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SYSTEM OF DEMAND EQUATIONS: THEORY AND APPLICATIONS

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ABSTRACT: *This paper notes the rapid advances that have been made in the modelling, estimation and applications of systems of demand equations in the literature. It attempts to empirically estimate for Ethiopian data sets using a two period price information following Pollak and Wales [57], Dybrig [31], and a saving information as in Lluch [46] and Howe [41] to identify all parameters of the Linear Expenditure System (LES) and The Extended Linear Expenditure System (ELES), respectively. In spite of the theoretical and empirical limitations of the LES, parameter estimates were found to accord with the right sign and magnitude required by the choice theory. Of particular interest is the process of estimating directly the Frisch Parameter and its welfare implications. The paper also discusses the estimation of compensated and uncompensated own-and-cross price elasticities in the context of Slutsky decomposition. Some areas of future research are pointed out in exploiting fully budget studies so far generated in Ethiopia. Notably, the possibility of estimating some generalized expenditure systems may stimulate interest for applications to some policy issues.*

BACKGROUND OF THE STUDY

The construction of system of demand equations from consistent utility maximizing exercise using the powerful programming concepts such as duality has gone through remarkable improvements over the past three decades or so. Stone's pioneering work [66], Frisch's investigative result [35] set the important stage that was later to produce alternative systems of demand equations in line with a certain preference structure underlining the consumer's utility. Stone's approach was to search for a demand function that would satisfy certain regularities like adding up and subsistence consumption level when current income is zero. His persistence produced the famous Linear Expenditure System. Frisch took up the utility implication of Stone's demand analysis for empirical works. Notably his instructive observation regarding the relationship between income elasticities and own-and-cross price elasticities gave an opportunity to estimate complete system of demand equations in the context of additive preferences or what is better known as additively separable utility functions. The whole body of the literature in the 1960s and 1970s was devoted to the

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expounding and derivation of demand functional forms that satisfy parametric restrictions implied by the maximization of quasi-concave utility functions subject to a linear budget constraint by an individual consumer.

The works of Theil [68, 67] produced the famous Rotterdam model, of Houthakker [40] indirect addi-log utility function, and the class of flexible demand functional forms by Christensen et.al., [16] and Diewart [29], and Almost Ideal Demand System of Deaton and Muellbauer [27] marked significant developments in the whole episode.

This paper makes an attempt at estimating demand systems in line with the neoclassical choice theory from available data sets for Ethiopia, and is organized as follows: Section I notes in brief important developments in the modelling, estimation and application of system of demand equations, section II discusses previous attempts to estimate demand systems in Ethiopia and the estimation of system of demand equations in the context of the Linear and Extended Linear Expenditure Systems based on budget studies for Addis Ababa for the years 1975,1979 and 1980 and for rural Ethiopia for the year 1980. Section III analyses empirical parameter estimates and makes concluding remarks on the uses of systems of demand equations estimated from budget studies for important policy issues.

I: Modelling, Estimation and Applications of Demand Systems.

In this section we shall make a brief attempt to note the process of refining the concept of choice from the following perspectives:

1.1. The search for an appropriate demand functional form in the context of a priori set parametric, semi-parametric and non-parametric tests

1.2. Major problems in the process of estimating demand systems;

1.3. The empirical applications and limitations of demand systems.

1.1 Parametric Restrictions and Demand Functional Forms.

Consumer behaviour has been systematically captured in the economics literature through two different approaches that just converge in the conclusions they finally arrive at: The Utility and Revealed Preference approaches. While the former dates as far back as to Marshall's *Principle*, the latter is a sole contribution made by Samuelson [62]; and it is this first one that we review in this section. Hicks'[39] remarkable contribution in interpreting Marshall's concept of utility (particularly marginal utility of money) in the context of substitution and income effect for price changes brought forth the famous Slutsky decomposition named after Slutsky's impressive theoretical exposition [45]¹. The work after that was the incorporation of Sheppard's Lemma into the utility maximization process to produce the notion of duality in consumer behaviour. In fact, it has been proved that given preferences are monotonic, strictly convex, continuous and twice differentiable, there always exists a utility function that satisfy second-order condition for maximum². Thus a utility function does exist not because of its psychological connotation as used to be implied in the early neoclassical literature, but, as a matter of mathematical necessity, implied by preference structure. More formally, given a utility function f defined over exhaustive set of quantity vector X , i.e., (x_1, x_2, \dots, x_n) , a typical consumer's choice problem for given income level y and price vector P , i.e., (p_1, p_2, \dots, p_n) can be written as:

$$\begin{aligned} & \text{Max. } f(X) \\ & \text{sub. } y \geq P'X \quad i=1, \dots, n, \dots [1] \end{aligned}$$

Alternatively, duality theory has made it possible to specify the above problem as:

$$\begin{aligned} & \text{Min. } e = P'X \\ & \text{Sub. } f \leq f(X) \quad \dots [2] \end{aligned}$$

where, e stands for total expenditure.

By manipulating the relevant Lagrangian function of (1) and (2) and observing that the Kuhn-Tucker necessary and sufficiency conditions ensure an interior and unique optimal solution, we have, respectively, vectors of demand functions $x_i(p_1, \dots, p_n, y)$ and $h_i(p_1, \dots, p_n, u)$ that maximize utility or minimize expenditure for an appropriately specified preference structure. Thus the vector of demand functions $X(P, y)$ is known as the Marshallian demand function, and of $H(P, u)$ as the Hicksian, or compensated vector of demand functions. If we

plug $X(P,y)$ and $H(P,u)$, respectively, into the objective functions (1) and (2) we get the Indirect Utility function $v(p_1, \dots, p_n, y)$ defined over prices and income, and the Expenditure function, $e(p_1, \dots, p_n, u)$. This synthesization of consumer preference generated important identities that evolved into Propositions and Lemmas of considerable analytical importance in applied demand analysis.⁷

When the inequality constraint in equation (1) is removed the following host of restrictions emerge:

1. The homogeneity of degree zero of demand functions.

Given that expenditure functions [inverse of $V = f(P,Y)$] are homogeneous of degree 1, then demand functions become homogeneous of degree zero in prices. Thus, using Euler's Theorem on homogeneity, it can be shown that,

$$\sum E_{ij} + E_i = 0 \quad i, j=1, \dots, n. \quad \dots [3]$$

where, the first term stands for the uncompensated cross price elasticity of demand for commodity i as a result of a change in the price of commodity j ; and the second term is income elasticity of commodity i .

2. Engle's Aggregation.

The direct differentiation of the budget constraint is shown to lead to the following identities:

$$\sum_{i=1}^n v_i E_i = 1 \quad [4]$$

where, v_i =average budget share of the i th commodity, and further more,

3. Cournot's Aggregation.

The principle underlining utility maximization results in the restriction:

$$v_j \cdot \sum_i v_i E_{ij} = 0 \quad i, j = 1, \dots, n \quad [5]$$

4. Symmetry and negativity of the Slutsky Substitution Matrix

Using the results of the problem in (1), it is shown to hold true that:

$$\frac{\delta X_i(P, y)}{\delta p_j} = \frac{\delta h_i(P, u)}{\delta p_j} - X_j \frac{\delta X_i(P, y)}{\delta y} \quad [6]$$

Where, (6) is known as the Slutsky Equation⁵, which decomposes the effect of a change in the j th commodity price on the demand for the i th commodity into two. The first term is the Hicks' compensated demand function that measures the substitution effect, and the last term is the income effect (see, e.g., Green [38]). The system of differential equations in [6] require symmetry of the substitution matrix which is given by the first term of the Right Hand side of [6] to be solved as is discussed in Deaton and Muellbauer [27]. Also, since a direct differentiation of the expenditure function with respect to p_j gives the Hicksian Compensated demand function by Shephard's Lemma⁶ it follows that $h_i(p_1, \dots, p_n, u) \delta p_j \leq 0$, that is the Substitution Matrix of the Slutsky equation is negative semidefinite. For a rigorous demonstration of the negativity condition see, for instance, Barten and Geyskens [8]. Further the Matrix that contains price and income responses of the Marshallian demand functions as its elements will have to be symmetric and negative semidefinite. This can be seen to hold by simply moving the income-effect term of the Slutsky equation in (6) to the Left Hand side. The literature in this regard has concentrated in the formulation of either a convenient utility function (usually indirect utility function) or demand function that satisfy these restrictions implied by the theory. Both approaches amount to the same thing as far as the integrability condition by an appropriate choice of parameters is met. That means, a system of demand equation that satisfy the above restrictions simultaneously implies that, it has a corresponding utility function and vice

versa. Among the list we have the noted Linear Expenditure System, Rotterdam Demand Model, the class of flexible transcendental demand functions, the add-log indirect utility function (constant elasticity demand function), and Almost Ideal Demand System. The specific functional forms of each is given in Appendix B. As empirical studies proliferated, a growing attention has been given to the type of data needed to justify evidences and to the econometric procedures that improve efficiency of estimates. The works of Barten [6], Barten and Geyskens [7], Luch [47], and Keifer [43] offered important and valuable insights to the empirical procedures for testing the theoretical restrictions indicated above in the context of the Rotterdam model. Beyond the exercise of testing parameter restrictions of a demand system generated from a specific utility function, a series of attempts were made to specify a demand system that would approximate to any direct utility function. The class of flexible demand systems initiated by Diewart [29], and Christensen et al. [16], in the context of the Translog system opened the way for the subsequent development of a family of flexible semi-parametric demand systems, including the Almost Ideal Demand System of Deaton and Muellbauer [27]. In spite of all such advances, one issue however remained elusive all along. As Deaton often remarked [26, 24, 23], and in fact many others too (e.g. Barten [7], Luch [47], Blundell [9]) there is so far no adequate general system of demand equation that readily lends itself for nested parametric tests (i.e. specific restrictions would lead to specialized system of demand equations. We may however note the Restricted Non-linear Demand System estimated for instance by Ray [61], the Quadratic Expenditure System suggested and estimated by Pollak and Wales [57, 58], and Normalized Quadratic Expenditure Systems of Diewart and Wales [30] as exceptions. But most of these reduce to the Linear Expenditure System for a certain restrictions without much of a change in the underlying preference structure. As a result there is no a unified approach that make comparisons easier among alternative functional forms. Deaton [23], and Pesaran and Deaton [56] developed and applied a technique to compare non nested demand systems. However, some quite disagree, albeit in a different sense, the justice of using demand systems with parametric restrictions (e.g. Varian [71]), they argue that the theory of revealed preference, a la Samuelson, is much more flexible and easily lends itself for non-parametric tests. The flexible semi-parametric demand systems referred to in the foregoing and others that were developed later were meant, as mentioned above, to approximate any

direct utility function, and were justified on the grounds that the parametric restrictions stated in the neoclassical choice theory would have to be imposed and tested empirically not built in the demand systems. Therefore, if restrictions are rejected by a data, then the neoclassical choice theory is said to be empirically invalid, and vice versa. We may however observe the reservations shown and the comments given, for instance, by Deaton and Muellbauer [27] on the same kind of claim Christensen et.al [16] made after they found that the Translog demand system had been rejected in almost all empirical cases they investigated. That is, there is no apriopi reason to suppose that preferences are translog and that the flexible demand systems have not yet satisfactorily resolved the empirical and theoretical issues surrounding the neoclassical choice theory. In fact, Diewart and Wales [30: 98] strongly contended that all demand systems in the semi-parametric family, including the popular Almost Ideal System, do not satisfy the desired flexibility and concavity they claimed to have possessed. They suggested a Normalized Quadratic Expenditure Linear and Quadratic Spline models that they showed satisfy important properties that have been missing for so long in most demand functional forms. In their own words [30: 98] " First they [i.e., these systems] are flexible in the sense of being able to locally approximate an arbitrary twice continuously differentiable preference functions to the second degree. Second, the concavity in prices property required by well behaved expenditure functions is imposed during the estimation. Third, a semi-flexible version of the model requiring fewer parameters may be estimated if there is a shortage of degrees of freedom, or if convergence difficulties are encountered during estimation ". It remains for subsequent empirical works to substantiate these claims and perhaps soon there shall be a single framework good enough for those looking for one. When Diewart and Wales [30] applied these demand systems for Japanese data, results turned out to be quite satisfactory and in accordance with the neoclassical choice theory. The trick that made it all possible was the Spline technique they aptly employed. A brief discussion of this technique's application to econometric procedures is given in Johnston [42].

1.2. Major Problems In Estimating Demand Systems

Apart from the theoretical problems of specifying an appropriate demand system,

the estimation process is beset with a number of statistical problems. Noteworthy are the identification and the aggregation problems.

The identification problem refers to whether or not the parameters of a given demand systems are estimable given the number of equations, number of commodities entering the demand system and number of independent parameters. This is an issue basically similar with the statistical problems regarding structural equations discussed in Jonhston [42]. As is the custom in econometrics, identification problem in system equations can be overcome either by imposing restrictions on parameters like the ones on demand systems implied by the choice theory, or use already available knowledge about the value of certain parameters estimated may be from previous studies. We have in section III an extension of this discussion in solving the identification problem in the context of the Linear Expenditure System by Pollak and Wales [57], Howe [41], and generally for all additive preferences by Dybrig [31].

Aggregation over households, commodities and prices constitute broadly the essentials of the problem. Demand systems in most cases have been estimated using data from national accounts or budget studies. The construction of system of demand equations in the context of choice theory however derives its fine results from the assumption of individuality of the consumer, compactness, continuity and convexity of the budget set, and a price vector that forms a separating hyperplane with the preference structure. Consistency, therefore, requires imposition of restrictive assumptions in applied demand analysis. Some of these are stringent, and others are quite tolerable. Aggregation problem over households arises by the common knowledge that observed expenditure aggregates in national accounts, or budget surveys represent mean expenditure values of households whose heterogeneity is evident at least with respect to family size, and age, not to mention those running through religious, ethnic and cultural grounds. From the theory, aggregation is allowed if only homogeneity is maintained across all households, and this is known in the literature as the assumption of exact linear aggregation, (e.g., Deaton and Muellbauer [27]). The Engel curves implied by this assumption are homothetic and thus linear; and individual preferences can be mapped into groups of households if only there is linearity in Engel

curves. Exact aggregation is a stringent restriction in application. Recent works reported that this restriction was summarily rejected by the data, (e.g. Nicol [53]), even though other regularity conditions were satisfied. Alongside with this, numerous attempts have been made to incorporate and capture demographic effects in demand system estimation. The works of Prais and Houthakker [59] and of Muellbauer [50] in the context of general and specific equivalent scales to bring compatibility between adult and child consumption produced impressive results. Pollak and Wales [58] introduced various ways of incorporating family size and age factors in demand systems. Nicol's result was a further indication that demographic variables play significant role in consumer behaviour determination. In cases where the data fits well into linear Engel curves, Seade [63] demonstrated its straightforward implications to the problem of measuring consumer surplus via Hick's compensated demand system. To avoid the severity of Exact Linear aggregation, subsequent works introduced Generalized Linearity of Engel curves or exact Non-linear aggregation with different special cases: Price Independent Generalized Logarithmic cost functions (PIGLOG), and, Generalized Gorman Polar Form discussed in Deaton and Mullebauer [27], Blundell [27], and the Modified Price Independent Generalized Logarithmic (MPIGLOG) form of Cooper and MacLaren [17]. As a result of such modifications most demand systems commonly used in empirical works satisfy exact non linear aggregation, at least locally.

Aggregation problem is manifested also in the nature of price data used in empirical application. Most studies take price indices reported in national accounts as representatives to individual prices. The uses of panel data, e.g., as in Keifer [43] indicated its advantage over other alternative sources in providing asymptotically consistent and efficient parameter estimates. The fact that market information is asymmetric, and that in most cases markets are fragmented and therefore are imperfect entail the prevalence of multiple prices at a point of time. The chance, therefore that an individual consumer may face different prices for the same commodity is quite substantial. Anglin [3] demonstrated the serious threat such diverse prices would bring on the efficiency of parameters estimated in either system Least Square Estimators or Feasible Generalized Estimators. Quota systems, price controls and other instruments of discrimination result in duplicity or multiplicity of commodity prices

causing kinks in the budget line. If one is provided with the data modifying the budget constraint, or the convexification assumption applied in production (see, e.g. Varian [70]) may be used to overcome the problem of aggregation in prices.

Finally, aggregation problem over commodities led to various interesting specifications of the preference structure. The familiar concepts such as want independence, utility tree and separability are known for immensely simplifying estimation procedures. The task of classifying commodities would have been inexhaustible without a certain degree of aggregation. In fact, all system demand analysis assume a certain degree of independence in the choice process that works through either separability or two-stage budgeting.

1.3. Empirical Application of Demand Systems

A growing body of the literature on optimal commodity taxes have used extensively the concept of neoclassical choice theory. We may cite the voluminous work made on the issues of marginal versus non-marginal tax reform in a revenue neutral setting. For example, Ahmad and Stern [1], Diamond and McFadden [28], Ray [61, 60], Deaton [22, 21], King [44], Cragg [19] applied system of demand equations to the problem of finding an optimal commodity tax rate that would maximize social welfare functions of the community subject to the government revenue constraint. We may elaborate this by appealing to propositions familiar in normative welfare economics. Cragg [19, p.126] explains that "the government is modelled as having preferences given by a symmetric, strictly concave, additively separable Social Welfare Function [SWF] which is increasing in the utility of each household". This SWF is specified in terms of indirect utility functions, $V^h(p_1, \dots, p_n, y^h)$ of the h^{th} household, $h = 1, \dots, H$, such that the government's problem will be to maximize this SWF subject to its fiscal revenue constraint.⁵ Such studies bring out the degree of income inequality inherent in the indirect system, and whether reform is necessary or not. Not so less important is also the role systems of demand equations play to understand and capture the process of economic growth. Tsujimura and Sato [69] and Lluch and Powell [69] for instance used systems of demand equations to investigate the changes in the structure of consumption of households in the

growth process. System of demand equations are also very useful in many planning exercises to project demand aspects and are helpful to cast growth strategies behind the structure of demand. In another sphere too, a system demand equations can be used to study the problem of financing such important services as education and health in the context of a federal government political structure. For instance, Coyte and Landon [18] analyzed and compared the method of cost-sharing with block-funding in financing health and education services for Canada. System of Demand equations are quite useful in measuring inflationary impacts on different income groups. The concepts of compensated and equivalent variation are easily captured and measured through the expenditure function. This brief description indeed suffers completeness without the statement that there is no area of economics, applied or theoretical, that does better without the principles of optimization and duality theory.

II. Estimation of The LES and ELES For Ethiopia's Budget Studies

Estimation of system of demand equations is one of those research areas that received little attention in Ethiopia so far, especially its empirical significance to policy formulations and to the understanding of patterns of consumption by households. Of the few contributions that have been made so far, some have more or less restricted the functional forms from reflecting the choice theory, because the estimated demand system were not types which can be generated from any direct utility function⁷, e.g. Asmerom [5,4], or used indirect ways to estimate price responses as in Getachew [36] following Frisch's decomposition. The only one that directly estimated price responses from cross-section data using the neoclassical choice theory is the study by the consultancy group better known by their acronym CESEN for ministry of Mines and Energy which reported its findings on the demand for energy for urban and rural twelve regions of Ethiopia including Addis Ababa [34].

This section discusses the attempts made in this study to estimate the parameters of the Linear Expenditure System [LES] and The Extended Linear Expenditure System [ELES] for Ethiopia.

2.1. Description of The Models

2.1.1 The Linear Expenditure System [LES]

The LES is the earliest empirically estimated demand system and in fact the most popular one in the literature. It is specified generally as,

$$\begin{aligned}
 p_i x_i &= \gamma_i p_i + \beta_i (y - \sum_{k=1}^n \gamma_k p_k) \\
 \sum_{i=1}^n \beta_i &= 1.
 \end{aligned}
 \tag{7}$$

Where, γ_i and β_i stand for constant parameters. γ_i is quantity of commodity i necessary for subsistence, and β_i is known as marginal budget share, i.e., it is equal to the value of the derivative of (7) with respect to income. Normally the bracketed term in [7] is understood as "supernumerary expenditure" (Goldberger and Gamaletsos [37]). As shall be explained later, subsequent manipulations of (7) imply a linear Engel curve, i.e., no inferior goods, and quasi-homothetic utility function. Indeed there is a proportional relationship between income elasticities and price elasticities implied by the LES; this is shown in different forms by Frisch [35] and Deaton [23]. Empirical evidences shade mixed results. The surveys (Brown and Deaton [10], Deaton [25,23]) suggest that in most cases the income data fitted well and price responses tended to be unstable and statistically less significant. In general however, it performed quite satisfactorily for broadly grouped commodities. A cross-country comparison by Goldberger and Gamaletsos [37], and Lluich and Powell [48] seem to support the LES in explaining consumption patterns. When one considers the visible data limitations in developing countries and the limited substitution possibilities in the specifically poor ones the empirical limitation of the LES is less restrictive.

The LES in [5] has $2n-1$ independent parameters to be estimated ($n-1$ β 's and n γ 's) owing to the budget constraint. Pollak and Wales [57] argued that a one period budget study identify all but one of the independent parameters. Without additional information,

or restrictions therefore, the parameters of LES are under-identified. A two-period budget study however exactly identifies all parameters of LES. In other words, two budget studies give two Engel curves each with β estimates. Their intersection uniquely determines the γ s (Pollak and Wales [57, P.350]). This line of reasoning has been taken up later on to formally prove the proposition that "knowing two Engel curves is typically sufficient to determine [the parameters of] an additive utility function" Dybrig [31, P. 379]. Therefore, one can estimate the parameters of other general systems as the Quadratic expenditure system and the Translog expenditure system from just two budget studies. In fact, since Frisch's demonstration of the possibilities of estimating cross-and-own price elasticities from one budget study, various studies emphasized the wider and deeper implication of Engel curves. Tsujimura and Sato [69] used Engel curves not exceeding six to recover price responses using the notion of numerical preference in the spirit of Dusenberry's Theory of Interdependent Preferences for Japan's Budget studies. The works of Deaton [57] in proving formally the implication of additive preferences with regard to the relationship between income and cross elasticities, and the insightful observations Pollak and Wales [57] made on the empirical properties of Engel curves opened new venues in the area of the Identification and Recoverability theory discussed in Dybrig [31]. In this context the crucial role the Frisch parameter plays needs mentioning in identifying all parameters of demand systems generated from additive preferences. If one justifiably fixes a value to this parameter, then, one cross-section study is enough to generate estimates of price and income elasticities (see Getachew [36] for the application to Ethiopia). In this particular model, however, two period price information is sufficient to directly estimate the Frisch parameter from the data, instead of fixing it from outside of the model. Details of the computation are given in Appendix A.

2.1.2 The ELES

Lluch [46] suggested the Extended Linear Expenditure System in an attempt to capture inter temporal decision problems in influencing consumption behaviour (this is an area of great controversy and numerous research work in economics literature; one need only be reminded of Patinkin's and Pigou's real balance effects). Howe [41], developed

the ELES by adding savings as the $n+1$ th commodity with the assumption that $\gamma_{n+1} = 0$, i.e., the subsistence saving amount is zero. With these modifications, the LES in (7) may be rewritten as:

$$p_i x_i = p_i \gamma_i + \beta_i (Z - \sum_{k=1}^n p_k \gamma_k) \quad [8]$$

$$S = \beta_{n+1} (Z - \sum_{k=1}^n p_k \gamma_k) \quad [9]$$

Where, Z stands for total income earned over a certain period of time; and S is for savings, and, (9) results because $\gamma_{n+1} = 0$. Further more, we may consider β_{n+1} as marginal propensity to save.

From (8) and (9), we infer that,

a. The budget constraint with equality is satisfied only if we make necessary modifications;

b. On the basis of (a), all parameters are exactly identified from a single cross-section study if there is information on savings. Case (b) is seen to hold as follows:

If we let

$$\mu = \sum_{i=1}^n \beta_i \quad [10]$$

then,

$$Z = \frac{(1 - \mu) \sum_{k=1}^n p_k \gamma_k + S}{(1 - \mu)} = \sum_{k=1}^n p_k \gamma_k + \frac{S}{1 - \mu} \quad [11]$$

Therefore, if we reformulate [7] as,

$$p_i x_i = p_i \gamma_i + \beta_i^* (Z - \sum_{k=1}^n p_k \gamma_k) \quad [12]$$

where,

then, by using a single regressand, Z and 1 for intercept term for the n goods we shall be

$$\beta_i^* = \frac{\beta_i}{\mu} \rightarrow \sum_{i=1}^n \beta_i^* = 1 \quad [13]$$

able to have $2n$ independent parameters which is the exact number of independent parameters in the ELES: μ , $n-1$ β_i s and n γ_i s. The inclusion of savings therefore played the crucial role of solving the identification problem in system equations.

2.2. The Theoretical Basis of LES, and ELES, and Other Important Derivations.

The LES and ELES are generated, respectively from the Stone-Geary type utility functions, or any of their positive monotone transform which are generally given as:

$$U(X) = \sum_{i=1}^n \beta_i \ln(X_i - \gamma_i) : \sum_{i=1}^n \beta_i = 1. \quad [14]$$

and,

$$U(X) = \sum_{i=1}^n \beta_i \ln(X_i - \gamma_i) : \sum_{i=1}^n \beta_i = 1, \gamma_n + 1 = 0. \quad [15]$$

Using Roy's identity, and Shephard's Lemma it is easy to verify that the Indirect Utility and Expenditure functions corresponding to the above utility functions, respectively, are given by:

$$\begin{aligned} v(P, y) &= \sum_{i=1}^n \beta_i \left[\ln \beta_i \left(y - \sum_{k=1}^n p_k \gamma_k \right) - \ln p_i \right] \\ e(P, \mu) &= - \frac{U \prod_{k=1}^n p_k^{\beta_k}}{\prod_{k=1}^n \beta_k} + \sum_{k=1}^n p_k \gamma_k \end{aligned} \quad [16]$$

Regularity conditions that must be exhibited by the cost function (like concavity, homogeneous of degree 1) in line with concave optimization (duality) impose the following restrictions on LES parameters:

$$1. 0 < \beta_i < 1,$$

2. $\gamma_i \leq X_i$

3. $\sum \beta_i = 1.$

The above restrictions imply a linear Engel curve, i.e., no inferior goods, and leads to the following derivations the details of which are given in Goldeberger and Gamaletsos [37], and also in Lluch and Powell [48] :

$$\begin{aligned}
 a. E_i &= \frac{\beta_i}{v_i} \\
 b. E_{ij} &= \phi E_i - E_i v_j (1 + \phi E_j), \\
 &= -E_i v_j (1 + \phi E_j) \quad i=j \\
 &= -E_i v_j (1 + \phi E_j) \quad i \neq j \\
 c. E_{ij}^* &= E_i (1 - \beta_i) \phi, \\
 &= -E_i \beta_j \phi, \quad i=j \\
 &= -E_i \beta_j \phi, \quad i \neq j
 \end{aligned}
 \tag{17}$$

Where, E_{ij} ($i=1, \dots, n$)= Uncompensated price elasticity of demand for commodity i with respect a change in the price of commodity j ;

E_{ij}^* ($i=1, \dots, n$)= Compensated price elasticity of demand for commodity i with respect to commodity j .

ϕ = " supernumerary" ratio, or the reciprocal of the Frisch Parameter(ω), or the Money Flexibility of income , the expression of which is given by the value of the Lagrangian Multiplier in constrained maximization of the relevant direct utility function.⁵

It is not difficult to see the important role ϕ plays in linking price elasticities with income elasticities. As a measure of welfare , Frisch argued that as real expenditure grows, ω declines from a bigger negative value to a smaller one, i.e., a fall in the absolute value of ω overtime is regarded as an improvement in the standard of living of households.

2.3 The Data and Method of Estimation.

2.3.1. The Data

Ethiopia does not have the practice of reporting aggregate expenditure on selected groups of commodities in the national accounts. Estimation of Systems of Demand Equations had to rely on data generated through budget studies. To the author's knowledge, published budget studies exist only for the years 1975, 1979, and 1980 for Addis Ababa region; and for the years covering 1980-1981 for the Ethiopian rural regions, excluding Tigray. All these are published in the Statistical Bulletins [12],[13], and [14] of the Central Statistics Authority, respectively.

All the budget studies use the household as baseline, and the details of the method of data collection and the sampling techniques utilized are given in the Bulletins mentioned. The important information provided in the Bulletins are: expenditure on broadly aggregated groups of commodities by different expenditure and income groups; savings in the form of *Iqub* (the traditional practice of holding cash on a non-interest bearing fashion), and bank accounts; household size and age by expenditure group. The demographic-expenditure matrix is incomplete to offer an opportunity to incorporate family size by including number of children in the models. The 1975 data is part of a series of well intended attempt by the Central Statistics Office (CSO) and the then National Revolutionary Campaign and Central Planning Council (NRDCCPC) to conduct a national budget study survey that would cover 30 towns of Ethiopia, including Addis Ababa. Thus far, only the budget study for Addis Ababa was published in Statistical Bulletin 19 of the CSO [12]. The uses into which the data were meant to be put could not better be explained than what was stated in the Bulletin itself [12, P.2], " i. To examine the pattern of consumer behaviour and provide up-to-date and accurate weighting diagram for the compilation of consumer price indices; ii. To utilize the result of Addis Ababa survey in the revision of the 1963 based Addis Ababa Cost of Living Index; iii. To compare consumption expenditure per household per month for the towns included in the survey; iv. To supplement the sources of information used in compiling the official estimates of national expenditure in order to improve national income estimates". Even though evidence is lacking to what extent these objectives were met,

Getachew [36] employed this data quite satisfactorily in his investigation of demand pattern for Addis Ababa households. The sample units covered in this survey were employees of industrial establishments and the civil service⁹. The 1979 and 1980 data were generated for quite specific purpose of analyzing energy demand and on this basis to draw energy policy options for the 1990s and beyond by making demand forecasts. The sampling units in these data include self-employed households in the business of trade, handicrafts and other household industrial units, apart from employees of government offices and the public sector.

The relevant price data utilized were taken from Addis Ababa Retail Price Index published in the Statistical Abstract [15]. The entire data set employed in this study and details of estimation procedures undertaken are available from the author on request.

2.3.2. Estimation Methods.

The identification problem briefly explained in 2.1.1 and in 2.1.2, and discussed in Appendix A suggest also the possible method of estimation. For model in 2.1.2, the only efficient method of estimation is Indirect Least Squares[ILS], i.e, estimates of β are obtained by Ordinary Least Squares method equation by equation, and structural estimates are derived from reduced ones. It is a matter of simple manipulations to show that the ILS is BLUE (see, e.g. Jhonston [42, P.469]). Generalized Least Square methods are just unnecessary because of the identical regressand in all equations. The Model in 2.1.1.(i.e., LES) however can be estimated alternatively by ILS and, following the procedure developed by Parks [54] by Maximum Likelihood Estimator [MLE]. The ILS procedure involves estimating the marginal budget shares for two periods by OLS and using the price information from outside of the model to derive the estimates of the structural parameters. The MLE procedure obviously uses the price information within the model, though it can not be in the Full Information MLE sense because of the very limited price information available. Therefore equation by equation estimation of error terms may have to be undertaken in line with SURE (Serially Uncorrelated Regression Estimates) models. In this paper the procedure followed in this case too is the ILS for the additional advantage it has

in computation simplicity, notwithstanding its appropriateness when system equations are exactly identified.

III. Analysis of Empirical Results.

The LES and ELES parameters were estimated for the groups of commodities given in table 1 below. The commodity groups were selected on the basis of the convenience provided in having complete information to compare the two models. Further more the level of aggregation is in line with the preference structure implied by LES, which is additive by construction. Price elasticities tend to be dominated largely by the income effect, rather than by the substitution effect when commodities are highly aggregated. The explanatory variable used for estimation purposes in the case of ELES was total income per person, and prices and total expenditure per person were used for LES; the dependent variable in both cases being money expenditure on the i^{th} commodity per person.

Table 1: Key To Commodity Classifications.

Commodity Groups	Description
1. Food	Food, Drinks, Tobacco
2. Housing Items	Housing Durable, Fuel, Water and light.
3. Clothing	Clothing and Foot Wear.
4. Transport	Same
5. Personal Care	Personal Care & Effects
6. Recreation	Recreation & Reading.
7. Others	Excluding medicare & rent .

3.1. Estimates of Marginal Budget Shares, Cost of Subsistence, and Income Elasticities.

Estimates of Marginal Budget Shares, Income Elasticities, and other important parameters of the LES and The ELES are given for 1975, 1979, and 1980 budget sets for Addis Ababa, and for 1980 Rural Ethiopia¹⁰ budget set in Tables 2,3,4, and 5, respectively. It is seen that nearly all are statistically significant¹¹ and comply with the restrictions stated for regularity purposes. The ELES was applied to the 1975 Addis Ababa Household Budget data and to the 1980 Rural Household Budget data, and the LES for the remaining budget sets. The main reason being that estimates of total cost of subsistence, which plays a crucial role in estimating the Frisch parameter, resulted in a negative value under ELES for the 1979, and 1980 budget studies for Addis Ababa creating a problem of interpretation (In fact negative intercept terms for Engel functions imply Luxury goods if the absolute value is within an acceptable range, see e.g., Deaton and Muellbauer [27]). Alternatively, the LES offered a better estimate particularly in the context of the Frisch parameter.

TABLE 2- Estimates Of Selected Parameters Of The ELES*
(1975 Budget Study For Addis Ababa)

Expenditure Group	$p \cdot y$ (in Birr)	R	V_i	F	β^{**}
1. Food	.8 8668	88265	5387	7895	4253 (.03887)
2. Hll. Items	1.55893	76135	1558	984	1558 (.02151)
3. Clothing	1.8409	.61135	1066	813	08667 (.01753)
4. Transport	-5.91065	77828	0771	2,2951	17695 (.02367)
5 Personal Care	-1.13525	73807	0144	1,1958	01722 (.00257)
6 Recreation	-1.8297	.68050	0351	1,7532	07907 (.01358)
7. Others	0971	.64710	.0623	9865	.06146 (.01147)

* The number of income group cells used are 15 for statistical reasons.

** figures in bracket are standard deviation estimates.

TABLE 3 - Estimates of Selected Parameters of The LES*
(1979 Addis Ababa Budget Study)

Items	β_i^{**}	p_i	V_i	E_i	R^2
1.Food	.48996 (.04081)	16.7109	.5322	.9206	.8472
2.HH Items	.13009 (.02939)	8.176	.1971	.66	.4298
3.Clothing	.090802 (.0227)	2.6113	.0914	.9935	.3811
4.Transport	.1432 (.0028)	1.2886	.1019	1.4053	.62245
5.Personal Care	.00978 (.00279)	.1205	.0077	1.2701	.4298
6.Recreation	.04133 (.00648)	-.6226	.0146	2.8308	.60998
7.Others	.0948 (.01137)	.0245	.0551	1.7205	.7279

* The number of income group cells used are 28

** The Figures in the bracket are standard error estimates.

TABLE 4. Estimates of Selected Parameters of LES*
(1980 Budget Study For Addis Ababa)

Items	β_i^{**}	p_i	V_i	E_i	R^2
1.Food	.3761 (.01777)	19.161	.4673	.8048	.9192
2.HH Items	.17298 (.02132)	7.294	.1957	.8839	.6963
3.Clothing	.1019 (.01244)	2.9181	.0979	1.0408	.7365
4.Transport	.08365 (.0287)	-.7882	.0405	2.0654	.2618
5.Personal Care	.0776 (.00829)	2.6252	.0797	.974	.785
6.Recreation	.07861 (.01081)	-.6759	.0389	2.0209	.688
7.Others	.10913 (.01259)	1.1258	.0799	1.3658	.7579

* The number of income group cells used are 26.

** The figures in parenthesis are standard error estimates.

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TABLE 5: Estimates Of Selected Parameters Of The ELES*
(Rural Household Budget Study 1980)

Item	β_i^{**}	$p_i Y_i^{***}$	V_i	E_i	R^2
1. Food	.6741 (.0178)	108.195	.7034	.9583	.98623
2. HH Items	.1647 (.0047)	33.1743	.1902	.8659	.98399
3. Clothing	.068 (.0075)	10.307	.0692	.9827	.803656
4. Transport	.0207 (.0045)	-1.2824	.0091	2.2747	.52455
5. Personal Care	.0704 (.015)	-5.6013	.0274	2.569	.52469
6. Recreation	-.002 (.0021)	-1.978	.0008	2.5	.39654

* The number of income group cells used are 22.

** The figures in parenthesis are standard error estimates

*** The "cost of Subsistence " figures are for a year, whereas for Addis Ababa Budget studies it is for a month.

Between 1975, 1979, and 1980 no significant change is observed in the values of β_i for Addis Ababa. This more or less supports the LES. In nearly all cases, Food expenditure took the highest share, and was followed by Housing Items expenditure. Transport expenditure took second place for 1975 and 1979 budget study though its share fell substantially in 1980. Expenditure share on Clothing remained nearly unchanged.

There is a causal relationship cutting across marginal budget shares, average budget shares, cost of subsistence and thus income or expenditure elasticities under LES. To see this, differentiating average budget shares expressions for LES with respect to income (expenditure) establishes that average budget share increases (decreases) as expenditure increases if total cost of subsistence multiplied by marginal budget share of the i th commodity exceeds (is less than) the cost of subsistence of commodity i . Following this derivation, one observes from Table 2 that for 1975 data the average budget share declined as real income increased for Food, Housing Items, and Clothing. For the other expenditure groups this value showed a positive correlation with income (expenditure). This is more

or less supported by the average income elasticity values given in Table 2. For 1979, average budget share declined with respect to real income for all commodity groups excepting for Recreation, showing a moderate discord with mean income elasticities. The same result also holds true for the 1980 Addis Ababa budget set as is clear from Table 4. The one reason for the inconsistency between the rate of change in the average budget shares with respect to income ($\delta v / \delta y$) and income elasticity for 1979 and 1980 data sets could be the use of sample averages instead of weighted mean income to calculate the income elasticity values. It is important to mention the fact that for the sample data 1979 and 1980 income distribution was biased against the low income group¹².

According to estimated average income elasticities for Addis Ababa, except for Food and Housing all commodity groups were luxury items in 1975, and in 1979 and 1980 Clothing became a necessity, and the rest conformed with 1975 situation. The picture for the rural household is quite revealing in many ways. Average budget shares declined for Food, Clothing and Housing expenditures, and increased for Transportation, Personal Care and Recreation with income. This more or less accorded with the income elasticity estimates. Food and Clothing for the rural household in 1980 were near-neutral commodities implying a unitary income elasticity. Also, both marginal budget shares and average budget shares values for Food were very high compared with that of Addis Ababa households. Rural households generally spent a significant amount of their income on Food. This result is not surprising in the setting of a subsistence economy. In fact, a 67% marginal or average budget share is not high for a household that produces and consumes generally Food items. It rather questions the strength of the edifice upon which the assertion that Ethiopian rural household is subsistence is formed. Housing is another expenditure item that was a necessity according to the income elasticity values. Considering the adequate statistical significance of parameter estimates, this result could not be by accident. We may conjecture that Housing items in the rural community do not make much of a difference across various income groups. Other expenditure groups are all luxuries to the rural community, including transportation. It may be a bit hasty, but tempting to note the limited market potential available for manufacturing items and services in rural Ethiopia during that period. In general, the very high income elasticity values (even for necessities) for both urban and

rural households depicts what is expected of a typical poor developing country scenario and in the process of economic growth these values tend to fall (see, for instance, LLuch and Powell [48]).

3.2. Saving Parameters and Welfare Implications of LES

One of the uses of parameter estimates from system of demand equations is the inference one may make about important features of the household. Estimates of marginal propensity to save (MPS) from ELES model for the 1975, 1979, and 1980 budget studies for Addis Ababa and for the rural household budget study are given in Table 6. These values for Addis Ababa vindicate the common perception that since 1975 things in the economy have gone really bad and rising prices eroded the purchasing power of households income which affected significantly their saving behaviour. MPS declined from .0964 to .0295 in these periods.

Table 6: Estimates of MPS and Frisch Parameter

Year	Estimate of MPS*	Estimate of Frisch Parameter(α)	Total Average cost of Subsistence (birr per month)
1975(A.A)	.0964	-1.1777(ELES)	8.51
1979(A.A)	.0231	-1.7325(LES)	28.3246
1980(A.A)	.0295	-1.6592(LES)	31.7269
1980(Rural)	.0678	-1.5461(ELES)	11.29

* ELES model.

In contrast to Addis Ababa the MPS of the rural households in 1980 was remarkably higher (about .07). Here again the common belief that rural households in Ethiopia seldom save, and when they do they spend it on investment items is brought to question. As explained in section 2.3.1 the saving data does not include investment expenditure or other forms of saving than cash. When we consider the fact that the process of saving determination by households works through the substitution effect (i.e., effect of alternative forms of savings on the decision of holding savings in a cash form), and the income effect

(as is the case in here) then, the value of MPS estimated for the rural households here indicates existence of some potential for mobilization in that period. It was, in fact, pointed out (e.g. Brüne [11]) that Ethiopian agriculture did better in 1979 and 1980 than in the years immediately before or after. This result, combined with estimates of Marginal Budget share, therefore call for a rethinking about the degree of monetization assumed to exist in the rural community in that period. Even more so, effort has to be made to closely study household saving behaviour for planning purposes in view of the growing conviction that the assumptions underlying aggregate saving behaviour, which is frequently used, are in practice untenable (see, Schimdt-Hebbel et.al [64] for a detailed discussion of the inappropriateness of relying on aggregate saving behaviour which hinge upon the Ricardian Equivalence assertion).

The process of estimating ω under LES is closely related with the estimates of total cost of "subsistence" and the mean income. The former is crucial when it comes to the proper sign ω should take so that the LES demand system satisfies all regularities needed by the choice theory. For this reason, LES and ELES models were alternatively applied as explained in section 3.1, to the budget studies where they appropriately satisfied these restrictions. A similar study by Getachew [36] for the 1975 budget study estimated the Frisch parameter outside of the demand system. The absolute value of his estimate for the Lower income group households was 3.02, which can be seen to be largely at variance with our estimates. This is not a surprising result given the different methodologies employed and the sensitivity of the Frisch Parameter itself to various demand specifications. There can be no dispute, however, regarding the advantage of direct methods over indirect ones in retaining relative accuracy. In concluding his work (which was probably the first of its kind in the Ethiopian context), Getachew [36] observed that " Finally, to the knowledge of this writer, no study seems to have been done to estimate the money flexibility [i.e., the Frisch parameter] for Ethiopia. In this paper this value was interpolated from the results of other studies undertaken elsewhere. It would be a worthwhile research project to stipulate this parameter on the basis of some Ethiopian data for the urban and rural population". Though long due, his call has been more or less answered by the attempts made in this study.

Estimate of the Frisch Parameter for all data sets confirm again the general impression many held about the Ethiopian Economy at least for the periods under discussion: From Table 6 it can be seen that the values of ω increased sharply for Addis Ababa data set between 1975 and 1979, and showed a slight decline in 1980. In fact, if we took account of income distribution factors to measure mean income, then, ω for 1979 and 1980 budget studies would be to the tune of -2.56 and -2.5, respectively, which further pronounces the gravity of welfare deterioration. By many accounts real income of households through these periods indeed declined quite substantially, and thus their welfare. One could not fail to notice the per person estimated cost of subsistence given in Table 6. We may go a bit further to reflect on its implication to the incidence of poverty if we take account of the percentage of people earning an income below this subsistence level from the samples. In 1980, the percentage of households in Addis Ababa earning per regularly employed an income level less than the cost of subsistence per person estimated for that year was about 43. If we make the not so unreasonable assumption that the rate of cost of subsistence between 1979 and 1980 (12%) apply to the years until 1990, and that income distribution remained neutral to real income changes in these years, then in 1990 the same percentage would come to 75. It seems that this value is not much far from those cited frequently in recent works (e.g. Eshetu [1992]) regarding intensity of poverty. In fact, there is no dispute concerning the reliability of budget studies in providing better estimate of income distribution aspects and incidence of poverty.

For the rural households ω was not much different from their urban counterparts; in fact better to some extent. A survey of the value of ω estimated for different countries can be found in Brown and Deaton [10], Goldberger and Gameltos [37] and Lluch and Powell [48]. In almost all cases the empirical values confirmed Frisch's theoretical observation: as real income of consumers increase the marginal utility of income declines. This is what is exactly observed for Ethiopian data sets too. We may point out further here the opportunity of measuring the " True Cost of Living " index using the expenditure function. We may go about this by asking the question that how much income would an individual consumer need in order to attain the same level of utility under two different sets of prices. Suppose we define vector of prices of n commodities as $P(T)=[p_1(T), \dots, p_n(T)]$ and $P(0)=$

$[p_1(0), \dots, p_n(0)]$, respectively, for some terminal period T and initial period 0 . Then, the "True" Cost of Living Index for period T and 0 is given by,

$$E(T,0) = y^*(T)/y(0) \quad \dots\dots(18)$$

where, $y^*(T)$ is income required at the terminal period T to attain the same utility as under the initial period 0 . Computation of the "True" Cost of Living thus requires existence of a utility function and its specification. In our case, since we have estimated the parameters of a demand system generated from the Stone-Geary utility function we will have no problem. Therefore, we illustrate here the application by taking 1980 as an initial period 0 , and 1990 First Quarter as terminal period T . There is no special reason for choosing the periods. It can be shown quite easily that the "True" Cost of Living Index underlying the LES is given by (see Goldberger and Gamaletsos [37] for details) :

$$E(T,0) = (1 - |\Phi(0)|) \sum_{i=1}^n w_i^*(0) p_i(T,0) + |\Phi(0)| \prod_{i=1}^n p_i(T,0)^{\beta_i} \quad [19]$$

where, $w_i^*(0) = p_i(0) \gamma_i / \sum_k p_k(0) \gamma_k =$ the subsistence budget share of the i^{th} commodity in period 0 ,

$-\phi(0) = y(0) - \sum_k p_k(0) \gamma_k / y(0) \equiv$ the supernumerary ratio in period 0 ,

$p_i(T,0) = p_i(T) / p_i(0) \equiv$ the price relative for good i , i.e., the ratio of its price in period T to that in period 0 . The computations made by inserting the relevant information into equation [19] resulted in the following:

$$E(T,0) = .3973 (1.6847) + .6027 (1.1516) = 1.583.$$

If we note the Cost of Living Index provided by the Conventional method computed from the Retail Price Index published by the CSA we have $\pi(T)/\pi(0)$, where $\pi(T)$ and $\pi(0)$ stand, respectively, for General Price Indices for periods T and 0 . In our illustration they are the years 1980 and 1990 First Quarter. Accordingly, $\pi(T) = 522.9$ and $\pi(0) = 353.5$ as given in Quarterly Bulletin [51]. The Conventional Cost of Living Index would thus be equal to 1.479. Since the "True" Cost of Living index omitted only one commodity group (medicare) out of the eight commodity group that had been used since 1963 to compute the

General Price index, no doubt that the Conventional method understated the Cost of Living Index. As it is the omission of medicare could not have made much a difference since its share in the 85.4 total weight of the eight commodity group is a mere 1.8 (see Quarterly Bulletin [51]), and its individual Cost of Living Index alone was in the same neighbourhood (1.302) as the Conventional Cost of Living Index itself. Rather, it is interesting, more so encouraging to see that the two measures of welfare changes came up with a value quite close to each other given the distinct approaches used in their evaluation. This is further pronounced if we note the same Cost of Living Indices given by the 1979 estimated parameters of the LES and the Conventional Cost of Living Index for the years between 1979 and 1990 First Quarter. They were computed to be, respectively, 1.59 and 1.54, and so much closer as it could be. Therefore we may be at least rest assured to continue to use the price series published by CSA with the due reservation as far as the group of commodities under consideration are concerned. A word of caution has to be made however here. The fact that both measures of welfare conveniently left out the rent component of household expenditure, the above estimates severely understate changes in Cost of Living as a result of rising housing rent. If, however, there were a reasonable mean estimate of rent paid by households in 1980, then the LES could incorporate rent in the calculation of Cost of Living Index since all budget studies did report per person mean expenditure of households on rent for all commodity groups. Not only house rents, but also the inclusion of expenditure on children (including school fees, etc.) improve parameter estimates and specially offer a very useful insight into the formulation of optimal indirect tax structures as is discussed in Ray [60]. From our result above, we could only say that Cost of Living deteriorated the welfare of the fixed-income earning households in the concerned periods so much that they would have needed a nominal increase in income of about 60% in 1990 just to remain as well-off as they had been in 1980. Considering that salaries and wages remained unchanged for the large part of these periods to many households, one could only imagine the consequent human misery and plight following the inflationary process. As a final remark, it might be much more instructive to support results of the estimated "true" Cost of Living Index here by estimating alternative demand systems using the available budget studies.

In concluding this sub-section what can be said for the moment is that demand systems generated as such are very useful indicators of welfare changes of households to policy makers, planners, the government and others concerned in the issue. The existence of poverty alone and its implicit acknowledgement may not suffice in the realm of plan formulation. Its intensity and magnitude have to be established to justify quantitative plan targets and to determine direction of policy actions. We may cite the concern Indian Planners showed to the incidence of poverty and its implication for the planning process, specially with regard to the setting of growth objectives (see, e.g., Perspective Planning Division [55], and Mahalanobis [49]). It need not be argued that at initial stage, economic growth worsens the degree of income inequality¹³, and therefore in a setting of abject poverty, no serious plan would rather dispense with income distribution matters when fixing the GNP growth rate. In the preparation of the Ethiopian 10th Year Perspective Plan [52], there was no an explicit attempt to treat issues of income inequality at all. Ironically, the domestic resource required to realize the GNP growth rate stipulated that households would cover a substantial percentage of total domestic saving the manner of whose determination had never been studied. In his observation of the growth constraint to the Ethiopian economy Eshetu [33, 32] emphasized the lack of surplus to be mobilized for investment and of market for manufacturing goods due to low level of income of households. It may be added here that even the available savings may not be transferred quite easily into investment the way the plan assumed, since households saving behaviour is not the same as the government's. It is therefore essential that concerned government authorities start in earnest to generate reliable data for the purpose of studying household consumption pattern and saving behaviour in order to get a better picture of the growth options open to the country.

3.3. Estimates of Own-and Cross Price Elasticities.

Price responses from LES models may be computed using the relations given in equation 17. Accordingly estimates of uncompensated own-and-cross price elasticities evaluated at sample mean are given in Tables 7, 8, 9, and 10 for the periods under investigation. It is apparent from the Tables that all uncompensated own price elasticities

are negative in absolute conformity with the utility basis of LES model. In fact the problem of finding a price response that are consistent with theoretical parametric restrictions have been discussed in Goldeberger and Gamaletsos [37], Lluch and Powell [48] and many others(see e.g. Brown and Deaton [10], and Blundell [9]). Therefore, in this regard LES and ELES model did not violate the theoretical restrictions imposed. If we look at the absolute values of estimated own price elasticities we notice the relatively higher magnitude for the 1975 Addis Ababa budget study than for 1979 and 1980. This difference has been no doubt because of the varying information used to identify the parameters of LES. The price information utilized for 1979, and 1980 gave a better result as is expected from a seven-group commodity classification. That is, own price elasticities could be well understood if they are inelastic for a commodity which is highly aggregated for the within substitution effect has been suppressed by the additive assumption in LES. On the other hand LES parameters for 1975 budget study were identified using saving information which has lesser role in measuring price responses than income responses. According to Tables 7,8,9 Food, Clothing and Housing Items were price inelastic in all cases, and Recreation price elastic. For the rural community the picture is that only Personal Care and Recreation were price elastic, the remaining being price inelastic, and one can explain the reason easily too.

Table 7: Estimate of Uncompensated Own-and-cross Price Elasticities
Addis Ababa Budget Study (ELES), 1975

	1	2	3	4	5	6	7
1	-0.8106	-0.0202	-0.0261	-0.0002	0.0578	0.0174	-0.0082
2	-0.1748	-0.8394	-0.0325	0.0002	0.0720	0.0216	-0.0099
3	-0.1444	-0.0208	-0.7171	0.0002	0.0595	0.0179	-0.0080
4	-0.2124	-0.0306	-0.0395	-1.0152	0.0875	0.0263	-0.0121
5	-0.4076	-0.0588	-0.0757	0.0005	-1.7808	0.0505	-0.0232
6	-0.3114	-0.0449	-0.0579	0.0004	0.1283	-1.4500	-0.0177
7	-0.1752	-0.0253	-0.0326	0.0002	0.0722	0.0217	-0.8382

Table 8: Estimate of Uncompensated Own-and-cross Price Elasticities
Addis Ababa Budget Study (LES) 1979

	1	2	3	4	5	6	7
1	-0.761	-0.11253	-0.0359	-0.01777	-0.00189	0.00850	-0.0004
2	-0.1646	-0.46140	-0.0257	-0.01270	-0.00140	0.00610	-0.0003
3	-0.2478	-0.12120	-0.6122	-0.01910	-0.00200	0.00920	-0.0070
4	-0.3505	-0.17150	-0.0548	-0.83820	-0.00290	0.01300	-0.0005
5	-0.3167	-0.15498	-0.0495	-0.02190	-0.73570	0.01176	-0.0005
6	-0.7059	-0.34540	-0.1104	-0.05450	-0.00580	-1.60780	-0.0011
7	-0.4291	-0.20995	-0.0669	-0.03310	-0.00360	0.01600	-0.9934

Table 9: Estimate of Uncompensated Own-and-cross Price Elasticities
Addis Ababa Budget Study (LES) 1980

	1	2	3	4	5	6	7
1	-0.6787	-0.07360	-0.0294	0.00800	-0.0265	0.0068	-0.01135
2	-0.2127	-0.61400	-0.0223	0.00875	-0.0291	0.0075	-0.01250
3	-0.2505	-0.08080	-0.6653	0.00880	-0.0291	0.0075	-0.01250
4	-0.4971	-0.18888	-0.0754	-1.22244	-0.0679	0.0176	-0.02910
5	-0.2340	-0.08900	-0.0356	0.00960	-0.6193	0.0083	-0.01370
6	-0.4863	-0.18470	-0.0738	0.02000	-0.0665	-1.2006	-0.02850
7	-0.3287	-0.12480	-0.0499	0.01350	-0.0449	0.0116	-0.84250

Table 10: Estimate of Uncompensated Own-and-cross Price Elasticities
Rural Household Budget Study (ELES) 1980

	1	2	3	4	5	6
1	-0.8761	-0.0241	-0.0802	0.00410	0.01740	0.00050
2	-0.2628	-0.6604	-0.0740	0.00422	0.01780	0.00050
3	-0.2315	-0.0218	-0.6328	0.00371	0.01571	0.00070
4	-0.6083	-0.0573	-0.1904	-0.14615	0.04130	0.00114
5	-0.6870	-0.0647	-0.2150	0.01102	-1.61540	0.00130
6	-0.6690	-0.0630	-0.1885	0.01070	0.04540	-1.61560

Abebe Shimeles: System of Demand Equations

By construction, all cross uncompensated price elasticities under LES and ELES have to be negative in view of the regularity conditions delineated in section II. This means that all goods are gross complements, implying income effects completely swamp off substitution effects. From our empirical estimate we observe that Food, Clothing and Housing were gross complements in all cases, and Entertainment a gross substitute with all other commodities. Personal Care expenditure and Transport were gross substitutes to the rural household. The issue of complementarity and substitutability may not have to be taken literally, more so in case of an additive preference, as in LES. In fact, we may reflect for a moment on the intuitive interpretation of our result by observing the fact that goods are gross complements if substitution in consumption is less important than the purchasing power implication of a change in price. This is mainly true of goods that are either independent or complements in consumption. By construction, our estimated demand system rules out complementarity. Thus, Food, clothing and Housing may be independents in consumption but complements in income effect because of their relative importance in total budget and on the average they are necessities to the individual consumer. The LES also has a clear implication to the issue of compensated and equivalent variation regarding consumer's surplus discussed in detail in Seade [63] and the distinguishing feature between Marshallian demand function and compensated demand function as in Hicks [39].

For the empirical application of price responses a recent study by Cragg [19] to issues of indirect tax reforms pointed out the differences between those obtained through additive preferences and those from semi-flexible functional forms like the normalized quadratic expenditure system in terms of their implication to aggregation. We shall nevertheless draw the reader's attention to the remarkable result of Deaton [22, p. 360] that says " Provided preferences are weakly separable between goods and leisure, and provided all consumers have parallel Engel curves for goods in terms of income, then, the differential commodity taxation is unnecessary given an optimal linear tax. Further, if there exists a separable group of goods for which the within group Engel curves are linear, then, all goods within-group should be taxed at the same rate." While this is a subject that indeed needs a separate treatment of its own, we may just reflect here on what the linearity of Engel curves implied by the LES, whose parameters we estimated, might mean to empirical

issues such as optimal tax rate determination. We have come quite close in supporting uniform commodity indirect tax rates for all commodity groups in question! If some more generalized systems like the quadratic Expenditure system and translog were estimated using the already available data sets there might be a broader room for making comparisons to the direction of reform the Ethiopian indirect tax system should take. One more constraint, however, that can be anticipated is how to find reliable actual tax rate for the groups of commodities considered in this study in the absence of published input-output data for Ethiopia. Nevertheless future investigation in this area is worth a try if at all we are supposed to know the way various economic variables are linked to each other in our economy under alternative settings.

Table 11: Percentage Share of Own-Price Elasticities to Expenditure Elasticities for Addis Ababa Budget Studies

Commodity group	1975	1979	1980
1	103	83	84
2	85	70	69
3	85	62	64
4	88	60	59
5	78	58	64
6	83	57	59
7	85	58	62

Further more, based on the Homogeneity property of demand systems we may note from Table 11 the relative importance of own price elasticities in the overall elasticity measures. Moreover, the importance of Food price increased between 1975 and 1980 in total expenditure elasticities, being in the order of 18% and 25% to total income elasticity accentuating further the sensitivity of overall price-elasticity to changes in the price of Food.

Finally, making use of the Slutsky decomposition we can compute the compensated price elasticities. Again as can be verified from Appendix C all compensated own price

elasticities were negative and compensated cross price elasticities positive, i.e., goods were net substitutes. All budget studies satisfied this condition in our empirical estimate. The issue of symmetry of the Slutsky substitution matrix implies unitary price elasticity and thus equality between marginal budget shares and average budget shares; this can occur if only Engel curves pass through the origin. Nevertheless concavity of the Substitution matrix is satisfied if marginal budget shares sum up to one, and all lie within specified range. In our case this has been satisfied in all cases.

CONCLUSION

The LES and ELES have been estimated using budget studies for Addis Ababa and Rural households for the years 1975,1979, 1980, and 1980-81, respectively. Parameter estimates to a larger extent satisfied the theoretical restrictions inherent in the models. An important insight was gained from the empirical results regarding the saving behaviour and consumption pattern for groups of aggregated commodities by urban as well as rural households. Particularly, the saving behaviour implied by ELES for Ethiopian rural households ran against the dominant perception ordinarily held by most of us: prevalence of subsistence consumption. The discussions brought out into light the welfare implication of changes in real income through the estimation of the Frisch Parameter which confirmed its theoretical edifice.

Further more, while in the literature much effort have gone into the task of empirically testing parametric restrictions implied by the choice theory, the simplicity of the LES does not require much of a concern in this regard. The Homogeneity and Aggregation restrictions are immediate results of the model. Concavity (negative semi-definiteness) of the Slutsky Substitution Matrix is guaranteed if marginal budget shares sum up, as they must under OLS, to unity. Therefore, one cannot claim to have found certain restrictions satisfied empirically that are already built in the model. However, important restrictions embodied in the utility function that generated LES need to be tested empirically. Regarding this, restrictions on marginal budget shares have all been satisfied

by our estimates; estimated cost of subsistence obeyed the restrictions implied by the model. As a result, we can say the LES and ELES more or less fitted well into budget studies for Ethiopia for the period under investigation.

Estimates of own-and-cross price elasticities gave results that are normally expected from the models except in some cases. In fact, goods were found to be gross complements if they were necessities and gross complements if they were luxuries. Of particular interest is the continuum observed regarding price responses between urban and rural households for selected commodities, especially in regard to gross complementarity.

Finally, the possibility of estimating generalized system like the Quadratic Expenditure System and the Translog Expenditure System for available Ethiopian budget studies using the Recoverability Theorem discussed in Dybrig [31] is an issue of interest for future endeavour. In this regard one may proceed to study the Ethiopian indirect system and incidence of poverty due to rising cost of living among different income groups using estimated demand systems.

APPENDIX A

Derivation of the Reduced Forms of LES and ELES

The LES demand system may be written in stochastic form :

$$p_{it}x_{it}^h = p_{it}y_{it}^h + \beta_i^h \left(y_{it}^h - \sum_{k=1}^n p_{kt}y_{kt}^h \right) + e_{it}^h \quad [1]$$

$$h= 1, \dots, H$$

$$t= 1, \dots, T$$

where, N is for the total number of commodities, H is for the total number of households and T is for time in years.

Econometric estimation of the parameters in [1] involves the pooling of cross-section and time series data, and standard Feasible Generalized Least Square methods are applied. The non-linearity within the parameters are taken care of following the algorithms developed by Parks [54]. The essential point to mark in [1] is the singularity of the Covariance matrix if its dimension is NxN. Barten[6] showed in the context of the Rotterdam model that dropping any one of the equations solves the singularity. Thus one can proceed with the estimation process along these lines. However, when the price information is limited to just a pair, the reduced form lends as well a convenient procedure to estimate all parameters of [1] through Indirect Least Squares. In fact, two Engel curves provide estimates of each periods β_i . Their intersection uniquely determines the $n \gamma_i$ s (Pollak and Wales [57: 350]). The reasoning that there is a one to one relationship between the number of equations, number of parameters to be estimated and types of demand systems run deep into the Recoverability and Identification problem discussed in Dybring[31]. Thus we may write [1] for each period, 0 and 1, respectively as : where e_{i0} and e_{i1} are stochastic error terms, respectively for the i^{th} commodity of the h^{th} household in period 0, and 1. The rest of the notations take the definitions used in the text.

$$\begin{aligned}
 (p_{i0} x_{i0})^h &= p_{i0} y_i + \beta_{i0} (y_0^h - \sum_{k=1}^n p_{k0} y_k) + e_{i0}^h \\
 (p_{i1} x_{i1})^h &= p_{i1} y_1 + \beta_{i1} (y_1^h - \sum_{k=1}^n p_{k1} y_k) + e_{i1}^h \\
 &\dots [2]
 \end{aligned}$$

And let,

$$\begin{aligned}
 \theta_{i0} &= p_{i0} y_i - \beta_{i0} \sum_{k=1}^n p_{k0} y_k \\
 \theta_{i1} &= p_{i1} y_1 - \beta_{i1} \sum_{k=1}^n p_{k1} y_k \quad [3]
 \end{aligned}$$

so that, we may rewrite [2] as :

$$\begin{aligned}
 (p_{i0} x_{i0})^h &= \theta_{i0} + \beta_{i0} y_0^h + e_{i0}^h \\
 (p_{i1} x_{i1})^h &= \theta_{i1} + \beta_{i1} y_1^h + e_{i1}^h \\
 &\dots [4]
 \end{aligned}$$

Equation by equation OLS regression of [4] on the $n-1$ commodities give $2n-2$ independent estimates for each period. Their intersection determines one more unknown so that the two equations in [4] can individually and jointly determine the estimate of $2n-1$ independent parameters which is the exact number required to identify all parameters of the LES. We may demonstrate this as follows:

Intersection of two Engel curves is given by the relation :

$$\frac{\theta_{i0}}{p_{i0}} + \beta_{i0} \frac{y_0^h}{p_{i0}} = \frac{\theta_{i1}}{p_{i1}} + \beta_{i1} \frac{y_1^h}{p_{i1}} \quad \dots [5]$$

set

$$\frac{y_0^h}{p_{i0}} = \frac{y_1^h}{p_{i1}} = y_i^h$$

so that,

$$\frac{\theta_{0i} - \theta_{1i}}{p_{i0} - p_{i1}} = y_i^h$$

.....[6]

Using [3] and [6], and the following identity at point of intersection:

$$\sum_{k=1}^n p_{k0} = y_0^h \quad \wedge \quad \sum_{k=1}^n p_{k1} = y_1^h$$

we have:

$$\sum_{i=1}^n p_{i0} y_i = \sum_{i=1}^n \beta_{i0} p_{i0} y_i$$

$$\sum_{i=1}^n p_{i1} y_i = \sum_{i=1}^n \beta_{i1} p_{i1} y_i$$

.....[7]

that completely identify all the independent parameters of LES for each period.

QED.

The ELES stochastic form is given by :

where e_i is a stochastic error term for the i_{th} commodity.

Letting $\mu = \sum \beta_i$ we have $\beta_{i-1} = 1 - \mu$, therefore,

$$\begin{aligned}
 p_i x_i &= p_i \gamma_i + \beta_i (Z - \sum_{k=1}^n p_k \gamma_k) + e_i \\
 S &= \beta_{n+1} (Z - \sum_{k=1}^n p_k \gamma_k) + e_{n+1} \\
 &\text{where, } \gamma_{n+1} = 0
 \end{aligned}
 \tag{8}$$

$$\sum_{i=1}^n p_i x_i = \sum_{i=1}^n p_i \gamma_i + \mu (Z - \sum_{k=1}^n p_k \gamma_k)
 \tag{9}$$

Combining [8] and [9] and setting $p_i \gamma_i = \gamma_i^*$ and $\beta_i^* = \sum \beta_i \mu$, we have:

$$\begin{aligned}
 p_i x_i &= \gamma_i^* - \beta_i^* \sum_{k=1}^n \gamma_k^* + \beta_i^* Z + e_i \\
 S &= -(1-\mu) \sum_{k=1}^n \gamma_k^* + (1-\mu) Z + e_{n+1}
 \end{aligned}
 \tag{10}$$

The reduced form in [10] has $n-1$ independent equations with $2n$ independent parameters to be estimated (n γ 's and $n-1$ β 's and μ). By rearranging [10], it is possible to estimate $2n$ independent parameters using Z and 1 as regressands from a cross section budget study. Since [10] is exactly identified if we drop one equation and each contains identical explanatory variables the Indirect Least Squares Method is efficient. For details see Howe [41].

APPENDIX B

Functional Forms of a Few Noted Demand Systems

1. The Linear Expenditure System [LES]

$$p_i x_i = p_i \gamma_i + \beta_i (y - \sum_{k=1, \dots, n} p_k \gamma_k)$$

$$\sum_{i=1} \beta_i = 1$$

where, x_i , y and p_i are, respectively, quantity demanded of the i^{th} commodity, y is total income of an individual consumer, and price of the i^{th} commodity; β_i is a constant parameter, interpreted as marginal budget share ($= \partial(p, x_i) / \partial y$); and γ_i is a constant parameter interpreted as minimum quantity of the i^{th} commodity necessary for subsistence.

See Goldberger and Gamaletsos [37] for the theoretical properties of the LES, and Howe [41], and Pollak and Wales [57] for their identification in empirical works and Luch and Powell [48] for empirical application.

2. Indirect Addilog demand Model.

$$x_i(p, y) = \frac{a_i b_i y^{b_i} p_i^{-b_i-1}}{\sum_{j=1, \dots, n} a_j b_j y^{b_j-1}}$$

The above demand system is generated from an Indirect Utility Function (IUF) of the type:

$$v(p, y) = \sum_{i=1} a_i \left(\frac{y}{p_i} \right)^{b_i}$$

$$i=1, \dots, n.$$

where, a_i and b_i are constant parameters (for the rest of the notations see the definitions

given above or in the text). The econometric procedure to estimate the addilog demand system is discussed in Johnston [42], Varian [70].

3. The Rotterdam Demand System.

$$\bar{v}_i \Delta(\ln x_{it}) = a_i + b_i \sum_{k=1, \dots, n} \bar{v}_k \Delta(\ln x_{kt}) + \sum_k S_{ik} \Delta(\ln p_k)$$

where, $\Delta(\ln x_{it}) = \ln x_{it} - \ln x_{i,t-1}$

$\Delta(\ln p_k) = \ln p_k - \ln p_{k,t-1}$

$$\bar{v}_i = v_{it} - v_{i,t-1} = \frac{p_{it} x_{it}}{\sum_k p_{kt} x_{kt}} + \frac{p_{i,t-1} x_{i,t-1}}{\sum_k p_{k,t-1} x_{k,t-1}}$$

$$S_{ik} = v_i (E_{ik} + E_{ki})$$

where, t and $t-1$ refer to current and preceding period, respectively; v_i , E_{ik} and E_{ki} are as defined in the text, a_i and b_i are constant parameters.

The theoretical basis and estimation procedure after the imposition of restrictions implied by the choice theory for the Rotterdam model is discussed in Barten [6], Luch [47], Barten and Geyskens [8], and Keifer [43].

4. The Translog Reciprocal Indirect Utility Functions.

Define: $h(x_1, \dots, x_n) = 1/v(p_1, \dots, p_n, y)$, i.e., $h(\mathbf{X})$ is a reciprocal of an IUF, and $q_i = p_i/y$.

$$\ln h(x_1, \dots, x_n) = a_0 + \sum_i a_i \ln x_i + \frac{1}{2} \sum_{i=1}^n b_{ij} \ln q_i \ln q_j$$

where, $b_{ij} = b_{ji}, \forall i, j.$

a_0, a_i, b_{ij} are constant parameters; and consumer demand functions are given by :

$$x_i(q) = \frac{q_i^{-1} (a_i + \sum_{i=1}^n b_{ij} \ln q_j)}{\sum_k a_k + \sum_{k=1}^n \sum_{m=1}^n b_{km} \ln q_m}$$

$i, k, m = 1, \dots, n.$

Varian observes [70, p. 132] that, " If the $b_{ij} \neq 0$ for any i and j , then the translog function will not satisfy the requirements for an indirect utility function globally, but may be regarded as approximation to any IUF. The translog function will be homogeneous of degree 1 if $\sum a_i = 1, b_{ij} = b_{ji},$ and $\sum b_{ij} = 0 \forall i:$ since the demand equations are homogeneous of degree 0 in the parameters a_i and $b_{ij},$ it is necessary to impose normalization. The most convenient normalization is $\sum_i \sum_j b_{ij} = 0."$

5. Almost Ideal Demand System

The model is given by,

$$\frac{P_i X_i}{Y} = v_i = \alpha_i + \sum_j \gamma_{ij} \log p_j + \beta_i \log \left(\frac{Y}{P} \right)$$

$i, j = 1, \dots, n.$
where,

$$\log P = \alpha_0 + \sum_k \alpha_k \log p_k + \frac{1}{2} \sum_j \sum_k \gamma_{kj} \log p_k \log p_j$$

where, $\alpha_0, \alpha_i, \beta_i,$ and γ_{ij} are the constant parameters to be estimated under the

following restrictions implied by the choice theory:

$$\sum \alpha_i = 1; \sum \gamma_{ij} = 1, \sum \beta_i = 0 \quad (\text{additivity}),$$

$$\sum \gamma_{ij} = 0 \quad (\text{homogeneity}),$$

$$\gamma_{ij} = \gamma_{ji} \quad (\text{symmetry}).$$

P is generally taken as an approximation to the general consumer price index.

Details of the properties of this model and their estimation procedures are given in Deaton and Muellbauer [27], and Coyte and Landon [18].

APPENDIX C

Estimates of Compensated Own-and-Cross Price Elasticities

Addis Ababa Household Budget Study

1975

	1	2	3	4	5	6	7
1	-0.3853	0.1028	0.0581	0.1186	0.0115	0.0530	0.0412
2	0.3553	-0.7074	0.0724	0.1478	0.0144	0.0660	0.0513
3	0.2936	0.1058	-0.6305	0.1221	0.0189	0.0546	0.0424
4	0.3448	0.2988	0.1689	-1.6039	0.0336	0.1541	0.1198
5	0.4318	0.2988	0.0880	0.1797	-0.9979	0.0803	0.0624
6	0.6731	0.2282	0.1290	0.2634	0.0256	-1.3709	0.0915
7	0.3562	0.1284	0.0726	0.1482	0.0144	0.0662	-0.7862

Estimates of Compensated Own-and-Cross Price Elasticities

Addis Ababa Household Budget Study

1979

	1	2	3	4	5	6	7
1	-0.2710	0.0691	0.0482	0.0761	0.0052	0.0220	0.0504
2	0.1866	-0.3314	0.0346	0.0546	0.0037	0.0158	0.0361
3	0.2809	0.0746	-0.5214	0.0822	0.0056	0.0237	0.0543
4	0.1162	0.1055 *	0.0736	-0.6950	0.0079	0.0336	0.0769
5	0.3592	0.0954	0.0665	0.1650	-0.7259	0.0304	0.0695
6	0.8006	0.2126	0.1483	0.2341	0.0159	-1.5660	0.1548
7	0.4866	0.1292	0.0902	0.1423	0.0096	0.0411	-0.8990

Estimates of Compensated Own-and-Cross Price Elasticities
Addis Ababa Household Budget Study

1980

	1	2	3	4	5	6	7
1	-0.3026	0.0839	0.0494	0.0406	0.0376	0.0381	0.0529
2	0.2004	-0.4406	0.0543	0.0446	0.0414	0.0419	0.0582
3	0.2359	0.1085	-0.5634	0.0525	0.0487	0.0493	0.0685
4	0.4682	0.2153	0.1268	-0.6478	0.0966	0.0979	0.1358
5	0.2210	0.1015	0.0598	0.0491	-0.5410	0.0462	0.0641
6	0.4581	0.2107	0.1241	0.1019	0.0946	-1.1222	0.1329
7	0.3096	0.1424	0.0839	0.0688	0.0639	0.0647	-0.7330

Estimates of Compensated Own-and-Cross Price Elasticities
Rural Household Budget Study

1980

	1	2	3	4	5	6
1	-0.2020	0.0421	0.1021	0.0128	0.0436	0.0012
2	0.4285	-0.5924	0.1047	0.0305	0.0447	0.0013
3	0.3776	0.0381	-0.0922	0.0116	0.0394	0.0010
4	0.9920	0.1000	0.0305	-1.4408	0.1031	0.0029
5	0.7861	0.1129	0.2737	0.0344	-1.5446	0.0033
6	1.0900	0.1100	0.2663	0.0335	0.1138	-1.6138

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Notes

1. Eventhough the original work of Slutsky appeared in French as early as 1915, it was only in 1936 that it attracted the attention of English speaking world and became a famous analytical tool in subsequent works (see for example, Brown and Deaton [10]).

2.monotonocity refers to invariability of preferences to appropriate transformations; for the proof of the theorem see Varian [70].

3. The most important identities of note are the following: (All notations below take the definitions given in the text)

a) $e(\mathbf{P}, v(\mathbf{P}, y)) = y$, the minimal expenditure to reach utility $v(\mathbf{P}, y)$ is y ;

b) $v(\mathbf{P}, e(\mathbf{P}, u)) = u$, the maximal utility from income $e(\mathbf{P}, u)$ is u ;

c) $h_i(\mathbf{P}, u) = x_i(\mathbf{P}, e(\mathbf{P}, u))$, the Hicksian demand at utility u is the same as the Marshallian demand at income $e(\mathbf{P}, u)$.

d) $x_i(\mathbf{P}, y) = h_i(\mathbf{P}, v(\mathbf{P}, y))$, the Marshallian demand at income y is the same as the Hicksian demand at utility $v(\mathbf{P}, y)$.

Following these we have Roy's Identity, and Shephard's Lemma, respectively, given as:

$$x_i(\mathbf{P}, y) = - \frac{\frac{\delta v(\mathbf{P}, y)}{\delta p_i}}{\frac{\delta v(\mathbf{P}, y)}{\delta y}} \quad i=1..n$$

$$h_i(\mathbf{P}, u) = \frac{\delta e(\mathbf{P}, u)}{\delta p_i}$$

The proofs for both of the above results is given in Varian[70].

4. the derivation of the Slutsky Equation and a very simple proof of it is given in Varian [70], and for intuitive interpretation see Green [38]. The original presentation is given in Slutsky

[65].

5. See Note 3 above.

6. Let the government's problem be stated as follows:

Maximize,

$$\Psi = \Psi\{v^1(p_1, \dots, p_n, y^1), \dots, v^H(p_1, \dots, p_n, y^H)\}$$

$$\text{Subject to: } \sum_t X_j = R \quad j=1, \dots, n$$

where, Ψ is the SWF of the government, t_j is the indirect tax rate on commodity j . X_j is $\sum_i x_{ij}$, $i=1, \dots, H$, the sum of quantity of commodity x_j consumed by the i_{th} household. R is a lump sum fiscal revenue constraint. The solution to the above problem and its empirical investigation leads to the issue of tax reform. For the theoretical exposition see Deaton [21], Diamond and McFadden [1974] and for a recent application Cragg [19].

7. The demand systems estimated by Asmerom [4, 5] were in the Cobb-Douglas family which do not have a direct utility function (See, e.g., Green [38]). Therefore, all the regularities outlined by the choice theory are not exhibited in these systems.

8. For LES and ELES, "supernumerary" ratio is given by, respectively,

$$\phi = 1 - \frac{\sum P_k Y_k}{\bar{y}}$$

$$\phi = 1 - \frac{\sum P_k Y_k}{\bar{z}}$$

9. Such a sampling unit is not typical of Ethiopia, rather common elsewhere. For example data employed by Darrough et.al [20] were generated in like manner in the context of Japanese households.

10. Estimation of demand systems for rural households here assumes that their production and consumption decisions are made independent of each other. The procedure is fairly justified on various grounds (e.g. see Deaton and Muellbauer [27]). An alternative is a model that incorporates both decisions simultaneously, see Alemayehu [2] for the theoretical exposition.

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11. Adjustments for possible heteroscedastic error terms failed in all cases; thus OLS estimates were taken. For 1975 budget set out of the 29 income groups, the lower 16 income groups were taken for estimation on the grounds that Engel curves tended to be non-linear when the entire observation was taken. A semi-log specification, however, did not do well either.

12. The percentage of households below the income bracket Birr 449 were respectively 54.3, 87.8, 87.2, for 1975, 1979, and 1980 Addis Ababa budget sets. The sample size of households in the budget studies for 1975, 1979, and 1980 were respectively 200, 500, and 500.

13. This is a stylized fact generally accepted to hold and there is no known evidence to the contrary, see Kuznets [1962]. In this connection an attempt was made to estimate Cost of Living Index for high and low income groups. Because it turned out statistically insignificant it is not reported here.

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THE CONTRIBUTION OF THE NEW INSTITUTIONAL
ECONOMICS TO THE STUDY OF MARKETS*

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ABSTRACT: This article first summarises the orthodox approach in market analysis and examines the contribution of the "new institutional economics" to the study of markets. In the third part it compares and contrasts the two approaches examining the strengths and weaknesses of both and concludes by emphasising the fact that they have a role to play in economic analysis.

The relatively recent development in the economics literature which has been coined as the "new institutional economics" (NIE) has brought about many new perspectives in the study of economic relationships. This essay tries to contrast the orthodox methodology in the analysis of the market with that suggested by the NIE. The first part is devoted to briefly outlining the orthodox approach; the second part will examine some aspects of NIE and the third concludes by looking at the significance of the two approaches to the study of markets.

Incidentally, that one of the Nobel Prize winners of economics this year (1993) is Douglas North, a well known institutional economist, may reflect the fact that the institutionalists are gaining recognition in economics.

I. The ORTHODOX APPROACH TO THE STUDY OF MARKET SYSTEMS

The orthodox approach is mainly based on the *perfectly competitive market model* which has played a very important role in neoclassical economics and in economics as a whole. Hence, to understand the basic idea behind the orthodox approach, it will be useful to start by looking at the assumptions underlying the perfectly competitive market model.

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One important assumption is the existence of free competition, i.e., a large number of buyers and sellers exist in the market (theoretically, infinite number of buyers and sellers). If there are a large number of buyers and sellers each one of them being too small to influence the market condition, they will be price-takers.

Perfect knowledge by all participants is also assumed. This means all buyers and sellers know about every thing that happens on the market. Participants in the market are not segmented by differential access to information. All know the prices of the different commodities, where and when they are sold, their specifications, etc. This assumption of perfect knowledge, coupled with the previous assumption of free competition, will create a condition where one commodity has only one price.

The perfectly competitive market model also assumes freedom of entry and exit for the firms in the industry. This means there are neither institutional nor legal obstacles against the free movement of firms between different industries. In addition to the freedom of entry and exit, the model also assumes that there is perfect mobility of resources. Resources used in the production of one commodity can be used in the production of another without any formidable problem. The above two assumptions draw a picture of an economy which is highly flexible. Since there are no obstacles against the entrance and exit of firms and there is no problem of using resources used in the production of one commodity for another, what is envisaged is an economic system which can quickly and flexibly respond to changes in demand.

In addition, the commodity that is sold and purchased in the perfectly competitive market is a homogenous one. That means the consumers see no difference in the goods that are offered by the sellers. All commodities of the same type are completely identical in quality.

In the perfectly competitive market, transactions are costless. In real markets, transactions involve transportation and other costs (costs incurred in gathering and disseminating information, advertisement costs, etc.). Between the producers and the

consumers, there are many middle men that take their own share of the 'margin'. In the competitive market model all transaction costs are ignored and it is assumed that producers and consumers are directly exchanging products without any 'friction'.

In a perfectly competitive market model, due to the 'invisible hand' of the market, efficiency will be achieved. Consumers equate their marginal utility per unit of money from different commodities to maximize utility and producers equate marginal revenue with marginal cost to maximize profit. And on the market as a whole total demand is equated with supply at equilibrium. This creates a condition where on the one hand the consumers' demand for the commodity at the ruling price is satisfied and on the other the producers' 'normal' profit is guaranteed.

No researcher who uses the orthodox approach will expect to find all the characteristics of the perfectly competitive market in reality. But the model is taken as a reference and real markets are judged by their similarities and differences with it. Those which are similar are taken to be more competitive and efficient.

If the market under study is one with many sellers and buyers it is taken as an indication that there is freer competition. If we have markets where information easily flows from one locality to another, the participants have a good knowledge of what is happening and correspondingly will have a better opportunity to rationally and timely respond to changes. If the government or other social institutions have not imposed restrictions on the movement of capital, labour, other resources, sellers and buyers, the assumption of freedom of entry and exit is approximated and correspondingly markets will be more competitive and efficient. If markets have a better system of determining the quality of the product differentiating it from other similar goods (for example scientific method of quality standardization) the assumption of homogeneity of the product is approximated.

The more the conditions in real markets approach the perfectly competitive market model the more the markets in a country or in a region will be integrated. If the markets

in a region or a country are well-integrated, the price differences between them will be the transport costs incurred to move the goods from one market to another. When there are price differentials, traders will start to move the goods from those markets with lower prices to others with higher prices reestablishing equilibrium. In order to examine whether markets are integrated or not the standard procedure that is used by many researchers is to calculate the correlation coefficients between the prices of different markets (net of transport costs). If the coefficient is significantly closer to one a stronger integration and if closer to zero a weaker integration is supposed to exist. Many researches have been made by using this orthodox approach [5,3].

The orthodox approach represents the market as an agglomeration of bilateral exchanges without considering the different institutions which make market relationships possible. It ignores both 'tangible' (middle men, transportation and other transaction costs, etc.) and 'intangible' (rules, business norms, customs, etc.) institutional factors. There is also no attempt to explain why there are different institutional forms. For example, there is no attempt to explain why commodities are produced by firms instead of individuals working independently (in contrast 'transaction cost economics', which may be considered as part of institutionalism, tries to explain the existence of firms as a way of minimizing both production and transaction cost). Behaviourial differences among people in different types of institutions are not taken into account. For instance, the behaviour of people as members of households and as members of business firms may vary; but in the orthodox approach they are always assumed to maximize on the margin.

Others criticised the use of correlation analysis to examine market integration because it takes into account a statistical model which neglects problems related with autocorrelated disturbances[7]. Under the presence of autocorrelated disturbances and non-stationary variables (and usually price data are like that) the significance tests on coefficients are invalid and as an alternative the method of co-integration is suggested[7].

Now let us look at the alternative approach suggested by the NIE.

2. THE NEW INSTITUTIONAL ECONOMICS AND THE MARKET

The NIE criticises most of the definitions of the market because they do not emphasise their institutional nature. As an alternative Hodgson defines the market in the following way:

"We shall here define the market as a set of social institutions in which a large number of commodity exchanges of a specific type regularly take place, and to some extent are facilitated and structured by those institutions. Exchange ... involves contractual agreement and the exchange of property rights, and the market consists in part of mechanisms to structure, organize, and legitimate these activities. Markets, in short, are organized and institutionalized exchange. Stress is placed on those market institutions which help to both regulate and establish a consensus over prices and, more generally, to communicate information regarding products, prices, quantities, potential buyers and potential sellers"[2].

In the process of exchange, the prices of goods and services must be fixed and communicated to potential buyers. The suppliers must also have a mechanism of knowing if there is demand for their produce. Before producing and in the process of selling the goods, the suppliers must use transportation. The exchange process is also a transfer of property rights from the seller to the buyer and this requires an established legal institution. To the NIE, "customary, legal, political and other social arrangements are central to all market systems." [2]

Nabli and Nugent also stressed the same aspects when discussing the important characteristics of institutions (which also apply to markets).

"The first characteristic is the rules and constraints nature of institutions. Elinor Strom ... has defined these rules and constraints as 'prescriptions commonly known and used by a set of participants to order repetitive, interdependent relationships. Prescriptions refer to which actions are required, prohibited or permitted.'"

"The second characteristic of institutions is their ability to govern the relation among individuals and groups..."

"The third characteristic of institutions is their predictability. The rules and constraints have to be understood, at least in principle, as being applicable in

repeated and future situations. Agents should expect these rules and constraints to have some degree of stability; otherwise, they would not have an institutional character"[6].

The definition of a market as a social institution brings about a different perspective to the understanding of the market than orthodox neoclassical theory.

(i) Mainstream economics considers the market as a "natural or normal order" and considers the institutional framework either as given or completely omits it from analysis[6]. In NIE the "view that the market is simply an aggregation of bilateral exchanges between individuals, or essentially some kind of reflection of given individual preferences and purposes, is rejected..."[2].

(ii) The usual dichotomy between "free" market and "institutional constraints" are rejected in NIE. In mainstream economics, while the market is assumed to be a mechanism encouraging mobility, institutions restrict it. And hence the influence of institutions must be minimized. But in NIE "as in the case of other social institutions, the market has enabling as well as constraining functions"[2].

(iii) The notion of the market representing the free expression of the individual in contrast to institutions representing "collectivist" behaviour is rejected in NIE.

"...this ethereal, non-institutional conception of the market [by orthodox economic theory] enables it to be regarded as the supreme medium for the expression of individual choice. Non-market institutions, by contrast, are seen as being 'collectivist' in nature; they are seen to restrict expression of those preferences and exchange activity based upon them. However, it is argued here that the market has ineradicable social and 'collectivist' aspects as well"[2]

(iv) The market does not only provide information to its participants, but like other social institutions it also influences the way people understand economic relations; "it structures the process of cognition of the agents involved and can actually affect

their preferences and beliefs"[2].

In addition to the above, NIE criticises orthodox economics on the grounds that it excessively overemphasises rationality of decision-making, it concentrates on equilibrium and statics, it usually ignores changes in preferences and underestimates the fact that behaviour is usually repetitive and habitual[6].

Even though the literature on the NIE can not be taken as a completely homogenous one, it basically developed around the discussions on problems of information and transaction costs and the theory of collective action.

To the NIE, markets are social institutions that minimize transaction costs. These costs are of three types: costs of discovering what the relevant prices are, costs of negotiating and concluding a separate contract and costs of policing and enforcing the contract [2]. Since the market is an organised form of exchange it helps by publicizing prices and creating regularized contacts between sellers and buyers. It also creates procedures and conventions for achieving bargains decreasing the cost of negotiating. Since norms of conduct are established in the market, policing and enforcement costs will be decreased.

Information cost can also be considered as part of transaction cost. If asymmetries of information are present in the market opportunistic behaviour will be an inevitable outcome. To overcome this danger sellers and buyers would have to incur a large amount of cost to collect the additional information. The market minimizes the cost needed to do that by both disseminating information more widely and by establishing norms and codes of conduct between the agents. In addition, institutions help as means of discriminating useless information from the useful one so that participants in the market are not overwhelmed by superabundance of information.

The NIE considers the participants in the market not as perfectly rational beings involved in complicated probability calculations but as people that are influenced by norms,

conventions, expectations and uncertainty playing very important roles. Due to this aspect, the game-theoretic literature is closely related with the NIE literature. Some of the recent works on the game-theoretic literature by using the models of recurrent games, i.e., games that are played over and over again, show that

"the players develop certain societally agreed to rules of thumb, norms, conventions and institutions which are passed on to succeeding generations of players".

Within this framework, Schotter shows that institutions and routines are, far from being market 'imperfection', actually necessary to supply vital information, particularly about the future stratagems of other agents." [2]

Even though the development of the game-theoretic literature is one of the important sources for the emergence of NIE, that particular literature alone can not be its foundation. This is true because in most of the game-theory literature the assumptions of the 'maximizing economic man' who is supposed to use all relevant information in global calculations is still retained. In addition, the literature usually also assumes the awareness of the players about the options and payoffs of each other. But in NIE instead of the rationally calculating economic agent, the focus is on actors who operate under uncertainty, one agent exploiting the ignorance of another and surprises playing a very important role [2: 192-193].

Another source of NIE is the literature (both economic and non-economic) on collective action.

"The key issue in the collective action literature is to 'explain collective outcomes in terms of individual motivation' ... , or, to put it differently, to explain the likelihood of success or failure of given set of self-interested individuals in undertaking actions that may benefit them collectively" [6: 1989:1338].

The existence of institutions (including the market) can be considered as a result of collective action. And usually to overcome the problems related with collective actions (like opportunism, 'the free-rider problem', 'the tragedy of the commons', etc..) people will institute (consciously or unconsciously) norms and values. Hence, to understand in what

ways institutions function it is essential to understand the 'rules of the game'.

The literature on collective action also emphasises the relationship between interest groups and the state.

"Frequently... the state and its agents are not merely neutral and passive bystanders in the process of group interaction. This has given rise to positive theory of rent seeking which is concerned with the means that interest groups use for getting what they want, i.e., by affecting voting patterns, legislation and regulatory agencies, administrative budgets, rules and/or judicial decisions" [6: 1339].

The concept of collective action can be (among other uses) a very good means of examining the political economy within which markets function.

In NIE, instead of rational and global calculations determining the outcome of events, the influence of other factors are stressed. One case in point is *path-dependent process*.

"... when there are increasing returns to adoption of a particular (technological or institutional) innovation - i.e., the more it is adopted the more it is attractive or convenient for the others to join the bandwagon on account of infrastructural and network externalities, learning and coordination effects and adaptive expectations - a path chosen by some initial adopters to suit their interests may 'lock-in' the whole system for a long time to come, denying later, more appropriate, technologies or institutions a footing... historical 'small events' early on may well decide the larger course of structural change" [1: 1391-1392].

To the NIE institutions may come into existence in different ways. The distinction between 'organic' and 'pragmatic' institutions (*a la* Menger) is relevant for the NIE. 'Pragmatic' institutions

"... are those which are the direct outcome of conscious contractual design, as in the case of some corporate structure and practices. Organic institutions... are, on the other hand, comparatively undesigned, and they evolve gradually as the unintended and unforeseeable result of the pursuit of individual interests... it is possible that an institution is created organically but preserved pragmatically" [1: 1392].

The market can be considered as an 'organic' institution which is being 'pragmatically' preserved.

To conclude, the NIE considers the market as a social institution which is a result of collective action, regulating the exchange relations in an organised manner by a set of rules, modes of conduct, habits and by so doing creates a more stable, predictable relationship between the agents and minimises the transaction and information costs.

3. SOME COMMENTS ON THE RELEVANCE OF THE ORTHODOX AND THE NIE APPROACHES

In the previous two sections we have looked at some of the salient features of the orthodox and the NIE approaches in the understanding of the market. In this section we will briefly examine the relevance of the two to the study of markets.

One important thing to bear in mind, as already indicated, is the fact that the NIE group is not still a group with a homogenous set of 'monolithic' ideas. But the outline of a clearly defined 'school of thought' is obviously discernible.

Even though the study of markets by considering the perfectly competitive market model as a reference can not be said to be totally worthless, the neglect of the institutional set-up of markets is not affordable. Probably, due to the understanding of this fact some neoclassical economists are now engaged in the study of institutional factors affecting economic relationships (the neoclassical NIE considers the changes in relative prices of different factors* of production as the central cause behind the evolution of institutions). The study of markets in the fashion of the orthodox approach (in its broadest sense) has still relevance because it helps to understand the mechanisms through which interactions of individuals can be coordinated and resources allocated through the market. But in trying to understand the mechanism of the market, looking at the somewhat 'mechanistic' relationships contained in them must not be the end of the story. A thorough examination

of the institutional set-ups must also be done.

Instead of considering the orthodox neoclassical models (models of perfect competition, monopoly, oligopoly, monopolistic competition, etc.) as totally alien theoretical constructs to NIE, it is better to consider them as highly simplified and stylized representations of reality, which can be developed and modified (sometimes discarded) and more 'flesh' added on them. In addition, we can look at them as skeletal representations of 'institutions' (in the NIE sense) under highly simplifying assumptions (it is as the result of these simplifying assumptions that they have become 'mechanistic'). On top of that, it is also wise to make them references in theoretical discussions since a lot of intellectual 'capital' has been invested on them and they are better known.

One strength of the NIE is that in trying to understand institutions (including the market) it follows a multi-disciplinary approach. Since in real life economic relationships are seldom found in isolation, this approach has an obvious advantage. But this strength is at the same time its weakness, since the problems to be solved correspondingly become complicated and multi-disciplinary. They become complicated because on the one hand many variables must be considered (more unknowns than the equations?) and on the other hand the researchers' capacity to rigorously analyze all these multi-disciplinary variables will be limited. The NIE stresses the importance of uncertainty, surprise, etc., but modelling these variables to examine their relationships is next to the impossible.

Even though the above problems are difficulties, this does not mean that there is no solution for them. With the recent development in game theory and related subjects we can hope that many important steps ahead will be made in the study of problems that are raised by the NIE.

In addition we should not always forget that the development of sciences is usually enhanced by cross-fertilisations that occur between them. The two methods discussed in this essay may also have a possibility of fertilising each other, the result being a better understanding of the problems at hand.

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PUBLIC ENTERPRISE REFORM AND PRIVATIZATION: A REVIEW OF EXPERIENCE*

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ABSTRACT: *The paper provides a review of country experiences on public-enterprise reform and privatization in a regional and socio-economic context. The discussion concludes that there is no single optimum strategy. Differences in socio-economic setting dictate that selective and properly evaluated procedures be used specific to an enterprise. The success or failure of a strategy however rests on whether or not the favourable macro-economic environment is set right a priori. The experiences of many developing countries witness that the central question is not one of ownership but that of proper mix of managerial skills at the enterprise level.*

I: GENERAL INTRODUCTION

1.1. Scope of the Paper

Since the early 80s, privatization and public-enterprise-reform has become the center of public policy concern in all societies. It is excessively emphasized to be an engine of growth, a means to broaden the basis of ownership and instrumental in fostering technological upgrading, particularly in the ex-socialist and developing economies. Though these policy objectives are more or less the same, different countries have followed different approaches and there is divergence in efficacy.

The coverage of this paper is less ambitious than what the title suggests. The paper only attempts to make a gross review of these experiences in a regional, social and economic context. Some efforts of course have also been made to include specific country experiences to support this contextual presentation.

The reform program is an on-going-experiment. These experiences are diverse and our "tour d'horizon" demonstrates that there is no such thing as an optimum privatization modality. The reason is quite trivial. Power elites in different countries differ on

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perception of the concept; and there are differences in priorities, long-term development objectives and immediate problems. No less important is disparity in the social fabrics and setting the policy-makers live in.

The paper therefore does not close with a prescription. It can generally be recognized, however, that the chance of success is higher if this reform program is integrated into a broad policy framework that envisions to tune the economy on the path of competitive market forces while choice of strategy is non-dogmatic.

The presentation of the paper is sequenced as follows. First, the changing perceptions as regards the role of the state vis-a-vis the economy is discussed as a background; then we proceed to the experiences of countries in a socio-economic context; and finally conclusions are drawn.

1.2. The Changing Role of the State.

1.2.1 A Revisit

The period that followed the end of world war II, the socialist revolutions and the liberation of the ex-colonies, until late 70s witnessed a strong argument for state and public intervention in production and distribution activities for both ideological and/or economic reasons [8:7-12; 5 :1-2]. The then political economy urged that planning and public ownership in the key economic sectors are vital to achieve rapid progress, resource mobilization, fair income distribution and productive allocation of resources. This is because the price mechanism does not always guarantee the desired level of goods and services commensurate with development objectives.

a) There prevailed an infant private sector and imperfect markets in the newly independent countries. The private sector lacked the necessary finance and entrepreneurial and managerial skills. It was felt necessary for the state to actively participate in economic

activities, mobilize domestic resources, protect the infant industries against international competition, pursue import substitution strategies and allocate resources in priority areas. As the economist would say development thinking was overwhelmed by the Harrod-Domar growth model. The state was expected to mobilize savings and investment resources in order to expand the productive capacity of the economy.

b) In the industrialized bloc, state intervention was called for mainly as a matter of market failures in few cases.

i) In some economic activities, there may exist a natural monopoly position. Public regulation or ownership may therefore be necessary in the interest of the public and smaller firms.

ii) A private firm may not find it profitable to go into the production of public or merit goods for the market. It thus becomes incumbent upon the state to provide such goods and services to the public.

iii) Usually short-term and long-term development objectives require state intervention in view of cushioning social welfare, alleviating regional imbalances and following up economic activities of strategic importance for the economy as a whole.

c) In the then socialist countries, it was believed that exploitation, poverty, mismanagement of resources, unemployment and inequality are inherent features of a market economy. It was contended that the economy would perform better and more efficiently under social ownership than in private hands. It was therefore the mandate of the state and the party to own, control and direct the allocation of resources, administer prices and distribute goods and services to the public. State control was also advocated on accounts of the social and development goals enunciated in (iii) above.

Unfortunately, whatever the social and economic context may have been, the preceding propositions are now dispelled on the grounds that the outcomes and achievements have not lived up to the expectations of the public, the proponents and designers of such policies.

This is not in any way to imply that state intervention is undesirable and unnecessary

in the developing countries but it should be one of creating a conducive economic environment for both the private sector and the public sector to grow.

Naya [8] underlines that, " At a more fundamental level, the central issue is not government intervention per se but the nature of that intervention. It is not just a question of government versus private sector but, more important, how government can create the best environment for a successful, competitive and technologically dynamic private sector."

1.2.2 Why Shift?

The functions of the state in the economic sphere are now being redefined and appraised as a result of the changing international economic environment, and experiences of countries that performed overwhelmingly better than those with state interventionist systems [8: 13-25]. The basis of delineation between state and private domains is becoming comparative advantage.

i) There are a host of empirical evidence supporting that market-based economies have done significantly better and the living conditions of the people improved better than in countries with unrestrained government interventions.

ii) The developing countries have now realized the potential dynamism of the private sector in developing their economies and its resilience to cope with changes in the international economic environment. These countries are faced with fluctuating export earnings, balance-of-payments problems, protectionist policies of developed countries, fiscal imbalances and dwindling inflow of foreign capital. Policy-makers have now become cognizant of the need to work hand-and-glove with the private sector in the development process.

iii) The public-owned enterprises in many of the cases suffer budget deficits and public debts. The financial burden has become so big that governments envisage at least in the long-run to withdraw from economic activities that can possibly be handled by the private sector.

1.2.3. The New Function

The state should demarcate economic activities between the private sector and itself, depending on comparative advantage, existing power setting, production and ownership structures, institutions and past policies. This complexity makes the reform program a dynamic and yet protracted process in its own right. The state needs to regularly consider its objectives and functions with the changing internal and external economic factors and enact policy measures accordingly. One cannot thus possibly be exhaustive and conclusive in prescribing a role to the state per se. But it is crystallized [8: 20-25] that the state:

- should continue with the provision of public and merit goods (education, health, defence, public order, etc.)
- actively engage itself in the development of social overhead (transportation, communications, power system, etc.) that enhance and support economic development and the smooth functioning of society.
- disseminate economic information so as to ensure efficient resource allocation and create awareness on the impacts of policy measures on welfare, production, trade, prices etc.
- institute a clear-cut legal and regulatory framework that minimizes bureaucratic mitegrity and stifles discretionary practice of the authorities.
- promote and internalize scientific and technological research and development.
- provide a safety net program for the ultra poor.
- prepare indicative and rolling plans with long- term development objectives in perspective.

II. COUNTRY EXPERIENCES

2.1. The Broader Framework

The concept of privatization is broad and loaded [10:4]. It covers a wide range of policy measures. It not only shows who should own assets but also includes the principle of public enterprise performance within the context of market forces, i.e., short of divestiture also. In recent years, privatization connotes "marketization" of the economy. That is to say, public enterprise reform is one form of privatization so long as the enterprise

is operating on the basis of market principle. Its interpretation is therefore to be taken within the relevant discussion.

There is now a universal agreement on the need for privatization to revitalize economic growth and achieve efficiency. This policy orientation is a result of objectivity and surrender to reality. The role and nature of privatization and public enterprise reform is once again to be discerned within the existing institutional framework [1: 45-49].

In mixed economies, privatization is a management reform in public enterprises. It is a product of the universal consensus that social interest can be served better through market forces than through cadre-led institutions or time-consuming government regulations and control. In the ex-command economies, privatization is to serve as a leverage to transform the old economic order into capitalism. It is a result of the fact that a market-based economy cannot emerge without privatization. In the case of non-socialistic societies, privatization is a means to "pull back the frontiers of government intervention" and create an enabling environment for the private sector to flourish. In theory the objectives of privatization are better realized in capitalist-oriented countries than elsewhere because the preconditions such as financial markets, stock exchanges and well-defined property rights are already in place. The task in the ex-command system is arduous and complex for the obvious reason that these supportive conditions are non-existent. The social and political repercussions call for prior scrutiny of the implications of the reform policy as privatization disturbs existing power and property relations in the then socialist countries.

In the following sections, a review of experiences within a regional and/or socio-economic context is presented. Lessons of experience are drawn on the basis of these experiences.

2.2. Latin American Countries

Privatization has become a key part of Latin America's growth strategy in recent years both as a matter of choice and response to financial difficulties [3: 6-17]. A comprehensive and longest privatization program has been going on in Chile after the fiasco of the 1970s. The other countries in the continent are also pursuing privatization but slowly and selectively. There is a cross-country variation in achieving the objectives of privatization. Some have enjoyed modest success and in other cases it has been a failure.

Chile is a pioneer in this exercise. The country enjoys favourable resource endowments and its people are better educated by Latin American standard and yet posted a poor record on the economic front. The military government claimed that this poor performance is a result of mismanagement of resources and leadership mediocrity. The government thus tapped technocratic and professional excellence in order to revamp the economy. Privatization in Chile is viewed as an integral element of SAP. It is supported by a series of other policy measures such as fiscal restraint, trade liberalization, price decontrol and so on. The policy implementation is a "learning-by-doing" process and "evolutionary". The experience of Chile clearly witnesses the importance of "putting the economic house in order" if allocational efficiency is to be attained.

Argentina had also carried out a significant reprivatization program during the late 70s and the 1980s. The outcomes, however, were not impressive. The program faced wide opposition from labour union and the public. For one, the state lacked sufficient political commitment. Second, the program itself was not integrated with the necessary changes in the macroeconomic environment. Third, the bureaucracy preferred to maintain the status quo and abused its responsibility. The state machinery is very well known for its Byzantine process of policy and decision-making. Fourth, the private sector in Argentina is largely rent-seeker and accustomed to corrupt practices.

Privatization has also been on the policy agenda of Mexico for long. The results are less than modest here too. The program has an amorphous structure. Privatization comes

to the fore for purposes of debt relief and political flirtations. The approach is versatile and ambivalent. The private sector is one that is guided by immediate gains. The cumulative effect has been allocational abuses and poor performance of the economy.

Brazil seems to be less enthusiastic about privatization than Chile, Argentina and Mexico. This is believed to be a product of the good performance of state-owned enterprises which enjoy technocratic and professional leadership. The pace of privatization has been modest but the results are acknowledged to be satisfactory.

The experiences of Latin American countries offer the following lessons [3: 6-17 ; 117-130].

a) Since there are differences in context, there is no such thing as "an optimum model of privatization" for all countries. The attainment of allocational efficiency, however, requires a clear understanding of the interaction between macro-economic policies and micro-economic performance. Privatization should thus be considered as an integral part of a broad structural adjustment package.

b) The start-off line in the privatization process is to clarify priorities and put the preconditions in place. That is, the government should begin with reforms that restore the macroeconomic environment to health.

c) Formal privatization does not always guarantee positive results in an environment of rent-seeking behaviour. Better results could therefore be attained if other plausible alternatives, in the short and medium term, to divestiture are sought under such circumstances.

d) The creation of a "lead institution" has been found useful to expedite the privatization process and availing advice and credit to the private sector.

e) Privatization programs have been resisted by managers, white-collar workers, civil servants, the general public, and other interest groups, obviously scared by massive lay-offs and dislocation or eventually diminishing benefits and favours. These are usually the intelligentsia that have strong influence over public opinion in casting doubts about the program. The experience of Latin America suggests that these political obstacles could be substantially reduced by depoliticising the privatization program. Some of such calming measures are encouraging workers' participation in privatization by introducing employee stock ownership programs, increasing enterprise autonomy while commercializing their activities and removing part of the accumulated debt burden, and the provision of safety net programs for the poor.

To overcome these political hurdles, the government may also launch an educative program to the public on the logic of privatization. The public should be told that privatization is not a complete withdrawal of the state from economic activities. The state is only redirecting its efforts and energy to social overhead projects, infrastructure and other priorities. The social goals of state interference are still noble and the state shall not in any way turn down these social objectives.

2.3. The Growing Asian Countries

It is an uncontested fact that the ever growing Asian countries have recorded a sustained growth by world standard. This has been a result of objective market-based policies.

These countries very well recognize that there is a long way to achieve the objectives of privatization [1: 97-98]. The thrust of enterprise reform in the short-run has been increasing managerial autonomy, instituting a prudent financial discipline and operating on the basis of markets and prices. Cognizant of the influence of property rights on the performance of public enterprises, ownership responsibilities are given to lower-level agencies. The role of the state is clearly delineated vis-a-vis the private sector. The two are conceived as complimentary and not as adversaries. Over time, the private sector is

gaining the upper hand, with the exception of China and Vietnam. In Asia, privatization is not a search for a laissez-faire economic policy [8: 27-30]. The "tigers" of Asia are often cited as testimony for the superiority of capitalism over alternative development strategies. The truth is that these countries have effectively distributed assets to the people, especially land [14: 37-38]. This has allowed expansion of the domestic market. Policy formulation is not dictated on political grounds but is a result of realistic assessment of the pros and cons of the outcomes of different modalities. It is to create a conducive environment for both the state and the private sector to facilitate the market process. There is a good relationship between government and businessmen. The government holds regularly policy dialogue with industrialists and bankers and coopts them in selecting viable and economic projects. In short, the two parties share knowledge and experience in promoting the policy implementation process. Naya comments that while this joint effort is to be taken positively, necessary safeguards have to be put in order to ensure that the macro policy is not compromised and corruption does not undermine policy objectives. As the supportive macro conditions and the tradition already exist, privatization is a smooth but gradual process.

China has also introduced policy measures in recent years to enhance aggregate efficiency and productivity of the economy [8:94-95 ; 14:56].

In the agrarian sector, production and investment decisions are left to the household. The household is given leasehold rights over land. Prices of farm products are now close to market prices. Positive achievements have been reported in the agricultural sector in response to these policy changes.

Official laws are now enacted that recognize the active role of the private sector as necessary. Owing to this legislation, the private sector is now aggressively participating in the service sector, light manufacturing industries and the informal sector in general. This policy change has been even more effective in transforming rural China.

As a first step to a market-based economic system, a considerable number of state-owned enterprises are now operating under a contractual responsibility arrangement. The main features of the new system are that managers enter into contract with the relevant government department and a provision is given to them upon guaranteed product delivery. The enterprises retain all above-quota profits. The modality however faces problems as the enterprises are not free from government price control and wage regulations.

Efforts are also under way to attract foreign investors under joint-venture arrangements. Import rules have been relaxed for those producing export goods. Other piecemeal and selective measures have also been implemented to improve the investment climate for foreigners.

Some people contend that the registered positive results may not be sustained for long since the enabling macroeconomic conditions are missing. In the long-run, the political implication of the reforms may not be welcomed by all. That is to say, it may be difficult at the end of the day to contain such market-based reforms within the existing political order.

Viet Nam is also undergoing an aggressive economic reform toward "a socialist market economy". These changes, among others, give greater autonomy to public enterprise management and legal status to private institution and guarantee peasants long-term right to use the land [14: 64]. As a result of these reforms, the Vietnamese economy has grown significantly despite the challenges and difficulties of external nature (collapse of the Soviet Union, U.S embargo). But the demobilized forces from Cambodia and the retrenched from state enterprises and public services pose a serious challenge to the reform process.

2.4. The Ex-command Economies

The state sector in the ex-socialist East European countries remains dominant. There were times when the state sector produced very good results but this was irrespective of cost considerations. Past reforms attempted to make the sector responsive to prices, costs

and consumer demand. The then reforms considered only the productivity enhancing aspects of the market. Even then these programs were not pursued in full vigour. Enterprise management and the bureaucracy showed a "risk-aversion" behaviour dictated by political and vested interests or fear of breaking away with old ways of doing things.

It is now recognized [9: 1-2] that any piecemeal approach is inadequate. In these countries recent public enterprise reform and privatization is a central aspect of a plan for a fundamental change. Past public enterprise reform policies did not address the question of ownership. Of course, they gave greater self-management to enterprises but failed to introduce stringent financial discipline. The reforms thus did not make much of a difference. The causes of failure are now understood to be shortcomings in macroeconomic policy, uneconomic pricing regime and deficient legal and regulatory framework [4: 39-41].

In the East European countries, privatization is embodied in the transformation of the economy along market forces. The problem is more complex than in countries with different socio-economic set-ups since the institutional and competitive framework are yet to be instituted [4: 21-24]. Small-scale firms in trade and services are largely privatized through auctions. Many or most of the large-scale enterprises are in government hands to date. The reform so far envisages that these enterprises operate along the principle of market forces and prudent financial management. In short, as there is no blue print on the question of ownership, these governments have adopted multi-faceted approach, ranging from establishing ownership rights to technocratic leadership on behalf of the state.

The experiences of Poland and Russia can provide a good example on the effectiveness of the reform program in Eastern Europe. Poland is gradually achieving macro-economic equilibrium [14: 62]. The private sector is expanding. The trade and distribution sector is nearly all privatized. Many small and medium size enterprises are also privatized. Management in the big enterprises is reorganized and restructured with greater independence. Greater efficiency has thus been reported. But many observers are sceptical

of the distribution of these benefits. It is noted that unemployment in small towns and rural areas has reached the range of 20 percent.

The economic and political difficulties of Soviet Russia has reached a catastrophic proportion [14: 63]. It is reported that in 1992 food alone claimed 75% of household expenditure and nearly 80% of the population has descended below poverty line. Some degree of privatization is underway in the midst of unprecedented economic, social and political crises. It seems that Russia is paying such a price because it wants to do away with its accumulated problems all at once.

Aside from the absence of macroeconomic institutional and competitive environment, the objectives of the privatization reform in the ex-socialist countries appear inherently contradictory. The ultimate goals of privatization are to improve efficiency, broaden ownership of assets, and augment fiscal revenues [4]. Suppose the government opts for the sales of assets. Then it can raise revenues but will concentrate ownership in a few hands, usually the "nomenklatura", black marketeers, and rent-reekers, thus defeating the major objective of privatization. Assume also that the government pursues free distribution of assets. This may result in equity in ownership but generates no revenue for the government and may even adversely affect efficiency promotion. What these hypothetical cases aim to transcend is that a policy measure may be socially and politically justified but can bring in unintended results such as political dissatisfactions and mismanagement of resources. The multiplicity of the problems in the then socialist countries thus calls for a conscious effort to follow a multi-track path depending on circumstances and the magnitude of the implied social, political and economic grievances.

The experiences of these countries grossly suggest the ensuing policy considerations (UNDP, pp. 143-149), [7: 22-25].

- i) The multiplicity and complexity of the problem necessitates a pragmatic selection and sequencing of privatization options and modalities.
- ii) There is need to clearly prioritize goals so that appropriate means are worked out to achieve these objectives.

iii) The state is not detached from old practices and interference. The program should therefore clearly bring out the role the state is to play in the process of instituting a market economy.

iv) There is a sound reason supporting privatization in these economies. It should be recognized, however, that this transition is not easy and requires patience and perseverance. It is taxing to conceive and implement such a program in an essentially socialistic economic configuration. Formal privatization is therefore a long-term objective. In the short and medium term, due attention should be given to creating the supportive macroeconomic environment.

2.5. The Developing Countries

Privatization is also gaining increased momentum in the developing countries as a result of continued financial deficits in the public enterprises and international financial lenders (Bank/Fund) pressure. The program is slow and opaque for there is mixed feeling and misconception on the part of governments and the public [2: v-vii], [6: 10].

In the first place, the developing countries are not ready to sell profitable state enterprises. They want to privatize the money losers only. It is not well apprehended that formal privatization should be based on comparative advantage considerations, economic efficiency and best use of resources. There is also a strong political opposition to divestiture because of the concomitant lay-off of workers and the just fear of people-friendly politicians that the rich and the privileged are to benefit. Nationalistic feelings are also frustrating the process as governments are resisting purchases by foreigners. On the other hand, the domestic capital market is too thin to discharge the task. The problem is further complicated by the fact that many government officials lack the political commitment. In many instances, it is also a lip service.

These limited experiences of developing countries suggest for the following actions:

- these countries need to clarify objectives, costs and benefits from formal privatization.

The objectives of privatization in the developing countries so far are borrowed from the developed countries. There is need to re-evaluate these objectives in light of existing circumstances.

- they need to make sure that the reasons for privatization and public enterprise reform are well understood by the people and the policy is clear and impartial. That way, consensus could be reached.
- they require to set up appropriate institutions that search for alternative forms of privatization and evaluate different options and modality.
- most important, countries in this category should concentrate in the short and medium-term on creating a favourable policy environment that encourages efficiency, competition, and efficiency pricing both in the private sector as well as in the state sector. It should be understood that privatization is a continuum concept. Commercialization may be more relevant than formal privatization in the immediate future.

The African countries have many problems in common with other developing countries. In most African countries, privatization is on the reform agenda [8: 42-65],[14: 57,58,60]. Many, if not all, of the large enterprises are under state ownership to this day. Privatization is not perceived as an ideological faith but as one of the strategies and techniques to improve efficiency and productivity of public enterprises. Some economists and policy-makers are increasingly advocating for divestiture but many doubt its viability in the African context. The sale of enterprises to private investors assumes the existence of a competent and entrepreneurial private sector. The private sector in Africa is weak in terms of capital, managerial skills and entrepreneurship. On the other hand, foreign investors demand concessionary terms such a protection and other discretions to let them retrieve their investment in a short span of time. More serious is that most of the public enterprises in manufacturing, extraction and services are state monopolies. If these are to be sold to private business, they will end up as private monopolies. In such cases, there is no guarantee that socio-economic interest of society will be better served under private

ownership. While the bottom line criterion could be financial relief, the social and political dimension of the reform could not be ignored. As in other developing countries, they need to work out the objectives of privatization in clear terms. The thrust could not be reducing the unmanageable size of the public sector. The central issue should be efficiency and productivity enhancement.

Privatization in Africa therefore requires time, wisdom and patience. Circumstances dictate policy-makers to be pragmatic, country-specific, and sector-specific while reform is necessary and urgent.

Subsequent to the economic crises of the 80s, many African countries have attempted to liberalize their economies and shy away from state guidance of the economy. In Egypt, efforts are underway to re-institute a market based economy [14: 57]. It has been reported that the immediate impacts have been positive in general terms, though unemployment has grown and prices of basic goods and services have gone up. In Ghana, the policy direction has been improving efficiency in the state sector and divest itself of a large number of these enterprises gradually [14: 58]. The private sector in Ghana has taken advantage of the favourable macro-economic environment and aggressively invested in the gold mining sector. The major bottlenecks have been shortage of capital for private sector borrowing. As in Egypt, the majority of the people remain poor. The experience of Kenya does not lend itself to any conclusion [14: 60]. The policy framework is not enthusiastic about divestiture for two reasons. Economic power is already concentrated in the hands of foreigners and second empirical evidence has shown that managerial skill is more responsible for good performance than private ownership.

In view of these considerations, the experiences of sub-saharan Africa have so far been [9],[15: 28-35]:

i) Divestiture is effected in enterprises that are small in terms of assets and employees

ii) Rehabilitation of strategic and large public enterprises with present ownership arrangements has been a prime policy concern through managerial and institutional reforms along commercial lines.

In order to realize sustainable results in future, policy measures need to pick on the following issues as a matter of highest priority in Africa:

- Under conditions of imperfect markets, the rule of profit maximization may not bring in the desired social outcomes. So, other logical alternative tools such as cost-benefit analysis, a specified rate of return on capital or setting prices to long-run marginal cost may be invoked to lead the actions of public enterprise.

- No less important is the creation of macro-economic policy conditions within the public policy paradigm that will give the proper signal to private producers and state enterprises.

- Decentralization of decision-making process is important. The government need to clearly state the objectives of the enterprise and support to be given while financial/commercial return is the driving force for the enterprise.

- In Africa, public sector officials are known to take the law into their hands and widely practise nepotism. Competence and integrity should therefore be the prime criterion in their recruitment. A program of education in ethics may also be necessary.

- Private and public sectors need to be perceived as complimentaries in the development process.

As the focus of the workshop is on Ethiopia, it will be proper to say a few words on the Ethiopian experience. Formal privatization was not considered under the defunct Derg regime. It was, however, cognizant of the bad performance of the state sector in general but its strategy was to improve efficiency through commercialization within the framework of state control [10:354]. Even this was not implemented. On the other hand,

the Transitional Government has explicitly stated that the direction of change and reform is to tune the Ethiopian economy on the path of market structures. Public-enterprise-reform-and-privatization is integrated into the broad structural adjustment program. Reforms are already under way to institute the supportive environment for effective privatization. Beyond this, the time frame is too short to judge the impacts.

III: CONCLUSIONS

Our global exploration in the foregoing chapters suggests the importance of the following points in the exercise.

(i) Privatization is on the testing ground. Different modalities have been designed as deemed appropriate vis-a-vis existing socio-economic factors and development objectives of different countries. Various options and approaches have also been utilised within the state sector of a country, depending on circumstances and previous policies. It should be emphasized that a single procedure can work differently in different socio-economic settings. The experiences of different countries offer the lesson that there is no single and neat avenue to follow.

ii) Effective privatization has a gradual nature and it takes sometime before it bears fruits. It is a "learning-by-doing" continuum. Of course, one should begin with the institutionalization of the relevant macro conditions; then various forms of privatization may be considered and evaluated specific to an enterprise. A second-best choice may be preferred if the social and political implications prove less severe.

iii) There is need to vow the private sector in Ethiopia. Many of the people with the ability to invest were engaged in seeking short-term benefits and are used to manipulation of bureaucratic discretions. Whatever entrepreneurship the country enjoyed prior to the Derg, was eroded as a result of ill-conceived policies. In the Ethiopian case a cut-throat competition amongst potential investors is wasteful. They should rather

complement one another as in southeast Asia. The government should make every effort within its limits to mould their outlook, provide expertise and information. It is to be understood that each potential investor in many cases may not be strong enough to establish a firm. The government may therefore help them organize under joint-stock arrangements and identify project. A regular policy dialogue with the business class may also be useful to internalizing the foregoing ambitions as success stories confirm.

iv) It should also be recognized that some policy measures could produce conflicting results vis-a-vis development objectives. One must clearly weigh and evaluate the effects of alternative procedures. Unlike what some economists contend, macroeconomic equilibrium is not always healthy. For instance equilibrium can be achieved with minimum effort through increased prices, lowered output and reduced consumption. But this is as good as defeating development and growth objectives. Efficiency should thus precede the objective of financial relief on the part of the government particularly when existing capacity is under utilized.

In conclusion, it should be underlined that privatization is not always a solution. It is "a political process" in its own right [7 :51]. The rationale for privatization has to be clearly weighed and articulated and it is not a question of endorsing a fad. If hastily pursued, there is a high risk of intensifying the very problems we want to redress.

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DETERMINANTS OF MILITARY EXPENDITURES IN SUB-SAHARAN AFRICA

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ABSTRACT: This study surveys the models of the determinants of military expenditure and then specifies a model for the determinants of military expenditure in Africa and tests it by time series, cross section and pooled cross-section time series data for thirteen least-developed Sub-Sahara African countries. The result of the analysis shows that military spending, in this sample, is determined mainly by strategic considerations rather than by pure economic conditions.

I. INTRODUCTION

African military spending constitutes a very small portion of the total world's military expenditure. It was only 0.32% of total world military spending in 1959, and it reached 2.09% in 1985. In the period between 1959 and 1977 the annual rate of growth of African military expenditure was very high, and exceeded the growth rate of total world military spending throughout the period. By 1978, however, total African military expenditure and the ratio of African military expenditure to total world military expenditure flattened out. Nevertheless, military expenditure in absolute terms is still high and its burden on individual countries is also high, but reductions in African military spending started before other LDCs regions.¹

The trends of military expenditure in many Sub-Sahara African countries differed from the experience of LDCs as a whole. Within the Sub-Saharan region, however, there are also considerable variations between trends of military spending across countries. This study selects a sample of thirteen least-developed Sub-Sahara African countries: Benin, Central African Republic (CAR), Ethiopia, Kenya, Mali, Niger, Rwanda, Somalia, Sudan, Tanzania, Togo, Uganda, and Zaire. The aim of this selection is to overcome the problems of dealing with a wide variety of countries. The choice of the sample is motivated by the following considerations: First, following the World Bank regional classification, the

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selected group belongs to the Sub-Sahara African region, with some common geographical, ethnic, cultural and social characteristics. Second, the selected group falls under the 'low income oil-importing' (LYC/M) category in the World Bank income and relative resource endowment classification. Third, the military involvement in the economic and political affairs of these countries is very high, to the extent that a military government is the rule rather than the exception. This is accompanied by intense civil wars and political instability. Fourth, none of these countries has a domestic armament industry. Finally, these countries are characterized by low per capita income and sluggish economic growth. Agriculture dominates economic activity both in its contribution to the GDP (ranging between 27% in Zaire and 61% in Tanzania, in 1987) and its absorption of the economically active population (ranging from 66% in Benin and 90% in Tanzania in 1987). The industrial sector is very small and is concentrated on agricultural food processing and import substitution.

In the last decade, most of the countries in our sample experienced a decrease in their military burdens, size of the armed forces, and arms imports, with a considerable variation in the magnitude of military burdens [40]. The principal objective of this study is to identify the major determinants of Sub-Sahara African military spending, and to ascertain the causes of variance in the countries' military burden.

Understanding the determinants of military spending is important for the study of the economic effects of military expenditure as well as its relevance to government policies. It helps to rationalize amounts and allocations of defence budgets, and it is also crucial in arms control, disarmament, and military conversion policies. Moreover, if the defence spending proved to have detrimental economic effects, then its reduction becomes an economic and political priority and the knowledge of the determinants will help in the reduction of military expenditure levels.

The first part of this paper briefly surveys some of the earlier work done in the area of military spending determinants. Then, the lessons drawn from these studies will be summarized and incorporated in our research design. Data for thirteen Sub-Sahara African countries, for the period 1963-1985, are used to identify the major determinants of military

spending in these countries; by using time series, cross-sectional, and pooled time series and cross-sectional analyses.

II. PREVIOUS STUDIES

The quantity of studies on the determinants of military expenditure is fairly impressive. Therefore, this review will not pretend to be exhaustive; it will, however, attempt to classify these studies into broad categories and examine the characteristics and contributions of each category. The survey examines the relevance of the previous approaches to our study and points out directions for future research.

A significant number of military spending determinants studies are built upon arms race models, and so they are treated as a separate category.² The second category of studies of the determinants of military expenditure is concerned with the bureaucratic, economic and strategic factors, without an explicit recognition of the existence of the arms race.

2.1 Arms Race Models

The pioneering work of Richardson [48] remains the basis for an enormous number of arms race models. His theory envisages two hostile nations in armament competition and the theory, thus, interprets the arms increases on both sides in terms of an international action-reaction process. The simplest version of his theory is given by the following two equations:

$$\frac{dx}{dt} = k y - \alpha x + g \quad (1)$$

$$\frac{dy}{dt} = l x - \beta y + h \quad (2)$$

where x and y are the two nations' defences, k and l are positive defence coefficients, α and

β are positive constants representing the fatigue and expense of keeping defence, while g and h are constants representing grievances and ambitions.³

Following this seminal work, a large literature in the area of arms race modelling was produced, with different modifications to the basic model. These can be categorized into three broad types. The first includes models which change the expressions of the variables used. The second takes the form of increasing or decreasing the variables in the model. The third emphasizes the implications of an asymmetric model (e.g., Deger [8]).

In the first category some arms race models are concerned with the determinants of military expenditure [21], while others are concerned with the explanation of the variation in the stocks of weapons [38]. The models which deal with military expenditure vary in the way they measure this spending. Some studies assume that each country's military spending depends on the level of its rival's expenditure in the preceding period [44]. Others use the change in expenditure instead of the level of military expenditure [28], while most recent models employ the distributed lag formulation (e.g., [37]).

Arms race models have made a remarkable contribution to the study of the determinants of military spending. Their simple framework helps in organizing thought about military interactions, facilitating the testing of the models against historical data and the systematic discussion and comparison of the results, and raising many research questions [54: 113]. However, the arms race models are open to criticism on a number of theoretical and practical grounds.

The principal objection to Richardson's type models is their mechanical nature, where the feedback process with an opponent plays the decisive role in determining military spending, while other autonomous forces within each country are ignored.⁴ In developing countries the need for military force to maintain ruling elites in power and to repress domestic opposition groups is crucial in deciding the level of military effort. Moreover, the system can have a variety of solutions depending on the parameters' values, and "to determine the parameters requires a theory of the nature of the state and the principles on

which it acts".⁵ The relevance of arms race models to developing countries is also questionable, either because of the absence of explicit armament matching policies [11: 69], the existence of more than one potential external antagonist [51: 574]. Furthermore, on the practical side, most of the arms race studies suffer from problems of multicollinearity, measurement error, and model specification [49].

Despite the contribution of arms race models to the literature, and the continuous effort to address the above-mentioned limitations, the quantitative evidence on arms race models has not been compelling.⁶ Their formulation was weak in explaining the variations in military expenditures between countries, particularly in the Third World. Deger [11], and Deger and Sen [13] provided many examples for the failure of the Richardson model in explaining changes in military expenditure even in cases where arm races were evident (for example Iran-Iraq, India-Pakistan and Turkey-Greece).⁷ In fact, these models have not been successful in analyzing even the military allocations of the superpowers, where arms matching policies are clearly prominent.⁸

2.2 Non-Arms Race Models

Studies that analyze the determinants of military expenditure without explicit consideration of arms races have focused on economic, political and military aspects, at the national or the international levels, or both. They can be classified into three categories. The first category of these studies is concerned with the economic conditions which influence the level of military expenditure. The second emphasizes the dominance of political and military considerations. The third category is more comprehensive and incorporates economic, political, and strategic factors in the analysis.

In the first category there are a number of different approaches reflecting different schools of thought. The Marxist school was the pioneer of this kind of reasoning. For Marxists, military institutions are subordinate to class, and military expenditure has a necessary role in the maintenance of the capitalist system; within the school there are, however, a number of strands which differ in the extent to which military expenditure is

necessary for capital accumulation.⁹ The underconsumption school is usually cited as the most explicit Marxist school in interpreting military spending. Following the tradition which concentrates on the purely economic function of defence spending, the underconsumption school considers the nature of the global economic system in the determination of military expenditure. Baran and Sweezy [4] argued that under monopoly capitalism there is a tendency for aggregate economic surplus to rise and the surplus will be absorbed mainly in the military sector of the economy. They asserted that military expenditure is used to stabilize capitalism by maintaining effective demand and moderating the downward pressure on the rate of profit. Military expenditure in capitalist countries also depends on their position in the international economic hierarchy.¹⁰

Lotz's [34] work is an earlier example of the studies which emphasized the influence of domestic economic conditions on levels of military expenditures. His purpose was to explain the factors which affect government decisions about expenditure, and variations in its composition and size, across 37 developing countries.¹¹ He fitted a cross-sectional equation with military burden as the dependent variable. The results showed a significant negative relationship with per capita income, and significant positive relationships with the total government expenditure as a percentage of GNP, percentage of population living in urban areas, and exports of minerals and oil as a percentage of total exports (the last three independent variables are proxies for the stage of development, social change and employment structure, and the size of the foreign-owned extractive sector, respectively). Nevertheless, although his results are statistically acceptable, the explanatory variables which were included in his equation are not related directly to the decision-making processes governing military allocations.

In the same vein, a considerable number of studies emphasized the overwhelming importance of domestic economic factors in determining the level of military spending (e.g., [23]).¹²

The second category of studies have focused on strategic, political and military factors as major determinants of military outlays. One of the first studies that stressed the

political influence of the military on military spending was Nordlinger [42]. He found that, in 74 non-Western countries, the type of government (military or civilian) exerted a significant influence on defence spending in the period between 1957 and 1962. Similar conclusions were reached by Thompson [61], Kennedy [29] and Whynes [64].¹³ However, the findings of Rothstein [50] suggest that it is perception of threat by the government that determines the defence allocations. Rothstein was interested in developing a conceptual framework to account for LDCs' security choices. He argued that threat perception by the ruling elite, and government legitimacy and effectiveness (both estimated by expert judgements) are the major determinants of Third World security expenditure (see also Deger and Sen's optimizing model [11]).¹⁴

These studies face many theoretical and practical objections, and their results are both conflicting and inconclusive. They cover only a limited number of potentially significant influences, and some of them tend to generalize their findings on the basis of very poor and insignificant results [23]. An example of the practical difficulties is found in studies which emphasized the predominance of the political factors. Creating relevant explanatory variables will be extremely difficult, requiring a high degree of subjective judgement. There are also problems in the estimation and operationalization of such concepts (see Rosh [49], and Rothstein [50]).

Needless to say, the limitations inherent in most of these studies are mainly associated with the exclusive use of cross-sectional or longitudinal research designs. Other causes of inconclusive results are differences in the samples chosen, study periods and the explanatory variables included in the studies. Nevertheless, it is clear that the decision-making process to determine the allocations of defence expenditure is complex. It involves the interaction of different economic, strategic, political and military factors, at the national, regional and international levels. The implications of this are that any serious attempt to analyze the determinants of military expenditures must follow a comprehensive approach that encompasses most of these factors. The third class of non-arms race models follows a comprehensive approach of combining all plausible economic, political and military influences in the analysis. This provides better results and insights, as the following survey

of the key studies of this approach will show. This category embraces the neoclassical school of thought and many other studies.

Neoclassical economic theory assumes that the state is a rational agent and a class-neutral actor, maximizing social welfare subject to its resource constraints. Military expenditure is, thus, determined by balancing its opportunity costs and the security benefits it provides. Smith's [55] study of U.K. military spending and Hewitt's [26] public choice model of demand for military expenditure are examples of the empirical application of this approach. However, the relevance of this approach to LDCs is suspect for a number of reasons. Deger [9] shows that domestic and international forces in the form of class structure, power relations and bureaucratic influence may upset the fine tuning of welfare maximization. Moreover, Smith [54: 64] argues that this account is misleading for three reasons:

it transforms the concrete political analysis of military expenditure into a metaphysical subject confined to technicians. It diverts attention from the role of private interests in the process by which decisions are made, making effective opposition to them more difficult. And it obscures the political and economic functions of military expenditure in a class society.

Choucri and North [6] provided an earlier study of the causes of military expenditures in six European countries between 1871 and 1914. Their model included both domestic factors (military expenditure in the previous year, population, income and colonial area) as well as international factors (military expenditures of non-allies and the intensity of colonial conflicts), which tend to contribute to military expenditures (see also Hill [27]; Hess [25]).¹⁵

Zuk and Thompson [67] studied the military spending of 66 LDCs in the period 1967-1976, focusing on the question of whether or not military coups or regimes have an impact on subsequent levels of military spending. However, their analysis adopted a wider framework. They pooled the data and regressed military outlays (with different measures) against several economic and political variables (such as regime type, coup occurrences, level of conflict, economic development and arms imports). They concluded that regime

of breaking down the Third World into smaller groups, or regions, of similar characteristics. Each region has a set of potential influences which are different from those of other regions. Thirdly, the studies which combine economic, political and military factors were successful in identifying the causes of variations in military expenditure than those which were concerned with a limited set of factors. Moreover, the incorporation of national, regional and global dimensions in the analyses proved to be of vital importance. Fourthly, most of the limitations of the longitudinal or the cross-sectional analyses can be surmounted by applying a pooled cross-sectional and time series analysis, which treats levels of military spending dynamically within and across nations. Lastly, much effort and emphasis is needed in data collection and analysis as well as the operationalization of the political and strategic influences.

III. THEORITICAL FRAMEWORK AND RESEARCH DESIGN

Defence expenditure is predominantly a public good, in the sense that almost all military spending comes out of government budgets. Governments choose the level of military expenditure as part of their optimal allocation of resources, and the choice reflects the preferences of the government in power. Third World governments decide on the level of military expenditure that provides appropriate 'security' against potential or actual 'threat' of domestic opposition, civil war or external threats. These strategic factors have both political and military dimensions. However, the determination of military expenditure is relatively independent of the economic situations in LDCs. Therefore, Third World military spending is generated mainly by its internal logic, unconfined by the calculus of marginal losses and gains implied by the rational optimization of the State of some well-defined social welfare function, as might be the case in developed countries. Deger [9:18] points to the examples of irrational military spending of some LDCs that are difficult to justify in terms of optimal strategic gains.

A more satisfactory approach to the analysis of the causes of military spending in developing countries must, therefore, conceive that military expenditure is principally determined by strategic considerations. It is influenced by the perception of threat that a

country faces and the needs of security. Moreover, the security and threat concepts have both political and military factors, and national, regional and global dimensions. These factors are extremely important in the determination of Third World military expenditures. However, the ability of governments (or the states they represent) to mobilize resources for defence is constrained by the overall economic conditions of the country. That is to say:

irrespective of whether internal or external security objectives dominate, the level of security expenditure should, in theory, be determined by an assessment of the likely security threats confronting a country and the most effective means of meeting them, within the overall framework of resource availability (Ball [3: 32]).

The major determinants of military expenditure are therefore: (a) political and military situations (security and threat perceptions); and (b) overall economic conditions. These factors operate at domestic, regional and global levels. This is the general framework within which this study attempts to analyze the determinants of military spending in Sub-Saharan Africa. Our analysis will start by specifying general working hypotheses on the relationship between military burden and a number of explanatory variables. The rationale behind these hypotheses rests on a set of assumptions that will be illustrated.

The population of this study consists of thirteen Sub-Sahara African countries. The time frame for this study is the period 1963-1985. The analysis starts from 1963 because most of the countries included obtained independence in the early 1960s, and 1985 is the last year for which we can find complete and comprehensive data. The data are examined, first, across time for each country to ascertain the causes of the change in military burden in each separate country. Then, they are analyzed using cross-sectional analysis to scrutinise the long-term determinants; and lastly, pooled time series and cross-sectional techniques are used.

IV. DETERMINANTS OF MILITARY EXPENDITURE IN SUB-SAHARAN AFRICA

In this section many potential influences on the military burden are identified. The interaction of economic, political and military influences is central to the analysis, as

MacKenzie [35: 31] argues that "we should not explain militarism only economically, nor see it as having merely 'internal' logic. The state and the international system of states are centrally important in militarism". Therefore, the potential regional and international factors are also incorporated in the analysis.

The military burden as measured by the share of military spending in output is the most widely used indicator of a country's militarization level, because it avoids the difficulties of finding a relevant deflator for military spending to construct constant price data, and it also avoids the distortions caused by exchange rate conversions when making cross country comparisons. It is a good indicator of the diversion of national resources to the military sector, and it controls for the large variations in the resources of different countries (GDP levels). Moreover, some empirical studies show that the military burden measured in this form has the highest mean correlation with numerous indicators of militarization.¹⁶ Using the ratio of military expenditure to the total government budget is less acceptable because of the great variance in the relative size of government budgets. Therefore, for these reasons, we follow the usual practise of focusing on the military burden (ME/GDP).

4.1 Economic Factors

A number of economic factors are likely to affect the overall levels of military expenditure in LDCs. First, the level of national income is argued to be relevant, with wealthier nations allocating higher military expenditure than poorer ones. Military expenditure (as with all other public expenditure) is determined by the availability of resources. As the national income increases (and consequently the taxable capacity increases) the ability to fund military activities also increases. Moreover, higher levels of income may result in structural changes, income inequalities and greater urbanization. These changes involve greater potential for conflict in the society, and consequently higher military spending [36: 1130]. GDP per capita is used as a measure for the level of income. The countries included in the sample fall under the "Poorest Countries" category in terms of their GDP per capita which ranged between 152 US\$ in Rwanda in 1965 and 781 US\$

Third, the role of global economic linkages in the determination of military expenditures is emphasized by the 'world system' school. The school claims that the country's incorporation into the world economy might affect its degree of militarization. However, the school does not specify the type and direction of this relation. Here we hypothesise that the greater the degree of incorporation in the world economy, the higher the military burden is likely to be. There are many reasons behind this hypothesis. High levels of military expenditure will be needed to suppress the internal groups who oppose the extraction of resources implied by higher levels of incorporation.¹⁸ In addition government revenues, and consequently the resources available to defence spending, will be increased by duties and tariffs on an increasing volume of trade, and by government efforts to dampen the fluctuations resulting from the move to an open economy, as governments usually smooth out such fluctuations by increasing the scope of the public economy by tax systems.¹⁹ The ratio of total exports and imports to GDP is used as a proxy for a country's degree of incorporation into the world economy. It is relatively high in Somalia, Togo and Zaire compared with other countries in the sample.

"Inertia" is considered as the fourth economic factor in determining military outlays. It is a salient feature of most economic time series. As there is a momentum built into military expenditure, we expect a positive relationship between current and past values of military spending. The current military expenditure may be rigid in the downward direction because it is likely that there will be some hangover from previous expenditures and commitments to military programmes, or simply a ratchet effect as in Peacock and Wiseman [45]. Previous military expenditure may also account for relatively consistent increases in military expenditure, and captures the effects of bureaucratic processes.²⁰ However, if pressures are exerted on such a level (e.g., revenue constraint) for a long time, inevitably expenditure has to be reduced.

Finally, many studies have emphasized the influence of the 'military-industrial complex'²¹ as a major determinant for defence spending. This represents the alliance of domestic arms industry and bureaucratic interests which act to persuade decision makers to agree on additional military spending. However, this influence is likely to be weak in

LDCs because of the small size of the arms industry, and in our Sub-Sahara African sample it is even less important as there are no such industries. Table (1) ranks these countries according to their levels of the proposed economic variables, and it is obvious from the ranking that there is no systematic relationship between these variables.

4.2. Political Factors

The political framework is essential in determining government allocations of expenditures within a country. The type of the government (whether civilian or military) is likely to be an important factor in this process. While the direction of this relationship is not straightforward, we can hypothesize that a military government is expected to spend more on defence than its civilian counterpart. The proposed relationship is the result of the interaction of different mechanisms and motivations.

Military corporate interests are likely to be effective in increasing the military share of government expenditure. The military as an organization has many reasons to promote higher levels of defence spending, as the armed forces want to ensure that their members are well paid (compared with other societal groups) and well equipped (compared with national paramilitary forces and the armed forces of the neighbouring countries). "When we add the enormous political power enjoyed by the military to their corporate interests, it comes as no surprise to find that the armed forces have sometimes been characterized as the country's most powerful 'trade union'"[42: 1134].²² The chance of promoting these interests increases when the army itself controls the government.

The promotion of the interest of the military was a strong motive behind many military coups. Indeed, "the great majority of coups are partly, primarily, or entirely motivated by the defence or enhancement of the military's corporate interests"[43: 78]. In the African context, the 1966 and 1972 coups in Ghana, the 1968 coup in Mali, and the 1980 Liberian coup are obvious examples. The pay rates of the armed forces increased immediately after these coups [3: 66-68].

Mutinies in many African armies also corroborate the military corporate interest argument. In Uganda, for example, the government was forced to increase the basic pay of soldiers following the 1964 mutiny. Military expenditure, consequently, expanded from 4.4 % of the government budget in 1964, to 12.3% in 1967. Furthermore, the armed forces are likely to be well rewarded by military regimes to retain support, and higher wages and new equipment will often be used to minimize the threat to the military regimes from disgruntled officers. Other motivations for military intervention are the deterrence of foreign threat, and the consolidation of national unity against rebellious or secessionist movements.²³ This will necessitate an increase in defence spending immediately after the success of the military coup.

The distinction between civilian and military governments has been criticized on many grounds. Some researchers have argued that it is the military influence on civilian governments rather than the existence of military governments which is the most important factor in determining military outlays. However, in the African context *such* influences usually take the form of direct military intervention. It is also evident that military governments face more domestic opposition than their civilian counterparts, and as Maizels and Nissanke [36] argue, the frequent use of violence against the public to maintain the ruling elite in power might lead to higher defence allocations. Moreover, high levels of repression may eventually increase domestic opposition which may express itself in either a civil war or a military coup.

Finding a way of distinguishing between civilian and military governments is a challenging task. Some civilian governments are composed of military officers, technocrats and politicians, while many military regimes allocate some ministerial portfolios to civilians to reduce the opposition to military rule. To avoid these categorization problems we focus on the origin of the government. "If a government came to power as a result of a military coup, we regard it as a military regime".²⁴ It is considered a military regime until power is returned to a civilian administration [see Table (2) below for the nature of the governments in the region].

Of the thirteen countries included in our sub-Saharan African sample, two were former Belgian colonies (Rwanda and Zaire), five were British (Kenya, Somalia, Sudan, Tanzania and Uganda), five French (Benin, C.A.R., Mali, Niger and Togo) and two were Italian colonies (Ethiopia and part of Somalia). General elections were carried out to form the first national parliaments and governments immediately after independence, with the exception of Ethiopia. A few years after independence the civilian governments were overthrown by military coups in most countries, with the exception of Kenya and Tanzania.²¹

Successive military coups became a general phenomenon in the region. Williams [65: 26] argues "almost the only generalization one can safely advance is that there is no country in Africa where power is beyond the reach of soldiers; and no military government beyond the reach of counter-coups. The military coup has become, along with death or retirement of the earlier generation of African leaders, the main mechanism for political change".

4.3. Military Factors

At the national level, civil wars are the most pivotal determinants of LDCs' militarization levels. They usually develop out of domestic conflict over the distribution of wealth or political power, or as a result of internal repression. In the post-War period civil wars constituted a significant proportion of the total number of wars in the world.²⁶ They are likely to increase the nation's commitment of resources to the defence sector, and to threaten the country's political stability, as well as national security and unity. Governments, therefore, tend to devote considerable resources and effort to end such wars by political or military means.

At the regional level, external conflicts (foreign wars, armed invasion or tension between neighbouring countries) have momentous effects on the military effort, and this is reflected in higher levels of military expenditure. In our region, for example, the war between Ethiopia and Somalia in 1977-1978 escalated military expenditure in the two

TABLE (2): THE NATURE OF THE GOVERNMENTS IN THE REGION.

Year	1	2	3	4	5	6	7	8	9	10	11	12	13
1959	*	*		*	*	*	*	*		*	*	*	*
1960				*			*			*		*	
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1 = Benin; 2 = CAR; 3 = Ethiopia; 4 = Kenya; 5 = Mali; 6 = Niger; 7 = Rwanda;
 8 = Somalia; 9 = Sudan; 10 = Tanzania; 11 = Togo; 12 = Uganda; 13 = Zaire.

* : not independent.

Shaded areas: military governments.

Non-shaded areas: civilian governments.

SOURCES: See the Data Appendix.

countries. It increased the Ethiopian military burden from 4% in 1977 to 7.1% in 1978, and the Somalian military burden from 2.9% in 1977 to 6.2% in 1978.

To make a simple distinction between civil and inter-state wars is, however, not very useful as "a substantial proportion of civil wars in developing countries have been connected with regional inter-state conflict, so that it seemed impracticable to draw a rigid line between the two" [36: 1132]. In Sub-Saharan Africa, for example, the war between Uganda and Tanzania, in the period 1978 to 1979, was a result of civil conflict in Uganda and Tanzanian support for Ugandan rebels. Similarly the 1977-1978 war between Ethiopia and Somalia over the Ogaden region was the product of the continuous Somalian support to the Western Somali Liberation Front (WSLF), operating inside Ethiopia. Moreover, Ethiopia maintained its support to the rebels of the Sudan People's Liberation Army (SPLA), formed in 1983. SPLA was allowed to use Ethiopian bases, had access over the border and was given artillery and air support by the Ethiopian army. At the same time, Sudan had maintained its support of the Eritrean guerrillas by giving them similar facilities.²⁷

To quantify the influence of wars and instability in determining levels of military expenditures, taking into account the above considerations, a war dummy is constructed. It encompasses both internal and external conflicts. Internal conflicts include civil war, mass executions, massacres and political violence (leading to at least 1,000 deaths a year). External violence includes involvement in a foreign war, intervention or invasion. The dummy variable takes a value of one if a country was involved in a civil or regional war, or both, and zero if it does not experience such conflicts [the sources of data for the construction of this dummy are listed in Table (3)]. Finally, given the nature and the composition of military expenditure in Africa, with a very high percentage of operating costs in total security expenditure (particularly personnel-related outlays),²⁸ the size of the armed forces plays a crucial role in the determination of military expenditures.

TABLE (3): MAJOR CONFLICTS IN THE REGION, 1959 - 1993.

PERIOD	AREA OF CONFLICT
1955-1972	Civil war in Southern Sudan.
1959-1965	Tutsi versus Hutu Government in Rwanda (massacres).
1960-1967	Violence and disorder in Zaire (Katanga crisis, Kasai and Stanleyville revolts, UN involvement, rebels in Albertville and Bukavu).
1961-1965	Endemic unrest and violence in Niger.
1963-1964	Frontier war between Ethiopia and Somalia.
1964.	Unrest in Kenya (Communist-inspired violence and British intervention).
1966.	Baganda revolt for secession (Uganda).
1971.	Border clashes and skirmishes between Uganda and Tanzania.
1971-1977	Civil war and massacres in Uganda, (Idi Amin).
1974-1991	Eritrean revolt and civil war in Ethiopia.
1976-1979	Uganda claims part of Kenya and reprisals against Kenyans in Uganda, and massing of troops along their borders.
1978-1979	Uganda attack on Tanzania which responded by invading Uganda.
1978-1979	Ogaden war in Ethiopia (Somali intervention).
1983-1991	Civil war in Southern Sudan.

SOURCES: Knede [31: 282-3]; Dupuy, Hayes & Andrews [18]; Hartman & Mitchell [24: 30-50]; Sivard [53: 10-11]; Dupuy & Dupuy [19 :1316-26]; and Williams [65: 19-30].

V. REGRESSION ANALYSIS

To test the previously mentioned hypotheses, and to quantify the role of the identified factors in the determination of the military burden, a simple one-equation model is constructed. The military burden is assumed to be a function of the military burden in the previous year, GDP per capita, ratio of government expenditure to GDP, ratio of total exports and imports to GDP, size of the armed forces, war dummy and the nature of the government dummy. This relationship is analyzed by techniques of time series, cross-section and pooled cross-sectional time series estimation.

5.1 Time Series Estimation

The time series technique permits comparison within countries over time but not across countries. The advantage of this technique is that it allows the examination of the major determinants of the military burden for each individual country which might differ in their weight among other countries. The equation to be estimated by time series data is written as:²⁹

$$M_t = \alpha_0 + \alpha_1 GDPc_t + \alpha_2 GX_t + \alpha_3 XM_t + \alpha_4 ARM_t + \alpha_5 M_{t-1} + \alpha_6 WAR_t + \alpha_7 MRD_t \quad (3)$$

where

- M_t : (ME/GDP) at time t - log transformed.
 M_{t-1} : (ME/GDP) at time t-1 - log transformed.
 $GDPc_t$: GDP per capita at time t - log transformed.
 GX_t : Share of government expenditure in GDP at time t - log transformed.
 XM_t : (Exports + imports)/GDP at time t - log transformed.
 ARM_t : The size of the armed forces at time t - log transformed.
 WAR_t : Dummy variable for war at year t (= 1 during wars, and = 0 otherwise).
 MRD_t : Dummy variable for the nature of the government at year t (=1 for military governments, and = 0 for civilian governments).

The results are presented in Table (4) together with several diagnostic tests produced by Micro-Fit econometric package;³⁰ the Lagrange multiplier test of residual serial correlation; Durbin-Watson statistics; and the F test for heteroscedasticity. The normality and functional form (Ramsey's RESET) tests were also carried out. In terms of the goodness of the fit, the results are fairly satisfactory, and the dependent variables capture most of the variation in the countries' military burdens (R^2 ranging between 0.64 and 0.98). Most important is that the specification test (for serial correlation, normality and homoscedasticity) shows that the equations are well-specified.

TABLE 4: TIME-SERIES REGRESSION RESULTS, 1963-1985.

	BENIN	CAR	ETHIOPIA	KENYA	MALI	NIGER
CONS.	-0.219 (-0.07)	-0.3975 (-0.10)	4.2146 (0.58)	-14.89 (-4.9) ***	-13.4505 (-1.98) **	-8.9823 (-1.25)
GDP _t	-0.1552 (-0.33)	-0.3486 (-0.58)	-0.023 (-0.02)	0.5210 (0.98)	-0.1000 (-0.11)	1.6359 (2.12) **
GX _t	-0.2013 (-0.79)	1.3417 (2.57) **	-0.793 (-1.60) *	2.6370 (4.62) ***	0.5877 (1.10)	-0.7347 (-0.64)
XM _t	-0.1261 (-1.22)	0.2888 (0.54)	1.654 (2.76) ***	-0.105 (-0.47)	0.0685 (0.33)	-0.0083 (-0.02)
ARM _t	0.2798 (2.05) **	-0.2076 (-1.95) **	0.0958 (1.05)	0.3820 (6.13) ***	1.3622 (4.10) ***	0.0814 (0.25)
M _{t-1}	0.3151 (1.63) *	0.5868 (3.57) ***	0.3737 (2.27) **	0.1955 (3.44) ***	0.8558 (4.80) ***	-0.0331 (-0.17)
WAR _t	-----	-----	0.0934 (0.69)	0.3501 (4.80) ***	-----	1.318 (4.67) ***
MRD _t	-0.193 (-2.47) **	0.2094 (0.91)	0.3643 (1.92) **	-----	0.1018 (0.66)	0.031 (0.14)
R ²	0.73	0.81	0.97	0.99	0.87	0.77
F	(6,16) 7.27	(6,16) 11.05	(7,15) 71.7	(6,15) 189.60	(6,11) 11.88	(7,15) 6.97
HET. test	(1,21) 0.78	(1,21) 0.33	(1,21) 1.60	(1,20) 0.06	(1,16) 0.06	(1,21) 2.10
SER. test	(1,15) 3.80	(1,15) 0.93	(1,14) 0.29	(1,14) 1.48	(1,16) 0.29	(1,14) 0.07

(CONT.) TABLE (2.4)

	RWANDA	SOMALA.	SUDAN	TANZAN.	TOGO	UGANDA	ZAIRE
CONS.	-5.8684 (-2.13) **	0.7006 (0.12)	2.1469 (0.47)	-5.8591 (-3.39) ***	-0.596 (-0.20)	-8.2832 (-1.94) **	-5.9667 (-1.83) **
GDP _t	0.7458 (4.27)	-0.1341 (-0.17)	-0.2439 (-0.42)	0.6442 (1.50) *	-0.331 (-0.87)	0.8129 (1.30)	2.9200 (6.52) ***
GX _t	0.086 (0.24)	0.8674 (1.66) *	0.0162 (0.05)	-0.1320 (-0.65)	0.4983 (2.09) *	1.3716 (1.92) **	-0.0876 (-0.33)
XM _t	0.3292 (1.22)	-0.0341 (-0.18)	-0.0068 (-0.03)	0.1513 (1.46) *	-0.006 (-0.02)	0.4243 (2.03) **	0.2173 (1.18)
ARM _t	0.2811 (0.96)	-0.1865 (-0.67)	-0.0404 (-0.41)	0.4007 (2.95) ***	0.2051 (1.16)	0.0346 (0.23)	-1.0512 (-4.51) ***
M _{t-1}	0.5285 (4.03) ***	0.2062 (1.06)	0.5907 (3.62) ***	-0.0892 (-0.60)	0.3155 (2.17) **	0.5653 (7.02) ***	-0.7801 (-4.45) ***
WAR _t	0.7503 (3.38) ***	0.4673 (3.71) ***	0.3052 (3.74) ***	0.4058 (5.09) ***	----	-0.0785 (-0.58)	0.1404 (0.49)
MRD _t	-0.5201 (-2.81) ***	-0.0090 (-0.05)	0.1894 (2.14) **	----	0.0346 (0.24)	0.2522 (1.58) *	2.0679 (7.62) ***
R ²	0.84	0.64	0.86	0.94	0.90	0.91	0.89
F	(7,14) 10.70	(7,15) 3.82	(7,15) 12.91	(6,16) 42.80	(6,16) 24.51	(7,15) 21.60	(7,15) 17.23
HET. test	(1,20) 0.003	(1,21) 0.02	(1,21) 2.60	(1,21) 2.65	(1,21) 2.00	(1,21) 0.18	(1,21) 1.70
SER. test	(1,13) 1.86	(1,14) 1.61	(1,14) 1.18	(1,15) 0.30	(1,15) 1.76	(1,14) 0.04	(1,14) 0.02

The dependent variable is ME / GDP.

Figures between brackets are t-ratios. F : F Statistic.

(----) : The dummy does not apply in this country.

*, **, **** : Significant at 10%, 5% and 1% level of significance respectively.

HET. test : Heteroscedasticity test based on the regression of squared residuals on squared fitted values (F version).

SER. test : Lagrange Multiplier test of residual serial correlation (F version).

GDP per capita exerted a significant positive influence on military expenditure in three countries only while its effect in other countries was insignificant. This could be explained partially by the existence of a certain absolute technical minimum size of a modern military establishment [34]. Our initial experimentation with the relationship between military burden and economic growth did not support the existence of such a relationship in all countries and we will return to this issue in the next chapter. However, the results showed a significant positive relationship between military burden and total government expenditure as a percentage of GDP in five countries (CAR, Kenya, Somalia, Togo and Uganda); insignificant positive relationship in three countries (Mali, Rwanda, and Sudan); significant negative relationship in Ethiopia; and insignificant negative relationship in the rest of the sample. In CAR, Kenya and Uganda the elasticity of military burden to government expenditure share in output is greater than unity, implying a crowding-out effect on other government activities. However, in the remaining countries, the military burden adjusts less than proportionally to total government expenditure changes.³¹

One noticeable result is the weak effect of the total trade as a proportion of GDP (as a proxy for the degree of incorporation into the world economy). Indeed, in some countries which became less incorporated into the world economy over time, a corresponding increase in their military burden was evident (e.g Sudan). For Ethiopia, Tanzania and Uganda, however, this factor proved to be a significant determinant of their military burdens. Moreover, the influence of previous military spending was significant and positive for nine countries. The effect was also positive for Somalia, but not statistically significant. However, a negative insignificant relationship was noticed in Niger and Tanzania, and a significant negative relationship in Zaire.

As expected, the size of the armed forces proved to be a crucial factor in the determination of military burden. In four countries it had a significant positive relationship, with elasticities less than unity, while its influence was negative in CAR, Somalia, Sudan and Zaire; a positive insignificant influence was noticed in the rest of the sample [see Table (4)].

Security considerations (whether internal or external wars and conflicts) were the predominant factors for military burden determination in Sub-Saharan Africa. Eventually, in countries where wars were evident, a corresponding escalation in their military burden was noticed.³² The war dummy is positive and significant in Kenya, Niger, Rwanda, Somalia, Sudan and Tanzania, and an insignificant positive relationship is noticed in Ethiopia and Zaire. This might be attributed to the long periods of wars and conflicts in these two countries. However, Benin, CAR, Mali and Togo did not witness any major conflict in the period investigated.

The time series results showed that the growth in the defence burden of military regimes in some countries is distinctive compared with that of civilian governments. The dummy variable for military governments is significant and positive in Ethiopia, Sudan, Uganda, and Zaire. The positive effect is not statistically significant in CAR, Mali, Niger, and Togo. Surprisingly, the dummy was significantly negative for Benin and Rwanda. For Benin, this might be attributed to the 50% increase in the size of the army by the civilian government in 1972.

5.2 Cross-Sectional Estimation

Cross-sectional analysis facilitates comparison across countries and clarifies the long-run properties of military burden patterns. Therefore, a cross-sectional model is estimated in this section although it might not be the most appropriate technique for the dynamic nature of our analysis. However, the analysis is modified to encompass longitudinal data, and the focus here is mainly on the economic variables. In the cross-sectional model, we modify equation (3) using the average values of the variables for the period 1967-1985.³³ The military burden in the previous year and the dummy variables were omitted and the percentage of population serving in the armed forces (ARP) is used rather than the absolute size of the forces; to control for differences in countries' total population. This percentage ranged between 0.03 % in Rwanda in 1963 to 1.22 % in Somalia in 1977. For the entire sample the mean value was 0.22 % for the period 1964-1985. The OLS estimation result is as follows:

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$$M_i = -2.7868 + 0.0677 GDPc_i + 1.0561 GX_i - 0.6656 XM_i + 0.3017 ARP_i \quad (4)$$

(-0.76)
(0.15)
(1.99)
(-1.48)
(1.51)

$$R^2 = 0.61 \quad F(4,8) = 3.11$$

$$F[\text{Functional Form}] (1,7) = 1.02$$

$$F[\text{Heteroscedasticity}] (1,11) = 0.64$$

$$F[\text{Serial correlation}] (1,7) = 0.64$$

Figures between brackets are *t* ratios.

ARP_{*i*}: average percentage of population serving in the armed forces in country *i*.

Although the estimated coefficients of the cross-sectional equation have different interpretations, the results show some consistency with the time series estimates. There is a significant positive relationship between the military burden and the ratio of the government expenditure to GDP across countries. The percentage of population serving in the armed forces exerted a positive effect on the military burden (although it is significant only at the 10% level). Gyimah-Brempong (1989: 84) confirms this by arguing that "countries with large force ratios are likely to have high defence expenditures, especially in the African context, where military establishments are not mechanized". However, the positive influence of GDP per capita on the military burden is very small and insignificant and the sign of the trade to GDP ratio (the proxy for the incorporation into the world economy) is contrary to our expectations. One plausible explanation for the seemingly bizarre result is that the countries with relatively high ratio of trade to GDP (Benin, CAR, Mali, Niger and Togo) actually had a relatively low military burden and a low percentage of the population serving in the army,¹⁴ because of their relations with France. The Francophone Zone has many economic, cultural and military links. Indeed, upon independence France signed mutual defence and military assistance agreements with them. These agreements included maintaining internal security, base rights, and transit and overflight privileges.¹⁵ Another plausible explanation was suggested by Rosh (1988), who claims that as countries become more involved in the world economy their policy makers begin to perceive greater benefits to be derived from competition in this arena than through military conflict in the interstate system.

5.3 Pooled Cross-Sectional and Time Series Design

The pooled cross-sectional and time series analysis permits examination of the dynamic year-to-year fluctuations in the military burden of individual countries as it treats levels of military spending dynamically within and across countries. In our analysis a Generalized Least Squares procedure is used, in which the explanatory variables and the regression disturbance are presumed to satisfy the assumptions of the generalized linear regression model:²⁶

$$M_{it} = \alpha_0 + \alpha_1 GDPc_{it} + \alpha_2 GX_{it} + \alpha_3 XM_{it} + \alpha_4 M_{i,t-1} + \alpha_5 ARPOP_{it} + \alpha_6 WAR_{it} + \alpha_7 MRD_{it} \quad (5)$$

The results are as follows: (13 Countries, 19 years 1967-1985):

$$\begin{aligned} M_{it} = & -0.2203 + 0.0195 GDPc_{it} + 0.1346 GX_{it} + 0.0424 XM_{it} + 0.7816 M_{i,t-1} \\ & (0.63) \quad (0.41) \quad (2.35) \quad (1.09) \quad (19.04) \\ & + 0.0505 ARPOP_{it} - 0.0337 MRD_{it} - 0.2366 WAR_{it} \\ & (2.05) \quad (-0.95) \quad (4.99) \end{aligned} \quad (6)$$

$R^2 = 0.97$

Figures between brackets are t ratios.

These results are consistent with both the cross-sectional model result and most of the time-series estimates for the individual countries. GDP per capita has a weak positive effect on the military burden but with an insignificant coefficient. Nevertheless, the relative size of government expenditure has a positive and highly significant effect. It is positively related to the military burden, with an elasticity of 0.13. This implies that in these countries the military burden adjusts less than proportionally to total government expenditure changes, and this result corroborates the revenue constraint argument in the least developed countries. Moreover, previous levels of military burden have a large and highly significant influence on current levels of military burden.

Contrary to the cross-sectional results, the ratio of total trade to GDP is positively related to the military burden, but it is also statistically insignificant. From the regression results, it is also evident that the percentage of the population serving in the armed forces has a significant positive effect on military burden (with an elasticity of 0.05). Similarly, the war dummy is also statistically significant and has a positive effect. However the effect of the nature of the government (MRD) dummy is not significant and its sign is contrary to our a priori expectations. One reason behind this might be that while the dummy variable is coded zero for Kenya and Tanzania throughout the period investigated because no significant change took place in the government and there was no direct intervention from the army into the political sphere, these countries also had a relatively high military burden. Some civilian governments also increased the size of the army, and consequently military outlays (e.g., Benin). Another explanation might be that military governments, which usually come to power by military coups, raise the banner of eradicating corruption, and reducing conspicuous government spending, and therefore make a temporary reduction in military spending. Moreover, some of these ruling juntas tend to expel disloyal officers and soldiers,³⁷ and consequently reduce defence outlays.

Equation (5) is estimated with country dummies to allow the intercept of each country to differ; also some variables are deleted or added to the initial equation. Table (5) gives the results of these modifications.³⁸ The results show that some of the coefficients became significant when the lagged M was deleted from the equation.

Ethiopia and Niger have the highest and lowest levels of military burden in our

sample, respectively. When we control for them by specifying a dummy for each, the results are still similar and the Ethiopian dummy is positive and significant, while the dummy for Niger is also significant but negative. The dummies for other countries are, however, insignificant. Equation (5) was also estimated with and without the lagged military burden. The signs and the significance of most variables were similar. However, when the lagged military burden was added it was highly significant. This implies the importance of inertia in determining military allocations in Sub-Saharan Africa.¹⁹

TABLE 5: DETERMINANTS OF ME (POOLED DATA ESTIMATION).

NO	CONS	GDP	GX	XM	M _{t-1}	ARP	MRD	WAR	DUMMIES	R ²
(1)	0.5978 (0.73)	-0.1801 (-2.57)	0.5065 (4.89)	-0.1909 (-2.83)	---	0.2104 (5.04)	-0.0184 (-1.32)	0.4977 (6.95)	NONE	0.55
(2)	0.0001 (0.001)	-0.0042 (-0.09)	0.1112 (2.08)	0.0694 (1.88)	0.8142 (22.63)	0.0548 (2.25)	-0.0306 (-0.93)	0.2247 (5.10)	NONE @/@	0.92
(3)	-0.4072 (-0.98)	0.0176 (0.39)	0.2156 (3.04)	0.0298 (0.69)	0.6936 (13.43)	0.0486 (1.82)	-0.0221 (-0.56)	0.2473 (4.76)	D3, D6	0.91
(4)	-0.6162 (-0.63)	0.1491 (0.75)	0.1313 (1.75)	0.0149 (0.12)	0.6133 (5.45)	0.1063 (1.87)	0.0273 (0.27)	0.3134 (2.89)	Dummies for all countries	0.92

D3 : Ethiopia D6 : Niger

@/@ Here numbers of the armed forces (ARM) are used instead of ARP.

Overall, the results clearly demonstrate the importance of the relative size of government expenditure, relative size of the armed forces, inertia and prevalence of wars in influencing these countries' levels of military burden even if we allow for country-specific effects. Moreover, the pooled regressions coincide with the cross-sectional and time series estimation results as all of them demonstrate the importance of the relative size of

the government expenditure as the main economic determinants and also emphasize the dominant role of the political and military factors in determining the military burden; most importantly, are the size of the armed forces, nature of the government (in some countries) and foremost the security web (wars and conflicts) of the country.

VI. SUMMARY AND CONCLUSIONS

The main objective of this study has been the clarification and quantification of the major determinants of military expenditure in Sub-Saharan Africa. We introduced the study by presenting a survey of the relevant literature and the findings of some earlier studies. It is clear from our evaluation of these studies that the models which incorporate bureaucratic, political, economic and strategic factors are better at explaining the determinants of Third World military spending than the arms race models. In addition to that, incorporation of the regional and global dimensions proves to be of vital importance.

We propose in this study that the strategic considerations of security and threat are the major determinants of defence spending. However, the variation in military expenditure is delineated by the boundaries of economic conditions, and particularly the governments' revenue constraint. Then the major determinants of military burden in Africa are identified, and a simple one-equation model is formulated and subjected to econometric analysis. The data are derived from thirteen Sub-Sahara African countries for the period between 1963 and 1985. Time series analyses for the individual countries is undertaken initially, and then a cross-sectional model is set for the averages of 1967-1985 variables. To address simultaneously the twin parameters of time and space, pooled time series and cross-sectional data are employed. The results are quite encouraging and consistent, and the model is able to explain most of the variations in the military burden of these countries.

The differences in the military burdens of the Sub-Sahara African countries appear to reflect a complex of economic, political and strategic factors, both at the national and the international levels. While the relative importance of the different factors varied from country to country, the need to maintain security and stability, and to counteract threats (to

the state or the government) is found to be the most important factor in most of the countries. The breakout of wars and internal conflicts was a key factor in the process of the escalation of military expenditures. In some countries, military governments have spent more on defence than their civilian counterparts, but across countries this argument is not supported by the pooled regression results.

While the income level (as measured by GDP per capita) was not binding for most countries, the military burden proved to be sensitive to the economic circumstances. The most important single economic factor is found to be the share of the central government in GDP. Adherence to a global power bloc is also found to be more important than the incorporation of the country into the world economy.

Studies of this type provide a consistent basis for comparison, pick out common features of countries, and suggest the relative importance of factors. But they can not be comprehensive because of problems of data quality and of operationalizing the relevant measures. Our study suggests that there are still unexplained factors accounting for the variation in the military burden. These may reflect historical, cultural and sociological features specific to each country. Such features can only really be analyzed by detailed individual country studies. The results do, however, have one very important policy implication. Since the strategic considerations of security and threat are the main determinants of defence outlays, then levels of military expenditures can be reduced by the conscious efforts of politicians and the military establishments to achieve political stability and the settlement of conflicts by peaceful means and negotiation. Regional organizations (such as, the Organization of African Unity - OAU) could also play a beneficial role in this respect. Border disputes, and the support of opposition groups of neighbouring countries were the main reasons for regional conflicts and, therefore, non-interference in the internal concerns of neighbouring countries will reduce regional conflicts. Moreover, democratic governments and institutions can solve most of these disputes at the national and regional levels.

7. Data Appendix

(1). Military Expenditure and the military burden (ME/GDP) figures from SIPRI Yearbook **World Armament and Disarmament** (various issues).

(2). Percentage of population serving in the armed forces = (armed forces / total population)X 100. The armed forces figures from USACDA **World Military Expenditure and Armed Transfers**, (Various issues). The armed forces refer to active-duty military personnel, including paramilitary forces if they resemble regular units. Reserve forces are not included; and population figures are taken from Summers and Heston (1988).⁴⁰

(3). GDP per capita: Real gross domestic product per capita, 1980 intentional prices, from Summers and Heston (1988).

(4). The total trade to GDP (XM/GDP): World Bank **World Tables**.

(5). The ratio of government expenditure to GDP (GX/GDP): Summers and Heston (1988) and World Bank **World Tables**.

(6). The nature of government dummy is bases on the extended articles on the recent political and military history of these countries in the Regional Survey of the World: **Africa South of the Sahara 1991**.

(7) The war dummy is formulated from the sources given in Table (3).

NOTES

1. See Mohammed [40] for a survey on African military spending.
2. For detailed surveys and critical evaluation of the literature on arms races models, see Russett [51], and Rosh [49].
3. In this context, defences can refer to military spending while the fatigue of keeping defences refers to the cost of having a specific level of military spending; while the grievances and ambitions term is specific for the political intensions of the regime in its regional setting.
4. For more discussion on this issue, see Smith [56], and McGuire [38: 330-4].
5. Smith [54: 63]. Moreover, the Richardson theory of arms race has been criticized for being deterministic, and because it implies a static base-line [31].
6. See Ostrom [44], Majeski & Jones [37], Leidy & Staiger [32], and Smith [56].
7. However, Deger [8] modifies the traditional models by incorporating asymmetric relationships between the antagonist countries and the results of the empirical analysis were consistent with her theoretical predictions.
8. See Cusack & Ward [7], and Rosh [49], for the evaluation of the models in the superpowers context.
9. For a fuller evaluation of the Marxist school, see Smith [54], and Dunne [16].
10. Empirical evidence conflicting with the Underconsumption School was provided by Smith [54]. Also, the school was criticized for its surplus concept which is different from the Marxian concept of surplus value. The tendency of the surplus to rise under monopoly capitalism is also questioned by MacKenzie [35].
11. The countries included in his sample were those with a *per capita* gross national product of US\$ 800 or less. They include six countries from our Sub-Sahara African sample (Ethiopia, Kenya, Mali, Sudan, Tanzania, and Uganda). See Lotz [34], pp. 119-25.
12. See Looney [33] for an evaluation of the approach, a literature survey, and a recent empirical study.
13. Other studies on the military's political influence on military spending suggest different conclusions. Zuk and Thompson [67: 61] summarized eleven of these studies. They justify the disparity of the empirical results by the differences in the research designs, as well as the differences in the countries included, periods of time, with the use of different independent and explanatory variables. Moreover, some studies did not confirm any significant relationship between regime type and resource allocations to the military (e.g., see Tannahill [59]).

14. Rothstein used military expenditure figures for 1983, while the judgements of the experts are based on evaluations for 1984 and 1985 political situations. This may affect the significance of his findings.

15. Similarly, Albercht, *et al.* [2] emphasized fear of neighbours, conflicting interests within the army, the needs of industrialization, and the costs of arms imports as the major factors behind militarisation in LDCs. Hewitt [26] also confirmed the importance of economic and financial indicators, political variables and demographic and geographic features of nations in explaining cross-country differences in levels of military spending.

16. Examples of these studies are given in Rosh [49: 677].

17. This factor was first emphasized by Lotz. He analyzed the different means of finance available to the governments of LDCs, and concluded that the revenue constraint is more binding to the LDCs. See Lotz [34: 130-1].

18. See Rosh [49: 682-5], for more discussion on the issue. Moreover, he argues that certain factions will benefit from this incorporation, and they will seek to maintain the existing economic order by applying force internally.

19. This argument is given by Cameron [5: 1250].

20. The last point was emphasized by Choucri and North [6]. However, Deger [10: 20] argues that the relationship between current and past values of military expenditure is negative in most LDCs because of their poor and limited resources.

21. See MacKenzie [35: 41-3] for an evaluation of the 'military-industrial complex' influence.

22. Moreover, Nordlinger's empirical findings from the analysis of 74 countries in the period between 1959 and 1962 corroborate his military corporate self-interest argument. See also Ball [3: 59-68] and McKinlay [39: 69-71] for the same argument.

23. For example, the June 1989 coup in Sudan was motivated mainly by the desire to end the armed conflict in southern Sudan. See Williams [65: 32] and Abdel-Rahim [1: 974].

24. Zuk and Thompson [67: 64]. Note that the Ethiopian monarchy (1941-1974) is not classified as military in our categorization.

25. In Kenya and Tanzania, the multi-party systems were abolished. They changed to single-party states. Moreover there was no return to civilian governments except in Benin, Sudan and Uganda for very short periods.

26. Knede [31: 270].

27. See Regional Surveys of the World [47: 459; 1050-2].

28. See Mohammed [40:41].

29. Initially, I started from an error correction model, but equation (3) below seems to give the appropriate formulation. Moreover, Dunne & Mohammed [17] estimated equation (3) for aggregate time series data of the whole sample using tests of restrictions. Their result shows that levels of income and changes in the GX and XM were the major determinants of the sample's military burden. See Dunne & Mohammed [17: 7-8] for the estimation procedures, restrictions and the coefficients of these determinants.
30. Micro-Fit Vax version 1.1, by Pesaran M.H. and Pesaran B., (C) 1989 Camfit Data Limited.
31. Some economists argue that for many LDCs, GDP and ratio of government expenditure to GDP tend to move upward with economic development (a variant of Wagner's law), and hence their inclusion in one equation might produce multicollinearity and possible misspecification (see Deger & Sen [13]). However, we examined the pair-wise correlations among the two regressors for all countries and it is very low. It is above 0.5 for Benin, Kenya, Niger and Rwanda. Nevertheless, when we delete one of the variables the t ratios, R^2 and other statistics do not change.
32. This factor was emphasized heavily by two UNECA African economists: Dr. Bahri and Dr. El-Egaily, in my interviews with them (Addis Ababa, May 1991).
33. This is known as "between" regression in panel analysis [57].
34. The absolute size of the armed forces in these countries in 1987 was as follows: Benin 4,000; CAR & Rwanda 5,000 each; Mali, Niger & Togo with an army of 8,000 each; Kenya 21,000; and Uganda 15,000. This is compared to 300,000 in Ethiopia; 50,000 in Somalia; 59,000 in Sudan; 40,000 in Tanzania; and 53,000 in Zaire in 1987.
35. For the dates and type of these agreements and the scope of the military cooperation with France, see Dupuy, Hayes and Andrew [18: 70-1, 94-5, 250-1, 318-9]. A dummy variable for Francophone countries was constructed to see the effect of the French alliance on military burden. The coefficient was negative but not statistically significant and the result is expected because of multicollinearity (high correlation between this dummy and XM).
36. For the model description and the estimation procedure, see Kmenta [30: 616-22] and White & Horsman [63: 133-5].
37. See Mohammed [41] for the Sudanese case.
38. Dunne & Mohammed [17] estimated the above equation with pooled data using OLS with country-specific dummies. The results were similar to those of equation (6) in signs and coefficients.
39. The lagged military burden was deleted because estimating dynamic models with pooled data can lead to inconsistent estimates [57].

40. See USACDA **World Military Expenditure and Arms Transfers** (1988: 132), for an extended definition and its sources of data.

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የክመና ቃላት

Glossary of Economic Terms Nos 103-132

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103-132 ቁጥር የተረቡ ቃላትና ትንተና

103. balance of payments (n) የከፍቻ ጧዛን / ስ /
104. foreign exchange reserves (n) የጫጫ ምንጭ ተተግጭ / ስ /
105. inflation (n) የዋጋ ንረት / ስ /
106. gross domestic product (n) ያልተጣራ ያገር ጫስጥ ገቢ / ስ /
107. raw material (n) ጥሬ ዕቃ / ስ /
108. exchange rate (n) የምንጭ ተመገ / የምንጭ ሂሳብ // ስ /
109. trade balance (n) የንግድ ጧዛን / ስ /
110. import trade (n) የገቢ ንግድ / ስ /
111. export trade (n) የጫጫ ንግድ / ስ /
112. black market (n) ጥቁር ገበያ / ስ /
113. contraband (n) ከንትሮባንድ / ሀገጦጥ ንግድ // ስ /
114. foreign exchange earnings (n) የጫጫ ምንጭ ገኝት / ስ /
115. small scale industries (n) አነስተኛ ሊንጥራት ሥራዎች / ስ /
116. cottage industries (n) የጎጃ ሊንጥራት ሥራዎች / ስ /
117. handicrafts (n) ለደጥበባት / ስ /
118. usury (n) አራጣ / ስ /
119. price stability (n) የዋጋ ጫረጋጋት / ስ /

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120. infant industries (n) ጠቅላላ ኢንዱስትሪዎች / ስ /
121. informal market (n) ይፋ አልባ ገበያ / ስ /
122. economic crisis (n) የክምግ ተጨስ / ክምግ ተጨስ / ስ /
123. gross national product (n) ያለተጣራ ባህሪዊ ምርት / ስ /
124. vicious circle of underdevelopment (n) የገንዘብ ለደረት ክብ / ስ /
125. efficiency (n) ትልቅና / ስ /
126. efficient (adj.) ተጣፋ / ትልቅ / ት /
127. inefficient (adj.) ትልቅ አልባ / ት /
128. division of labour (n) የሰራ ክፍፍል / ስ /
129. hypothesis (n) ግምት / ስ /
130. income distribution (n) የገቢ ስርዓት / ስ /
131. interest (n) ወለድ / ስ /
132. free market competition (n) ነፃ የገበያ ጠድድር / ስ /

ትገተና

COMMENT

Balance of payments

Conceptually, this term refers to 'A systematic record of all the economic transactions between one country and the rest of the world in a given period, usually one year'. Both the English and the suggested Amharic equivalent do not show this fact on the surface. If the English one does not show that but the economist knows exactly how the term is used, there is no reason why the Amharic one does not do the same. Therefore, the shorter የክፍያ ግዛገ is preferred to የጠጪ ክፍያ ግዛገ፣ የጠጪ 'external' referring to the foreign countries involved in the

transactions. This concept can be shown in the dictionary.

Gross Domestic Product

ፆልተጣራ 'gross' is preferred to ጠቅላላ because we have used this term for 'gross income' ፆልተጣራ ገቢ in EJE Vol.1 No. 2(36). In this way, we show that 'gross domestic product' includes depreciation while at the same time we maintain consistency in word coinage. የፆንገራ ተመን 'exchange rate' is coupled with የፆንገራ ሂሳብ. The latter is given as an alternative. The reason is that the word ሂሳብ is used in the sense of 'rate' as the following illustrate:

- He is paid at the rate of five Birr an hour.

በሰአት አምስት ብር ሂሳብ ይከረሰዋል።

The train arrived at 6 pm travelling at the rate of forty miles per hour.

ባሁኑ በሰአት 40 ግድል ሂሳብ እየተገነባ በ12 ሰአት ይረሰብ።

Black Market

The loan translation method* is used here. This means the Amharic coinage (ጥቁር ገበያ) is a word for word substitute of the English term: black 'ጥቁር' market 'ገበያ'. Thus, ጥቁር ገበያ has the same characteristics

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in Amharic as black market does in English linguistically. The dictionary can elaborate the rest.

Contraband

The word contraband consists of Italian contra- 'against' and bando 'proclamation'. The word is used to mean 'illegal or prohibited commerce'. The Amharic ህደግ ገዢ is thus suggested as an alternative since we realize that it is against convention to reject or discourage the use of a term which is already in wide currency. Moreover, the Amharic word includes all kinds of illegal economic transactions of which contraband is one aspect.

Small scale industries

All the methods have been exhausted to coin a word for 'industry' but none of them was successful. When this occurs, we follow the principle of borrowing* and other related principles*. The word must either be adapted or adopted. In this case, it is adapted with respect to its English pronunciation. Thus, the word appears in all the contexts in which it is used with other words as in the word under discussion.

All the rest of the coinages seem to be self-evident. If there are any questions or suggestions, please send them to the Ethiopian

Economic Association or the Economics Department at the addresses shown in the inside back cover of EJE.

COMMENTS ON Dr. Baye's COMMENTARY.

We appreciate Dr. Baye's commentary in vol. II No. 1. of EJE. We found his comments on some of the coinage constructive and encouraging. We will react to them below but, first, we apologize for our dismaying comment in the introduction. It was not directed towards constructive criticisms. His type of comment is scholarly. We were thinking of those who sneer at the efforts of others without being involved in the actual work of coinage themselves. Our comment on his commentary will now follow. The numbers refer to the technical terms in the above volume.

58. አጠቃላይ ግንባራ is coined for equilibrating tendency not for equilibrium tendency. The mistake was not detected at the time.

59-63. We agree with Dr. Baye, except for ተለግጭ for which our suggestion should be maintained. We opted for ተለግጭነት for fear that the possible word ለጠን will not be readily acceptable.

64. We had discussed የላጎን at length before we decided upon ተረጋጎጥን We thought የላጎን indicated 'need' without having the power to buy. But we now accept the suggestion on the following grounds:

a. Our awareness and acceptance of the fact that it patterns with ለትርጉም

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and is shorter than ተረፋፋይነት

- b. The fact that it has been used an Amharic equivalent for 'demand' since the out break of the revolution.
- c. Dr. Baye's preference and support for use of ደፋፋይነት rather than ተረፋፋይነት
- d. The fact that even if its usual meaning indicates 'need' in Amharic its technical usage can be expanded by the method of semantic shift¹.

This method has already been in use when words such as the following are made to serve as technical terms: መደብ 'class', ተፈገጅ 'progressive', ግግ 'foot', ለደገፈ 'reactionary', ፖርት 'production', ሸቀጥ 'commodity' etc. In the same way, ደፋፋይነት 'demand' can be used on the basis of the same principle. We also checked if the word fits the context of the sentences we gave for illustration in Vol. I No. 2. (p.81) as follows:

- a. The demand for fish this month exceeds the supply.

በዚህ ወር ለሌላ ያለው ደፋፋይነት ከእትርቶ ይበልጣል።

- b. The demand for skilled workers is high; but there is no demand for unskilled ones. ለሰራተኛ ሰዎች ደፋፋይነት ከፍተኛ ነው፤ ነገር ግን ላሰራተኛ ደፋፋይነት የለም።

- c. There is a high demand for butter these days

ሰጥኑን ለትቧ ከፍተኛ ደፋፋይነት ለለ።

we added the following new example for further illustration.

Urban people have a demand for fish.

የከተማ ሰጪ ለሌላ ፍላጎት ለሰጪ።

68. See the comment on No's 59-63.

76. This word is unclear because it violates the principle of transparency¹. This principle requires that those who coin words should make the coined words clear by explaining where they got them from. We failed to do so and the result was obscurity. We will now explain where we got the word from. The first word in a የተረ ለድል ዐጪ 'opportunity cost' is formed from the root verb k'r 'he(it) became absent'. ተረ is formed on the model of ዐጥ, ለጥ, ለደረ, etc., which can be used as follows: ለላባ ዐጥ 'new comer', ሥረ ለጥ 'unemployed', and ላባ ለደረ 'proletariat'. In fact, the word in question can be used with ኋላ 'behind, later' in a similar way as in 'ኋላ ተረ 'backward'. But, unfortunately, we used it as an alternative to ተረ 'he(it) became absent'. Thus የተረ ለድል 'opportunity' in the sense 'opportunity' is used in economics to mean 'the best alternative benefits forgone'. We now realize that Dr. Bayé found it obscure because the occurrence of the word as the first element instead of the second has made the construction ungrammatical as are ለጥሰረ, ለደረላባ, ዐጥ ለላባ. Instead, we should have used the form ተረ or ተረ to enable us to get the phrase የተረ ለድል or ተረ ለድል 'opportunity'. ተረ ለድል is preferable since የተረ ለድል ዐጪ 'opportunity cost' is clearer.

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79. An even better one is ጭጭጥላኝ since for (77) the word አነስተኛ can be used to give us አነስተኛ ጭጭ instead of the one originally suggested.

80. We agree.

81. We agree with the first alternative - ትርፍ አላላጊ

88. We had a lengthy discussion with Dr. Baye. He had explained well that Amharic normally uses morphologically singular words in the plural, e.g. ከበደ ብዙ መጻሕፍ አለጧ 'Kebede has a lot of books'. The present-day use of the morphological plural nouns is the influence of European languages. 'Factors' can, therefore, be represented by the morphologically singular form ነገር instead of ነገራት modelled on the Geez plural formation pattern. ነገረ-ፖርት can, therefore, be used for 'factors of production'. We have no objection. Our only comment, the validity of which we want to test, is on the hyphenation. Compound words of this type, we suggest, should in the future be written as single words without a hyphen - ነገር ፖርት.

94. በካርታል ተጠቃሚ ፖርት ዘዴ can be made grammatical by changing the form ተጠቃሚ to ተጠቅሮ. The Amharic ተጠቅሮ can thus represent the English word <using> more appropriately than ተጠቃሚ, which is closer to 'user' than

to 'using'. Thus, በካፒታል ተጠቅሞ የግምገማ ዘዴ can reasonably be equivalent to capital using method of production. Hence,

95. በሰራተኛ ተጠቅሞ የግምገማ ዘዴ - labour using method of production. The alternative is to use Dr. Baye's first alternative - በካፒታል የግምገማ ዘዴ without the word ተጠቅሞ. What makes this choice also appropriate is that, it is shorter, and in Amharic, the phrase (term) indicates a method which makes use of capital in the process of production even though the word 'using' is not shown on the surface. While such a construction, in which the word 'using' is absent, is possible in Amharic, it is not possible in English. Just as the presence of an inappropriate form of the word 'using' has made the term ungrammatical in Amharic, the absence of it makes the English phrase ungrammatical, e.g.* Capital method of production (the star is a symbol of ungrammaticality). It must be noted, however, that the Amharic phrase uses በ 'by' instead of the English 'using'. But the use of 'by' will not make the English phrase grammatical e.g. * by capital method of production but the Amharic one በካፒታል የግምገማ ዘዴ is grammatical and it can substitute the English term capital using method of production.

97. ተለዩ ተጠቅሞ የግምገማ ዘዴ

99. ጠናኛ ታርታታርታርታ is an even better alternative.

NOTES

1. For the methods and principles employed in the coinage of all terms published in EJE see Takkele Taddese *Ways and Principles of Developing Technical Vocabulary: The Case of Amharic*. It is hoped that the material will be issued in the future.

COMMENTS ON TERMS NO 103-116

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103. I prefer የገንዘብ ግንኙነት since it relates more to transactions than to payment.

104. Does not follow the structure of Amharic NPS; it would be የገንዘብ ግንኙነት

105. የገንዘብ ግንኙነት ገቢ

106. የገንዘብ ግንኙነት ስርዓት

net national income - የተግባራ ግንኙነት ገቢ

107. 'ገንዘብ' is also possible as it is widely used among rural people.

ገንዘብ ገቢ / ገንዘብ ትኩረት / በ10 ገቢ ይሸረረላል

ገንዘብ ስንት ነው ? how was the daily exchange rate?

ገንዘብ በግንዘብ የተለወጠ ነው

108. I prefer አገልግሎት ገንዘብ : does not make sense to people, who speak no English.

109. Use the singular as it is more natural; the use of the plural

110. is the influence of English.

111. I prefer 'ገንዘብ' / በሰውነት ለይቻል / ወይም 'ገንዘብ' ገንዘብ ስርዓት: 'ገንዘብ', cannot concur with industry because of semantic constraint. Industry is (-HUMAN) whereas 'ገንዘብ' is (+HUMAN).

112. I prefer 'ገንዘብ ገንዘብ' since the contrast is with official exchange.

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113. see 107.

114. delete 'ከብ' as the concept is implied in አቅራቢ.

115. not consistent with the structure of Amharic Compounds, አልብ does not form adjectival compounds. I suggest ጸገ

116. I prefer የገቢ ክፍፍል. The English word 'distribute' does not mean 'ሰርዋት' in this context.

NOTES TO CONTRIBUTORS

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