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# Fiscal Financial Intervention, Factor Prices and Factor Proportions: A Review of Issues

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# Fiscal Financial Intervention, Factor Prices and Factor Proportions : A Review of Issues

*by*

Shankar N. Acharya*

## I. INTRODUCTION

Widespread unemployment in LDCs is generally attributed to the scarcity of complementary factors, especially capital. But a variety of distortions in factor markets are alleged to underprice capital and overprice labor relative to social scarcity prices. Such price distortions are believed to induce inappropriate choices of technique and sectors of production, hindering a better utilization of factor endowments. Fiscal and financial systems clearly play a part in influencing factor prices faced by private producers. In very broad terms what one would like to know is:

(a) which features of the fiscal/financial systems contribute to or alleviate factor market distortions, and something about their relative importance ;

(b) what is the scope for fiscal and financial policy in correcting factor price distortions?

The entire exercise rests on the premise that "factor prices matter". The scope for factor-price intervention to shift to efficient factor combinations with more employment per unit of capital in the economy (whether on average or only at the increment) is limited by:

(i) techonological substitution possibilities within a "sector", "industry" or "product" ;

(ii) *the possibilities for changing the output mix in favour of labor-intensive "sectors", "industries" or "products"* ;

(iii) the responsiveness of producing units to price signals, and

(iv) the success of intervention policies in changing prevailing factor prices in the desired direction.

This paper attempts a selective review of issues pertaining to each of the four limiting factors,listed above, constraining the effective deployment (or correction) of fiscal/financial measures to improve factor utilization. The plan of the paper is as follows. Section II addresses the production function approach to investigating available choice of technology. Section III takes a look at some of the micro-studies on capital-labor substitution and tries to distill the lessons. Section IV briefly discusses the influence of factor-price changes on output-mix, assuming profit-maximizing responses by producers. Section V explores the question whether decision-making units behave, at least approximately, as profit maximizers,in response to factor price changes, when choosing between techniques or whether other considerations dominate. Returning finally to the influences, current and potential, of fiscal/financial interventions on factor prices, Section VI critically surveys some theoretical attempts to isolate optimal intervention instruments, and draws some general lessons for theorizing in this field. The final section pulls together the conclusions arising from the discussion in earlier sections.

## II. ECONOMETRIC ESTIMATES OF THE SCOPE FOR CAPITAL-LABOR SUBSTITUTION: SOME PROBLEMS

Three separate levels of problems may be distinguished:
    (A) Is there a meaningful production function at the levels of aggregation (in outputs and inputs) investigated in most studies?
    (B) Conceptual inadequacies of the two-factor CES production function.
    (C) Estimation problems which cast doubt on the reliability of parameters estimated.

This broad classificatory scheme will be used to list the problems with CES production function estimates in LDCs.

### A. Does a Production Function Exist ?

All econometric estimations of neoclassical production functions have involved some degree of aggregation in either (or all of) outputs, capital inputs or labor inputs. Output is sometimes defined narrowly enough to be considered homogeneous. But labor and capital are always aggregates of heterogeneous elements which "differ in their longevity, impermanence, productive qualities, mobility, etc." [ 105, p. 1144 ]. For a production function to be interpreted to embody solely technological characteristics, it is necessary that the quantity of capital and labor, as defined in the function, be independent of both relative prices

and the distribution of income. The necessary and sufficient conditions permitting such aggregation are stringent [59].

The aggregation problem also rears its ugly head whenever the production function in question attempts to model more than one micro-economic production unit. Even if production in each unit is accurately conceptualized by a "well-behaved" neoclassical production function (i.e., the problem of nonhomogeneity of factors is assumed not to exist), Fisher [55] has demonstrated that very stringent restrictions need to be satisfied to permit aggregation across producing units and representation of production possibilities in a "sectoral" neoclassical production function.

## B. The Two-factor CES Function : Some Limitations

In its most general form the two-factor CES function may be written thus:[1]

$$Y = \gamma \left[ \delta K^{-p} + (1-\delta)L^{-p} \right]^{-\frac{\mu}{p}} \quad \ldots (1)$$

where Y, K and L are the usual variables and $\gamma$, $\delta$, $\mu$ and p are respectively, the parameters for efficiency, distribution, degrees of returns to scale and substitution. The elasticity of substitution $(\sigma)$ is equal to $1/(1+p)$. The CES suffers from a number of limitations in modelling characteristics of production in LDCs :

(i) The assumed independence of the elasticity of substitution from factor proportions and scale is not supported by either casual empiricism or the few available micro-studies of production processes[33].

(ii) CES studies relying on "indirect" estimation (see sub-section C below) implicitly assume constant returns to scale to capital and labor. This is at odds with most studies, especially of process industries. More importantly, the CES cannot incorporate returns to scale which vary with factor proportions [33; 129;-137; 145].

(iii) Applied to production in an industry or sector, the CES assumes *ex post* malleabilitly of factor-combinations (a "putty-putty" assumption). A "putty-clay" assumption would be much closer to reality.

(iv) Attempts to fit CES functions to LDC production sectors take value added as the measure of output. There is an implicit assumption that intermediate input requirements are in fixed proportion to gross output. Roemer [129, p.5] has pointed out "it is almost always possible to save raw materials, sometimes by

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[1]The function was formally introduced into economic literature in a celebrated article by Arrow, Chenery, Minhas and Solow [8].

adopting more efficient production processes".[2] More important, capital may be substituted more efficiently for intermediate inputs than labor.

(v) The two-factor CES suffers from the shortcoming of artificially conceptualizing the production process to be composed of only two primary factors, assumed to be homogeneous. In theory, the CES may be generalized to N factors in a number of ways. But the generalizations are either too complex to permit estimation, or too restrictive about the manner in which factors cooperate, to be believable [38; 104; 143; 160].

(vi) All too frequently the production function conceptualization treats capital as a stock, when it is the flow of capital services which is appropriate. As Winston [165, p. 29] points out, the distinction would be unimportant (it would reduce to a constant multiplier), if capital services per unit of capital stock were a constant, that is, there was a constant rate of capital utilization. But since the rate of utilization varies due to numerous reasons (including factor prices), the stock/flow distinction cannot be minimized in production function specification.

## C. Estimation Problems

All applications of the CES to LDCs, of which I am aware, use the "indirect" method for estimating σ. Basically this relies on the assumption that competitive factor markets bring about equality between the marginal products of factors and their real earnings. Constant returns to scale are implicitly assumed to ensure that factor incomes add up to value added. The data for investigations consist either of observations (time series and/or cross-section) on firms in a sector in a country [130; 163] or for a sector, defined as uniformly as possible, across countries [48].

An imposing set of problems confront such empirical testing of CES production functions, the more important of which are the following:

(i) The methodology assumes that the data represent points on the production frontier, that is, all production units observed have adjusted fully to the prevailing factor prices. This is unrealistic.

(ii) For cross-section data, at any one time, different units will have accomplished different degrees of adjustment towards profit-maximizing factor combinations. In fact the discrepancy between actual and "best practice" combinations may reflect differences in managerial quality across firms.[3] The analogous problem

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[2]This becomes particularly important if the inputs are foreign (and domestically non-substitutable) and a foreign exchange constraint is operative.

[3]This is really one dimension of excluding management as a separate factor of production.

for time series data is the implicit assumption of full adjustment within the observation period. Attempts have been made to model lagged adjustment behaviour; [130 ; 163]. But mis-specification of the lag-structure biases the estimate of $\sigma$.

(iii)  To correspond to points on a production frontier, the value-added data used should be value-added at "capacity". With few exceptions [20], the studies do not make adjustments for under-utilization of capacity.

(iv)  All studies need to assume that the observed production units employ techniques derived from the same production function. This would appear to be a particularly difficult condition to satisfy for a cross-section of units in LDCs. The breach of the assumption would imply that the econometric estimates of $\sigma$ relate not to the substitution possibilities of a unique production function, but rather they reflect, in some average way, the "varying responses to market conditions of firms producing with different vintages of technology" [130, p.3]. For estimation based on time-series data, the analogous problem is that of correctly specifying the nature of technological change.

(v)  All too often the definition of sectors is so aggregative, that the elasticity of substitution estimates based on time series data subsume substitution of one kind of products for another intra-sectorally. This change in output mix may or may not be due solely to changes in factor prices. In both cases the meaning of the measured elasticity is unclear.

(vi) Again, if time series data from an inflationary situation are used, undeflated [65], then, assuming the CES captures the true production relation, variations in the rate of inflation bias the estimate of $\sigma$ towards unity [110]. Even in cross-section, if undeflated data are used and prices are positively correlated with nominal wages, a bias towards unity occurs [107].

(vii)  For cross-section estimates the neglect of differentials in quality of labor across observation units biases the estimate of $\sigma$ towards unity [60].

A number of direct estimation procedures have emerged over the past decade [44; 45; 80; 81; 105; 169]. However, none of these estimation procedures and other more sophisticated variants in the pipeline have yet been usefully deployed on LDC data. Until they are, the strictures levelled against the indirect estimation method remain pertinent.

## III. CHOICE OF TECHNOLOGY: WHAT DO MICRO-STUDIES
## TELL US ?[4]

### Some Early Case Studies

Some of the best early micro-studies on the choice of technique were done in the Netherland Economic Institute during 1956-62 by a research team headed by Gerard K. Boon.

The results were published in a series of progress reports; Boon, *et al.* [28;-29; 30; 31; 32]. Much of the work was subsequently synthesized in Boon [33]. Boon presented detailed analyses of alternative methods for "single, isolated" industrial processes such as metal-turning and metal-facing, for "a group of processes" which together produce a specified industrial product (in his case, woodworking to produce window frames), for "single" agricultural processes such as ploughing and making field trenches, and for a "group of processes" in producing foodgrains. In each case attempts were made to cost techniques for different output scales to arrive at optimal techniques given scale and factor prices. The broad conclusions Boon derived from these studies were:

(i) for industrial processes, profit-maximizing (cost minimizing) factor proportions were quite sensitive to factor prices for "lower output brackets", but such sensitivity diminished with higher output ranges, where capital-intensive techniques tended to be optimal over wide ranges of factor prices,

(ii) for agricultural and earth-moving processes, the available range of efficient techniques was generally wide, "regardless of the volume of production", implying substantial sensitivity of cost-minimizing factor proportions to factor prices.

Another early set of micro-studies on choice of technique was precipitated by the debate on Indian policy vis-a-vis employment potential of small-scale industries,in the late 1950's and early 1960's. Bhalla[24;25] conducted studies comparing alternative techniques for cotton spinning and rice milling, while Sen [133] analyzed technological choices in cotton weaving.[5] In cotton spinning Bhalla found traditional labor-intensive methods more profitable at prevailing factor prices than factory methods, but the Gandhian Ambhar Charka was inefficient relative to both the other techniques at prevailing prices. In rice milling, the scale economies associated with machine milling were large enough for Bhalla to find these techniques more profitable to a variety of hand-pounding methods, at the

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[4]What was stated earlier in general, holds true for this section. It is not a comprehensive review of literature on micro-studies. That would unnecessarily duplicate some recent review studies such [66; 101; 145; 146].

[5]See also Dhar and Lydall [51].

prices employed in the comparison.[6] In a more sophisticated analysis, using shadow prices to cost factors, Sen found the labor-intensive fly-shuttle hand-loom technique to be much more socially profitable than the automatic power loom in Indian cotton weaving. Unlike Boon's investigations, these studies did not explore the implications for profitability of alternative techniques as factor prices were varied. In other words, the scope for efficient factor substitution was not systematically studied.

These early studies have been subjected to several criticisms by recent, researchers : [7]

(i) Stewart [145] characterizes Boon's insistence on product homogeneity for technique comparisons as a source of downward bias in computing the scope for capital-labor substitution. She argues that the traditional investigation of scope for factor substitution in two stages, at the product-mix level stage, tends to encourage "adopting different definitions of product at the different stages of the argument" [145, p. 111].[8] Typically, the variability of factor proportions from altering product-mix are investigated at a fairly aggregated level. But when intraproduct technique choice is explored, the premium placed on product homogeneity leads to over-specification of the product so that it is no longer representative of the output category from which it is taken. And over-specification tends to squeeze out choice of technique. To reduce this danger from combining noncomparable product definitions, Stewart advocates replacing the product-mix/technique-choice sequence, with a sequence which would encourage exploration of the possibility for "varying goods (in terms of physical characteristics) for fulfilling given needs" [145, p. 111].[9]

(ii) Like production function analyses, most micro-studies fail to account for indirect capital/labor requirements of alternative process [83]. Such neglect refers not just to requirements for intermediate goods and services used in the processes under study, but also to the factor requirements for producing the different capital goods used in the different processes. On the latter point, in the absence of neoclassically perfect markets, purchase values of different capital

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[6]A number of objections can be made against Bhalla's assumptions for costing factors, particularly capital.

[7]For those wishing to broaden the sample of research reported here, a number of other references (by no means exhaustive) may be cited : UNECLA [157] studies of textiles in Latin America, a series of studies by Baranson [11; 12; 13; 14; 15] focusing on the vehicle industries, Marsden [96] and Sharpston [137].

[8]Emphasis mine. If the definition did not alter, this criticism of Stewart's would be irrelevant.

[9]Her analysis draws on Lancaster's [85] attempt to reshape consumer theory in terms of basic human needs.

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assets cannot be taken as adequate measures of "capital" directly required for the process.

(iii) Most importantly, the characterization of alternative processes or techniques for manufacturing a given product or service, as a point in two-dimensional capital-labor space is either ludicrously naive or must encapsulate a series of economic/engineering choices at different "stages" encountered in the manufacture of the product. Even simple products boast numerous stages of production, each of which could be conceptualized as a "process" allowing certain choices.[10] Nor are choices at each stage independent of choices at earlier and subsequent stages. And the potential of joint production possibilities at each stage seriously complicates matters. These, and other points, silhouetting the complexity of real-world production against the naive backdrop of economic theorizing, have been forcefully made by Nam, Rhee, and Westphal [106], Sharpston [137] and Stewart [145].

### More Recent Research: The ILO Program

Since early 1972 the ILO has sponsored a major research program on Technology and Employment as a substantial component of the World Employment Program's employment-related research. The program has begun to yield a rich crop of micro-studies, some finalized, some in early draft form and some ongoing. [11]

The studies on the employment implications of different agricultural production techniques emphasize that, in this area, choice of technique (from a given production function) questions are inextricably linked with technical progress questions (i.e., shifts in the production function). They also underline the importance of natural resource factors such as soil quality, terrain and climate in defining the scope for adopting alternative techniques [142]. Another important complication in predicting employment implications of adopting alternative techniques, found by researchers, is the relative importance (and differential impact) of alternative organizational modes (e.g., capitalist vs. family farms) under which the labor input is utilized in agricultural production.

In manufacturing, the two studies of cotton and jute textiles, constitute interesting explorations of the rationality of using older used equipment in preference to the latest machines, in new LDC textile ventures. Pack [112] draws on the detailed industrial information compiled by the U.K. Textile Council [155]

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[10]Stewart [143] disaggregated the production of a simple commodity, cement blocks, into eight separate stages of production.

[11]See ILO [70] for a complete listing.

in its effort to gauge the viability of the U.K. textiles industry in the face of competition from low-wage countries. Despite several qualifications, Pack [112, p.3] feels that his analysis "suggests that at factor prices relevant for many poorer countries, the choice of used equipment would be optimal". One of the major qualifications is the legitimacy of Pack's assumption that the "productivity of the various vintages or types of equipment would be the same in the LDC as it is in the U.K." [112, p. 31]. Cooper and Kaplinsky's [46] study of the economic appropriateness of second-hand jute processing machinery in Kenya underlines the fragility of this assumption. They highlight the much greater uncertainty and risk, from the purchaser's viewpoint, clouding the technical efficiency of old, transplanted equipment, compared to new. Such uncertainty invalidates generalizations about the economic appropriateness of older used machinery for LDCs. But both studies indicate that with careful selection second-hand textile machines can often be the optimal technique in LDCs.

The two studies of techniques of road construction, which have issued progress reports so far, both point to the presence of efficient alternative techniques. Lal's [84] work is based on *ex ante* engineering data for a 5.76 km. pilot gravel road. Lal uses Little-Mirrlees [89] project evaluation procedures to show that the labor-intensive technique is more socially profitable at both market and shadow prices.[12] When it comes to concrete paving of the gravel road, the capital-intensive technique is marginally cheaper at market prices and the ranking becomes sensitive to the specification of shadow factor costs. The study by Irvin, *et al.* [71] includes a sample of five roads. The choice of optimal technique was found to be sensitive to specification of distributional and intertemporal weights. Incidentally, the UNIDO system of shadow-pricing was adopted, thus complicating comparisons with the Lal study. The five-road sample permitted the researchers to demonstrate that the factor-input requirements of the alternative techniques varied with road type and terrain, thus sounding a caution on generalizations about appropriate road construction techniques based on single pilot-case studies.

## Other Studies

The World Bank has been participating in several major research projects in the field of technology choice. A research project on civil construction draws on direct observations of road construction techniques in India, Indonesia and Nepal. Even more than the ILO road construction studies (the IBRD project

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[12]In these comparisons between different techniques of road construction the term "technique" is used as a short-hand form of reference to a particular set of techniques used, one for each of the "tasks" into which road construction was disaggregated for analysis.

was launched before these) this study disaggregates road construction into sub-components: "tasks" and "activities", and prepares alternative input-output coefficients for them [64, p. 13]. The authors claim that "the study clearly indicates that labor-intensive construction techniques traditionally practiced in many developing countries are not economically competitive with equipment-intensive technology under most conceivable factor prices and environmental conditions" [64, p. viii]. This strong claim conflicts with the results of the two ILO studies discussed earlier. A thorough relative evaluation of these studies would constitute a major exercise, outside the scope of this paper. Suffice to say that much of the discrepancy in results appears attributable to different input productivity assumptions. While the more thorough development of engineering data in the IBRD study might vest it with stronger credibility, caution suggests that the concluding remarks of one of the ILO studies have captured a more prudent tone: "these conclusions remain tentative primarily because of the lack of firm, relevant technical data on the local relative productivities of men and machines" [84, p. 196].

Another World Bank study entailing detailed modelling of the Mexican agricultural sector yields some interesting results on factor substitution. Based on simulations with the 33-crop CHAC model [53;108] conclude that if factor-substitution in the agricultural sector is interpreted to refer to substitution between agricultural machinery and on-farm labor (hired and own-account), holding other factors constant, then the elasticities are very high, ranging from 1.0 to above 3.0, varying with different isoquant definitions empoloyed in their study. Amongst other things these results highlight the importance of disaggregating capital stock concepts into appropriate sub-categories for sectoral factor-substitution investigations.

The above account of ongoing micro-study research into choice of technology is by no means exhaustive. Two other significant research efforts deserve mention in even an incomplete review. The University of Strathclyde's Overseas Development Institute is engaged in a major project to investigate choice of technique (and the reasons for appropriate and inappropriate choice) in a wide spectrum of industrial sectors in LDCs. The results of pilot investigations into sugar refining and footwear manufacture in Ghana and Ethiopia have already been reported in Pickett, *et al.* [116]. Meanwhile, the Yale University Economic Growth Centre has begun work on a three-year research effort into micro-economics of industrial technology choice under the overall direction of Professors Ranis and Fei.

## IV. FACTOR PRICES AND OUTPUT-MIX

There is hardly any empirical work which quantifies the dimensions of the influence of factor prices on factor proportions via the output-mix ..."indirect substitution" as it is sometimes called [42]. This is not because choice of output-mix is seen to offer little scope for improvements in total economy-wide factor proportions employed. Quite the contrary. Many analysts feel that variations in output-mix provide the best hope for altering economy-wide factor proportions in the desired direction. Much of their optimism comes from a faith in highly elastic foreign demand for possible labor-intensive LDC exports [10; 21; 22;- 68; 79; 87; 90]. But these same analysts tend to relegate the scope of factor-price intervention for altering output-mix to the background, preferring to focus on the structure of output taxes and subsidies, explicit or implicit in the foreign trade/exchange and fiscal regimes.

On the face of it this tendency would appear to conflict with the theoretical dicta of the literature on optimal intervention in the presence of domestic distortions.[13] This literature teaches that if the distortions (from competitive equilibrium) are in the factor markets, first-best correctives should focus there. But in arriving at these conclusions the models assume competitive conditions in all areas of the economy save for the factor market distortions under analysis. As against this, the OECD studies referred to earlier, dwell on economies cluttered with myriad foreign-trade controls and tax-subsidy interventions which underlie broad import-substitution strategies. In such contexts, the focus on reforming output taxes and subsidies, implicit or explicit in foreign trade/exchange and fiscal regimes is a theoretically sound strategy for altering an economy's output-mix to bring it in closer correspondence to the country's comparative advantage.

"Getting the factor prices right" can, of course, also play a role in bringing the economy's production mix more in line with its comparative advantage. After all, variations in factor prices also influence the relative profitability of different products. But this influence is filtered through the complicating choice of technique factor, making the final effect on relative sectoral profitability much harder to predict.

Conversely, when looking at historical data on the evolution of output-mix in a country, it is extremely difficult to isolate the effect of altering factor prices from all the other influences on relative profitability, stemming from changes in

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[13]This literature is now voluminous. Two classic pieces are Bhagwati and Ramaswami [23] and Johnson [73]. For a recent literature survey, see Magee [95].

effeotive tariffs, quotas, domestio output tax/subsidies, price support schemes and suoh. Over fairly long time-spans, the influence of altering faotor prices may, sometimes, be qualitatively disoerned. Ranis [121], interprets the ohanging composition of Japanese output-mix (and techniques for each produot) between 1868 and 1930 from an initial dominance of labor-intensive products for foreign and domestio markets to gradually increasing importance of capital intensive production as a response to altering faotor endowments and prices. But even over this long historioal cyole, he does not try to distinguish the factor price effects from other "prioe variables" whioh undoubtedly affected the character of Japanese development.

## V. DO PRODUCERS RESPOND TO PRICE SIGNALS IN CHOOSING TECHNIQUE ?

Granted that for a wide range of products there is considerable choice of teohnique, do entrepreneurs respond to factor prices in making their choices, or are they guided by other desiderata which swamp the factor price signals.? Before oiting some research which throws up cases of "perverse" (that is non-oost-minimizing) behaviour, a few oautionary remarks on the notion of "available teohnology" are in order.

The phrase begs the question: to whom and at what prioe ? Even the range of "best-practice" techniques, at the ourrent "state of the art" (that is abstraoting from teohnical progress) is not a sharply defincd set from whiçh produoers may hypothetioally shop. For example, nearly all responses of the Intermediate Technology Development Group[14] for information on available teohnology have involved both the transfer of information on the "state of the art" and minor innovations [146]. And even if we grant a more or less definable set of "best-praotice" teohniques at the ourrent "state of the art", access to this set varies enormously amongst produoers. Information oosts money, and since the market for information is very imperfeot, the price for the same unit of teohnologioal information oan vary enormously amongst produoers.[15] The problem of imperfeot information on "best praotice" technology is severely compounded when the souroe of information is foreign. For industrial sectors, where LDCs are usually heavily reliant on technology imported from developcd countries, the dynamio labor-saving bias of innovations in these countries [113 ; 146] is

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[14]The now famous institute founded by Dr. Schumacher.

[15]This in turn points to major socially profitable roles for transfer mechanisms (including technology institutes) to close and equalize the gap between "best practice" possibilities and actual choices faced by the producer.

likely to make the latest maohinery the least appropriate from the LDC's viewpoint. Yet these are preoisely the items on whioh foreign salesmen are best informed.[16] Information on foreign seCondhand maohinery is muoh scantier. And, abstracting from the temporal dimension, the effect of aid-tying and the spread of developed oountry based multinational oorporations, both work to bias a poor country's teohnology shopping against foreign souroes whioh may reflect factor endowments oloser to that of the importing oountry [146].

Choioe of "inappropriate" technology may ocour due to either lack of information to or non-oost-minimizing behavior by the decision maker. An illustration is provided by the ongoing, and muoh-mentioned, University of Strathclyde research on ohoice of technology. In a preliminary paper, Picket, *et al.* [117] report on oases of inappropriate technique choice in sugar production in Ghana and footwear produotion in both Ghana and Ethiopia. Using process information from a variety of oountries, Picket, *et al.* oonclude that (a) there is substantial choice amongst "best practice" sugar production teohniques, (b) even at "distorted" market (and more so at shadow prices) the labor-intensive Khandsari teohniques were more profitable than the oapital-instensive vacuum pan prooess, and yet (c) the oapital-intensive prooess was actually ohosen. Similar paradoxioal behavior is reported for footwear production, with the important differenoe that the teohniques oosted and compared were not actually in use any-where, but were "'synthetio' techniques ...(which) have no counterpart in reality. They are, however, teohnologically feasible combinations of existing sub-processes or operations" [117, p. 49].

Picket, *et al.* attribute the paradox to the "malign influenoe of the engineer and...the oonceit of the economist" [117, p. 51]. More simply, engineers trained in developed (oapital-rioh) oountry moulds embody a labor-saving bias in their mapping of blue-print choioes. Beoause they love machines, they only design ohoices amongst a small range of oapital-intensive options. And economists, imbued by the Schumpeterian conoeit that teohnical choioes nurtured in a given economio environment must reflect the prevailing scarcities, do not conduct independent searches for possible techniques from other parts of the production function.

A study whioh directly ohallenges the strength of the cost-minimizing/ profit-maximizing hypothesis is Wells' [161] analysis of technique choices in half

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[16]Pack and Todaro [113] however, are skeptical about the potential of older imported machi-nery for optimal technology decisions. They favor indigenous capital-goods industries structured to bias technological progress in favor of labor-intensive segments of the isoquant map.

a dozen light manufacturing industries in Indonesia.[17] In most of these industries the co-existence of alternative techniques (in the same country at the same time) makes it difficult to use "inadequate information" arguments to explain inappropriate technique choices. Wells argues that businessmen are not solely "economic men" who are driven by motives of profit-maximization/cost-minimization, but rather they embody a more complex objective function which includes "engineering man" love of automation and machines *per se*. As to the relative importance of the two motives, Wells sees this as varying with market structure. In a competitive industry, "survival" of the firm rests on the dominance of "economic man" over "engineering man". But if the entrepreneur is a monopolist (foreign or domestic) he is much more likely to indulge the "engineering man" aspect of his psyche with non-profit-maximizing, capital-intensive technique choice.[18]

Wells' analysis is often qualitative and difficult to grapple with. In particular, the complexity of his hypothesized objective function (for entrepreneurs) makes for limited stability. In any case, Wells is not saying that factor prices don't matter, but that in certain situations (of monopoly and oligopoly) they may not be the only explicands of technique choice. Such a position certainly complicates the already difficult task of predicting factor demand changes arising from manipulated factor-price changes. But it does not vitiate the policy role of factor-price intervention.[19]

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[17]Fifty plants were sampled in six industries : plastic sandals, cigarettes, soft drink bottling, bicycle and betjak tires, flashlight batteries and woven bags.

[18]One group of private producers have recently attracted growing attention about their factor proportion response to factor prices. These are the subsidiaries of developed country multinationals (mainly from the U.S) in LDCs. According to conventional wisdom these units follow metropolitan production design and do not adapt factor combinations in response to local factor market conditions. Available research offers weak support for this view. Yeoman [167] found little difference in factor-proportions between metropolitan and LDC subsidiaries of thirteen U.S. firms. Though suggestive, the evidence is not conclusive without supporting information on choice of technique. Arguing that local firms might use more appropriate techniques, if these were available, Mason [97] compared factor proportions of U.S. subsidiaries and locally-owned firms in Philippines and Mexico, making comparable products. His tests were not conclusive in showing a bias in favor of capital-intensive techniques by multinational subsidiaries. In a preliminary comparison of metropolitan U.S. units and their Brazilian subsidiaries in metal-working industry. Morley and Smith [103] do find differences in factor prices between Brazil and the U.S. While hinting at relatively little scope for capital-labor substitution, they are cautious to point to the satisfying behaviour of the Brazilian subsidiaries which inhibits them from searching for labor- intensive alternatives.

[19]It is difficult to disentangle this "machine love" hypothesis from an alternative explanation, often put forward by entrepreneurs, which attributes apparently "inappropriate" technique choices to the non-monetized costs associated with managing labor. In this view wages constitute only a component of cost of labor as perceived by employers.

Given the explanatory power of the profit-maximizing hypothesis in so many other areas of economics, including even amongst allegedly tradition-bound peasant farmers,[20] it would be very unusual if private agents suddenly abandoned such motives when it came to technique choice.[21] And even in the arena of technique choice there is considerable quantitative, but nonrigorous, evidence of private agents responding to factor prices. In most countries fragmented factor markets ensure widely divergent factor price relatives between "formal" and "informal" sectors, with the latter facing a much higher relative price of capital. This is associated with the coexistence in the same "industry" of capital-intensive techniques in the formal sector with labor-intensive techniques in the informal sector.[22] And such association is certainly consistent with profit-maximizing hypotheses. Problems with product homogeneity, quality differences and conceptual difficulties of including the time dimension, render it difficult to make stronger statements based on such associations.

## VI. FACTOR PRICE INTERVENTION: WHAT LESSONS FROM THEORY?

The hypothesis that factor prices have some (undetermined in magnitude) effect on economy-wide factor combinations leaves open the question of the role, current and potential, played by fiscal/financial elements. One can readily enumerate fiscal/financial features which may be presumed to have a direct influence on relative factor prices :[23]

-payroll taxes; social security contributions ;

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[20]See, for example, literature on price-sensitivity of farmers referred to in Krishna [82] and Behrman [19]. Schultz [132] discusses studies supporting allocative efficiency by traditional peasants.

[21]This does deny that public decision-makers often make decisions including those on technique, for considerations other than profit-maximization. Thomas [152] records the choice of an intermediate (in preference to labor-intensive) technology for tubewells in Bangladesh (the then East Pakistan) because of the organizational preferences, "machine love" and other prejudices of both the aid donors and the local implementing agencies, even though the labor-intensive technique was socially more profitable.

[22]See, for example, Khan [78] and Acharya [1] for such a view of Pakistan and Ranis [125] for Taiwan.

[23]A caveat is in order here. While all fiscal/financial intervention in a general equilibrium model may influence equilibrium factor prices ("everything depends on everything else")'this paper is restricted to interventions which bear directly on factor prices. Furthermore, this section is somewhat low brow and positivist in spirit. It is more concerned with how different fiscal/financial interventions may be expected to influence factor prices than with pronouncing on optimal degrees of intervention. There is a body of formally elegant literature on optimal taxation, which should, in principle provide guidance on the latter aspect. See, for example Diamond and Mirrlees [52] and Dasgupta and Stiglitz [49]. The practical utility of these theoretical results is quite another matter.

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-taxes/subsidies on wage goods ;
-labor subsidies ;
-interest rates/credit availabilities ;
-investment allowances and tax holidays given profits and/or corporate income taxation ;
-discriminatory tariffs on capital equipment ;
-foreign exchange allocation regime;
-taxation of capacity.

*Prima facie* it would appear to be a simple matter to aggregate the incentives/ disincentives of these measures and form a judgment on the extent to which they make relative factor prices different from what they would otherwise have been. One could then evaluate the efficiency of the various instruments in terms of bringing about a specified change in relative factor prices with minimum distortive reperoussions elsewhere in the economy. Based on such an evaluation one would choose to retain and expand the scope of certain instruments and jettison others. Unfortunately, matters are not so simple. The anticipated impact of different interventions on relative factor prices depends crucially on the underlying general model of the economic system. This section illustrates this proposition with a couple of examples from the theoretical literature. It goes on to question the utility of such simple models for assessing the effect of intervention, pointing out key real-world features, such as fragmentation of factor markets and non-zero, non-infinite factor supply elasticities, which need to be incorporated in the analysis.

### The Peacock/ Shaw Analysis

One route in search of theoretical guidelines is partial equilibrium and micro-economic. This is the approach taken by Peacock and Shaw [114] in their OECD review of fiscal policies for employment. They analyze the first order profit maximizing conditions of a firm which is assumed to produce according to a two-factor, constant returns to scale Cobb-Douglas production function and to purchase factors in competitive markets at fixed prices. For "convenience" they further assume that the output demand curve facing the firm is such as to imply a rectangularly hyperbolic marginal revenue curve. This allows them to analyze the effects of fiscal interventions knowing total firm outlays on factors to be constant. Within this restrictive framework it is easy to show that the profit maximizing level of employment of each factor depends solely on its price and that factor's exponent in the production function. And since the factors are assumed to be in perfectly elastic supply to the firm, a factor tax (subsidy) changes the factor price by the full amount of the tax (subsidy). This means that subsidy (tax) on labor will

inorease (decrease) both output and employment without affecting the optimal quantity of oapital, while a oapital tax(subsidy) will reduoe both output and the quantity of oapital used, without influenoing the employment of labor.

Peaoock/Shaw reoognizes the embarrassingly optimistio soope for faotor subsidies in this purely mioro-eoonomio framework. To injeot some notion of alternative resouroe oost at the maoro level, they informally introduoe a government budget oonstraint. This is done by assuming "every firm in the eoonomy pays an equivalent amount of tax for any subsidy reoeived" [114,p. 69]. The effeots of suoh oompensated fisoal intervention are then analyzed. It is shown that a oapital tax (oompensated by an equivalent output subsidy) and a labor subsidy (oompensated by an output tax) both lead to smaller firm output, higher labor employment and lower oapital use than in the oase of no fisoal intervention. In other words, employment of labor oan be inoreased, but there is an output-employment tradeoff. Peaoook/Shaw also show that "the employment impaot of the two self-finanoing measures will not be identioal for fisoal measures of equal size". The effect will depend on the size of the Cobb-Douglas exponents. In partioular, if the labor exponent (whioh also models labor share in output for Cobb-Douglas under oonstant returns) is greater than 0.5, as eoonomy wage shares would lead one to believe, then oapital taxation is more effioient than labor subsidy in terms of employment inorease "per unit of fisoal intervention". For this and administrative reasons Peaoook/Shaw prefer oapital taxation to labor subsidy.

The Peaoock/Shaw analysis is subjeot to a number of serious, and oumulatively fatal, objeotions:

(i) the generality of their results at the mioro-eoonomio level is severely qualified by their very speoifio assumptions about oonditions of production and output demand;

(ii) their oonoept of oompensated fisoal interventions is, at best, arbitrary;

(iii) their use of an informally treated eoonomy-wide budget oonstraint to transfer the results of mioro-eoonomio, partial equilibrium analysis to the general, maoro-eoonomio level is theoretioally insupportable. Indeed, there is even an element of internal inoonsistenoy in their reasoning. While they reoongnize the need for inoorporating an eoonomy-w$_i$de oapital oonstraint into the analysis [114,p.69], they do not do so explioitly, being oontent to hint that their introduotion of the budget oonstraint is an adequeate proxy. This won't do. It is easy to show why. The oompensated oapital tax oase leads to more employment of labor, less of oapital, less output for all firms, oompared to no fisoal intervention. This means, oompared to the latter situation when, *ex hypothesei,* oapital stook is fully utilized (otherwise it oan't be a oonstraint on

output), compensated capital taxation releases some capital. Where does it go? The budget continues to be balanced, but capital is now under-utilized. In other words, the assumed capital constraint has not been properly accounted for;

(iv) most important of all, the Peacock/Shaw assumptions of perfectly elastic supply of both factors at the micro level, cannot be transferred meaningfully to the macro setting. And if, for the economy as a whole, these factor supply elasticity assumptions cannot be made, then the whole question of how factor taxes (subsidies) will affect equilibrium factor prices becomes moot and central to the evaluation of factor employment effects. To sum up, the Peacock/Shaw analysis is theoretically too unsound to form a basis for intervention policy. In particular, the absence of an explicit general model tempts them to illegitimately transfer micro-economic results to the macro level.

## The Ahluwalia Model[24]

In pleasing contrast to the Peacock/Shaw work, Ahluwalia [4;5] tackles the assessment of fiscal intervention on factor prices in an explicitly hypothesized, though simple, formal model pitched at the general level.[25] The economy is assumed to be partitioned into two segments. The overpopulated subsistence segment produces "food" for its own consumption with an unspecified technology, but with zero marginal product of labor. It has no product or capital flow links with the modern segment. Its only role in the model is to offer a perfectly elastic supply of labor to the modern segment in a two-sector economy, with "food" and "manufacturing" produced according to two-factor, constant-returns-to scale neoclassical production functions. Within the modern segment factor and product markets are assumed perfectly competitive and capital is conveniently assumed to be a "homogeneous, malleable, physical commodity". The minimum wage in the modern segment is fixed in terms of food.

Ahluwalia shows that under these assumptions, for a given minimum real wage, the model yields an equilibrium solution for the modern segment of the economy where the following are determined :

(i)    choice of technique in each sector;

(ii)    relative price of manufactures to food;

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(iii)   the production possibility curve;

(iv)   the level of employment.

Heuristically, fixing the minimum real wage in terms of food immediately yields the profit-maximizing technique (the K/L ratio) and profit rate in the food sector (a convenient property of constant return to scale).   Competitive factor markets. ensure that the wage-rental ratio in food also prevails in manufacturing, immediately yielding the choice of technique in that industry.   And in this model there is a one-to-one relation between factor price ratios and product price ratios.   So once the first is known the latter is determined.   Given the modern segment capital endowment and the K/L ratio in each sector, labor employment in the modern sector is known.   And the production possibility "curve" is a locus of profit maximizing production combinations for the given product price ratio (corresponding to the minimum-wage-determined factor price ratio) for differing levels of modern segment labor employment, given the modern segment capital stock.[26]

Ahluwalia goes on to show that a general labor subsidy increases both output and employment in the modern segment of the economy.   Basically, a labor subsidy involves working through the model for a lower effective minimum real wage.   As one would expect this implies an outward shift in the production possibility "curve", or, in other words, the economy now works on a higher Rybczynski line, corresponding to the lower minimum real wage.   Conversely, a general labor tax would reduce employment and output in the modern sector.   So the micro-economic percipation of Peacock and Shaw (not to mention conventional wisdom) survives transfer to this more general model.   The same cannot be said for a general capital tax.   In sharp contrast to the Peacock/Shaw analysis and conventional wisdom, such a tax (or subsidy) leaves equilibrium output, employment, and choices of technique unaffected.

The reason for this assymetry in factor taxation is straight forward.   It simply reflects the assymetry in assumptions about the elasticity of factor supply to the modern segment.   Labor is assumed to be in perfectly elastic supply at the given minimum real wage.   So any tax (subsidy) on labor shifts the supply curve by the full amount of the tax (subsidy).   It is not borne (enjoyed) by labor.   In contrast, the fixed stock of capital, like Ricardian land, bears the full burden of a capital tax.   Its effective price from the production view point is not altered by the intervention.   Owners of the factor have to settle for lower (by the amount of the tax) rewards.

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[26]It is in fact a straight line in this case and trade theorists will readily recognize it as simply the Rybczynski line for a given product price ratio [131].

**What Lessons ?**

Some lessons oan be drawn from this brief disoussion of two attempts to oreate an analytical framework to assess faotor-prioe interventions. First, the most general and also the most important lesson isthat the optimal ohoioe of intervention instruments is sensitive to speoifioation of how the eoonomy works. To draw the same lesson differently, the assessment of the distortive influer.oe of existing faotor-prioe interventions is sensitive to assumïptions about the eoonomy. Seoond, and morepartioularly, the transfer of results derived from mioro-eoonomio analysis to a general level is an exeroise fraught with danger. This should not be interpreted to vest the partioular general model disoussed here, Ahluwalia's, with legitimaoy. While it offers a oorreotive view on Peaoaok/Shaw's partial equilibrium work, many of its assumptions (to whioh the analytioal results are sensitive) oonfliot with reality. In this oontext, it is important to raise two important questions relating to faotor supply oonditions and faotor market fragmentation.

**Factor Supply Conditions**

Nothing was said in earlier seotions about faotor supply oonditions. Onoe one departs from the polar assumptions in Ahluwalia and other Lewis-type [88] labor-surplus models, the evaluation of faotor-prioe intervention beoomes enmeshed in tax inoidenoe theory. The question is how effeotive is a given faotor-prioe intervention in aotually ohanging faotor prioes? Most of the empirioally-oriented oontroversy has oentered around who bears the payroll taxes for sooial seourity. [27] Suoh taxes usually have two oomponents, the employers' oontribution and the workers'. Treating both as one tax paid by employers for the moment, in the Lewis-type model there is no shifting of the tax at all. The employer bears the full burden and the tax fully inoreases the oost of labor to produoers. The opposite oase would oooour if the supply of labor were oompletely inelastio. Employers oould then shift the entire tax to workers, reduoing the latters' take home pay by the full amount. Sinoe the oost of labor to produoers would be unohanged, the tax oould be deemed to have no distortive influenoe on faotor prioes. If labor supply oonditions fall between these two-extremes, the degree of shifting oan no longer be deduoed on the basis of supply alone. [28]

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[27]Lent [86] and Prest [119] provide good discussion of the question. One the importance of payroll taxes in social security finance, Reviglio [127] provides cross-country data. For more general reviews of tax incidence theory, see Miezkowski [98] and McLure [93]. Brittain [36] provides one of the few attempts at empirically establishing the incidence of such taxes.

[28]As elsewhere in this Section, the discussion assumes a general factor tax (subsidy). The effect of selective measures is usually more complex, sometimes indeterminate and obviously depends on the nature of the selectivity.

Given the importance of the incidence issue to the question of how factor tax-subsidies influence factor prices and combinations, one might expect considerable empirical literature in this field. But that expectation is disappointed. Brittain's [36] investigation into the incidence of social security employers' taxes, using cross-country data for manufacturing sectors, is an exception. His overall finding was that "the presence of a payroll tax on employers tends to reduce the wage in dollars by roughly the amount of the tax" [36, p. 122]. And Brittain seems to take it for granted that the employees' tax is borne fully by them. He does not hesitate to draw, for his results, the conclusion that "payroll taxes are neutral with respect to the allocation of capital and labor in the aggregate and within a given industry".

Brittain's theoretical reasoning and econometric methodology have been seriously challenged by Feldstein [54]. Without going into the details of the rather acrimonious debate which ensued, one can extract the central point, namely, the acceptance by Brittain [37, p. 740] of Feldstein's charge that the former's estimated equation for modelling the shifting of the employers' tax can be interpreted as just the demand function for labor. It says nothing about supply. The estimated positive "shift" parameter then simply implies "that the payroll tax comes out of the real demand price for labor" [37, p. 742]. This is not a particularly startling result. It is certainly not equivalent to the claim that these taxes are "neutral with respect to the allocation of capital and labor". That conclusion would only be valid if supply was perfectly inelastic. Brittain's theoretical reasoning in favor of such inelasticity is flawed and is totally at variance with the long (almost venerable) tradition of labor surplus/dual economy theorizing. The proper econometric approach to the problem would involve specifying (and identifying) separate demand and supply function for labor. This remains to be done.

As for supply elasticities for capital the existing stock of physical capital may be taken to be in perfectly inelastic supply, though utilization can clearly vary.[29] But increments to the existing capital stock, through savings-investment, could be sensitive to the anticipated return. Most of the literature on savings determinants, however, suggests that income and rates of change in income are the main determinants of an economy's domestic savings [99; 141], and the price of this fresh capital only becomes important for allocation between alternative techniques and sectors.[30]

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[29]Changes in utilization do create further conceptual difficulties for the "price of capital". As Winston [29] points out, what neoclassicists, such as Jorgenson [74] have termed the "service price of capital", is in fact the "price of owning a capital stock for a period of calendar time" which is not the same as a price for machine-hours used.

[30]We abstract from price-induced inter-country capital flows.

**Factor Market Fragmentation**

A second important criticism of . the Ahluwalia model, applies to both factor supply and demand conditions, and raises the most intractable problems of both theory and practice. Basically it urges recognition of factor market fragmentation in the assessment and design of factor-price intervention. This is easier said than done. Given the existence of multiple, imperfectly linked markets for factors, it is no longer clear that focusing on factor-price intervention in one market is all that important. Heuristically, it would appear that efforts at market unification should be the first order of the day. The simulteneous prevalence of different factor prices in different sub-markets suggests scope for efficiency gain via inter-market factor allocations, quite apart from any intervention policy designed to correct (alter) prices in the ultimately unified markets. And the design of strategies for factor market unification may require a very different kind of focus, dwelling on the impediments to inter-sub-market factor flows and the correction of discriminatory pricing of factors amongst different sub-markets. At the very least, factor-price intervention policy aimed at one sub-market should recognize and allow for reperoussions such a policy may have (possibly perverse) in other sub-markets.[31]

## VII.  CONCLUSIONS\

The time has come to bring together the perceptions and prejudices arising from the review of issues conducted in this paper.[32] The paper began by outlining four main types of limitations to the "scope for factor-price intervention to shift to efficient factor combinations with more employment per unit of capital in the economy". The summary perceptions may be grouped in the same format.

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[31]The importance of diagnosing inter-sub-market linkages for formulating first-best intervention policy, is illustrated, for labor markets, in the simple model by Harris and Todaro [66].

[32]To repeat the obvious, this review of issues has been selective. Two important ommissions deserve emphasis. The first refers to income implications of alternative technique choices. This "loops" back to output-mix question via demand patterns and, in a more dynamic dimension, to incremental capital availability via savings implications. The last feature has received enormous attention in the project evaluationliterature, see, for example, Sen [133], UNIDO [158] Little and Mirrlees [89] and Acharya [2]. Stewart and Streeten [146] and Sen [134] provide the best discussions of future employment implications of today's choice of techniques. The second, related, omission concerns the neglect of any discussion of a social welfare function, which is essential for deriving the "shadow prices" of factors, presumably the "target" prices of fiscal/financial intervention. See Sen [134].

## A. Technological Substitution Possibilities within a "Sector" or "Product"

The main conclusions here were:

(i) The mountain of work on production function estimates of capital-labor substitution has produced fairly untrustworthy mice. The theoretical and empirical objections to this approach warn against further research investment in this area.

(ii) Detailed micro-studies are a viable alternative. Their close resemblance to project choice questions bring them into a genuine policy crucible, and nudges researchers towards a more realistic understanding and modelling of engineering options.

(iii) The main analytical inconvenience of micro-studies of alternative techniques is their failure to yield summary measures for the scope for capital-labor substitution. This is a corollary of mapping real, as opposed to mathematically convenient, isoquants.

(iv) If micro-studies are to be done systematically with a view to drawing out macro factor employment implications of alternative technique choices in a wide range of "products" or "sectors", special care must be taken to assure consistency of product definition between the output-mix level and technique choice level. For products satisfying domestic demand where marketability is less constrained by quality and homogeneity considerations, compared to exports, a broad definition of product is more appropriate. Sharp product definition tends to squeeze out technique choice.

## B. Factor Prices and Output-mix

While variations in output-mix offer considerable potential for altering economy-wide factor proportions, factor price intervention is likely to take a back seat relative to reforms of foreign trade and taxation regimes, mainly because the latter have more predictable effects on relative product profitability and output-mix. Available evidence on the influence of factor prices on output-mix, *ceteris paribus*, is scanty.

## C. Producer Response to Factor Prices

Evidence regarding the hypothesis of profit-maximizing responses by private producers to factor prices remains mixed. As a first approximation it would be fair to say that the hypothesis receives considerable support in competitive market situations. But under conditions of monopoly or oligopoly, private

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producers are likely to dilute their cost-minimizing behavior with other considerations. In assessing research results in this area it is important to distinguish "inappropriate" technique choices (relative to profit-miximizing ones) due to poor information on available technology from those which reflect motivation other than profit maximization.

## D. Fiscal/Financial Intervention

The existing theoretical literature makes too many simplifying assumptions for the derived advice on optimal intervention to be readily accepted in a real-world context. At least three key assumptions of the simple two-factor, two-good neoclassical models, militate severely with reality, demanding modifications:

(i) the assumption of complete capital malleability ("putty-putty"). The response to factor prices of factor demands associated with existing capital stock will be very different from those associated with planned investment ;

(ii) the assumption of extreme factor supply elasticities; it is only when such assumptions are made that tax/subsidy incidence questions can be neatly dealt with. Otherwise questions of shifting and incidence have to be squarely faced. Attempts, to date, to measure labor-tax shifting have used questionable methodologies ;

(iii) most fundamentally, theory has tended to assume unified factor markets (allowing for well-defined distortions such as a minimum wage), though evidence on market fragmentation is considerable. If factor markets are severely fractured, allowing a wide range of factor price relatives to prevail in different markets, fiscal/financial strategies for market unification may be more important than price-intervention in a particular sub-market.

## REFERENCES

1. Acharya, S.N., "Consumption Patterns and Their Primary Factor Content : A Case Study for Pakistan", in *Some Aspects of Imperfections in Primary Factor Markets of Less Developed Countries*, unpublished Ph. D. Thesis, Harvard University, October 1971.

2. ————,"Public Enterprise Pricing and Social Benefit-Cost Analysis", *Oxford Economic Papers*, March 1972.

3. Ahluwalia, M., "Tax-Subsidy Intervention and Employment", in *Fiscal Measures for Employment Promotion in Developing Countries,* International Labor Office, Geneva, 1972.

4. ————,"Taxes, Subsidies and Employment", *Quarterly Journal of Economics,* August 1973.

5. ————,"The Scope for Policy Intervention", in Chenery, *et al.* (1974).

6. Appu, P.S., "The Bamboo Tubewell : A Low Cost Device for Exploiting Ground Water", *Economic and Political Weekly,* June 29, 1974.

7. Aranjo, M.M., "Technological Change and Employment in Sugar in Argentina", *World Employment Program Research,* International Labor Office, Geneva (forthcoming).

8. Arrow, K.J., *et al.,* "Capital-Labor Substitution and Economic Efficiency", *Review of Economics and Statistics,* August 1961.

9. Atkinson, A.B. and Stiglitz, J.E., "A New View of Technological Change", *Economic Journal,* September 1969.

10. Balassa, Bela, *et al., The Structure of Protection in Developing Countries,* Johns Hopkins Press, Baltimore, 1971.

11. Baranson, J., *Manufacturing Problems in India : The Cummins Diesel Experience,* Syracuse University Press, Syracuse, New York, 1967.

12. ————,"Automotive Industries in Developing Economies", (mimeo.), IBRD, 1968.

13. ————,*Industrial Technologies for Developing Economies,* New York, Praeger, 1969.

14. ————,"Technology Transfer Through the International Firm", *American Economic Review Proceedings,* May 1970.

15. ————,"International Transfer of Automotive Technology to Developing Countries, (mimeo.), New York, U.N. Institute for Training and Research 1971.

16. Baron, C.G., "Sugar-Processing Techniques in India", *World Employment Program Research Working Paper,* International Labor Office, November 1973.

17. ————,"Impact of the Use of Computers on Employment", *World Employ-ment Program Research,* International Labor Office, Geneva (forthcoming).

18. Bartsch, W.H., "Employment Effects of Technologies and Techniques in Asian Crop Production", *World Employment Program Research Working Paper*, International Labor Office, Geneva, August 1973.

19. Behrman, J.R., *Supply Response in Underdeveloped Agriculture: A Case Study of Four Major Annual Crops in Thailand, 1937-63*, North Holland, Amsterdam, 1968.

20. ———,"Sectoral Elasticities of Substitution between Capital and Labor in a Developing Economy: Time Series Analysis in the Case of Post-War Chile", *Econometrica*, March 1972.

21. Bergsman, J., *Brazil: Industrialization and Trade Policies*, Oxford University Press for O.E.C.D., London, 1970.

22. Bhagwati, J.N. and Desai, P., *India: Planning for Industrialization. Industrialization and Trade Policies Since* 1951, Oxford University Press for O.E. C.D., London, 1970.

23. ——— and Ramaswami, V.K., "Domestic Distortions, Tariffs and the Theory of Optimum Subsidy", *Journal of Political Economy*, February 1963.

24. Bhalla, A.S., "Investment Allocation and Technological Choice—A Case of Cotton Spinning Techniques", *Economic Journal*, September 1964.

25. ———, "Choosing Techniques: Handpounding vs. Machine-Milling of Rice: An Indian Case", *Economic Journal*, March 1965.

26. ——— and Gaude, "Appropriate Technologies in Services with Special Reference to Retailing", *World Employment Program Research Working Paper*, International Labor Office, Geneva, January 1973.

27. Bhatty, I.Z. and Sarkar, G.K., "Employment and Technological Change in Selected Plantation Crops in India", *World Employment Program Research*, International Labor Office, Geneva (forthcoming).

28. Boon, G.K., *Progress Reports on Alternative Techniques of Production*, No. 1, "A Case Study of Filling and Grinding", January 1957.

29. ———, *Progress Reports on Alternative Techniques of Production*, No. 2, "A Case Study of Three Turning Operations", May 1957.

30. ——— and Van Harreveld,———, No. 4, "A Case Study of Wooden-Window Frame Production, Scale of Wood-working Machines", March 1959.

31. ———, ———,No. 5, "A Case Study of a Construction Process, Field Trenches", April 1960.

32. ———, ———,No. 6, "Choice of Agricultural Technology. Five Methods of Producing Grain", April 1961.

33. ———, *Economic Choice of Human and Physical Factors in Production*, North Holland, Amsterdam, 1964.

34. Brecher, R.A., *Minimum Wage Rates and the Pure Theory of International Trade*, Unpublished Ph.D. dissertation, Harvard University, 1971.

35. ———, "Minimum Wage Rates and the Pure Theory of International Trade", *Quarterly Journal of Economics*, February 1974.

36. Brittain, J.A., "The Incidence of Social Security Payroll Taxes", *American Economic Review*, March 1971.

37. ———, "The Incidence of Social Security Payroll Taxes: Reply", *American Economic Review*, September 1972.

38. Brown, Murray, *On the Theory and Measurement of Technological Change*, Cambridge University Press, Cambridge, 1968.

39. Bruton, Henry J., "The Elasticity of Substitution in Developing Countries", Williams College, Centre for Development Economics, *Research Memorandum*, No. 45, April 1972.

40. Chandavarkar, A.G., "Some Aspects of Interest Rate Policies in Less Developed Economies: The Experience of Selected Asian Countries", International Monetary Fund, *Staff Papers*, March 1971.

41. Chenery, H.B., "Process and Production Functions from Engineering Data", in W. Leontief, (ed.), *Studies in the Structure of the American Economy*, New York, Oxford University Press, 1953.

42. ——— and Raduchel, W.J., "Substitution in Planning Models", in H.B. Chenery, (ed.), *Studies in Development Planning*, Harvard University Press, 1971.

43. ———, *et al.*, *Redistribution with Growth*, Oxford University Press, 1974.

44. Chetty, V. and Sankar, V., "Bayesian Estimation of the CES Production Function, *Review of Economic Studies*, 1969.

45. Coen, R.M. and Hickman, B.G., "Constrained Joint Estimation or Factor Demands and Production Functions", *Review of Economics and Statistics*, August 1970.

46. Cooper, C. and Kaplinsky, R., "Second-hand Equipment in a Developing Country—A Study of Jute Processing in Kenya", *World Employment Program Research Working Paper*, International Labor Office, Geneva, November 1963.

47. ————,————, and Bell, R., "An International Comparison of the Choice of Manufacturing Techniques in the Production of Cans in Kenya, Tanzania and Thialand", *World Employment Program Research*, International Labor Office, Geneva (forthcoming).

48. Daniels, M.R., "Differences in Efficiency among Industries in Developing Countries", *American Economic Review*, March 1969.

49. Dasgupta, P. and Stiglitz, J.E., "On Optimal Taxation and Public Production", *Review of Economic Studies*, January 1972.

50. Dean, Genevieve, "A Note on the Source of Technological Innovation in the People's Republic of China", *Journal of Development Studies*, October 1972.

51. Dhar, P.N. and Lydall, H.F., *The Role of Small Enterprises in Indian Economic Development*, Delhi, Asia Publishing House, 1961.

52. Diamond, P.A. and Mirrlees, J.A., "Optimal Taxation and Public Production", *American Economic Review*, March-June, 1973.

53. Duloy, J. and Norton, R., "CHAC, a Programming Model of Mexican Agriculture", in L. Goreux and A. Manne, (eds.), *Multi-Level Planning: Case Studies in Mexico*, North Holland, Amsterdam, 1973.

54. Feldstein, M.S., "The Incidence of the Social Security Payroll Tax: Comment", *American Economic Review*, September 1972.

55. Fisher, F., "The Existence of Aggregate Production Functions", *Econometrica*, October 1969.

56. Ford Foundation, *Technology and Employment in Developing Countries* Vols. I and II, papers for a seminar, New Delhi, India, March 1973.

57. Gaude, J., "Analyse des Relations entre la Main-d'oeuvre l,Echelle et la Technologie dans le Petit Commerce a Lima", *World Employment Program Research Working Paper*, International Labor Office, Geneva, September 1973.

58. ————, "Capital-Labor Substitution Possibilities: A Review of Empirical Research", *World Employment Program Research Working Paper*, International Labor Office, Geneva, May 1974.

59. Green, H.A., *Aggregation in Economic Analysis : An Introductory Survey*, Princeton University Press, Princeton, 1964.

60. Griliches, Zvi, "Production Functions in Manufacturing : Some Preliminary Results", in M. Brown, (ed.), *The Theory of Empirical Analysis of Production*, National Bureau of Economic Research, Studies in Income and Wealth, Vol. 31, Columbia University Press, 1967.

61. Hall, R.E. and Jorgensen, D.W., "Tax Policy and Investment Behavior", *The American Economic Review*, June 1967.

62.———, "Application of the Theory of Optimum Accumulation", in G.Fromm, (ed.,) *Tax Incentives and Capital Spending*, Brookings, Washington, D.C., 1971.

63. Harcourt, G., "Some Cambridge Controversies in the Theory of Capital", *Journal of Economic Literature*, June 1969.

64. Harral, C.G., *et al.*, "Study of the Substitution of Labor and Equipment in Civil Construction : Phase II Final Report", *IBRD Staff Working Paper No. 172*, January 1974.

65. Harris, J.R. and Todaro, M.P., "Wages, Industrial Employment, and Labor Productivity : The Kenya Experience", *East African Review*, June 1968.

66. ———,———,"Migration, Unemployment and Development : A Two-Sector Analysis", *American Economic Review*, March 1970.

67. Helliwell, J.F., *et al.*, *Structure of RDX2*, Bank of Canada Staff Research Studies, No. 7, 1971.

68. Hsing, Mo-Luan, Power, J.H. and Sicat, G., *The Philippines and Taiwan: Industrialization and Trade Policies*, Oxford University Press for O.E.C.D., London, 1970.

69. Hughes, H., "The Scope for Labor Capitalization Substitution in the Developing Economies of Southeast and East Asia : A Sectoral Approach", *IBRD Working Paper No. 140*, January 1973.

70. International Labor Office, *World Employment Program : A Progress Report on its Research-Oriented Activities*, Geneva, December 1973.

71. Irvin, G., *et al.*, "Roads and Redistribution—A Social Cost-Benefit Study of Labor-Intensive Road Construction Methods in Iran", *World Employment Program Research Working Paper*, International Labor Office, Geneva, September 1973.

72. Ishikawa, S., "A Note on the Choice of Technology in China", *Journal of Development Studies*, October 1972.

73. Johnson, H.G., "Optimal Trade Intervention in the Presence of Domestic Distortions", in R.E. Baldwin, *et al.*, *Trade, Growth and the Balance of Payments*, 1965.

74. Jorgensen, D.W., "The Theory of Investment Behavior", in R. Ferber, ed., *Determinants of Investment Behaviour*, National Bureau of Economic Research, New York, 1967.

75. Karcher, M., "Unemployment and Underemployment in the People's Republic of China", (mimeo.), Harvard University Center for International Affairs, Cambridge, Massachusetts, 1973.

76. Kazt, J., *Production, Foreign Investment and Growth*, North Holland, Amsterdam, 1969.

77. Kennedy, C. and Thirlwall, A. P., "Surveys in Applied Economics: Technical Progress", *Economic Journal*, March 1972.

78. Khan, A.R., "Capital Intensity and Efficiency of Factor Use", *Pakistan Development Review*, Vol. X, No. 2, Summar 1970.

79. King, T., *Mexico: Industrialization and Trade Policies Since 1940*, Oxford University Press for O.E.C.D., London, 1970.

80. Klein, L. and Bodkin, R., "Nonlinear Estimation of Aggregate Production Functions", *Review of Economics and Statistics*, February 1967.

81. Kmenta, J., "On the Estimation of the CES Production Function", *International Economic Review*, June 1967.

82. Krishna, R., "Agricultural Price Policy and Economic Development", in H.M. Southworth and B.F. Johnston (eds.), *Agricultural Development and Economic Growth*, Cornell University Press, Ithaca, New York, 1967.

83. ———, "Measurement of the Direct and Indirect Effects of Agricultural Growth with Technical Change", (mimeo.), prepared for Ford Foundation Seminar, New Delhi, March 1973.

84. Lal, D., "Men or Machines—A Philippine Case Study of Labor-Capital Substitution in Road Construction", Phase I Report, *World Employment Program Research Working Paper*, International Labor Office, Geneva, October 1973.

85. Lancaster, K., "New Approach to Consumer Theory", *Journal of Political Economy*, April 1966.

86. Lent, George E., "Tax Policy for the Utilization of Labor and Capital in Latin America", International Monetary Fund, D.M., October 1972.

87. Lewis, S.R., Jr., *Pakistan: Industrialization and Trade Policies,* Oxford University Press for O.E.C.D., London, 1970.

88. Lewis, W. Arthur, "Economic Development with Unlimited Supplies of Labor", *Manchester School,* May 1954.

89. Little, I.M.D. and Mirrlees, J.A., *Social Cost-Benefit Analysis, Manual of Industrial Project Analysis in Developing Countries,* Vol. II, O.E.C.D., Development Centre, Paris, 1969.

90. Little, I., Scitovosky, T. and Scott, M., *Industry and Trade in Some Developing Countries,* O.E.C.D., Paris, 1970.

91. McKinnon, R., *Money and Capital in Economic Development,* Brookings, Washington, D.C., 1973.

92. McLeary, W.A., "Employment and Technical Choice in Road Construction in Thailand", *World Employment Program Research,* International Labor Office, Geneva (forthcoming).

93. McLure, C.E., "General Equilibrium Incidence Analysis: The Harberger Model after Ten Years", forthcoming in *Journal of Public Economics,* 1974.

94. Magee, S.P., "Factor Market Distortions, Production and Trade : A Survey", *Oxford Economic Papers,* July 1973.

95. Marsden, K., "Progressive Technologies for Developing Countries", *International Labor Review,* May 1970.

96. Mason, R.H., "Some Observations on the Choice of Technology by Multinational Firms in Developing Countries", *Review of Economics and Statistics,* August 1973.

97. Miezkowski, P., "Tax Incidence Theory : The Effects of Taxes on the Distribution of Income", *Journal of Economic Literature,* December 1969.

98. Mikesell, R.F. and Zinser, J.E., "The Nature of the Savings Function in Developing Countries : A Survey of the Theoretical and Empirical Literature", *Journal of Economic Literature,* March 1973.

99. Morawetz, D., "Elasticities of Substitution in Industry: What do We Learn from Econometric Estimates "? (mimeo.), IBRD, October 1973.

100. ————, "Employment Implications of Indstrialization: A Survey", *Economic Journal,* September 1974.

11—

101. ————, *et al.*, Studies of Inappropriate Technologies for Development, Harvard University, Center for International Affairs, Monograph (forthcoming).

102. Morley, S.A. and Smith, G.W., "The Choice of Technology: Multi-National Firms in Brazil", paper presented at the Workshop on Income Distribution and its Role in Development, Houston, April 26, 1974.

103. Mundlak, Y., "Functional Forms of Production Functions: A Survey", (mimeo.), IBRD, May 1973.

104. Nadiri, M.I., "Some Approaches to the Theory and Measurement of Total Productivity", *Journal of Economic Literature*, December 1970.

105. Nam, J.W., Rhee, Y.W. and Westphal, L.E., "Data Development for a Study of the Scope for Capital-Labour Substitution in the Mechanical Engineering Industries", (mimeo.), IBRD, February 1973.

106. Nerlove, M., "Recent Empirical Studies of the C.E.S. and Related Production Functions", in Murry Brown, (ed.), *The Theory and Empirical Analysis of Production*, National Bureau of Economic Research, Studies in Income and Wealth, Vol. 31, Columbia University Press, New York, 1967.

107. Norton, R. and Bassooo, L.M., "A Quantitative Agricultural Planning Methodology", *IBRD Working Paper No. 180*, May 1974.

108. Nowshirvani, V.F., "The Contribution of the Agricultural Machinery Industry to Technological Change and Employment : A Case Study of Iran", *World Employment Program Research*, International Labor Office, Geneva (forthcoming).

109. O'Herlihy, C. St. J., "Capital-Labour Substitution and the Developing Countries : A Problem of Measurement", *Bulletin of the Oxford University Institute of Economics and Statistics*, August 1972.

110. Pack, H., "Employment and Productivity in Kenyan Manufacturing," *East African Economic Review*, December 1972.

111. ————, "Capital-Labour Substitution Possibilities in the Textile Industries", *World Employment Program Research Working Paper*, March, International Labor Office, Geneva, 1974.

112. ———— and Todaro, M.P., "Technological Transfer, Labor Absorption and Economic Development", *Oxford Economic Papers*, November 1969.

113. Peacock, A. and Shaw, G.K., *Fiscal Policy and the Employment Problem*, O.E.C.D., Paris, 1971.

114. Perkins, D.H., "Plans and Their Implementation in the People's Republic of China", (mimeo.), IBRD, Economic Development Institute, 1973.

115. ——, "Growth and Distribution in the People's Republic of China", (mimeo.), IBRD, Economic Development Institute, 1973.

116. Pickett, J., *et al.*, "The Choice of Technology, Economic Efficiency and Employment in Developing Countries", *World Development*, March 1974.

117. Pratten, C.F., *Economics of Scale in Manufacturing Industries*, Department of Applied Economics, Occasional Papers, No. 28, Cambridge University, 1971.

118. Prest, A.R., "The Role of Labor Taxes and Subsidiaries in Promoting Employment in Developing Countries", in International Labor Office, *Fiscal Measures, for Employment Promotion in Developing Countries*, 1972.

119. Raduchel, W.J., *General Equilibrium Model of Development Planning*, unpublished Ph.D. thesis, Harvard University, 1972.

120. Ranis, G., "Factor Proportions in Japanese Economic Development", *American Economic Review*, September 1957.

121. ——, "Production Functions, Market Imperfections and Development", *Economic Journal*, June 1962.

122. ——, "Technology, Employment and Growth : The Japanese Experience", in International Labor Office, *Automation in Developing Countries*, Geneva, 1972.

123. ——, "Some Observations on the Economic Framework for Optimum LDC Utilization of Technology", Yale Economic Growth Center, *Discussion Paper 152*, 1972.

124. ——, "Employment and Labor Absorption in Development," paper presented at Rehovet Conference, September 1973.

125. Reiger, H.C., *et al.*, "A Comparative Evaluation of Road Construction Techniques in Nepal", International Labor Office (forthcoming).

126. Reviglio, F., "The Social Security Sector and Its Financing in Developing Countries", International Monetary Fund, *Staff Papers*, November 1967.

127. Reynolds, L.G. and Gregory, P., *Wages, Productivity and Industrialization in Puerto Rico*, Homewood, Illinois, 1965.

128. Rhee, Y.W. and Westphal, L.E., "Planning Future Import Substitution and Export Expansion in Korea's Mechanical Engineering Industries", paper presented at Joint Korea Development Institute, October 1973.

129. Roemer, M., "The Neoclassical Employment Model Applied to Ghanaian Manufacturing", Harvard University, Development Research Group, *Economic Development Report No.* 225, 1972.

130. Rybczynski, T.M.,"Factor Endowment and Relative Commodity Prices", *Economica,* November 1955.

131. Schultz, T.W., *Transforming Traditional Agriculture*, Yale University Press, New Haven, 1964.

132. Sen, A.K., *Choice of Technique*, Blackwell, First Edition, Oxford, 1960.

133. ———, ———, Blackwell, Third Edition, Oxford, 1968.

134. ———, *Employment Policy and Technological Choice*, Oxford University Press for International Labor Office, 1973.

135. ———, "On Some Recent Debates in Capital Theory", *Economica*, August 1974.

136. Sharpston, M.J., "Capital-Labor Substitution Possibilities: An Empirical Approach", (mimeo.), IBRD, July 1973.

137. Sigurdson, J.,"Rural Industry—A Traveller's View", *The China Quarterly*, April-June, 1972.

138. ———, "Technology and Employment in China", *World Development*, March 1974.

139 Silbertson, A., "Economies of Scale in Theory and Practice", *Economic Journal* (supplement), March 1972.

140. Singh, S.K., "The Determinants of Aggregate Savings", *IBRD Working Paper No. 127*, March 1972.

141. Smith, L.D. and Brown, C.J.F., "Employment and Coffee Production Techniques : An International Comparison", *World Employment Program Research Working Paper*, International Labor Office, Geneva, February 1974.

142. Solow, Robert S., "Some Recent Developments in the Theory of Production" in M. Brown, (ed.), *The Theory and Empirical Analysis of Production*, National Bureau of Economic Research, Studies in Income and Wealth, Columbia University Press, New York, 1967.

143. Stewart, F., "The Choice of Techniques : A Case Study of the Manufacture of Cement Blocks in Kenya", (mimeo.), Oxford University, 1971.

144. ———, "Choice of Techniques in Developing Countries", *Journal of Development Studies,* October 1972.

145. ———, "Technology and Employment in LDCs", *World Development,* March 1974.

146. ———, and Streeten, P.P., "Conflicts between Output and Employment Objectives in Developing Countries", *Oxford Economic Papers,* July 1971.

147. Strassman, W.P., "Mass-Production of Dwellings in Colombia: A Case Study", *World Employment Program Research Working Paper,* International Labor Office, Geneva, April 1974.

148. ———, "Industrialized Systems Building for Developing Countries: A Discussing Prognosis", *World Employment Program Research Working Paper,* International Labor Office, Geneva, 1974.

149. Streeten, P.P., "Technology Gaps between Rich and Poor Countries", *Scottish Journal of Political Economy,* November 1972.

150. Todd, J., "Size of Firms and Efficiency in Colombian Manufacturing", *Research Memorandum No. 41,* Centre for Development Economics, Williams College, October 1971.

151. Thomas, J.W., "The Choice of Technology in Developing Countries: The Case of Irrigation Tubewells in Bangladesh", forthcoming in Morawetz, *et al.* (1974).

152. Trejo, Saul, *Industrialization and Employment Growth : Mexico 1950-65,* unpublished Ph.D. Dissertation, Yale University, 1971.

153. Tyler, W., "Labor Absorption with Import-Substituting Industrialization: An Examination of Elasticities of Substitution in the Brazilian Manufacturing Sector", *Oxford Economic Papers,* March 1974.

154. U.K. Textile Council, *Cotton and Allied Textiles,* two volumes, Manchester, 1969.

155. United Nations, *Appropriate Technology and Research for Industrial Development,* Report on the Advisory Committee on the Application of Science and Technology to Development on Two Aspects of Industrial Growth, 1972.

156. U.N.E.C.L.A., *Choice of Technique in the Latin American Textile Industry,* United Nations, 1966.

157. U.N.I.D.O., "Industrial Information : A Pre-requisite for Appropriate Choice of Technology", paper suomitted by U.N.I.D.O., to O.E.C.D. Study Group on the Choice and Adaption of Technology in Developing Countries, November 1972.

158. ———, *Guidelines for Project Evaluation*, United Nations, 1972.

159. Uzawa, H., "Production Functions with Constant Elasticities of Substitution", *Review of Economic Studies*, October 1962.

160. Wells, L.T., "Economic Man and Engineering Man: Choice of Technology in a Low-Wage Country", *Public Policy*, Summer 1973.

161. Westphal, L.E., "Research on 'Appropriate' Technology", paper presented at Conference on Technology, Employment and Development, Penang.

162. Williamson, J.G., "Relative Price Changes, Adjustment Dynamics and Productivity Growth: The Case of Philippine Manufacturing", *Economic Development and Cultural Change*, July 1971.

163. Winston, G.C., "Capital Utilization and Optimal Shift Work", *The Bangladesh Economic Review*, Vol. II, No. 2, April 1974.

164. ———, "The Theory of Capital Utilization and Idleness", *IBRD Working Paper No.176*, forthcoming in *Journal of Economic Literature*.

165. ———, "Factor Substitution *Ex Ante* and *Ex Post*", *Journal of Developing Economics*, June 1974.

166. Yeoman, W.A., *Selection of Production Processes for Manufacturing Subsidiaries of U.S.-based Multinational Corporations*, unpublished Ph.D. Thesis, Harvard University, April 1968.

167. Young, N., Valenzuela, G. and Montes, P., "The Capacity of the Engineering Industry in Colombia: A Study of Equipment Development and Design in a Developing Country", *World Employment Program Research*, International Labor Office, Geneva (forthcoming).

168. Zellner, A. and Revanker, N., "Generalized Production Functions", *Review of Economic Studies*, April 1969.

*Lesotho: A Development Challenge* by Willem Maane, distributed by The Johns Hopkins University Press, 1975

*Nigeria: Options for Long-Term Development* by Wouter Tims and others, published by The Johns Hopkins University Press, 1974

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