
UNEMPLOYMENT THEORY IN THE LDCs: A TEST OF
THE GENERALISED SEGMENTATION HYPOTHESIS

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DRAFT NOT FOR QUOTATION

October, 1990

A B S T R A C T

In this paper an empirically testable version of the generalized segmentation model is specified and tested on a sample of young job seekers. The approach utilized is the truncated regression approach. Our major findings are that there is an empirical basis for the "bumping" or "job-ladder" hypotheses advanced separately by Bhagwati and Srinivasan (1977) and Fields (1976). Moreover, we found evidence that those individuals in the sample who experienced long term unemployment had become "scarred" by the experience in the sense that they had become less employable or less willing to find "legitimate" employment.

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I. INTRODUCTION

The socio-economic significance of the unemployment situation in the LDC's has always been the cause of much controversy. Stewart and Streeten (1971) have argued that in the representative LDC the link between unemployment and output or even unemployment and economic welfare is not as strong as in the more developed countries. Rather, the high rates of open unemployment in LDC's is a phenomenon associated with relative well being and as such ought not to be regarded as a serious socio-economic problem (Berry 1975). As a consequence, the major focus of labour market policy in the LDCs should be on the inter-related problems of poverty and under employment [see Heywood (1982) and Weeks (1971)].

Squires (1981) carries the argument further, arguing that, left to themselves, LDC labour markets function well; any open unemployment in LDCs is the result of the distorting influence of trade union activity, minimum wage legislation or mis-directed educational policies. As such, even the problems of poverty and income distribution ought not be addressed within the context in labour market policy but rather by policies which would treat with these directly such as land redistribution schemes or welfare payments.

On the other hand, writers like Cumper (1971), Farrell (1977, 1980a) have argued that the traumatic nature of the unemployment experience has serious productivity and welfare implications; not only for the individuals experiencing extended spells of unemployment but for the society at large. As a consequence LDC governments should devote more of their resources towards solving these problems.

While it is true that to some extent this divergence of views may be the result of ideological differences. A major contributor to the confusion surrounding LDC unemployment is undoubtedly the lack of satisfactory theoretical models which focus on the micro-foundations of unemployment behaviour. In this paper we highlight the results of a test of the segmentation hypothesis initially proposed by Todaro (1969), on a sample of non-employed youth in Trinidad and Tobago. The segmentation model tested in this paper has been "generalized" in the sense that we have incorporated the theory of search into the analytical framework. This is possible because the simple segmentation model proposed by Todaro is really a special case of the more generalised search model.

The paper is divided into five sections. In the next section of the paper we attempt to show why segmentation models are most appropriate in the LDC context but we also emphasize the problems which this approach poses for empirical work. We show that it is necessary to build on this model by dropping the assumption of perfect information in the labour market. The resulting generalized segmentation hypothesis is non-deterministic and based on the theory of information. In Section III we present a short discussion of some of the problems which attend the specification and estimation of empirically testable search models and

present a simplified model of the theory for testing. In Section IV, this model tested on a sample of young persons drawn by matching cases across consecutive rounds of the Continuous Sample Survey of Population (C.S.S.P.). In the final section of the paper we present our summary and findings and give some suggestions for future research.

II. LABOUR MARKET SEGMENTATION IN LDC'S

In an earlier analysis (Clarke 1989) we examined in some detail the specification problems of some of the traditional approaches to labour market analysis in the LDC's. We saw that of the major approaches identified segmentation theory was considered by many to be most appropriate. However, we noted that the simple segmentation model itself suffers from a number of specification problems which render it unsuitable for empirical work.

To illustrate these, we first outline the 'bare-bones' of the Todaro (1969) model. Todaro takes the segmented labour market as a stylized fact of the LDC context and addresses the issue of the impact of segmentation on labour market behaviour. The model is a two-sector model segmented along the lines of an urban sector, characterized by a wage which is sticky downwards, and a rural sector which is characterized by free entry and wage flexibility. Segmentation, in itself, is neither a necessary nor sufficient condition for open unemployment or even an excess supply of labour. Open unemployment arises because workers do not believe that they are confined to a particular segment of the labour market. Indeed if they intend to get modern sector jobs they cannot

continue to participate in the rural sector. In other words the incentive to choose open unemployment is supplied by the fact that participation in the rural sector and in the modern high wage sector are mutually exclusive events. Hence in a certain limited sense unemployment is a productive activity which yields a return - the prospect of a modern sector job - which is not available to those who continue to participate in the rural sector.

Furthermore, open unemployment functions as an equilibrating mechanism, necessary to bring expectations about labour market conditions in the modern sector in line with reality and thus slow the rate of migration from the countryside. Hence, paradoxically, any attempt to reduce urban unemployment by for example, public sector job creation could actually induce more migration from the countryside and increase the equilibrium unemployment rate.

Tidrick's (1975) version of the model has stimulated much interest among Caribbean economists. This model provides a plausible explanation for relatively low internal migration rates, high levels of open unemployment and rural labour shortages which plague many Caribbean countries. The model proposes that in these small open economies, workers can participate in the urban sector without physically migrating from their villages. These workers are then voluntarily unemployed with respect to the rural sector while they are involuntary unemployed with respect to the urban-sector. Thus segmentation manifests itself in the phenomenon of 'wait' unemployment as workers queue for jobs in the modern sector rather than in rural de-population.

The major specification problem of these models stems from the fact that they are by nature too deterministic to capture the complexities of LDC unemployment behaviour. Empirically they tend to over-predict unemployment rates in Africa while typically under-predicting Latin American unemployment rates. This problem arises fundamentally because the models developed by Todaro (1969), Harris-Todaro (1971) and Tidrick fail to distinguish between those who are unemployed and those who may have decided to take jobs in the urban informal sector. The analysis focuses on the role of the **urban traditional** sector as the equilibrating mechanism rather than on open unemployment in itself. Todaro defines the urban traditional sector to include not only the unemployed but also

"... underemployed and those sporadically employed, those who grind out a meagre existence in petty trades and services..." (Todaro, 1969, p. 139).

He believes that there is no fundamental difference between these states as all workers in the urban traditional sector are involuntarily unemployed with respect to the modern sector.

The problem with this abstraction is that the workers who becomes employed in the urban informal sector workers actually lower their chances of selection for modern sector jobs. Indeed, if we interpret the model strictly, then employment in the urban traditional sector should reduce the probability of being selected for modern sector jobs towards zero. The Tidrick-Todaro model thus provides no explanation for the rapid growth of the urban informal sector, as workers prefer to remain in urban poverty rather than return home to their villages.

Moreover, once we consider the admittedly controversial evidence of the possibility of a "dynamic" urban informal sector [for examples see ILO, 1972 and South Magazine (1990)], in which a considerable part of the urban labour force may be employed for substantial parts of their working lives, then it is more realistic to consider that participation in the urban traditional sector and open unemployment as behaviourably distinct states.

Despite the weaknesses outlined above, the simple segmentation (or "wage gap") hypothesis continues to be regarded favourably by many writers such as Brown (1980), Farrell (1981) and Worrell (1980). Other writers such as Mazumdar (1976), Sabot (1977) and Fields (1975) have proposed a general respecification of the model to account explicitly for the problems posed by the urban informal sector. The most obvious way to approach this problem is to propose a three-sector model and allow workers in the urban informal sector to have a probability of selection into modern sector employment. This probability is higher than it would be if the worker participates in the rural sector but is lower than if he had chosen open unemployment. In these models participation in the informal sector is a second best alternative.

However, as Mazumdar (1982) himself points out, even these models cannot adequately distinguish the frictional element of unemployment typically observed in the urban-formal sector and the involuntary element of the unemployment in the urban informal sector. In response to these specification problems, Friedman and Sullivan (1974) have developed a multi-sector model of the urban labour market. They make the basic distinction between formal and informal sectors but then further segment the informal sector into a small scale family enterprise

sector which is quite dynamic (i.e. micro-enterprise sector) and an irregular "street" economy typified by low status and low skill trading and service activities.

Our rather truncated discussion of the extensive literature on multi-sector unemployment models is just sufficient to highlight a more fundamental problem which will eventually confront the proponents of the multi-sector approach. As long as we keep within the parameters of the Harris-Todaro framework we must limit ourselves to assuming that actors have perfect information about labour market conditions and a finite (small) number of alternative courses of action. This allows our decision making unit to form expectations about a few known alternatives.

On the other hand, labour markets in general and LDC labour markets in particular are much more complex than the above discussion would indicate. As Harris and Sabot (1981) point out, the empirical evidence suggests a wide dispersion of earnings and conditions of employment in LDC labour markets and considerable overlap between urban informal and formal sectors.

This suggests that one should replace the assumptions of certain knowledge and a few discrete segments, with the weaker and more appropriate assumptions of uncertain knowledge and a wide dispersion of wage offers. The problem is that such models of the labour market behaviour cannot be deterministic. If one is to construct a more appropriate segmentation model one must turn to a theory of decision making based on available information. Such a theory will naturally focus attention on the most efficient channels of acquiring such information. This is the basis of the theory of search.

Search Theory

In the theory of search decision makers construct optimal rules for action in labour markets characterized by incomplete information. The decision to accept a particular job offer or hire a particular employee is based on these rules. We first consider the model originally outlined by Stigler (1961).

In this model Stigler considers the problem of an individual looking for a job. In each period (day) he is assumed to generate one job offer. The model allows the possibility of no job offers by admitting that some employers offer a wage equal to zero.

Attached to each job offer is a fixed cost c , which includes all "out-of-pocket" expenses such as transport, advertising, and the preparation cost of interviews. We assume that the individual is faced with a dispersion of wage offers which can be modeled by the notion of a probability distribution of wage offers F . This governs what wage (w) is offered to the worker on any particular day i.e. $P(x \leq w) = F(w)$ so that $F(\cdot)$ is a cumulative distribution function which is assumed to be known by the searcher.

If the utility function of the searcher is linear and he is an income maximizer then his only problem is to decide when he must terminate his search. The amount of time the searcher spends looking for a job will depend both on the cost of search, and the distribution of wages that is known to be associated with the particular skills of the worker. If the worker knows that his skills are highly valued then he

rejects all offers which do not measure up to his expectations, and will extend the period of his search. On the other hand if the cost of the search is high then it will pay to reduce the duration of search. Note however, that the two may be related to each other as for example an educated searcher may make more efficient use of available information (want adds etc.) than less educated searchers and so incur lower search costs.

Let us consider the case when $F(\cdot)$ is time independent. Let x_i be the random variable determining the wage presented in each period. This random variate has a C.D.F., $F(\cdot)$, a finite mean $E(x_i)$ and each X_i is stochastically independent of the other. If the searcher retains the best wage offer (recall) then accepting a job after the n 'th search results in a net benefit (Y_n) to the searcher such that:

$$(1) \quad Y_n = \max (X_1, \dots, X_n) - nc$$

If N is a random variable representing the number of offers that the searcher receives before he stops searching, the searcher must then find a rule to maximize $E(Y_n)$.

The first step is to find a rule with which to decide which offers are acceptable. Stigler (1961) shows that this rule has the following form. First, we define w^r as the expected gain from shopping as dictated by the best shopping rule. Then, if we consider the first day where the individual receives a realization from the random variate X_1 , say x , the rational individual will accept this offer if it is at least equal to the expected gain of shopping. If not, then the

individual will continue to search. This is the Stigler decision rule or the reservation property of the searchers problem. For any realization x ,

- (2) accept job if $x \geq w^r$
continue to search if $x < w^r$

where w^r is termed the reservation wage.

Now, consider the position of the searcher at the end of day one. He has generated an offer x , a realization of X_1 and incurred expenditure c . The searcher must decide if he is to continue to search on day two. Applying the reservation property, the expected gain from search is

$$(3) \quad E [\max(w^r, X_1)] - c$$

But we have already defined w^r as the net benefits from search

$$(4) \quad w^r = E [\max(w^r, X_1)] - c$$

so that (4) can be rewritten

$$(5) \quad c = \int_{w^r}^{\infty} (x - w^r) dF(x) = H(w^r)$$

so that c is the marginal cost of search and $H(w^r)$ is the marginal return for an extra job offer.¹ $H(w^r)$ is a convex, non-negative, strictly decreasing function.

¹ Note the 'H' function is defined as $H(x) = \int_x^{\infty} (y-x) dF(y)$.

In other words, to maximise the net benefits from search, the searcher sets a reservation wage at the point where the marginal cost of search c is equal to the marginal return from searching one extra offer $H(w^r)$. This is the myopic property of the solution to the searcher's problem. As the cost of search rises $H(\cdot)$ implies that the reservation wage decreases and the duration of search falls.

The Tidrick-Todaro model can thus be interpreted as a special case of the more general search model. The worker searches a discrete offer distribution where he can observe two realizations, the urban wage and the rural wage. The individual sets a reservation wage so that he can maximize the gain from searching. Todaro shows that initially the wage gap is large and it is more rewarding for workers to search the urban sector even though they may expect to remain unemployed to some time. It is only when the probability of employment in the modern sector falls, with migration and the growth of the urban traditional sector, that the marginal returns from searching the modern sector fall below the wage in the rural wage sector. The migration rate slows as it becomes optimal for workers to participate in the rural sector.

The advantage of the search theoretic approach is that it can be extended to cover more complex modes of labour market behaviour. In the traditional statement of the employee search model it is usually assumed that the reservation wage declines with the duration of unemployment due to the discounting of time, systematic job search or to economic bankruptcy. However, Lippman and McCall (1976) demonstrate that once workers form adaptive expectations about the reservation wage, or if the reservation wage set depends on the state of the economy, or if employers

discriminate against disadvantaged groups in the labour force, the reservation wage may decline only slowly with the duration of a spell of unemployment.

Furthermore, on statistical grounds, when one considers any sample of unemployed individuals one has to remember that each of these individuals may differ in innate 'ability'. Ability however defined is difficult to measure and conceptualize but presumably has some impact on the probability of escape from unemployment. In such a sample any observation of the duration dependence of unemployment spells may result more from the fact that those with more 'ability' are selected first from the pool, leaving the less talented who have poorer labour market prospects. In such a case the observed stickiness of the reservation wage and the apparent duration dependence of unemployment spells may be 'spurious' i.e. due more to the failure of the researcher to control for individual effects.² These unmeasured ability variables may be temporally correlated with the duration of unemployment. Hence, the generalised segmentation model may be used to discern the long term effects of unemployment on individual who have experienced unemployment.

The generalised segmentation model also can highlight the role of education in LDC labour markets. For example, one can address the problem of persistent excess demand for education in the LDCs despite the apparent shortage of jobs for graduates. The search explanation of this is simply that employers tend to discriminate in favour of the educated

² For a more involved discussion of this issue see Hackman and Borjas (1980).

so that it pays to attain more formal educational qualifications. Fields (1974) attributes such behaviour to the belief that there is a correlation between productivity and educational attainment. Alternatively, Bhagwati and Srinivasan (1977) suggest it may be the result of a general sociological principle of selection where it is 'fair' in the context of excess supply of labour to allocate jobs first to the most educated. The result is, that the returns from extra education tend to remain high (despite the existence of educated unemployment) especially when we consider the tendency for unskilled jobs to be 'up-graded' to require more and more formal educational qualifications. Moreover, in such a labour market less qualified workers may find that there may be only hired when graduates are in short supply. In slack periods the less educated are typically released before their more educated counterparts. Hence, any observed unemployment among the educated is largely frictional, while there may be serious problem of chronic long term unemployment among the less educated.

Thus, in the extended perspective offered by generalised segmentation hypothesis we shift our emphasis away from segmentation itself and focus on consequences and implications of wait unemployment (or search in complex labour markets). Protracted spells of unemployment are transformed from simply being the outcome of a queuing process and into a partially productive activity in the sense that such search enhances the potential workers information about labour market conditions and future job prospects. In the next section we look at some of the problems which attend the specification and estimation of models based on the theory of search.

III. SPECIFICATION AND ESTIMATION

The difficulties that attend the specification and estimation of search models arise from the fact that one can only observe the outcome of the search process. One cannot observe the reservation wage directly while the wage offer distribution actually observed is truncated. This feature destroys the linearity assumption necessary for OLS estimation. Indeed, the nature of the non-linearity is such that we cannot rely on any continuous density to explain the conditional density of wage offers.

The model we propose to examine is a two equation model loosely based on our discussion in the last section. A simplified version of the job search model is chosen as our point of departure since it seems to provide a reasonable explanation of labour market behaviour in the LDCs. Recall from the preceding section that that individual searcher was faced with a distribution of wage offers with a mean μ_i such that

$$(1) \quad \mu_i = X_i' \beta$$

where X_i is a vector of individual and worker characteristics which affect earnings while β is a vector of parameters. The cost of searching this distribution is c . The search strategy requires for optimality that offers below some critical wage level w^r , termed the reservation wage, are rejected while those above it are accepted. Thus, the individual's reservation wage is a function of the mean of the individual's wage offer distribution and his discount rate as well as those factors which affect the cost of search. The model can be represented as:

$$(2) \quad w_i^o = X_i' \beta + e_i^o \quad \text{[offer equation]}$$

$$(3) \quad w_i^r = g(X_i, \beta, c_i, r) \quad \text{[reservation equation]}$$

where $e_i \rightarrow N(0, \sigma_o^2)$ and it can be demonstrated that g is defined implicitly by the following theorem established by Kiefer and Neuman (1979).

$$(4) \quad 0 < \frac{dw_i^r}{dx_i} = \alpha_i(t) / (\alpha_i(t) + \theta_i)$$

where $\alpha_i(t)$ is the probability that the i 'th member of the sample finds a job in period ' t '.

Given this we can define the approximate functional form for (3)

as

$$(5) \quad w_i^r = \kappa + g_1 X_i \beta + g_2 c_i + e_i^r$$

where $e_i^r \rightarrow N(0, \sigma_r^2)$ and $E(e_i^r, e_i^o) = \sigma_{or}$

If we include the constant term (κ) as well as all those variables which affect the cost of search in a vector Z_i with corresponding parameters Ψ , we have

$$(6) \quad w_i^r = g_1 X_i \beta + Z_i \Psi + e_i^r$$

This approximation implies that there is a proportional restriction between the co-efficients in the offer and reservation equation. This implies that suitable restrictions must be imposed on the model if we are to attempt to identify the parameters in (6). We will

return to consider the exact nature of these restrictions presently but we note, that the estimation of the offer equation has been discussed in some detail in Heckman (1979).

Estimating the Offer Equation

The nature of the job search problem is such that equation (2) cannot be estimated by the more common econometric techniques (OLS, 2SLS, etc.). This is so because we cannot observe the entire wage offer distribution, we can only observe w_i^o if $w_i^o \geq w_i^r$, if a wage offer falls short of the reservation wage it cannot be observed.

In other words the conditional density of wage offers $w_i^o | X_i$ is a censored density function while if we only considered the observations of w_i^o then they would have an incomplete or truncated density where the point of truncation is w_i^r . This feature destroys the linearity necessary for the estimation of the offer equation by OLS. Indeed, the nature of this non-linearity is such that we cannot rely on any continuous density to explain the conditional distribution of wage offers.

Heckman (1979) shows how this subtle form of non-linearity discussed above could be represented. First, it is necessary to define a random variable S_i such that

$$(7) \quad S_i = w_i^o - w_i^r = (1-g)X_i \beta - Z_i' \gamma + e_i^o - e^r$$

or

$$(8) \quad S_i = (1-g)X_i \beta - Z_i' \gamma + e_i \quad (\text{employment equation})$$

where $e_i \rightarrow N(0, \sigma^2)$.

Heckman (1979) assumed that the error terms were jointly and normally distributed so that a joint density function $f(e_i^0, e_i)$ can be defined. The random variable S_i is positive if the i 'th individual in the sample has found employment over the time period observed and negative if he has not. We can then define an indicator variable D_i such that

$$D_i = 1 \text{ if } S_i > 0$$

$$D_i = 0 \text{ if } S_i < 0$$

This variable (D_i) determines whether or not w_i^0 is observed i.e. w_i is observed if $D_i = 1$ and not observed if $D_i = 0$

Heckman then goes on to show that OLS on that portion of the sample which has found employment will lead to biased estimates of parameters in the offer equation. This is shown as follows. The regression function for the employed part of the sample is

$$(10) \quad E(w_i | X_i, S_i > 0) = X_i' \beta + E(e_i | S_i > 0)$$

the second term on the RHS does not vanish as in the non-censoring case and Heckman (1979) gives this term as

$$(11) \quad E(e_i | e_i > S_i) = \rho \cdot (\sigma_0 / \sigma) \cdot \lambda_i$$

where

$$(12) \quad \lambda_i = \phi(E(S_i)/\sigma) / \Phi(E(S_i)/\sigma)$$

where λ_i is the inverse Mills ratio and ϕ and Φ are the standardized normal density and distribution functions evaluated at $E(S_i)/\sigma$.

Heckman's two-step procedure is outlined as follows:

(1) We replace S_i by D_i in (8) and estimate the employment equation on the full sample using a Probit MLE.

(2) λ_i so obtained is then used as a regressor in the offer equation for that portion of the sample which has found employment. The conditional mean of the selected sub-sample is

$$(13) \quad E(w_i | X_i, S_i > 0) = X_i \beta + \rho \cdot (\sigma_o / \sigma) \cdot \lambda_i$$

Given (13) Heckman (1979) showed that the variance of the disturbance term in the selectivity bias corrected offer equation is heteroscedastic and derived the correct limiting distribution for the variance co-variance matrix for the parameters. However, this derivation rests heavily on the assumption of joint normality of S_i and w_i^o . Amemiya (1985) has demonstrated that Heckman's two-step estimator can still be consistent under somewhat less restrictive assumptions. Moreover, under these weaker assumptions one can consistently estimate the variance co-variance matrix of the parameters of the offer equation by the method suggested by White (1980). This approach is adopted in this paper.

Next, we show how the parameters in the reservation equation can be estimated and examine the restrictions which must be imposed on the model to identify g_1 , γ and σ_r^2 . The difficulties which arise in estimating these parameters result largely from the fact that the point of truncation of the offer distribution is stochastic while the reservations wage is itself non-observable.

In our discussion above we saw that we can convert the reservation equation into an employment equation. A mish-mash of reduced form parameters can be consistently estimated from the probit MLE since this forms an integral part of the likelihood function for the model. However, since the Probit MLE ignores the magnitude of the reservation wage and only utilizes information on whether or not the i'th member of the sample is employed or not, then the parameter estimates obtained will tend to be inefficient.

The identification of g_1 , ψ and σ_r^2 requires some more involved argument. We first rewrite the reservation wage equation as:

$$(7) \quad w_i^r = H_i' O_i + e_i^r,$$

where H_i' is a vector such that $H = (g_1 X_i', Z_i')$ we can further partition H_i' into $H_i' = (x_i^J, x_i^K, Q)$ where x_i^J is a set of variables which affect wage offers and the cost of search, x_i^K is the set of variables which affect wage offers and not the cost of search and Q is the set of variables which only effect the cost of search. O is defined as $O = (\beta, \psi)$. Now if the reservation wage function can be represented as $w_i^r = g(x_i', \beta, \psi, r)$ then O can be considered as Taylor series expansion of this function around X_i i.e.

$$(8) \quad O = (g_1 \beta_J + o_J, g_1 \beta_K + o_K Q)$$

where $g_1 = \partial w_i^r / \partial (x_i' \beta)$. Combining this with equation (7) we have

$$(9) \quad S_i = -\{x_i^J \cdot [(1-g_1) \beta_J + o_J] \cdot \sigma^{-1} + x_i^K \frac{(1-g_1) \beta_K}{\sigma} - Q_1(o_Q/\sigma)\}$$

or equivalently

$$(10) \quad S_i = -\{x_i^J \beta \cdot (1-g_1) \sigma^{-1} + x_i^K o_Q \sigma^{-1} - Q_1(o_Q \cdot \sigma^{-1})\}$$

This implies that if all the variables which affect the cost of search also affect labour market productivity it is impossible to identify any of the parameters in the normalized reservation equation i.e.

$$\sigma J/\sigma, \sigma Q/\sigma, \sigma K/\sigma \text{ and } (1-g_1) \cdot \sigma^{-1}$$

Hence, the necessary condition for identifying these parameters is that some of the elements in X_1' only affect reservation wages by way of their effects on wage offers.

This result is similar to the result obtained for a two-equation simultaneous model. However, more information is needed to identify the underlying parameters of interest i.e. unless $g_1 = 0$ then it is impossible to identify the underlying parameters. However Keifer and Neuman (1979) have established that the following theorem is valid

$$(11) \quad 0 \leq [dw^r(t)/dX_1'\beta] = g_1 = \alpha_i(t)/(\alpha_i(t) + \theta_i^*t) \leq 1$$

Since $\alpha_i(t)$ can be estimated from the probit and θ_i can be determined from a person's age and his individual discount rate r , this provides us with an estimate of g_1 which can be then used to identify g_1 which can then be used to identify σ or σ_r .

IV. RESULTS

In this section we apply the model discussed above to a sample of non-employed youth drawn by matching individuals across consecutive rounds of the Continuous Sample Survey of Population (CSSP rounds 43, 44,

45). The panel covers the period January 1985 to June 1986. A discussion of the CSSP, the matching procedure, relevant data definitions etc. is given in the appendix.

We have utilized a fairly liberal definition of active search in our empirical work and defined this to include not only those who have been officially classified as actively searching for employment, but also those who have been officially classified as being out of the labour force. At the same time, the limitations of our data base forced us to exclude workers engaged in on-the-job search.

Our definition of the scope of search activity has its advantages and disadvantages. On the positive side, the inclusion of those officially classified as drop-outs is justified when we consider that in the early stages of a individual's work history one would tend to expect a high degree of career transience. This may be due to the fact that at this point in a person's employment history, relative inexperience in labour market conditions may mean that while he may contemplate several alternate careers, the returns from searching these alternatives may be tightly bunched. In other words, in the early part of a person's employment history he may find it difficult to choose among alternative occupations. At the same time the cost associated with quitting are relatively insignificant since we would expect that investments in specific training would be small. Under these circumstances 'out of the labour force' and 'unemployed' are behaviourally indistinct states and instead, according to Clark and Summers (1982), really represent inconsistent reporting of quite consistent behaviour.

TABLE 1

Variable	Offer equation Dependent Variable LN(Wage)	Normalized Reservation Equation
Constant	5.6187 (.62818)	34.2820 (8.0198)
Years of Schooling	0.6434×10^{-1} ($.6194 \times 10^{-1}$)	0.3470 (0.1245)
Experience (Age - Education - 5)	0.17345 (0.6179×10^{-1})	0.4396 (6.1160)
Experience Squared	0.8436×10^{-2} (0.5006×10^{-1})	-----
Local Unemployment Rate	$-.43797 \times 10^{-2}$ (0.3804×10^{-2})	-0.1509×10^{-1} (0.8416×10^{-2})
Support Variable Ln (H.Hold INC/SHH)	-----	$+0.6550 \times 10^{-2}$ (0.6073×10^{-2})
Duration of Search (months)	-----	$+0.9239 \times 10^{-1}$ (0.1120×10^{-1})
Sex Dummy (1 male : 0 female)	-----	-0.11618 (.822)
wi	-----	-6.1133 (1.401)
p	0.313016 (1.4741)	-----
σ_w^0	.361866	-----
R ²	0.1153	-----
ln(π)	-----	134.1830

NOTE: Standard errors in parentheses.

The disadvantage of this approach is that by abstracting from the problems of drop-outs and on-the-job search we are unable to examine behaviour which may be important in Trinidad and Tobago setting. In the context of this paper however, this may not represent a serious problem. Since we are merely trying to place the theory of search on an empirical footing. The model that we test is intended to be mainly exploratory and we do not intend to use it for extensive policy simulations.

Our most significant findings in Table 1 are that in the case of the education (for the entire sample) the rate of return for each additional year of schooling is about 6%. While, this coefficient is not statistically significant at the 5% level, we can reject the hypothesis of education having no effect on post-employment earnings at the 10% level of significance. For those who became employed during the observation period the effect of education was much smaller i.e. 1.8% for each additional year of education. This seems to suggest a fairly small role for earnings once a job has been found. Most of the effect of education on earnings (70%) takes the form of an increase in the probability of selection weighted by expected earnings once employed. This seems to conform with the 'Bumping' or 'Job-ladder' hypothesis discussed in the last section. There may be preference for educated labour regardless of the field of employment. Education has a positive effect on earnings largely because the relatively well educated find it easier to find employment even if the response of wage offers to education once a person has been selected for employment tends to be quite flat. On the other hand as we would expect education has a positive effect on the normalized reservation wage. This effect appears to be more pronounced than the effect of education on wage offers.

We now turn our attention to the observation that instead of falling temporally, the reservation wage appears to rise with the duration of a spell of non-employment. We should not be surprised at this finding since the model we specified above does not permit us to identify the reason for the movements in the reservation wage. Furthermore, we noted in our discussion of search theory that there is no reason why the reservation wage should decline with the duration of non-employment.

Standing (1977) in a study of the Jamaican labour market, also finds evidence of a stationary reservation wage. He attributes the resulting decline in employability to the fact that individuals experiencing chronic long term non-employment may often turn to criminal activities. On the other hand Gordon (1972) attributes it to the deterioration in marketable skills such as the ability to read. Gordon also notes that during a prolonged spell of non-employment a person's ability to undertake sustained work may have been undermined by 'debilitating idleness'. Finally, a prolonged spell of non-employment may result in a pervasive sense of anomie, the searcher may reduce their search effort and may eventually become "passive, pessimistic and inefficient job seekers" [Standing (1977) p. 236]. Standing's results seem to uphold the hypothesis of structural duration dependence, as they show no significant relationship between the duration of unemployment and the aspiration wage.

However, one must be careful about accepting the findings that the experience of prolonged non-employment 'scarred' individuals in Standings sample. Standing fails to control for individual effects in

the sample. While many of the early studies (see for example [Becker and Hills, 1978]) relied heavily on background variables to accomplish this, Standing makes no use of such variables. Indeed even the validity of the using background variables as controls has been questioned by Elwood (1982).

An alternative explanation for Standing's findings has already been discussed above. As we pointed out in the last Section employers are likely to hire the workers who they deem to be more productive first. Hence for any group of job seekers leaving school at a particular point in time, one is likely to find that those who are of highest quality (as defined by the norms and conventions of the labour market) are hired first. Hence long term non-employment is as much reflection of weak attachment to the labour market as well as the poor quality of the worker. Hence another source of duration dependence of non-employment spells may explain the increasing reservation wage (or more accurately the marginal cost of search), a form of spurious state dependence due to the presence of uncontrolled 'ability' variables in the sample. In order to get an idea of the extent of the problem in the sample we carry out a test for heterogeneity based on an orthogonal decomposition of the error terms in the model.

A Test for Searcher Heterogeneity

To obtain an estimate of the degree of heterogeneity in the sample we first consider the residual in Equation [6] which is the exact solution to Equation [3]. This implies that e_1^r represents the factors which are not controlled for, in empirical analyses but presumably may

affect labour force attachment. A part of this residual is due to population differences which affect labour market performance and a part is the result of differences in the cost search which does not affect labour market productivity. We are interested in the first part of the residual, since if the uncontrolled factors impact on labour market performance then the estimator of the variance in wage offers will be too large since it would include the effect of uncontrolled 'ability' variables. Kiefer and Neuman (1979) suggest the following method for isolating the differences between pure wage offer variation and population heterogeneity. We first consider that e_i^o can be broken down as follows:

$$e_i^o = k e_i^r + e_i^*$$

where e_i^* is the unsystematic part of the residual and k may be taken as a scale factor relating individual-specific disturbances in reservation wage and to wage offers $E(e_i^o) = \sigma_0^2$. Hence

$$E(e_i^o)^2 = k^2 e_i^r + e_i^{*2}$$

and this in turn implies that $E(e_i^o, e_i^r) = k\sigma_r^2$. Note that e_i^r and e_i^* will be uncorrelated. We can then interpret σ_{or} as $k\sigma_r$. In our case, solving for k we have $k = 0.1518$. Thus the variance corrected for population heterogeneity is $\sigma^2 = 0.1182$ or some 90.2% of the variance in wage offers.

However one must be cautious about accepting the hypothesis that population heterogeneity is not a serious problem in this particular sample of job seekers. The analysis that we have performed above is an

ex-post analysis of the error terms in the model specified. As Keifer and Neumann (1979) note, a more rigorous treatment of the problem would require the explicit treatment of individual effects. However our findings allow us to conclude tentatively that the duration dependence observed is 'true' or structural state dependence, i.e. the unemployment experience has apparently 'scared' those individual experiencing prolonged spells of non-employment, making them less employable.

Finally, we consider whether or not the model conforms with the assumption of log-normality in terms of wage offer distribution. Following Kiefer and Neumann we apply the Kalmogorov-Smirnov distribution test based on the statistic $D_1 = \max [i/N - S_n(y_i)]$ where S_n is the empirical cumulative distribution function. At the 95% level of confidence we accept hypothesis of normality of the generated offer distribution. The consideration of log-normality is important since the validity of the Heckman two-step estimator is questionable in the absence of normality [see Ameniya (1985)]. Furthermore, the finding that the generated wage offers are log-normal has only reinforced our confidence in the specification of the model.

V. SUMMARY AND CONCLUSION

The micro foundations of unemployment behaviour in the LDC context has not received the kind of attention it deserves. In this paper a brief examination of the specification problems immanent in the segmentation model of Harris-Todaro (1971) and Tidrick (1975) suggest that they are most appropriate in the LDC context but tend to be too deterministic to capture the complexities of LDC labour market

behaviour. It is suggested that the theory of search be incorporated into the analytical framework. This allows us to examine some of the more enigmatic features of the micro dynamics of the LDC labour markets such as; the impact of education and the role of the informal sector. A stylized two-equation model is then developed which can be estimated using the truncated regression approach. The model is fitted on a sample of young job seekers drawn by matching cases across consecutive rounds of the Continuous Sample Survey of Population.

The major finding reveals an empirical basis for the "bumping" or "job-ladder" models of Bhagwati and Srinivasan (1977), and Fields (1975). Furthermore, there is structural as opposed to spurious state dependence in terms of the duration of non-employment among those experiencing long-term non-employment i.e. those experiencing such long-term non-employment have become less employable or less willing to find "legitimate" employment.

However, this result depends critically on a measure of searcher heterogeneity based on an orthogonal decomposition of error terms in a model which does not account explicitly for data heterogeneity. Hence, one has to be cautious about generalizing these results for the whole population.

Further analysis of the issue of "structural" versus "spurious" state dependence would require the use of duration or survival models which attempt to specify directly how realizations of discrete random variables depend on past occurrences of these variables. Direct test of heterogeneity can thus be utilized. This could form part of future research work.

APPENDIX 1

The data utilized in this paper has been obtained by matching individual cases across consecutive rounds of the Continuous Sample Survey of Population (CSSP). This survey has been conducted continuously by the Central Statistical Office of Trinidad and Tobago (CSO) since 1967.

Like many large official surveys it may be basically described as a two-stage stratified cluster sample. The design of this survey has been discussed at length elsewhere by CSO (1968) and Smith (1967). In this Appendix we need only reiterate the fact that design utilized is said to be continuous in the sense that the grand sample which represent about one-twentyfifth of all households has been further divided up into nine sub-samples of which each represent one-seventy-fifth of all households, these are observed over a six month period which is known as a round.

The original design called for a pattern of rotation of sub-samples in which sub-samples would be divided up into three sets. One of the sub-sample in each set would be replaced and another substituted. However, because of logistical difficulties it was decided to abandon the practice of rotation sub-samples while still retaining the practice of rotating clusters within enumeration districts. Any given cluster of households is still enumerated on three consecutive occasions.

Matching Procedure and Variable Definitions

Data diskettes for representing three consecutive rounds of CSSP in rounds 43, 44 and 45 which covered the period January 1985 to June 1986. Starting at round 43 we obtained a sample of non-employed youth and matched those individuals across the next two rounds by utilizing the fact that the households always retain the same identification number in the CSSP. It was difficult to control the individuals inside of the household. Because of the persistent reoccurrence of number of mis-matches it was decided to drop all cases which did not show a consistent pattern of response on age, sex, education, etc. We were then able to reconstruct the employment histories of the members in our sample looking at the answers given by individuals to questions about months worked in the last year, when last worked, ever worked, first job and present employment. In this way the duration of both completed and uncompleted spells of non-employment could be determined. This exercise was quite difficult and time consuming since it involved a manual reconstruction of an 18-month time line for all the individuals in our sample. Furthermore, since the CSSP is not a panel survey, and is in fact designed to minimise this effect, the pattern of responses over time tended to be rather inconsistent. This of course implies that the accuracy of our duration data is open to question.

Household data was obtained by concatenating cases for identical households. Data on aggregate household income, education of the heads and their spouses, the number of other persons employed in household, etc. could be obtained. However, the number of one-person households in

the sample implied that for a number of cases the data obtained from this procedure would have a low information content. Hence it was decided to minimize the use of this generated data.

However, for some variables such as household income and size of the household enough information was supplied in the CSO survey to carry out a consistency check of our concatenations.

In the case of the 'wage' variable we were not able to obtain information on labour income so that total income from all sources had to be utilised as a proxy. We assume that for this cohort of the population the information loss from the use of such a proxy should be small since we would not expect any large accumulations of non human capital among the numbers of this cohort.

Finally, we end this section with a comment on the accuracy and coverage of the CSSP. The validity of the survey findings have been challenged by a number of writers such as Farrell (1980s) who claimed that his consistency check showed that the CSSP was under representing the general level of unemployment. However, Borden (1980) in a critical examination of Farrell (1980a) has highlighted many serious methodological flaws, which have tended to invalidate his claim. We may note however, that as of the end of round 45, the CSO has completely revamped its methodology and moved to a quarterly survey. We cannot make any comments about the reasons for or advantages of the new methodology since the general report of the new CSSP has not been issued by the CSO.

REFERENCES

- ABDULAH, Norma: The Labour Force in the Commonwealth Caribbean: A Statistical Analysis. Institute of Social and Economic Research. The University of the West Indies, Trinidad (1977).
- AITEHISON, J. and J.A.C. Brown: The Lognormal Distribution. Cambridge. Cambridge University Press (1963).
- AMEMIYA, Takeshi: "Regression Analysis when the Dependent Variable is Truncated Normal". Econometrica, Vol. 42, No. 6 (1974), pp. 999-1012.
- _____ : "Advanced Econometrics. Havard University: Cambridge Mass. (1985).
- BERRY, Albert, R.: "Open Unemployment as a Social Problem in Urban Colombia: Myth and Reality". Economic Development and Cultural Change, Vol. 23, No. 2 (January 1975), pp. 276-291.
- _____ : "A Positive Interpretation of the Expansion of Urban Services in Latin America, With Some Colombian Evidence". Journal of Development Studies, Vol. 14, No. 2 (January 1973), pp.210-231.
- BROWN, Adlith: "Employment Policy in the Open Dual Economy". Social and Economic Studies, Vol. 29, No. 4 (December 1980), pp. 96-112.
- CLARKE, C.: "An Application of the Theory of Search to Trinidad and Tobago". mimeo, 1989.
- CLARKE, K. and Summers, L.: "The Dynamics of Youth Unemployment" (pp. 199-235) in The Youth Labour Market Problem: Its Nature, Causes and Consequences. Edited by Freeman R.S. and Wise, D.A. Chicago: University of Chicago Press (1982).
- CRAMER, J.S.: Econometric Application of Maximum Likelihood Methods. New York: Cambridge University Press (1986).
- DOMAR, E.: Essay in the Theory of Economic Growth, New York: Oxford University Press (1957).
- ELWOOD, D.T.: "Teenage Unemployment: Permanent Scars or Temporary Blemishes?" (pp. 349-385) in The Youth Labour Market Problem. Edited by Freeman, R.S. and Wise, D.A. Chicago: University Chicago Press (1982).

FARRELL, Trevor M.A.: "Why is Unemployment a Major Problem". Caribbean Issues: A Journal of Caribbean Affairs, 3:2-3 (1977), pp. 162-179

FARRELL, Terrence W.: "Wage Distortions and Unemployment in Trinidad and Tobago: A Test of the Lewis-Tidrick Wage Gap Hypothesis" (mimeo). Research Department, Central Bank of Trinidad and Tobago (1981).

FIELDS, Gary S.: "The Private Demand for Education in Relation to Labour Market Conditions in Less-Developed Countries". Economic Journal, Vol. 84, No. 36 (December 1974), pp. 906-925.

_____ : "Rural-Urban Migration, Urban Unemployment and Underemployment, and Job Search Activity in LDCs". Journal of Development Economics, Vol. 2, No. 2 (June 1975), pp. 165-187.

HAREWOOD, J.: "Unemployment and Poverty in the Commonwealth Caribbean" (pp. 135-193) in Perspective on Economic Development: Essays in the Honour of W. Arthur Lewis, T.E. Barker, A.S. Downes, and J.A. Sackey (eds.): Lanham: University Press of America (1982).

HARRIS, John, R. and Sabot Richard H.: "Urban Unemployment in LDCs: Towards a More General Search Model". In Migration and the Labour Market in Developing Countries. pp. 65-88. Edited by Richard H. Sabot, Boulder, Colorado: West View Press, 1982.

HECKMAN, James, J.: "Sample Selection Bias as Specification Error". Econometrica, Vol. 47, No. 1 (1979), pp. 153-162.

HECKMAN, James J. and Borjas, A: "Does Employment Cause Future Unemployment? Definition, Questions and Answers from a Continuous Time". Model of the Heterogeneity and State Dependence, Economica, Vol. 47, No. 187 (1980), pp. 247-283.

HOUSE, William H.: "Nairobi's Informal Sector: Dynamic Entrepreneurs or Surplus Labour". Economic Development and Cultural Change, Vol. 32, No. 2 (1984), pp. 276-302.

International Labour Office: Employment, Incomes and Equality: A Strategy for Increasing Productive Employment in Kenya, Geneva: International Labour Office (1972).

KIEFER, Nicholas M. and Neuman, George R.: "An Empirical Job Search Model, With a Test of the Constant Reservation Wage Hypothesis". Journal of Political Economy, Vol. 87, No. 1 (1979), pp. 89-107.

- _____ : "Individual Effects in a Non Linear Model: Explicit Treatment of Heterogeneity Empirical Job-Search Model". Econometrica, Vol. 49, No. 1 (1981a), pp. 965-979.
- _____ : "Structural Reduced Form Approaches to Analyzing Unemployment Duration" (pp. 171-186) in Studies in Labour Markets. Edited by Sherwin Rosen, Chicago: University of Chicago Press (1981b).
- LEWIS, W. Arthur: "Unlimited Supplies - Further Notes". Manchester School of Economic and Social Studies, Vol. 7, No. 3 (1958), pp. 42-53.
- _____ : "'Employment Policy in an Underdeveloped Area". Social and Economic Studies, Vol. 7, No. 3 (1958b), pp. 42-53.
- _____ : "The Dual Economy Revisited". Manchester School of Economic and Social Studies, Vol. 22, No. 2 (1979), pp. 139-191.
- MAZUMDAR, Dipak: "The Marginal Productivity Theory of Wages and Disguised Unemployment". Review of Economic Studies, Vol. 26(3), No. 71 (June 1959), pp. 190-197.
- _____ : "The Urban Informal Sector". World Development, Vol. 4, No. 8 (August 1976), pp. 665-679.
- PHELPS, Edmond S. (ed): Micro-Economic Foundations of Employment and Inflation Theory. New York: W.W. Norton and Company (1970).
- SABOT, Richard H.(ed). Migration and the Labour Market in Developing Countries. Boulder, Colorado: West View Press, 1982.
- SQUIRE, Lyn: Employment Policy in Developing Countries: A Survey of Issues and Evidence. New York: Oxford University Press (1981).
- STANDING, Guy: "Aspiration Wages, Migration and Urban Unemployment". Journal of Development Studies, Vol. 14, No. 2 (1977), pp. 233-348.
- STEWART, Frances and Streeten, Paul: "Conflicts Between Output and Employment Objectives in Developing Countries". Oxford Economic Papers (New Series), Vol. 23, No. 22 (July 1971).
- STIGLER, George J.: "Information in the Labour Market". Journal of Political Economy, Vol. 70, No. 3 (October 1962), pp. 94-104.

STIGLITZ, J.E.: "The Efficiency Wage Hypothesis, Surplus Labour and the Distribution of Incomes in LDCs". Oxford Economic Papers, Vol. 28, No. 2 (1976), pp. 324-356.

TIDRICK, G.M.: "Wage Spillover and Unemployment in a Wage Gap Economy. The Jamaican Case". Economic Development and Cultural Change, Vol. 23, No. 2 (1975), pp. 306-324.

TOBIN, James: "Estimation of Relationship for Limited Dependent Variables". Econometrica, Vol. 26 (1958), pp. 24-36.

WEEKS, J.: "Does Employment Matter?" In Third World World Employment: Problems and Strategy, pp. 61-65. Edited by Richard Jolly, Emmanuel de Kadt, Hans Singer and Fiona Wilson, Middlesex, Englan: Penguin (1973).

WHITE, Halbert: "A Heteroskedastic Consistent Covariance Matrix and a Direct Test for Heteroskedasticity". Econometrica, Vol. 48, No. 3 (1980), pp. 721-746.