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OPTION VALUES, SWITCHES AND WAGES - AN ANALYSIS OF THE EMPLOYMENTGUARANTEE SCHEME IN INDIA

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Abstract

Consistent with the theory of real options, it is argued that the value of the Employment Guarantee Scheme (EGS) in the Indian state of Maharashtra and its impact on workers' behaviour do not depend so much on its income supplementation as on enlargement of opportunities in an uncertain environment of the local labour market. The choice between the EGS and other activities in rural areas is modelled in a dynamic optimisation framework that takes into account a fixed wage rate and certainty of employment under the former and a stochastic wage rate in the latter. Besides, entry and exit costs of various employment options are taken into account. Finally, allowance is made for volatility of regular labour market activities (e.g. agricultural wage earnings). The predictions of this model are validated with the help of a panel household survey in a semi-arid region of south India. If this analysis has any validity, the incentive case for rural public works schemes such as the EGS in terms of screening and deterrent arguments, premised on a fixed wage rate differential, needs to be reformulated.

Key words: options, uncertainty, entry and exit costs, incentives.
JEL codes: D3, D8, H5, I3, J2.

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1. Introduction

Much of the earlier work focuses on the targeting and poverty alleviating potential of the Employment Guarantee Scheme (hereafter EGS) in the Indian state of Maharashtra (e.g. Gaiha, 2001, Ravallion, 1991, Ravallion and Datt, 1995). Attention is given to various mechanisms through which it impacts on the rural poor. These include direct transfer benefits as well as indirect ones through a positive effect on agricultural wage rates. A point of departure of the present study is the focus on switches into the Employment Guarantee Scheme in the Indian state of Maharashtra in a framework consistent with the theory of real options. This theory appears relevant for the problem on hand, because the value of the EGS scheme and its impact on workers' behaviour do not depend so much on its effects as an income supplement, but on the enlarged set of opportunities that it provides in the uncertain environment of the local labour market and farm and non farm activities. Thus, rather than actual increase in income and employment, the EGS promises potential increases of these variables for given levels of volatility in the regular labour market, or, alternatively, potential decreases in volatility for given levels of income and employment. As in most insurance schemes, these effects, in turn, may change workers'

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behaviour in a way that may not be fully consistent with "ex ante" conditions. For example, the extent to which workers diversify their portfolio of activities may be reduced and a larger proportion of workers may participate in the regular labour market, rather than in own farming or non- farm activities, since the EGS provides a form of employment of last resort, at an institutional wage, that can be readily used to cover unemployment and wage risks.

The choice between the EGS and other activities in rural areas-including farm and non-farm- is modelled in a dynamic optimisation framework that takes into account a fixed wage rate and certainty of employment under the former (for a fixed period of time) and a stochastic wage rate in the latter, over different seasons.[2] Besides, entry and exit costs of various employment options-specifically, the EGS and farm and non-farm activities- matter. Allowance is also made for volatility of regular labour market activities – in the present case, agricultural wage earnings. The focus therefore is on switches between these alternatives on the basis of a (discounted) cash flow analysis that encompasses these factors. Some interesting insights into participation in the EGS emerge. The higher the EGS wages, for example, the higher would be the proportion of higher income workers for two mutually reinforcing reasons: higher EGS wages (net of entry costs) will induce more

[2] This is a significant point of departure from an earlier model of intrahousehold time allocation across various activities such as wage labour, own farm work, self-employment, domestic work, etc. as a function of a vector of exogenous variables and the time spent on the EGS. The problem is one of household utility maximisation in which employment under the EGS is rationed. Although an interesting model, it has two limitations. One is that the entry and exit costs of various options are not considered. A second limitation is that rationing under the EGS became a serious concern only after the wage hike of 1988.This is an important issue as the data analysed cover the period 1979-84. For details, see Ravallion and Datt (1995).

higher income workers to opt out of other labour market activities in favour of the former; and higher EGS wages would also make fewer higher income participants to opt out of this scheme in response to expected wage increases in other labour market activities. Moreover, since higher expected incomes can be used to offset entry and exit costs, the EGS would also tend to select a disproportionately higher proportion of higher income workers, as they can afford to switch back and forth more easily than less affluent ones. Indeed, some of these insights may throw new light on and explain better the worsening of mistargeting of the EGS during the 1980s- a period marked by a sharp rise in EGS wages rates.[3] But, more generally, premised as they are on a given wage rate in regular labour market activities, the screening and deterrent arguments that are invoked to support workfare programmes- of which the EGS is a special case – lose some of their appeal.[4]

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[3] For illustrative evidence on a worsening of the mistargeting of the EGS, see Gaiha (2000, 2001).

[4] In an influential contribution, Besley and Coate (1992) elaborate the rationale of workfare programmes, given the distribution of the population into low and high ability groups. The objective of workfare is to minimise the cost of poverty alleviation subject to the constraint that everybody obtains a fixed minimum income, z. The transfer package (b, c), where b refers to transfer amount and c denotes a cost in terms of a work-requirement, may induce high ability (and the more affluent) individuals to masquerade as low ability persons to benefit from it. Besides, the cost of poverty alleviation may rise to the extent low ability (poor) individuals reduce their hours of work in the regular labour market. A solution is worked out in terms of a particular work-requirement, c^*, that enables low ability individuals to obtain the minimum income and discourages high ability individuals from claiming the transfer amount. A limitation of this analysis, however, is that wage rates in the regular labour market and the benefits of workfare are taken as given. The point of the present analysis is to focus on choices in a context of changing option values.

Guided by the option value model developed here, an empirical analysis of switches into the EGS and non-farm activities is carried out, as these seem important in the context of a semi-arid region in south India.[5] While consistent with a basic insight of the model, there are some striking differences in the underlying factors.

The scheme is as follows. In Section 1, salient features of the EGS are described. This is followed by a short description of the ICRISAT panel survey in Section 2, on which the switching analysis is based. Section 3 contains a condensed version of the option value model of participation in different activities including the EGS. In the next Section, an econometric analysis of switching is given. The paper concludes with a brief review of the main findings from a broad policy perspective.

[5] Other related issues are addressed in a companion piece (Scandizzo, Gaiha and Imai, 2003).

Section 1
Salient Features of the EGS
EGS – Salient Features[6]

(i) Genesis

In a large part of India – especially in the semi-arid region to which Maharashtra belongs – agriculture is a highly seasonal activity. During the lean periods, large sections of rural households eke out a bare subsistence through short spells of mostly unremunerative employment. If employment opportunities expanded, the severity of hardships would lessen. Motivated by this concern, Mr. V. C. Page initiated the EGS experimentally in 1965. (In fact, it was known for some time as the Page scheme). It was subsequently expanded as part of an integrated rural development project, culminating in the EGS Act (No. XX of 1978) and its implementation in Maharashtra in 1979. From a modest beginning, the EGS expanded rapidly into the most important poverty alleviation programme in Maharashtra.

(i) Nature

The scheme guarantees that every adult who wants a job in rural areas will be given one, provided that the person is willing to do unskilled manual work on a piece - rate basis.[7] Self-selection of the poor is built into the EGS. First, no choice of work is offered. Secondly, until 1988, the wage rate was usually below the agricultural wage rate.[8]

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6 This draws upon GOM (1997).

7 However, a person who is between 15-18 years old can be given employment if there is no earning member in the family.

8 Following the High Court directive, the EGS wage rate was hiked in conformity with the Minimum Wages Act. The piece-rates for different types of

Thirdly, as the guarantee holds at the district level, a person may be required to travel a long distance for a few days of temporary work.

The employment seeker has to get his/her name registered under this scheme with the registering authority of the village (e.g. the Village Level Worker (VLW) or *Gram Sevak*) by filling in a form. Thereafter a formal request for employment is made to the *Samiti* Officer (i.e. the *Tahsildar*) by filling in another form. The *Tahsildar* is obliged to provide work within 15 days of receiving the 'demand for work'. The employment seeker is required to work for a minimum of 30 days on the site assigned by the *Tahsildar*. The person must present himself/herself for work within 7 days of the issuing of the letter by the *Tahsildar*. Failure to provide employment within 15 days entitles the person to an unemployment allowance (of Rs.2 per day).[9] Ex-gratia payment up to Rs.10,000 is admissible in case of death or disablement of a worker on the site.
Some amenities provided on the site include potable water, crèches, resting place and first aid.

(ii) Projects

The scheme operates through identification of projects which must satisfy two criteria: they must be labour – intensive and create

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manual/unskilled work are so fixed that an average person working diligently for 7 hours a day would earn a wage equal to the minimum wage prescribed for agricultural labour for the concerned zone, under the Minimum Wages Act (GOM, 1997).

[9] Hirway and Terhal (1994) draw attention to the use of an elaborate procedure which involves completing several documents, contacting several different persons, and exasperating bureaucratic negligence and bribery. Consequently, the poor suffer more. To illustrate, lack of coordination between technical and revenue departments often results in delays in execution of EGS projects, forcing the poor to seek alternative sources of employment.

productive assets. The labour – intensity criterion is defined rather strictly- the ratio of cost of unskilled labour to equipment, materials, supervision charges and so on must be 51:49 or higher.[10, 11] Productive works are, however, somewhat loosely defined as those which directly or indirectly lead to an increase in production or which, if not undertaken, would cause production to decline. With a view to minimising the recurrence of droughts, priority is given to moisture conservation and water conservation works (e.g. percolation and storage tanks). Other priorities are soil conservation and land development works, afforestation, roads, and flood protection schemes. It is mandated that work under the EGS should be so organised that it does not interfere with normal agricultural activities. Also, this scheme is not activated when work is available on other plan or non-plan works in progress.[12]

(iii) Organisation

A three – tier set up, comprising committees for planning, direction and co-ordination, exists at the State, District and Panchayat Samiti levels. At the State level, overall responsibility is vested in the Planning Department, at the District level, in the Collector, and, at the Panchayat Samiti level, in the Tehsildar.

The Planning Department makes a budgetary provision. Quarterly credit limits are released to the Collectors. An account of expenditure is required to be maintained at the District and Panchayat Samiti levels in accordance with the normal government procedures.

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[10] This is down from 60:40. A few exceptions include canal works of medium and major irrigation projects which involve rock cutting.

[11] Often as a consequence of inflation of material costs some of these are deliberately included in labour costs in order to maintain this norm (Dev, 1993)

[12] New projects under this scheme are undertaken only when (i) at least 50 labourers are available, and (ii) they cannot be absorbed in on-going works. However, exceptions can be made for works in hilly areas (GOM, 1997).

Weekly and monthly progress reports are sent by the implementing agencies to the Collectors for onward transmission to the Planning Department. To minimise the malpractices, a high level vigilance committee under the chairmanship of the Revenue Secretary has been constituted. Vigilance squads have also been constituted at different levels. The workers have been given identity cards-cum-wage books in which their attendance and wages are shown.

(iv) Financing

The scheme is financed through taxes levied specifically for it and a matching contribution from the state government. The former include (i) a tax on profession, trades, etc., (ii) an additional tax on motor vehicles, (iii) a surcharge on sales tax, (iv) a surcharge on land revenue, and (v) a tax on non-residential urban land and buildings.

(v) Recent Developments

(a) SSGV

A sub-scheme of the EGS – *Shram Shaktidware Gram Vikas* (SSGV) – was launched in June, 1989. It is designed to take up all development activities in a village in an integrated manner. More specifically, backward and forward linkages will be taken into account in selecting them. The construction of a percolation tank, for example, will be linked to construction of wells and installation of pumps. Once a village is selected for this programme, its implementation will continue until all works undertaken are completed. Individual beneficiary schemes such as wells, horticulture and farm forestry on land owned by marginal and small farmers are financed by the government.[13] All other beneficiaries bear 50 per cent

[13] The definition of marginal and small farmers used corresponds to that of NABARD. This takes into account whether the land is irrigated or rainfed.

of expenditure. The participation of a village in this scheme is conditional upon an undertaking by the *Gram Sabha* (the village assembly) that 50 labourers will be available per day, two (land owning) workers will provide free labour for one day in a month (or, alternatively, will bear the labour cost involved). Also, there will be stall feeding of cattle and a ban on cutting trees illegally. Villages with surface irrigation exceeding 20 per cent of the land are excluded from this scheme. Beyond a radius of 5 kms of selected villages, the usual EGS works will continue.

In the absence of details, serious doubts about the workability of this scheme persist. Specifically, the issues are: who will identify the projects? Would the project selection be guided by the preferences of the community? If the outlay is predetermined, and there is a binding budgetary constraint, what would be the project selection criteria? Would all selected projects be subject to the labour intensity norm of the EGS? If some projects are subject to this norm, and others are not, who will ensure that these norms are adhered to? Some of these difficulties may be causally linked to the decline in the relative importance of this scheme in the overall EGS outlay during the early 1990s (the share fell from 12 per cent to 6 per cent during 1990 –96).

(b) Horticulture Programme

Horticulture is increasingly emphasised in rural development programmes, as it is highly labour intensive and remunerative under certain conditions. Accordingly, a horticulture programme linked to

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Typically, the cut-off point for small farmers in rainfed areas is at least twice as much as in irrigated areas. In Baramati block (Pune district), for example, the cut-off point for small farmers is 7 acres in irrigated areas, and 18.25 acres in rainfed areas.

the EGS was introduced in 1990. During the 8th Plan period, 10 lakh/one million hectares of land will be covered under it. Its salient features are: (i) it is not restricted to any group; (ii) however, the entire cost of extending it to the lands of SC/ST/small farmers will be borne by the government while others will bear part of it;[14] and, finally, (iii) plantations are allowed on landholdings between 0.2 and 4 hectares.

Some prerequisites for the success of horticulture are: availability of irrigation, transportation and marketing. Even if these requirements are met, a few other concerns remain. In particular, while some benefits of additional employment will accrue to agricultural labourers, the bulk of the gains is likely to accrue to the landowners. Since the scheme is not restricted to a specific group of landowners, participation of even large landowners is not ruled out. Moreover, it is not clear whether there is any additional provision of extension to enable marginal and smallholders to benefit from it.

(c) Jawahar Wells Scheme

Given the semi-arid conditions, and limited expansion of irrigation, crop yields are highly dependent on rainfall. In the absence of efficiently functioning credit markets, there is thus a strong case for public provision of wells for the benefit of smallholders unable to bear the full cost. Guided by these considerations, as a sub-scheme of the EGS, Jawahar Wells Scheme was launched in 1988. Initially, it was confined to marginal and small farmers below the poverty line. In 1991, however, in accordance with the NABARD definition, it was extended to all marginal and small farmers. Wells are dug on their lands at government cost. However, quotas have been fixed for

[14] For details, see GOM (1997).

backward classes by size of landholding.[15,16] As argued below, this shift of emphasis from community assets to individual assets and horticulture has important implications for the cost effectiveness of EGS expenditure. Also, there are other serious concerns relating to inadequate planning and inability of smallholders in raising their share of the financial contribution.

6. Performance

(a) Employment

As shown in Fig.1, over the period 1980-97, there was a decline in EGS participation – the person days of employment fell from 20.55 crores to 9.01 crores[17]. The expenditure (at constant prices) also fell over this period – from Rs.30.17 crores to Rs.24.66 crores. Although participation fluctuated, there was a sharp reduction in 1989, following the hike in the EGS wage rate. Between 1987-89, there was a reduction in person days of employment of over 5.50 crores. A large part of this reduction was due to rationing.[18] Soon after there was a gradual rise in EGS participation until 1993, followed by a steady decline in subsequent years.[19] Considering that the peak of 1980 has not been surpassed and the gap between it and participation has widened considerably – especially during the 1990s – it may be

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15 For details, see GOM (1997).

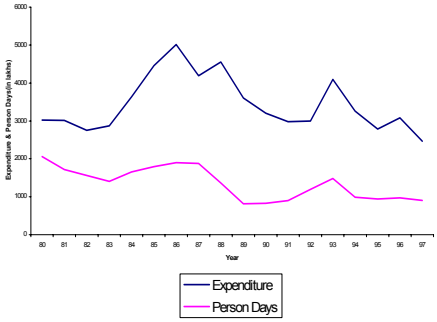
16 However, as there is a large subsidy (of Rs 45,000 in a total cost of Rs 70,000 - Rs 1,00,000), manipulation of these quotas is not implausible.

17 A crore is equivalent to 10 million.

18 About 50 per cent of the reduction in EGS participation between 1988 and 1989 was a direct consequence of the lowering of the EGS expenditure and the hike in the wage rate. Taking this as an approximate measure of rationing, it follows that the extent of rationing was large. For details, see Gaiha (1997). Ravallion et al. (1993), however, attribute 86 per cent of the reduction to rationing.

19 Except for 1996 when there was a slight rise in EGS participation.

Figure 1 EGS Employment and Expenditure during 1980-1997



inferred that the importance of the EGS as a supplementary source of employment has diminished in recent years. However, as argued elsewhere, the EGS continues to perform an important income stabilising role in backward regions.

Over the period 1991-96, the share of female participants (i.e. female participants/total participants) ranged between 30 to 39 per cent. Although these are high shares, it is arguable that they are lower than expected. In Pune district, for example, the number of females registered for the EGS was considerably higher than the number of

males registered. Yet the share of females in total EGS employment was much lower.[20]

Another neglected group is tribals, usually confined to isolated settlements lacking basic amenities (e.g. access to drinking water). Possessing few income earning skills or assets, if any, most of them are condemned to abject poverty. Even the EGS has bypassed them – their share in total participants fell from a meagre 13.30 per cent in 1991 to 8.50 per cent in 1996.

Limited participation of deprived groups – women and tribals – raises a concern about the effectiveness of the guarantee. What adds to this concern is that barely a quarter of those registered under the EGS secured employment within 15 days (of registration) in Pune.[21]

(b) Composition

Over the period 1991-96, the composition of EGS expenditure changed significantly. The share of (usual) EGS projects fell slightly – from over 74 per cent to about 70 per cent; that of the SSGV nearly halved – from about 12 per cent to about 6 per cent; while that of Jawahar Wells rose sharply – from over 13 per cent to nearly 23 per cent. Similar patterns are observed in all 29 districts of Maharashtra in which the EGS operated during this period.[22]

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[20] In 1995, for example, the share of females among the persons registered for the EGS was 57 per cent while their share in total person days of employment was about 37 per cent.

[21] Such estimates are no more than illustrative, as the registration numbers tend to be unreliable.

[22] Except for Pune where the χ^2 statistic is weakly significant (i.e. at the 13 per cent level), in all other districts it is significant at the 5 per cent level, implying significant changes in the pattern of allocation of EGS outlays.

It is plausible that these compositional changes – especially the increasing importance of Jawahar Wells Scheme – impinged on the cost – effectiveness of EGS employment.[23] Some implications of this shift may be serious. Replacement of community assets with individual assets (i.e. wells) could divert the benefits of the EGS away from the poorest landless households to the moderately poor or relatively affluent owning land[24]. Moreover, it is not obvious whether financing of such assets through the EGS is preferable to that through a micro-credit scheme. Finally, to the extent that (small) contractors are involved in the construction of wells, it is unlikely that the employment benefit accrues largely to the poorest workers. Guided by profitability considerations, contractors prefer physically strong and dexterous workers, making it harder for the poorest to fend for themselves.[25, 26] Besides, the contractors are notorious for some

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[23] $L_t = \alpha + \beta_1 E_t + \beta_2 D_t + \varepsilon_t$ .....(1)
where L_t represents person days of employment, E_t denotes EGS expenditure, D is a dummy that takes the value 0 upto 1990 and 1 in all subsequent years, ε is the error term and t denotes year. Using an AR(2) specification, a (significant) negative coefficient of the dummy was obtained, implying a reduction in EGS person days, given the EGS expenditure. This is partly consistent with our conjecture, as the negative coefficient also embodies the dampening effect of expansion of irrigation on EGS demand.

[24] Even if employment created through additional crops is taken into account, this argument is likely to hold.

[25] Since the cost of a well varies from Rs.70,000 to Rs.1,00,000, it is not too low to attract (small) contractors.

[26] There may be elements of the poverty trap here, as emphasised by Dasgupta (1995). If there is a large number of assetless persons relative to the aggregate wealth in an agrarian economy, some of them may find employment at a wage equal to the energy intake at which efficient productivity is maintained while the rest are forced to eke out a bare subsistence. In the next period, the employed have a nutritional advantage over the rest, making it harder for the latter to improve their employment prospects and to break out of the poverty trap. For a

malpractices (e.g. use of inferior material, diversion of resources, etc).

(c) Seasonality

As shown in Fig.2, EGS employment continued to peak during the slack period i.e. April - June. Although the mean EGS participation (about 2 lakhs/0.2million) remained unchanged over the period 1991-96, the coefficient of variation declined slightly – from 53.24 to 49.11. As may be seen from Fig: 2, EGS employment was slightly more evenly spread from its peak in 1996 relative to 1991. Whether in fact this is a manifestation of the changing composition of EGS activities (e.g. a higher share of Jawahar Wells Scheme) cannot be ruled out. Digging of wells is often spread over a few months as the subsidy is released in instalments at different stages of completion. Since some small farmers are unable to raise loans to supplement the subsidy quickly, the construction gets delayed. If this trend continues, EGS may have a stronger effect on agricultural wage rate through a spillover of its activities into busier months.[27]

2. ICRISAT Panel Survey

Agroclimatologically, the SAT includes those tropical regions where rainfall exceeds potential evaporation four to six months in a year. Mean annual rainfall ranges from about 400 to 1,200 mm. India's SAT is vast and covers about 15 to 20 large regions, each embracing several districts.

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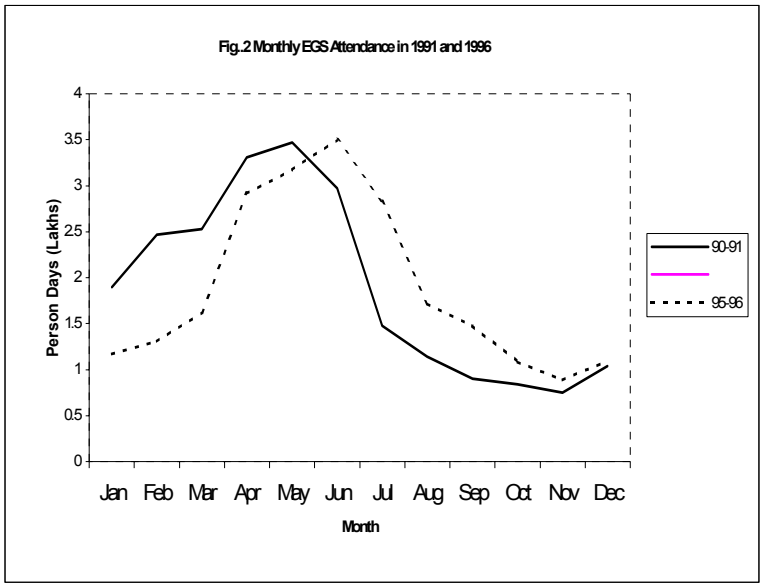
critique questioning the existence of the poverty trap, see Srinivasan (1994), and Subramaniam and Deaton (1996).

[27] For an analysis of the effect of EGS on agricultural wage rate, see Gaiha (1997).



Based on cropping, soil and climatic criteria, three contrasting dryland agricultural regions were selected by ICRISAT: the Telengana region in Andhra Pradesh, the Bombay Deccan in Maharashtra, and the Vidarbha region also in Maharashtra. Three representative districts viz. Mahbubnagar in the Telengana region, Sholapur in the Bombay Deccan and Akola in the Vidarbha region were selected on rainfall, soil and cropping criteria. Next, typical *talukas* (i.e. smaller administrative units) within these districts were

selected, followed by the selection of 6 representative villages within these *talukas*.[28] Finally, a random stratified sample of 40 households was selected in each village. This comprised a sample of 30 cultivator and 10 landless labour households. To ensure equal representation of different farm size groups, the cultivating households were first divided into three strata, each having an equal number of households. A random sample of 10 households was drawn from each tercile. 10 landless labour households were also randomly selected. Landless labour households were defined as those operating less than half an acre (0.2 ha) and whose main source of income was agricultural wage earnings. All households were interviewed by investigators who resided in the sample villages, had a university degree in agricultural economics, came from rural backgrounds, and spoke the local language.

A fixed sample size of cultivator and landless labour households in each village means that the sampling fractions and relative farm sizes that demarcate the cultivator terciles vary from village to village. The likelihood that a village household was in the sample ranged from about one in four in the smaller Akola villages to about one in ten in the larger Mahbubnagar villages. Landless labour households are somewhat underrepresented in the sample. On average across the 6 villages, they comprise about one-third of the households in the household population of interest, but their share in the sample is only one-quarter. However, since their mean household size is less than that of cultivator households, a one-quarter representation is a fair reflection of their presence in the individual population of interest (Walker and Ryan, 1990).

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[28] Two villages in each district were selected: Aurepalle and Dokur in Mahbubnagar, Shirapur and Kalman in Sholapur, and Kanzara and Kinkheda in Akola.

The data collected are based on panel surveys carried out at regular intervals from 1975 to 1984 covering production, expenditure, time allocation, prices, wages, and socio-economic characteristics for 240 households in 6 villages representing 3 agro-climatic zones in the semi-arid region in South India. Given the agro-climatic conditions and purposive selection of the villages, the VLS data are not representative of all of rural south India or, for that matter, even of its semi-arid region. Nevertheless, the longitudinal nature and richness in terms of variables included are what make the ICRISAT VLS data unique.

As part of the ICRISAT VLS, detailed data on time allocation, especially time spent on public employment schemes, were collected continuously for 3 villages from the sample households for the period 1979 to 1984. Of these, 2 (Shirapur and Kanzara) are located in Maharashtra where the EGS operates. Some of the data files (including those covering the EGS) were updated for 1989. Given the sample design, 12 households were selected randomly from each stratum in the sample villages. However, only a fraction of the original panel of households could be retrieved. The present analysis is based on the samples for these two villages. Since the EGS operates only in Maharashtra, an issue is the representativeness of these two villages of the SAT sample for Maharashtra. Table 1 provides a description of agroclimatological differences in the sample villages.

Briefly, the contrast between Sholapur and Akola villages in terms of rainfall, soil quality, cropping patterns, and technological advancement is striking. Since Shirapur is in Sholapur and Kanzara in Akola, the contrast is represented in the sub-sample for the EGS. On

the other hand, the shares of labourers, cultivators and others, as well as average farm sizes of small, medium and large cultivators are largely similar. Thus a small sub-sample of two villages is unlikely to be a serious constraint.

(d) Spatial Concentration

A few earlier studies have drawn attention to the concentration of EGS activities in a few districts.[29] Almost two – thirds of all EGS employment (averaged over the period 1979 – 97) was concentrated in

[29] See, for example, Ranade (1998).

Table 1: Characteristics of Study Regions and Villages

Region and Village		
Mahbubnagar	Akola	Sholapur
Aurepalle	Dokur	Shirapur Kanzara / Kalman Kinkheda
Rainfall unassured; Pronounced rainfall uncertainty at sowing	Rainfall unassured; frequent crop failure	Rainfall assured
Red soil; marked soil heterogeneity	Deep black soils in lowlands; shallower lighter soils in uplands	Black soils; fairly homogneous
Kharif, or rainy season, cropping	Rabi, or post-rainy season, cropping	Kharif cropping
Paddy, castor, and local kharif sorghum	Rabi sorghum	Upland cotton, mung bean, and hybrid sorghum
Agricultural intensification around dug wells and tanks	Some dug wells	Limited irrigation sources in 1970s and early 1980s
Neglect of dryland agriculture	Technologically stagnant	Sustained technical change in dryland agriculture
Harijans and caste rigidities; inequitable distribution of land ownership	Tenancy; dearth of bullocks; more equitable distribution of land	More educated

Source: Walker and Ryan (1990)

one – third of the districts.[30] If, however, the districts are ranked in terms of an
index of development, weighted by their shares in the total rural population, a less skewed distribution of EGS employment is observed.[31] The main findings are as follows. (i) The (cumulative) share of the five least developed districts in total EGS employment was over 18 per cent in 1990, as against about 16 per cent in the total rural population. By contrast, in the five most developed districts, the corresponding shares were about 12 per cent and 18 per cent, respectively. These figures suggest that on a rural population weighted basis the employment benefits of the EGS were slightly greater in the least developed areas. (ii) Over the period 1990-95, the spatial distribution of EGS activities changed little. In fact, the shares of both the least and most developed districts in EGS employment rose slightly i.e. by less than 1 percentage point. Even though the share of the poorest districts continues to be slightly larger, a case for a substantially larger allocation can be made if the findings from the Ahmadnagar sample are replicated in other backward regions with long slack periods.

Section 3
The Model

The traditional approach to the analysis of employment programmes has considered the benefits of a separating equilibrium,

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30 The top ten districts were: Ahmadngar, Aurangabad, Beed, Bhandara, Bhule, Nanded, Nasik, Osmanabad, Pune and Solapur. For further deails, see Ranade (1998).

31 This index was devised by the Centre for Monitoring the Indian Economy, taking into account social and physical infrastructure.

based on the self selection characteristics of the work - salary combination (see, for example, Besley and Coate, 1992). In a situation of dynamic uncertainty, however, we may conjecture that self selection may be less effective, for several reasons. First, rather than acting on a once – and – for - all allocation of labour, the employment programme may motivate workers to switch back and forth between the programme and the labour market in response to threats and opportunities provided by stochastic wages. Because higher skilled workers are better off economically and more secure in their market positions, they may be expected to afford entry and exit costs much more effectively than low skilled workers. In other words, workers near the poverty level may be more reluctant to leave a job in the regular market, in spite of the apparent attractiveness of the guaranteed employment salary, because they are more dependent on their employers and re-entry costs may be large or prohibitive. While its impact is more difficult to hypothesise, uncertainty appears to be an additional, important factor in determining differential behaviour between poorer and richer workers, since, while higher wages may be more volatile, lower wages are generally associated with higher risks of unemployment.

In order to explore these factors and their impact on the EGS, we have resorted to the use of real option theory. This is a recent innovation in decision theory, which promises to be of great relevance to analyse and model all problems where decisions are taken, not only under conditions of imperfect information, but also of dynamic uncertainty. This last term indicates a situation where uncertainty evolves over time, as a consequence of the new information that becomes available as sequences of different states of nature materialise. Unlike traditional decision making analysis, which concentrates exclusively on expected present values of future benefits

and costs, methodologies based on real option theory are based on the idea that the decision maker holds one or more "options", i.e. rights, but not obligations, to undertake certain actions whose outcomes are uncertain. As a consequence, these methodologies focus on the risks and opportunities arising from the uncertain unfolding of events over time.

In the case of an agricultural worker, in particular, the traditional analysis considers his decision problem as one of optimal allocation of his labour resources, given certain expectations on the levels of variables, such as wage levels and the probability of finding employment, in agricultural and non- agricultural markets. According to real option theory, we consider instead the worker to be endowed with a real option reflecting the working opportunities open to him, given his present status. In particular, we consider the case of an agricultural worker who may choose to allocate his labour supply to two alternative uses. On one hand, he may work in the regular market for a wage whose size depends on market conditions as well as on the probability and the length of employment. On the other hand, he may decide to join an employment scheme with a fixed wage and a known portion (possibly all) of his employment time. Joining the scheme, however, will entail a cost for three reasons: first, it will cause average employment time in the formal market to fall; second, it will entail administrative expenses (red tape) in the form of money and time loss; third, it may cause a loss of reputation of the worker on the formal market. This may happen either because the worker breaks a commitment, for example, in the form of an implicit contract, with an employer, by not waiting in an unemployment line or by abandoning his job when the wage rate of the scheme appears more attractive.

We assume that participation and exit costs consist of commitment of non-recoverable resources and that workers decide for every period (say, different seasons) the regime that they will follow, by predicting the discounted cash flow (DCF), possibly adjusted for risk aversion, that they will obtain by choosing one of the employment alternatives. For simplicity, we assume that the worker evaluates his position as if the corresponding income stream were to last indefinitely[32]. We model the employment in the regular market as a search process, whereby the worker samples jobs for openings and salaries from an underlying random distribution. Within a given interval of time (for example, a season), wage income in the regular market is assumed to change, in such a way that the variance of mean income shift, expressed in percentage terms, grows linearly with time, as participation in the labour market increases and labourers confront a higher degree of job and task differentiation. Employment in the regular market is thus assumed to yield a net cash flow y evolving according to a stochastic process of the geometric, Brownian motion variety with zero drift:

(1) $dy = \sigma y dz$,

where σ^2 is the variance and dz is a normally distributed random variable such that $Edz=0$ and $Edz^2 = dt$.

The option to participate in the public employment scheme can be considered a "put" option, i.e. a faculty, given to the workers employed in the regular labour market, to join the programme, should

[32] It would be possible to assume that the worker expected net present value were calculated with reference to a given predicted duration of the job (for example, up to the end of the season), but this would not add anything to the analysis, while making the notation more cumbersome.

the regular salary or wage (or the probability of employment) fall below a certain critical level[33]. The value of such an option, F(y), can either be determined by replicating it with a portfolio of assets and liabilities (see Dixit and Pyndick, p.189) or, more simply, by using dynamic programming. The Bellman equation, in fact, prescribes:

$$(2) \quad \rho F(y) = EdF(y)$$

where ρ is an appropriate rate of discount reflecting the worker's opportunity cost for delaying consumption as well as his degree of risk aversion. Note that the dynamic programming method requires the specification of the discount rate as a subjective parameter. The portfolio replicating technique, instead, by relying on the existence of a market for risky activities, does not require any subjective parameter. Because the formal results are the same, however, except for the interpretation put on the parameter ρ, the determination of the preferences of the worker with respect to time and risk does not change the analysis and may pose a problem only in the empirical specification.

Equation (2) states that, in order to maximise the present value of the option, the worker is to equate, in continuing time (that is, at the margin between holding and exercising the option), the value that he would obtain by exercising the option, to the expected present value of the future capital gains obtained by holding the

[33] More generally, we can assume that the stochastic process y concerns the income obtained by the worker by dividing his labour among on farm and off farm activities. Note also that regular market salary is used synonymously with wages.

option. This equation may be used to determine the functional form of the option value function. After applying Ito's lemma, in fact, it yields a partial differential equation whose general solution is:

$$(3) \quad F(y) = A_1 y^{\beta 1} + A_2 y^{\beta 2}$$

where $A_1$and A_2 are constants determined by boundary conditions and β_1 and β_2 are, respectively, the positive and the negative root of the characteristic equation:

$$(4) \quad \rho - \frac{\beta}{2}(\beta - 1)\sigma^2 = 0$$

The functional form obtained in (3) can be used to represent the option to enter the programme, as a put option. The same general form, however, may be used for the "call " option that the worker acquires, after joining the programme, to switch to the regular labour market. The value of the put option to participate in the programme (by switching away from the market) should increase with any decrease in the cash flow generated by regular employment. But the first term on the right hand side of (3) goes to infinity as y grows without limits. Thus, if the worker is in the regular labour market, the constant A_1 can be set to zero. On the other hand, if he is in the employment scheme, he has the option to switch back to the regular job market. In this case, re-interpreting equation (3) as such an option, the second term on the RHS is no longer acceptable. Its value, in fact, increases without limits if the regular wage rate decreases

toward zero, while the value of the option to revert to the regular labour market should only increase as the value of the (regular) wage increases. Thus, in representing the option to switch from the employment programme to the market, we can set $A_2 = 0$.

We also assume that, once the first decision is taken, it is possible for the worker to switch back and forth from the regular market to the employment programme. Exit from the programme and entry into the programme have to meet the two "value matching" conditions (Dixit and Pindyck, 1994, p.218):

$$(5) \quad \frac{w}{\rho} - C + A_1 y_e^{\beta_1} = \frac{y_e}{\rho} + A_2 y_e^{-\beta_2}$$

$$(6) \quad \frac{w}{\rho} + A_1 y_u^{\beta_1} = \frac{y_u}{\rho} - E + A_2 y_u^{-\beta_2}$$

where y_e and y_u denote, respectively, the entry and the exit threshold value of income in the programme, respectively, from and into the regular labour market, C and E are the corresponding entry and exit costs, and $\delta = \rho - \alpha$.

Expressions (5) and (6), and the related smooth pasting conditions form a non linear system that cannot be solved explicitly (Dixit and Pindyck, p. 218). We can gain analytical insights into the solution, however, considering the case in which the worker is

supposed to change his status only once in each season. In this case, we can think of the options available to the worker as triggered by a spline of stochastic processes of the same type as in equation (1), but whose parameters change at each turn of the season. In this case, equation (5) can be modified to state the condition to switch from the off –season market to the programme, and equation (6) as the condition to return from the programme to the on – season market. The problem in (5) and (6) thus becomes a sequential one (Knudsen and Scandizzo, 2002) and equations (5) and (6) can be re-written as follows:

(5bis)

$$\int_{t}^{t_\tau} y_{e\tau} e^{-\rho s} ds + \sum_{i=1}^{n} A_{1\tau+i} y_{\tau+i}^{\beta_{1\tau+i}} + A_{2\tau} y_{e\tau}^{-\beta_{2\tau}} = \frac{w}{\rho} - C + \sum_{i=1}^{n} A_{1\tau+i} y_{\tau+i}^{\beta_{1\tau+i}}$$

(6bis)

$$\frac{w}{\rho} + A_{1\tau+1} y_{u\tau+1}^{\beta_{1\tau+1}} + \sum_{i=2}^{n} A_{1\tau+i} y_{\tau+i}^{\beta_{1\tau+i}} = \int_{t_\tau+t}^{T} y_{u\tau+1} e^{-\rho s} ds - E + \sum_{i=2}^{n} A_{1\tau+i} y_{\tau+i}^{\beta_{1\tau+i}}$$

where τ indicates the low season, with duration from 0 to t_τ, and $\tau+1$ the high season, with duration from $t_{\tau+1}$ to T and the subscripts e and u denoting, respectively, entry and exit levels from the programme. Expression (5bis) states that at any time t the worker decides to join the programme, his expected income from remaining in the (slack season) labour market, plus the value of the option to join the programme at any time in the future within the slack season, plus the value of the options to enter the market in any of the next seasons must equal the expected income from the programme over the same time span, minus entry costs, plus the value of the option to

go back to the market in the busy season. Because the options to enter the labour market in any of the future seasons are common to both conditions (i.e. being in the market and being in the programme), their expression drops out, so that equation (5bis) depends only on the option to join the programme.

Equation (6bis), on the other hand, states that, during the busy season, at any time $t_\tau + t$ the worker may switch from the programme back to the labour market . At the time of the switch, the discounted value of his income from the programme over the remaining part of the season plus the value of the options to re –enter the labour market in the same season, or in one of the future ones, must equal the expected value of his income from the market minus re –entry costs, plus the value of the option to enter again the market in the next season or in any of the future ones.

Applying the smooth pasting condition to the equation for the $\tau - th$ season, (5 bis), we obtain:

$$(7)\ \frac{y_{e\tau}}{\rho} = \frac{\beta_{2\tau}}{\beta_{2\tau}+1}\left(\frac{w}{\rho} - C\right)\left(\frac{1}{e^{-\rho t} - e^{-\rho t_\tau}}\right)$$

Thus, the entry level of income that causes the worker to join the programme is higher, the higher is the programme wage, the lower are programme entry costs, the closer the timing to the end of the season, and the lower is the uncertainty (the higher the beta parameter)[34]. Similarly, if we consider the condition to exit the

[34] To see the relation between entry level and uncertainty, differentiate equation (7) with respect to σ , using also the characteristic equation (4) to obtain:

programme (i.e. 6bis), applying again the smooth pasting condition and substituting into (6bis):

$$(8)\ \frac{y_{u\tau+1}}{\rho} = \frac{\beta_{1\tau+1}}{\beta_{1\tau+1}-1}\left(\frac{w}{\rho}+E\right)\left(\frac{1}{e^{-\rho t_{\tau+1}}-e^{-\rho T}}\right)$$

Expression (8) indicates that the salary at which the worker decides to re-enter the market in the busy season is higher the higher the programme wage, the higher the re-entry costs, the closer the timing to the end of the season and the higher is the uncertainty.

How do we interpret these two results? Expression (7) is straightforward: the worker will exit the labour market to enter the employment scheme, only if the income that he can hope to gain from the market is sufficiently below the income from the programme net of the entry costs. The more advanced is the season, and the higher the uncertainty, the more willingly the worker will go, since the little time left and the uncertainty combine to reduce the value of his put option that, in effect, expires at the end of the season. Expression (8) shows a symmetric result: the worker will return to the regular market only if his wage income promises to be larger than his programme income, the wedge between the two being larger the larger the uncertainty. In this case, the worker will be more reluctant to change, that is, to go from a secure situation to an uncertain one, the larger is the uncertainty and the more advanced is the season.

$$d\left(\frac{y_{e\tau}}{\rho}\right) = -\left(\frac{w}{\rho}-C\right)\left(\frac{1}{e^{-\rho t}-e^{-\rho t_\tau}}\right)\left(\frac{1}{(\beta_{2\tau}+1)^2}\right)\left(\frac{1}{4}+\frac{2\rho}{\sigma^2}\right)d\sigma^2 \le 0 \quad \text{A}$$

symmetric result obtains for equation (8):

$$d\left(\frac{y_{u\tau+1}}{\rho}\right) = \left(\frac{w}{\rho}+E\right)\left(\frac{1}{e^{-\rho t_{\tau+1}}-e^{-\rho T}}\right)\left(\frac{1}{(\beta_{1\tau+1}-1)^2}\right)\left(\frac{1}{4}+\frac{2\rho}{\sigma_{\tau+1}^{\ 2}}\right)d\sigma^2 \ge 0 \quad .$$

Thus while the uncertainty and time elapsed encourage switching from the market to the programme, they discourage switching from the programme to the market.

If wage volatility does not change from one season to the other, furthermore, comparison of the entry and exit income levels in (7) and (8) suggests that the value of the current income that will induce the worker to join the programme will be lower, ceteris paribus, than the value that will convince him to re-enter the market. The entry – exit switching value, in other words, will not coincide, but will determine a band of inertia within which the worker will tend to remain in its previous status and will take no action. This suggests that there may not be a separating equilibrium, i.e. a level of programme wage that discriminates between "rich" and "poor" workers, attracting the latter and keeping the former on the market. The larger the band of inertia, in fact, the larger the number of "poor" workers, who will not join the programme, and the larger the number of "non poor" workers who, having joined the programme, will not switch back to the market. Indeed, if the band is large enough, the self -selecting power of the programme may be insignificant. Moreover, since volatility (and the value of the beta) may change from one season to the other, the band may be larger or smaller according to whether the uncertainty increases or decreases. If wage volatility decreases from the slack to the busy season, the band will become smaller and self- selection will improve, while the opposite will occur if volatility increases. On the other hand, if volatility increases for less poor workers and decreases for poorer ones, we will have the paradoxical result that the latter may return to the market in higher proportion with respect to the former.

Equations (7) - (8), therefore, suggest that there may be several limits to the effectiveness of the employment programme as a mechanism to selectively administer a transfer to lower income

workers. On the one hand, for any given level of programme wages, the fact that effective incomes in the programme depends on worker's productivity (piecewise performance) will tend to select higher skill and harder working labourers. This will induce, ceteris paribus, a higher proportion of higher income workers to leave the labour market for the programme. On the other hand, higher programme incomes, for any given salary, will also make fewer higher income people to leave the programme in response to expected income increases from the labour market. Furthermore, since higher expected incomes can be used to offset entry and exit costs, the programme may also tend to select a disproportionately higher proportion of higher income persons because they can afford to switch back and forth more easily (being able to pay the related costs) than those with low incomes. Also, if higher labour incomes are associated with higher volatility, i.e. the uncertainty is higher for high income workers, we can expect the latter to be more inclined, *ceteris paribus*, to join the programme and, once in it, more inclined to stay there. Finally, the uncertainty, and entry and exit costs will determine a band of inaction that will tend to be different for different workers and may also change over time according to the workers' incomes, skills and market ability.

An important issue, at this point, concerns the other alternatives open to the worker, who may also switch his labour to on and off- farm activities. These alternatives are not formally different from the rural labour market, since in both cases the worker will face the choice between a risky activity (the "next best") and the employment programme. Thus, all results obtained so far apply also to the switching between the risky alternative and the employment programme.

In order to see more clearly what the results obtained imply for programme participation, assume that at the beginning of the year all

workers make their decision by comparing the realized value of y (i.e. the salary offered on the labour market for their skill group) with the entry value y_e. For the same skill group, we will thus have a participation rate equal to 0 if the wage in the labour market is above the critical value and 100 per cent otherwise. Similarly, if the market wage changes are such that it is no longer remunerative to stay in the regular market compared to the programme, participation would revert to 100% . For any given skill group, the number of switches to and from the programme should be a function of the entry and exit critical levels of the stochastic market wage. More specifically, denoting by e_t and u_t the number of switches respectively into and out of the programme at time t for workers, respectively, in the labour market or in the employment programme, we can write: $e_t = e_{t-1} + F(G_t(y_e))$ and $u_t = u_{t-1} + H(1 - G_t(y_u))$, where $G_t(y)$ is the distribution function of the market wage at time t and $F(.)$ and $H(.)$ are two functions with positive first derivative. In other words, for any given interval of time, the number of workers switching from the market into the programme should be a positive function of the probability that market wage is below the programme entry level, y_e, while the number of people switching out of the programme should be a positive function of the probability that the market wage is above the programme exit level, y_u. By assumption, the wage distribution is log-normal with mean equal to y_0 and variance equal to $y_0^2(e^{\sigma^2 t} - 1)$ so that, if this distribution corresponds to the true income distribution over time, we should observe that $prob(\ \log y_t \le (h(y_i)\sigma^2)t) = \phi(h(y_i))$, where $h' = \partial h(y_i)/\partial y_i \ge 0$, $i = e, u$.

By integrating the two difference equations corresponding to e_t and u_t, for t = T, where t denotes the numbers of units of time considered (for example, the number of working days in a year), we obtain:

(9) $$e_T = \sum_{t=0}^{T} F(G_{T-t}(y_e)) = \sum_{i=0}^{T} F_{T-i}(y, w, \sigma, C, t)$$,

where the expected pattern of signs for the partial derivatives is, according to (7): $(-,+,-,-,+)$.

(10) $$u_T = \sum_{t=0}^{T} H(1 - G_{T-t}(y_u)) = \sum_{i=0}^{T} H_{T-i}(y, w, \sigma, E, t)$$

, where the expected pattern of signs is, according to (8): $(+,-,+,-,-)$.

,

Equations (9) and (10) can be tested against the empirical data by nesting them in a regression model of the type:

(11) $$e_{Tj} = \sum_{i=0}^{T} F_{T-i,j}(y_j, w_j, r, \sigma_j; C_j, E_j) + b\sum_j X_{Tj} + \nu_{Tj}$$

where j denotes the j-th worker, X_{Tj} a vector of shifters and ν_{Tj} a well behaved random disturbance and r is the interest rate or any other acceptable proxy for the worker's subjective discount rate.

Section 4
Estimation and Results

(a) Wage Equation

The ICRISAT panel survey does not contain estimates of wage rates for farm and non-farm activities and the EGS. As these variables have an important role in the option value model, we have constructed two alternative sets. In the first set, actual wage earnings in these activities are divided by the number of days worked by each individual in a year and then ratios of wage rates are computed. In the second, ratios of wage rates in the EGS and in farm activities, and in non-farm and farm activities are posited to be *endogenous* to individual, household and village characteristics. A random-effects Tobit specification is used to estimate the wage ratio functions, as shown below.

As specified in equation (12), the ratio of EGS and farm wage rates is determined by a health

(12) $W_{egs\ itv}/W_{agr\ itv} = f_{itv}\ (H_{itv}, S_{itv}, A_{itv}, B_{itv}, V_{itv}, R_{tv},,\alpha_{iv})$

indicator viz. body mass index, BMI, denoted by H, a schooling index (number of years) denoted by S, a vector of socio-demographic characteristics (viz. age, gender, caste, whether married), denoted by A, other household characteristics (viz. schooling and occupation of household head, household debt) denoted by B, a measure of wealth (landowned or net worth) denoted by V, a measure of aggregate risk faced by households (viz. coefficient of variation of monthly rainfall)

denoted by R, an unobserved factor (say, ability) denoted by α, and i indexes individual, t represents year ((t= 1 for 1979, ---, t=6 for 1984) and v denotes village.

As shown in equation (13), a similar set of factors influences the ratio of off or non farm and agricultural wage rates except that there are a few interaction terms involving the gender

(13) $W_{off\_farm\ itv}/W_{agr\ itv} = f_{itv}\ (H_{itv}, S_{itv}, A_{itv}, B_{itv}, V_{itv}, R_{tv},,\alpha_{iv})$

dummy and a few other explanatory variables.

Column (a) of Table 2 contains the results on the determinants of the ratio of EGS and agricultural wage rates. While the BMI and its square do not influence this ratio, age has a negative effect. This is plausible given that EGS wage rates are piece rates calculated on the basis of work done. The female dummy has a negative coefficient, implying much lower wages for female participants in the EGS. Relative to the lowest caste individuals, the medium low caste individuals have higher wage ratios presumably as a result of higher EGS wage rates. Individuals belonging to agricultural labour households also have higher wage ratios – especially because of higher EGS wage rates. The lagged unemployment rate has a positive coefficient, implying a stronger dampening effect of unemployment on farm wage rates of a lowering of reservation wage rates[35]. The overall specification is validated by a Wald test.

Column (b) of Table 2 contains results on the determinants of the ratio of non-farm and farm wage rates. As both wage rates are market determined, some determinants of this ratio are likely to be different. Both high and medium high caste individuals have significantly

[35] A two-year lagged unemployment rate did not yield a significant coefficient.

higher wage ratios than those belonging to the lowest castes. Schooling has a negative coefficient, presumably as a result of a positive effect on agricultural wage rates**.** Individuals belonging to agricultural labour households have a significantly higher wage ratio. The underlying reason is unclear. A higher debt is associated with a lower wage ratio, consistent with (relatively) unattractive non-farm wage options**.** The dummy for Shirapur has a positive coefficient presumably because of low farm wage rates in the more backward of the two ICRISAT villages. The measure of aggregate risk (i.e. the cv of monthly rain) is associated with a higher wage ratio, reflecting a risk premium. The lagged unemployment rate also has a positive coefficient, mainly because of a stronger dampening effect on farm wage rates. Female dummies interacted with caste and Shirapur dummies have negative coefficients, implying significantly lower wage ratios. The overall specification is validated by a Wald test.

(a) Switching Equations

The number of switches between different activities over the entire sample period of six years (1979-84) is calculated as follows: total number of switches of all individuals in the workforce aggregated over 6 years/ total number of individuals in x 6. Thus the switches denote *average* switches of a worker in a year. A striking feature is that generally switches into and out of the EGS and non-farm activities are relatively high. So, for validation of our option value model, we shall concentrate on the switches into the EGS and non-farm/off-farm sector (denoted by *e* for the EGS and by *u* for the non-farm sector). These switches are determined as specified below:

$$(14) \qquad e_{it} = e_{it}\,(W_{EGS\,it}/W_{AGR\,it},\ L_{it-1},\ H_{it},\ S_{it},\ A_{it},\ B_{it})$$

$$(15) \qquad u_{it} = u_{it}\left(W_{\text{non-farm } it}/W_{\text{AGR } it}, L_{it}, H_{it}, S_{it}, A_{it}, B_{it}\right)$$

Table 2

The Random EffectsTobit Estimation Result of the Ratios of Wage Rates

Explanatory Variables	(b) Dependent Variable: EGS Wage / Daily Agricultural Wage	(b) Dependent Variable: Non-farm Wage / Daily Agricultural Wage
	Coefficient (z value)	Coefficient (z value)
Constant	-0.35	-0.64
	(-0.68)	(-1.19)
H_bmi (body mass index)	0.006	0.007
	(1.11)	(1.24)
H_bmi^2 (square of body mass index)	-0.00016	-0.00018
	(-1.11)	(-1.14)
A_ age (years)	-0.002	-0.003
	(-1.72)†	(-1.41)
A_ female (whether female)	-0.89	0.04
	(-2.63)**	(0.29)
A_ high caste	0.02	0.11
	(0.35)	(1.74)†
A_ medium high caste	0.03	0.13
	(0.58)	(1.88)†
A_ medium low caste	0.11	0.05
	(1.96)*	(0.73)
S_ schooling (years)	---	-0.01
		(-2.84)**
B _ agri labourer (whether household head is agricultural labourer)	0.17	0.10
	(3.86)**	(2.19)*
B_ debt (total borrowing of household)	---	-0.000006
		(-2.05)*
V_ land (land owned: acre)	-0.002	-0.001
	(-1.46)	(-0.59)
I_ Shirapur (whether	-0.04	0.10

from Shirapur)	(-1.07)	(1.83)†
R _cv rain (The cv of rainfall)	-0.00008 (-0.10)	0.002 (2.64)*
R _unemp (-1) (The first lagged unemployment rate)	0.002 (4.06)**	0.001 (3.15)**
A_ female* A_ age	---	-0.00007 (-0.03)
A_ female* A_ high caste	---	-0.17 (-1.81) †
A_ female* A_ medium high caste	---	-0.31 (-3.19)**
A_ female* A_ medium low caste	---	-0.12 (-1.15)
A_ female* V_ land	---	0.001 (0.53)
A_ female* I_ Shirapur	---	-0.16 (-1.94) †
Number of observations	892	892
Joint significance (Wald Chi Square)	$\chi^2(12)=55.82$ **	$\chi^2(20)=80.26$**

* denotes significance at 5 % level and †denotes significance at 10 % level.
** denote significance at 1 % level,

These equations are estimated as Poisson regressions, as the sample size is large and the number of switches is small (more specifically, a preponderance of zeros and small positive values).[36] The results are given in Tables 3 and 4.

[36] As the Poisson is a special case of the negative binomial, a test will be used for its appropriateness in the present context. But in general the Poisson provides a close approximation when the sample is large and the number of events'is small ($n \geq 100$ and $n\ \theta \leq 10$). See, for example, Freund and Walpole (1987), and Greene (1993).

As stated earlier, in the absence of direct estimates of EGS and farm/agricultural wage rates, two ratios are used: those based on actual earnings in these activities, and estimated values. Some results are similar**.** In both cases, as predicted by the model, the switches into the EGS are greater the higher is the ratio of EGS wage rate to farm wage rate. Besides, the switches into the EGS are also greater among those who participated in this scheme earlier, presumably as a result of lower entry costs. Thirdly, the higher the coefficient of agricultural wages, the lower the switches into the EGS. Fourthly, the positive coefficient of agricultural wages being in the highest interval (i.e. the top 5 per cent) implies that those in this interval switch into the EGS more often. This coefficient is, however, significant only in the case of the actual wage ratio. But other results differ in a more striking way. In the case of the actual wage ratio, the dummy for 1981 has a negative coefficient, implying lower switches in this year. In the predicted wage ratio case, on the other hand, the occupational dummy (i.e. whether the household head was an agricultural labourer) has a negative coefficient, implying lower switches into the EGS. Since agricultural labour households are highly poverty prone or mostly at the lowest tail of income distribution**,** the lower number of switches among them could well be due to high entry costs or negative reputation effects (given the nature of labour contracts in rural India). Also, the coefficient of the dummy for 1982 has a positive coefficient, implying higher switches into the EGS in this year. The goodness-of-fit test does not reject the Poisson functional form and the joint significance test confirms the overall specification of this regression.

The switches into the non-farm sector are linked positively to the actual and estimated non-farm/farm wage ratios. Also, the switches are greater among those who worked in this sector in the previous

year. (The coefficient of the latter is, however, significant only in the predicted wage ratio case). As noted above, experience and entry costs are presumably inversely related, other things being given. A third similarity in the results with both wage ratios is that among high caste individuals the switches are lower. To the extent that many among them are relatively well-off, the switches into non-farm activities are likely to be higher because they can afford higher entry and exit costs. However, they may have a stronger aversion to loss of reputation and social status as a consequence of a switch out of agriculture. Yet another similarity is that the higher the coefficient of variation of agricultural wages the lower is the number of switches into non-farm activities, reflecting a larger band of inertia from the previous activity. A fifth similarity is the negative coefficient of the dummy for 1982, implying lower switches into non-farm activities. A few dissimilarities may also be noted. To avoid repetition, we shall refer only to the results with the actual wage ratio. The BMI and its square have positive and negative coefficients, respectively. So to the extent farm wages are productivity linked, a higher BMI would imply higher wages. In that case, the switches are higher with higher wage rates but at a diminishing rate. The negative coefficient of the female dummy implies lower switches among females presumably because of higher entry costs. The positive coefficient of Shirapur suggests that higher switches into non-farm activities may be motivated by minimisation of higher unemployment risks in agriculture**.** Also, all year dummies except that for 1983 have negative coefficients, implying lower switches. The Poisson functional form is not rejected by the goodness-of-fit test and the overall specification is validated by the joint significance test.

What then are the implications of these results ? The first important point is that switches into the EGS and non –farm activities are

governed by the wage ratio. The higher is this ratio (say, the EGS/farm wage ratio), the greater are the switches into the EGS, in accordance with a higher discounted cash flow. The wage ratios do not, however, reflect fully the entry and exit costs. It is therefore significant that the switches are greater among those who worked in the same activity in the previous year. To the extent that this reflects lower entry costs into the EGS (e.g. due to greater familiarity with registration procedure) or non-farm activities, this further corroborates

Table 3 Poisson Regression Analysis of Switches into the EGS

	Case 1 **Based on the actual wage ratio: [EGS wage rate /Agricultural wage rate]**	**Case 2** **Based on the *predicted* wage ratio: [EGS wage rate /Agricultural wage rate]**
Dependent Variable:	**Number of switches into the EGS (ENTRY)**	**Number of switches into the EGS (ENTRY)**
Explanatory Variables		
	Coefficient (z value) [1)]	Coefficient (z value) [1)]
Constant	3.23 (0.69)	2.07 (0.37)
EGS Participation Dummy (-1) [2)] (whether participates in the EGS in the previous year)	0.37 (1.66)†	0.61 (2.79)**
The actual wage ratio: [EGS wage rate /Agricultural wage rate]	1.82 (8.92)**	---
The predicted wage ratio: [EGS wage rate /Agricultural wage rate]	---	3.19 (1.97)*
H_bmi (body mass index)	0.35 (-0.76)	-0.28 (-0.48)
H_bmi^2 (square of body mass index)	0.0079 (0.67)	0.0073 (0.49)
S (schooling years:	-0.05	-0.05

years)	(-1.19)	(-1.09)
A_ female (Whether female or not)	-0.27 (-0.47)	-0.68 (-1.15)
A_ age (age: years)	-0.02 (-1.55)	-0.01 (-1.27)
A_ high caste [2)]	-0.14 (-0.38)	-0.22 (-0.60)
A_ medium high caste [2)]	0.39 (0.98)	-0.06 (-0.14)
A_ medium low caste [2)]	0.12 (0.24)	-0.09 (-0.18)
A_ CV (coefficient of variation) in agricultural wage for each year	-0.007 (-3.03)**	-0.010 (-5.24)**
A_ whether the lagged agricultural wage is in top 5 %	0.75 (1.98)*	0.59 (1.51)
B _ agri labourer [2)] (whether household head is agricultural labourer)	0.03 (0.13)	-0.75 (-1.73)†
I_ Shirapur (Whether from Shirapur) [2)]	0.41 (1.23)	0.29 (0.87)
A_ female* A_ high caste	-0.50 (-0.66)	0.39 (0.52)
A_ female* A_ medium high caste	-0.48 (-0.72)	0.39 (0.52)
A_ female* A_ medium low caste	-0.48 (-0.66)	-0.46 (-0.66)
A_ female* I_ Shirapur	0.49 (0.81)	0.79 (1.40)
Year Dummy (Year 80)	-1.04 (-1.71) †	0.29 (0.65)
Year Dummy (Year 81)	-0.99 (-1.56)	-

Year Dummy (Year 82)	0.16 (-0.28)	0.68 (1.66) †
Year Dummy (Year 83)	-0.78 (-1.32)	0.29 (0.62)
Year Dummy (Year 84)	-0.86 (-1.48)	0.70 (1.51)
Number of Observations	367	356
Joint Significance (LR χ^2) test*	χ^2 (23)=212.03**	χ^2 (22)=116.34**
Goodness-of-fit (χ^2) test	χ^2 (343)= 151.44	χ^2 (333) = 232.29

Note: [1] ; *denotes significance at 5% level, and + denotes significance at 10% level.
**denote significance at 1% level

the central argument of the option value model. This is further corroborated by higher switches among a top subset of agricultural wage earners (i.e. in the top 5 per cent). A third important point is that greater volatility of agricultural wages has a dampening effect on switches into the EGS and non-farm activities, consistent with a larger band of inertia from the previous activity (in the present context, agriculture). Apart from some gender and caste related variables that are also arguably linked to entry and exit costs, the results point to the more significant role of the year dummies in the context of switches into the non-farm activities. This suggests that environmental factors (controlling for the effects of wage ratio) matter more in regular labour market activities through their implications for unemployment risks and re -entry costs.

The results given in Table 5 point to a worsening of the targeting of the EGS over the period 1979-89. During 1988, there was a sharp upward hike in the EGS wage rate. In fact,

Table 4 Poisson Regression Analysis of Switches into the Non-Farm Sector

	Case 1	**Case 2**
	Based on the actual wage ratio: [Non=farm wage rate/Agricultural wage rate]	**Based on the *predicted* wage ratio: [Non-farm wage rate /Agricultural wage rate]**
Dependent Variable:	**Number of switches into the Non-Farm Sector(ENTRY)**	**Number of switches into the Non-Farm Sector (ENTRY)**
Explanatory Variables		
	Coefficient (z value) [1)]	Coefficient (z value) [1)]
Constant	-15.30	-12.29
	(-2.35)	(-1.65)
Off-Farm Participation Dummy (-1)	0.38	1.01
	(1.41)	(3.60)**
(whether participates in the EGS in the previous year)		
The actual wage ratio: [Non-farm wage rate /Agricultural wage rate]	1.33	---
	(7.56)**	
The predicted wage ratio: [Non-farm wage rate /Agricultural wage rate]	---	3.70
		(2.86)**
H_bmi (The BMI index)	1.39	0.09
	(2.16)*	(1.28)
H_bmi^2 (The square of the BMI index)	-0.34	-2.40
	(-2.14)*	(-1.23)
S (schooling years: years)	0.04	0.06
	(0.99)	(1.43)
A_ female (Whether female or not)	-0.59	-0.53
	(-1.82)†	(-1.45)
A_ age (age: years)	0.010	0.02
	(1.04)	(1.88) †
A_ high caste	-0.57	-0.93
	(-1.97)*	(-2.71)**
A_ medium high caste	-0.31	-0.81
	(-0.90)	(-2.15)*
A_ medium low caste	-0.39	-0.73
	(-0.77)	(-1.39)

A_ CV (coefficient of variation) in agricultural wage for each year	-0.005 (-2.64)**	-0.005 (-3.02)**
A_ whether the lagged agricultural wage is ranked top 5 % or not	0.06 (0.18)	0.15 (0.39)
B _ agri labourer (whether household head is agricultural labourer)	0.08 (0.26)	-0.40 (-1.24)
I_ Shirapur (Whether from Shirapur)	0.68 (2.25)*	0.17 (0.52)
Year Dummy (Year 80)	-0.65 (-1.72)†	0.34 (1.04)
Year Dummy (Year 81)	-1.24 (-2.92)**	-
Year Dummy (Year 82)	-0.72 (-1.74) †	-0.29 (-2.79)**
Year Dummy (Year 83)	---	-0.16 (-0.40)
Year Dummy (Year 84)	-1.27 (-2.87)**	-0.07 (-0.16)
Number of Observations	367	356
Joint Significance (LR χ^2) test*	χ^2 (19)=192.05**	χ^2 (18)=138.51**
Goodness-of-fit (χ^2) test	χ^2(347) = 125.65**	χ^2(337) =164.195

Note: [1)]Number in parentheses are *t* ratios; **denote significance at 1% level; *denotes significance at 5% level and + denotes significance at 10% level.

over the period 1983-91, with one exception, the EGS wage rate has exceeded the farm wage rate and the gap widened sharply in 1989.[37]As shown below, the targeting of the EGS also worsened with a much higher share of participants belonging to (relatively) affluent households.

[37] For details, see Gaiha (1997).

Table 5

Descriptive Statistics of EGS Distributions

Distribution	Mean Income (Rs.)	Skewness	Kurtosis
EGS Participants by Income in 1979	188.32	1.28	3.88
EGS Participants by Income in 1989	226.64	1.63	6.25

Source: Gaiha (2001).

In both years, the mean income of the EGS participants exceeded the poverty threshold and the excess was greater in 1989 than in 1979. Both the distributions were positively skewed, implying a greater concentration at higher income levels. In both cases, the distributions were leptokurtic, with the peaks to the right of the poverty threshold. A worsening of the targeting of the EGS is also confirmed by tests of stochastic dominance.[38]

To further explore the reasons underlying the mistargeting of the EGS, we examine the relationship between switches into the EGS and the EGS wage rates. Since the latter are determined on a piece-rate basis, the higher skilled and more hardworking individuals would tend to switch into the EGS and earn higher wages, given slack

[38] For details, see Gaiha (2001).

season options in farm and non-farm activities. Moreover, considering the band of inertia, they are more likely to remain in the EGS. That the switches into the EGS are in fact greater among those earning higher EGS wages is confirmed by the results in Table 6. What is perhaps equally significant is the confirmation that both EGS and agricultural wage rates are higher depending on land owned, as shown in Table 7. Thus the mistargeting of the EGS was in part a reflection of greater switches of the higher skilled and wealthier workers, induced by the prospect of more remunerative opportunities in this scheme.

Table 6: Switches into EGS by EGS Wage Group, 1979-84

		Based on the Predicted Number of Switches
EGS Wages (Rs. in 1961/day)	Average Number of Switches	Number of Observations
9 <	0.977	32
7 < <=9	0.965	25
5 < <=7	0.799	26
3 < <=5	0.798	17
0 < <=3	0.100	7
0	0.072	261
average/ total	0.297	361

Table 7 : Agricultural Wage Rates, and EGS Wage Rates by Land Owned, 1979-84

Owned Area	Agricultural Wage Rate		EGS Wage Rate	
	Mean Wage rate (Rs. In 1961/ day)	Number of Observations	Mean Wage rate (Rs. In 1961/ day)	Number of Observations
10 Acres <	11.41	30	15.00	4
5 < <=10 Acres	10.95	57	9.93	18
2 < <=5 Acres	7.42	128	7.49	35
1 < <=2 Acres	5.99	129	7.12	47
0 < <=1 Acres	5.99	138	5.88	60
0	6.14	386	6.39	166
average/ total	6.78	868	6.81	330

What the preceding analysis suggests is that, while the wage ratio matters, this by itself cannot explain the worsening of the targeting. The choice between the EGS and regular labour market activities (in the present context, agriculture) must take into account discounted cash flows associated with them, the entry and exit costs, and the volatility of agricultural wage rates. The option value model used here demonstrates how these considerations could be incorporated in a dynamic optimisation framework. In particular, what emerges from this analysis is that the case for rural public works is a more complex one, as it must go beyond the screening and deterrent arguments premised on a fixed wage differential.

5. Concluding Observations

Some observations are made to put the main findings in perspective. A point of departure of this analysis was to focus on the switches, that occur between the EGS- a rural public works scheme with guaranteed employment at a fixed wage rate- and regular labour market activities with a market determined stochastic wage rate. As a result, the emphasis is on employment options judged on the basis of their discounted cash flows. So not just the wages in different activities but also entry and exit costs matter in labour supply decisions in the option value framework. The econometric evidence confirms that switches into the EGS are positively linked to the ratio of EGS/farm wage ratio. It also suggests that switches are linked to variables that proxy some of the entry and exit costs (e.g. employment in the EGS in the previous year). There is also some evidence confirming greater participation of a top subset of agricultural wage earners in the EGS, reflecting their ability to better afford higher entry and exit costs. Besides, volatility of agricultural wage rates matters a great deal. As far as non-farm activities are concerned, environmental factors reflecting unemployment risks have a more significant role. Taking some of these factors into account in a dynamic optimisation framework, the model suggests that the selective power of EGS may be impaired by several biases in favour of higher income individuals and by the fact that programme entry and exit are not determined by a single income level, but by bands of inertia of different size. An explanation based on these factors may help understand better the worsening of the targeting of the EGS during the 1980s. But perhaps equally importantly the fact that switches into the EGS and regular labour market activities are a result of the joint influence of all these factors suggests that the risk of those benefiting from public support- especially the poor-becoming dependent on it is often exaggerated.

In conclusion, if this analysis has any validity, the incentive case for rural public works schemes such as the EGS in terms of screening and deterrent arguments needs to be reformulated in a dynamic optimisation framework, taking into account discounted cash flows, entry and exit costs and volatility of agricultural wage rates. If an allowance is also made for bands of inertia, dependent on incomes and individual levels of uncertainty, the incentive case for workfare is further weakened.

Appendix: Definitions and the Descriptive Statistics of the Variables:

Variable Name/(Definition):	Observations	Mean	Standard Deviation
CV_wage (Coefficient of Variation of real monthly wage earning)	977	157.91	101.73
CV_wage Ls (CV_wage of Landless)	703	171.37	102.08
Legs_dum (Dummy variable: 1 if one participates in the EGS and 0 Otherwise)	2846	0.12	0.32
Legs_day (Days of participation in the EGS in a crop year: Day)	2846	6.98	27.75
Legs_ern (Earning from the EGS in a crop year: Rs.)	2846	42.07	172.05
L_dumLs (Dummy variable: 1 if the landless participates in the EGS and 0 otherwise)	2271	0.09	0.29
L_dayLs (Days of participation in the EGS in a crop year: positive only in the case of landless: Day)	2271	4.71	21.46
Legs_ern (Earning from the EGS in a crop year, positive only In the case of landless: Rs.)	2271	29.97	140.41
W_ agr (Rreal daily agricultural wage in a crop year)	2846	2.07	4.04
W_ egs (Real daily agricultural wage in a crop year)	2846	0.79	2.49
H_bmi (The BMI index: Weight (in kilograms) devided by height (in metres) squared)	1113	0.19	0.026
H_bmi^2 (The square of the BMI index)	1113	0.035	0.0097
School (Years of education: years)	2846	2.48	3.63
A_ age (age: years)	2846	25.19	18.63
A_ female (1 if female and 0 otherwise)	2846	0.48	0.50
A_ high caste (1 if high caste and 0 otherwise)	2846	0.41	0.49
A_ medium high caste (1 if medium high caste and 0 otherwise)	2846	0.25	0.43
A_ medium low caste (1 if medium low caste and 0 otherwise)	2846	0.10	0.30
B _ School (education of household head: years)	2846	2.81	3.87
B _ agri labourer [2)] (1 if household head is agricultural labourer and 0 otherwise)	2846	0.28	0.45
B_ debt (household's debt: Rs.)	2846	3080.87	4705.80
B_ no. of female earner (no. of female earner)	2846	0.72	0.94
B_ no. of male earner (no. of male earner)	2846	1.13	1.37
B_ female household head (whether household head is female)	2846	0.11	0.31
B_availability of non-farm employment (total days worked by all household members in non-farm	2846	32.22	86.82

sector)			
B_ age of household head	2846	48.91	10.50
B_ dependency burden (the share of children under 15 years in a household).	2846	32.08	20.05
V_ land (Land owned by household: Acre)	2846	8.08	14.55
V_ networth (Net- Worth : Total assets of household minus liabilities: Rs.)	2846	13393.28	17451.49
I_ Shirapur (1 if located in Shirapur and 0 otherwise)	2846	0.50	0.500
R _cvrain (CV of rainfall in a year)	2846	59.49	12.87
ε _egs (previous participation in the EGS: days)	2846	29.15	89.64

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