

THE ECONOMY-WIDE IMPACTS OF THE LABOUR INTENSIFICATION OF INFRASTRUCTURE EXPENDITURE IN SOUTH AFRICA

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Abstract

This paper examines the performance of public works in addressing both micro and macroeconomic policy objectives relating to growth, employment and poverty reduction in South Africa. Survey data on the micro-economic impact of public works programme participation is used alongside a social accounting matrix (SAM) for the South African economy which models the impact of a demand stimulus to the South African economy reflecting a hypothetical annual public works programme of R3 billion¹, using data from a labour based road rehabilitation programme.

Drawing on recent survey data from two public works programmes in South Africa, the microeconomic impacts of public works programme participation in terms of income poverty, non income poverty and labour market performance are reviewed. These microeconomic findings are then linked to recent research examining the macroeconomic impacts of public works programmes and the two are considered together in order to assess the micro-macro linkage of public works programmes and their contribution to development and poverty reduction. This analysis is particularly relevant given the popularity of public works as an instrument for labour market and social protection intervention throughout the continent.

The microeconomic analysis suggests that while participation in a public works programme may contribute to a reduction in the depth of poverty, with improvements in participation in education and nutrition, and have positive psychosocial benefits, the impact of a short term programme may not be significant in terms of a reduction in headcount poverty or improvements in asset ownership (material or financial). In this case the public works programme income may function essentially as a temporary wage shock, since the insurance function of the transfer is limited by the short duration of the employment period. If targeted to poorer groups, with lower levels of school participation and poorer nutrition, impact may be greater per unit of wage transferred, in terms of contributing to human capital, but is still not likely to move participants out of poverty, but rather reduce the depth of their poverty.

¹ R3 billion is approximately US\$500 million at September 2004 exchange rates.

The research also indicates that participation in a public works programme may not significantly improve labour market performance among workers in immediate aftermath of programme employment, largely due to lack of demand for labour in the formal sector. Also the likelihood of PWP employment to stimulate secondary informal income generation activity is found to be limited due to capital, skills and market constraints. The integration of initiatives such as income generation training, savings clubs could address these constraints and increase the likelihood of transfers having a longer term impact. However, the limited amount of transfer and duration of employment militates against investment in productive assets which could be used to generate employment in the informal economy.

From a macroeconomic perspective the economy-wide impact of a demand stimulus to the South African economy reflecting a hypothetical annual extended public works program of R3 billion is examined, based on a social accounting matrix (SAM) for the South African economy, and data from a labour based road rehabilitation programme. Two options are considered; labour and machine based public infrastructure provision. Currently machine based infrastructure provision is the norm, and the purpose of this part of the paper is to evaluate the impact of shifting from machine to labour based provision with a given budget constraint. Using a SAM it is estimated that the impact of shifting R3 billion expenditure from machine to labour based infrastructure provision over a one year period would be to increase employment by 1%, the income of the poorest quintile by 2% (if employment were exclusively targeted to this group) and GDP by 0.1%. While these are positive outcomes, they are not significant in terms of South Africa's overall economic and employment performance

The conclusion is drawn that from both a macro and microeconomic perspective, there is reason to be cautious about the potential of a national public works programme based on shifting the labour intensity of infrastructure provision, and offering short term employment opportunities, to have a significant impact on poverty, employment or growth.

Finally it is suggested that these limited impacts may be the consequence of the fact that in South Africa PWPs tend to offer only short term employment, having the characteristics of counter cyclical interventions, and hence an inherently limited risk insurance function, in the context of a mass chronic and essentially structural unemployment problem, in which demand for labour is the key constraint. Hence inconsistencies between the nature of the PWP instrument selected in South Africa and the characteristics of the labour market crisis are identified as the fundamental cause of the limited macro and microeconomic impacts of the intervention.

Introduction

This paper starts by outlining the nature of the labour market situation in South Africa, and characterising it as a chronic and structural problem. Next the policy response is briefly reviewed, and the inconsistency between the accepted function of public works in the context of transitional labour market crises in the international policy discourse, and the use of this instrument in the South African context, highlighted.

This problem is investigated from both the micro and macro perspectives through the use of survey and technical programme data from a case study public works programme with similar characteristics to the proposed national public works programme. The programme is interrogated through the discussion of survey data analysis in order to gain microeconomic insights into the household level poverty and labour market impacts of programme participation², while a social accounting matrix (SAM) is used to model the anticipated macroeconomic impacts in terms of growth, income and demand for labour. Finally the key findings from both analyses are reviewed and the implications for the attainment of policy objectives discussed.

The Labour Market Context

The South African labour market problem may be characterised as one of chronic labour market crisis, a high unemployment stasis. After rising for three decades, unemployment reached a plateau in 2003 at extremely high levels, standing at 31% (5.3 million) in March 2003, by the narrow definition, and 42% (8.4 million) by the broad,³ with unemployment concentrated in the African population, for whom the narrow unemployment rate was 37%, and the broad 49%, a labour market situation described by Kingdon and Knight in 2000 as ‘catastrophic’ (2000:13).⁴ These elevated levels of unemployment are the consequence of major structural shifts within the South African economy, arising from shifts in labour intensity and declining primary sector activity, which has had a major impact on both total employment levels and the composition of labour demand, leading to slow employment growth overall during the 1990s and early 2000s (McCord and Borat, 2003) and a significant decline in the demand for unskilled labour (Bhorat and Hodge, 1999). Economic growth rates are insufficient to absorb the growing pool of unemployed labour, and even in the most positive growth scenario⁵ it has been estimated that broad unemployment among the semi-skilled and unskilled would not fall significantly below 30% in the medium term (Lewis, 2001: 55).

² For a full discussion of the survey findings see McCord 2004.

³ The official or narrow rate of unemployment is calculated by Statistics South Africa (Stats SA) on the basis of those unemployed who a) did not work during the seven days prior to the interview, b) want to work and are available to start work within a week of the interview, and c) have taken active steps to look for work or to start some form of self-employment in the four weeks prior to the interview, while the broad or expanded unemployment rate excludes criterion c). (Stats SA, 2002).

⁴ However, recent research in South Africa indicates that self-employment, subsistence agriculture and casual employment may not always be considered as ‘work’ (see. for example Adato et al., 2004). This may lead to a bias in survey-based estimates of unemployment.

⁵ The positive growth scenario used by Lewis in this calculation was ten years with projected GDP growth of between 4% and 5% per annum.

Unemployment is structural and will not be significantly reduced in the coming decades without major state intervention.⁶

The structure of unemployment in South African is directly influenced colonial and apartheid manipulations of the labour market, the development of the migrant labour system, and related constraints on subsistence and informal sector activity (see for example Dieden 2004 for a discussion of some of the historical policy influences on the pattern of current unemployment, and Wilson 1972 for a description of the South African migrant labour system). Unemployment then represents a sustained structural challenge, which will not be adequately addressed through conventional growth in GDP, as the current South African growth trajectory does not include a mass increase in the demand for low or unskilled labour (Lewis 2001). The implication of these trends is the exclusion of growing numbers of the poor from engagement in the economy, hence there is an urgent need for active labour market and social protection interventions to attempt a reversal of this process of exclusion.

The Policy Response

In recognition of this challenge the government has instituted a range of labour market initiatives since the early 1990s, (for a full overview see Streak and van der Westhuizen, 2004), which has included a variety of public works interventions, the most recent being the Expanded Public Works Programme (EPWP), launched in September 2004. The EPWP has received considerable attention in the popular discourse, and is perceived as a significant response to the chronic unemployment situation outlined above. In the light of the policy prominence given to this public works based response to unemployment in South Africa (see McCord 2004), and the current preference for public works or ‘workfare’ style programmes as a core tool for addressing unemployment in low and middle income countries, as evidenced by the emphasis on public works in the World Development Report 2001, and the centrality of public work responses to unemployment in donor funded social protection programmes throughout Africa, this paper uses survey data and SAM analysis to explore the macro and micro-economic impacts of such an intervention.

Within the labour market and social protection cannon, as exemplified by the 2000/1 World Development Report, public work programs (PWPs) are conventionally viewed as counter-cyclical labour market interventions, to be implemented in response to acute labour market crises or cyclical periods of unemployment, in situations of ‘[e]conomic crises and natural disasters, deep and sudden collapse in national output, and sharp increases in income poverty’ (World Bank, 2001). PWPs are conceptualised as ‘a mix of risk mitigation and coping’ and such that ‘[p]roviding households with income following a crisis helps them avoid costly and damaging strategies (such as selling assets, reducing food intake)’. At the core of this approach is the idea of assisting the poor to manage risk and the provision of insurance benefits through PWP employment,

⁶ Abedian argues further that the more rapid the rate of economic growth, the more rapidly structural transformation of the economy will take place and demand for unskilled labour fall (Abedian, 2004).

during a period of acute crisis. Most of the current literature on PWP assesses their performance in terms of mitigating the negative poverty and livelihoods impacts of such transient labour market shocks.

Hence World Bank policy prescriptions include public works as a component of social protection (see the World Development Report 2001) as a short term intervention, promoting survival through periods of acute and transient crisis, which may be natural or economic in nature. It is widely agreed that sustained poverty reduction is largely contingent on the risk insurance function of the programme (Dev 1995, Devereux 2000, World Bank 2001), which in the most positive scenario may enable accumulation, and in the worst could prevent asset divestment. This is feasible in context of cyclical unemployment, through the stimulation of counter cyclical labour demand through public works, (for example in the Maharashtra Employment Guarantee Scheme) or in the context of short term, acute situations, arising from natural disaster or economic crisis (for example Korea during the period of the Asian crisis) (ibid).

The South African national public works programme, the Expanded Public Works Programme (EPWP) is constructed similarly, offering short term employment on the basis of the characterisation of unemployment as a transitional phenomenon (*italics added*);

‘The EPWP is one of an array of government strategies aimed at addressing unemployment. The fundamental strategies are to increase economic growth so that the number of net new jobs being created starts to exceed the number of new entrants into the labour market, and to improve the education system *such that the workforce is able to take up the largely skilled work opportunities which economic growth will generate*. In the meantime, there is a need to put in place short to medium-term strategies. The EPWP forms one of government’s short to medium-term strategies.’

(Department of Public Works, 2003).

It is argued that PWP are required as a transitional short to medium term strategy, pending increased labour demand as a result of economic growth, and by implication that participation in the PWP will enhance labour quality such that it will be able to access the future skilled work opportunities arising from economic growth. In line with this analysis the proposed EPWP is similar to the PWP concept outlined in the 2001 WDR, representing a response to transient, acute unemployment. However, in the context of sustained unemployment which is chronic and mass, rather than cyclical or acute, it is not apparent that this prescription is appropriate. Given the structural nature of the South African unemployment problem outlined above, and the acute characteristics of the policy response, which is most frequently used in situations of transient employment crisis, the paper raises the question of a possible mismatch between the nature of the labour market problem, and the characteristics of the policy response. Given this asymmetry between the chronic problem and the acute response, the international literature suggests that the public works concept adopted in South Africa is unlikely, by virtue of its design, to have a significant impact on poverty,

unemployment or by extension, growth. Both recent survey data and a SAM model of the South African economy are interrogated in this paper in order to ascertain whether this concern regarding a mismatch between the problem and the policy response, is valid.

Methodology

This paper draws on survey and budget data from the Gundo Lashu Public Works programme in Limpopo province. The programme has been chosen as it has similar characteristics to the national Extended Public Works Programme launched in September 2004, for which it is a model. Both programmes use the terms and conditions set out in the Special Public Works Programme Code of Good Conduct to govern targeting, remuneration and employment, (Department of Labour 2003a and 2003b) and so data from this programme is likely to offer insights into the likely performance of the EPWP. The microeconomic analysis is based on a random one stage survey administered to 263 households with either current or former PWP employees, drawn from two clusters within the District of Capricorn (Mankweng and Sekhukhune), while the SAM draws on budgetary information derived from the same programme. In both cases the data was gathered in collaboration with the Limpopo Roads Authority.

While there is an extensive literature on the impact of infrastructure on development, (see for example Gannon & Liu, 1997), and the impact of infrastructure on income distribution (Calderon and Chong, 2004), the macro analysis abstracts out the impact of infrastructure created through the PWP, excluding any modelling of the impact of the infrastructure itself. The reason for this exclusion is that under the provisions of the national Extended Public Works Programme (EPWP) new funds are not being allocated to infrastructure provision, rather the factor intensity of existing budgetary allocations is being shifted. The infrastructure produced through the EPWP would have been constructed in the absence of the EPWP, but using capital rather than labour intensive methods. Hence the impact of the EPWP is exclusively the impact of shifting the factor intensity of the production of any given the asset.

The Gundo Lashu Programme and EPWP

The goal of the Gundo Lashu programme is the ‘improvement on livelihoods in rural communities in the Northern Province’, and the purpose ‘employment creation within the rural communities... skill transfer from private contractors to community members... [and] enhancement of livelihoods for those community members providing labour to the programme’ (Roads Authority Limpopo, 2003). The programme is implemented by the Roads Authority Limpopo,⁷ with support from DFID and the ILO,

⁷ The Roads Authority Limpopo is a parastatal with responsibility for the management of all provincial level roads.

and is focused on both employment creation, and the training of contractors and consultants in labour intensive road rehabilitation. The programme was initiated in 2000, and had employed a total of 1,700 labourers at the time of the survey in mid 2003. The programme was implemented through contractors who directly recruited PWP workers who were employed for between one and four months, and workers were recruited on the basis of the Special Public Works Programme targeting objectives and conditions of employment.⁸ Remuneration was set at a task rate of R30, which in most cases translated into a daily wage of R30. Wage payments were made directly in cash to workers by the contractors, and training inputs delivered by the Department of Labour.⁹

The Expanded Public Works Programme (EPWP), was launched in September 2004 and has been ascribed a range of objectives centering on infrastructure provision, poverty reduction, employment and growth (Department of Public Works 2003). It is based on shifting the factor intensity of R3 billion infrastructure expenditure per annum throughout a five year period, and is complemented by the development of short term labour absorbing initiatives in the social and economic spheres (ibid). The programme is described as ‘a nation-wide programme which will draw significant numbers of the unemployed into productive work, so that workers gain skills while they work, and increase their capacity to earn an income once they leave the programme’ through the utilisation of public sector budgets to ‘reduce and alleviate unemployment’ (ibid). The programme aims to create 200,000 short term employment opportunities each year, and in the popular political discourse is anticipated to deliver significant benefits to the economy at both micro and macro levels, in terms of poverty, employment and growth. Each of these aspirations is examined in the following sections, drawing on data from the Gundo Lashu programme outlined above.

The Micro impact of Public Works Participation

Survey data from the Gundo Lashu programme is used to assess the microeconomic impact of public works programme participation in terms of selected indicators of poverty, taking into account both income and non income dimensions of poverty, and labour market performance.¹⁰

⁸ The Special Public Works Programme Code of Conduct, gazetted in 2001, sets out targets of 60% women, 20% youth and 2% disabled, prohibits employment exceeding 24 months in duration, and also allows for a derogation from the minimum wage in favour of a locally negotiated wage, in return for training inputs for workers for 2 days for every 20 worked.

⁹ It should be noted that the training package offered to the Gundo Lashu workers was recognised not to be optimal, and has subsequently been revised.

¹⁰ For a full analysis of the survey findings see McCord 2004.

The Impact on Income Poverty

First the level of the PWP wage and its likely impact on ‘self-targeting’ to the poorest is reviewed, and then the impact of PWP participation on household income is calculated and income poverty examined.

The mean monthly PWP wage is R579, and for 93% of workers no additional income from other sources was reported. By comparing the PWP wage to the mean income for working household members and with the mean income for formal and informal sector workers and elementary workers from the 2003 LFS for non-urban Limpopo the PWP wage may be seen in the context of the wage distribution in the province¹¹, see table 1 below.

Table 1: Monthly PWP incomes with provincial comparators, 2003

Kind of work	Mean	Range
Public Works	579	200-1000
Regular wage labour	774	200-2640
Casual wage labour	612	100-3960
Subsistence agriculture	218	36-400
Non-farm enterprises	446	40-1320
Formal sector (LFS)	1618	30-9000
Informal sector (LFS)	385	6-9000
Elementary workers (LFS)	549	6-5000

The PWP wage is less than both the casual and regular labour income wages but higher than income earned from subsistence agriculture and non-farm enterprises. While it is above the informal sector mean it falls below the formal sector mean, conforming closely with the mean elementary wage¹². The fact that the public works wage falls above mean monthly wages in the informal sector, the elementary sector, subsistence agriculture and non farm enterprise is likely to compromise the effectiveness of the wage as the primary instrument for targeting access to employment, in terms of the ‘self selection’ of the poorest, and risk drawing workers from alternative informal sector employment, rather than attracting only those without alternative access to income. This is problematic if targeting the poor¹³ is an objective of the programme, as the poor

¹¹ PWP workers may be compared to elementary workers in terms of their skill levels.

¹² According to the LFS in non urban Limpopo of those who specified the nature of their employment 59% were in the formal sector, and 31% the informal sector.

¹³ The concept of targeting ‘the poor’ is itself problematic in the case of South Africa, where approximately 40-50% of the population are estimated to be poor and up to 8 million are unemployed (Stats SA 2003c). Clearly there is a need to disaggregate ‘the poor’ and target the programme using alternative criteria relating to depth of poverty. Moreover, the national public works programme will

are less likely to succeed in accessing employment under these conditions, than those with superior socio-economic status and social capital. This problem is compounded if the 'effective' value of the public works wage is taken into consideration, since PWP task-based employment is designed to demand an average of only five hours of labour per day¹⁴. The limited work hours of the programme render the effective wage higher in comparison to prevailing wages, and further undermine the self targeting impact of the programme on the basis of the principle of 'less eligibility'.¹⁵ It should be noted, however, that the wage levels for some forms of employment reported by workers were as low as R6 a day, and so the issue of attracting labour out of prior employment into PWP employment should not *de facto* be considered undesirable.

In order to assess the wage impact of participation in a PWP, wage foregone must be taken into account. This represents a directly measurable opportunity cost for programme participation, which is important when considering the net labour market and income impact of public works. 33% of the workers surveyed gave up other work in order to participate in the programme, indicating significant labour market substitution occurring as the result of the programme. Focus group discussion indicated however that this is related to the extremely low wage levels prevailing in the area, in both the local informal sector, and the informalised component of the agricultural sector¹⁶ and the relative ease within which workers can move in and out of low paid informal sector work. Focus group discussions revealed that work available in the area tended to be sporadic and difficult to predict, varying in terms of availability and duration of employment, as well as remuneration and certainty of being paid for work performed¹⁷. In the light of this the regular and certain employment offered by the PWP was considered superior to the more uncertain and discontinuous employment otherwise available, rendering the decision to forego alternative income a rational one. For the PWP workers reporting no income foregone, the net income gain was R579, compared to R270 for the 33% who reported foregone earnings.

offer employment to a maximum of 200,000 people per annum; the implications in terms of the difficulty of oversubscription are immediately apparent. For a discussion of this issue, see McCord 2004.

¹⁴ International evidence suggests that 5 hours output of a motivated worker paid on a task basis results in as high output as, or higher output than, 8 hours of a less well-motivated worker paid on a daily basis. This is one of the key principles behind the use of task-based payment systems.

¹⁵ Under the principle of 'less eligibility' remuneration for public works employment should be lower than the alternatives available in the market, in order to ensure that public works employment is only accessed by the poorest, without access to market alternatives. Unfortunately, given the low levels of the prevailing wage in some areas, adherence to this principle may have negative moral and humanitarian implications (see Chirwa et al 2004).

¹⁶ The introduction of the minimum wage in agriculture was perceived as having little impact on the highly casualised lower end of the agricultural sector, in which workers are recruited and paid daily on a task basis, with no employment registration or documentation of their employment, wage in this sector were reported to be as low as R6 per day.

¹⁷ The difficulty in ensuring payment for informal work carried out within the community was raised as a concern among some of the PWP workers.

The Impact on Poverty Reduction

Once PWP income and income foregone have been calculated, total household income can be reviewed in relation to the poverty line, in order to assess the contribution of PWP income to reducing poverty. Several poverty lines are in use in South Africa, offering differing estimates of the proportion of the population living in poverty. For this analysis a per capita Household Subsistence Line (HSL) of R486 has been selected following Meth 2004¹⁸. This measures the theoretical monthly cost of basic needs derived from a basket of goods and services, comprising food, housing, fuel, light and transport.

When adjusted per capita income was calculated for members of the PWP households¹⁹ it was found that notwithstanding the relatively generous effective wage offered in the PWP 87% of members of households with public works employees fell below the per capita HSL of R486 with a mean per capita rand shortfall of R227 per capita per month. In the households with former rather than current PWP employees, 96% of household members fell below the HSL poverty line, with a mean shortfall of R322. If the two groups are considered to broadly represent the same population sample, this suggests that a high percentage of households were below the poverty line prior to PWP employment, and that the headcount poverty rate is reduced as a result of the PWP income.

Even with public works income, 87% of participating households still fell below the poverty line by a significant margin. These findings indicate that public works employment does not move the majority of participating households out of poverty. However, since for all participants the PWP income represented an increase in household income, it is possible to conclude that PWP participation has reduced the poverty gap, and hence reduced the intensity of poverty experienced by workers' households. The fact that the PWP has not moved the majority of participants out of poverty, indicates that offering lower wage rates would further compromise the income poverty impact of the programme.

¹⁸ This figure is derived from Potgeiter 2003, and was developed for urban households. However, given the lack of a rural HSL for South Africa, it will be used as an approximate indicator of household poverty.

¹⁹ Following Woolard and Leibbrandt (2001 54) .

The Impact on Other Dimensions of Poverty

The survey data indicates that the impact of PWP participation on headcount poverty is limited, but that it does have an impact on reducing the depth of poverty. By exploring the impact of participation on non-income dimensions of poverty it is possible to investigate the experiential meaning of this reduction in the depth of poverty. In this section the impact on asset ownership, human capital and psychosocial ‘functionings’²⁰ as indicators of non-income dimensions of poverty, are explored.

The ownership of financial assets (formal or informal savings, insurances etc) and material assets (cooking implements, furniture etc) was reported to increase in 25% of households with current public works employment. However, 70% reported no change, with the PWP income having been directly consumed²¹. Only 18% of households in which PWP employment had already been completed reported a sustained benefit in terms of an improvement of financial assets after the period of PWP employment. This suggests that the impact on reducing future vulnerability (by increasing the asset base of workers) was limited, and closely associated with the period during which employment was experienced. The international literature suggests that the accumulation of assets is linked to the duration of the employment period, as a short period of income receipt does not tend to have a significant impact on savings or investment in assets, but rather is directly consumed (Devereux 2000).

This is confirmed by the fact that for 79% of Gundo Lashu households the main use of additional income earned through PWP employment was food, (for 13% of households the main expenditure item was clothing, and for 4% it was education).

In terms of human capital, as illustrated by school participation and nutrition, the impact of PWP participation was found to be marginal. The impact on school participation was explored through recall questions²², and found not to be significant, as 95% of children in the surveyed households attended school regularly even prior to participation in the programme. PWP employment however did have an impact on nutrition within the household, in terms of the incidence of adults skipping meals, not eating for a whole day, and the reduction of food given to children due to lack of cash. While responses to all three questions indicated a positive correlation between improved household nutrition and PWP participation, these impacts were of limited significance due to the relatively low incidence of these problems even prior to programme participation²³.

²⁰ Following Sen’s concept of functionings, see for example Sen 1993: 30-54.

²¹ 5% reported a decrease in ownership of financial assets over the period of PWP employment.

²² The use of recall questions was necessitated by the lack of baseline data gathered on participating households. A difference-in-difference’ methodology would have been the most appropriate to evaluate the impact, using as a control households with similar pre-programme characteristics to those of the households subsequently ‘treated’ by becoming PWP participants. However this approach was not feasible due to the fact that the characteristics of PWP participants were not known a priori, rendering the inclusion of a non-treatment control group in the survey impossible; the identification of the characteristics of participants itself formed one of the critical questions which the study set out to examine, see McCord 2004.

²³ As a result of participation in the programme the percentage of households with adults never skipping meals rose from 55% to 75%, the percentage of households where adults never went without food for a

Survey data gathered in parallel with the Gundo Lashu survey, on a PWP in which extremely poor households were explicitly targeted using poverty as a the main criterion for programme participation²⁴ (as opposed to a combination of poverty, age, gender and disability status as in the SPWP conditions governing the Gundo Lashu programme and the EPWP), did find significant changes in both participation in schooling, and nutrition, despite a monthly wage of R334, compared to R650 in the Gundo Lashu programme. This was found to be related to the significantly greater depth of poverty of those participating in this programme, and the lower *ex ante* investment human capital among the worker's households, ie the programme had a greater impact, despite the lower value of the transfer, since it was targeted at a poorer population group.

Focus groups revealed that both programmes however had significant psychosocial impacts, in terms of improving the quality of the participation of workers and their households in community activities, facilitating membership of burial societies, enabling participants to shift from the position of mendicants to donors within the community, and reducing the shame experienced as a result of wearing dirty and worn clothing. In this sense programme participation contributed directly to improved 'functionings'.

Poverty Conclusion

Despite the continued high levels of income poverty, with the majority of PWP participants remaining below the poverty line regardless of their participation in the programme, in all cases positive impacts on various dimensions of poverty were noted as a consequence of participation in the programme. However these benefits were marginal for most households, and the survey indicated that benefits accrued under the programme may not be sustained beyond the end of the employment period. Among households who had completed their period of public works employment, only 33% stated that participation in the programme would lead to a sustained reduction of poverty, while 67% believed that the benefits accruing from PWP employment would be of only temporary duration.

Two issues emerge from the discussion of the impacts of public works programmes above; i) the anti poverty impacts of public works programmes may be marginal²⁵ and ii) the duration of poverty reducing benefits arising from PWP employment may only be sustained as long as the wage transfer is taking place. This represents a critical insight into the limitations of short term public works employment as an instrument of social protection, and confirms that the selection of short term PWPs as the policy option of choice to address these issues in the context of chronic poverty and unemployment may

whole day experiencing this rose from 65% to 79%, and the percentage of households reporting never reducing the size of children's meals rose from 63% to 80%.

²⁴ This parallel study was carried out on the Zibambele programme, implemented by the Department of Transport in KwaZulu Natal, see McCord 2004 for a comparative analysis.

²⁵ Survey evidence also suggests however that if a programme is targeted to a poorer subsection of the population, the impacts may be less marginal, and of greater significance (see McCord 2004).

be problematic. This is particularly true if the findings of Devereux 2000 and Dev 1995 regarding the critical role of PWP in terms of their risk function is taken into consideration, since this would suggest that a short term transfer in the context of a chronic labour market crisis, would be unlikely to have a sustained risk function impact, and that consequently the sustained anti-poverty impact would be likely to be limited, with the transfer likely to serve simply as a positive wage shock.

The Impact on the Labour Market

In addition to the direct poverty relief function of receipt of the PWP wage, work experience and training is seen as one of the key benefits of participation in a public works programme within the EPWP in terms of improved labour market performance as a consequence of improved quality of labour supply²⁶. In focus groups, workers stated that the experience of working on the PWP and the skills gained through participation did not significantly enhance their employment prospects, due to the high unemployment rates and lack of demand for labour with the skills gained during participation in the PWP. This corroborates the survey finding that former PWP workers had no significantly greater chance of working than other household members, with similar levels of former PWP employees working at the time of the interview as households' members without PWP employment experience, with figures of 17% and 19% respectively²⁷. The broad unemployment rate among former PWP workers is stark, with 80% of former employees unemployed. This may be compared to rates of 72% among non-Gundo Lashu workers, and a mean rate of 60% among the non urban Limpopo population (Stats SA 2003a). This suggests that being employed in a PWP did not have a significant beneficial impact on the subsequent employment performance of workers²⁸. While it is important, to bear in mind that there may be a lag between

²⁶ An example of this is the conceptualisation of the EPWP as a 'work experience and training period', at the end of which workers graduate to employment under 'normal conditions'. Post PWP employment options are characterised as 'moving to a new employer, further education, better equipped job seeking, remaining with the same employer under normal employment conditions, or self employment' (Department of Public Works, 2004).

²⁷ It is possible that the two groups have different labour market characteristics, and hence a direct comparison between the two may not be instructive. This is an area for further analysis of the survey findings. It is however clear that at 19%, the absolute level of work among former PWP workers, is low.

²⁸ The unemployment rates in non-urban Limpopo are 39.6% (narrow) and 59.7% (broad) (Stats SA 2003c). This compares to a broad unemployment rate among all Gundo Lashu household members, including current PWP workers of 56.1%. As would be anticipated given the inclusion of PWP employment into these households, this is below the prevailing broad unemployment rate of 59.7%. A rate of 71.6% is found if PWP employees are excluded. It could be argued that this reflects a high unemployment rate among the selected group of PWP participant households in general, or may be indicative of the fact that those who enter PWP employment may be among the more 'employable' members of the household, in terms of characteristics such as age, physical strength, health etc, given the degree of employment substitution revealed by the survey, and that consequently the unemployment rate among the non participants, who may be 'unemployable' (those who are 'never going to find sustainable, long-term employment in their lifetimes' by virtue of their lack of skills and the remoteness of their rural location in relation to labour demand (Bhorat 2001; 40)) may be higher. However this interpretation is

completing public works employment and finding alternative employment, it is also true that experience and skills become less valuable as the duration of unemployment increases. The data confirms however the fact that the unemployment rate among former PWP employees is at least as high as among non PWP workers in the survey, which challenges the assumption that PWP participation has a significant beneficial impact on subsequent employment performance, at least in the short term. This also challenges the assumption underlying public works which suggests that participation in a PWP is a 'stepping stone' to employment in the open labour market (Department of Public Works, 2004).

Training and employment performance

While 38% of PWP workers reported that they had received some training, either in entrepreneurship, technical road maintenance/construction, supervision or life skills, the majority reported no training in technical skill areas. Only 6% of former workers thought that the training they had received had enabled them to find additional wage employment, with the main reasons that training had not enabled them to find employment being lack of employment opportunities (61%), followed by lack of resources for job search (29%). The kind of skills gained by workers through participation in a construction based PWP were not the skills for which a significant unmet labour demand is apparent. On the contrary, such PWPs promote labour skilled in a sector which is stagnant or contracting²⁹.

The Generation of Self Employment

58% of workers stated that they would like to set up as contractors, but lack of finance and skills were cited as the main deterrents. Given the lack of availability of both capital and skills training in contractor development (as opposed to basic skills) for the workers, programme participation alone is unlikely to enhance their labour market performance. These findings challenge the assumption of current policy that workplace participation *sui generis* will promote the development of SMMEs in the construction sector or elsewhere.

Likewise the development of micro-enterprise activity as the result of increased availability of cash at local level was found to be limited, with only 14% of households using PWP income to set up or expand small business enterprises. The income generating activities which were initiated were primarily small scale trading (54%) and service provision (30%). For all households the main factor preventing the development of micro enterprise was lack of credit/capital, which was highlighted by over 80% of respondents. This is consistent with findings by Devereux (2000), who argued that the poor use incremental income to satisfy basic consumption needs first,

challenged by the extremely high unemployment rate prevailing among the former PWP employees, 79.8%, which exceeds that of the non PWP participants.

²⁹ The construction sector has either been declining or stagnant since 1996 (McCord and Borat 2003).

then invest in human capital (education and health) and social capital, and only then to invest in income generating activities and seeds³⁰. In this way the public works wage would only impact on productive investment if it were large enough to cover consumption needs, or sufficiently sustained to enable accumulation. On the basis of this analysis a prolonged period of employment, higher wage level and/or additional institutional supports (micro finance, appropriate micro-enterprise training etc) may be required if the policy goal of stimulating household income generating activity is to be achieved.³¹

The Impact on the Local Economy

The survey indicated that 67% of workers purchased most of their food from local shops, indicating that resources were flowing into the local economy. However, focus group discussions revealed that the local micro-enterprises which sprang up around the work teams ceased trading once the period of employment was completed. The other vector through which PWP had the potential to stimulate the local economy is economic benefits accruing from the asset created (see for example Gannon & Liu, 1997). However, this impact is contingent on two external factors, i) the strategic value of the asset created for the community as a whole, and for different members of the community, and ii) the quality and durability of the asset. These factors are related to the asset selection processes and the management of asset production, which are reliant on local government performance, and the quality of district Integrated Development Plans. The survey findings did not provide evidence that the construction of the roads had brought economic benefits, and did not assess the strategic value of the roads, although the potential for disappointment in terms of the actual, rather than anticipated benefits of road construction is highlighted in Mashiri and Mahapa (2002), and it may not be assumed the infrastructure construction will *per se* engender a significant economic benefit for the local economy.

Labour Market Summary

From the survey data it is clear that there is not a significant improvement in labour market performance among PWP workers in the immediate aftermath of programme participation, primarily due to the overwhelming lack of demand for labour, even if the quality of labour has been enhanced through PWP experience. The anticipated supply side benefits resulting from increased experience and skills are not able to function in context of massively constrained demand. Equally, the impact on informal employment and income generation activity is limited by lack of capital, skills and market demand,

³⁰ Devereux stated that 'high value transfers are associated with higher propensities to invest in agriculture, social capital, (including in financial assistance to relatives), education and acquisition of productive assets' (*ibid*; 4), while low value transfers by contrast, are mainly consumed, in the form of food and clothes.

³¹ It should be noted that in the absence of a sustained period of PWP employment, micro finance inputs would not be likely to have a significant impact.

which could only be addressed by complimentary social development initiatives (microfinance, income generation etc) which could increase the likelihood of the wage transfer having longer term impacts. Without such complimentary inputs, the limited value of the transfer and duration of employment, make investment in productive assets which could be used in the informal economy unlikely.

The Macroeconomic Impact

Having identified the likely microeconomic impacts of a PWP designed in accordance with the specifications of the EPWP through the analysis of survey data, the macroeconomic impacts of the EPWP were modelled using a social accounting matrix (SAM) of the South African economy to see if there was a consistency between the macro and microeconomic findings. The impacts identified at micro level above suggest that the macroeconomic impacts would be limited, in line with the theoretical critique of the implementation of a short term policy response to a chronic labour market problem.

The economy-wide impact of shifting from machine to labour based infrastructure provision were be modelled using data from the Gundo Lashu programme in a first generation SAM based model for South Africa³², and comparing it to the data for the provision of the same infrastructure using conventional methods³³. The model illustrates the potential GDP, labour market and household income distribution effects under each scenario, and this impact of shifting to labour based production is assessed by comparing the situation under the two scenarios. In doing so this model takes rural gravel road rehabilitation as a proxy for infrastructure provision in general, as typical of the kind of activity implemented under a labour based public works programme³⁴.

In order to conduct an economy-wide impact analysis an, expenditure profile was created for each of the two options reflecting the nature of each option as precisely as possible, one reflecting a machine based (capital intensive) option, and the other a labour based one. The model was run using a budget of R3 billion which is equal to the planned shift in annual expenditure from capital to labour intensive infrastructure production under the national Expanded Public Works Programme (EPWP).

³² The Social accounting matrix (SAM) for the South African economy is representative of the year 2000

³³ This section draws on data provided by IT Transport. For a full discussion of this data see Taylor, McCord and van Seventer, forthcoming.

³⁴ The cost of infrastructure provision has been estimated to be similar using either method (Taylor et al, forthcoming).

5.1 The model

The impact of shifting factor intensity in the production of infrastructure is modelled using a representation of the South African economy which assumes that the structure of the economy is fixed. This is not a serious problem in this kind of application since the small scale of a R3 billion public works program is unlikely to effect the basic structure of a R1,200 billion economy (in 2003 prices).

The structure of this economy is captured by a social SAM³⁵, which represents conventional national accounting practices with sectoral, factor market, household and other detail added in an internally consistent manner. The SAM identifies 43 industries (and their associated primary products), 3 labour categories and 14 household income classes. Labour income earned by each labour category feeds into a set of household income classes in addition to income derived from capital and other sources such as transfers as part of fixed household income distribution mapping.

This SAM is the underlying data base for a simple fixed coefficient model which can be presented as the following single linear algebraic equation:

$$\text{Eqn 1} \quad \mathbf{X} = \mathbf{AX} + \mathbf{F} = (\mathbf{I} - \mathbf{A})^{-1} * \mathbf{F}$$

In which \mathbf{X} is a column vector of endogenous variables, including industry output, demand for commodities, factor income and institutional income of aggregate enterprises as well as disaggregated households, \mathbf{F} a column vector of exogenous variables including the commodity demand by government, aggregate investment demand and exports, \mathbf{I} an identity matrix of appropriate size and \mathbf{A} a matrix of coefficients describing the interrelationships amongst the endogenous variables in per unit terms³⁶.

$$\text{Eqn 2} \quad \Delta\mathbf{X} = (\mathbf{I} - \mathbf{A})^{-1} * \Delta\mathbf{F}$$

Given the identity of Eqn 1, a model can be set up which allows for the impact of a change in final demand $\Delta\mathbf{F}$ to be evaluated in terms of a change in the endogenous variables, $\Delta\mathbf{X}$. The challenge of our modelling exercise is to represent the EPWP in terms of the vector of the change in final demand $\Delta\mathbf{F}$.

³⁵ This SAM is updated by Thurlow (2003) from an earlier SAM (with full description) for the year 1998 by Thurlow & van Seventer (2002). The dimensions of the SAM that is used for our purposes are shown in Appendix A.

³⁶ Endogenous variables include amongst others; Supply of commodities (each commodity can be produced by more than one industry, each industry can produce more than one commodity (primary and secondary)), Intermediate inputs (each industry uses a range of commodities as intermediate input), factor incomes paid by industries, distribution of income to institutions, indirect taxes and trade and transport margins.

A number of auxiliary variables can be derived from the change in the endogenous variables, ΔX , including imports, government revenue and also employment, as it is often assumed that for all sectors that will indirectly receive a boost as a result of a stimulus such as the EPWP, the average employment - output ratios of the relevant industries apply. However evidence exists of economies of scale in the use of labour, especially when it involves the marginal expansion of output in a sector, which implies that a rise in output is absorbed by more efficient use of existing labour, or overtime. To capture these dynamics, the computation of indirect (upstream or knock-on) employment is selectively based on economy-wide long term econometric estimates of non-linear employment-output elasticities estimated by Moolman (2003).

Most labour employed as a consequence of a public works program would typically be from the unskilled category with some from higher skilled labour for management. The economy-wide income distribution patterns embedded in the underlying SAM data base mean that unskilled labour income would not only accrue to very poor households. For purposes of modelling the EPWP, an additional labour category '*public works labour*' was added to the SAM, which maps *all* public works income to the poorest two deciles³⁷.

In this model the production structures of the economy are assumed to remain constant following the modelled stimulus, meaning that the SAM analysis is comparative static and ignores any dynamic effects, including substitution between the production factors labour and capital and between domestically and imported intermediate purchases³⁸. This approach is adequate for the purpose of modelling the impact of the EPWP, since this is not likely to fundamentally change the structure of the economy.

³⁷ This allocation of public works income most closely represents the ideally targeted distribution of PWP income. An alternative and less convenient way of making sure that the unskilled labour employed by the public works program is actually mapped to poor household is to treat it as a direct transfer. The results will be the same except that this short-cut would by-pass GDP in the SAM and one would have to do some ex-post, and therefore less elegant, modelling in order to make sure that the labour income paid out by the public works program is actually taken along in the computation of GDP. A sensitivity analysis was performed around this issue by also allocating this income to the 'regular' unskilled labour category which means that it is distributed to a much wider range of households according to the existing patterns in the SAM.

³⁸ Input-output analysis assumes that there is sufficient capacity available in the backward linkages to satisfy the demand of the stimulus at hand and that prices will therefore remain constant. This may be true for most secondary and tertiary sectors, but not necessarily for primary sectors. It is possible that agriculture or mining will not expand their production to meet additional demand for its products that is related directly and indirectly to the stimulus. It may well be that those sectors will divert exports to an expanding domestic market. We will accommodate this by imposing supply side constraints on the multipliers. The values of supply constrained multipliers are usually lower than standard multipliers. Note also that all government revenues from taxes, both direct and indirect, are collected at the national level and we ignore revenues of local and provincial governments apart from those directly related to the stimulus. We also ignore the revenues that provincial and possibly local governments obtain from inter provincial and other inter governmental transfers.

Input data

Labour and machine based infrastructure expenditure patterns were each applied to an overall budget of R3 billion, and the results of the two expenditure patterns evaluated. The difference between the two expenditure patterns represents the impact of ex-ante budget neutral switching from machine to labour based infrastructure provision, as envisaged under the EPWP.

The expenditure patterns of the two options was derived from information based on case studies in Limpopo Province which also supplied the micro-economic survey data in the previous section, drawing on actual expenditure from the Gundo Lashu public works programme, and quotations for the implementation of similar road reconstruction using conventional machine based methods, see table 2.

Table 2: Summary expenditure patterns for labour based and machine based infrastructure production (2003)

		Labour Based Method	Machine Based Method
1.	Overhead	3.6%	3.6%
2.	Gain	7.2%	7.2%
3.	Unskilled lab.	26.0%	7.6%
4.	Skilled lab.	5.5%	6.8%
5.	Plant	11.8%	22.8%
6.	Fuels	8.7%	9.9%
7.	Transport	0.3%	3.1%
8.	Materials	26.8%	28.9%
9.	Project design	10.0%	10.0%
10.	Total	100.0%	100.0%

Source: Taylor et al (forthcoming)

The main differences are in the percentage of costs allocated to unskilled labour, plant and to a lesser degree fuel and transport. As anticipated, a large proportion of the labour based budget is allocated to unskilled labour. This labour, as explained above, is public works specific labour whose income is, unlike regular unskilled labour, assumed to be distributed only to the bottom 20% of the income earning households. The machine based method allocates a large proportion of its expenditure on plant. The allocations to building materials are more or less the same for both scenarios, but fuels and transport costs are higher for the machine based option as this is linked to the use of plant. Overheads and profits were the same for both methods. More details on the expenditure pattern are presented in Appendix B.

The expenditures of both public works options may be expressed in terms of the model variable ΔF , (see Appendix C for a detailed breakdown across all the variables). Demand associated with the public works programs focuses on a limited number of commodities, including petroleum products, non metallic minerals, metal products,

machinery, transport equipment and other services. In addition, capital and labour also benefit directly. Demand for all other commodities is initially not affected.

Table 3 shows the percentage of a total budget of R3 billion, which would be allocated to labour in both the machine and labour based scenarios over a one year period, and also actual expenditure. The impact of this expenditure on sectoral output across the model is illustrated in Appendix C.

Table 3: Allocation of expenditure to labour variables

	1	2	3	4
	Labour	Machine	Labour	Machine
	Based	Based	Based	Based
	Method	Method	Method	Method
	%	%	R	R
			million	million
Public works labour	26.0%	7.6%	781	228
Low skilled labour			0	0
Skilled labour	5.5%	6.8%	166	205
High skilled labour	10.0%	10.0%	300	300

Source: Taylor et al (forthcoming)

Note: abbreviations are explained in full in the Appendix

Given the budget constraint and the proportion of total expenditure allocated to unskilled labour, (26% of the budget of the labour based method and 8% of the machine based method), the number of workdays of labour that will be directly employed on site can be calculated, given a known daily wage rate. This can also be calculated in terms of annual person year equivalents, is can be seen in Table 4.

Table 4: Direct impact on labour demand for labour based and machine based infrastructure provision (2003)

		Labour Based Method	Machine Based Method	Machine Based Method
			Industry minimum wage	Industry average wage
1.	Ave EPWP wage rate per day	29.2	52.1	35.0
2.	Days per month	21.67	21.67	21.67
3.	Months per year	12	12	12
4.	Ave EPWP wage rate (annual)	7,593	13,553	9,101
5.	Ave med skilled wage rate (SAM annual)	81,726	81,726	81,726
6.	Ave hi skilled wage rate (SAM annual)	304,763	304,763	304,763
7.				
8.	Project budget (Rm annual)	3000	3000	3000
9.				
10.	Wage bill EPWP(unskilled) (Rm annual)	781	228	228
11.	Wage bill med skilled (Rm annual)	166	205	205
12.	Wage bill hi skilled (Rm annual)	300	300	300
13.				
14.	Empl EPWP (unskilled) (annual)	102,836	16,834	25,068
15.	Empl med skilled (annual)	2,027	2,513	2,513
16.	Empl hi skilled (annual)	984	984	984

Source: Taylor et al, forthcoming

* Wage derived from Gundo Lashu public works programme wage

Assumed average wage rates are indicated in row 1, the number of working days per month in row 2 (including on the job training courses taking place during the days employed), and an annual equivalent wage in row 3 (calculated on the basis of the daily wage). The same information is represented for the other two skill categories, using industry average wage rates for the construction industry as reported in the SAM data base and updated with the wage deflator from the SA Reserve Bank³⁹. Rows 5-6 indicate that medium skilled labour was estimated to earn around R81 000 per year and highly skilled labour in the construction sector (engineers etc) took on average home (before tax) more than R300 000 per year in 2003.

Given the budget constraint of R3 billion (as shown in row 7) and the expenditure patterns from the case study, the total wage bill for each labour category can be calculated (rows 8-10 of Table 3). Division of the wage bill by the average wage rate provides an estimate of the direct demand for labour by the project, see rows 11–13. In the machine based option between 4.5 and 6.6 million unskilled workdays would be required directly on site per annum, (between 17,000 and 25,000 full time jobs), depending on the average wage rate assumed. The lower the average wage rate, the

³⁹ Using Reserve Bank Series 7012 and a log linear estimate for the year 2003

more workers can be hired within the budget constraint. By contrast, in the labour based option 27 million unskilled workdays were required per annum, approximately 103,000 full time jobs. This represents 309,000 temporary 4 month job opportunities, or 206,000 temporary 6 month job opportunities⁴⁰

The Model Results

The direct and indirect impact of both methods of infrastructure provision on the economy is calculated using the SAM. By taking the difference between the results of the two methods we arrive at the impact of budget neutral switching from machine to labour based methods of infrastructure production on output. The impact on the food processing sector is estimated about R150 million⁴¹, while other industries that benefit from the switch to labour based methods are beverages, trade and electricity. There are also a number of industries that will see their gross value of output decline including petroleum refineries, machinery, iron & steel and non metallic minerals. These industries are more prominent in the machine based method and tend to lose out with a switch to labour based methods. The full set of results for all sectors is included in Appendix D.

The impacts in terms of labour demand and growth are set out in Table 5. The direct impact is shown in the first two columns, and the total (direct plus indirect) impact in columns 3 and 4. The impact of shifting from one machine based to labour based infrastructure provision is shown in column 5. In terms of factors of production, rows 1 to 5 apply. The production factor capital is expected to gain substantially from expenditure on infrastructure provision, but there is very little difference between a labour based and a machine based approach. Row 2 indicates that there is only a direct impact on public works labour, ie, there are no indirect or knock-on effects on this type of labour. The reason is that by assumption no other sector in the South African economy employs this type of labour. The difference of R550 million between the two options (see last entry of the row) represents the impact of switching from machine to labour based methods. Other 'regular' unskilled labour and indeed to a larger degree the other skill categories (rows 3-5) will benefit upstream from the expenditure on infrastructure, although as with capital, there is very little difference between the two options. The most striking observation can be made for medium skilled labour which benefited more from the machine based than the labour based option.

⁴⁰ While the number of workdays created is objective, the actual number of workers employed as a consequence is dependent on political and management factors.

⁴¹ For example in Appendix D, row 1 indicates that while the direct impact on output (gross value of production) of food processing is zero, due to income expenditure by the project, output of the food processing sector is expected to rise by R450 million in the labour based scenario compared to R300 million in the machine based.

Table 5: Direct and indirect impact on factors of production, labour demand and growth for labour and machine based infrastructure provision (2003).

	1	2	3	4	5
	Labour Based Method	Machine Based Method	Labour Based Method	Machine Based Method	Impact of switching from machine to labour based R million (unless indicated otherwise)
	Direct impact	Direct impact	Total impact	Total impact	
1. CAP	216	216	1,386	1,345	41
2. LABEPWP	781	228	781	228	553
3. LABLowSkill	0	0	236	229	7
4. LABMedSkill	166	205	592	622	-30
5. LABHiSkill	300	300	621	610	12
6. Gross sectoral output	809	1,039	4,848	4,679	169
7. Output multiplier			1.6	1.5	
8. GDP	1,462	950	3,615	3,033	583
9. GDP multiplier			1.2	1.0	
10. % of GDP	0.1%	0.1%	0.34%	0.28%	0.05%
11. Government inc	345	389	1,039	1,021	19
12. Imports	268	425	1,452	1,488	-36
13. % Ch in 0-20%	3.1%	0.9%	3.2%	1.0%	2.1%
14. % Ch in 20-50%	1.1%	0.3%	1.2%	0.5%	0.8%
15. % Ch in 50-90%	0.0%	0.0%	0.2%	0.2%	0.0%
16. % Ch in 90-100%	0.0%	0.0%	0.2%	0.2%	0.0%
17. Employment EPWP (full time jobs p/a)	104,384	25,543	104,384	25,543	77,767
18. Low skilled	0	0	3,123	2,769	353
19. Medium skilled	2,027	2,513	8,456	8,288	168
20. High skilled	984	984	3,435	3,177	258
21. Total	105,847	28,565	117,850	39,303	78,547

Source: Own calculations

GDP Effect

A summary of the impact on sectoral output and GDP is provided in rows 6-10. The direct contribution to GDP is relatively high in the labour based method, as a large proportion of project expenditure is on labour, which feeds directly into GDP (here measured at factor costs). The direct and indirect impact of the labour based option is about 0.1% (rounded) higher than the impact of the machine based approach. When taking the indirect contribution into account, the difference between the two options is about R600 million worth of value added, very similar to the difference if only direct impacts are considered. This suggests that the final (direct and indirect) impact on GDP is mainly driven by the direct effects. In short, the impact on GDP of shifting from machine based to labour based methods, represents 0.1% of total GDP, as measured for the year 2003⁴².

Given the initial expenditure of R3 billion, the output multiplier is estimated at 1.6 in the labour based and 1.5 in the machine based option while the GDP multipliers are 1.2 and 1.0 respectively⁴³. In terms of GDP, the labour based option therefore adds 20% to the initial expenditure while the machine based option returns the same initial amount of R3 billion. The impact of shifting from machine to labour based technologies is worth about 0.1% of GDP for every R 3 billion spent. Growth in GDP was measured at 1.9% during 2003. With the addition in GDP due to the shifting from capital to labour intensity as estimated in the last entry of row 47, GDP growth would have been 0.06% higher.

It would therefore appear that the impact of a budget neutral switching from machine to labour based infrastructure provision to the tune of R3 billion has a very small but perceptible positive impact on GDP. The reason is that the labour based option is less import intensive as the machine based option so that there are less leakages out of the demand side system. The linear nature of our model makes it easy to evaluate the size of the public works programs in order to make switching more noticeable in terms of GDP. A R10 billion program of infrastructure expenditure, would, given the multipliers outlined in the previous table yield an increase in GDP of about 1%. Switching between the two options is however, still limited to about 0.2% of GDP. A switch of R60 billion from capital to labour intensive infrastructure provision would be required to a sizeable (1%) impact on GDP.

⁴² 2003 GDP at factor costs is estimated by taking 2002 GDP and applying an estimated 8% (2% real growth and 6% deflator) nominal growth rate

⁴³ These multipliers are typically lower than the conventional (unconstrained supply) multipliers which are around 2.1 and 1.0 for the labour based and machine based output multipliers respectively and 1.4 and 1.2 for the labour based and machined base GDP multipliers respectively. This suggests that the supply constraint is quite important, taking about 30% off the output effect and about 20% off the impact on GDP

Government Income Effect

The impact on government income is shown in row 11. The initial budget neutrality is not maintained, as government revenues increase slightly when shifting from a machine to a labour based scenario. The reason is that with slightly higher economic activity (see last entry of row 8) more direct and indirect taxes are raised. The direct impact is derived from the expenditure patterns of the two options and mainly involves commodity and import taxes. The latter makes the machine based option more attractive given the higher import content, which is confirmed in the next row in where it can be seen that the import content of the machine based option is indeed higher, although the difference is reduced when indirect effects are accounted for. The lower difference in direct and indirect imports between the two options can be explained by the knock-on multiplier effects of the labour based option, which in terms of value of output, are much higher, as shown above, thereby pulling in more imports, even if the import content of the indirect effects is more or less the same. As a result, the direct and indirect impact on imports of shifting from machine based to labour based production of infrastructure is relatively small, with imports falling by R36 million.

Household Income Effect

In terms of household income, the impact is expressed in terms of percentage change from the base⁴⁴. In the first two columns the direct impact on household income is shown. Poor households, here defined as the bottom 20% of the income earning households, would benefit most, particularly in the labour based scenario, if employment were explicitly and successfully targeted to this group. Machine based infrastructure is also beneficial for the poor due to the scale of expenditure, but not as much as labour based. The direct plus indirect impact on the bottom 20% is larger than the impact of labour income of workers employed on site only. This means that poor households will also benefit from labour income from the other skill categories and capital income identified in the expenditure patterns of the program, which follows from the income distribution patterns embedded in the underlying SAM. The direct impact of the labour based option on the household income of the poorest quintile is 3.1%, and the upstream knock-on multiplier effect adds another 0.1%, thereby raising it by 3.2%. Nevertheless, the impact on household income is mainly driven by the direct effect and the multiplier knock-on effects are very modest. Under the machine based scenario the total impact is only 1.0%, hence shifting from machine to labour based technology has a substantial positive impact on poor households (the bottom quintile), raising their income by more than 2% but this is mainly driven by the direct effect⁴⁵. Other household income groups identified in Table 5 also benefit from the shift in labour intensity, but the impact is extremely limited.

⁴⁴ Using the same factoring-up of the 2000 SAM base to the year 2003 as described in footnote 14 above.

⁴⁵ This was calculated by dividing the R560 million increase in income of the bottom quintile by the total income of these households, which is estimated to be around R26 billion in (2003 prices).

However, the analysis above attempts to model a successfully poverty targeted EPWP whereby public works employment was distributed to the lowest quintile only. It may not be assumed that this level of success in poverty targeting will take place, and a sensitivity analysis was carried out around the earning of wage income by unskilled labour to explore the implications of this assumption. In the analysis above the special unskilled labour category was used to simulate poverty targeting. This may be compared with the outcome when public works wage income is allocated according to the conventional SAM distribution of 'regular' unskilled labour, which distributes income to a much wider range of households. Under this scenario the impact on GDP (not shown in the table) is negligible but the benefits are much wider spread among the rich and poor, with the largest increase being recorded by the 20-50% income class, and the 50-90% income class benefiting to the same degree as the bottom 20%. This suggests that without targeting the impact is much more defused and the impact on the poor less significant.

The Impact on the Demand for Labour

The impact on the demand for labour, like the monetary effects discussed above, only applies for as long as the expenditures take place; the 'jobs' created are not permanent positions but rather 'temporary employment opportunities'. The effects are measured in full time person year equivalents but can easily be converted to workdays using the conversion factors shown in rows 2 and 3 of Table 4. Demand for labour from the special employment category 'public works labour' does not benefit from upstream multiplier effects, as it is solely linked to the project. The difference between the labour based and machine based option is about 78 000 person year equivalents (see row 17). Row 18 suggests that other low skilled labour will benefit, although not directly (see first two entries) through similar levels of upstream multiplier effects in both options, with 3 000 person year equivalents in the labour based option and about 2 700 person year equivalents in the machine based option. The impact of shifting factor intensity is therefore about 350 person year equivalents. Similarly, the impact of shifting is 170 and 260 person year equivalents for medium and high skilled labour respectively. In short, shifting from machine based to labour based public works technologies is expected to generate a few hundred person year equivalents in the regular labour categories. This is due to the upstream multiplier effects of labour based public works expenditure, which tends to be more labour intensive, but the impact is not significant, comprising less than 1% of the total employment created. In total, i.e., accounting for the direct as well as indirect effects (see row 21), the impact on employment of shifting from machine to labour based infrastructure provision for a R3 billion budget is about 1%, i.e., 79 000 person year equivalents out of about 8 million workers currently employed in South Africa.

The machine based employment results in Table 5 are based on a daily wage rate of R35, the reported wage in the industry (see Table 4). If the daily wage rate is raised to R52 (the industry minimum wage) in the machine based option the number of workdays

for the machine based option drops by 8 000 person year equivalents. Since the same total value of labour income is paid out to the same target households, no other changes take place in the model. In this instance shifting from a machine based option which employs less labour initially (at R52), to a labour based option employing workers at R29.2 (as in Table 4) will therefore add to the 79 000 already calculated another 8 000 person year equivalents, a further 0.1% of the 8 million workers currently employed in South Africa, a representing a total increase in employment of 1.1%.

Finally, we mentioned earlier that we were using marginal employment output relationships as a more realistic way to compute the knock-on employment effects compared to using the traditional average employment output relationship. The question can be raised what the difference between these two assumption is in terms of our application. Firstly, note that the difference between marginal and average employment output relationships only applies to the knock-on effects. The bulk of the impact of switching from machine based to labour based public works technology relates to directly employed workers and is therefore not effected by the difference in the marginal - average employment output assumption. The latter therefore only applies to the indirect employment impacts which, as we had noted above, is about 1% of the total employment created by the shift. As it turns out, indirect unskilled labour is about 2.9 times higher using average employment – output ratios which yields about 1 000 person year equivalents in stead of the 350 reported in the last entry of row 18 of Table 4 above. Similarly, the factors are 2.4 and 1.4 for medium and high skilled labour taking them to 400 and 350 in stead of 170 and 260 as reported in rows 19 and 20 of Table 4 respectively. The total impact on indirect employment, across all labour categories, is then 1 800 instead of 800 person year equivalents. In summary, the difference in assumptions about the relationship between employment and output represents therefore about 1 000 person year equivalents.

Summary of Macroeconomic Impact

Overall the impact on GDP of shifting from machine to labour based methods is 0.1% of total GDP, as measured for the year 2003, which is mainly driven by the direct effects. The direct impact on government income mainly involves commodity and import taxes, with import taxes making the machine based option more attractive given the higher import content. The difference is reduced when indirect effects are considered, due to the higher knock-on multiplier effects of the labour based option, which pulls in more imports, even though the import content of these indirect effects is similar. As a result, the total impact on imports of switching from machine to labour based options is relatively small. Industries benefiting from the budget neutral switching to labour based methods are beverages, trade and electricity, with the impact on output of the food processing sector standing at R150 million. A number of industries will suffer as a consequence of the shift, including petroleum refineries, machinery, iron & steel and non metallic minerals.

As would be anticipated, poor households, the bottom 20% of income earning households, benefit most *if employment is targeted to them*; if successfully targeted, shifting from machine to labour based technology has a substantial positive impact on the poor, raising their income by 2%. The impact on household income is mainly driven by the direct effect as the multiplier effects are modest. Other household income groups also benefit but the impact is limited. If employment is allocated to ‘regular’ unskilled labour, as suggested by the microeconomic study rather than the poorest quintile, the impact on GDP (not shown in the table) is negligible but the benefits are much wider spread, with the largest increase recorded by the 20-50% income class, while even the 50-90% income class benefits to the same degree as the bottom 20%. This suggests that in this case the impact is much more defused.

In terms of labour demand, the difference between the labour and capital based options is estimated to be about 80 000 person year equivalents (or 20 million workdays), with a few hundred additional person year equivalents in the other skill categories. The upstream multiplier effects of labour based public works expenditure are more labour intensive as the composition of output shifts towards activities that employ more labour per unit of output. In sum, the impact on national employment can be estimated at about 1%, or 80 000 person year equivalents out of about 8 million workers currently employed in South Africa.

Conclusion

At the microeconomic level, survey data suggests that the income poverty reduction impact of short term PWP employment will be limited, although the poverty gap (depth of poverty) experienced by participating households is temporarily reduced. The implication is that a short term employment opportunity is not likely to have significant insurance benefit function in the context of chronic ongoing unemployment, and hence is unlikely to facilitate a sustained movement out of poverty.

Some improvement in the material and financial asset base of participating households was indicated by the survey findings, but only limited investment in formal or informal income generating activity, and a limited stimulus to the local economy. These benefits are likely to be limited to the period of PWP implementation. The survey data also suggests that the labour market effect of programme participation, mediated through improved labour skills and experience, will be limited in the context of mass unemployment, given the critical challenge is the structural and mass nature of unemployment. Targeting a poorer group for PWP employment, and extending programme duration would be likely to maximise the impact of the intervention.

Likewise the survey data findings suggested that the labour market benefits of the programme may only be temporary in nature, and were unlikely to promote significant secondary economic activity or employment, given the mass nature of unemployment and the limited demand for un or semi-skilled workers on the one hand, and the lack of

access to capital on the other, constraining both formal and informal sector labour demand activity.

These findings conform with the concern outlined above; that the nature of the policy prescription is inconsistent with the nature of the labour market problem, and hence unlikely to meet the policy objectives of making significant impacts on poverty and unemployment.

The macroeconomic analysis further supports this contention, indicating that an annual shift in the factor intensity of R3 billion of existing infrastructure budget allocations is unlikely to have a significant impact at macro level on employment or GDP growth, largely due to the limited scale of the intervention. The impact on poverty would be contingent on targeting of PWP employment to the poorest quintile, in which case it could increase income in the aggregate by 2%, but if employment were spread across unskilled labour more generally, as as indicated in the survey findings, the impact on the poor would cease to be significant.

Hence the micro and macro analysis suggests that a programme such as the EPWP could be expected to make a temporary contribution to poverty alleviation, but not to offer a significant response at micro or macro level to poverty, unemployment or growth, as the policy instrument selected is inappropriate given the structural and chronic nature of the labour market problem in South Africa, and its scale too limited.

While these conclusions are derived from South African data, they serve to illustrate a more widespread problem within social protection policy internationally; an analytical conflation of acute and chronic labour market crises, which leads to the adoption of short term public works interventions as a central response to transient *and* structural labour market crises alike. Given the limited risk insurance function of a short term public works programme in the context of chronic unemployment, and the limited benefits of shifting the factor intensity of a small portion of the national budget, it is unlikely that the adoption of such policies will be significant in terms of addressing poverty, labour market or growth objectives.

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Appendix A: Disaggregation of a 2000 SAM for South Africa

Commodities and activities

		Commodities / activities	Abrev			Commodities / activities	Abrev
1	11-13	Agriculture, forestry & fishing	AGRI	23	353-355	Metal products excluding machinery	METP
2	21	Coal mining	COAL	24	356-359	Machinery & equipment	MACH
3	23	Gold & uranium ore mining	GOLD	25	361-366	Electrical machinery	ELMA
4	22, 24, 25, 29	Other mining	OTHM	26	371-373	TV, radio & communication equipm	COME
5	301-304	Food	FOOD	27	374-376	Professional & scientific equipment	SCIE
6	305-306	Beverages & tobacco	BEVT	28	381-383	Motor vehicles, parts & accessories	VEHI
7	311-312	Textiles	TEXT	29	384-387	Other transport equipment	TRNE
8	313-315	Wearing apparel	APPA	30	391	Furniture	FURN
9	316	Leather & leather products	LEAT	31	392	Other industries	OTHI
10	317	Footwear	FOOT	32	41	Electricity, gas & steam	ELEG
11	321-322	Wood & wood products	WOOD	33	42	Water supply	WATR
12	323	Paper & paper products	PAPR	34	51	Building construction	CONS
13	324-326	Printing, publishing & record media	PRNT	35	52-53	Civil engineering & other construct	TRAD
14	331-333	Coke & refined petroleum prods	PETR	36	61-62	Wholesale & retail trade	HCAT
15	334	Basic chemicals	BCHM	37	63	Catering & accommodation services	TRAN
16	335-336	Other chemicals & man-made fibres	OCHM	38	71	Transport & storage	COMM
17	337	Rubber products	RUBB	39	72	Communication	FINS
18	338	Plastic products	PLAS	40	81-82	Finance & insurance	BUSS
19	341	Glass & glass products	GLAS	41	83	Business services	MAOS
20	342	Non-metallic minerals	NMMP	42	93-98	Medical and other services	OTHP
21	351	Basic iron & steel	IRON	43	99	Other	GOVS
22	352	Basic non-ferrous metals	NFRM				

Labour categories

	Description
Highly skilled	Professional, semi-professional and technical occupations Managerial, executive and administrative occupations Certain transport occupations, e.g. pilot navigator
Skilled	Clerical occupations Sales occupations Transport, delivery and communications occupations Service occupations Farmer, farm manager Artisan, apprentice and related occupations Production foreman, production supervisor
Semi- and unskilled	The rest

Household income classes

	% of income earned	
d0	0%	- 10%
d1	10%	- 20.0%
d2	20%	- 30.0%
d3	30%	- 40.0%
d4	40%	- 50.0%
d5	50%	- 60.0%
d6	60%	- 70.0%
d7	70%	- 80.0%
d8	80%	- 90.0%
d91	90%	- 95.0%
d921	95%	- 96.25%
d922	96%	- 97.50%
d923	98%	- 98.75%
d924	99%	- 100.00%

Appendix B: Allocation of detailed expenditure patterns to model variables (2003)⁴⁶

Overhead & gain	Labour based method Share of total	Machine based method Share of total	SAM classification
Overhead	3.6%	3.6%	Other services
Gain	7.2%	7.2%	Capital
Subtotal	10.8%	10.8%	
Labour			
Unskilled lab.	26.0%	7.6%	Low skilled
Skilled lab.	5.5%	6.8%	Med skilled
Subtotal	31.5%	14.5%	
Plant			
Tipper Trucks	5.5%	4.7%	Other trnsp eq
Heavy Plant	0.0%	9.8%	Machinery
Compaction Plant	3.3%	5.5%	Machinery
Small Plant	3.1%	2.8%	Machinery
Subtotal	11.8%	22.8%	
Fuel			
Diesel	8.7%	9.9%	Petrol refineries
Subtotal	8.7%	9.9%	
Transport			
Transport	3.1%	0.3%	Transport serv
Subtotal	3.1%	0.3%	
Materials			
Road signs	0.4%	0.4%	Metal products
Pre-cast concrete units	7.4%	7.9%	Non-met mins
Cement	0.5%	0.5%	Non-met mins
Concrete aggregated	0.8%	0.8%	Non-met mins
Bituminous materials	17.8%	19.2%	Petrol refineries
Subtotal	26.8%	28.9%	
Project design			
Wages	10.0%	10.0%	Highly skilled
Subtotal	10.0%	10.0%	

Source: I.T. Transport Limited

⁴⁶ Detailed expenditures are allocated to model variables, as can be seen in the last column of the table. In row 1 expenditure on overheads is allocated to other services in the model, while gain is appropriated by the production factor capital as can be seen in row 2.

Appendix C: Direct impact on commodity demand for labour based and machine based infrastructure provision (2003)

	1	2	3	4
	Labour Based Method %	Machine Based Method %	Labour Based Method R million	Machine Based Method R million
CAGRI			0	0
CCOAL			0	0
CGOLD			0	0
COTHM			0	0
CFOOD			0	0
CBEVT			0	0
CTEXT			0	0
CAPPA			0	0
CLEAT			0	0
CFOOT			0	0
CWOOD			0	0
CPAPR			0	0
CPRNT			0	0
CPETR	26.5%	29.1%	795	873
CBCHM			0	0
COCHM			0	0
CRUBB			0	0
CPLAS			0	0
CGLAS			0	0
CNMMP	8.6%	9.3%	259	279
CIRON			0	0
CNFRM			0	0
CMETP	0.4%	0.4%	11	12
CMACH	6.4%	18.2%	191	545
CELMA			0	0
CCOME			0	0
CSCIE			0	0
CVEHI			0	0
CTRNE	5.5%	4.7%	164	140
CFURN			0	0
COTHI			0	0
CELEG			0	0
CWATR			0	0
CCONS	0.0%	0.0%	0	0
CTRAD			0	0
CHCAT			0	0
CTRAN	0.3%	3.1%	10	94
CCOMM			0	0
CFINS	0.0%	0.0%	0	0
CBUSS			0	0
CMAOS	3.6%	3.6%	108	108
COTHP			0	0
CGOVS			0	0
CAP	7.2%	7.2%	216	216
LABEPWP	26.0%	7.6%	781	228
LABLS			0	0
LABSK	5.5%	6.8%	166	205
LABHI	10.0%	10.0%	300	300
Total	100.0%	100.0%	3,000	3,000

Source: I.T. Transport Limited and own calculations, Note: abbreviations are explained in full in Appendix A.

Appendix D: Direct and indirect impact on commodity demand for labour based and machine based infrastructure provision (2003)

	1	2	3	4	5
	Labour Based Method	Machine Based Method	Labour Based Method	Machine Based Method	Impact of switching from machine to labour based
	Direct impact	Direct impact	Total impact	Total impact	R million
AFOOD	0	0	451	300	151
ABEVT	0	0	201	134	68
ATEXT	0	0	37	32	6
AAPPA	0	0	34	27	8
ALEAT	0	0	4	3	1
AFOOT	0	0	13	10	3
AWOOD	1	1	17	16	1
APAPR	0	0	76	70	6
APRNT	0	0	44	42	3
APETR	378	415	498	534	-37
ABCHM	12	13	80	77	3
AOCHM	1	1	105	91	14
ARUBB	0	0	14	14	-1
APLAS	0	1	30	28	2
AGLAS	0	0	8	7	1
ANMMP	188	202	215	231	-16
AIRON	1	1	55	73	-18
ANFRM	0	0	25	30	-5
AMETP	13	21	54	67	-13
AMACH	57	159	89	196	-108
AELMA	0	0	20	22	-2
ACOME	0	0	6	6	0
ASCIE	0	0	4	4	0
AVEHI	4	7	97	102	-4
ATRNE	46	39	54	47	7
AFURN	0	0	17	15	2
AOTHI	0	0	15	14	1
AELEG	0	0	126	102	24
AWATR	0	0	46	37	9
ACONS	0	0	32	30	2
ATRAD	0	0	768	717	51
AHCAT	0	0	69	65	4
ATRAN	8	78	301	360	-60
ACOMM	0	0	168	153	15
AFINS	0	0	387	368	19
ABUSS	0	0	332	321	11
AMAOS	100	100	197	187	11
AOTHP	0	0	144	133	10
AGOVS	0	0	12	11	1
CAP	216	216	1,386	1,345	41
LABEPWP	781	228	781	228	553
LABLS	0	0	236	229	7
LABSK	166	205	592	622	-30
LABHI	300	300	621	610	12
Gross sectoral output	809	1,039	4,848	4,679	169
Output multiplier			1.6	1.6	
GDP	1,462	950	3,615	3,033	583
GDP multiplier			1.2	1.0	
% of GDP	0.1%	0.1%	0.34%	0.28%	0.05%
Government inc	345	389	1,039	1,021	19
Imports	268	425	1,452	1,488	-36
% Ch in 0-20%	3.1%	0.9%	3.2%	1.0%	2.1%
% Ch in 20-50%	1.1%	0.3%	1.2%	0.5%	0.8%
% Ch in 50-90%	0.0%	0.0%	0.2%	0.2%	0.0%
% Ch in 90-100%	0.0%	0.0%	0.2%	0.2%	0.0%
Employment EPWP (full time jobs p/a)	104,384	25,543	104,384	25,543	77,767
Low skilled	0	0	3,123	2,769	353
Medium skilled	2,027	2,513	8,456	8,288	168
High skilled	984	984	3,435	3,177	258
Total	105,847	28,565	117,850	39,303	78,547

Source: own calculations, Note that output results are not given for the first 4 industries because they are supply constrained. Given this constraint, these sectors will record a decline in final demand, so as to satisfy intermediate demand emanating from the exogenous shocks. The decline in final demand may be achieved by lower exports or by lower household demand. These results are not reported in this analysis.