, (7) the hospitality industry and (8) contract cleaners. In reality there are eleven sectoral determinations. The sectoral determination covering learnerships was excluded due to a lack of information in the IES/LFS 2000.[11] The civil engineering sectoral determination was also excluded since virtually no workers falling in this category were found to earn below the stipulated minimum wage. The sectoral determination applicable to children working in performance arts was also excluded since children are

9 The studies reported on in Card and Kruger (1995) show that employment gains were not always statistically significant, but at least employment declines were never reported. It is important, however, to note that their analyses focused on a fairly short period (1 to 3 years at the most). Elasticities are understandably small and possibly insignificantly different from zero in such a short period. While the authors suggest that long term analyses are necessary to complement their research, they caution against these given the difficulties in isolating other exogenous shocks that affect employment levels in the long run as well as the eroding effect of inflation on real wage levels.

10 See http://www.labour.gov.za/programmes/programme_display.jsp?programme_id=2664.

11 More precisely, learnerships were only introduced after 2000, hence there were none captured in the IES/LFS 2000.

not classified as being part of the labour force. Hence no wage is reported by children and no occupation code is provided.

The minimum wage structure in South Africa is fairly complex. As explained, there is no single minimum wage covering all workers in all sectors, with the level of the minimum wage typically depending on the sector of employment, the occupation type or skill level of the worker and the region in which the person is employed. In some special cases, as we show further below, factors like firm size may also determine the level of the minimum wage. This means that for any given sectoral determination, a number of different wage minima may exist. Table 17 in the appendix (section 7.1.3) provides a breakdown of the 38 different minimum wage levels identified for this study.

There are two alternative approaches to analysing the impact of minimum wages on poverty. The first approach is to analyse data on wages, employment and poverty over time using panel data. Panel data consists of a series of cross-sectional datasets. For example, the series of Labour Force Surveys in South Africa are considered a quasi-panel[12]. A study by Hertz (2005), which investigates domestic worker employment responses to minimum wages over time using the Labour Force Surveys, is a recent example of the use of quasi-panel data in this area of study. The focus of such studies is on long-term trends and the establishment of statistical relationships between so-called dependent and independent variables in the model. For example, in Hertz's study the "*microeconomically anticipatable loss in employment*" among domestic workers ascertains that there is a negative relationship between employment and wages of domestic workers.

The second approach is to conduct experiments using either a partial or general equilibrium modelling approach (see earlier discussions). Whereas econometric models establish statistical relationships between economic variables based on historical time-series or panel data, experimental models of this nature typically rely on economic theory about firm behaviour and labour demand to arrive at a likely set of results which can be compared against the base data. This type of analysis is called comparative static analysis. The base data is typically derived from data representing the state of the economy in a given year. In this study, for example, the IES/LFS 2000 data represents the base case for the partial equilibrium model, while a Social Accounting Matrix (SAM) is used as the base data for the general equilibrium application (explained in more detail in section 4.3). The theory of labour demand forms the basis of the functioning of the labour market in both the partial and general equilibrium models. These models are both in a similar vein as the Lewis-Kanbur model discussed earlier, i.e. model parameters (most importantly in this case the wage elasticity or elasticity of substitution) play an important role in determining the counterfactual outcome.

12 The exact same individuals or households are not surveyed in every period, which is a requirement for panel data, although there is some degree of overlap; hence the term quasi-panel.

The use of the fairly dated IES/LFS 2000 may seem surprising to some, especially given that Statistics South Africa has already released the Labour Force Survey of March 2007, which means much more recent wage and employment are available. The choice of the IES/LFS 2000 is, however, justified for two reasons. Firstly, the main aim of the analysis is to explore the impact of minimum wages on poverty. A comprehensive poverty analysis at the household level must take into account other non-wage income sources of households as well, none of which are captured in the Labour Force Surveys. At the time of doing the analyses described in this paper the most recent Income and Expenditure Survey conducted in 2005 had not yet been officially released,[13] while this survey can also not be merged with the LFS 2005 as was the case with the IES/LFS 2000 datasets. The 2000 data therefore is the latest available year for which the merged labour force and household income and expenditure data is available. The absence of non-wage income data in the more recent Labour Force Surveys also precludes us from following the panel data approach to studying minimum wage and poverty effects over time.

Secondly, the 2000 data predates the introduction of minimum wages in South Africa. The first were introduced in 2002 and others followed in the three to four years thereafter. The aim here is to model or simulate the impact of minimum wages on poverty; hence the 'base case' has to be the situation prior to the introduction of minimum wages, i.e. the use of pre-2002 data is important in this instance.

3.2. Definitions, Data Adjustments and Assumptions

A number of points of clarification have to be made around definitions used in this study as well as data adjustments and assumptions:

Covered workers: A covered worker is defined as any individual who, in terms of the sectoral determinations, is protected by minimum wage legislation. For each covered worker a minimum wage is specified, based on that worker's sector of employment and occupation code. We use the term 'minimum wage coverage rate' to denote the share of workers in an economic sector that are covered by minimum wages.

Minimum wage adjustments: The minimum wage that is applicable to each covered worker (as published in the sectoral determinations) is adjusted to account for differences in hours worked. The monthly minimum wages shown in Table 17 are all based on a 45 hour work week. Workers working shorter hours (for example part-time workers) would therefore be paid a lower wage than the published minimum wage.[14] Since the analyses are based on the IES/LFS 2000, all minimum wage levels are also converted to 2000 prices by deflating the latest published

13 The IES 2005 was released in March 2008.

14 The stipulated minimum wage (w_M) is multiplied by the average number of hours normally worked as reported in the IES/LFS 2000 (*Hrs*) and divided by 45 to arrive at an adjusted minimum wage, i.e. $w_M^{adj} = w_M * Hrs / 45$. This adjusted minimum wage is used throughout the rest of the analysis.

minimum wages of the various sectoral determinations as per the Department of Labour website (see Table 17 in section 7.1.3) using the national consumer price index published on the Statistics South Africa website[15].

Workers above and below the minimum wage: After making the adjustments to minimum wages as explained, we now have a record of actual wages earned (as reported in the IES/LFS 2000) as well as the minimum wage that would eventually apply to covered workers once introduced. Both the original reported wage and the minimum wage that applies to each individual (where applicable) are expressed in 2000 prices and are therefore comparable. It will now emerge that some covered workers already earn at a level equal to or above the minimum wage. These workers are classified in this study as 'covered workers above the minimum wage', and by assumption their wages will not be affected once the minimum wage is introduced. Covered workers earning less than the minimum wage (or 'sub-minimum wage workers') will see their wages rise to the level of the minimum wage that applies to them under the assumption that employers comply fully with the minimum wage legislation.

Uncovered and self-employed workers: Uncovered workers include all those workers who are not eligible for minimum wages, as well as the self-employed. Although some self-employed workers may have the same sectoral and occupational classifications as covered workers, they determine their own wages and cannot be forced to pay themselves a minimum wage.

Section 3.3 analyses the IES/LFS 2000 dataset in order to get a better understanding of the likely impact of minimum wages on employment and poverty. We first consider minimum wage coverage across different economic sectors in section 3.3.1), before turning to an analysis of wage distributions and the level of minimum wages in 2000 prices relative to actual wages reported in 2000 prior to the introduction of minimum wages (section 3.3.2). Finally, we briefly look at minimum wage coverage and poverty at the household level in order to establish preliminary links between the labour market (and specifically workers covered by minimum wages) and poor households (section 3.3.3). The data analysis forms a precursor to the models introduced in section 4. No modelling is introduced yet in section 3.3; we only report on economic relationships that exist in the 'base' (IES/LFS 2000) prior to the introduction of minimum wages.

15 See http://www.statssa.gov.za/keyindicators/cpi.asp.

3.3. Wages, Minimum Wages and Poverty

3.3.1. Minimum Wage Coverage

Table 1 below shows the eight sectoral determinations identified for this study cross-tabulated against the main economic sectors in South Africa. The sectoral breakdown here corresponds to the sectors included in the partial and general equilibrium analyses conducted as part of the study. The choice of sectoral breakdown was governed by the sectoral determinations, i.e. care was taken to keep sectors for which a sectoral determination is in force separate from other industries. The industry disaggregation therefore facilitates the analysis of the impact of minimum wages at a sectoral level.

Some of the sectoral determinations, however, only cover specific types of employees in sectors that cannot be disaggregated further due to data limitations as far as sectoral classifications in the IES/LFS 2000 are concerned. Examples include the taxi industry (part of the transport sector), the contract cleaning sector (mainly part of community, social and personal services) and the security sector (mainly part of business and financial services). Coverage in these sectors, as we see below, are automatically low.

From the table we note that the retail trade sectoral determination covers all non-self-employed workers in the retail and wholesale trade sector. Occupations for which separate minimum wages are specified range from senior officials/managers to clerks and elementary occupations. This sectoral determination therefore includes security workers and contract cleaning workers. In total just over 58 per cent of workers in this sector are covered by minimum wages. This seemingly low coverage rate reflects the fact that 42 per cent of workers in this sector are reported as self-employed. As shown previously in Table 17, monthly minimum wage levels (in 2000 prices) range from R800 to R2 081, depending on the occupation and region of employment of the worker.

There are just over a million domestic workers in the database, all of whom are covered by the domestic worker sectoral determination. The domestic services sector (or private households) also employs contract cleaners and security workers. We assume that such individuals are covered by the private security and contract cleaning sectoral determinations respectively. In total 83 per cent of people employed in private households are domestic workers and are therefore covered by the minimum wage regulations. Monthly minimum wage levels (in 2000 prices) for a full time domestic worker range from R590 to R727 with the region of employment determining the wage level.

All agricultural sector workers are covered by the farm worker sectoral determination. The majority of these workers are semi- and unskilled labourers, classified either as ‘skilled agricultural workers’ or ‘elementary workers’ (farm hands). However, as noted everyone working on farms are covered in theory. Hence, we include all types of non-self-employed workers[16] in the agricultural sector, which leads to a fairly high coverage rate (82 per cent). The remaining 18 per cent uncovered workers are classified as self-employed. Monthly minimum wage levels for agricultural workers range from R660 to R742 (in 2000 prices), depending on the geographical region of employment.

Overall coverage in the forestry sector is also high – about 97 per cent. This sectoral determination also covers all workers in the sector; hence we do not filter on occupation types. Only about 3 per cent of workers in this sector are self-employed, given limited private (households or individuals) ownership of plantations in South Africa. The minimum wage for all forestry workers is R624 per month, only marginally higher than domestic workers. This fairly low wage level means that very few of those in more senior occupations in the forestry sector will be affected by the minimum wage policy, even though they are covered in theory.

The taxi sectoral determination covers all people classified as (minibus) taxi drivers or taxi fare collectors[17] in the transport sector. Overall coverage in the transport sector is about 21 per cent, which includes a small number of security workers and contract cleaners also classified as working in the transport sector (see below) but are not covered by the taxi sectoral determination. All taxi operators and fare collectors should earn a minimum of approximately R1 055 per month (2000 prices).

Both private security workers and contract cleaners tend to report a variety of industries, which makes these two sectoral determinations somewhat different from the rest. Such contract workers sometimes tend to report the industry in which they are deployed as contract workers and not the primary industry of employment, which would be the business services or private services industries. Looking at security workers covered by minimum wages, we note that about two-thirds ‘correctly’ report the financial and business services sector as their sector of employment. When adding contract cleaners, sectoral coverage in the financial and business services sector is about 28 per cent. On their own, security workers account for about 19 per cent of the total industry employment. This perhaps reflects the fact that the relevant occupation codes used[18] to identify covered workers include occupations as diverse as guards, patrolmen, bodyguards, coastguards and game wardens. It is quite probable that not all of these were intended to fall under the sectoral determination, which strictly covers private security workers. Unfortunately it is not possible to identify these workers more accurately, given the degree of detail of the information in the LFS 2000:2. Minimum wages for security workers range from R1 001 to R1 439, depending on the area of employment (2000 prices).

16 This ensures that covered workers do not fall through the ‘cracks’. For example, tractor drivers or harvester operators on farms may classify themselves as machine operators, while farm foremen may classify themselves as managers, even though they still, in theory, are covered by the minimum wage. By only selecting on farm workers as occupation type these people will be wrongly excluded.

17 Occupation codes in the LFS 2000:2: 8325: Taxi driver (minibus taxi driver, informal/ shared/ long distance); 4290: Customer services clerks not elsewhere classified: (Taxi fare collector).

18 Occupation codes in the LFS 2000:2: 5169: Protective services workers not elsewhere classified (Guard, Patrolman/-woman, Bodyguard, Coastguard, Lifeguard, Patrolman/-woman, Traffic warden, Game warden, Taxi-guard, Traffic coordinator); 5190: Personal and protective services workers not elsewhere classified; 9152: Doorkeepers, watchpersons and related workers (Ticket collector, Concierge, Porter, Gatekeeper, Guard, Watchman/-woman, Attendant, Doorkeeper, Usher)

Table 1: Number of Workers by Sectoral Determination and Industry

Industry	Retail sector	Domestic workers	Farm workers	Forestry workers	Taxi operators	Security personnel	Hospitality industry	Contract cleaning	***Total covered workers***	Self-employed	Other uncovered workers	***Total uncovered workers***	***Total employ-ment***	*Total sectoral coverage*
Agriculture			**741,506**						***741,506***	165,130		***165,130***	***906,636***	*81.8%*
Forestry				**68,573**					***68,573***	1,869		***1,869***	***70,442***	*97.3%*
Fishing									***0***	3,313	12,572	***15,885***	***15,885***	*0.0%*
Minerals and mining						6,648		8,404	***15,052***	1,597	500,469	***502,066***	***517,118***	*2.9%*
Food products						1,071		4,693	***5,764***	10,992	202,343	***213,335***	***219,099***	*2.6%*
Beverages and tobacco						2,407		681	***3,088***	15,858	50,545	***66,403***	***69,491***	*4.4%*
Textiles						1,305		11,610	***12,915***	93,950	271,074	***365,024***	***377,939***	*3.4%*
Leather, wood and paper						865		2,747	***3,612***	21,197	147,831	***169,028***	***172,640***	*2.1%*
Petroleum								399	***399***	2,342	18,972	***21,314***	***21,713***	*1.8%*
Fertilisers and pesticides								438	***438***	1,385	41,906	***43,291***	***43,729***	*1.0%*
Pharmaceuticals & other chem.								535	***535***	495	13,723	***14,218***	***14,753***	*3.6%*
Non-metals								4,365	***4,365***	8,811	130,677	***139,488***	***143,853***	*3.0%*
Metals								4,213	***4,213***	18,992	192,597	***211,589***	***215,802***	*2.0%*
Machinery, equip. & other manuf.						984		12,809	***13,793***	18,553	219,293	***237,846***	***251,639***	*5.5%*
Electricity and water						1,135		4,099	***5,234***	1,242	71,986	***73,228***	***78,462***	*6.7%*
Construction and building						1,914		4,493	***6,407***	120,511	505,554	***626,065***	***632,472***	*1.0%*
Retail and wholesale trade	**1,108,620**								***1,108,620***	796,450		***796,450***	***1,905,070***	*58.2%*
Accommodation							**239,858**		***239,858***	123,055		***123,055***	***362,913***	*66.1%*
Transport and communication					**94,855**	10,376		2,327	***107,558***	73,094	343,720	***416,814***	***524,372***	*20.5%*
Financial and business services						**159,688**		79,136	***238,824***	76,823	544,894	***621,717***	***860,541***	*27.8%*
Government, social & other serv.						43,925		**150,405**	***194,330***	144,354	2,103,871	***2,248,225***	***2,442,555***	*8.0%*
Domestic services		**1,001,394**				1,498		5,585	***1,008,477***	9,031	191,923	***200,954***	***1,209,431***	*83.4%*
	1,108,620	1,001,394	741,506	68,573	94,855	231,816	239,858	296,939	***3,783,561***	1,709,044	5,563,950	***7,272,994***	***11,056,555***	***34.2%***

Source: IES/LFS 2000

Note: Industry breakdown corresponds to the activity classification in the SAM used to calibrate the CGE model. Employment figures represent formal employment including domestic workers. (*) The bold cells represent the 'main sector' associated with each sectoral determination.

As stipulated in the note below Table 17, the wage for Grade C security officers was used as the benchmark wage since the Grades of security workers are not identifiable with the information supplied in the LFS 2000:2. This decision may bias estimates of the average minimum wage somewhat, although it is unclear in which direction the bias would be. For example, in Area A, Grade A officers earn R2 733, while Grade E officers earn R1 500 (2004 prices). The Grade C wage used as the benchmark is below the average across the five grades, but at the same time, it is also likely that qualifications are biased towards the lower Grades anyway.

The hospitality industry sectoral determination applies to all non-self-employed workers in the industry. About one-third of workers are self-employed, hence the coverage rate is only 66 per cent. In contrast to the other sectoral determinations, the only variation in the minimum wage comes from the fact that small firms (less than ten employees) face a lower minimum wage than medium to large firms.[19] These levels are R1 105 and R1 231 respectively (2000 prices).

Finally, the contract cleaning sectoral determination applies to all people who work in the contract cleaning services 'industry', i.e. these are not domestic workers.[20] As was the case with security workers, respondents in the LFS 2000:2 tend to report the industry where they are deployed (as contract workers), which is not necessarily their true sector of employment. In the case of contract cleaning staff the 'correct' industry, which is also most frequently reported as the sector of employment (51 per cent of covered workers), would be the 'government, social and other services' sector. This sector is unlikely to be affected much by minimum wages, with only about 8 per cent of employees covered by either the security (2 per cent) or the contract cleaning sectoral determination (6 per cent). Minimum wages for contract cleaning workers range from R1 047 to R1 305 per month in 2000 prices, depending on the region of employment.

3.3.2. A Comparison of Reported Wages and Minimum Wages

Our estimates show that just over one-third (see Table 1) of workers are covered by sectoral determinations, with coverage rates varying significantly by sector. However, when it comes to analysing the impact of minimum wages on employment and household poverty, coverage rates are certainly not the only or most important part of the equation. Previously it was explained that 'covered workers' include workers above and below the minimum wage. The introduction of minimum wages will cause average wages in a sector to increase as long as at least some of the covered workers in that sector initially earn below the minimum wage in the base, assuming that employers comply with the legislation once it is introduced.

19 Respondents in the LFS 2000:2 report the size of the firm for which they work. This information could be used to identify minimum wage levels for different workers.

20 By definition domestic workers can only be employed in private households.

A proper analysis of the likely impact of minimum wages needs to consider two things. Firstly, the extent of the wage increase depends on the number or share of workers in a sector that earn below the minimum wage (sub-minimum wage workers). Secondly, and even more importantly, it depends on the average distance between wages and minimum wages among sub-minimum wage workers. These two concepts are very similar to what is referred to in poverty analysis as the 'headcount ratio' and 'poverty gap'. The FGT poverty index (see equation [4] in section 2.2) can be used to calculate these two measures of poverty. A modified version of this same equation can be used to calculate the share of (covered) workers that are sub-minimum wage workers as well as the 'wage gap', that is, the average difference between the minimum wage and the reported wage. Thus, in the equation below for W_α the 'sub-minimum wage worker headcount ratio' can be calculated by setting $\alpha = 0$, while the wage gap is calculated when $\alpha = 1$.

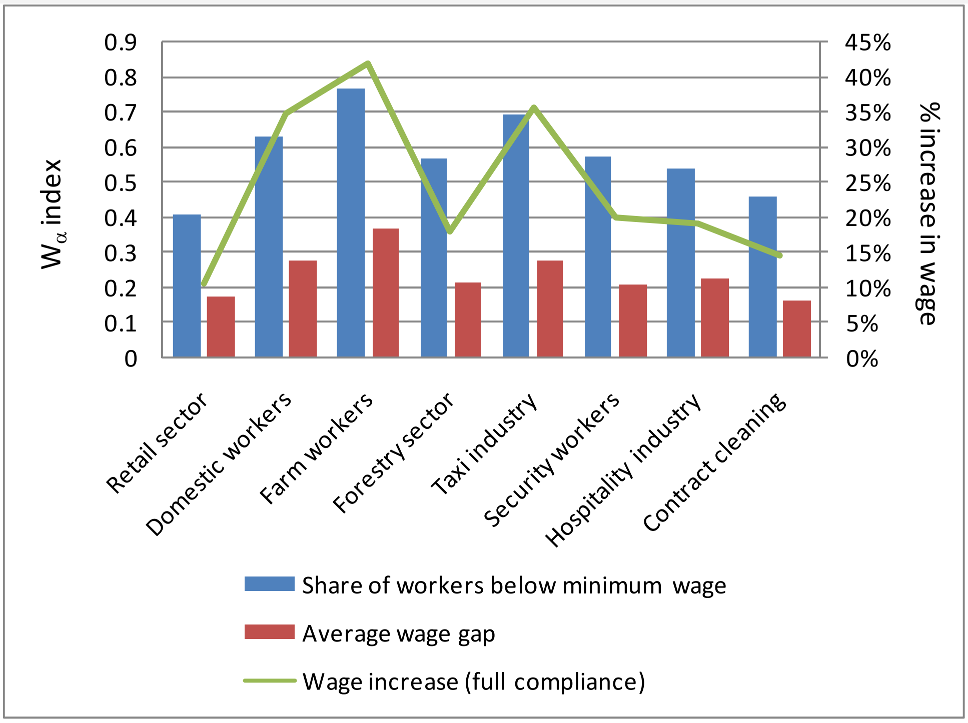
$$W_\alpha = \frac{1}{n}\sum_{i=1}^{q}\left(\frac{w_i^M - w_i}{w_i^M}\right)^\alpha \qquad [5]$$

In the equation for W_α the symbol n represents the number of covered workers, q is the number of sub-minimum wage workers, w_i^M is the minimum wage and w_i is the actual reported wage of each worker. An important distinction between the poverty index (P_α) and our 'minimum wage index' (W_α) is the indexing of the minimum wage w_i^M over i. The minimum wage in this context plays the same role as the poverty line (z) in the standard FGT index. However, whereas there is a single poverty line in poverty analysis, the minimum wage in the South African case is not a constant level across all sectors and for all workers, for reasons explained. By indexing the minimum wage variable over i we account for the fact that each sub-minimum wage worker faces a unique minimum wage level.[21]

Figure 4 shows the sub-minimum wage worker headcount ratio (W_0) and the wage gap (W_1) calculated for covered workers falling under each of the eight sectoral determinations. For most of the sectoral determinations the share of covered workers earning less than the minimum wage ranges between 40 and 60 per cent. However, this share is slightly higher for domestic workers (63 per cent) and measures 69 and 76 per cent for taxi and farm workers respectively.

21 The index can be simplified by substituting $s_i = w_i / w_i^M$, thus yielding $W_\alpha = \frac{1}{n}\sum_{i=1}^{q}(1 - s_i)^\alpha$, which is now similar to the standard FGT index with a 'poverty line' or normalized minimum wage of 1 and a 'wage' of s_i, where s_i is each worker's wage expressed relative to the minimum wage.

Figure 4: Sub-Minimum Wage Worker Headcount Ratio and Wage Gap by Sectoral Determination (Covered Workers Only)



W_0 and W_1 tend be correlated, with a higher W_0 often coinciding with a higher W_1. Thus, farm worker wages are, on average, furthest away from their respective minimum wages (W_1), while this sector also has the highest W_0 of all the sectors. This is followed by domestic workers and the taxi industry with similar levels of W_1. The values of W_0 and W_1 will largely determine the extent to which average wages of covered workers will rise once minimum wages are introduced. The line graph in Figure 4 (values are read off on the right-hand side axis) shows the percentage by which wages would increase among covered workers that fall under each of the sectoral determinations.[22]

In addition to causing a shift in the mean, the introduction of minimum wages causes the wage distribution to change. All those workers earning below the minimum wage are pushed up to the minimum wage, while covered workers above the minimum wage (uncovered workers and self-employed persons) still earn the same wage as before, provided that there is no spill-over effect that causes wages that are already above the minimum wage to rise marginally.[23] Figure 5 shows the wage distributions of covered workers before the introduction of the minimum wage as reported in the

22 Of course, the eight sectoral determinations do not precisely define entire industries since uncovered workers are excluded from the analysis. When calculating the average wage increase at a sectoral level (as we do in the partial equilibrium and general equilibrium models, see Table 9) the estimates of W_0 and W_1 across all workers in a sector need to be considered in conjunction with the coverage rates shown earlier in Table 1. To recap, the coverage rate is 58 per cent in retail and wholesale trade, 83 per cent for domestic workers, 82 per cent for agriculture, 97 per cent for the forestry sector, 21 per cent for the transport sector (of which the taxi industry forms a part), 28 per cent in the business services sector (of which security services forms a part), 66 per cent in the hospitality industry and only 8 per cent in the social services sector (of which contract cleaning forms a part). The particularly low coverage rates in the transport, business and financial services and community, social and personal services sectors imply that these sectors will be largely unaffected by minimum wages despite significant wage hikes among covered workers. We return to this in section 4.

23 This possibility is discussed in section 4.2 when we consider the model setup and assumptions of the partial equilibrium model.

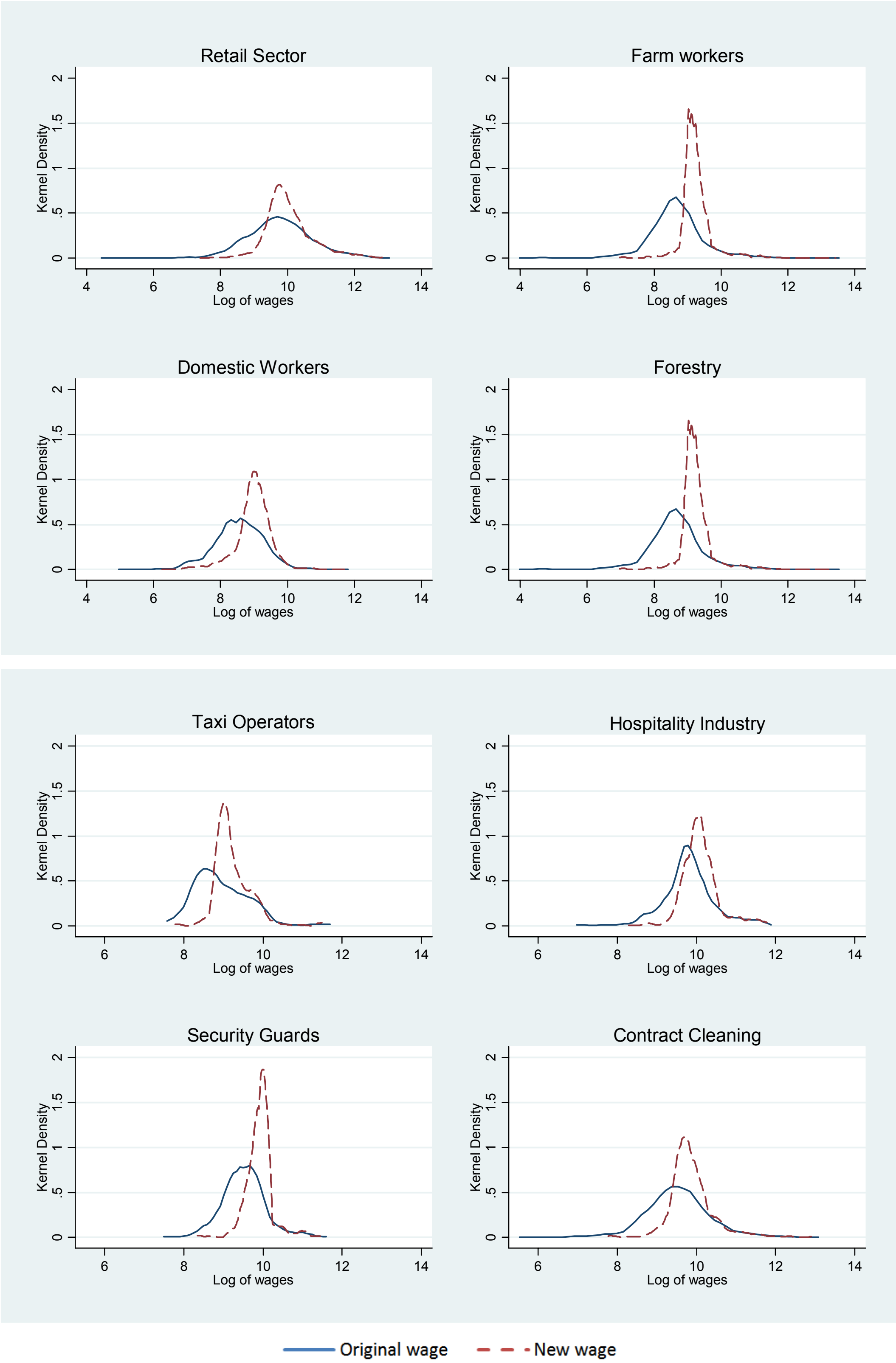
IES/LFS 2000. The new wage distribution that results from minimum wages being paid to all covered sub-minimum wage workers (i.e. assuming full compliance) is also shown. An important assumption here is that no job losses occur as a result of the minimum wage. This means that all covered sub-minimum wage workers will now earn the minimum wage that applies to them, while covered workers above the minimum wage will see no change in their wages.

When a single minimum wage applies to all workers that fall under a particular sectoral determination the new wage distribution will form a distinct spike at the level of the minimum wage, with no workers lying to the left of this minimum wage. Since there is no unique minimum wage in South Africa, the new wage distribution is still fairly smooth, but it is clear from the Figure 5 that distribution shifts to the right, while a more prominent mode[24] appears. This is evidence of a lower variance in the distribution of wages of covered workers as those at the bottom end of the distribution (below the minimum wage) are pushed to a higher level. Those covered workers that are above the minimum wage level that applies to them experience no change; hence the new wage distribution joins the original wage distribution at the upper end of the distribution.

Of course, Figure 5 assumes no employment loss associated with minimum wages. Under such a scenario sub-minimum wage workers are unambiguous 'winners'. However, if it turns out that employment levels are responsive to wage changes, with the degree of responsiveness depending on the wage elasticity, some workers may lose their jobs, thus causing their wages to drop to zero. It is intuitive that those workers that stand to gain from higher minimum wages – the sub-minimum wage workers – are also the same workers that are vulnerable to becoming unemployed as a result of it.

24 The mode is the point at which the distribution function is a maximum.

Figure 5: Density Estimates of Wage Distributions Before and After Minimum Wages are Introduced; By Sectoral Determination and for Covered Workers Only



Source: IES/LFS 2000

3.3.3. Minimum Wage Coverage and Poverty at the Household Level

When considering the linkages between household poverty and wages or employment, it is necessary to also consider the type of income sharing that takes place at the household level. Every household is either linked to the labour market or not. In the case of the latter it simply means that all of the household members are either economically inactive (pensioners, scholars or homemakers) or unemployed. Households with linkages to the labour market earn at least some of their income from at least one household member that is employed. In a minimum wage scenario, households with employed members that are covered by sectoral determinations and classified as sub-minimum wage earners are likely to be affected by minimum wages in one of two ways: the household may benefit if the member who is the sub-minimum wage worker remain employed and earn a higher wage, or the household can lose out if that member become unemployed as a result of the minimum wage.

The assumption about how non-wage and wage income earned by the household as a whole is shared among individual members will determine the welfare implications for individuals. Very little information is available about how income is shared among members of households in South Africa. As a result, perfect income sharing similar to the family sharing model proposed by Fields and Kanbur (2007) is generally assumed for South African studies. This means that wage and non-wage income (pensions and other grants, remittance income and investment income) earned by the household is pooled and then divided equally among household members. Under this approach each individual household member is assumed to enjoy the same level of welfare, where welfare is approximated by the per capita income of household members. By extension all household members are either poor or non-poor, depending on whether the household per capita income is above or below the poverty line. When the household income increases, each member's per capita income increases proportionately to the change in the total income of the household. Similarly, if the poverty status of one household member changes (e.g. a member becomes non-poor), it means that the entire household escapes poverty.

The aim of this section is to get a better understanding of likely poverty impacts of minimum wage legislation. For this analysis households are first grouped into five 'welfare groups', which are formed around the 25th, 50th, 75th and 90th percentiles of per capita income. These groups are labelled 'ultra poor', 'poor', 'lower middle-income', 'upper middle-income' and 'high-income' respectively. The implied ultra poverty and poverty lines are the 25th and 50th percentiles of per capita income, thus yielding poverty headcount rates of approximately 25 and 50 per cent respectively. Once a household welfare classification is in place, it is possible to explore differences in household size and composition and income sources between household groups, as well as the distribution of workers across these groups. This will give us better insights into how minimum wages are likely to affect households across the welfare spectrum.

Table 2 shows some general household welfare group statistics. Approximately 30 000 households were interviewed in the IES 2000, which translates to about 11 million households when weighted up using sampling weights. There are roughly 10.6 million individuals in the bottom three welfare groups, and a further 10.6 million in the top two groups, giving a total population of just under 43 million in 2000. Poorer households are generally larger in size, which explains why fewer households are found in the poor quartiles, even though each of these groups contains exactly 25 per cent of the population. This is important from a welfare perspective, since it means that any additional income earned by poor households is distributed between more household members than is the case for non-poor households.

Table 2: General Household Welfare Group Statistics

	Number of households	Number of individuals	Average household size	Min per capita income	Max per capita income(*)	Number of working adults	Proportion earning wage income
Ultra poor	1,721,143	10,663,133	6.20	~	1,846	855,571	8.0%
Poor	2,232,683	10,696,603	4.79	1,847	4,000	1,739,353	16.3%
Lower-mid inc	2,954,293	10,625,217	3.60	4,001	10,593	3,115,397	29.3%
Upper-mid inc	2,249,261	6,397,856	2.84	10,597	29,251	2,739,985	42.8%
High income	1,819,717	4,262,787	2.34	29,253	~	2,606,246	61.1%
Total	*10,977,096*	*42,645,595*	*3.88*			*11,056,552*	*25.9%*

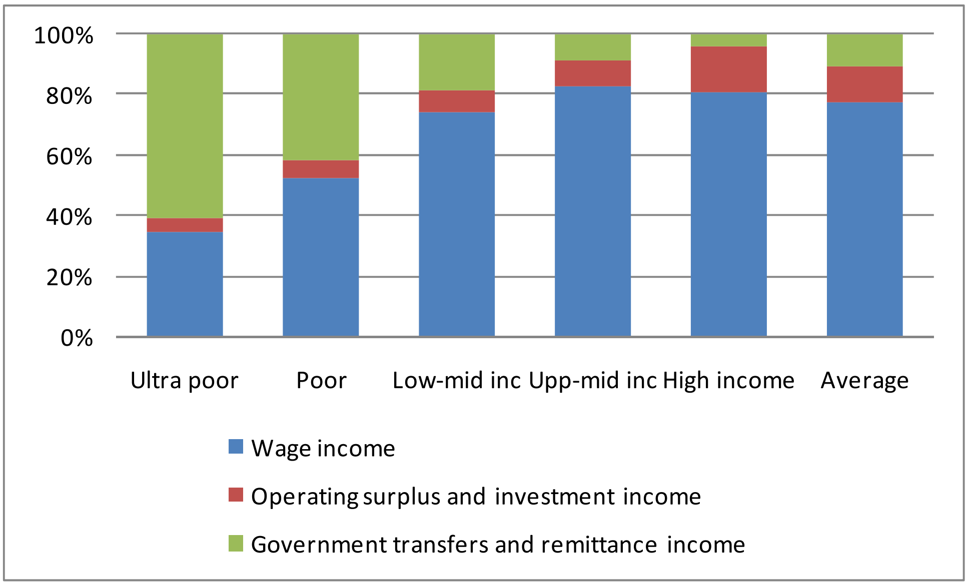
Note (*): The values R1 846 and R4 000 represent the ultra poverty and poverty lines (in 2000 prices) assumed for this study. This latter value is comparable with Hoogeveen and Özler's (2004) lower bound poverty line of R3 864 per capita per annum (2000 prices). The ultra poverty line is fairly close to the Rand-equivalent of a $2/day poverty line (R2 088 in 2000 prices, given PPP conversion rates that prevailed at the time).

Source: IES/LFS 2000

When contemplating how households are likely to be affected by labour market shocks it is instructive to look at the distribution of the employed people across household groups. Table 2 shows that only about 2.6 million or 23 per cent of workers are attached to poor households, although poor households account for 50 per cent of the population. This attests to high unemployment among the poor, as well as the fact that a person's labour market status is an important predictor of his or her poverty status. Only 8 per cent of the ultra poor are wage income earners. This figure rises to 16 per cent among poor households, which stands in sharp contrast to the 61 per cent found in high income households.

Minimum wages are often used to protect vulnerable, low-wage workers and to lift the working poor out of poverty. Since wages are an important source of income to households, contributing about 78 per cent to total household income on average, many would argue that minimum wage legislation could have a significant impact on poverty. This may be a misguided perception. Figure 6 shows how income sources differ between different types of households. Previously it was shown that a very small proportion of poor people in South Africa earn wages, which explains why wage income only contributes about 34 per cent to ultra-poor household's income and 52 per cent to poor households' income. For poor and ultra-poor households combined the wage income share is 47 per cent.

Figure 6: Household Income Sources and Income Shares

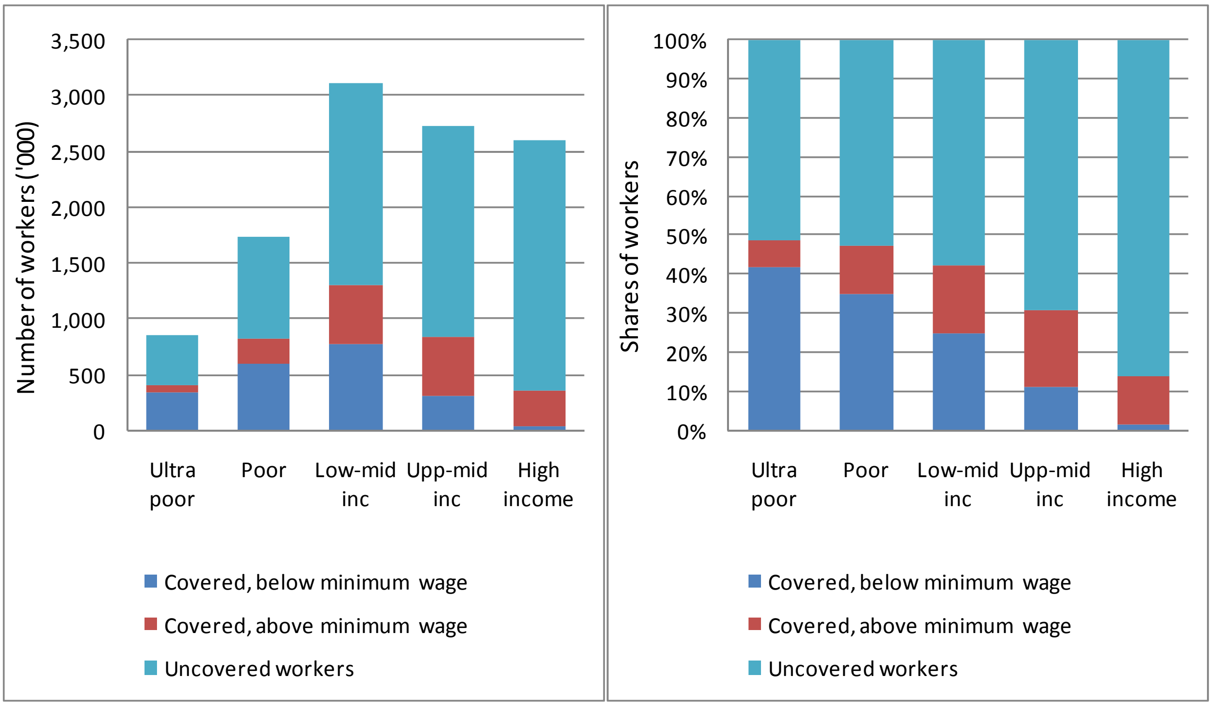


Source: IES/LFS 2000

A much more important income source among the ultra poor, for example, is welfare transfer and remittance income. The conclusion that can be drawn from Figure 6 is that for every one per cent rise in wages of the working poor, household incomes will only rise by half that. It would take a considerable increase in wages before a substantial number of people are able to cross any given poverty line. This early evidence already suggests that poverty effects of minimum wages will probably be small, even in the absence of any employment losses.

Given the way in which sectoral determinations are formulated in South Africa, some workers are covered by minimum wage legislation and others not. Covered workers, as explained before, may either earn below or above the minimum wage that applies to them. A more nuanced approach towards understanding the likely poverty effects of minimum wages is to consider the distribution of these different 'types' of workers across household welfare groups. In the absence of a spill-over effect to the rest of wage earners, the only workers that are set to gain from minimum wages are sub-minimum wage earners. As shown in Figure 7 below (left-hand panel), in absolute terms most sub-minimum wage workers are found in the lower-middle income group, followed by poor and ultra-poor workers. When summing across the welfare groups it can be shown that there are roughly equal numbers of non-poor (1.1 million) and poor (1 million) sub-minimum wage workers.

Figure 7: Workers per Household Group According to Minimum Wage Classification



Source: IES/LFS 2000

Relatively speaking, though, minimum wage legislation is important in reaching large numbers of ultra-poor or poor workers. The right-hand panel of Figure 7 shows that just under 50 per cent of both ultra poor and poor workers are covered by minimum wage legislation. The majority of these workers earn below the minimum wage and are therefore set to gain from minimum wages.

The important point remains that wage income is not a major income source for the poor, while further evidence presented here shows that of the few poor and ultra poor workers, less than half will benefit from minimum wages. The fact that poor households are larger in size compared to non-poor households adds further concern about the effectiveness of minimum wages in reaching the poor (see Table 2). For every R1 gained in a poor household, over 5 people have to share that income (approximately 20c each); in non-poor households just 3 people share in income gains (33c each). Although to initial per capita incomes 20c gained by a poor person is probably more than 33c gained by a non-poor person, every R1 still has the same purchasing power in the economy, whether a person is poor or not.

The next chapter uses two modelling applications in order to try and simulate what happens to incomes and poverty at the household level when minimum wages are introduced and under different assumptions about the responsiveness of employment to wage changes.

4. Modelling the Impact of Minimum Wages

4.1. Introductory Remarks

Minimum wages have been in place for some time in South Africa. The two types of models used here (partial and general equilibrium models) are both comparative static in nature, i.e. they compare one state of the economy with another. The benchmark against which we compare is the economy of South Africa in 2000, in other words a period prior to the introduction of minimum wages.

Modelling a policy that is already in place is precarious. Some may consider the results presented here and compare this against current economic data, which may contradict some or all of the results from the model. The aim of these modelling exercises is therefore very specific. We do not attempt to forecast or predict the economy. Comparative static models are not predictive tools, but rather policy tools that are useful for evaluating the impact of very specific policy shocks under strict behavioural conditions and assumptions about the underlying economy. These static models do not account for long-term dynamic changes, such as sectoral growth or decline over time, changes in household size or structure, population growth or economic growth. They also does not account for any other exogenous shocks, be they internal policy changes or external/international economic shocks. It is therefore a given that the economy today looks different to the economy represented by the counterfactual data produced in the partial and general equilibrium models. The point remains that we wish to isolate an economic shock and evaluate the very specific effects of that shock within a controlled environment, so that outcomes are not confounded by external events.

Minimum wages may take a long time to work their way through the economy. It is exactly for this reason why Pollin et al. (2006) argue that wage changes as a policy tool to affect employment levels are highly uncertain. The results in comparative static analyses are not time-bound and represent the outcome once the shock has fully passed through the economy and a stable 'equilibrium' condition is reached again. Often, in reality, during this adjustment period various other exogenous economic shocks would have caused a different outcome from the one observed here. Within the minimum wage context, consider the following scenarios:

- The models here suggest that agricultural employment will decline due to the introduction of minimum wages. This corresponds with evidence that the wage elasticity for this sector is negative. The agricultural sector has been characterised by a long-term decline in employment, a trend natural to any developing economy. This means that true employment trends may have been influenced by both minimum wages and the long-term decline in agriculture, which will explain some of the discrepancies between modelled outcomes and actual outcomes.

- Although model results predict a decline in employment in the retail and wholesale trade sector, actual employment data for the period after 2000 actually shows a sharp increase in employment in this sector. This came despite the introduction of minimum wages during this period. Without going into a detailed analysis of the sector it can be hypothesised that cost increases associated with minimum wages could well have been mitigated by cheaper imports of retail goods that have become available in South Africa during this time. It may also be that the consumer boom and the resulting increase in demand for retail sector workers would have driven up wages in this sector. The end result is that the minimum wage levels ended up being equal to or lower than market wages.

- The models (in particular the general equilibrium model) suggest that a large decline in the employment levels of domestic workers can be expected. However, during the last decade South African households have become smaller and more fragmented, and hence there are many more potential employers of domestic workers. Anecdotal evidence also suggests that more wealthy families now rely on two incomes, which has increased the demand for domestic services at homes. The impact of minimum wages may well have been countered by these effects.

4.2. Partial Equilibrium Model: Identifying Gainers and Losers in a Micro-Framework

4.2.1. Model Overview

The partial equilibrium model developed here departs from a similar modelling framework as the Lewis-Kanbur model with income sharing at the household or family level. As a theoretical construct Lewis and Kanbur's (2007) model is useful for illustrating the importance of model parameter values (particularly the wage elasticity) and other assumptions about how economic agents interact in determining the overall outcome of a policy shock such as minimum wages. However, practical application of their model is limited. A major limitation is their assumption that the entire population is part of the labour market, which is unrealistic for any economy.[25] This assumption makes the ratio of the minimum wage to the poverty line extremely important in determining the poverty impact of minimum wages, as illustrated by Lewis and Kanbur (2007). In the South African case, however, this ratio holds very little relevance for a number of reasons. Firstly, as discussed earlier, a multitude of minimum wage levels apply in South Africa, while there can be both covered and uncovered workers in economic sectors. In the absence of a single minimum wage there is also no single minimum wage-poverty line ratio for the economy.

25 South Africa, for example, has about 11 million employed people – approximately one per household – and a further 6 million unemployed persons (expanded definition of unemployment). Therefore, of the 43 million people in South Africa, only 40 per cent are actively part of the labour market in the broadest sense (data based on IES/LFS 2000).

Secondly, in reality income sharing is not as straightforward as the Lewis-Kanbur model suggests. Households differ in terms of size and labour force participation of household members. This means that a R1 increase in the wage of one worker has very different poverty implications for that worker and her family than a R1 increase for another worker. A third complication is the fact that observed wage distributions tend to follow a fairly smooth lognormal distribution. While the assumption that homogenous workers earn a single market wage is "*analytically convenient*", it is not very appealing from an applied point of view (Card and Krueger, 1995:360-361). In terms of welfare analyses this means that some sub-minimum wage workers are further away from the minimum wage than others. These workers are set to gain relatively more from the introduction of minimum wages, provided they remain employed.

Since the Lewis-Kanbur model does not take into account the heterogeneity of workers, all workers are assumed to have the same probability of becoming unemployed and also earn the same wage. In a sense therefore, when job losses do occur they are randomly distributed across the population in the Lewis-Kanbur model; whether worker *x* or worker *y* loses her job has the same distributional impact. The reality is that workers are not homogenous, and this is reflected in the fact that wage distributions (as noted) tend to follow a lognormal distribution. In order to deal with this apparent diversion from traditional neo-classical economics, Card and Krueger propose the use of the 'human capital model'. This model incorporates the assumption that different workers possess different amounts of human capital, where human capital is usually seen as a function of schooling, experience, ability and so on. The labour market is still characterised by a single wage (w) for an "*efficiency unit of human capital*" (Card and Krueger, 1995:360-361). A transformation function is then specified to explain how the single market wage (w) is related to the observed wage (w_i) for each individual, i.e. if we let h_i denote the measured human capital of individual i, then:

$$w_i = h_i w \qquad [6]$$

Under this model the distribution of wages is affected in two ways once a minimum wage is imposed. Firstly, the entire distribution shifts to the right as the market price for human capital increases from w to w'. Secondly, the distribution is truncated to the left of the minimum wage. Any individual with $h_i < w_M / w'$ (for w_M the minimum wage) will now be excluded from the market, reflecting the fact that workers whose services are worth less than the minimum wage are discharged. As noted by Card and Krueger (1995:363), the interesting aspect of this model is the predicted pattern of employment losses: those individuals that are farthest away from the minimum are most likely to lose their jobs, while those that are initially just below the minimum may see their incomes rising enough (due to the increase in w) to remain employed. It is this important feature of the Card and Krueger model that we explicitly adopt in our partial equilibrium model, as discussed later.

There are also alternative approaches to identifying workers that are more likely than others to become unemployed in a minimum wage scenario where employment is assumed to be responsive to wage changes. Heckman selection models are frequently used to predict so-called unemployment probabilities for labour force participants, based on personal characteristics such as age, gender, education, skills or education levels, occupation type, sector of employment and geographical area of employment. Often these same characteristics are also important in determining an individual's poverty status, and hence the use of predicted unemployment probabilities to identify workers that are most likely to lose their jobs may have important implications for the poverty effects simulated. The selection model is discussed in more detail later in this section.

Our partial equilibrium model therefore adopts many of the basic principles of labour market models such as the Lewis-Kanbur model, but adds refinement through the use of micro-simulation techniques to identify winners and losers in a minimum wage scenario. Further, through the use of real household and labour force survey data, wage and household income distributions (rather than mean values) are explicitly taken into account when evaluating the possible poverty and distributional effects. In short, the partial equilibrium model results are generated in a sequence of four steps:

Step 1: The IES/LFS 2000 data is used to identify workers covered by any of the sectoral determinations. The minimum wage that applies to these workers is sourced from the sectoral determination documentation, and converted to 2000 prices. This minimum wage value is compared against the original reported wage in order to identify all the sub-minimum wage earners in the sample. We then assume that, once implemented, employers will comply fully with the minimum wage regulations, which means that all sub-minimum wage workers will earn the minimum wage under the simulated outcome. We further assume that all covered workers earning more than the stipulated minimum wage as well as all uncovered workers will continue to earn the same wage as before, i.e. the spill-over effects predicted by Card and Krueger (1995) model is not incorporated here.

Assuming no employment response initially, a new low-skilled wage bill[26] is calculated for each economic sector (see listing in Table 1) in the partial equilibrium model. The original low-skilled wage bill is simply the reported wage multiplied by the employment level in each industry, while the new wage bill is a recalculation based on the new wage distribution that emerges when sub-minimum wage workers now earn the minimum wage.[27] The percentage change in the wage bill in each industry will determine the employment loss in that industry. The extent of the employment loss depends on the wage elasticity assumed or estimated for each industry.

26 Low-skilled workers include male and female workers with an education level of grade 12 ('matric') or below. This corresponds with the low-skilled labour grouping used in the general equilibrium model later, and hence ensures that the simulations performed in the partial and general equilibrium models are consistent as far as the wage shock is concerned.

27 In the calculation we initially assume no employment response.

Thus, the percentage change in employment in industry *i* (dE_i) is equal to the employment elasticity for that industry (η_i) multiplied by the percentage change in the wage bill, which is equivalent to the percentage change in the average wage (dw_i) (compare equation [1]).

$$dE_i = \eta_i . dw_i \text{ for industries i = 1,…, } n \quad [7]$$

In all the basic simulations performed the change in the average wage remains constant. This means that the employment response is only dependent on the wage elasticity level. A higher elasticity level implies a higher employment loss and vice versa. We assume a range of 'weighted national' elasticities, ranging from 0 (no employment response) to 1 (a 1 per cent increase in the wage causes a 1 per cent decline in employment). A technique is developed to disaggregate the 'national' wage elasticity into appropriate sectoral elasticities that will generate consistent employment results when aggregating across sectors. This technique is discussed further in section 7.1.1 in the appendix (also see earlier discussions in section 2.3).

Table 9 in the appendix shows the employment effects associated with national elasticities ranging from 0.1 to 1. The simulations are all based on the same increase in the sectoral wage bill. Expected employment losses range from just over 50 000 when the elasticity is 0.1 (0.5 per cent of total employment) to over 500 000 (4.6 per cent of total employment) for an elasticity of 1 (total employment in the base is just over 11 million). Results associated with a wage elasticity of 0.7 can be considered the 'benchmark' for the medium to longer run. At this wage elasticity level, job losses amount to 355 000, or approximately 3.2 per cent of total employment in South Africa.

Step 2: Once the expected employment loss is calculated, the next step is to identify the individuals that are most likely to lose their jobs. The approach taken here is to estimate predicted unemployment probabilities of labour force participants, but to also incorporate the ideas of Card and Krueger (1995), who argued that people further away from the minimum wage level are more likely to lose their jobs. Thus, unemployment probabilities are first estimated using a Heckman selection model that uses observed employment data to predict worker's probability of becoming unemployed. This predicted unemployment probability is then multiplied by a weighting factor, which is calculated as the ratio of the minimum wage to the original wage. This attaches a greater weight to the unemployment probabilities of people that are further away from the minimum wage. In each economic sector those sub-minimum wage workers with the highest weighted probability of being unemployed lose their jobs first until the employment loss in each sector matches the employment loss calculated on the basis of equation [7]. The wages of all individuals who become unemployed are set to zero. Full details of the job loss allocation methods are provided in the appendix (section 7.1.2).

Step 3: The remainder of sub-minimum wage workers who keep their jobs will see their wages rise to the level of the minimum wage that applies to them. We assume no supply response to changes in wages, i.e. existing employed people do not change their hours worked, while economically inactive people do not enter the labour market in response to higher wages.

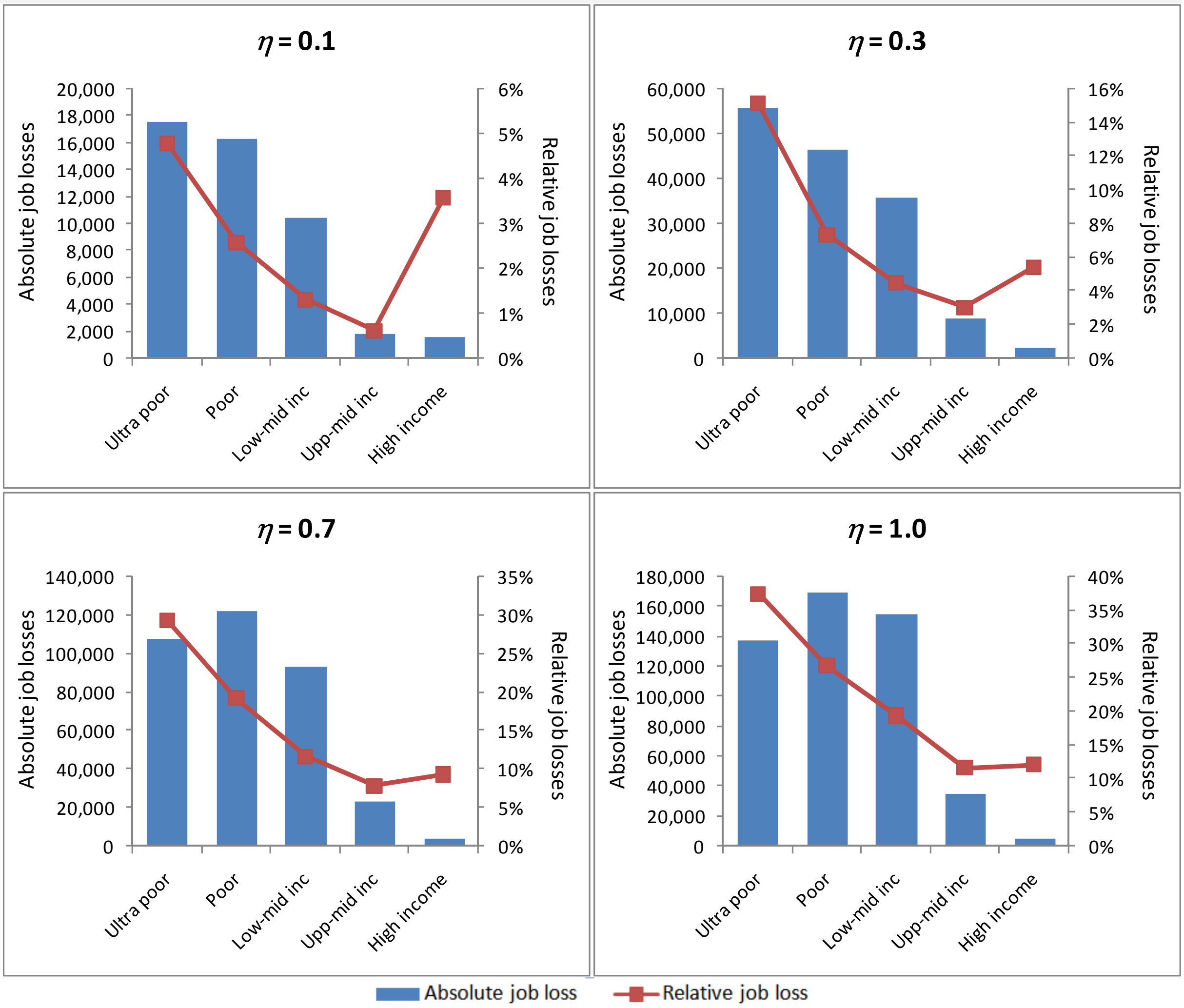
Step 4: As explained the partial equilibrium model will predict that minimum wages cause some individuals to lose their jobs, the extent of which depends on the assumed wage elasticity. Wages of newly unemployed individuals drop to zero, while other sub-minimum wage earners gain and now earn the minimum wage. This causes the total income of the household attached to these affected workers to change. Given the assumption of perfect income sharing within the household, each individual in the household is also affected, with his or her per capita income changing by the same percentage as the change in total household income. A new per capita income variable is calculated for each simulation and compared against the base. This allows for the recalculation of poverty and income distribution measures, which can be compared against the base outcome.

To summarise, the overall results in terms of poverty and the distribution of gains (wage increases) and losses (increased unemployment) associated with minimum wages are highly dependent on two modelling assumptions. Firstly, the extent of the employment effect is determined by the sectoral wage elasticities assumed. Higher elasticities imply larger employment losses, which will offset more of the gains of minimum wages. Secondly, the process used to select or identify the people that are most likely to become unemployed has important implications for how job losses are distributed among sub-minimum wage workers, and hence also on the overall distributional effects of the policy. We next turn to a discussion of the key model results.

4.2.2. Simulation Results

We first look at the distribution of job losses across the household welfare groups. Figure 8 shows the absolute number of job losses within each household group, as well as the ‘relative’ job losses, expressed as a share of the number of sub-minimum wage workers in the base. Results are presented for elasticity values of 0.1, 0.3, 0.7 and 1.0. Detailed results are shown in Table 18 in the appendix. Job losses tend to be biased against ultra poor and poor workers, especially at low elasticity values. The weight appears to shift slightly towards poor and lower-middle income workers at high elasticity values. In relative terms, however, it is clear that job losses affect ultra poor and poor workers disproportionately at all elasticity values (see line graphs). This result is explained by the fact that poor and ultra-poor workers have lower unemployment probabilities and/or are generally further away from their respective minimum wage levels; hence their weighted unemployment probabilities are higher than those of non-poor workers.

Figure 8: Distribution of Job Losses across Household Groups

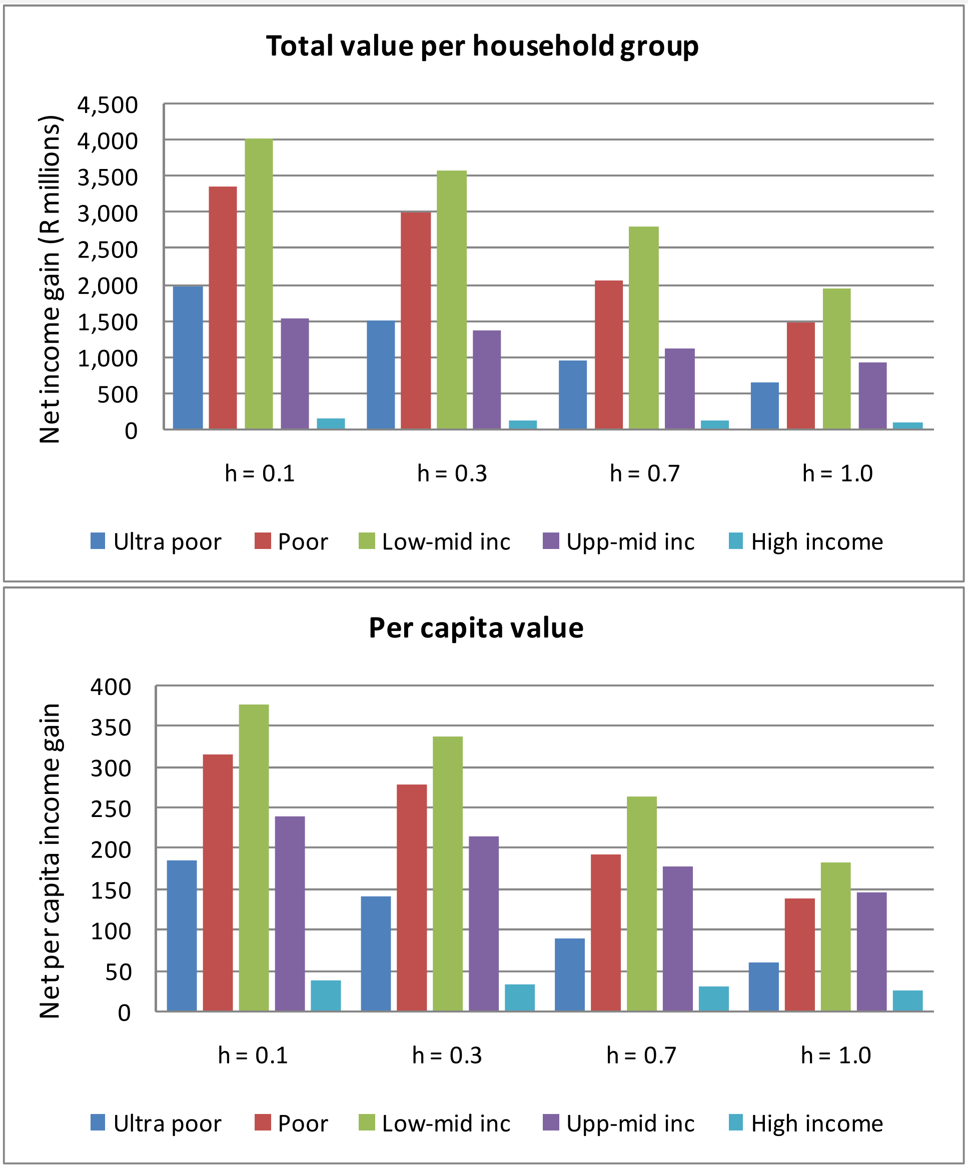


Note: Relative job losses reflect job losses as a share of the number of sub-minimum wage workers in the base.

Source: Partial equilibrium model results

Figure 9 shows transfer of funds to household groups. The top panel shows the total transfer value per household group, expressed in millions of Rands, while the bottom panel shows the per capita values. The fact that these values are positive in all the simulations implies that income gains from minimum wages more than offset income losses arising from increased unemployment. As expected, the net gains become smaller at higher elasticity values as more jobs are lost. The distribution of the gains across household groups, however, appears to remain fairly stable at different elasticity values.

Figure 9: Net Income Gains (Per Annum) across Household Welfare Groups

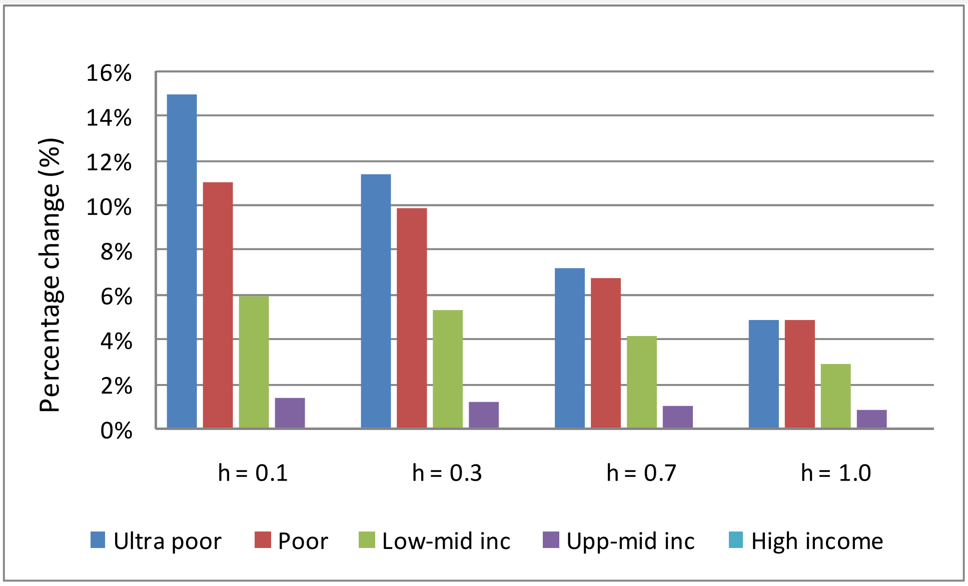


Source: Partial equilibrium model results

In absolute terms the greatest benefit accrues to people in the lower-middle income group. This is true in the aggregate as well at a per capita level. By construction each of the bottom three income groups roughly contain one-quarter of the population (around 10.7 million people). The upper-middle income and the high income groups contain about 6.4 and 4.3 members respectively, and hence the distribution of per capita income gains is slightly different from that of the total income gains. In fact, Figure 9 suggests that in per capita terms upper-middle income households gain more at all elasticity values, and not only at high elasticity values.

In relative or percentage terms the increase in per capita income is significantly higher among the poor and ultra poor compared to the non-poor (Figure 10). This result is consistent across all elasticity values. On average, per capita income increases by 2.1 per cent when the wage elasticity is 0.1 and drops to 1.0 per cent at a wage elasticity of 1.0. At the benchmark elasticity the average increase in per capita income across all household groups is 1.3 per cent.

Figure 10: Percentage Change in Per Capita Income across Household Welfare Groups



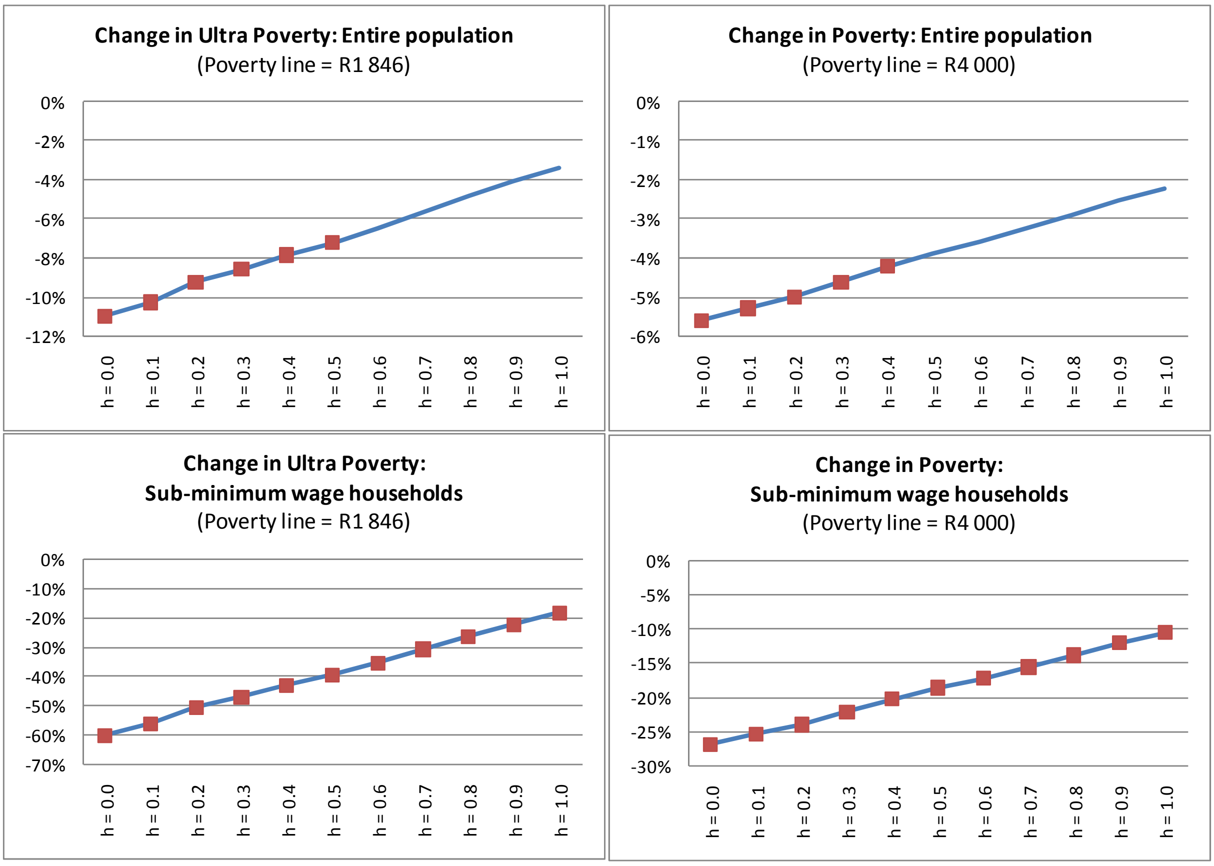
Source: Partial equilibrium model results

These results suggest that both ultra poverty and poverty rates are likely to decline, since net transfers are positive in all income groups. If at least some recipients are close enough to the poverty line the additional income may help them transcend it. These are, however, only average effects. There are also distributional effects that should be considered. Some people may move towards higher welfare groups as their income levels increase due to the minimum wage, while others may drop down to lower income groups due to the increase in unemployment. Hence, below we consider changes in average poverty rates, and then conduct a more in-depth analysis of how the winners and losers move between household groups after the introduction of a minimum wage.

Figure 11 shows the percentage changes in ultra poverty and poverty. The top two panels show the changes for the entire population. As explained, minimum wages affect a relatively small part of the population, and hence the declines in the poverty rates for the entire population are fairly small. As expected the decline in poverty is the highest at low elasticity values. Ultra poverty declines by 11.0 per cent at a zero wage elasticity. When the elasticity reaches 0.5 this decline is 7.2 per cent, while at higher elasticity values the decline is no longer statistically significantly different from zero (the red markers indicate declines in poverty that are statistically significant at a 5 per cent level). 'Normal' poverty declines by 5.6 per cent at a zero wage elasticity, reaching 4.2 per cent at an elasticity value of 0.4. Beyond this the decline is no longer statistically significant.

At our benchmark wage elasticity level of 0.7 the decline in ultra poverty is 5.6 per cent, which translates into a decline from 26.5 per cent in the base to 25.0 per cent in the simulation. 'Normal' poverty declines by 3.3 per cent from 51.3 per cent in the base to 49.6 per cent.[28] However, neither of these declines is statistically significant.

Figure 11: Percentage Changes in Ultra Poverty and Poverty Rates



Note: The red markers indicate declines in poverty that are statistically significant at a 5 per cent level. Detailed poverty results and confidence intervals, also for estimates of P_1 and P_2, are provided in Table 19 in the appendix (section 7.2).

Source: Partial equilibrium model results

The only households that are directly affected by minimum wages are those households that are attached to sub-minimum wage workers. These households and by extension their members will either see an increase or decrease in their per capita incomes depending on whether the sub-minimum wage workers in those households lose their jobs or receive higher wages. The bottom two panels in Figure 11 show the changes in poverty among the population living in households where sub-minimum wage workers reside (referred to here as sub-minimum wage households). The decline in ultra poverty and 'normal' poverty is statistically significant at all wage elasticity levels. Ultra poverty rates decline sharply by between 60 (zero wage elasticity) and 18 per cent (at a wage elasticity of 1.0).

28 Although by construction the base-level poverty rates should be 25 and 50 per cent respectively, the household groups were originally constructed using household-level survey data and household weights. The simulated poverty rates are calculated using person-level survey data and person weights, hence this slight discrepancy. In comparative static context this discrepancy is not important since we are interested in the change in poverty and not the absolute level thereof.

At the benchmark elasticity of 0.7 the poverty rate among sub-minimum wage households declines from 27.8 per cent in the base to 19.3 per cent, a decline of 31 per cent.

'Normal' poverty declines by between 27 and 11 per cent at the two extreme wage elasticity values. At the benchmark wage elasticity level the poverty rate declines by 16 per cent from 61.6 per cent in the base to 52.0 per cent. These results suggest that sub-minimum wage households as a group benefit from minimum wage policies, and particularly that income losses associated with job losses among sub-minimum wage households are overshadowed by gains from higher wages.

While this partial equilibrium analysis suggests that minimum wages have a positive impact on poverty, and especially so for sub-minimum wage workers and the households in which they live, it is still important to consider what happens to those that are not as fortunate as to keep their jobs. Our calculations show that job losses of approximately 350 000 can be expected at a wage elasticity of 0.7 and given the increase in the average wage due to the introduction of minimum wages (see Table 9 in the appendix). As shown below in Table 3, this will affect about 1.2 million individuals in households attached to the newly unemployed persons. These individuals will see their average per capita income decline rather substantially by 22.2 per cent. About 6.4 million people live in households that benefit from minimum wages, with their per capita income levels rising by an average of 23.5 per cent.

Table 3: Winners and Losers in a Minimum Wages Scenario

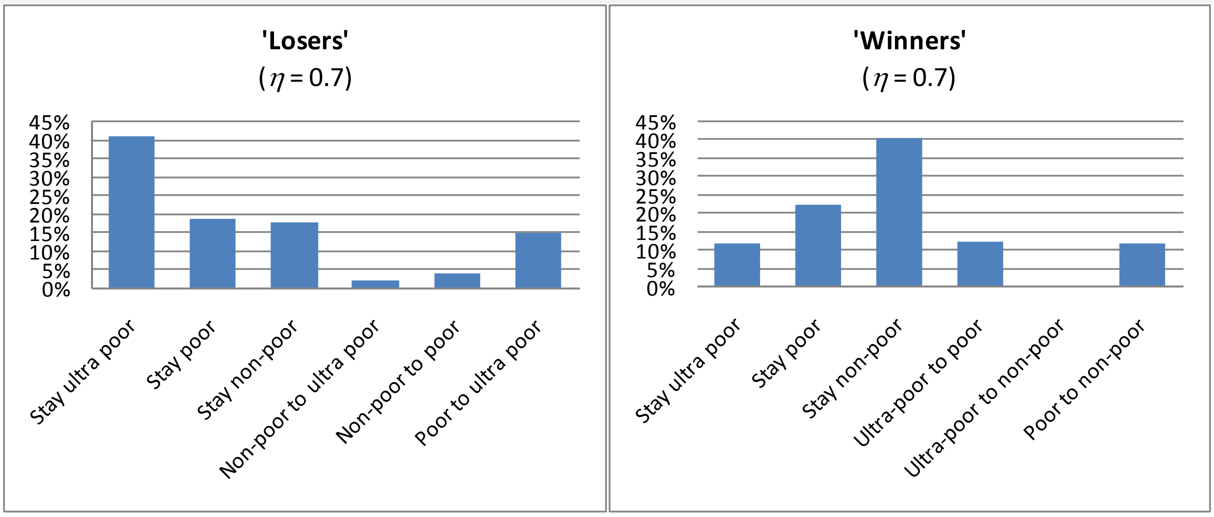
	Population	Original per capita income	New per capita income	% change
η = 0.7				
Not affected	35,753,505	13,939	13,939	0.0%
"Losers"	1,157,674	3,948	3,073	-22.2%
"Winners"	6,390,558	5,402	6,673	23.5%
Total	*43,301,736*	*12,412*	*12,576*	*1.3%*

Source: Partial equilibrium model results

Also evident from Table 3 is the fact that those sub-minimum wage households that benefit from minimum wages are better off initially. The average per capita income in 'winner' households is R5 402 in the base, compared to R3 948 in 'loser' households. This outcome is largely a result of the job loss allocation method used, which attaches a greater unemployment probability to workers that are further away from the minimum wage. Such workers are typically low-wage earners and therefore also more likely to be poorer than the 'winners'. As argued before, this assumption is not necessarily unrealistic and hence this represents quite a plausible outcome. While any policy has winners and losers, the worrying aspect in this instance is that minimum wages seem to make those at the lower end of the income spectrum (of sub-minimum wage households) worse off while those at the higher end of the income spectrum become better off.

Figure 12 explores this aspect further. The figure shows the shares of 'losers' and 'winners' that either stay in their original household groups (divided here into ultra poor, poor and non-poor for simplicity) or move downwards to poorer households groups (in the case of 'losers') or up towards higher-income groups (in the case of 'winners'). The results shown are for a wage elasticity of 0.7. The left hand panel shows that most 'losers' tend to stay in their original group, although 41 per cent are already ultra poor and hence cannot move down any further. About 19 per cent of people stay in the poor group, while a further 18 per cent stay in the non-poor group. Rather significantly, about 15 per cent of 'losers' move from being poor to ultra poor. Very few people move from being non-poor to becoming poor or ultra-poor.

Figure 12: Share of Individuals Moving between Household Groups



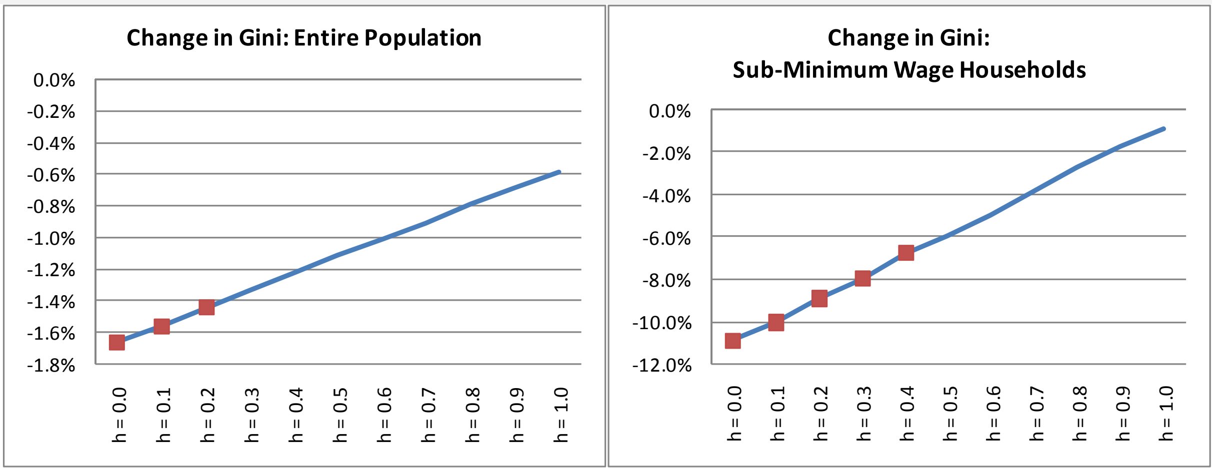
Source: Partial equilibrium model results

The right-hand panel of Figure 12 shows the results for winners. Many of the winners are initially non-poor and stay there (41 per cent), while 22 per cent remain poor and 12 per cent remain ultra poor. About 12 per cent move from being ultra poor to poor, but virtually none of the ultra poor are able to cross the 'normal' poverty line to become non-poor (0.5 per cent). This is evidence that minimum wages only increase average per capita incomes marginally, partly because wages are shared between many family members or because wages are already fairly close to minimum wage levels. About 12 per cent of 'winners' are able to move from being poor to non-poor.

These movements and changes in average incomes seem to suggest that minimum wages could cause inequality to increase, at least among sub-minimum wage households. This hypothesis is based on the evidence presented above that seems to indicate that 'losers' are located at the bottom end of the sub minimum wages household income distribution, while 'winners' are more likely to be at the top end. The Gini coefficient is an inequality measure that is frequently used by economists, and takes into account income levels off the entire population and not only average incomes. This measure will therefore give a better idea of the change in inequality.

Figure 13 shows the simulation results for the change in the Gini coefficient. Inequality changes are shown for the population as a whole, and then also for the population living in sub-minimum wage households. As before, changes that are statistically significant at a 5 per cent level are indicated by red markers. The left-hand panel shows that overall inequality declines marginally in all the simulations, but this decline is only statistically significant at very low wage elasticity levels (0.2 and below). As the wage elasticity increases, job losses among households at the bottom end of the income distribution tend to counter any gains made in terms of inequality.

Figure 13: Percentage Change in the Gini Coefficient



Note: The red markers indicate changes in the Gini that are statistically significant at a 5 per cent level.

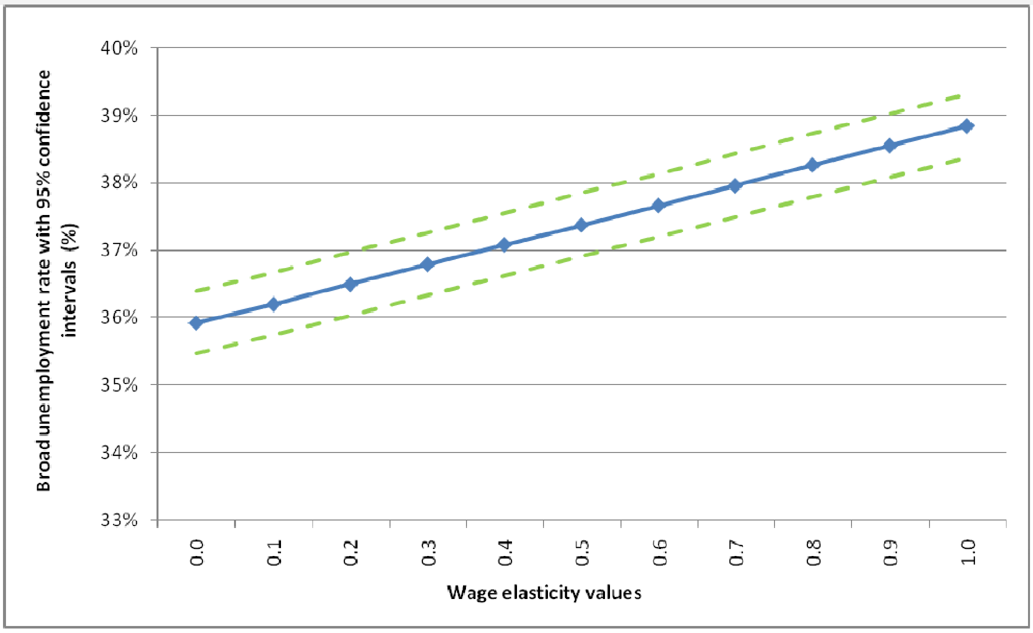
Source: Partial equilibrium model results

The right-hand panel shows the inequality changes among sub-minimum wage households. Although the initial expectation was that inequality would increase for reasons discussed, it actually declines at all wage elasticity values. The decline is statistically significant for wage elasticity levels of 0.4 and below. This result can be explained as follows. Inequality can be thought of as consisting of two components, namely between-group inequality and within-group inequality. Within the population of sub-minimum wage households there are ‘winners’ and ‘losers’. The mean per capita income estimates shown in Table 3 are an indication that, at the average, inequality between the ‘winners’ and ‘losers’ increases, i.e. between-group inequality increases. Our calculations show that at the benchmark wage elasticity (0.7), inequality among the ‘losers’ increases by 16 per cent, while inequality among ‘winners’ decreases by 8 per cent. The decrease in inequality among ‘winners’ is indicative of the fact that sub-minimum wage earners from across the sub-minimum wage spectrum become ‘bunched together’ at more equitable minimum wage levels once the minimum wage is introduced. Since ‘winners’ form by far the majority of sub-minimum wage households (see Table 3), the decrease in inequality among ‘winners’ overshadows the increase in inequality among ‘losers’ as well as the increase in inequality between the groups.

This is a powerful result, as it shows that although there are ‘losers’ when the wage elasticity is high enough, and although these ‘losers’ tend to be relatively disadvantaged relative to the ‘winners’ even in the base, minimum wages are nevertheless important in creating a more equitable income distribution in the economy. This is especially true at low wage elasticity levels when the decline in overall inequality and inequality among sub-minimum wage households is statistically significantly different from zero.

We finally present results on the unemployment effects of minimum wages under various wage elasticity levels. Figure 14 shows the broad unemployment rate in the economy at different wage elasticity levels. The dashed lines above and below the unemployment estimate represent the boundaries of the 95 per cent confidence interval of the estimates. Already at a wage elasticity of 0.4 the rise in the unemployment rate is statistically significant. At a wage elasticity of 0.7 the broad unemployment rate is likely to reach 38 per cent, an increase of just over 2 percentage points over the base.

Figure 14: Unemployment Effects under Minimum Wage Simulations



Source: Partial equilibrium model results

4.2.3. Sensitivity Analysis

Three sets of additional analyses are carried out to determine the sensitivity of our results in the basic analysis to assumptions about how workers are selected to become unemployed as well as the assumptions regarding compliance with minimum wage regulations. As discussed previously and in more detail in the appendix (section 7.1.2), the predicted unemployment probabilities estimated from the second stage of the Heckman model were weighted by multiplying each probability with a weighting factor indicating sub-minimum wage workers' relative distance from the minimum wage. This weighted probability was then used in the 'basic' simulations reported on above. As a way of testing how sensitive poverty and inequality results are to this weighting system, the basic simulations are repeated only now using normal or 'unweighted' unemployment probabilities. Therefore, the overall extent of the job loss is still the same, but the way in which job losses are allocated across sub-minimum wage workers is altered in this scenario.

A second set of sensitivity analyses (called the 'low compliance' scenarios) are also carried where we assume that only employers in the formal sector comply with minimum wage regulations. About 39 per cent of sub-minimum wage workers are employed in the informal sector, and it is quite conceivable that the enforcement of minimum wages will be less effective in the informal sector. Formal sector workers often earn more than informal sector workers in South Africa, which suggests that the average wage change in the 'low compliance scenarios' will be slightly lower than in the 'full compliance scenarios'. This implies that expected job losses are also lower compared to the full compliance scenarios. In fact, job losses are shown to be about half that of the full compliance scenario. The low compliance scenarios include simulation runs using weighted unemployment probabilities and 'unweighted' probabilities as before.

Detailed results and a discussion of the results from the sensitivity analyses are included in the appendix (section 7.1.3). Two main conclusions are drawn from these sensitivity analyses. Firstly, when compliance levels are low, the decline in poverty is generally smaller than under a full compliance scenario. With low compliance levels the income transfer to low-wage workers is lower, and this seems to dominate the net effect despite the fact the job losses are also lower under a low compliance scenario. Secondly, the poverty effects are insensitive to the weighting of the unemployment probabilities, suggesting that the poverty and inequality results obtained under the basic simulations are robust.

4.2.4. Final Remarks

The results presented here highlight the importance of the wage elasticity in these types of scenario analyses. At low wage elasticity values minimum wages as stipulated for the South African economy will lead to small but statistically significant declines in poverty and inequality without affecting the unemployment rate in any significant way. However, once higher wage elasticity values are assumed, and especially at our 'benchmark wage elasticity' of 0.7, which is based on the widely cited estimates of Fallon and Lucas (1998), poverty gains are no longer statistically significant. There is also no statistical evidence that inequality would improve. This comes at the expense of a statistically significant increase in the unemployment rate.

It has to be stated that results from the partial equilibrium analysis should be considered within the context of the obvious limitations of the approach. While useful for identifying where potential winners and losers might be located in the welfare spectrum, the model only accounts for first-round effects of wage increases and income losses associated with job losses. Any feedback effects arising from increased or decreased disposable income are not accounted for here. Such income changes may impact indirectly on the demand for commodities in the economy. Also not accounted for are the effects of minimum wages on production costs and consumer prices. For example, under a low wage elasticity scenario employers will be more compelled to pass the cost of higher wages onto consumers as they are unable to mitigate production cost increases through reducing employment levels. These downstream effects are captured explicitly in the general equilibrium model introduced in the next section.

4.3. General Equilibrium Model: Capturing the Indirect Effects

4.3.1. Model Overview

In this part of the study a computable general equilibrium (CGE) model is used to model the impact of minimum wages on the economy. The simulations are set up in much the same way as in the partial equilibrium model, i.e. the percentage change in the low-skilled wage bill enters into the model as a shock parameter. Whereas in the partial equilibrium model the employment effect was defined in terms of the wage elasticity (see equation [7]), the employment effect in a general equilibrium model is governed by the elasticity of substitution (see earlier discussions in section 2.1). However, since the wage elasticity and the elasticity of substitution are related concepts (equation [2]) the employment effects in the CGE model are slightly larger but of a similar magnitude of those in the partial equilibrium model. Any differences between the two models can be ascribed to indirect effects captured in the general equilibrium model, and particularly the impact of price changes (equation [3]).

Another important difference between the general and partial equilibrium analyses is that the latter only considered changes in household incomes due to changes in sub-minimum wage workers' wages. In the CGE model, household incomes may also be affected by changes in income of other types of factors of production such as skilled labour, capital or land. These factors are affected indirectly by minimum wages, an effect that was not captured before in the partial equilibrium model. CGE models further explicitly model changes in consumption behaviour of households due to household income changes. Such indirect demand effects may have further knock-on effects in the economy.

The study makes use of the Standard General Equilibrium (STAGE) model developed by McDonald (2006). This model is calibrated with a Social Accounting Matrix (SAM) for South Africa with base-year 2000, which was compiled by the Western Cape Department of Agriculture (PROVIDE, 2007).[29] A technical overview of the STAGE model and SAM as well as the model closures selected for this study is provided in the appendix (section 7.2). Closure rules in CGE models define how equilibrium is

29 The IES/LFS 2000 database that was used in the partial analysis was also used by the PROVIDE Project as a main data source of information on households and factors in the SAM, hence the reason why we were able to ensure consistency between the partial and general equilibrium models as far as employment effects are concerned.

reached in various markets. Of particular importance for this study is the labour market closure. The labour accounts in the SAM are grouped into unskilled and skilled workers. Unskilled workers are assumed to represent workers that are in excess supply; hence their wages are fixed (unless changed exogenously in a minimum wage scenario) and employment levels vary to ensure equilibrium is maintained. All sub-minimum wage workers are assumed to fall in this category. Skilled workers, on the other hand, are assumed to be fully employed at a national level but mobile between sectors. Average wages therefore adjust to ensure that the full employment equilibrium is maintained.

Two sets of simulations are performed. The first simulation set considers the general equilibrium effects of minimum wages across a range of different elasticities of substitution. These simulations are related to the ‘basic’ simulations in the partial equilibrium model. Simulations are run for elasticity of substitution values that are equivalent to partial wage elasticities ranging from 0.1 to 1.0 (as in the partial equilibrium model), while we also add simulation runs for a high elasticity scenario where the wage elasticity rises to 1.5 and 2.0. Section 7.2.4 provides further technical information around the calculation of sector-specific elasticity of substitution values that are consistent with the wage elasticities used in the partial equilibrium model. In the results section we only report on the scenarios where the wage elasticity is 0.3, 0.5, 0.7, 1.0, 1.5 and 2.0.

A second simulation set explores the impact of increased labour productivity under an efficiency wage scenario. The same average wage change as before is modelled, but unskilled workers are now assumed to become more productive in response to earning a higher wage. All the productivity simulations are run at a wage elasticity of 0.7, which serves as the ‘benchmark’. The productivity gain realised is modelled as a function of the wage increase for each factor in each sector. The first simulation in this set assumes no labour productivity increase. In the second through to the fifth simulations, productivity is increased by a factor of 25, 50, 75, 100 and 125 per cent of the percentage wage increase for unskilled workers in each sector. For example, if the wage of an unskilled worker in a certain industry increases by 10 per cent, the productivity increase in the six simulations run here will be zero, 2.5, 5.0, 7.5, 10.0 and 12.5 per cent. Section 7.2.5 discusses some technical aspects around modelling labour productivity increases in a CGE model framework.

Both the ‘no labour productivity’ and the ‘labour productivity’ simulation sets are conducted under a short run and long run scenario. In terms of the capital market closure, capital stock is activity specific and fixed in the short run and mobile across sectors in the long run (refer to section 7.2.3 in the appendix for details). Thus, in the long run the model allows for greater flexibility as far as the structure of the economy is concerned, i.e. profitable sectors are able to expand by employing more capital stock and vice versa. However, the overall capital stock level in the economy, representing the aggregate production capacity, remains constant.

4.3.2. Simulation Results

a) Labour Demand and Factor Incomes

In terms of the model closures all labour categories are assumed to be fully mobile across sectors in both the short run and long run scenarios. At a national level skilled workers are fully employed, which means the total employment level in the economy remains constant, while wages adjust to ensure equilibrium in aggregate supply and demand for skilled workers. Sectoral skilled employment levels, however, may adjust depending on demand and supply conditions within sectors. Unskilled workers, on the other hand, face constant wages and flexible employment levels both at sectoral and national level, reflecting the 'excess supply' or unemployment that exists among unskilled workers in South Africa.

Table 4 presents selected employment and wage results for unskilled and skilled workers, as well as results on the return to capital and land in the short- and long run scenarios. Employment results are shown separately for the 'main' minimum wage sectors (i.e. those sectors that are affected directly by minimum wages). In terms of employment, the domestic worker sector suffers the highest loss, accounting for almost three-quarters of the roughly 350 000 job losses in the economy under the low-elasticity scenario ($\eta = 0.3$). Interestingly, however, domestic worker job losses are much less sensitive to the wage elasticity than in other sectors. For example, when the national average wage elasticity is unity ($\eta = 1.0$) domestic sector job losses 'only' account for 50 per cent of overall job losses.[30]

The other major contributors to job losses are the agriculture, retail and wholesale trade and accommodation (hospitality) sectors. A large employment effect might be due to a combination of factors, including the relative size of the sector, the share of workers classified as sub-minimum wage workers and the average distance between the original wage and new minimum wage. These sectors' combined share in job losses rise systematically as the share of domestic workers among the job losers declines. Overall, 3.7 per cent of unskilled workers lose their jobs in the low-elasticity scenario ($\eta = 0.3$). This figure rises to 4.8 per cent at our 'benchmark' elasticity ($\eta = 0.7$).

30 This sector is unique in that no capital is employed (private households are the employers) and virtually all domestic workers are unskilled workers. This means that there is no way for the sector to partially mitigate the effects of higher wages by substituting away from unskilled workers given the rigid production structure in the sector.

Table 4: Employment, Wages and Return to Capital

	Short run						Long run					
	η = 0.3	η = 0.5	η = 0.7	η = 1.0	η = 1.5	η = 2.0	η = 0.3	η = 0.5	η = 0.7	η = 1.0	η = 1.5	η = 2.0
Unskilled employment												
Agriculture	-19,050	-29,999	-39,873	-53,072	-71,832	-87,663	-55,704	-67,547	-75,480	-84,079	-94,473	-102,650
Forestry	-381	-594	-782	-1,028	-1,368	-1,652	1,291	1,996	2,313	2,468	2,350	2,031
Retail and wholesale trade	-35,261	-52,695	-67,376	-86,028	-111,617	-133,142	-70,670	-77,524	-84,675	-95,528	-113,618	-131,525
Accommodation	-23,322	-32,712	-39,797	-47,876	-57,530	-64,589	-59,189	-60,311	-61,427	-63,077	-65,777	-68,426
Transport and communication	-2,547	-4,356	-6,244	-9,182	-14,244	-19,394	-1,602	-3,800	-6,128	-9,687	-15,640	-21,530
Financial and business services	-3,279	-6,014	-9,025	-13,860	-22,369	-31,096	-3,062	-6,471	-9,971	-15,233	-23,918	-32,437
Government, social and other services	-4,158	-10,316	-17,335	-28,563	-47,878	-67,211	-1,815	-10,465	-19,055	-31,813	-52,750	-73,279
Domestic services	-254,800	-257,093	-259,188	-262,090	-266,541	-270,693	-259,646	-261,385	-263,104	-265,609	-269,659	-273,597
Other Sectors	-6,386	-11,003	-16,295	-24,824	-40,133	-56,311	18,491	11,232	2,606	-10,828	-33,604	-56,346
Net change	**-349,184**	**-404,781**	**-455,915**	**-526,523**	**-633,510**	**-731,752**	**-431,906**	**-474,276**	**-514,923**	**-573,387**	**-667,088**	**-757,759**
Percentage change in unskilled employment	*-3.7%*	*-4.3%*	*-4.8%*	*-5.6%*	*-6.7%*	*-7.7%*	*-4.6%*	*-5.0%*	*-5.4%*	*-6.1%*	*-7.0%*	*-8.0%*

…Table 4 continued…

	Short run						Long run					
	η = 0.3	η = 0.5	η = 0.7	η = 1.0	η = 1.5	η = 2.0	η = 0.3	η = 0.5	η = 0.7	η = 1.0	η = 1.5	η = 2.0
Skilled employment												
Agriculture	-506	-782	-1,023	-1,334	-1,753	-2,084	-1,656	-1,958	-2,137	-2,300	-2,449	-2,531
Forestry	-2	-2	-3	-2	-1	2	20	32	39	45	50	52
Retail and wholesale trade	-1,858	-2,569	-3,052	-3,506	-3,841	-3,882	-4,444	-4,280	-4,138	-3,941	-3,633	-3,336
Accommodation	-1,362	-1,871	-2,231	-2,608	-2,997	-3,224	-3,658	-3,632	-3,605	-3,564	-3,494	-3,425
Transport and communication	54	105	153	217	300	361	253	279	287	287	274	254
Financial and business services	203	198	89	-219	-988	-1,951	699	472	194	-252	-1,022	-1,798
Government, social and other services	3,538	4,572	5,301	6,123	7,159	8,014	6,019	6,162	6,334	6,607	7,069	7,526
Domestic services	-772	-770	-768	-763	-754	-744	-784	-780	-776	-770	-759	-748
Other Sectors	706	1,120	1,534	2,093	2,875	3,509	3,551	3,706	3,802	3,888	3,965	4,006
Net change	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Skilled wages												
Male Tertiary	-2.3%	-2.5%	-2.5%	-2.6%	-2.6%	-2.6%	-2.8%	-2.8%	-2.8%	-2.8%	-2.8%	-2.8%
Fem Tertiary	-2.2%	-2.3%	-2.4%	-2.5%	-2.5%	-2.5%	-2.8%	-2.7%	-2.7%	-2.7%	-2.7%	-2.7%
Return to capital												
Capital	-0.9%	-1.3%	-1.5%	-1.8%	-2.0%	-2.1%	-2.7%	-2.8%	-2.8%	-2.8%	-2.9%	-2.9%

Source: CGE model results

Net job losses among skilled workers are zero, with wages adjusting to ensure full employment at an economy-wide level. However, sectoral employment of skilled workers may vary as skilled workers are attracted to expanding sectors. As unskilled labour becomes relatively more expensive due to the introduction of minimum wages, their skilled counterparts will be relatively more attractive to employers. In the interim period, therefore, a *substitution effect* takes place along the value added production isoquant (see Figure 2 and related discussions), with more skilled workers demanded relative to unskilled workers. This will result in a decline in unskilled employment and an increase in skilled employment at a sectoral level.

However, a *scale effect* may also be observed. Since unskilled wages rise exogenously in the minimum wage sectors, overall employment costs increase, thus causing production costs and hence consumer prices to rise. This leads to a decline in demand for the affected industry's output, which may cause the demand for all types of labour to decline in that sector.[31] The results presented in Table 4 suggest that the scale effect actually dominates; skilled employment declines in most of the minimum wage sectors. The results further show that skilled wages decline by about 2.5 per cent when $\eta = 0.7$ (Table 4). This is evidence of a decline in aggregate demand for skilled labour in the economy, an effect also driven by increased consumer prices and ultimately a decline in overall demand. This result contradicts the partial model's prediction that net income will rise across all household groups as a result of minimum wages. This illustrates the importance of factoring prices into the equation when evaluating welfare effects.

The short and long run scenarios differ only in one aspect, namely the assumption about whether capital is mobile across sectors or fixed. In the short run, capital stock, which affects the production capacity in a sector, is locked down; in the long run it is mobile between sectors. Greater flexibility in the long run allows contracting sectors to shed capital stock, which is then re-employed elsewhere. This ultimately causes the employment response to minimum wages to be larger in the long run than in the short run. This is consistent with evidence that long run wage elasticities tend to exceed short run wage elasticities. In a CGE modelling context it is not wage elasticities (or elasticities of substitution) themselves that increase in the long run (these model parameters remain unchanged). It is merely the economy that develops the ability to undergo structural shifts in the longer run, at least as far as sectoral production capacities and output levels are concerned.

Table 5 presents results on changes in total factor income. Total factor income of a factor group is the product of total wages earned and the number of employed individuals (also called the wage bill). As in the partial equilibrium model, total factor income of unskilled workers is raised by higher wages on the one hand, but dragged down by job losses on the other. Variations in skilled factor income come largely as a result of wage changes, but given factor mobility and the fact that wages in some sectors

31 The word 'scale' in this context refers to the scale of production. As demand declines, production activities also decline, i.e. less is produced.

are higher than in others, the movement of workers between sectors may also cause changes in total factor income.[32]

We first consider the results under the 'basic' scenario where no labour productivity gains are modelled. A number of distinct trends are observable as far as labour is concerned. Firstly, female unskilled workers benefit relatively more than male unskilled workers in both the short run and long run scenarios. This occurs despite large employment losses among domestic workers, which affects mostly female workers. However, female unskilled workers are in a relative position of disadvantage in terms of wage levels prior to the minimum wage. Thus under the assumption of full compliance the rise in their average wage is higher than that of male unskilled workers (about 10 per cent, compared to 6 per cent for males). The net effect is a larger increase in total factor income among female workers.

Secondly, factor income gains deteriorate as the wage elasticity increases. This result is similar to that of the partial equilibrium model and is simply explained by the fact that higher wage elasticity values are associated with higher job losses, which counter any the (constant) wage income gains. The results in Table 5 do however suggest that unskilled workers as a group will experience rising income levels under all 'reasonable' elasticity levels ($0.3 \leq \eta \leq 1.0$). For example, for $\eta = 0.7$ the income gain is about 2.1 per cent in the short run and 1.7 per cent in the long run. However, as we have seen, this comes at the expense of between 450 000 and 515 000 job losses among unskilled workers.

Thirdly, total factor income of skilled workers declines due to minimum wage legislation, irrespective of the wage elasticity level. This is a direct result of the decline in skilled wages reported before. The combined effect for unskilled and skilled workers is a small rise in total factor income at very low wage elasticity levels (for example, for $\eta = 0.3$ the total labour income increases by 1 per cent). However, this income gain is quickly eroded as we approach $\eta = 0.7$ (0.3 per cent gain). In fact, in the long run under a more flexible capital stock closure there is no change in total factor income when $\eta = 0.7$. Importantly, however, from a factor income perspective the minimum wage policy does tend to distribute factor income from skilled workers, who are typically attached to higher income households, to unskilled workers, who are typically attached to lower income households. This redistribution of wage income, however, comes at the expense of job losses among unskilled workers, while rising production costs cause consumer prices to increase (as we see later). These additional effects make the overall distributional and welfare effects less clear cut.

---

32 The CGE model makes provision for sector-specific wage differentials. The wage of each skilled factor is the product of the 'average skilled wage' (an economy-wide equilibrium wage) and a 'wage distortion' factor, which varies across sectors. Therefore, if labour moves from a low-wage sector to a high-wage sector total factor income may increase even if the 'average skilled wage' remains unchanged.

Table 5: Changes in Total Factor Income

	Short run closure						**Long run closure**					
	η = 0.3	η = 0.5	η = 0.7	η = 1.0	η = 1.5	η = 2.0	η = 0.3	η = 0.5	η = 0.7	η = 1.0	η = 1.5	η = 2.0
No labour productivity												
Female unskilled	4.7%	4.0%	3.4%	2.6%	1.3%	0.1%	3.7%	3.2%	2.7%	2.0%	0.9%	-0.2%
Male unskilled	2.5%	2.0%	1.5%	0.8%	-0.3%	-1.4%	2.2%	1.7%	1.3%	0.6%	-0.5%	-1.6%
All unskilled	3.2%	2.7%	2.1%	1.4%	0.2%	-0.9%	2.7%	2.2%	1.7%	1.1%	-0.1%	-1.2%
All skilled	-2.2%	-2.2%	-2.3%	-2.3%	-2.4%	-2.4%	-2.5%	-2.5%	-2.5%	-2.5%	-2.5%	-2.5%
All workers	1.0%	0.6%	0.3%	-0.2%	-0.9%	-1.5%	0.6%	0.3%	0.0%	-0.4%	-1.1%	-1.7%
Capital	-2.7%	-2.7%	-2.7%	-2.7%	-2.7%	-2.7%	-2.6%	-2.7%	-2.7%	-2.8%	-2.8%	-2.8%
Land	-13.1%	-12.5%	-12.0%	-11.3%	-10.4%	-9.6%	-34.3%	-26.5%	-21.9%	-17.6%	-13.6%	-11.3%
Total factor income	**-0.8%**	**-1.0%**	**-1.2%**	**-1.4%**	**-1.8%**	**-2.1%**	**-1.1%**	**-1.2%**	**-1.4%**	**-1.6%**	**-1.9%**	**-2.3%**
	η = 0.7, no lab. prod.	25% lab prod.	50% lab prod.	75% lab prod.	100% lab prod.	125% lab prod.	η = 0.7, no lab. prod.	25% lab prod.	50% lab prod.	75% lab prod.	100% lab prod.	125% lab prod.
With labour productivity												
Female unskilled	3.4%	4.0%	4.6%	5.1%	5.6%	6.0%	2.7%	3.4%	4.0%	4.6%	5.1%	5.6%
Male unskilled	1.5%	2.0%	2.5%	2.9%	3.3%	3.7%	1.3%	1.8%	2.3%	2.7%	3.1%	3.5%
All unskilled	2.1%	2.7%	3.2%	3.6%	4.1%	4.5%	1.7%	2.3%	2.8%	3.3%	3.7%	4.2%
All skilled	-2.3%	-1.4%	-0.6%	0.1%	0.8%	1.4%	-2.5%	-1.6%	-0.8%	-0.1%	0.6%	1.3%
All workers	0.3%	1.0%	1.6%	2.2%	2.7%	3.2%	0.0%	0.7%	1.3%	1.9%	2.5%	3.0%
Capital	-2.7%	-1.9%	-1.2%	-0.6%	0.0%	0.6%	-2.7%	-2.0%	-1.3%	-0.7%	-0.1%	0.5%
Land	-12.0%	-10.8%	-9.8%	-8.9%	-8.1%	-7.4%	-21.9%	-19.7%	-18.0%	-16.4%	-15.1%	-14.0%
Total factor income	**-1.2%**	**-0.4%**	**0.2%**	**0.8%**	**1.4%**	**1.9%**	**-1.4%**	**-0.6%**	**0.0%**	**0.6%**	**1.2%**	**1.7%**

Source: CGE model results

Table 5 also shows results on changes in the returns to capital and land. The return to capital is negative in all the short run and long run scenarios (approximately -2.7 per cent and varying little across the simulations). The decline in the return to land, a production factor only employed in the agricultural sector, is fairly large, but given that this factor contributes very little to overall value added in the economy (about 0.4 per cent, based on calculations from the SAM) it has a limited impact on overall factor returns. Total factor income is shown to decline in all the scenarios, suggesting that gains in wage income at low elasticity levels are overshadowed by the decline in the return to capital. Capital accounts for about 47 per cent of value added in the economy. Total factor income (including labour, capital and land) declines across all the scenarios considered, both in the short and long run. For example, when η = 0.7 the decline is 1.2 per cent in the short run and 1.4 per cent in the long run.

We next turn to the impact of labour productivity gains among unskilled workers, the main beneficiaries of minimum wages.[33] The impact of increased labour productivity is not always clear, and depends on a multitude of direct and indirect effects. As workers become more efficient, fewer workers are required per unit of output. Thus, given demand conditions, an initial response from firms may be to lower employment levels of the more efficient factor. However, if only certain factors of production become more efficient relative to others, they now also now represent better value for money from an employment perspective, so depending on the degree of substitutability between factors a more likely scenario is an increase in demand for the more efficient factor. In a general equilibrium framework, increased efficiency also means that production prices and hence consumer prices decline. This causes demand for firms' output to increase, and hence these firms respond by increasing employment of all factors of production.

The bottom half of Table 5 shows the effect of minimum wages on total factor incomes under the labour productivity scenario. Detailed employment results under this scenario are not presented here, but as we show later in a summary graphic (Figure 16), the negative employment effects of minimum wages are certainly reduced when unskilled workers become progressively more productive (note all the labour productivity scenarios are run at a wage elasticity level of 0.7). From Table 5 it is clear that increased productivity among unskilled workers causes total factor income among these workers to rise further, with gains reaching 4.1 per cent when the productivity gain equals the wage gain ('100 per cent' labour productivity gain) (short run). This is almost double the gain when there is no increase in productivity.

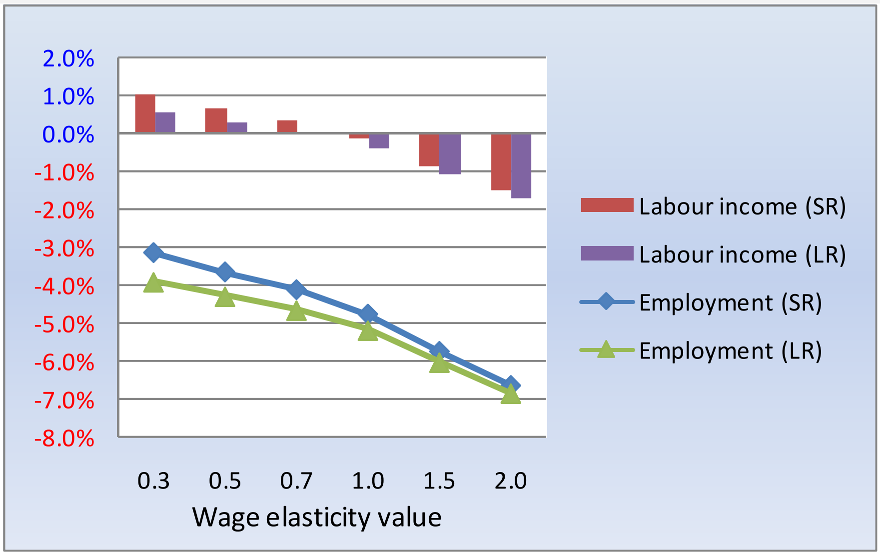
Increased productivity among unskilled workers also benefits skilled workers. Already in the 75 per cent labour productivity scenario skilled workers experience a marginal increase in their total factor

33 The use of representative factor groups rather than individual factors in a CGE model makes it impossible to isolate sub-minimum wage workers from uncovered workers or covered workers above the minimum wage. Therefore, as with our assumption that minimum wages affect the average wage of the unskilled labour group as a whole, we also assume that the group as a whole becomes more efficient in response to the wage increase, even though in reality it is only the sub-minimum wage earners that earn higher wages.

income, up significantly from the 2.3 per cent decline under the no productivity scenario when $\eta = 0.7$. The same is true for the returns to capital and land, which decline less sharply as unskilled workers become progressively more productive.

Figure 15 summarises the factor income and employment results for all workers combined. Under a no productivity scenario factor income gains are realised at low elasticity levels. However, as the elasticity rises, these income gains are eroded by increased job losses among unskilled workers. In the long run job losses are higher as the adjustment process reaches its full effect. In the long run and at low elasticity values, factor incomes gains are therefore understandably lower than in the short run, while at higher elasticity values, long run factor income losses are larger than in the short run.

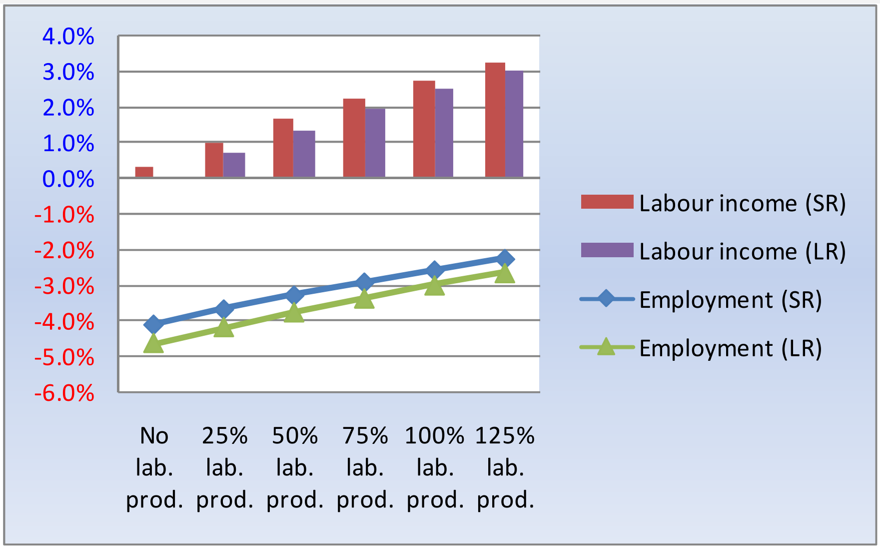
Figure 15: Summary of Labour Income and Employment Results: No Labour Productivity



Source: CGE model results

When labour productivity increases, the upward pressure on production costs caused by higher unskilled wages is relieved somewhat, since fewer person hours are needed to produce the same level of output. This means that consumer prices do not increase as much as in the 'no labour productivity' scenario, and hence demand for output also does not decline to the same extent as before. This is good for employment and labour income, as Figure 16 clearly shows. Total labour income is positive and rises as productivity increases. Also, at higher productivity levels, job losses are reduced although not completely eliminated. Even in the 125 per cent productivity scenario where workers become 1.25 times more efficient than the wage increase they are offered, job losses still occur in the economy. This is partly because each unit of output can be produced by fewer and fewer workers as productivity levels increase, but also because increased demand associated with increased disposable income under this scenario (see following section) is insufficient to cause employment to rise above the original (base) levels.

Figure 16: Summary of Labour Income and Employment Results: With Labour Productivity



Source: CGE model results

b) Household expenditure and welfare

Real disposable income is often used as a measure of welfare. A comparison of changes in disposable income levels across different household groups in the CGE model gives some indication as to how welfare levels of the group as a whole have changed, and also how different groups are affected in different ways. Household disposable income is calculated as that portion of household income net of personal income tax, remittances and savings. Household income in this context includes income from all sources, including wage income, returns to capital, dividend and investment income, welfare transfers and transfers from abroad. Taxes are calculated as a fixed share of household income, while the savings rate is flexible in terms of the savings-investment closure selected for this particular model. Although the savings rate increases in the simulations, the base-level savings rate is so low for most household groups that disposable income is largely unaffected.[34] Remittances are also fixed in real terms. Hence, the only factor that can really affect the change in disposable income is the change in total household income.

Value added is the joint factor income to capital, land and labour. These factors of production are owned by domestic institutions, such as government, enterprises and households, as well as foreign institutions. Capital stock employed in the economy is either owned by households or domestic enterprises; about 24 per cent of the return to capital is allocated to households. For land the figure is 93 per cent. Virtually all wage income is allocated to domestic households, while a small proportion is remitted to foreign households. On average, 64 per cent of value added in the economy is allocated to

34 South African households generally have very low savings rates, averaging around 1 per cent of total household income (SAM data). Enterprises save almost five times as much, with a savings rate of over 26 per cent. Thus, in the savings-investment closure where household and enterprise savings adjust to ensure that the savings-investment balance is maintained, enterprises will carry the bulk of the extra 'burden'. In fact, the average savings rate adjusts by between 6 and 10 per cent in the simulations, which means that households' average savings will increase from 1 to 1.1 per cent of income in the extreme case (this can be safely ignored), while the enterprise savings rate increases to 28 per cent.

domestic households. Households also have other sources of income which can be referred to as ‘transfer income’ (welfare transfers, remittances and transfers from enterprises or the rest of the world). Value added, though, remains the most important income source, contributing about 77 per cent to household income. Table 21 in the appendix (section 7.1.3) summarises income shares for different household sub-groups as calculated from the SAM.

Transfer income is largely unaffected in the minimum wage simulations; hence any changes in household income are explained by changes in that portion of factor income (or value added) that is allocated to households. We can therefore expect to find that changes in total disposable income for the various scenarios match changes in total factor income (shown previously in Table 5) fairly closely. This is confirmed by the results in Table 6 and Table 7. The interesting aspect therefore is not how large the income change is, but rather how factor income is allocated between different types of households. Given the household account setup it is possible to analyse household income distribution patterns across a number of dimensions, including by race, location and income status of households (see footnote 49 in the appendix).

We first consider disposable income changes in the ‘no productivity gain’ scenario. African and Coloured/Asian households only experience marginal increases in income levels in the low elasticity scenarios. This is due to a fairly strong reliance on unskilled wage income (see Table 21) relative to White households. These small gains disappear in the long run scenario as job losses start to dominate and overall factor income dwindles. The majority of white households’ factor income is derived from capital, land and skilled labour, all of which are factors that experience fairly sharp declines in income.

As far as household income changes across geographical areas are concerned we note a drop in urban formal income, an area where income from skilled labour and returns to capital and land dominates (see Table 21). In urban informal areas unskilled wages form a very important income source, and many sub-minimum wage earners are likely to live in these areas. Hence fairly significant income gains are experienced by households in urban informal areas. Households in rural commercial areas initially gain from minimum wages when factor substitutability is low, probably due to the rise in unskilled wages, which represents an important income source to farm workers and their households that live in these areas. At higher elasticity levels, however, diminished returns to land and capital, an important income sources to commercial farming households, causes the net income effect in these regions to become negative. Incomes also decline in the former homelands where roughly half of factor income is derived from unskilled wages.

As far as distributional effects are concerned, the results for the household income groups at the bottom of Table 6 largely confirm results obtained from simulations in the partial model, namely that the greatest beneficiaries are poor and lower middle-income households. Ultra poor households rely much more on transfer income and are removed to some extent from formal employment. Hence, in relative terms they also gain less from increases in unskilled wages. As we move to higher income groups there is an increased reliance on skilled wages and, although not monotonically so, capital (see Table 21). Hence, net income gains decline, with upper middle-income and high income households experiencing a net loss in income at most elasticity levels. Given the skew distribution of income in South Africa, the decline in income among the higher income household groups drags the overall disposable income in the economy down in all the scenarios under the both the short and long run closures. This result contradicts the partial equilibrium model result, which, in the absence of accounting for indirect effects, predicted a net gain in the economy.

Turning next to the labour productivity scenarios we notice a much improved outlook for households. Increased productivity among unskilled workers limits employment losses, and African and Coloured/Asian households experience income gains. Income losses among White households are also limited given improved returns to capital, land and skilled labour relative to the scenarios without labour productivity gains. It is further interesting to note that lower middle-income households now gain relatively more than poor households, which suggests that lower employment losses under this scenario benefit workers in the middle-income groups. Overall, when labour productivity increases by as little as 50 per cent of the increase in the average wage, disposable income starts to increase.

Table 6: Changes in Disposable Household Income: No Labour Productivity

	Short run closure						Long run closure					
	η = 0.3	η = 0.5	η = 0.7	η = 1.0	η = 1.5	η = 2.0	η = 0.3	η = 0.5	η = 0.7	η = 1.0	η = 1.5	η = 2.0
African	0.4%	0.2%	-0.1%	-0.4%	-1.0%	-1.5%	-0.0%	-0.2%	-0.4%	-0.7%	-1.2%	-1.6%
Coloured and Asian	0.2%	-0.1%	-0.3%	-0.7%	-1.3%	-1.8%	-0.2%	-0.4%	-0.6%	-0.9%	-1.5%	-2.0%
White	-2.5%	-2.6%	-2.6%	-2.7%	-2.9%	-3.0%	-2.6%	-2.7%	-2.8%	-2.9%	-3.0%	-3.1%
Urban formal	-1.1%	-1.3%	-1.5%	-1.7%	-2.0%	-2.4%	-1.3%	-1.5%	-1.7%	-1.9%	-2.2%	-2.5%
Urban informal	2.5%	2.1%	1.7%	1.2%	0.3%	-0.5%	1.9%	1.6%	1.3%	0.9%	0.1%	-0.7%
Rural commercial	0.3%	0.1%	-0.2%	-0.5%	-1.1%	-1.6%	-0.3%	-0.4%	-0.6%	-0.8%	-1.3%	-1.8%
Ex-homelands	-0.1%	-0.3%	-0.4%	-0.7%	-1.0%	-1.4%	-0.8%	-0.8%	-0.9%	-1.0%	-1.3%	-1.6%
Ultra-poor	1.3%	1.1%	0.9%	0.6%	0.2%	-0.3%	0.5%	0.5%	0.4%	0.3%	-0.1%	-0.4%
Poor	1.8%	1.5%	1.2%	0.8%	0.2%	-0.3%	1.3%	1.1%	0.9%	0.6%	0.0%	-0.5%
Lower middle-income	1.8%	1.4%	1.1%	0.6%	-0.1%	-0.8%	1.3%	1.1%	0.8%	0.4%	-0.3%	-1.0%
Upper middle-income	0.1%	-0.2%	-0.4%	-0.8%	-1.4%	-1.9%	-0.3%	-0.5%	-0.7%	-1.0%	-1.6%	-2.1%
High income	-2.2%	-2.3%	-2.3%	-2.5%	-2.7%	-2.8%	-2.3%	-2.4%	-2.5%	-2.6%	-2.8%	-3.0%
All Households	**-0.7%**	**-0.9%**	**-1.1%**	**-1.4%**	**-1.7%**	**-2.1%**	**-1.0%**	**-1.2%**	**-1.3%**	**-1.6%**	**-1.9%**	**-2.3%**

Source: CGE model results

Table 7: Changes in Disposable Household Income: With Labour Productivity

	Short run closure						Long run closure					
	η = 0.7, no lab prod	25% lab. prod.	50% lab. prod.	75% lab. prod.	100% lab. prod.	125% lab. prod.	η = 0.7, no lab prod	25% lab. prod.	50% lab. prod.	75% lab. prod.	100% lab. prod.	125% lab. prod.
African	-0.1%	0.6%	1.2%	1.7%	2.2%	2.7%	-0.4%	0.3%	0.9%	1.5%	2.0%	2.5%
Coloured and Asian	-0.3%	0.4%	1.0%	1.6%	2.1%	2.6%	-0.6%	0.1%	0.7%	1.3%	1.9%	2.4%
White	-2.6%	-1.8%	-1.0%	-0.3%	0.3%	0.9%	-2.8%	-1.9%	-1.2%	-0.5%	0.2%	0.8%
Urban formal	-1.5%	-0.7%	-0.0%	0.6%	1.2%	1.8%	-1.7%	-0.9%	-0.2%	0.5%	1.1%	1.6%
Urban informal	1.7%	2.3%	2.8%	3.3%	3.8%	4.2%	1.3%	1.9%	2.5%	3.0%	3.4%	3.9%
Rural commercial	-0.2%	0.5%	1.1%	1.6%	2.1%	2.6%	-0.6%	0.1%	0.7%	1.3%	1.8%	2.3%
Ex-homelands	-0.4%	0.2%	0.7%	1.3%	1.7%	2.2%	-0.9%	-0.2%	0.4%	0.9%	1.4%	1.8%
Ultra-poor	0.9%	1.3%	1.7%	2.1%	2.4%	2.7%	0.4%	0.9%	1.3%	1.7%	2.0%	2.4%
Poor	1.2%	1.7%	2.2%	2.6%	3.0%	3.4%	0.9%	1.4%	1.9%	2.3%	2.7%	3.1%
Lower middle-income	1.1%	1.7%	2.2%	2.7%	3.2%	3.6%	0.8%	1.4%	1.9%	2.4%	2.9%	3.3%
Upper middle-income	-0.4%	0.3%	0.9%	1.5%	2.0%	2.5%	-0.7%	-0.0%	0.6%	1.2%	1.8%	2.3%
High income	-2.3%	-1.5%	-0.8%	-0.1%	0.6%	1.2%	-2.5%	-1.7%	-0.9%	-0.2%	0.4%	1.0%
All Households	**-1.1%**	**-0.4%**	**0.3%**	**0.9%**	**1.5%**	**2.0%**	**-1.3%**	**-0.6%**	**0.1%**	**0.7%**	**1.3%**	**1.8%**

Source: CGE model results

c) A note on prices

Before considering some of the poverty effects in more detail, we briefly discuss some of the important price effects that can be observed. Table 8 below shows the change in domestic commodity prices in the long run scenarios. These price changes, as explained, are relative to a fixed CPI. In a sense, therefore, they are expressed relative to each other. Most of these price results are in line with expectations, with prices of commodities that are produced primarily in industries that are affected directly by minimum wages, e.g. agriculture/forestry, trade, accommodation and domestic workers, rising relative to other prices. Some sectors are also affected indirectly. This is particularly true for the food processing sector, which relies heavily on agricultural goods as an intermediate input. What is also obvious from the table is that increased productivity is very important in reducing the unit costs of production.

Table 8: Changes in Domestic Commodity Prices

	Long run - no productivity gain						η = 0.7; Long run - with productivity gain				
	η = 0.3	η = 0.5	η = 0.7	η = 1.0	η = 1.5	η = 2.0	*25% lab. prod.*	*50% lab. prod.*	*75% lab. prod.*	*100% lab. prod.*	*125% lab. prod.*
Agriculture	1.7%	2.0%	2.2%	2.4%	2.6%	2.7%	1.3%	0.6%	0.0%	-0.4%	-0.8%
Mining	-1.2%	-1.3%	-1.3%	-1.4%	-1.4%	-1.5%	-0.9%	-0.5%	-0.1%	0.2%	0.5%
Food	0.3%	0.3%	0.3%	0.4%	0.4%	0.4%	0.2%	0.1%	0.0%	-0.1%	-0.2%
Bev & Tobacco	-0.6%	-0.6%	-0.6%	-0.6%	-0.5%	-0.5%	-0.4%	-0.3%	-0.2%	-0.1%	0.0%
Textiles	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.2%	0.0%	0.0%	0.0%	0.0%	0.0%
Leather	-0.3%	-0.4%	-0.4%	-0.4%	-0.4%	-0.4%	-0.2%	-0.1%	-0.1%	0.0%	0.1%
Petroleum	-1.2%	-1.2%	-1.2%	-1.3%	-1.3%	-1.3%	-0.8%	-0.5%	-0.2%	0.1%	0.3%
Fertilizer	-0.8%	-0.8%	-0.8%	-0.8%	-0.8%	-0.8%	-0.6%	-0.4%	-0.2%	0.0%	0.1%
Pharmaceuticals	-0.9%	-0.9%	-0.9%	-1.0%	-1.0%	-1.0%	-0.6%	-0.4%	-0.1%	0.1%	0.3%
Non-metals	-1.0%	-1.0%	-1.0%	-1.1%	-1.1%	-1.1%	-0.7%	-0.4%	-0.2%	0.0%	0.2%
Metals	-1.3%	-1.3%	-1.3%	-1.4%	-1.4%	-1.4%	-0.9%	-0.6%	-0.2%	0.0%	0.3%
Machinery	-0.6%	-0.7%	-0.7%	-0.7%	-0.8%	-0.8%	-0.5%	-0.3%	-0.1%	0.0%	0.2%
Utilities	-1.6%	-1.7%	-1.7%	-1.7%	-1.7%	-1.8%	-1.2%	-0.7%	-0.3%	0.0%	0.4%
Construction	-1.0%	-1.0%	-1.0%	-1.1%	-1.1%	-1.1%	-0.7%	-0.4%	-0.2%	0.1%	0.3%
Trade	0.8%	0.7%	0.7%	0.7%	0.7%	0.6%	0.6%	0.4%	0.2%	0.0%	-0.2%
Accommodation	2.9%	2.9%	2.9%	2.8%	2.8%	2.8%	2.1%	1.4%	0.6%	-0.1%	-0.8%
Transport	-0.9%	-0.9%	-0.9%	-1.0%	-1.0%	-1.0%	-0.6%	-0.4%	-0.2%	0.0%	0.2%
Finance	-1.4%	-1.5%	-1.5%	-1.5%	-1.6%	-1.6%	-1.0%	-0.6%	-0.3%	0.0%	0.3%
Social	-1.2%	-1.3%	-1.3%	-1.3%	-1.3%	-1.3%	-0.9%	-0.5%	-0.2%	0.1%	0.4%
Domestic	29.4%	29.4%	29.4%	29.4%	29.4%	29.4%	20.4%	12.7%	6.0%	0.2%	-5.0%

Source: CGE model results

A result that stands out in the table above is the sharp rise in the price of domestic services. This relates to the particular production structure in the domestic services industry. This industry is unique in that it does not employ capital. There are also no intermediate inputs. The sector is purely labour-driven, and for that matter employs only unskilled workers.[35] All production cost increases are therefore directly passed on to consumers[36] as there are no possibilities of mitigating costs through substituting towards relatively cheaper factors of production (see Figure 19). Domestic services can also not be imported; hence there is no option for consumers to save money by switching to imports. The result is that demand for domestic services declines sharply and therefore employment also drops considerably. These results explain why the result for domestic workers appears to be so different from the other sectors.

d) Poverty effects

We next turn our attention to the poverty effects as observed in the CGE model. As noted, this study is concerned with *income* poverty. Previously in the partial equilibrium model, changes in income poverty were calculated at several arbitrarily selected poverty lines. However, in that approach only *nominal* income changes were considered. In the general equilibrium approach the inclusion of commodity prices allows us to consider real income changes, that is, the income change after taking into account changes in prices.[37] The basic notion here is that income gains that arise from minimum wages are partly eroded by rising prices. The extent of the price increase is potentially very important in determining the overall impact on poverty. Section 7.2.6 in the appendix elaborates on how real per capita incomes are obtained first by adjusting nominal income with the national CPI and then by a household-specific CPI measure.

Although the CGE model is more accurate in predicting poverty changes due to the fact that price data is considered, this accuracy is limited to a fairly aggregated level. The partial equilibrium model used previously was arguably more suited for analysing changes at the micro- or survey level. In that model information on differentials between original wages and minimum wages was known for each (surveyed) individual. It was therefore possible to accurately identify individuals that would benefit from minimum wages. It was furthermore possible to link wage income changes directly to the individual households that are attached to minimum wage workers. In a CGE model, representative factor and household groups are used. The model disregards the wage income distribution underlying each representative factor group, and hence in the minimum wage simulation shock in the CGE model we only adjust the average wage of each factor group as a whole.[38]

The resulting average changes in factor incomes are carried over to household groups via the so-called functional distribution (the function in the model that allocates factor incomes to households).

35 In reality about 0.3 per cent of workers in this sector are reported to have a tertiary qualification, and hence are classified as skilled according to our definition. This can safely be ignored as a reporting error.

36 Consumers in this context are effectively the employers of domestic workers, although domestic services is captured here as a local industry supplying a service, which is purchased by consumers.

37 In fact, given the choice of numeraire in the model – the CPI – all results are already expressed in real terms. For example, the results on changes in disposable income presented earlier (Table 6 and Table 7) are in real terms.

38 This same average wage change was also used in the partial model, but only to estimate the extent of the job loss at different wage elasticity levels. All other calculations of changes in wages and per capita incomes was based actual data reported by individuals and households.

Thus, changes in household incomes are again only known at the household group level, and not at the individual level. Fortunately, however, we know what the underlying income distributions within representative household groups look like (having access to the survey data). Hence, if we make the assumption that each household's income shifts by the same percentage change as the income of the group, it is possible to at least say something about how the entire household group's income distribution shifts about some poverty line.[39] By default it is not only those households that are attached to minimum wage workers that are affected. Rather, if a particular household group is attached to a factor group that is affected by minimum wages (i.e. all low-skilled workers), everyone in that household group will be affected the same.

To summarise, the partial model considered individual workers and drew the link between these workers and individual households. Income sharing was assumed to take place at the household level. In the general equilibrium model labour groups are formed, and the impact of minimum wages on the group is considered. The link between factors and households still exists, but this link is to household groups and not individual households. Income sharing therefore takes place at a household group level (community sharing). It must be added though that the CGE model represents a fully integrated approach where the behavioural responses of all agents in the economy are taken into account. The obvious loss in specificity is unfortunately unavoidable in such a comprehensive and consistent modelling framework simply because there would be too much information to consider if all factors and households were included as independent agents in the model.[40]

Both partial and general equilibrium approaches have advantages and drawbacks, with the obvious advantage of the general equilibrium approach being the consistency in the modelling setup and, more importantly from a poverty perspective, the fact that prices are taken into account. The impact of prices on model results is already clear when comparing two sets of results presented previously. As show in Figure 10 (partial equilibrium model) average income gains among poor and ultra-poor people were in the region of 7 per cent ($\eta = 0.7$). Compared to the results in Table 6 (general equilibrium model without labour productivity gains and also for $\eta = 0.7$) average income gains were 0.9 per cent for ultra poor and 1.2 per cent for poor people. Some of this difference could also be explained by the loss of specificity in the CGE model, but the rising prices certainly play an important part.

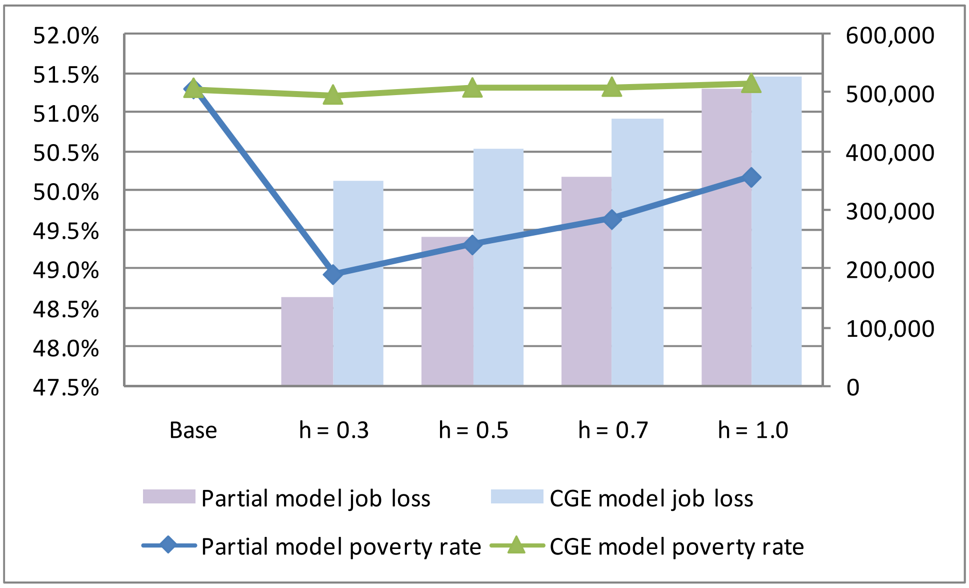
The above results should already be an indication that poverty effects will be small in the CGE model. Previously, in the partial model it was shown that the introduction of minimum wages leads to small

39 The assumption that each member of the household group is affected in the same way (i.e. the percentage change in income is the same as for the group) is an important assumption in CGE models. This assumption is tantamount to assuming that the income distribution stays the same, but that the mean of the group shifts up or down depending on whether the group income goes up or down.

40 There are almost 30 000 households and as many workers in the IES/LFS 2000 dataset. Some have gone the route of including all surveyed households in CGE models, but this is only possible when the underlying household sample is small. Cockburn (2001), for example, uses a CGE model for Nepal where the household survey consists of only 3 000 observations. This is not a possibility in the case of South Africa. In reality, however, even survey-level analyses can be criticised for suffering from exactly the same drawback as CGE models in that the observed outcomes or survey observations used are actually representative of many others. There are over 10 million actual households in South Africa represented here by 30 000 sampled observations.

declines in poverty. These declines were, however, shown to only be statistically significant at very low wage elasticity levels (when job losses were limited). As soon as the elasticity levels increased, the drop in poverty became smaller as more people lost their jobs. The same scenario in the CGE model suggests that poverty is virtually unchanged in all of these basic scenarios. Figure 17 shows the comparison in poverty rates in the two models. The poverty rates are indicated by the line graphs (left-hand axis) and are calculated at a poverty line of R4000 per capita per annum.

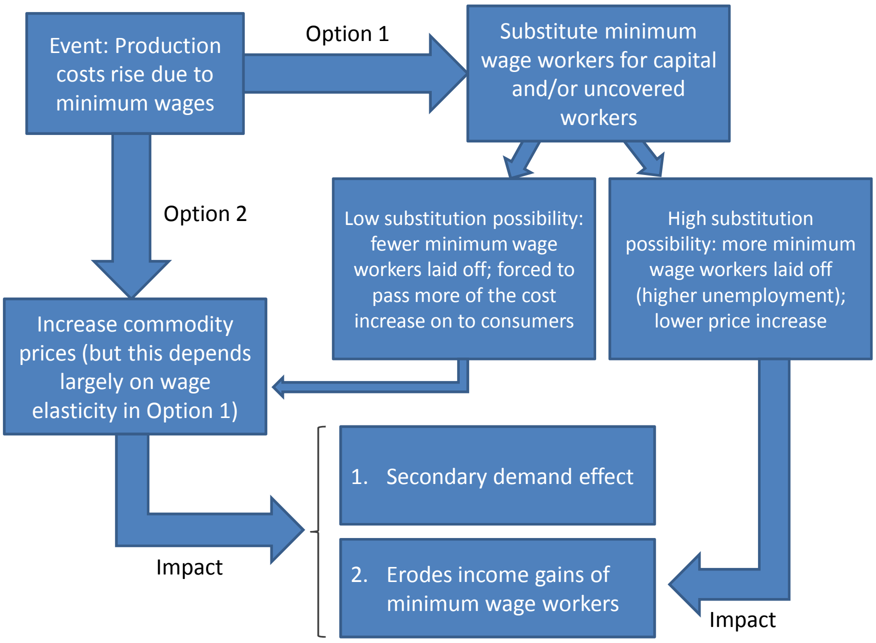
Figure 17: Poverty Changes and Job Losses: Partial and CGE Models



Source: CGE and partial equilibrium model results

The reason why poverty in the CGE is unresponsive to minimum wages can be explained as follows. When a minimum wage is introduced, firms experience a rise in production costs. As shown in Figure 18, these are mitigated in one of two ways. The first option is to lower employment levels of the more expensive factor. Under a low wage elasticity scenario fewer workers will lose their jobs, but this means that firms need to find alternative ways of dealing with rising costs. The second option, therefore, and one that is largely dependent on the wage elasticity, is to pass the cost increases on to consumers in the form of higher commodity prices. In the partial model, job shedding was the only effect captured (Option 1), hence at low wage elasticity values a larger net transfer to low-income workers was observed, the result being a relatively large reduction in poverty.

Figure 18: Flow Diagram: Cost Mitigation Options for Employers of Minimum Wage Workers



Crucially, the partial equilibrium model ignored the fact that firms will probably pass more of the cost on to consumers when wage elasticities are low. Higher commodity prices have two effects; firstly, they erode the income gains associated with minimum wages, and secondly they cause a secondary demand shock, with consumers demanding less at these higher prices. Secondary impacts are also observable under a high wage elasticity scenario. Higher levels of job shedding mean that the net gains of minimum wages are reduced, which implies that the spending power of households is affected.

The secondary demand-side effects (price increases) and the erosion of real incomes (either due to higher prices or higher job losses) explain why employment losses are larger in the CGE model compared to the partial model (see bar graphs in Figure 17, with employment numbers on the right-hand axis). This also explains why the CGE employment results do not vary as much across different wage elasticity values. In short, at low wage elasticity values 'direct' employment losses associated with higher wages are complemented by 'indirect' employment losses associated with higher commodity prices. At high wage elasticity values the CGE results are more in line with the partial equilibrium model results because the minimum wage has less of an impact on prices. As far as the poor are concerned, low wage elasticities mean incomes are eroded by price increases, while high wage elasticities mean incomes are eroded by higher job losses. The overall impact on poverty is therefore insignificant, also at low wage elasticity levels.

Additional results of changes in poverty by different population or household sub-groups are not reported here due to statistical insignificance of all these results at all elasticity values, in both the short and long scenarios. This is also the case when there is increased labour productivity. Generally, however, the following trends seem to emerge. Firstly, poverty rises marginally as wage elasticity values increase and the burden is shifted away from consumers (increased prices) towards low-wage workers (job losses). Secondly, poverty results in the long run follow a very similar trend to the short run results, although the poverty rates are marginally higher in the long run, mainly due to the larger unemployment effects that emerge in the long run. Finally, increased productivity among minimum wage workers reduces poverty rates relative to the scenarios where there is no productivity increase.

4.3.3. Sensitivity Analysis

A series of additional results or analyses were also conducted in order to test the sensitivity of our results to different assumptions. These results are discussed in detail in section 7.2.7 in the appendix. These additional analyses consider first the poverty results under different poverty lines, and secondly the impact of increasing the model specificity through increasing the number household and factor groups in the model. It is found that the poverty results in the CGE model are insignificant at all poverty lines between R750 and R4 000 per capita, i.e. the choice poverty line does not alter the finding that minimum wages have no significant impact on poverty. Increased model specificity also does not change the results significantly, suggesting that our earlier findings are fairly robust. This confirms that the so-called indirect effects, and specifically prices and demand responses to minimum wages, counteract the initial benefits that are transferred to households in the form of minimum wages, and once again illustrates the importance of considering these indirect effects when studying poverty effects.

5. Conclusions

The question around minimum wages and their impact on employment and poverty is an important one. Minimum wages are usually instituted on the basis of their poverty-reducing effects. The argument is that by targeting low-wage sectors or the working poor, minimum wages present an effective way of transferring money to poor households without having to increase government spending. As with any economic policy shock, however, there are winners and losers. Most economists tend to agree that there is a trade-off between employment and wages, although debates around the exact extent of this trade-off will probably never be resolved. Estimates of wage elasticities differ depending on the source of data, the level of aggregation of the data (firm-level, sectoral level or national level), the time period over which changes are analysed and the statistical estimation methods used. In South Africa there seems to be some consensus that wage elasticity levels of between 0.3 and 0.7 are probably accurate, which suggests that while employment levels may well be expected to drop in response to wage increases, the employment levels are likely to be inelastic (wage elasticity is less than one).

The results from the partial model, although statistically inconclusive at higher wage elasticity levels, show that poverty levels are likely to decline if employers comply fully with minimum wage regulations. This presents a strong case for supporters of minimum wages. Even at high wage elasticity values it is unlikely that poverty will increase despite larger employment losses. Our sensitivity tests revealed that a higher level of compliance results in an improved poverty effect. This suggests that enforcement of minimum wage laws, for example in the unregulated or informal sector, may be even more beneficial to the poor than minimum wages that only apply to formal sector employers.

Under the credible assumption that job losses are likely to be biased against those that are further away from the minimum wage, perhaps the most important result from this partial equilibrium model emerges: those that lose their jobs are likely to be poor already; hence losing their jobs does not change their poverty status, but it does cause them to fall further into poverty. Those that gain from higher wages are likely to be closer to the minimum wage and possibly non-poor or close to the poverty line. Thus, when their incomes increase (even marginally) it enables them to escape poverty. Thus, minimum wages may well end up benefiting the relatively better off among the poor or even the non-poor, while workers who are already living in abject poverty may lose out further. Those that do end up losing their jobs would simply become part of the unemployed ‘outsiders’, and may well be unable to find employment again given their low employment probabilities.

The partial equilibrium model, however, only accounts for first-round effects of wage increases and income losses associated with job losses. Therefore it was also considered necessary to run comparable minimum wage scenarios in a general equilibrium framework which accounts for factor market substitution, demand and price effects. The CGE model considered minimum wage scenarios assuming full compliance in both a short run and long run context, with the longer run being a period that allows for more flexibility in the economy as far as adjustment processes are concerned (capital stock levels are mobile across economic sectors). Scenarios were added where, in line with the efficiency wage theory, productivity levels of minimum wage workers increased in response to the wage increase.

A number of important results emerged from the general equilibrium analysis. At low wage elasticity values employment losses among unskilled workers are limited, but firms are compelled to increase commodity prices in order to mitigate the effects of increased production costs. Higher commodity prices cause real disposable incomes to decline, which erodes income gains among minimum wage workers and causes overall demand to decline. The result is that demand for skilled workers and capital also declines due to the contraction of the economy. At high wage elasticity levels the employment loss among low-skilled workers is higher, as expected. This reduces income gains associated with minimum wages.

The CGE analysis illustrates the important of considering prices and indirect demand effects in a study of this nature, something that was omitted from the partial equilibrium analysis. In contradiction to the partial equilibrium model results, the poverty reducing effects of minimum wages are found to be statistically insignificant at all wage elasticity levels, and also in the scenarios where increased labour productivity was modelled. The CGE results were further shown to be robust at several poverty lines and also in a CGE model calibrated against a much more detailed SAM as far as household and factor group accounts are concerned.

In conclusion then, while poverty reduction is often said to be one of the main aims of minimum wage policies, the results here suggest that poverty effects are very limited. Income gains associated with minimum wages are eroded either by higher prices under a low wage elasticity scenario or by higher employment losses when the wage elasticity is high. Thus, while in a partial equilibrium framework the net effect can be shown to be positive, the general equilibrium effects should not be ignored, and are in fact shown to dominate to such an extent that poverty is unlikely to change significantly. From an overall (and arguably simplistic) income poverty perspective minimum wages are unwarranted. That said, minimum wages are often justifiable on other grounds. South Africa has a history of labour market discrimination, which has resulted in some unskilled workers earning wages that are well below a fair living wage. Minimum wages set within the context of fairness, dignity and ‘making work pay’ rather than simply giving handouts to the poor in the form of unconditional welfare transfers may well be better received within the economic community.

6. References

Bhorat, H. and Hodge, J. (1999). "Decomposing Shifts in Labour Demand in South Africa," *South African Journal of Economics,* 67(3): 348-380.

Bhorat, H. and Leibbrandt, M. (1996). "Understanding Unemployment. The Relationship between the Employed and the Jobless." In *Against the Current. Labour and Economic Policy in South Africa*, edited by Baskin, J. Randburg: NALEDI.

Bhorat, H. and Oosthuizen, M. (2005). *What Have We Learnt about the South African Labour Market?*: Development Policy Research Unit, University of Cape Town.

Card, D. and Krueger, A.B. (1995). *Myth and Measurement: The New Economics of the Minimum Wage*. Princeton University Press: Princeton.

Cockburn, J. (2001). "Trade Liberalisation and Poverty in Nepal. A Computable General Equilibrium Micro Simulation Analysis," *Mimeo*.

Dervis, K., de Melo, J. and Robinson, S. (1982). *General Equilibrium Models for Development Policy*. Cambridge University Press: New York.

Edwards, L. (2001). "Trade and the Structure of South African Production, 1984-97," *Development Southern Africa,* 18(4): 471-492.

Fallon, P.R. and Lucas, R. (1998). "South African Labor Markets: Adjustment and Inequalities," *World Bank Informal Discussion Papers on Aspects of the Economy of South Africa,* 12.

Fedderke, J. and Mariotti, M. (2002). "Changing Labour Market Conditions in South Africa: A Sectoral Analysis of the Period 1970-1997," *South African Journal of Economics,* 70(5): 830-864.

Fields, G.S. and Kanbur, R. (2007). "Minimum wages and poverty with income-sharing," *Journal of Economic Inequality,* 5: 135-147.

Fields, G.S., Leibbrandt, M. and Wakeford, J. (2000). "Key Labour Market Elasticities in South Africa. " Report Commisioned by the South African National Department of Labour, Pretoria.

Freeman, R. (1996). "The Minimum Wage as a Redistributive Tool," *Economic Journal* 106(436).

Hamermesh, D.S. (1993). *Labor Demand*. Princeton University Press: Princeton.

Heintz, J. and Bowles, S. (1996). "Subsidising Employment. Wage Subsidies and Job Creation." In *Against the Current. Labour and Economic Policy in South Africa*, edited by Baskin, J. Randburg: NALEDI.

Hertz, T. (2002). "Forecasting the Effects of Pending Minimum Wage Legislation on Poverty in South Africa," *Mimeo*.

Hertz, T. (2005). "The Effect of Minimum Wages on the Employment and Earnings of South Africa's Domestic Service Workers," *Development Policy Research Unit,* Work ing Pa per 05/99.

Hoogeveen, J.G. and Özler, B. (2004). "Not Separate, Not Equal. Poverty and Inequality in Post-Apartheid South Africa". World Bank.

Islam, N. (1999). "Capital Mobility in CGE Models: A Survey". Department of Economics, Emory University, Atlanta. March 1999.

King, B.J. (1985). "What is a SAM?" In *Social Accounting Matrices: A Basis for Planning*, edited by Pyatt, G. and Round, J. Washington D.C.: World Bank.

Lewis, J.D. (2001). "Policies to Promote Growth and Employment in South Africa". World Bank, Washington.

Löfgren, H., Harris, R.L. and Robinson, S. (2001). "A Standard Computable General Equilibrium (CGE) Model in GAMS," *International Food Policy Research Institute (IFPRI): Trade and Macroeconomics Division Discussion Paper,* 75.

McDonald, S. (2006). *STAGE Static CGE Model V1*.

Nattrass, N. (2000). "The Debate about Unemployment in the 1990s," *Studies in Economics and Econometrics,* 24(3): 73-90.

Pauw, K., Edwards, L. and Leibbrandt, M. (2007a). "Trade-induced employment changes: Promising or problematic for poor households in South Africa?," *Studies in Economics and Econometrics,* 31(2): 89-108.

Pauw, K., McDonald, S. and Punt, C. (2007b). "Agricultural Efficiency and Welfare in South Africa," *Development Southern Africa,* 24(2).

Pollin, R., Epstein, G., Heintz, J. and Ndikumana, L. (2006). *An Employment-Targeted Economic Program for South Africa*. International Poverty Centre, United Nations Development Policy: Brasilia.

PROVIDE (2005). "The PROVIDE Project Standard Computable General Equilibrium Model. Version 2." *PROVIDE Technical Paper Series*, 2005:3. PROVIDE Project, Elsenburg. Available online at www.elsenburg.com/provide.

PROVIDE (2006). "Compiling National, Multiregional and Regional Social Accounting Matrices for South Africa", *PROVIDE Technical Paper Series*, 2006:1. PROVIDE Project, Elsenburg. Available online at www.elsenburg.com/provide.

PROVIDE (2007). "An Input-Output Social Accounting Matrix for South Africa and Labour Use and Time Use Satellite Accounts for 2000", *PROVIDE Technical Paper Series*, 2007:2. PROVIDE Project, Elsenburg. July 2007. Available online at www.elsenburg.com/provide.

Pyatt, G. (1998). "A SAM Approach to Modelling," *Journal of Policy Modelling,* 10: 327-352.

Reinert, K.A. and Roland-Holst, D. (1997). *Applied Methods for Trade Policy Analysis*. Cambridge University Press: Cambridge.

Shapiro, C. and Stiglitz, J. (1984). "Equilibrium Unemployment as a Worker Discipline Device," *The American Economic Review,* 74(3): 433-444.

SSA (2002). *Time Use Survey 2000,* Pretoria: Statistics South Africa.

7. Appendix

7.1. Partial Equilibrium Model: Technical Notes

7.1.1. Estimating Sectoral Wage Elasticities

Rather than estimating a single wage elasticity level, we assume a range of 'weighted national' elasticities ranging from $\eta = 0$ (no employment response) to $\eta = 1$ (i.e. a 1 per cent rise in the wage will lead to a 1 per cent drop in employment) and applied to eleven separate simulations.[41] Given differences in employment levels and the coverage rate in sectors, it is not possible to simply apply the same wage elasticity level across all industries in the hope that this would yield an employment response that is consistent with the assumed national wage elasticity level for that simulation. This problem is related to the elasticity aggregation problem mentioned previously. In order to arrive at sectoral elasticities that produce aggregate employment results that are consistent with national wage elasticities ranging from 0 to 1, a simple solving technique is used. First, industries are grouped into agricultural, mining, manufacturing, and services sectors. Next, plausible boundaries are set for the wage elasticities of these aggregated sectors, loosely following those sectoral wage elasticities estimated by Fallon and Lucas (1998). This assumes lower elasticities for mining, agriculture and domestic workers (between 0.2 and 0.6), moderate elasticities for manufacturing sectors (0.5 to 0.8) and higher elasticities for services sectors (0.6 to 0.9) relative to a 'weighted' national wage elasticity of 0.7. Finally, through an iterative solving process[42] a set of sectoral wage elasticities are estimated subject to the constraints.

Table 9 shows the expected change in the average sectoral wage due to minimum wages, as well as the sectoral elasticities that are consistent, in this case (as an example) with a national weighted elasticity of 0.7 (second column). These values are for illustrative purposes only. The sectoral elasticities for the remainder of the simulations are calculated by assuming that the sectoral elasticity remains a fixed share of the weighted national elasticity.

41 The absolute value of wage elasticities are reported from here onwards.

42 The solver add-in in Microsoft Excel was used here. This application uses an iterative solve process, converging towards a solution to a problem subject to constraints imposed and subject to the existence of a solution.

Table 9: Average Wage Changes and Calculated Job Losses for Various Wage Elasticity Levels

			Elasticity Values									
	Calculated %change in wage by sector (full compliance)	*Sectoral elasticities for a -0.7 national elasticity*	**-0.1**	**-0.2**	**-0.3**	**-0.4**	**-0.5**	**-0.6**	**-0.7**	**-0.8**	**-0.9**	**-1.0**
Agriculture	*24.8%*	*0.34*	10,590	21,180	31,770	42,360	52,950	63,540	74,129	84,719	95,309	105,899
Forestry	*19.1%*	*0.34*	646	1,291	1,937	2,583	3,228	3,874	4,520	5,165	5,811	6,457
Fishing	*0.0%*	*0.34*	0	0	0	0	0	0	0	0	0	0
Minerals and mining	*0.2%*	*0.20*	27	53	80	107	133	160	187	213	240	267
Food products	*0.6%*	*0.50*	84	167	251	335	418	502	585	669	753	836
Beverages and tobacco	*1.3%*	*0.50*	58	116	175	233	291	349	408	466	524	582
Textiles	*0.6%*	*0.50*	162	323	485	647	808	970	1,132	1,294	1,455	1,617
Leather, wood and paper	*0.3%*	*0.50*	36	71	107	143	179	214	250	286	321	357
Petroleum	*0.0%*	*0.50*	0	0	0	0	0	0	0	0	0	0
Fertilisers and pesticides	*0.3%*	*0.50*	8	16	24	32	39	47	55	63	71	79
Pharmaceuticals & other chem.	*0.3%*	*0.50*	2	4	6	8	9	11	13	15	17	19
Non-metals	*0.1%*	*0.50*	12	23	35	46	58	69	81	92	104	115
Metals	*0.3%*	*0.50*	45	89	134	179	223	268	313	357	402	447
Machinery, equip. & other manuf.	*0.4%*	*0.50*	58	115	173	231	288	346	404	461	519	577
Electricity and water	*0.5%*	*0.60*	30	59	89	119	148	178	208	237	267	297
Construction and building	*0.2%*	*0.60*	86	171	257	343	429	514	600	686	771	857
Retail and wholesale trade	*8.1%*	*0.60*	12,312	24,625	36,937	49,249	61,561	73,874	86,186	98,498	110,810	123,123
Accommodation	*14.5%*	*0.60*	4,229	8,457	12,686	16,915	21,143	25,372	29,601	33,829	38,058	42,287
Transport and communication	*3.4%*	*0.60*	1,348	2,697	4,045	5,394	6,742	8,091	9,439	10,788	12,136	13,484
Financial and business services	*4.8%*	*0.60*	2,349	4,697	7,046	9,394	11,743	14,091	16,440	18,788	21,137	23,486
Government, social & other serv.	*1.0%*	*0.60*	1,360	2,720	4,079	5,439	6,799	8,159	9,519	10,879	12,238	13,598
Domestic services	*29.6%*	*0.34*	17,329	34,658	51,988	69,317	86,646	103,975	121,305	138,634	155,963	173,292
Total	*5.4%*	*0.70*	*50,768*	*101,535*	*152,303*	*203,070*	*253,838*	*304,605*	*355,373*	*406,140*	*456,908*	*507,675*
Job loss as % of total workforce (11m)			*0.5%*	*0.9%*	*1.4%*	*1.8%*	*2.3%*	*2.8%*	*3.2%*	*3.7%*	*4.1%*	*4.6%*

Source: IES/LFS 2000 and author's calculations

7.1.2. Job Loss Allocation Model

The next step then is to decide how job losses will be allocated across individual workers. A Heckman selection model is used to estimate predicted unemployment probabilities for all individuals. The model is set up in two stages. In the first stage the full sample of potential labour market participants, which includes adults between the ages of 15 and 65, are included in a *probit* model. The dependent variable is a binary variable that takes on the value one (1) if an individual is a participant (this may include employed or unemployed persons) and zero (0) otherwise (non-participants, including full-time scholars and homemakers). Independent variables included in the model are

- Dummies for various age groups: age 15 to 24, 25 to 34, 35 to 44, 45 to 54, with 55 and up the referent group
- Dummies for population groups: African, Coloured and Asian, with White the referent group
- A dummy for gender: female, with male the referent group
- Dummies for location: Western Cape metropolitan, Eastern Cape metropolitan, Free State metropolitan, KwaZulu-Natal metropolitan, other urban areas, rural areas in former homelands and other rural areas, with Gauteng metropolitan as the referent group
- Splines for education: Grade 8 – 11, Grade 12, tertiary diplomas and tertiary degree, with zero education through Grade 7 as the referent.
- The number of children below working age (15) in the household.

Table 10 shows the participation equation estimated in stage one. The entries in the column with heading, *dF/dx*, contains the transformed coefficient value for a discrete change in the dependent variable from 0 to 1. For example, the value for the African dummy is interpreted as ‘Africans have a 19.1 per cent higher chance of participating in the labour force relative to Whites’.

Table 10: Participation Equation (Stage One)

	dF/dx	Std. Err.	z	P>|z|
Age 15 to 24	0.017	0.007	2.37	0.02
Age 25 to 34	0.406	0.005	62.72	0.00
Age 35 to 44	0.394	0.004	64.96	0.00
Age 45 to 54	0.318	0.004	49.44	0.00
African	0.191	0.011	17.56	0.00
Coloured	0.176	0.010	15.74	0.00
Asian	0.009	0.017	0.56	0.58
Female	-0.123	0.005	-26.67	0.00
Western Cape metro	-0.061	0.014	-4.64	0.00
Eastern Cape metro	-0.068	0.014	-4.79	0.00
Free State metro	-0.054	0.020	-2.83	0.01
KZN metro	0.001	0.015	0.08	0.93
Other urban	-0.064	0.008	-8.12	0.00
Rural homelands	-0.216	0.008	-26.49	0.00
Other rural	-0.054	0.009	-5.94	0.00
Grade 8 to 11	0.007	0.002	3.56	0.00
Grade 12 (matric)	0.182	0.007	22.64	0.00
Diploma	0.080	0.016	4.88	0.00
Degree	-0.041	0.011	-3.76	0.00
No. below working age in the hhold	-0.015	0.001	-11.34	0.00
obs. P	0.615			
pred. P	0.652	(at x-bar)		

Source: IES/LFS 2000

The Heckman two-step approach used here is useful (and necessary) when the sample of participants upon which the employment model (stage two) is based is believed to be a non-random sample of potential labour market participants (stage one). Therefore, in the second stage, the inverse Mills ratio (lambda), which can be calculated from results in the first equation and is a measure of the selectivity bias in the model, is included as an independent variable in the model. All the same independent variables are used in this equation, with exception of the number of children below working age. The estimates are shown in Table 11. The negative and statistically significant coefficient for lambda shows that there was in fact selection bias present in the model, and this was corrected for through the inclusion of this independent variable. This means that the estimated employment probabilities are also unbiased estimates of the true employment probabilities.

Table 11: Employment Equation (Stage Two)

	dF/dx	Std. Err.	z	P>|z|
Age 15 to 24	-0.613	0.012	-39.12	0.00
Age 25 to 34	-0.561	0.030	-16.12	0.00
Age 35 to 44	-0.428	0.036	-11.30	0.00
Age 45 to 54	-0.334	0.034	-9.53	0.00
African	-0.327	0.011	-20.68	0.00
Coloured	-0.253	0.023	-11.13	0.00
Asian	-0.161	0.030	-5.62	0.00
Female	-0.079	0.008	-9.77	0.00
Western Cape metro	0.094	0.013	6.68	0.00
Eastern Cape metro	-0.046	0.016	-2.94	0.00
Free State metro	0.030	0.021	1.39	0.17
KZN metro	0.000	0.019	-0.02	0.98
Other urban	0.013	0.009	1.45	0.15
Rural homelands	-0.042	0.015	-2.92	0.00
Other rural	0.090	0.009	9.17	0.00
Grade 8 to 11	-0.007	0.002	-3.07	0.00
Grade 12 (matric)	-0.003	0.012	-0.22	0.83
Diploma	0.138	0.012	10.03	0.00
Degree	0.042	0.012	3.63	0.00
Lambda	-0.256	0.040	-6.32	0.00
obs. P	0.640			
pred. P	0.679	(at x-bar)		

Source: IES/LFS 2000

While such employment probabilities could be used directly in the selection model (see for example Pauw et al., 2007a) it was decided to introduce a further dimension to the selection process. A weighting factor (γ) is created that indicates how far below (in relative terms) a sub-minimum wage worker's current wage (w) is from his or her adjusted minimum wage.[43] Thus:

$$\gamma = w_M^{adj} / w \qquad [8]$$

Whereas the Heckman model is used to predict employment probabilities (e), our partial model requires unemployment probabilities. Each individual's unemployment probability (u) is simply equal to one minus the estimated predicted employment probability ($1 - e$). This unemployment probability is then multiplied by the weighting factor (γ) to yield a new set of unemployment probabilities (u^*) so that those workers that are further away from the minimum wage have a higher chance of being selected.

$$u^* = \gamma.u = \gamma.(1 - e) \qquad [9]$$

43 Gamma (γ) is of course the inverse of s which was used in previous analyses of sub-minimum wage distributions.

This approach means that although individual characteristics such as age, race, gender, geographical location and education play a role, the importance of the distance from the minimum wage is not overlooked, which borrows from the model described in Card and Krueger (1995). This approach is a modification of Hertz's (2002) approach, in which selection of sub-minimum wage workers was based on 'weighted random probabilities'. As his description suggests, Hertz's approach generates random unemployment probabilities (between 0 and 1), and thereafter weights them in a similar way as we have done here. Hertz's approach, however, suffers one major drawback in that the randomisation prevents replication of his results.

The entire sample of sub-minimum wage workers is now sorted by its weighted unemployment probability (u^*). Those with the highest unemployment probabilities are assumed to lose their jobs first until the target number of jobs in each industry and for each simulation is reached. For example, when the national weighted wage elasticity is 0.7, we calculate that 74 129 farm workers are likely to lose their jobs. The first 74 129 sub-minimum wage farm workers, as ranked by their weighted unemployment probabilities, are therefore selected.[44] These workers' wages are reduced to zero due to the fact that they now become unemployed. Those sub-minimum wage workers that retain their jobs now earn a wage equal to their adjusted minimum wage.

These changes imply that the pool of household income of each household attached to a minimum wage workers either falls (in the case of the worker becoming unemployed) or increases (in the case of the workers retaining his/her job and earning a higher wage).[45] Under each simulation, therefore, a new per capita income variable can be calculated and various poverty, inequality and unemployment estimates are re-estimated and compared against the base in a comparative static fashion.

7.1.3. Sensitivity Analysis: Partial Equilibrium Model

As explained in section 4.2.3, three sets of additional experiment sets were conducted in order to test the sensitivity of the results in the 'basic' simulations in the partial equilibrium model. The basic simulation represents the default set up of the partial equilibrium model, where the predicted unemployment probabilities of sub-minimum wage workers that are further away from the minimum wage are weighted upwards. The first conducts the same experiment as in the basic scenario, only

44 The use of sample data as opposed to true population data such as a census reduces the accuracy of the employment loss scenarios. It is seldom possible to select exactly 74 129 workers, since individuals in the survey sample each have a sample weight ranging between 47 and 1757 (in the IES/LFS 2000 used here). The approach adopted here is to create a cumulative sampling weight variable and to use this in selecting the optimal number of sample observations so that the weighted number of people fired is as close as possible to the true number of people that have to be fired in each simulation. For example, if the weighted population size of first 208 sample observations selected to be fired in the agricultural sector is 74 121 (as happens to be the case), and the next ranked sample observation (the 209th observation) has a sample weight of 182.02, this last observation will not be added. This means that actual employment loss simulated here is slightly lower than the calculated employment effect as shown in Table 9.

45 Two income sharing models are considered by Fields and Kanbur (2007), namely a family sharing and a community sharing model. Essentially this model assumes perfect sharing of income at the household or family level, which seems an appropriate choice in the South African context. In the CGE model, however, the use of representative household groups implies that in that particular model framework we lean more towards a community sharing model.

now with ‘unweighted’ unemployment probabilities. The second and third simulations assume that informal sector employers do not comply with the stipulated minimum wage, i.e. only sub-minimum wage workers classified as formal sector employees will earn the higher minimum wage in these simulations. These two simulation sets are also conducted first using the weighted unemployment probabilities and then the ‘unweighted’ probabilities.

Table 12 shows the distribution of job losses and net income gains for the three sensitivity analyses. We also include the results from the original scenario for ease of comparison (‘basic’). The coloured bars in the cells of Table 12 are embedded frequency graphics. In the basic scenario with ‘unweighted’ probabilities we notice more of a bias against lower-middle income workers than against the poor as far as job losses are concerned. Workers living in poor households generally earn lower wages, and hence are more likely to be further away from the minimum wage. This implies that poor workers have higher average weight factors (γ). To illustrate, ultra-poor workers have an average weight of $\gamma = 3.8$, compared to 2.5 for poor workers and around 2 for workers in the remaining income groups. Removing the weight factor means that job losses are no longer biased against poor workers, but more so towards lower-middle income workers. Interestingly, the ‘unweighted’ unemployment probabilities of labour force participants in ultra poor, poor and lower-middle income groups (0.54, 0.48 and 0.41 respectively) would still suggest that job losses should be biased against the poor, although this is not the case. This can be explained by the fact that there are complex interactions between household size, earnings levels, unemployment probabilities and the number of employed people in each household group. Hence the outcome is not necessarily easily explained by only comparing unemployment probabilities of workers in a household income group.

Job losses in the first low compliance scenario appear to be fairly similarly distributed across household income groups compared to the first basic scenario, although job losses are about 50 per cent lower. By assumption only formal sector workers receive the higher minimum wage and hence are also vulnerable to losing their jobs. When looking at the distribution of formal sector workers across household income groups it is evident that they are less likely to be attached to poor or ultra-poor households than their informal counterparts, mainly due to the better remuneration earned in the formal sector.[46] Hence we expect to see more job losses among the lower middle-income workers. However, as before, the weights applied to the unemployment probabilities significantly increases poor and ultra poor workers’ chances of being fired, even where only formal sector workers are covered (the average weights in the formal sector are similar to the overall weights by income group reported above). Thus, as can be seen from Table 12, job losses in this scenario are biased against lower income workers, especially at lower elasticity values.

46 About 41 per cent of formal sub-minimum wage workers are in poor or ultra poor households, compared to 55 per cent of informal sub-minimum wage workers.

The final simulation, a repeat of the low compliance simulation only now with 'unweighted' unemployment probabilities, yields, as expected, a similar job loss distribution as in the first sensitivity analysis. Thus, when the weights are removed, the bias against workers that are far away from the minimum wage and typically live in ultra poor or poor households is removed.

Table 12: Sensitivity Analysis: Distribution of Job Losses and Net Income Gains

	Distribution of job losses				Distribution of (net) aditional wage income (R millions)			
	η = 0.2	η = 0.5	η = 0.8	η = 1.0	η = 0.2	η = 0.5	η = 0.8	η = 1.0
Weighted unemployment probability (basic)								
Ultra poor	40,817	83,269	120,513	137,968	1,690	1,194	823	655
Poor	28,716	84,736	138,761	170,132	3,228	2,519	1,859	1,503
Low-mid inc	21,061	63,713	112,281	154,890	3,846	3,211	2,530	1,958
Upp-mid inc	5,858	15,842	27,181	34,776	1,463	1,276	1,083	947
High income	2,059	2,668	4,535	5,374	154	145	129	114
Total	*98,511*	*250,228*	*403,271*	*503,140*	*10,381*	*8,345*	*6,424*	*5,177*
Unweighted unemployment probability								
Ultra poor	21,819	50,606	65,842	77,220	1,933	1,635	1,475	1,350
Poor	30,784	77,305	123,023	146,629	3,250	2,740	2,215	1,930
Low-mid inc	32,557	90,052	155,395	205,844	3,755	3,013	2,167	1,531
Upp-mid inc	12,519	29,267	51,910	66,128	1,379	1,107	777	570
High income	985	2,020	7,415	8,241	176	166	107	97
Total	*98,664*	*249,250*	*403,585*	*504,062*	*10,493*	*8,661*	*6,741*	*5,478*
Low compliance with weighted probability								
Ultra poor	19,677	43,949	55,853	67,210	860	545	421	295
Poor	14,667	44,167	76,625	92,016	2,164	1,751	1,324	1,112
Low-mid inc	9,519	29,903	55,492	78,020	2,634	2,295	1,926	1,584
Upp-mid inc	5,010	9,714	17,087	20,271	1,064	965	828	777
High income	675	1,283	2,407	3,122	119	110	100	87
Total	*49,548*	*129,016*	*207,464*	*260,639*	*6,841*	*5,666*	*4,599*	*3,855*
Low compliance with unweighted probability								
Ultra poor	11,358	24,991	35,179	38,801	980	818	707	665
Poor	15,466	39,856	61,703	76,501	2,154	1,848	1,589	1,422
Low-mid inc	18,567	50,587	81,241	108,255	2,540	2,079	1,656	1,296
Upp-mid inc	4,507	11,865	26,858	32,781	1,088	958	697	609
High income	545	1,234	2,228	3,651	124	113	107	83
Total	*50,443*	*128,533*	*207,209*	*259,989*	*6,886*	*5,816*	*4,756*	*4,075*

Source: Partial equilibrium model results

The right-hand side of Table 12 shows how net income gains under a minimum wage scenario are distributed across household groups. As before, net income transfers are always positive, thus implying that income gains under minimum wages are likely to offset the negative effects of income losses associated with job losses, at least in this partial analysis. The first set of results in Table 12 is a repeat of the results from Table 18 before, followed by results for the three sensitivity analyses. For both the full compliance and low compliance results, the 'unweighted' probabilities cause the biggest net gain to shift from lower-middle income households to poor households. Ultra-poor households also gain relatively more than under the scenarios where weighted probabilities are used. These results are consistent with our expectations.

We next turn to some poverty results that are included in Table 13. A detailed discussion of these results is excluded, although two general conclusions are listed below the table.

Table 13: Sensitivity Analysis: Comparison of Poverty Measures

	P_0				P_1				P_2			
	Basic	Un-weighted	Low compl.	Low compl. un-weighted	Basic	Un-weighted	Low compl.	Low compl. un-weighted	Basic	Un-weighted	Low compl.	Low compl. un-weighted
All households - Ultra poverty measures												
Base	0.265	0.265	0.265	0.265	0.099	0.099	0.099	0.099	0.050	0.050	0.050	0.050
η = 0.0	0.236	0.236	0.250	0.250	0.087	0.087	0.093	0.093	0.044	0.044	0.047	0.047
η = 0.2	0.241	0.240	0.252	0.252	0.090	0.089	0.095	0.095	0.046	0.045	0.048	0.048
η = 0.5	0.246	0.246	0.256	0.256	0.093	0.093	0.097	0.097	0.048	0.048	0.050	0.050
η = 0.8	0.252	0.250	0.259	0.259	0.097	0.095	0.099	0.098	0.052	0.050	0.051	0.051
η = 1.0	0.256	0.253	0.262	0.260	0.100	0.097	0.100	0.099	0.053	0.051	0.052	0.051
All households - Standard poverty measures												
Base	0.513	0.513	0.513	0.513	0.262	0.262	0.262	0.262	0.164	0.164	0.164	0.164
η = 0.0	0.484	0.484	0.494	0.494	0.240	0.240	0.249	0.249	0.147	0.147	0.155	0.155
η = 0.2	0.487	0.488	0.496	0.496	0.243	0.243	0.251	0.251	0.150	0.150	0.156	0.156
η = 0.5	0.493	0.492	0.499	0.499	0.248	0.247	0.254	0.253	0.154	0.154	0.159	0.159
η = 0.8	0.498	0.498	0.502	0.501	0.253	0.251	0.256	0.256	0.159	0.157	0.161	0.160
η = 1.0	0.502	0.501	0.504	0.503	0.256	0.253	0.258	0.257	0.161	0.159	0.163	0.161
Households below minimum wage - Ultra poverty measures												
Base	0.278	0.278	0.278	0.278	0.096	0.096	0.096	0.096	0.047	0.047	0.047	0.047
η = 0.0	0.111	0.111	0.190	0.190	0.029	0.029	0.064	0.064	0.011	0.011	0.031	0.031
η = 0.2	0.137	0.135	0.204	0.204	0.043	0.041	0.072	0.072	0.021	0.020	0.037	0.036
η = 0.5	0.168	0.166	0.223	0.224	0.064	0.061	0.086	0.083	0.036	0.034	0.047	0.045
η = 0.8	0.205	0.191	0.242	0.240	0.088	0.074	0.096	0.093	0.055	0.044	0.054	0.051
η = 1.0	0.227	0.209	0.258	0.249	0.101	0.084	0.103	0.097	0.063	0.050	0.059	0.054
Households below minimum wage - Poverty measures												
Base	0.616	0.616	0.616	0.616	0.297	0.297	0.297	0.297	0.176	0.176	0.176	0.176
η = 0.0	0.451	0.451	0.507	0.507	0.165	0.165	0.219	0.219	0.082	0.082	0.125	0.125
η = 0.2	0.469	0.473	0.518	0.521	0.185	0.184	0.230	0.230	0.098	0.097	0.134	0.134
η = 0.5	0.502	0.497	0.535	0.534	0.213	0.209	0.247	0.245	0.122	0.118	0.149	0.146
η = 0.8	0.531	0.527	0.552	0.548	0.243	0.232	0.262	0.258	0.148	0.136	0.161	0.157
η = 1.0	0.551	0.545	0.564	0.558	0.260	0.245	0.272	0.265	0.162	0.146	0.170	0.163

Source: Partial equilibrium model results

- The poverty reducing effect of minimum wages is sensitive to assumption about the extent to which employers comply with the regulations. Under the low compliance scenario the reduction in poverty rates is generally lower. This result is expected since, as shown in Table 12, the net income transfer is significantly higher under the full compliance scenario. The difference between the full compliance and low compliance scenarios is more evident when comparing poverty rates of people in sub-minimum wage households.

- The poverty effects of minimum wages appear to be insensitive to whether weighted or 'unweighted' unemployment probabilities are used, despite the fact that net income gains are distributed differently under the two scenarios. This effect does not influence the poverty headcount rate to any visible extent, but can be picked up in the estimates for P_1 and P_2. Statistically speaking, however, it has to be concluded that differences between the poverty effects under scenarios using weighted or 'unweighted' probabilities, are insignificant.

7.2. General Equilibrium Model: Technical Notes

7.2.1. CGE Models

The STAGE model used in this study is a member of the class of single country CGE models that are descendants of the approach to CGE modelling described by Dervis et al. (1982). The model adopts the SAM approach to modelling (see Pyatt, 1998). CGE models combine the productive sectors or activities with commodity and factor markets, and also draw linkages between these markets, domestic institutions (households, government and incorporated business enterprises) and the rest of the world. A CGE model can be seen as an extension to input-output (IO) or SAM-multiplier models. The main differences are the introduction of flexible prices and a variety of substitution mechanisms that allow for a more realistic representation of economic behaviour in response to relative price changes. These features of the model ensure that economic multipliers are more in line with expectation than those found in fixed price multiplier models.

CGE models are further unique in that they preserve features found in macroeconomic models (for example, all the macro-economic balances are maintained) but the behaviour of micro-agents in the same model is based on neoclassical microeconomic consumption and production theory. Under the assumption of well-functioning markets and rationality, agents optimise behaviour subject to various constraints; for example, households (or consumers) maximise utility subject to prices and a budget constraints, while producers (or activities) maximise profits subject to a production technology constraint. Equilibrium is reached when supply equals demand in all the commodity and factor markets simultaneously, subject to various macroeconomic constraints: aggregate demand equals aggregate supply, total investment equals total savings, government and household budgets balance (revenue or income equals expenditure plus savings or deficit), and the foreign account is also balanced (balance of payments). Full details of the model is documented in PROVIDE (2005).

7.2.2. A South African Social Accounting Matrix

When economic agents are involved in transactions with each other financial resources exchange hands. A SAM has two principle objectives: firstly, to organise information about the economic and social structure of an economy (e.g. a region or a country) in a specific period (usually one calendar year), and secondly, to provide the statistical basis for the creation of plausible economic models (King, 1985:17). A SAM can therefore be described as a "*comprehensive, economy-wide data framework*" (Löfgren et al., 2001:2). A SAM is made up of a multitude of accounts representing agents (or markets) that are involved in economic transactions. The entries in a SAM show both the values and direction of resource flows associated with transactions. Since all transactions that take place in the economy are accounted for, a SAM can be described as a *complete* database of economic transactions.

A SAM can also be described as consistent in the sense that it adheres to the principles of economic accounting.

> *"Economic accounting is based on a fundamental principle of economics: For every income or receipt there is a corresponding expenditure or outlay. This principle underlies the double-entry accounting procedure that makes up the macroeconomic accounts of any country." (Reinert and Roland-Holst, 1997:95)*

A SAM is set up as a square matrix with the same row and column headings, where each row/column represents an economic agent or market in the economy. These include accounts representing productive activities, commodity markets, factor markets, as well as domestic institutions (households, government and incorporated business enterprises) and foreign institutions (rest of the world accounts). There are also accounts representing savings-investment flows in the economy. Entries along column accounts in the SAM represent payments or expenditures, while incomes are accounted for in the row. Thus, the row totals represent total income earned by an account while the column total represents total payments. An extension of the economic accounting principle is that total income has to match total expenditure, and hence row totals and column totals of SAM accounts have to match. It is for this reason that a SAM is considered a *consistent* data framework.

The study uses the PROVIDE SAM for 2000. The SAM is used to calibrate the CGE model. This means that all model parameters not related to substitution mechanisms, i.e. the various share parameters as well as shift parameters used in production functions, are calculated on the basis of the data in the SAM. The SAM also represents the base of the model. All CGE simulation results are compared against the base (SAM) in a comparative static fashion.

Various account types in the original PROVIDE SAM are aggregated to reduce the number of accounts in the SAM used for this study.[47] Table 14 shows the SAM accounts used in the study. This SAM contains 20 commodity accounts. Commodities are either imported or produced domestically by the 22 economic sectors, represented by activity accounts in the SAM. A one one-to-one mapping between the activity and commodity accounts is not required in the SAM since the CGE model allows for multi-product industries (the same sector produces different types of commodities) or for the same commodities produced by different sectors. An example of the latter is agriculture, forestry and fishing commodities (*cagric*) which are produced by either the agricultural (*aagric*), forestry (*aforest*) or fishing industry (*afish*).[48] Trade and transport margins, i.e. the cost of transporting goods from the factory gate to commodity markets, are captured in the margins account.

47 It is customary to select an account disaggregation that is suitable for each particular study. Having fewer accounts simplifies the interpretation of results, but enough detail should be maintained in order to properly evaluate the impact of shocks. In the current study, for example, care is taken to ensure that the sectors that are affected most by minimum wages are kept as separate accounts, while many of the manufacturing accounts, for example, are aggregated.

48 This disaggregation of the original agriculture, forestry and fishing industry is required in order evaluate the forestry and agricultural sector sectoral determinations separately.

Table 14: SAM Accounts

SAM Code	Account Description
	Commodities
cagric	Agric forestry & fishing
cmine	Minerals and mining products
cfood	Food products
cbevs	Beverages and tobacco
ctext	Textile products
clwpap	Leather wood and paper products
cpetro	Petroleum products
cfert	Fertilisers and pesticides
cpharm	Pharmaceutical and other chemicals
cnonmet	Non metallic products
cmetprod	Metal products
cmach	Machinery equipment and other
cutil	Electricity and water
cconst	Construction and building
ctrad	Trade services
caccom	Accommodation
ctrans	Transport & communication
cfinbus	Financial and business services
csocial	Govt social and other services
cdomes	Domestic workers
	Trade Margins
marg	Margins
	Activities
aagric	Agriculture
aforest	Forestry
afish	Fishing
amine	Minerals and mining
afood	Food products
abevs	Beverages and tobacco
atext	Textiles
alwpap	Leather Wood and Paper
apetro	Petroleum
afert	Fertilisers and pesticides
apharm	Pharmaceuticals and other chemicals
anonmet	Non metallics
ametals	Metals
amach	Machinery equipment and other
autil	Electricity and water
aconst	Construction and Building
atrad	Trade services
aaccom	Accommodation
atrans	Transport & communication
afinbus	Financial and business services
asocial	Govt social and other services
adomes	Domestic services

SAM Code	Account Description
	Representative Households
hufafrup	Urb formal African Ultra poor
hufafrpr	Urb formal African Poor
hufafrlm	Urb formal African Lwr inc
hufafrum	Urb formal African Upp inc
hufafrhi	Urb formal African High inc
hufcoaup	Urb formal Col_Asi Ultra poor
hufcoapr	Urb formal Col_Asi Poor
hufcoalm	Urb formal Col_Asi Lwr inc
hufcoaum	Urb formal Col_Asi Upp inc
hufcoahi	Urb formal Col_Asi High inc
hufwhilm	Urb formal White Lwr inc
hufwhium	Urb formal White Upp inc
hufwhihi	Urb formal White High inc
huiafrup	Urb informal African Ultra poor
huiafrpr	Urb informal African Poor
huiafrlm	Urb informal African Lwr inc
huiafrum	Urb informal African Upp inc
huiafrhi	Urb informal African High inc
hrcafrup	Rur comm African Ultra poor
hrcafrpr	Rur comm African Poor
hrcafrlm	Rur comm African Lwr inc
hrcafrum	Rur comm African Upp inc
hrcafrhi	Rur comm African High inc
hrccoaup	Rur comm Col_Asi Ultra poor
hrccoapr	Rur comm Col_Asi Poor
hrccoalm	Rur comm Col_Asi Lwr inc
hrccoaum	Rur comm Col_Asi Upp inc
hrccoahi	Rur comm Col_Asi High inc
hrcwhilm	Rur comm White Lwr inc
hrcwhium	Rur comm White Upp inc
hrcwhihi	Rur comm White High inc
hhlafrup	Ex-hland African Ultra poor
hhlafrpr	Ex-hland African Poor
hhlafrlm	Ex-hland African Lwr inc
hhlafrum	Ex-hland African Upp inc
hhlafrhi	Ex-hland African High inc
	Government and Tax Accounts
SALTAX	Sales taxes
INDREF	Production rebates
DIRTAX	Direct income taxes
GOVT	Government
	Enterprises
ENT	Enterprises

…Table 14 continued…

SAM Code	Account Description	SAM Code	Account Description
Factors of production		**Savings-investment accounts**	
fgos	GOS	KAP	Savings
fland	Land	DSTOC	Stock Changes
fmget	Male None to GET	**Rest of the World Account**	
ffget	Female None to GET	ROW	Rest of World
fmmat	Male Matric	**Account Totals**	
ffmat	Female Matric	TOTAL	Account Totals
fmter	Male Tertiary		
ffter	Female Tertiary		

Source: South African SAM (PROVIDE, 2007).

Activities employ factors of production in order to add value to intermediate inputs consumed as part of the production process. The SAM contains six labour categories disaggregated by education level and gender, as well as accounts for capital and land respectively. There are 36 representative household groups in the SAM, disaggregated by an indicator of location (urban formal, urban informal, rural commercial and rural former homelands)[49], race (African, Coloured and Asian, and White), and an indicator of per capita income level of the household (groups are formed around the 25th, 50th, 75th, and 90th percentiles of per capita household income).

The SAM also contains numerous government tax accounts that capture information about different types of taxes collected by government or (production) subsidies paid by them. A core government account records all aggregate tax revenues as well as payments made by government, including transfers to other domestic institutions (households and enterprises) or government expenditure on service delivery. The savings-investment accounts capture information on savings activities of domestic institutions (this includes the government deficit or surplus), as well as investment expenditures and capital stock changes. Finally, the rest of the world accounts capture all resource flows relating international trade and capital flows.

7.2.3. Model closures

CGE models are set up with a range of flexible macro adjustment or closure rules. While, importantly, these closures ensure that a solution can be found for the complex system of simultaneous equations (i.e. it ensures that the number of variables equal the number of equations), they also define the way in which several of the macro-equilibriums are reached. Therefore, subjective beliefs or assumptions

49 These location groups are based a similar method used to define households' locations in the Time Use Survey of 2000 (SSA, 2002). The 'formal' and 'informal' in urban areas refer to the residential areas, where informal includes squatter camps and informal housing settlements. By assumption only Africans live in informal urban areas due to low 'representativity' of other race groups in these areas. Rural areas are divided into 'commercial' and 'ex-homelands'. Commercial refers to rural areas (including small towns) where commercial agricultural activities dominate the economy. The remainder of rural areas mainly fall under the former homelands, hence the location description. Again, only African households are assumed to live in ex-homelands. For detailed description of and motivation for the household groups included in the SAM, see PROVIDE (2007).

about how the economic system operates crucially determine outcomes. There are four main closure settings that need to be considered:

- The *foreign exchange market* is cleared under the assumption of a flexible exchange rate regime, in line with current practices of the South African Reserve Bank. The alternative closure (not selected here) is a fixed exchange rate and a flexible external balance.

- The *capital account***,** which records all savings and investment related transactions, can be closed in a variety of ways, ultimately ensuring that investment equals savings in the economy. The investment level can be fixed, which implies that institutions (government, households and enterprises) generate enough savings to finance investments (investment-driven closure). This is typically achieved by allowing average savings rates of households and enterprises to vary. Alternatively, under a savings-driven closure the investment level is determined by the level of savings in the economy, with average savings rates of households and enterprises fixed. A further option, often regarded as a more balanced approach, is allowing the share of investment expenditure in total final domestic demand remains constant. This latter closure is selected here.

- The *government account* is either closed by variations in the level of government borrowing or savings, i.e. the size of the budget deficit or surplus, whereby all tax rates remain constant, or by allowing tax rates to vary in order to generate a level of government revenue sufficient to maintain the base-level budget deficit or surplus. The closure selected here allows for a flexible government budget balance since the budget is largely unaffected by a minimum wage policy. The only impact is indirectly via tax revenues, which fluctuate as the economy expands or shrinks. On the expenditure side, however, we assume that government expenditure is fixed relative to the level of domestic absorption (as with the savings-investment closure), hence as the economy shrinks (for example), government's expenditure levels also drop to compensate to some extent for the expected drop in revenues.

- The *factor market* closure typically involves different treatments for different factors. In the current simulations of minimum wages the factor market closures are crucial.

    - Labour is subdivided into skilled (tertiary qualification) and unskilled (Grade 12 or lower) groups. A valid assumption for the South African labour market is that skilled workers are fully employed and face flexible wages. Skilled wages therefore adjust to ensure full employment. For unskilled workers, however, wages are fixed, signifying the fact that unskilled workers are unemployed (excess capacity) and are willing to work at prevailing wages. In the simulations these fixed wages are adjusted upwards to reflect the introduction at minimum wages, and employment levels (rather than wage levels) will adjust to equilibrium demand and supply in each of the sectors in the economy. All labour categories are mobile between sectors.

- Under a short run closure capital stock is assumed to be immobile (or activity-specific), reflecting the assumption in production theory that capital stock levels (plant, machinery and equipment) can only be adjusted in the long run. Under a long run closure capital stock is mobile, with capital being attracted to those sectors where the return to capital is the highest.[50] In both the short run and long run scenarios the total capital stock employed in the economy is fixed, representing fixed production capacity in this comparative static model.
- The factor land is only employed in the agricultural sector. Land is assumed to be fully employed and immobile, i.e. it is only employed in the agricultural sector.

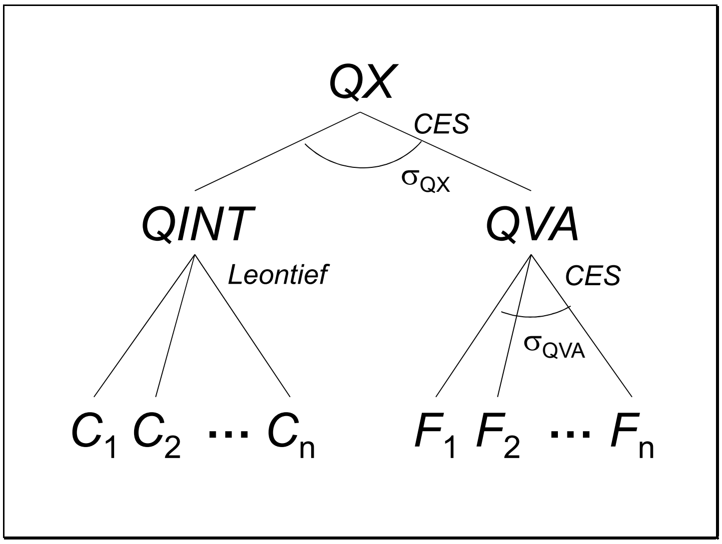
All prices in a CGE model are expressed relative to the *numéraire*, a fixed price (or price index) in the model, usually the consumer price index (CPI). This ensures that all the value results are expressed in real terms.

7.2.4. A Note on the Elasticity of Substitution Parameters in the CGE Model

Most model parameters in a CGE model are calibrated using the SAM data. These model parameters determine relationships and shares between agents and aggregates in the model. However, several behavioural relationships are also specified in CGE models, and typically these rely on the specification of model elasticities. Most important in the context of this study are the elasticities that govern the substitutability between different types of labour in the production function. A two-tier production structure is used in the CGE model, which is similar to what was shown earlier in Figure 2. A generalised version of this production structure is shown in Figure 19 below. At the top-level of the production structure aggregate primary inputs (or value added, denoted by *QVA*) and aggregate intermediate inputs (*QINT*) are combined in a Constant Elasticity of Substitution (CES) function to form final output (*QX*). At the second level, primary inputs ($F_1, F_2,\ldots,F_n$) are combined in a CES production function to form *QVA*, while various commodities (C_1, $C_2,\ldots,C_n$) used as intermediate inputs are combined in a Leontief function to form 'aggregate' intermediate input, *QINT*.

50 The mobility of capital stock should not be seen as the physical movement of production equipment and machinery from one industry to another over time. There is very little evidence that such movements take place, while such an assumption would disregard the fact that physical capital stock is often very industry-specific. Rather, capital stock mobility should be viewed in the context of capital being run down through depreciation in one sector, while funds coming from depreciation is used to finance capital formation in a new sector (Islam, 1999). The long run is therefore a period that is sufficiently lengthy for this process to happen.

Figure 19: Two-tier Production Structure in a CGE Model



The degree of substitutability between different factors of production (the six labour categories, capital and land as listed in Table 14), denoted in the figure above by σ_{QVA} will to a large extent determine the results in our simulations. Previously it was also shown that the own price partial wage-employment elasticity (η_L) for a given factor of production is related to the elasticity of substitution (σ) (see equation [2]).

Partial equilibrium wage elasticities are not specified in CGE models; rather sectoral elasticities of substitution are defined. Therefore, in order to arrive from partial elasticities used in the partial model (see for example Table 9 and related discussions) to sectoral elasticities used in CGE models, each factor's share in total value added needs to be known. This is fortunately easily calculated using the SAM data, and hence it is possible to ensure that the direct employment loss resulting from minimum wages modelled in the CGE model is consistent with that of the partial model. Of course, this does not mean to say that we should see a similar employment change. CGE models also capture all indirect effects, and any change in factor and household incomes will lead to changes in household consumption demand, thus causing employment demand to also be affected indirectly (to name but one of the possible indirect effects). Table 15 reports the wages shares (τ), the partial elasticities from the partial model (η_L) and EOS (σ_{QVA}) specified for the CGE model simulations.

Table 15: Sectoral Elasticities of Substitution for Value Added Production Function

	Average factor share of value added (τ)	*Sectoral elasticities for a -0.7 national elasticity (η_L) (*)*	*Equivalent EOS (σ_{QVA}) (**)*
Agriculture	0.067	0.340	0.364
Forestry	0.031	0.340	0.351
Fishing	0.091	0.340	0.374
Minerals and mining	0.063	0.200	0.214
Food products	0.085	0.500	0.546
Beverages and tobacco	0.053	0.500	0.528
Textiles	0.136	0.500	0.579
Leather Wood and Paper	0.096	0.500	0.553
Petroleum	0.039	0.500	0.520
Fertilisers and pesticides	0.031	0.500	0.516
Pharmaceuticals and other chemicals	0.057	0.500	0.530
Non metallics	0.086	0.500	0.547
Metals	0.069	0.500	0.537
Machinery equipment and other	0.066	0.500	0.535
Electricity and water	0.050	0.600	0.632
Construction and Building	0.120	0.600	0.682
Trade services	0.091	0.600	0.660
Accommodation	0.116	0.600	0.679
Transport and communication	0.069	0.600	0.645
Financial and business services	0.073	0.600	0.647
Government, social and other services	0.139	0.600	0.697
Domestic services	0.167	0.339	0.407

Notes: (*) As used in partial model. See Table 9. (**) Used in CGE model.

Source: Author's calculations.

7.2.5. Modelling Productivity Gains in CGE Models

Production efficiency in a CGE modelling context can be understood in a number of ways (see Pauw et al., 2007b for a detailed explanation). Previously in Figure 19 the two-tier production structure typically used in standard CGE models was shown. If efficiency occurs at the top-level of this function it entails a process where firms become more efficient at combining aggregate intermediate inputs and value-added in the production process. Production efficiency can also occur at the second level in the QVA in instances where firms manage to combine factors of production in a more efficient way. Another type of efficiency can occur when firms use intermediate inputs more efficiently, i.e. less of a certain input (or all inputs together) is needed per unit of output. An example of this is increased energy efficiency in production that enables producers to use less electricity per unit of output. Finally, specific factors of production such as capital, labour or land can be utilised more efficiently. In a labour market context this latter type of efficiency is called labour productivity.

7.2.6. The National CPI and Household-Specific CPIs: Adjusting Per Capita Incomes for Poverty Analysis

The national consumer price index or CPI is the numeraire in the CGE model. This means the CPI is fixed and all other prices are expressed relative to the CPI. Typically under such a closure rule the value of the CPI is arbitrarily set to one. This means that all income and expenditure flow results in the CGE model are already expressed in real terms, since dividing by one does not change the nominal value. The CPI is, however, a 'national average' CPI. By adjusting nominal values in this way (and this is generally how it is done in economics) we ignore the fact that individual household groups in the model face unique price changes given their distinct consumption bundles.

Poorer households, for example, spend a greater proportion of their income on agricultural produce; hence the minimum wage in agriculture may cause their particular bundle to become relatively more expensive relative to other consumers' bundles that are less food-intensive. Similarly, 'domestic services' is a luxury service used mainly by higher-income households. It is apparent that different households will be affected in different ways by minimum wage policies as far consumption costs and hence true poverty levels are concerned. Consequently, real income values in the CGE model are further adjusted by the household-specific CPI, a model variable that takes into account household-specific price bundles.[51]

Therefore, in order to obtain the income measure used for poverty analyses in this study, each household's nominal income (Y_h) as per the CGE model results is adjusted by the inflation rate (*dCPI*) as well as the household-specific inflation rate ($dCPI_h$). The inflation rate is unchanged (zero) since the CPI is the numeraire, and hence the equation reduces to:

$$Y_h^* = Y_h(1 + dCPI_h) \qquad [10]$$

Since we assume that each individual household that forms part of a particular household group is affected in the same way, household-level incomes in the underlying survey data are adjusted in the same way. The same applies to individual members of households, i.e. per capita incomes are also adjusted in the exact same way since we assume perfect income sharing within the household.

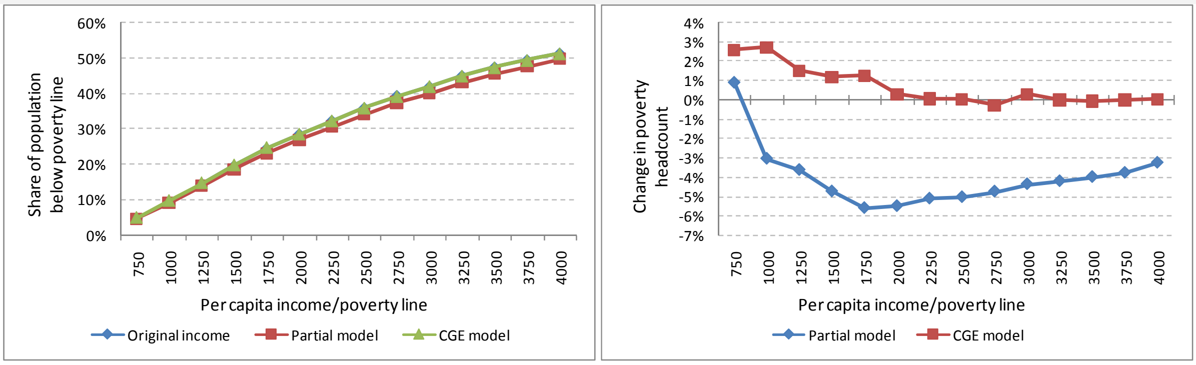
51 Since these household-specific CPIs are also expressed relative to the numeraire, and since households change their consumption bundles in response to price changes, changes in household-specific CPIs are generally quite small. In these particular analyses they range between -0.4 and 1.4 per cent.

7.2.7. Sensitivity Analysis: General Equilibrium Model

a) Poverty Results and the Choice of Poverty Line

The CGE poverty results were found to be largely insignificant, thus compelling us to conclude that minimum wages have no meaningful impact on poverty. In poverty analysis the choice of poverty line may sometimes be important in determining the outcome. The use of one or two poverty lines means that any significant movement at some other point in the income distribution is not picked up by simple headcount poverty measures. As a way of testing the robustness of our results we look at poverty rates at a variety of poverty lines. The left-hand panel of Figure 20 compares poverty rates at poverty lines ranging from R750 to R4 000 per capita per annum. The three lines in the graph represent the poverty rates in the base (original income levels) and the outcomes under the partial and CGE models for a wage elasticity of $\eta = 0.7$.

Figure 20: Cumulative Distributions of Per Capita Income and Poverty Changes



Source: CGE and partial equilibrium model results

Poverty results under the partial model are marginally better for reasons discussed, while in the CGE model the poverty rates remain virtually unchanged at all poverty lines considered. The right-hand panel shows the percentage difference between the headcount ratios in the partial and CGE model results and the base.[52] The CGE results tend to suggest that poverty rates increase at low poverty lines, while they remain close to zero at higher poverty lines. However, none of these changes in poverty were statistically significant. This leads us to conclude that the poverty effects in the CGE model are similar (and statistically insignificant) at all poverty lines between R750 and R4 000.[53]

b) Increasing the Number of Factor and Household Groups in the Model

The above results are generated in CGE model with only six types of labour and 36 household groups. While this already presents significantly more detail about the functional distribution of income in the

52 These are percentage changes in shares, i.e. if the poverty rate is 10 per cent, a 5 per cent increase in the poverty rate means the rate increases to 10.5 per cent. None of the changes shown in the figure are statistically significant.

53 This result is related to the assumption that each individual member of a household group is affected similarly, irrespective of where that individual household lies in the income distribution.

economy than many other SAMs available in the South Africa, a lot of the micro-level effects that we were able to study in the partial model is lost through aggregation of household and factor types. One of the older versions of the PROVIDE SAM (PROVIDE, 2006) allows for a much richer specification of households and factors. In this version there are 162 representative household groups, disaggregated by province, race, and gender and education of the head of the household. Where data allowed for it, some of these sub-groups were further disaggregated to identify households in former homelands as well as ‘agricultural households’, broadly defined as any household that derives a significant portion of its income from formal or informal agricultural activities. This SAM also has 88 labour groups, disaggregated by province, race and occupation type.

A 162x88 functional distribution matrix necessarily contains much richer information than a 36x6 matrix, and hence using this SAM provides more precise information of the micro-level effects. The same simulations were therefore run using this highly disaggregated SAM. Interestingly though, results on poverty changes were shown to still be statistically insignificant at a 95 per cent confidence interval, despite the use of a significantly refined functional distribution matrix in the SAM.[54] This suggests that our earlier results are fairly robust. Indirect effects, and specifically prices and demand responses to minimum wages, counteract the initial benefits that are transferred to households in the form of minimum wages.

54 Results are omitted here for space reasons.

7.3. Additional Tables and Figures

Table 16: Wage-Employment Elasticities for Black Formal Sector Workers by Economic Sector

Economic Sector		Long Run	Impact
Manufacturing	Beverages	-0.184	-0.095
	Tobacco	-0.057	-0.018
	Textiles	-0.984	-0.346
	Wearing apparel	-2.508	-0.709
	Wood products	-0.196	-0.603
	Furniture	-0.364	-0.139
	Chemicals	-1.166	-0.344
	Rubber and plastic	-0.243	-0.153
	Non-metals and minerals	-2.929	-0.451
	Basic metals	-0.758	-0.166
	Fabricated metals	-0.466	-0.175
	Non-elec machinery	-0.632	-0.408
	Transport equip	-0.440	-0.201
Other sectors	Mining	-0.146	-0.118
	Construction	-0.554	-0.360
	Service	-0.948	-0.147
National average		***-0.709***	***-0.156***

Source: Fallon and Lucas (1998)

Table 17: Minimum Wages Sectoral Determinations

Sectoral Determination	Occupation/Other Specifications	Area (*)	Minimum Wage in Simulations (Rand, 2000 prices)	Latest Published Minimum wage	Year of Publication
Retail and Wholesale Trade	Managers	Area A	R 2,081	R 2,664	2005
	Managers	Area B	R 1,678	R 2,147	2005
	Managers	Area C	R 1,435	R 1,837	2005
	Clerks	Area A	R 1,430	R 1,831	2005
	Clerks	Area B	R 1,152	R 1,475	2005
	Clerks	Area C	R 1,042	R 1,334	2005
	Sales assistant	Area A	R 1,694	R 2,168	2005
	Sales assistant	Area B	R 1,376	R 1,762	2005
	Sales assistant	Area C	R 1,250	R 1,600	2005
	Shop assistant	Area A	R 1,339	R 1,714	2005
	Shop assistant	Area B	R 1,080	R 1,383	2005
	Shop assistant	Area C	R 976	R 1,249	2005
	Drivers	Area A	R 1,291	R 1,652	2005
	Drivers	Area B	R 1,024	R 1,311	2005
	Drivers	Area C	R 875	R 1,120	2005
	Forklift operators	Area A	R 1,217	R 1,557	2005
	Forklift operators	Area B	R 964	R 1,234	2005
	Forklift operators	Area C	R 800	R 1,024	2005
	Security guards	Area A	R 1,142	R 1,462	2005
	Security guards	Area B	R 1,087	R 1,391	2005
	Security guards	Area C	R 804	R 1,030	2005
Domestic Workers	All Domestic Workers	Area A	R 727	R 930	2005
	All Domestic Workers	Area B & C	R 590	R 755	2005
Farm Workers	All Farm Workers	Area A	R 742	R 994	2006
	All Farm Workers	Area B & C	R 660	R 885	2006
Forestry Workers	All Forestry Workers	No region specified	R 624	R 836	2007
Taxi Operators	Taxi Drivers	No region specified	R 1,055	R 1,350	2006
	Taxi Fare collector	No region specified	R 1,055	R 1,350	2006
Private Security Workers (‡)	All Security Workers	Area A (†)	R 1,439	R 1,756	2004
	All Security Workers	Area B (†)	R 1,326	R 1,618	2004
	All Security Workers	Area C (†)	R 1,197	R 1,460	2004
	All Security Workers	Area D (†)	R 1,124	R 1,371	2004
	All Security Workers	Area E (†)	R 1,001	R 1,221	2004
Hospitality Sector Workers	Small firm employees	No region specified	R 1,105	R 1,480	2007
	Medium to large firm employees	No region specified	R 1,231	R 1,650	2007
Contract Cleaners	All Contract Cleaners	Area A (§)	R 1,305	R 1,671	2005
	All Contract Cleaners	Area B (§)	R 1,176	R 1,505	2005
	All Contract Cleaners	Area C (§)	R 1,047	R 1,340	2005

Source: Department of Labour website and authors' calculations

Notes: (*) All areas labelled A, B and C are the same across the sectoral determinations, except: (†) the five private security workers regions, and (§) the three contract cleaner regions. (‡) Minimum wages are differentiated by the security officers' grade (qualification). Grades A to E are specified, but these cannot be identified in the LFS 2000:2, hence we use Grade C wages as the benchmark. We assume that security workers employed in the retail sector fall under the retail sectoral determination.

Table 18: Distribution of Base-Level Sub-Minimum Wage Workers, Simulated Job Losses and Simulated Income Gains across Household Income Groups

	Base / η = 0.0	η = 0.1	η = 0.2	η = 0.3	η = 0.4	η = 0.5	η = 0.6	η = 0.7	η = 0.8	η = 0.9	η = 1.0
	Distr of sub-min wage workers in base	Distribution of job losses in simulations									
Ultra poor	368,237	17,552	40,817	55,734	71,297	83,269	93,793	107,540	120,513	127,795	137,968
Poor	634,899	16,376	28,716	46,624	66,331	84,736	101,886	122,069	138,761	156,890	170,132
Low-mid inc	800,921	10,501	21,061	35,788	47,835	63,713	80,534	93,296	112,281	132,565	154,890
Upp-mid inc	298,077	1,880	5,858	9,057	11,927	15,842	20,465	23,422	27,181	30,303	34,776
High income	44,388	1,590	2,059	2,399	2,668	2,668	3,268	4,135	4,535	5,059	5,374
	2,146,522	*47,899*	*98,511*	*149,602*	*200,058*	*250,228*	*299,946*	*350,462*	*403,271*	*452,612*	*503,140*
	Distribution of (net) additional wage income (R millions)										
Ultra poor	2,200	1,978	1,690	1,510	1,330	1,194	1,094	960	823	752	655
Poor	3,596	3,377	3,228	3,001	2,749	2,519	2,317	2,064	1,859	1,647	1,503
Low-mid inc	4,175	4,018	3,846	3,602	3,458	3,211	2,962	2,805	2,530	2,262	1,958
Upp-mid inc	1,575	1,539	1,463	1,384	1,332	1,276	1,196	1,144	1,083	1,029	947
High income	192	164	154	149	145	145	144	136	129	121	114
Total	*11,738*	*11,077*	*10,382*	*9,645*	*9,013*	*8,345*	*7,713*	*7,109*	*6,423*	*5,811*	*5,178*

Source: Partial equilibrium model results

Table 19: Poverty Indices for Minimum Wage Simulations – All Individuals

	P_0			P_1			P_2		
	Estimate	95% conf interval		Estimate	95% conf interval		Estimate	95% conf interval	
All households - Ultra poverty measures									
Base	0.2651	0.2559	0.2742	0.0989	0.0946	0.1032	0.0502	0.0475	0.0529
η = 0.0	0.2360	0.2271	0.2450	0.0871	0.0830	0.0913	0.0440	0.0414	0.0466
η = 0.1	0.2379	0.2289	0.2469	0.0880	0.0839	0.0922	0.0446	0.0419	0.0472
η = 0.2	0.2406	0.2316	0.2496	0.0896	0.0854	0.0938	0.0457	0.0430	0.0483
η = 0.3	0.2423	0.2333	0.2514	0.0908	0.0866	0.0950	0.0466	0.0439	0.0493
η = 0.4	0.2443	0.2352	0.2533	0.0921	0.0878	0.0963	0.0475	0.0448	0.0502
η = 0.5	0.2460	0.2369	0.2550	0.0932	0.0890	0.0975	0.0484	0.0456	0.0511
η = 0.6	0.2479	0.2389	0.2570	0.0945	0.0902	0.0988	0.0494	0.0466	0.0522
η = 0.7	0.2502	0.2411	0.2593	0.0958	0.0915	0.1001	0.0502	0.0474	0.0531
η = 0.8	0.2524	0.2433	0.2615	0.0975	0.0931	0.1018	0.0515	0.0487	0.0544
η = 0.9	0.2543	0.2453	0.2634	0.0985	0.0941	0.1029	0.0522	0.0493	0.0551
η = 1.0	0.2562	0.2471	0.2653	0.0997	0.0953	0.1041	0.0531	0.0502	0.0560
All households – Standard poverty measures									
Base	0.5131	0.5021	0.5241	0.2625	0.2557	0.2693	0.1638	0.1587	0.1688
η = 0.0	0.4843	0.4733	0.4953	0.2396	0.2329	0.2463	0.1473	0.1423	0.1522
η = 0.1	0.4859	0.4749	0.4970	0.2411	0.2343	0.2478	0.1484	0.1435	0.1534
η = 0.2	0.4874	0.4764	0.4984	0.2430	0.2362	0.2497	0.1502	0.1452	0.1551
η = 0.3	0.4894	0.4783	0.5004	0.2447	0.2379	0.2514	0.1515	0.1465	0.1566
η = 0.4	0.4914	0.4804	0.5024	0.2465	0.2397	0.2532	0.1530	0.1480	0.1580
η = 0.5	0.4931	0.4822	0.5041	0.2480	0.2412	0.2547	0.1543	0.1493	0.1593
η = 0.6	0.4946	0.4837	0.5056	0.2496	0.2428	0.2563	0.1557	0.1506	0.1608
η = 0.7	0.4964	0.4854	0.5074	0.2514	0.2446	0.2582	0.1572	0.1521	0.1623
η = 0.8	0.4983	0.4873	0.5092	0.2531	0.2463	0.2599	0.1588	0.1537	0.1640
η = 0.9	0.5002	0.4892	0.5111	0.2547	0.2479	0.2615	0.1601	0.1550	0.1652
η = 1.0	0.5018	0.4908	0.5127	0.2561	0.2493	0.2629	0.1613	0.1562	0.1665

Source: Partial equilibrium model results

Table 20: Poverty Indices for Minimum Wage Simulations – People Living in Sub-Minimum Wage Households

	P_0			P_1			P_2		
	Estimate	95% conf interval		Estimate	95% conf interval		Estimate	95% conf interval	
Households below minimum wage - Ultra poverty measures									
Base	0.2775	0.2583	0.2968	0.0961	0.0875	0.1046	0.0469	0.0416	0.0522
η = 0.0	0.1110	0.0963	0.1258	0.0286	0.0237	0.0335	0.0111	0.0086	0.0135
η = 0.1	0.1216	0.1065	0.1366	0.0338	0.0286	0.0391	0.0145	0.0118	0.0173
η = 0.2	0.1372	0.1217	0.1528	0.0428	0.0369	0.0486	0.0208	0.0173	0.0243
η = 0.3	0.1473	0.1314	0.1632	0.0498	0.0434	0.0562	0.0263	0.0222	0.0304
η = 0.4	0.1584	0.1422	0.1746	0.0568	0.0500	0.0637	0.0313	0.0268	0.0358
η = 0.5	0.1680	0.1515	0.1844	0.0637	0.0565	0.0709	0.0364	0.0315	0.0412
η = 0.6	0.1793	0.1626	0.1961	0.0709	0.0631	0.0786	0.0421	0.0365	0.0477
η = 0.7	0.1925	0.1755	0.2094	0.0783	0.0702	0.0864	0.0470	0.0411	0.0529
η = 0.8	0.2050	0.1878	0.2221	0.0878	0.0791	0.0966	0.0546	0.0481	0.0611
η = 0.9	0.2161	0.1986	0.2337	0.0938	0.0848	0.1028	0.0585	0.0518	0.0652
η = 1.0	0.2267	0.2090	0.2444	0.1008	0.0916	0.1100	0.0634	0.0566	0.0703
Households below minimum wage – Standard poverty measures									
Base	0.6163	0.5968	0.6358	0.2968	0.2844	0.3092	0.1763	0.1668	0.1859
η = 0.0	0.4513	0.4305	0.4722	0.1654	0.1550	0.1758	0.0818	0.0749	0.0886
η = 0.1	0.4606	0.4397	0.4815	0.1739	0.1633	0.1845	0.0884	0.0814	0.0955
η = 0.2	0.4692	0.4483	0.4900	0.1848	0.1739	0.1958	0.0982	0.0907	0.1058
η = 0.3	0.4802	0.4592	0.5011	0.1945	0.1833	0.2057	0.1062	0.0983	0.1142
η = 0.4	0.4920	0.4712	0.5128	0.2049	0.1934	0.2163	0.1146	0.1063	0.1230
η = 0.5	0.5019	0.4816	0.5222	0.2135	0.2019	0.2250	0.1220	0.1134	0.1306
η = 0.6	0.5105	0.4904	0.5306	0.2226	0.2108	0.2344	0.1300	0.1211	0.1390
η = 0.7	0.5205	0.5004	0.5406	0.2332	0.2211	0.2452	0.1387	0.1295	0.1480
η = 0.8	0.5314	0.5114	0.5513	0.2429	0.2306	0.2553	0.1481	0.1384	0.1578
η = 0.9	0.5423	0.5225	0.5622	0.2520	0.2395	0.2645	0.1553	0.1453	0.1652
η = 1.0	0.5515	0.5317	0.5713	0.2600	0.2475	0.2726	0.1625	0.1524	0.1725

Source: Partial equilibrium model results

Table 21: Household Income Sources in the SAM

	Factor income					
	GOS/Land	Unskilled	Skilled	Total factor income	Total transfer income	Total income
African	14.5%	46.6%	19.8%	80.9%	19.1%	100.0%
Coloured and Asian	8.4%	50.6%	23.3%	82.3%	17.7%	100.0%
White	14.3%	22.0%	34.0%	70.3%	29.7%	100.0%
Urban formal	11.8%	34.1%	31.0%	77.0%	23.0%	100.0%
Urban informal	17.4%	67.8%	2.7%	87.8%	12.2%	100.0%
Rural commercial	20.5%	49.4%	9.2%	79.0%	21.0%	100.0%
Ex-homelands	20.4%	34.1%	12.3%	66.7%	33.3%	100.0%
Ultra-poor	9.7%	30.9%	0.1%	40.7%	59.3%	100.0%
Poor	12.7%	46.9%	1.0%	60.6%	39.4%	100.0%
Lower middle-income	14.3%	61.6%	4.0%	80.0%	20.0%	100.0%
Upper middle-income	11.6%	53.4%	15.9%	80.9%	19.1%	100.0%
High income	14.4%	24.8%	38.2%	77.5%	22.5%	100.0%
All households	13.6%	37.0%	26.1%	76.7%	23.3%	100.0%

Source: South African SAM (PROVIDE, 2007)