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Articles

THE IMPORT-SUBSTITUTION PATTERN : A STRATEGY OF GROWTH WITHIN SUBORDINATION THE POSSIBLE ALTERNATIVE STRATEGY OF DEVELOPMENT

By

Dr. MOHAMED DOWIDAR*

The purpose of this article(**) is to explicit the socio-political implications of economic choices adopted within the framework of growth policies which we find in most of the underdeveloped countries since their political independence. We do not mean, hence, to emphasise the technical aspects of the choices concerning the different domains of the economic activity. Far from that. Such choices unite together to form a growth strategy usually labelled as the "Import-Substitution" strategy. In our attempt to lay bare the socio-political implications of such a strategy we have kept this appellation, being very currently in use, although we consider it as unscientific : for a strategy is not simply defined by the domains of economic activity which receive priority in the developmental efforts. It is defined by its social belonging, its class nature. That is why we prefer talking about the strategy of the combinat : middle class — petty bourgeoisie. This allows us to locate this strategy both from the viewpoint of the direct producers and with respect to the international capital.

To discuss the general pattern of development for a certain society, in our case an underdeveloped society, supposes :

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(**) This article represents the author's contribution to the Seminar on "Regional Planning in Africa" which was organized by the United Nations Institute of Economic Development and Planning (I.D.E.P.), Dakar, and the University of Ibadan, in Ibadan (Nigeria), 15 April - 5 May, 1973.

— a proper understanding of the process of the historical formation of the under-development of this society;

— a proper understanding of the type of social formation (its structure and superstructure, in their mutual interaction) dominating this society, within the context of today's world economy;

— the possibility of a conscious action that opts for a certain pattern of development, let us say strategy of development. This strategy cannot be chosen from the viewpoint of the whole of the society, given its class structure.

A conscious action supposes a conscious choice based on a critical knowledge of the different possibilities open to the society. Some of these possibilities are real and might lead to development. Others are illusionary and sure of keeping the society underdeveloped, albeit, under another form. To which of these two categories does the Import-Substitution Strategy of Growth (and I intentionally talk about growth, and not development) belong ?

To answer this question, I will attempt :

1 — first, to see the theoritical significance of the Import-Substitution pattern, the assumption underlying its basic idea and their limitations;

2 — second, to find out its place in the reality of the world process of development and underdevelopment, the results it gives and whether they mean for the underdeveloped society a way out of its underdevelopment.

3 — third, to relate the Import-Substitution pattern to the strategy of the international capital at the different phases of capitalist development, and,

4 — fourth, to put this Import-Substitution pattern in contrast with an alternative pattern of development.

I

In theory, Import-Substitution, as a strategy of growth, reposes on one of the versions of the idea of "unbalanced growth", the antithesis of "balanced growth". To understand both these,

one has to seize the idea according to which a society's economic system should be conceived as an organic body composed of different parts between which exist the relations of interdependence. Each of its parts depends, in its existence and functioning, on the other parts, and on it depend the existence and functioning of these other parts. (This has been a basic idea in the reproduction schemes analysis and that of input-output).(1)

Balanced growth can be looked at from the viewpoint of the necessity of developing both agriculture and industry, given the relations of interdependence between them (agriculture providing industry with raw materials, with food supply for the industrial labour force, and through foreign trade with basic equipment — Industry providing agriculture with equipments, industrial current inputs and industrial consumption goods). Balanced growth could be looked at, too, from the viewpoint of all the economic activities producing for final consumption. Given the fact that the income created in one of these activities represent the demand for consumption goods in this and other activities, different projects producing the different consumption goods have to be created together in order to guarantee a demand for the products of all of them. To this must be added the basic services. This idea of balanced growth calls for the necessity for a simultaneous investment in the different branches producing consumption goods as well as in the construction of the material basis of basic services. (This is the idea of balanced growth associated with the name of Nurkse and others).

In contrast with balanced growth, we have "unbalanced growth". That is, growth through successive stages at each of which a certain area of economic activity will be emphasised receiving relatively more effort and preparing for the next stage till we reach a stage at which the whole economy will have a balanced growth : it is the realisation of a balanced growth through successive unbalances. Here, we can distinguish two versions of unbalanced growth. According to the first which is at the same time balanced and unbalanced, the economy is conceived to be composed of two departments : Dep. I producing

(1) See in this respect, my book : Reproduction Schemes and the Methodology of Socialist Planning (in French), Tiers-Monde, Alger, 1964.

the means of production and Dep. II producing the consumption goods. Between them exist relations of interdependence : Dep. II uses the products of Dep. I as means of production and Dep. I uses the products of Dep. II for the consumption of people engaged in its activity. Branches included in Dep. I, especially those of industrial nature, have more inductive effects on the development of the whole economy, for they are basic for its functioning. Hence, their existence, besides it guarantees the independence of the economy vis-à-vis the outside world, gives rise to more linkage, effects and hence a higher rate of development for the economy as a whole. Thus, when choosing a strategy of development, this will be one of unbalanced development with Dep. I receiving at a first stage a relatively higher emphasis. Priority should be given then to Dep. I in his relation to Dep. II. But as an expansion of Dep. I depends on the capacity of Dep. II to provide Dep. I with consumption goods for the latter's labour force. Dep. II must be capable of producing an amount of food big enough not only to meet the consumption needs of its proper labour force but also to cover those of the labour force engaged in Dep. I. In this sense, we say that the expansion of Dep. I depends on the amount of consumption goods surplus produced in Dep. II. Therefore, if Dep. I is to be given priority in development efforts, it should not ignore the relation of proportionality which should exist between the two departments.

Another way of conceiving unbalanced growth limits itself to the industrial sector of the economy. Within this sector, a distinction is made between industries producing for final consumption, consumption goods industries, industries producing intermediary goods, and basic industries. The industrial sector is conceived then as one embarrassing three sectors: a sub-sector of consumption goods industries, a sub-sector of intermediary production goods, and a sub-sector of basic production goods.

With respect to their effect on the overall rate of growth, the sub-sector of basic production goods has the highest one for it has the highest linkage effect (be it formed in relation to other activities using basic production goods as inputs, or backward effects, in relation to other economic activities whose products are used as inputs by the basic production goods industries). After that comes the sub-sector of intermediary production goods.

To be followed by the sub-sector of consumption goods as the one having the least linkage effects and therefore the least of effect on the overall rate of growth. If we are to maximise the rate of growth, the strategy of unbalanced growth should emphasise basic industries at the first stage of development. But, as investment decisions depend on the existence and the extent of the market. And, as for the underdeveloped economies, the market of basic production goods is considered narrow, especially if we bear in mind that the minimal size of industrial units producing basic production goods, at the actual level of technological progress, this minimal size is very big. If the market of these basic production goods in limited, it would not be economic to build them up at the first stage. But, as we have, in these underdeveloped economies, a relatively larger market for the consumption goods, a market that was created gradually for the imported consumption goods, growth could start by the construction of industries producing these consumption goods for which there is an already existing demand. The existence of such industries will create, at a second stage, a demand for intermediary production goods and hence a pressure for the establishment of industries producing them. So, this will be done, giving place to a demand for the products of basic production goods industries, whose construction will be achieved at a last stage.

This is the essence of the Import-substitution strategy of economic growth advocated for underdeveloped economies as one path of achieving growth through unbalances.(1) To assess it

(1) This version of unbalanced growth is usually associated with the name of A. Hirschman (see his Strategy of Economic Development, 1957). Effectively, it represents one of the outcomes of the discussion that took place in the 1920's in the Soviet Union and the pattern of industrialisation to be adopted. (see A. Erlich, The Soviet Industrialisation Debate, Cambridge, Massachusetts, 1960 - N. Spulber (ed.) Foundations of Soviet Strategy of Economic Growth : Selected Soviet Essays, 1924-1930, Bloomington, Indiana University Press, 1964 — M. Dobb, Capitalism, Development and Planning, Routledge and Kegan Paul, London, 1967). Historically capitalist development was realised through, firstly a simultaneous revolutions in agriculture and industry. For industry, industrialisation was realised through the construction of consumption goods industries at a first stage and production goods industries at a second stage where the relative weight of the latter surpassed up till now that of the former. With basic industries always having a bigger relative weight in the industrial structure,

critically, it is necessary to lay bare its underlying assumptions. These are :

1 — That economic development is to take place in the underdeveloped societies through the market mechanism and within the capitalist world market. And that, in these societies, the market is limited in general, and more specifically that of basic and intermediary production goods.

2 — It does not only take the existing pattern of demand of consumption goods as given, but it considers it as the basic pilar of the strategy. It find its basic then on the existing pattern of income distribution and hence the existing type of production relations, a type which is not, evidently, in favour of the masses of direct producers.

3 — That the only technological possibility for producing consumption goods (at the first stage) and the production goods is in adopting techniques available on the today's capitalist market. (Techniques, one should not forget, which correspond to the actual state of the concentration and centralisation of capital in advanced capitalist economies). This rules out the possibility of finding out through technological research starting from the available resources of the underdeveloped society, other techniques.

4 — That the underdeveloped economy continues, at least till the last stage, to import at least the basic production goods.

5 — By omission, this strategy assumes that the situation in the countryside awaits the realisations of the first stage of industrial growth.

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qualitative changes did, and do continue to, occur within each of these two categories of industries.

In Soviet Union, priority was given, at the first stage, to heavy industries and agriculture. At a second stage, although Department I still in general receives the first priority, the pattern of allocation of resources has been modified in favour of consumption goods industries and agriculture.

But, a theory of unbalanced growth based on these assumptions :

1 — fails, consciously or otherwise, to understand the genesis of underdevelopment, and imagines, consequently, the possibility of development within the context that created underdevelopment, that is the context of capitalist relations of production;

2 — ignores the possibility that the society chooses a path of development which aims at the narrowing down, in the long run, of the domain of exchange within the economy, a development that is to be realised through a conscious effort of planning where politics will command economics. This process of planning is a feeding-back process, in the sense that demand is first projected to be fed back with the projected supply;

3 — and even if we do not leave the framework of the conventional analysis, this theory does not see that when dealing with development, a long run phenomenon, it is the potential, and not the actual, demand that has to be taken into consideration. Looked at this way, the "market" will not be as narrow as imagined;

4 — this theory fails to see the process of industrialisation as a self-contained process, from the view point of demand, i.e., as a process which creates its own demand throughout the phase of the construction of the industrial base of the economy.

This is, in theory, the significance of the Import-Substitution strategy of growth, its basic assumptions and the limitations that these very assumptions imply.

However, the import-substitution pattern of growth does not find its origin in the imagination of a Hirschman or of any other writer. It is the product of the process of development of the world economy.

II

In the reality of the world process of development and underdevelopment, Import-Substitution, as a "pattern of growth", has shown itself at a certain stage in the development of the world capitalist economy;

— first, at a limited process that became qualitatively recognisable starting from the 1930's, but which was initiated before in Latin American countries[1], Egypt and, one would add, India, and,

— later, within the context of the deliberate efforts of underdeveloped countries after political independence in the post Second World War period.

Let us see, with no details, how it occured in both cases. With respect to the first case, the period of the colonisation of these countries led, in the next stage, to their integration in the world capitalist market, an integration that took place through the continuous process of the primitive accumulation of capital in these countries : the penetration of capital which subordinates the previous modes of production changing some of their important characteristics and giving place to the creation of the market of a supply of labour force, as well to the emergence, within foreign capital, of some local capital (some might call it national capital, I would not). This occurs with the whole economy being foreign trade oriented. The dynamism of the economy depends on the demand of its exports.

With the First World War and the Great Depression of the 1930's, a host of factors call forth the construction of some industries within the underdeveloped economies :

1 — The Great Depression, which reflects a deep crisis of capital, and the War, which is a conflict between national capitals, weakened the control of the metropoli-

(1) For the case of Latin American countries cf. M. Urquidi : Les deux étapes de la croissance en Amérique Latine. Paper presented to the IDEP's Seminar on the Strategies for the development of the Land-locked African countries, Bamako, March, 1973.

tan capital on the underdeveloped society, a matter which gives the possibility — and during the war when the local market is isolated, it becomes a necessity — that capital, foreign or local, shifts to new fields of production. It might be even an occasion for the introduction of a tariff system for the protection of the new activities. This has been at least the case for Egypt for which the threat of the Japanese textiles dumping, which happened to occur during the depression, helped in the establishment of such tariff system.

2 — Another factor was the effect on the situation of exports. The decline in the physical volume of exports and the drastic fall of their prices, within the context of a long-run trend which embrasses a declining rate of increase of the demand for primary products and a deterioration in their terms of trade, reduced the underdeveloped economy's capacity to import. This was to announce that the stage over which exports were the main engine of growth was coming to its end, for these underdeveloped economies. In the absence of imports, a solution of substitution could take place.

3 — The local production of these products proved, for capital dominating the economy, to be profitable. For, on one hand, a demand for these products was already there thanks to the pattern of income distribution and the consumption habits created through importation. On the supply side, the profitability of the production of these products was assured :

a) by the existence, on the market, of a supply of a relatively cheap labour force which could be used, even with a relatively low level of technical formation, in the production of industrial consumption goods (textiles, food, etc.). This supply of labour force has two sources : the flow of labourers from the countryside as a result of the continuous process of the primitive accumulation of capital; and the increase in labour force due to the natural growth of population;

b) the existence of a certain infrastructure of basic services (without forgetting that they were established for a foreign trade oriented economy).

This host of factors called for the creation of some industries whose products would substitute the imported ones. The pattern of substitution is determined then by the assortment of imported products, and was characterised by :

— a simplicity in the technology, which implies a feable demand for imported production goods, and

— a local origin for the most of the raw materials necessary for production.

The results of such a pattern of import-substitution was to reduce the pressure on the balance of payments, but within the overall subordination of the economy. This subordination manifest itself :

— with respect to exports which continued to flow towards the capitalist centres;

— by a pattern of consumption whose determination and changes take place through the relations of exchange with the capitalist centres;

— in a dependency with respect to production goods, which implies technological dependency.

What about the results of such a pattern from the viewpoint of regional inequalities within the underdeveloped economy ? As the conditions favourable to import-substituting industries were concentrated in urban areas, these industries were located there. The result was a widening regional inequalities between urban areas (which have no homogeneous social structure) and rural areas (them, too, not having a homogeneous social structure).

Whatever may be the case, this import-substitution phase represents, for these countries, a participation to a new form of the capitalist international division of labour.

The second case started with the National Liberation Movement in the colonies and political independence (sometimes genuine, but oftenly formal). Import-substitution was adopted as a strategy for growth efforts. This was carried out, this time :

— with a heavier dose of state intervention;

— in some cases, growth efforts are mainly carried out by the State (State sector), in some others some both State and private capital contribute. Still in a third category, of countries, foreign capital do play a significant role. This latter dominates in some other countries, and in this case, local capital might find itself a place with great difficulty;

— with the use of capital-intensive techniques, a fact that reduces the employment effect of these industries. This implies a strong demand for imported production goods.

The result in this case was the construction of some import-substituting industries (and I don't talk about industrialisation), an import substitution :

— but not necessarily with a reduction of pressure of the balance of payments :

  a) in as far as this substitution does not affect the importation of luxurious consumption goods;

  b) and in the case of the constructing of industries without having their raw materials within the country, or industries producing durable consumption goods which have usually to import their semi-manufactured inputs. Here, they might have a worse effect on the situation of the balance of payments for, before they are built, in case of a balance of payments crisis, the importation of the final product could be curtailed to diminish foreign obligations. But once the industries are built up, engaging a number of working people, it would not be easy to cut down the importation of their inputs in case of a balance of payments crisis.

The result is an import substitution, but within the dependency of the whole underdeveloped economy :

a) a dependency with respect to the pattern of consumption, which is not only the outcome of the recent past, but always lags behind the pattern of consumption in advanced capitalist economics. The most dangerous effect of such a policy is that it perpetuates the actual pattern of consumption with the actual system of values which it materialises and turns the attention away from the necessity of changing it (that is, the system of values) if we are to develop our society ;

b) a dependency with respect to exports which remain, in the main, of primary products nature. As for the products of the import-substituting industries, it is difficult to market them abroad, for they are mainly of that type which other underdeveloped economies tend to produce :

— because of the domination of monopolies in the world market, or

— because of their incapacity to compete as far as quality is concerned;

c) a dependency with respect to basic production goods and current semi-facturated inputs which the underdeveloped countries continue to import, a dependency which implies a technological dependency.

From the viewpoint of regional inequalities, the result is :

— a concentration of these industries in the existing urban areas, and

— hence, the reproduction of the colonial pattern of regional inequalities on a quantitatively larger scale. However, with a new element which characterises the situation with respect to the relation between the towns and the countryside in so far as local capital replaces foreign capital and to the extent that the terms of trade between agricultural and non-agricultural products are unfavourable to the countryside, post-independence towns will be replacing the capitalist metropolitan town in extracting another part of the agricultural surplus;

— as linkage effects of the established industries are realised abroad, somewhere in a capitalist centre, the centres of development continue to exist outside the dependent economy. And what is meant to be "poles of growth" are mere "stops" on the way towards the real centre that exists in the advanced capitalist economy. And for those "stops" or towns, the function is well defined : they are not to provide the countryside with what real centres provide agriculture even in the capitalist economies. They live on the appropriation of a part (quantitatively dependent on the bargaining power with international capital) of the surplus created in primary production and in the some existing industries, and facilitate, not always without frictions, the drain of the rest of the surplus towards the capitalist centre.

And within the boundaries of these towns live, in the post-independance period :

— on the one hand, the dominating social class or strata (so-called elite), with their mode of life, pattern of consumption, ideals, etc., and

— on the other, the lower stratum of the urban population, with worsening conditions of living, and with their number continuously increasing due to the deteriorating situation in the countryside and the effective loosening of restrictions on population movements after political independence.

III

This is the import-substitution strategy as it takes place in the reality of the world process of development and underdevelopment. And as such, it corresponds to one of the phases of the strategy of capital, a strategy which changes with the change in the structure of the capitalist system. In other words, the strategy of capital[1] in the world market is not given once and

(1) Talking about capital in the international market does not mean that we have a single "national" or a single "international" capital. What we have on the international field is many national capitals which struggle between themselves for the world market. Although the strategies of the different national capitals may differ, one can distinguish, for a certain stage, in the development of the system as a whole, a certain strategy for capital in general.

for all, it changes in function of structural changes in both the developed and the undeveloped parts of the world capitalist economy. The capitalist international division of labour has its dynamics. Throughout the development of the capitalist mode of production it changes its form. From this viewpoint, the following phases could be roughly distinguished;

1 — With the emphasis, at a first stage of capitalist industrialisation on industries producing consumption goods, the annexe countries (the colonies) were to provide raw materials and to be markets for industrial products.

2 — With a further specialisation in industry in the capitalist centres and a shift towards basic industries, the annexe countries (the colonies) were to produce raw materials (new ones) and foodstuff, and carry on being markets.

3 — With the construction of the industrial base in the centre, capital would go out, in quantitatively different scale, to penetrate the relations of production in the colonies (its integration and transformation, which means a wider market), a process which enables it to use directly the created labour force and to subordinate the existing modes of production in the rural society. This process means too the possibility of the birth, within foreign capital, or local capital.

4 — With the development of basic industries in the centre and that of local capital in the annexe, a crisis or a general war might for a while weaken the control of the metropolitan capital on the annexe giving the possibility (not without frictions) of producing industrial consumption goods for the local market. Some of the imports will be substituted. In addition to raw materials, foodstuffs, the annexe will be producing some consumption goods. But in the centre, the biggest relative weight of basic industries is already assured. This represents a certain change in the form of the capitalist international division of labour.

5 — With the shift within the capitalist centres towards new and more impressive production goods industries, the existence, on the international scenery of the socialist countries and with the national liberation movement in the colonies and the creation of local states in the ex-colonies, there emerges the

possibility that the underdeveloped politically independent country produces, in addition to raw materials (with a shift to oil) and foodstuffs, some industrial consumption goods and even some industrial traditional production goods (cement, steel, etc.). This is to be realised through import-substitution policy. This might represent a new change in the form of the capitalist international division of labour.

This is the stage which we are living now. Therefore, it is of the utmost importance to elaborate what might be the strategy of the international capital in general (with all the rivalities that exist between its national parts) of maintening the dependency of underdeveloped economies under a new form. This strategy might be to compose with the underdeveloped societies based on the following schemes :

a) with a change in their economic activities as we have already seen. Given the change in the composition of production in the advanced capitalist economies, the logistic growth of the industries of the traditional consumption goods and the emergence of new leading branches (petro-chemical, electronic, etc.); given to the crisis of export production in the underdeveloped economies, we might have a change towards :

   — a certain specialisation of the underdeveloped economies in the production of traditional consumption goods (textiles, food industries, etc.);

   — a certain production of certain durable consumption goods, and

   — a certain production of certain traditional production goods.

   This new form of specialisation does not endanger the dependency of the underdeveloped economies upon the capitalist centre with respect to the products of the new leading branches in the centre, and hence, from the technological viewpoint;

b) from the viewpoint of employment, the new strategy of international capital implies a situation with the following characteristics :

   — the migration of the highly qualified labour force towards the capitalist centres;

— as a significant part of the surplus produced in the underdeveloped economy is mobilised towards the capitalist centre, and as an another part of the surplus is used in the consumption of the dominating classes within the underdeveloped economy (given the pattern of income distribution), a part devoted to the purchasing of consumption goods whose pattern is defined in the centre, the rate of expansion in the underdeveloped economy will be relatively limited. If we add to this, the tendency in the underdeveloped economy to establish capital-extensive industrial projects, the capacity of new industries to absorb labour force will be limited. The result will be that the potential surplus of labour continues to exist within the agricultural production units having the family as a social form, and that an increasing part of the labour force will flow to the industrial reserve army amassed in the urban areas. This labour force could be used either through the movement (relatively limited) of labour from the underdeveloped societies towards the capitalist ones, or through the movement of capital (which is extremely mobile) towards the underdeveloped economies.

c) From the socio-political viewpoint, it seems that the new strategy of international capital implies to maintain or create, according to the case, a situation in the underdeveloped economy which is characterised by a shift of the effective control of the means of production within the underdeveloped economy (if they are not directly controlled by the capital of the centres) as well as of political power from the old classes towards the middle-class and the petit bourgeois classes whose social and ideological belonging as well as the ideal and the mode of life (usually foreign oriented) must be thoroughly studied. (political power tends to be in the hands of new "so-called neutral" groups, living on the appropriation of a part of the economic surplus without any participation in the process of social labour, and antagonizing direct producers).

d) It seems that the international capital tends to prefer, where it does not act directly on the territory of the underdeveloped economy, to compose with the state possessing a certain "public sector". But why ?

— from the viewpoint of efficiency, as international capital takes the form of big corporations, it may be preferable to contract, in the underdeveloped economy, with big units, with the State sector. After all, rare are the underdeveloped economies who have a "chiffre d'affaires" bigger than that of General Motors;

— The processing and the marketing of the products produced by the State enterprises are usually carried out by enterprises dominated by the International Capital, a fact which permits it to control the part of profit that will be to the State enterprises.

— The fact that State owns the enterprise puts the State in between the international capital and the national workers of the enterprise, a situation which allows the international capital to avoid conflicts with the workers ;

— The nationalisation by the State of certain enterprises gives it a certain internal political support which it might need badly to survive.

But this, on the other hand, increases the bargaining power of the State in its relation with international capital. Here, we have a contradiction between it and the State, for they divide, in a sense, the economic surplus produced within the underdeveloped economy.

This leads us to the vital importance of the state in the underdeveloped society. A state should be analysed to know its socio-political nature and its role. A matter which could be done only on the basis of a knowledge of the social stratification of the society in question.

We see then, that the Import-substitution pattern corresponds to the Strategy of International Capital at the actual stage of the development of the world capitalist economy, a strategy that could be realised with the underdeveloped economies knowing a new form of division of labour, but within the capitalist market, within dependency, which means with underdevelopment. As import-substitution pattern of growth is not liable to take us out of the state of underdevelopment, it is not liable to represent for an underdeveloped society the path of development. What other alternative pattern could we have ?

IV

To give an Alternative Pattern of Development (which occurs through structural changes) one cannot do more that to draw out a general scheme, given the different conditions — natural as well as social — in the underdeveloped societies, without forgetting that it is a matter of the society's main decision. A decision that has to be taken collectively in the real life of the society. So, it must be clear from the very beginning that what I am offering you is just a general framework for the discussion of the different (main) problems which a pattern of development implies.

To talk about the pattern of development is to talk, effectively, about its strategy. And the strategy has always a colour: development by whom ? and for Whom ? Let us be clear from the outset. In this context, we mean development for the majority of the population the masses of direct producers in agriculture and other economic activities.

The development is then one to satisfy internal needs, the needs of the masses of direct producers, a development which takes place through structural changes (in the organisation and the productive forces), through the accumulation of means of production : this raises two problems :

— the problem of relation between accumulation and consumption, and

— that of the definition of a pattern of consumption for the masses.

A — With respect to the relation between accumulation and consumption, one can distinguish, in the historical experiences of development, two possible types of these relations :

— In the capitalist development : accumulation of capital is an objective in itself, for it is the basis of social (and capital) power and prestige. It occured first in the domains of consumption goods for which there existed a demand, and then in the fields of production goods, giving a certain pattern of consumption corresponding to the pattern of income distribution that came to be

shaped and controlled especially at the actual stage of monopolistic manipulation of the market. (This is done as far as consumption is concerned through the so-called sales promotion costs).

— in the Soviet experience of development, accumulation was taken as an objective at the first stage of planned development. During the process of accumulation, priority was given to heavy industries, the types known in the Western countries. Consumption was considered (along with agriculture) as a non-priority area. It was a residual element. The fact that they built up the type of heavy industries that existed in the capitalist economies, and that the pattern of consumption chosen to be generalised was the one already existing in urban societies, gave at the end of the first stage of development, along with the industrial base, a pattern of consumption similar to that prevailing in the Capitalist Western economies.

— Is it possible, in the light of these historical experiences, to think in terms of a different type of relation between accumulation and consumption ? A relation according to which accumulation (its magnitude and modality) will be determined in function of a certain pattern of consumption ? We think that a positive answer could be given to this question. And it is in the direction of this third type of relation between accumulation and consumption that we will work out the Alternative Pattern of Development.

We have to start then from a definition of a pattern of consumption to be realised for the masses of direct producers in the long run. It represents, hence, the main objective of economic development. How could we define this pattern of consumption ?

B — This pattern of consumption could be defined :

— starting from the actual pattern of consumption of direct producers;

— on the basis of an elaborate idea of what might be considered as social needs (in contrast with the individual

needs), meaning that, the needs that could be satisfied for these masses given their standard of living on one hand, and the society's resources on the other;

— to define the pattern of consumption, the elements, the system of values which the society aims to achieve must be defined;

— the definition of this long-run pattern of consumption of the masses implies, then, a knowledge of the society's resources.

A basic requirement for the elaboration of the Alternative Pattern of Development and for its realisation, is a thorough knowledge of the society's resources (taken into a dynamic sense). This necessitates :

1 — a serious effort of surveying each country to know its resources potential.

2 — a serious research work :

a) to start from the accumulated scientific and technological knowledge;

b) to study — the different techniques applied abroad, and

— the different internal authentic techniques;

c) in order to find out :

— with respect to foreign techniques, the ones that could be selected (with or without modifications),

— with respect to internal techniques :

— the techniques that could be used as they are;

— the techniques that could be used with modification, and

— the new techniques that have to, and could be, elaborated.

Having defined the main objective, the pattern of consumption, on one hand, and the resources and the technical possibl-

lities, on the other, this main objective could be realised by launching a process of structural changes that has to embrace:

- changes in the pattern of distribution of income in favour of the masses. This could be realised through a new type of production relations which permits us :
  - to eliminate foreign capital,
  - to liberate the economic surplus from internal classes wasting it in one way or another,
  - to find new forms of organisation of the production units, forms which come out from the concrete conditions of each society and prove more appropriate for development.
- and changes in the level of development of the productive forces of the society, that is changes that aims at process of production and reproduction through :
  - the liberation of the creative working people through ideological consciousness;
  - the technical formation of the labour force (education, about which we will have some additional word to say), and
  - the increase in quantity and quality of the means of production.

In other words, the changes in the level of development of productive forces will be realised through accumulation as a process finding its source in the economic surplus of the society which is, in the context of underdeveloped economics, mainly agricultural or in the primary production in general. One has then to acquaint himself with this surplus, its magnitude, the activities in which it is produced, the type of production units in which it is produced, the types of monetary icomes in which it is manifested and so on.

Once the surplus localised, the problem of its mobilisation for developing the productive forces has to be considered; the different means of mobilisation : taxes, prices, recognization of productive units and of units of trade, etc.

The path of development, of structural changes necessary for the realisation of the main objective (the defined pattern of consumption), will be determined by the magnitude of accumulation, that is the amount of surplus invested, and the modality of accumulation, that is the manner of the distribution of investment resources between agriculture, industry and services, as well as the type of agricultural and industrial projects that will be chosen.

As for the magnitude of accumulation, we need not to sacrifice the present through a freezing up of the level of consumption in order to increase investment. But lavish consumption should be abolished. Apart from that, we should bear in mind that the productivity of the direct producers is determined among other things (such as the type of organisation, the degrees of their political mobilisation, the system of values prevailing, etc). by the level of their consumption. We should observe, too, the necessity of increasing, at a relatively higher rate, the level of consumption of the lower stratum of the population. This should be done at the same time with the increase of investment. Consumption as well as investment will be increasing in absolute terms, with the possibility of increasing investment at a relatively higher rate of increase.

As for the modality of accumulation, it is determined by :

— the share of each of agriculture, industry and services, in accumulated means of production;

— the type of activity that will be stimulated within each, and

— the pattern of location of new projects in each of these three fields.

The modality of accumulation could be determined in the light of the following considerations :

— in agriculture, the long-run objective would be transform it in an industrial branch where science and technology could be applied, what emphasis within agriculture ? This depends on the nature of the agriculture that we are to start with :

— if it is not producing food, we will have to transform it partly over time into an agriculture producing food for the masses.

— if it is producing food products, we should see which ones, to transform it, if necessary, for the production of the appropriate (and enough diversified from a nutritional viewpoint) food products ;

— if other primary production (mining and oil extraction) exists besides the agriculture which produces food products, this will help a transformation of both agriculture and industry with a simultaneous relatively high increase in consumption.

— the problem of the transformation of the rural society : creation of a new sort of agglomeration that eliminates the contradiction between the town and the countryside :

  — rural industrialisation (types and scale of industries (production goods and consumption goods) ;

  — at a later stage : desurbanisation of the overcrowded areas.

In industry and connected mining fields, the long run objective should be to build the basic industries and the consumption industries necessary for the production of goods responding to the pattern of consumption defined.

What emphasis within industries? This depends on :

— the type of resources, actual and potential;

— the type of the already existing industries;

— the necessity of building up the appropriate industrial base, to assure :

  — the industrial requirements necessary for the transformation of agriculture,

  — independence,

  — a higher effect on the overall rate of development.

For the **technical forms of projects** : We should have selective (foreign) techniques and authentic ones. Effectively, the final outcome will be a combination of techniques in the projects of different activities, within varying combinations of labour and means of production. We should bear in mind that, for some sort of projects, the choice is limited, and that in general, labour productivity will be higher, other things being equal, the more and the better quality of, the means of production at its disposal.

In the domain of **services**, we will need to think in a totally different manner. To take some examples :

— **Education** : the necessity of elaborating, given the cultural background, a new pattern of education. To do so, we must:

1 — keep in mind that education and struggle, i.e., are the same.

2 — realise that the main function of education is to remold the "mentality" through the establishment of a system of values which negates the established concepts held by capitalist society. [1]

The objective will be a type of man who while having a speciality can, at the same time, perform productive labour, pursue political activity and so on. And to realise this, it will be necessary to combine productive labour with learning.

3 — This implies a new significance of the right of education: it would not merely mean the right to receive as it does in capitalist society, but it also means the right to **practice** education. The educational reform should affirm the transformation from passive recipient to active participant and ultimately prime movers. This is because when man is respected as man and the exercice of his sovereign rights are guaranteed, he moves and acts without the need of material stimulants and indu-

(1) Even for the contemporary capitalist societies, the latest discoveries show that these material incentives tend to stop being workable. After all, why working more if the conditions of work are one of alienation. People start to look for something else.

cements thereby making possible, e.g., the promotion of production and the ongoing political struggle.

— **Health** : given the relatively limited resources at the first stage, especial attention could be given to preventive medecine to change the conditions of chronical diseases, along with the creation of small units of curative medecine with not necessarily highly formed physicians to live necessarily with the direct producers.

— **Housing** : at the first stage, furnish decent houses to the lower stratum of the population. At a second stage, the necessity of the construction of new type of agglomeration :

  — not necessarily big, on the site of production;

  — to be built by the producers themselves;

  — according to techniques mastered by them;

  — using local construction materials.

As for the location of new activities, this could be effectuated on the basis of the following considerations :

— the type of resources in the region;

— the necessity of respecting cultural reality ;

— the necessity, for the region, of having a certain minimum of product mix;

— services to be located at the disposal of direct producers.

For the location of industrial projects, it is possible to make the distinction between :

— industrial projects which are basic at a national level;

— industrial projects which are basic at regional level; and

— industrial consumption projects, to be located, as far as possible near to consumers.

The locational pattern should specifically, at the first stage, care for :

— the countryside, and especially lower stratum, and

— the lower stratum of the urban population.

The process of development should not take the form of expanding urbanisation in form talked about, within the context of current regional analysis for development. Emphasis should be rather on the process of rural industrialisation with the possibility of certain desurbanisation at a later stage.

* * *

This is a possible framework of an Alternative Pattern of Development. The basic idea about it is that it is worked out according to social, and not profit-making, criteria. In other words, it is thought of according to a system of values different from that of the type of social organisation that produced underdevelopment.

Such an Alternative Pattern raises some problems of transition. Most important of them are :

— the one relative to a reorganisation of the society from the political point of view, the realisation of another type of State, and,

— that relative to foreign trade, for the planned objectives have their import requirements. An underdeveloped economy has no choice in this context. We have to take the social conditions of the world market as given and try, given the import requirements of the plans (which have to be as minimal as possible), to maximize, in the short run, the foreign earnings through better trading conditions (from the viewpoint of prices or geographical distribution of foreign trade) in order to cover the import requirements without never forgetting the necessity of being selective with respects to foreign transactions implying the importation of equipments. Moreover, even if we have balance between domestic resources and needs, we might still have unbalance between foreign requirements and earnings from exports. Here, if we have to do without foreign capital, there is the possibility of recurring to foreign credit provided it

does not contradict the conditions of the realisation of our strategy.

It is clear that the realisation of such an Alternative Pattern of Development necessitates a new type of socio-political set-up to be based on the free mobilisation of the masses of direct producers. The realisation of such set-up should represent the first priority. Until its realisation, what are we to do ?

1 — First, having known this alternative, we have to participate in the political activity that leads to its realisation.

2 — Second, to carry out, individually, on in team-works, the studies of the different elements evoked by this pattern.

3 — Third, whenever we have the occasion to advise for a certain solution or participate to a single action, the advice or the participation should be carried out in the direction indicated by this Alternative Pattern of Development.

Whetever may be immediate role that each of us can play, no effort should be saved to accelerate the process of changes, whatever its nature, taking place in our societies. For, the more rapidly it goes, the sooner comes the moment that shows the limitations of the actual types of organisations and their incapacity to solve the basic problems of underdevelopment of our societies.

DISPARITIES OF EGYPTIAN PERSONAL INCOME DISTRIBUTION AS REFLECTED BY FAMILY BUDGET DATA

By

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I — Introduction

Maximization of net social product and optimization of income distribution are the master ends of economic policy. Optimum income distribution is achieved if everyone has access to an adequate minimum standard of subsistence regarding food, clothes, housing, medical care, and education i.e. the subsistence norm, and if everyone can earn incomes above his minimum living floor commensurate with his efforts and abilities contributed to the production process, i.e. the contributive norm. Any specific economic policy should reduce, or at least not increase the number of families living below adequate subsistence standards and should assist and induce individuals to earn incomes proportional to their actual or potential productivity.(1)

Optimum income distribution is not only asked for achieving social justice, but also because of its role in keeping opportunities open for all, which is one of the most fundamental functions of economic policy. Preventing concentration of wealth, and economic power and its counterpart, namely mass poverty and insecurity are directly related to the pattern of income distribution. Developing individual initiative and talents, whenever they are found, requires a reasonable degree of equa-

(1) Raznor Schickele, Agricultural Policy, Farm Programs and National Welfare, New York, McGraw-Hill Book Co., 1954, pp. 38 - 40.

lizing both opportunities and distribution of wealth. So, public policies should be formulated to call for equalising opportunities, strengthing the bargaining power of vulnerable individuals and groups, and restraining the powerful from exploiting the weak in order to reduce the effect of economic and social environment to give the individual better chances to develop his best and contribute his most to society's progress. Hence, policies appropriately designed to improve income distribution are not likely to depress the flow of goods and services, instead they usually tend to increase the social product.(2)

Optimum income distribution, therefore, does not imply equal incomes for all. The degree of departure from absolute equality, regardless of how it is increased or stated, have to be referred in some way or another to a standard or justifiable pattern of distribution. A dead level of uniformity is neither practicable nor desirable. The most serious aspect of income distribution is not the presence of a larger or smaller degree of concentration, but the general distortion of the whole scheme, reflecting, as it exists, undoubtful high degree of inequality in the distribution of opportunities(3).

The Egyptian pattern of income distribution, notably during the fifties and sixties was severely and bitterly criticised, being condemned as pertaining to feudalistic, imperialistic, and capitalistic principles. The Egyptian Society at that time was described as the 0.5 percent Society, namely that few families aquired the largest share of national income. Severe measures were adopted to remedy the abuses of the pattern of income distribution. Progressive taxing, with respect to both brackets and rates, became more tight. Nationalization, not only to foreign interests but also to a vast major sector of Egyptian capitalists, was widely applied. Confiscation, as away for eradicating the remainders of feudalism, was extensively ap-

(2) Osman A. El-Kholie, «Economic Policy Ends and Agricultural Econ. Development in the U.A.R.», L'Egypte Contemporaine, Jan. 1969, p. 88.

(3) Allyn A. Young, «Do the Statistics of the Concentration of Wealth in the United States Mean What They are Commonly Assumed to Mean ?, Jour. Am. Stat. Ass., Vol. XV, New Series, No. 117, March 1917, pp. 471 - 484.

plied, notably to royal, foreign, and Egyptian capitalists. The agricultural reform act of 1952 was adjusted and readjusted, reducing in each case the upper limit of land ownership. Upper limit of ownership, accordingly, was reduced from 200 to 100, then to 50 feddans per capita. An upper limit for family ownorship was imposed so as not to exceed 100 feddans per family. Another upper limit was imposed on the size of agricultural holding, so as not to exceed 50 feddans per holder. Rental values of cultivated acreage were determined equivalent to those existing in 1945, with no margin of flexibility so as to vary in accordance with changing technological, economic and social conditions. These extremist measures were believed capable of rectifying the abuses of the pattern of income distribution.

Regardless of their indirect effects, no attempt whatsoever was made to measure empirically the effect of these measures in achieving their ultimate goal. The availability of family budget data for 1958 and 1964, however, made it possible, at least to a certain extent, to detect the effectiveness of those measures in achieving their ultimate goal.

II — Data, and Methodology of Income Distribution Comparisons

Sampling Procedure : Egyptian census of dwelling units is considered as the basic population, of which the sample of households was drawn. Cairo, Alexandria, Port-Said, Ismailia, and Suez, in addition to capitals of other governorates and their counties exclusive of their suburbs which are of rural character, are considered, according to the design of the sample, as the Egyptian urban sector. The rural sector, on the other hand, include the villages and urban suburbs which are rural character. Sampling, with respect to the urban sector, was carried on two stages. Each urban center, in case of Cairo, Alexandria, Port-Said, Ismailia, Suez, and capitals of other governorates, was classified into regions coinciding with the geographical boundaries of police departments. Households included in the sample were withdrawn by the means of simple random sampling from each of these regions. In case of county capitals, one-half their

number in each governorate was chosen at random, and of each selected capital a number of households, comparable to that residing in it, was selected at random.

Number of households included in the sample as of 1958 amounts to 3283 observations, compared to 9334 observations in 1964.(4)

Sampling from the rural sector was carried on three stages. Firstly, one-half the countries of each governorate was chosen at random. Villages of selected counties were classified in the second stage into two classes, namely big and small villages. A village was classified as a big one provided that the number of its households equals or exceeds 1000, otherwise it was considered as a small one. A number of villages, amounting to 2.5 per cent of each of the big and small villages were randomly chosen. A number of households comparable to that residing the village was, in the third stage, chosen at random for the sample. Size of the sample as of 1958 amounted to 3090 households, compared to 4480 households in 1964.(5)

Sample observations, therefore, were investigated and classified according to income brackets, as well as other socio-economic characteristics. The number of households existing in each income bracket, as a consequence of the sampling procedure, can be seen as endogenously and not exogenously determined. The number of households appearing in each income bracket is not previously determined since their distribution into income brackets occured following the selection of sample observations. Therefore, the distribution of households according to different income brackets can be considered as a representation of the pattern of income distribution. The accuracy and perfection of representation depends, of course, on the extent to which the sample presents the population of which it has been drawn, namely the Egyptian society.

(4) The Central Committee of Stat., Research of Sampled Family Budgets in the Eg. Region 1958 - 1959, Cairo, Oriental Ad. Co. April 1961, pp. 11 - 13.

(5) Ibid.

Measuring Disparities of Income Distribution; Different criteria have been advocated for measuring disparities of income distribution. Pareto used the formula;

$$\log N = \log A - \alpha \log X \qquad (1)$$

Where;

X = income size

N = Number of individuals having that income or larger

A & α = parameters of the functional form (1) to be estimated from the sample.

(α) represents the slope of (1) and is used as a measure of inequality of income distribution. The steeper the slope of the Pareto function, the less the dispersion in size of income within the Pareto range, i.e. the less the inequality within that range. No known distribution of incomes fits this formula except for high income tail begining well above the mean income. The slope of the high income tail tells little about the character of the rest of the distribution unless this tail begins at a level not above the arithmetic mean income.(6) Pareto criterion, however, was condemned as being inferior for the measurement of inequality. Yntema throws out the Pareto coefficient as both insensitive and unstable(7). Gini's attack on Pareto should have been sufficient to dispel for all time the notion that Pareto has proven a given degree of inequality to be characteristic of even those distributions included in his investigations(8).

Gini, on the other hand, used the functional form :

$$\log N = P + B \log A X$$

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(6) Mary Jean Bowman, «A Graphical Analysis of Personal Income Distribution in the United States,» Readings in the Theory of Income Distribution, London : George Allen & Unwin Ltd., 1954, p. 79.
(7) Ibid. p. 84.
(8) Ibid. p. 84

Where :

X — Size of individual income

N — Number of income receive with income of (X) or more.

A X — Aggregate income above the level (X).

The Gini formula describes the income distribution down to a much lower income level than is adequately described by Pareto formula. The slope (B) has been used as an index of the degree of inequality in the distribution of incomes. The less the slope of the Gini function, the more nearly equal the distribution of income would be.(9)

Despite the fact that the Gini formula gives better description of the model range of the income distribution than is provided by the Pareto formula, it still emphasizes the behavior of the income distribution in the upper rather than the lower income levels.(10) The Lorenz curve is the technique most commonly used to indicate difference in the degree of inequality of different income distributions. The convexity of the plotted curve toward the origin will be greater the greater the degree of inequality. Conclusions concerning the degree of inequality are again ambiguous, notably when comparing interecting Lorenz curves of different income distributions. The concentration ratio, defined as the ratio of area of concentration shown by the Lorenz curve to the area of maximum possible concentration, is used as a measure of inequality. This measure has the advantage over the Pareto (α), and the Gini (B) that it is independent of any mathematical formula to which the data must present a reasonably good fit. The Lorenz curve, however, gives no clue as to the general level of incomes or the numbers or proportions of households in different income — brackets(11).

Two basic types of information, according to Bowman, are important in the analysis of personal income distribution :

(9) Ibid. p. 81.
(10) Ibid. p. 85.
(11) Ibid. p. 98.

(1) the general level of living that such distribution may indicate, and (2) the shape of the distribution. The question of shape is not merely a matter of "degree of inequality or concentration" however measured, but the particular character of income disparities. Bowman, therefore, suggests using two types of charts, namely the Lorenz curve and the semi-logarithmic chart, which he believes that when coupled together would provide a sufficient complete analysis. The semi-logarithmic chart showing the cumulative distribution indicates the general level of incomes and the numbers or proportions of families in different income size classifications.

Gibrat, on the other hand, used the formula :

$$Y = \pi \quad e^{-\frac{1}{2}Z^2} \qquad (3)$$

with : $Z = a \log (X - Xo) + b$ (4), where :

Y = number of income recipients

X = Size of incomes

$(X - Xo)$ = Selected income constant.

Successful descriptions of a large number of frequency distributions have been obtained by using formula (3). A measure of inequality can be derived from (3), being equal to (100/a), where (a) is a constant in (4).[12] The average and the standard deviations of income frequency distributions can be used as indices of inequality of incomes, both taken relatively to some average income, either the mode, median, arithmetic or geometric mean.[13]

Still there exists measures of inequality based upon functional relation between size of income and economic welfare. These measures are derived on the assumption that welfare of different persons is additive, i.e. that the relation of income to

(12 & 13) Simon Kuznets, «National Income», Readings in Theory of Income Distribution, London : George Allen & Ltd., 1954, p. 35.

welfare is the same for all members of the society, and that for each individual marginal economic welfare diminishes as income increases. According to Bernoulli the function is given by :

$$W = dX/X \qquad (5.1)$$

According to Dalton (5.1) is expressed as :

$$W = DX/X^2 \qquad (5.2)$$

Whereas according to Cramer welfare varies with the square root of income or :

$$W = X^{1/n} \quad , \quad n>1 \qquad (5.3), \text{ where :}$$

W — economic welfare

X — Size of income

From each of these functions, i.e. (5.1), (5.2), and (5.3) one can derive an index of inequality by comparing maximum aggregate welfare with actual aggregate welfare as shown by the empirical sample.[14] The choice of a measure depends on three considerations, namely the conception of the measure as an index, the understanding of the measure as a summary of the welfare equivalents of income distribution[15], and the imperfection of data at hand. Those measures that may be best by the criteria of statistical representation or theoretical adequacy may be the most susceptible to imperfections of statistical data.

III — Emperical Frequency, and Cumulative Functions of Egyptian Personal Income Distribution

Data presented in Table (1) show sampled urban households, (column 2), as of 1958 distributed between different income brackets, (column 1). Dividing figures of column (2)

(14) Ibid. p. 37.
(15) Ibid. p. 38.

through by the sample size, i.e. by 3145, gives emperical frequencies of households falling in each income bracket, (column 3). Cumulative frequencies are computed in column (4). Total annual expenditures[16] for different income brackets are shown in column (6) of Table (1). Dividing through by total annual expenditures for sampled households, namely L.E. 853, 105, gives percentage share of each income bracket, which are presented in column (6). Cumulative percentage shares are computed in column (7). Graphing columns (4), and (7) gives the ordinary Lorenz curve for personal income distribution of the Egyptian urban sector as of 1958. Figures of column (8) represent total annual expenditures per household for different income brackets, which are computed by dividing figures of column (5) by these of column (2). Figures of column (8), coupled with those of column (3) indicate the emperical frequency function of personal income distribution of the urban sector as of 1958. Elements of column (8) designate the values of the random variable (X_1), i.e. total annual expenditures per household, whereas those of column (3) represent respective probabilities attached to different values of (X_1). Frequency function of (X_1) is graphed in fig. (1).

The same procedure was applied to data of the rural sector as of 1958, (Table 2), to those of the urban and rural sectors as of 1964, (Tables 3 and 4 respectively). Accordingly, the frequency function of the random variable (X_2), i.e. total annual expenditures per household for the rural sector as of 1958, is computed in Table (2), and graphed in Fig. (1). Frequency functions of the random variables (X_3) and (X_4), i.e. total annual expenditures per household for urban and rural sectors as of 1964 respectively, are computed in Table (3) and (4). These functions are graphed in Fig. (2).

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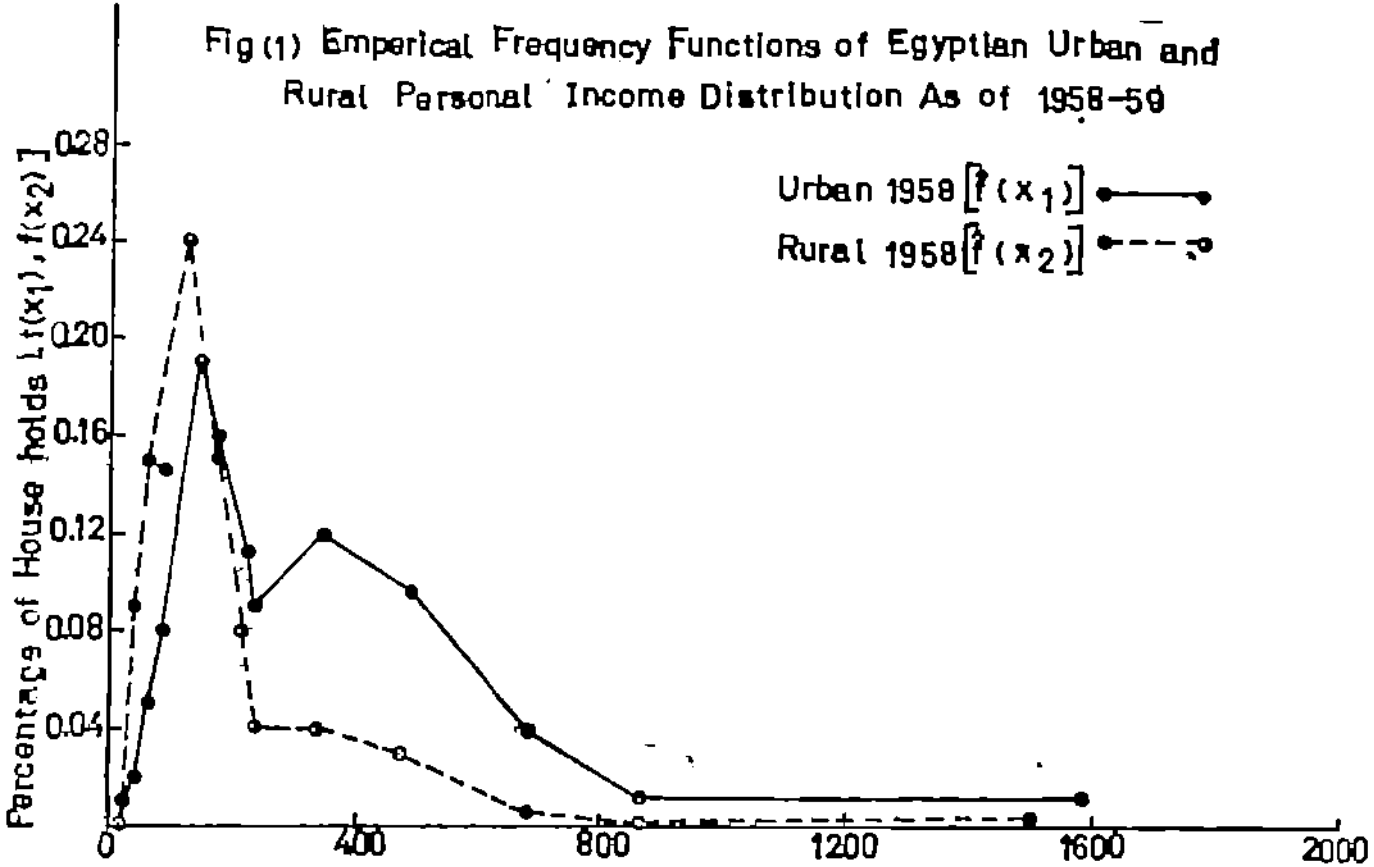
16) Total annual expenditures, instead of incomes, are available for different income brackets. Regardless of savings, total annual expenditures are likely to be equivalent to income levels. Total annual expenditures under the Egyptian Conditions account for nearly 95% of annual incomes. Personal distribution of total annual expenditures, therefore, is likely to represent to a great extent that of income distribution.

TABLE 1. Sampled Egyptian Urban households distributed according to total and average annual expenditures as of 1958 - 1959

Income Brackets (L.E.)	No. of Households			Total Annual Expenditures			
	Total	Percent		Total L.E.	Percent		Total Annual Exp. per Household L.E. (xl)
		f (xl) %	cumulative f (xl)		%	cumulative	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
less than 25	6	0.19	0.19	112	0.01	0.01	18.67
25 -	65	2.07	2.26	2,637	0.31	0.32	40.57
50	165	5.25	7.51	10,379	1.20	1.52	62.90
75 -	251	7.98	15.94	22,167	2.60	4.12	88.31
100	602	19.14	34.63	75,783	8.88	13.00	125.89
150 -	512	16.28	50.91	88,588	10.38	23.38	173.02
200	356	11.32	62.23	79,826	9.36	32.74	224.23
250 -	269	8.55	70.78	73,760	8.65	41.39	274.20
300	377	11.99	82.77	130,041	15.24	56.63	344.94
400	307	9.76	92.53	149,647	17.54	74.17	487.45
600 -	131	4.17	96.70	89,674	10.51	84.68	684.53
800	45	1.43	98.13	39.204	4.70	89.38	871.20
1000 & more	59	1.87	100.00	91,284	10.62	100.00	1547.19
Total	3145	100.00	-	853.105	100.00		271.26

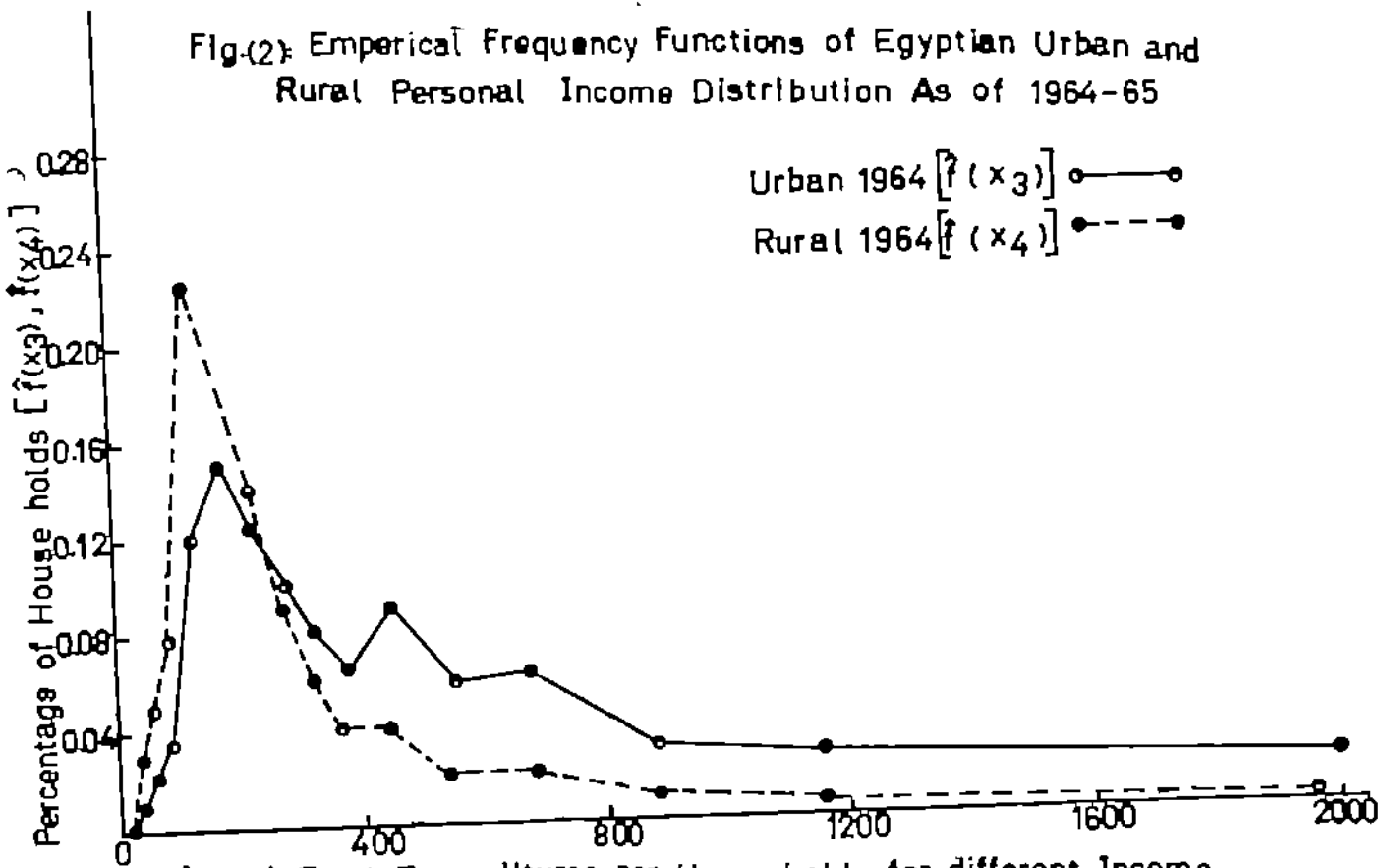
Source : Collected and computed from the Central Committee of Statistics, *Research of Sampled Family Budgets in the Egyptian Region* 1958 1959, Cairo : Oriental Ad. Co., April 1961, pp. 193 – 194.

Fig (1) Emperical Frequency Functions of Egyptian Urban and Rural Personal Income Distribution As of 1958-59



Source: Tables (1) & (2)

Fig.(2): Emperical Frequency Functions of Egyptian Urban and Rural Personal Income Distribution As of 1964-65



Source: Tables (3) & (4)

TABLE 2. Sampled Egyptian Rural households distributed according to total and average annual expenditures as of 1958 - 1959

Income Brackets (L.E.)	No. of Household			Total Annual Expenditure			
	Total	Percent		Total (L.E.)	Percent		Total Annual Exp. per Household (X_2) (L.E.)
		$\hat{f}(X_2)$ %	Cumulative $\hat{f}(X_2)$		%	Cumulative	
less than 25	42	1.38	1.38	,864	0.19	0.19	20.57
25—	279	9.19	10.57	10,994	2.45	2.64	39.41
50—	460	15.15	25.72	29,044	6.47	9.11	63.14
75—	442	14.55	40.27	39,028	8.70	17.81	88.30
100—	748	24.63	64.90	92,007	20.51	38.32	123.00
150—	443	14.59	79.49	76,490	17.05	55.37	172.66
200—	246	8.10	87.59	54,608	12.17	67.54	221.98
250—	134	4.41	92.00	36,425	8.12	75.66	271.83
300 –	127	4.18	96.18	43,013	9.59	85.25	338.69
400—	89	2.93	99.11	42,352	9.44	94.69	475.87
600—	18	0.59	99.70	12,737	2.84	97.53	707.61
800	4	0.14	99.84	3,466	0.77	98.30	866.50
1000 & more	5	0.16	100.00	7,541	1.70	100.00	1508.20
Total	3037	100.00		448,574	100.00		147.70

Source: Collected and computed from the Central Committee of Statistics, *Research of Sampled Family Budgets in the Egyptian Region* 1958 – 1959. Cairo : Oriental Ad. Co., April 1961, pp. 194 – 196.

The surprising feature that can be deduced from Fig. (1) is that the Egyptian urban society, in view of the pattern of income distribution existing in 1958, can be classified into two main classes, namely the low and high income classes. A distinguished pattern of income distribution exists for each income class. Stated differently, there existed two income distributions for the egyptian urban sector in 1958, the first pattern included nearly 70% of the sample observations with a mode value of annual total expenditures amounting to nearly L.E., 140 per household. The second pattern, i.e. that of the high income group included nearly 30% of sampled households with a mode value of annual total expenditures amounting to nearly L.E. 360 per household.

The pattern of income distribution for the rural sector as of 1958 was almost similar to that of the urban sector. Nevertheless, the pattern was less acute, in the sense that the low income group included nearly 92% of sampled households, compared to only 8% for the high income group. Mode values of annual total expenditures per household amounted to L.E. 120 and L.E. 336 for low and high income groups respectively. The reduced acuteness of disparities of income distributions in the rural sector relatively to that of the urban one may be explained, at least partly in view of the effects of the land reform act of 1952.

The existence of the same phenomenon in the distributions of 1964 is rather more surprising, since this means complete failure of those measures undertaken to remedy the abuses of the pattern of income distribution. Percent of urban households included within the high income class in 1964 amounts to 28.57% of sampled households, compared to 29.22% in 1958.(17) This result

(17) Urban household with annual expenditures exceeding L.E. 271.20 in 1958 amount to 29.22% of sampled households. Households with annual total expenditures of L.E. 345 account for 11.99%, compared to 9.76% for those of L.E. 487 per annum, and 4.17% for those of L.E. 684 annually. Households with annual total expenditures amounting to L.E. 871 amount to 1.43%, compared to 1.87% for those of L.E. 1547 per annum. As of 1964 the 28.57% of households with annual total expenditures exceeding L.E. 374.25 distributed as follows:
9.04% of households with annual total expenditures of L.E. 417

TABLE 3 — Sampled Egyptian Urban Households Distributed According to Total and Average Annual Expenditures As of 1964 — 65.

Income Brackets (L.E.)	No. of Household Total	Percent $\hat{f}(x_3)$ %	Percent cumulative $\hat{f}(x_3)$	Total Annual Expenditures Total (L.E.)	Percent	Percent Cumulative %	Total Annual Exp. per Household(x_3) (L.E.)
less than 25	10	0.11	0.11	.119	0.01	0.01	19.90
25–	114	1.22	1.33	4.597	0.11	0.12	40.32
50–	208	2.23	3.56	13.165	0.11	0.23	63.29
75–	336	3.60	7.16	29.468	0.87	1.10	87.70
100–	1113	11.92	19.08	141.076	4.15	5.25	126.75
150–	1352	14.48	33.56	237.019	6.97	12.22	175.31
200–	1162	12.45	46.01	261.035	7.68	19.90	224.64
250–	968	10.73	56.38	266.470	7.84	27.74	275.28
300–	792	8.49	64.87	256.105	7.53	35.27	323.36
350–	612	6.56	71.43	229.038	6.74	42.01	374.25
400–	844	9.04	80.47	376.985	12 14	54.15	446.66
500–	525	5.62	86.09	288.107	8.48	62.63	548.78
600–	574	6.15	92.24	393.784	11.58	74.21	686.03
800–	285	3.05	95.29	253.313	7.45	81.66	888.81
1000–	259	2.77	98.06	299.201	8.80	99.46	1155.22
1400 & more	180	1.94	100.00	349.584	10.28	100.74	1942.13
Total	9334	100.00	——	3.399.146	——	——	364.17

Source : Collected and computed from The Central Agency of General Mobilization & Stat., Research of Sampled Family Budgets in the Arab Republic of Egypt 1964 65, Cairo : Cen. Ag. of Gen. Mob. & Stat., Jan. 1972, pp. 18 -- 20.

TABLE 4 — Sampled Egyptian Rural Households Distributed According to Total and Average Annual Expenditures As of 1964 — 65.

Income Brackets (L.E.)	No. of Households			Total Annual Expenditures			
		Percent			Percent		Total Annual
	Total	$\hat{f}(x_4)$ %	cumu. $\hat{f}(x_4)$	Total (L.E.)	%	cumu.	Exp. per Household(x_4) (L.E.)
less than 25	12	0.27	0.27	233	0.02	0.02	19.42
25–	125	2.79	3.06	4.821	0.48	0.50	38.57
50–	218	4.87	7.93	13.999	1.39	1.89	64.22
75–	344	7.68	15.61	30.412	3.03	4.92	88.41
100–	1007	22.48	38.09	126.479	12.59	17.51	125.60
150–	850	18.97	57.06	148.849	14.82	32.33	175.12
200–	613	13.68	70.74	137.159	13.66	45.99	223.75
250–	410	9.15	79.89	111.849	11.14	57.13	272.80
300–	280	6.25	86.14	90.037	8.97	66.10	321.56
350–	186	4.15	90.29	69.483	6.92	73.02	373.56
400–	184	4.11	99.40	81.981	8.16	81.14	445.55
500–	109	2.43	96.83	59.200	5.89	87.07	543.12
600–	84	1.88	98.71	57.007	5.68	92.75	678.65
800–	24	0.54	99.25	21.348	2.13	94.88	889.50
1000	19	0.42	99.67	22.042	2.19	97.07	1160.11
1000 & more	15	0.33	100.00	29.381	2.93	100.00	1958.73
Total	4480	100.00		1.004.280	100.00		224.17

Source : Collected and Computed from The Central Agency of General Mobilization & Statistics, Research of Sampled Family Budgets in the Arab Republic of Egypt 1964 — 65, Cairo Cen. Agency of Gen. Mob. & Stat. Jan. 1972, pp. 21 — 23.

can be interpreted that despite the eradication of most of the Egyptian capitalists in the fifties, the same and or other policy measures resulted the existence of another group of high incomes in such way that the size of the new class is almost equivalent to that of the fifties. The same phenomenon was also evident with respect to the rural sector, where the high income group in 1964 embodied 9.72% of sampled households, compared to 8% in 1958.(18) The gap between the urban and rural sectors was found to be ever widing. Hence, annual total expenditure per household for the urban sector increased from L.E. 271 in 1958 to L.E. 384 in 1964, compared to L.E. 148 and L.E. 224 for the rural sector. These results, on the other hand, support the hypothesis that disparities of income distribution are far more acute in the urban rather than the rural sector. It also advocates the hypothesis that the problem is rather crucial in Cairo metropolitan area (including Giza), followed by Alexandria, and capitals of other governorates.

IV — Statistical Analysis Applied to Egyptian Personal Income Distribution

Data presented in Table (5) show sample means and estima-

5.62% of households with annual total expenditures of L.E. 549
6.15% of households with annual total expenditures of L.E. 666
3.06% of households with annual total expenditures of L.E. 899
2.77% of households with annual total expenditures of L.E. 1155
1.94% of households with annual total expenditures of L.E. 1943

(18) Rural households with annual total expenditures exceeding L.E. 271.83 in 1958 account for 8% of sampled households, distributed as :
4.19% of households with annual total expenditures of L.E. 339
2.83% of households with annual total expenditures of L.E. 476
0.59% of households with annual total expenditures of L.E. 706
0.14% of households with annual total expenditures of L.E. 946.5
0.06% of households with annual total expenditures of L.E. 1508
As of 1964 the 9.72% of households with annual total expenditures exceeding L.E. 373.56, distributed as :
4.11% of households with annual total expenditures of L.E. 445
2.48% of households with annual total expenditures of L.E. 543
1.86% of households with annual total expenditures of L.E. 679
0.54% of households with annual total expenditures of L.E. 890
0.43% of households with annual total expenditures of L.E. 1160
0.33% of households with annual total expenditures of L.E. 1959

ted variances for random variables (X_1), (X_2), (X_3) and (X_4), i.e. for annual total expenditures per urban and rural household as of 1958 respectively. Estimated variances were computed according to the formula

$$S^2(Xij) = \frac{I}{nj - I}\left[\sum_{I-I}^{nj} X^2 j \hat{f}(Xij) - \bar{X}j^2\right]$$

$i = 1, 2, 3, \ldots nj \; ; \; j = 1, 2, 3, 4.$

$\hat{f}(Xij)$ = emperical frequency function of the jth random variable.

$\bar{X}j$ = sample mean of the jth random variable.

Annual total expenditures for the urban sector increased from L.E. 271.26 in 1958 to L.E. 364.17 on the average. However, estimated variance relative to sample mean increased from 0.0703 in 1958 to 0.1700 in 1964, a finding that supports the hypothesis of more acute disparity in distributing urban incomes. Rural annual total expenditures per household increased from L.E. 147.70 in 1958 to L.E. 224.17 in 1964. Unlike the urban sector, estimated variance relative to sample mean remained unchanged, namely in the vicinity of 0.032, indicating no significant deviation from the existing disparity of income distribution.

Differences of means, i.e. ($\bar{X}i$-Xj) for $i \neq j$, in addition to the size of the gap between the urban and rural sector (D) were statistically investigated, and the results are presented within Table (6). Differences of average annual total expenditures of urban households in 1958 and 1964, i.e. ($\bar{X}_4$-$\bar{X}_2$), and average annual total expenditures of rural households in 1958 and 1964, i.e. ($\bar{X}_3$-$\bar{X}_1$), were found to be statistically significant at the 0.005 level. However, this result does not necessarily imply better levels of living, since prices during the period 1958-64 were subject to noticeable inflationary effects.

Differences of average total expenditures of rural and urban sectors ($\bar{X}_1$-$\bar{X}_2$), ($\bar{X}_4$-$\bar{X}_3$), ($\bar{X}_2$-$\bar{X}_3$) and ($\bar{X}_4$-$\bar{X}_1$) were sta-

TABLE 5 — Sample Means and Estimated Variances for Random Variable (X_1), (X_2), (X_3) and (X_4)

Random Variables (xi)	Sample Means ($\bar{x}i$)	$\sum_{i=1}^{n} Xi^2 \hat{f}(xi)$	$\sum_{i=1}^{n} xi^2 \hat{f}(xi) - \bar{x}i^2$	n-1	$s^2(xi)$
	(L.E.)				
X_1	271.26	133.505.69	59.923.79	3144	19.0597
X_2	147.70	36.296.44	14.481.15	3036	4.7698
X_3	364.17	233.175.05	100.555.26	9333	59.49
X_4	224.17	82.691.02	32.438.83	4479	7.2424

Source : Compiled and computed from tables (1), (2), (3) and (4).

TABLE 6 — T-test Applied to the difference of Means of the Urban sector (1958 & 1964); difference of Means of Rural Sector (1958 & 1964), and to the Gap between the Rural and Urban Sectors.

Statistical Hypotheses	$\bar{(xi-xj)}$ L. E.	$s^2(\bar{xi-xj})$	$s(\bar{xi-xj})$	d.f.	t	Significance
(M1–M2) ·0	123.56	0.0077	0.088	6180	1404.10	sig. ato 0.005
(M3–M1) ·0	92.91	0.0125	0.112	12477	829.55	" " 0.005
(M1–M4) ·0	47.09	0.0077	0.088	7623	535.11	" " 0.005
(M2–M2) ·0	216.47	0.0080	0.090	12369	2405.22	" " 0.005
(M4–M2) ·0	76.47	0.0032	0.057	75.15	1341.58	" " 0.005
(M3–M4) ·0	140.00	0.0080	0.090	13812	1555.56	" " 0.005
D ·0	16.44	0.0157	0.130	19.992	131.52	" " 0.005

(1) $D = (M_1 - M_2) - (M_3 - M_4)$, $\hat{D} = (\bar{X}_1 - \bar{X}_2) - (\bar{X}_3 - \bar{X}_4)$.

$V(D) = \sum_{i=1}^{4} V(\bar{Xi})$, $S_{\hat{D}} = 0.0157$.

Source : Compiled and computed from Table (6).

tistically investigated. All t-ratios were found to be statistically significant at the 0.005 level, indicating a sounded difference in average annual total expenditures of the urban and rural sectors whether on comparing the situation in 1958 or 1964. Accordingly, it can be stated that there exists a sounded gap between the rural and urban sectors, yet the size of this gap has increased from L.E. 123.56 in 1958 to L.E. 140 in 1964. The size of that gap (D) was statistically investigated, and the t-test indicated a definite move towards widing that gap; (Table 6).

This result may help explain the ever increasing trend of rural migration to urban centers. The urban sector provides, aside of better social services and activities, opportunities for higher incomes, and, therefore, acts as a source of attraction to rural population. The ever widing gap between the rural and urban sector is expected to support more and more rural migration to urban centers. Despite the cronic and acute abuses of the pattern of urban income distribution, it still provides better incomes, services, and social activities to various labor categories of the rural sector.

This ever widing gap is highly related to the government's economic policy, notably that of socio-economic planning. The largest share of investments of the first five years plan was used to execute projects located within or nearby the Egyptian urban centers. This resulted better incomes and conditions of living in the urban centers compared to the rural ones, which was reflected in turn in the ever widing gap. Bridging this gap, however, requires a structural change in the government's socio-economic policy of planning, stressing to the greatest extent rural rather than urban development. Stated differently, sizable part of the investments of the development plans ought to be allocated to the rural sectors. Development plans have to be adjusted in order to permit increasing rural incomes at rates that exceeds those of the urban sector. Allocation of investments designed to improve services and social activities has to stress the rural rather than the urban sector.

V — Summary and Conclusions

Maximization of net social product and optimization of income distribution are the master ends of economic policy. Opti-

mum income distribution is attained if everyone has access to an adequate minimum standard of subsistence regarding food, clothes, housing, medical care, and education, and if everyone can earn income above his minimum living floor comparable with his efforts and abilities contributed to the production process. Optimum income distribution, therefore, does not imply equal incomes for all.

The Egyptian pattern of income distribution, notably during the fifties and sixties, was accused as being pertaining to feudalistic, imperialistic, and capitalistic principles. Severe measures were adopted to remedy the abuses of the pattern of income distribution. Regardless of their indirect effects, no attempt whatsoever was made to measure empirically the effect of those measures in achieving their ultimate goal.

Egyptian census of dwelling units is considered as the basic population, of which the sample of households was drawn for family budget investigations. The number of households existing in each income bracket, as a consequence of the sampling procedure, can be seen as endogenously and not exogenously determined. The number of households appearing in each income bracket is not previously determined, since their distribution occured following the selection of sample observations. Therefore, the distribution of households according to different income brackets can be considered as a representation of the pattern of income distribution.

Egyptian urban income distribution as of 1958 indicates a rather surprising phenomenon, namely that the society can be classified into two main distinguished groups. A pattern of income distribution exists for each of these two groups. The first pattern includes nearly 70% of Egyptian urban households, with a mode value of annual total expenditures of nearly L.E. 140 per household. The second pattern, i.e. that of the high income class, includes nearly 30% of sampled households, with a mode value of total annual expenditures of L.E. 360 per household.

The pattern of income distribution of the rural sectors as of 1958 reflected the same phenomenon, last to a less acute state. The pattern of the low income group included 90% of sampled

households, compared to only 8% for the high income group. Mode values of annual total expenditures per household amounted to L.E. 120 and L.E. 336 for low and high income groups respectively.

The existence of the same phenomenon in the distributions of 1964 is rather more surprising, since this means complete failure of those measures taken to remedy the abuses of the pattern of income distribution percent of urban households included in the high income class as of 1964 amounts to 28.57% of sampled households, compared to 29.22% in 1958. This result can be interpreted that despite the eradication of most of the Egyptian capitalists of the fifties, the same and/or other policy measures resulted the existence of another group of high incomes of almost the same size. The same phenomenon was also evident with respect to the rural sector, where the high income group in 1964 included 9.72% of sampled households, compared to 8% in 1958.

The gap between the urban and rural sectors was found to be ever widing. Hence, annual total expenditures per household for the urban sector increased from L.E. 271 in 1958 to L.E. 364 in 1964, compared to L.E. 148 and L.E. 224 for the rural sector. These results are in support of the hypothesis that disparities of income distribution are rather far chronic and acute in the urban sector. It also advocates the hypothesis that the problem is rather crucial in Cairo metropolitan area, followed by Alexandria, and Capitals of other governorates. These results are directly consistant with those of Austria, Italy and Germany, where income disparities among income recieplants is less conspicuous in agricultural than in other industries, in rural than in urban areas, in smaller cities than in the big centers.(19)

Annual total expenditures for urban sector increased from L.E. 271.26 in 1958 to L.E. 364.17 on the average. However, estimated variance relative to sample mean increased from 0.0703 in 1958 to 0.17 in 1964, a finding that supports the hypothesis of more acute disparity in distribution of urban incomes. Rural annual total expenditures per household increased from

(19) Kuznets, op. cit., p. 40.

L.E. 147.70 in 1958 to L.E. 224.17 in 1964. Unlike the urban sector, estimated variance relative to sample mean remained unchanged in the vicinty of 0.032 indicating no significant deviation from the existing pattern of income distribution. Average annual expenditures for the rural and urban sectors as of 1964 were found to differ significantly from those of 1958. However, this result does not necessarily imply better levels of living, as prices were subject to noticeable inflationary effects within the period 1958-64.

Differences of average total expenditures of rural and urban sectors were statistically investigated. All t-ratios were found to be statistically significant at the 0.005 level, indicating a sounded difference in average annual total expenditures. Accordingly, it can be stated that there exists a sounded gap between the rural and urban sectors. Yet, the size of this gap has increased from L.E. 123.56 in 1958 to L.E. 140 in 1964. The size of the gap was statistically investigated, and the t-test indicates a definite move towards widing that gap.

This result may help explain the ever increasing trend of rural migration to urban centers. The urban sectors provides, aside of better services and social activities, opportunities for higher incomes. Despite chronic and acute abuses of income distribution in the urban sector, still it provides better incomes than those available in the rural sector. This ever widing gap is highly related to the government's economic policy. The largest share of investments of the first five year plan was used to execute projects located within or nearby urban centers. Bridging the gap requires acrucial change in the government's socio-economic policy stressing to the largest extent rural, rather than urban, development.

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SOME POSSIBLE MODELS FOR THE RESHUFFLING OF THE MAIN AGRICULTURAL RESOURCES IN NORTHERN EGYPT

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INTRODUCTION

Egypt is faced with extremely difficult economic, social, and political problems. Economic development is severely inhibited by very unfavourable natural and demographic circumstances. The main feature in this background is the explosion of the Egyptian population coupled with a small and rigidly limited land area which is already cultivated to capacity. The typical conditions of underdevelopment exist in an extreme form : an excessively high density of population; rural unemployment and a rate of population increase which greatly surpasses the rate of increase in agricultural production(1).

Under such conditions of scarcity and human privation there is obvious need to get as much as possible out of the productive resources that are available. That is, to use labour, capital, natural resources, and intelligence of the community with maximum efficiency. Such effort enlarges the supply of goods and thus mitigates the pressing problems of the society.

Accordingly, in order to meet the upward increasing requirements for over-all economic development in Egypt, its limited agricultural resources, in particular arable land and capital in its many particular forms, should be employed most efficiently in attaining those requirements. Stated another way, because Egypt is endowed with severely limited agricultural resources,

(1) Warriner, Doreen, Land Reform and Development in the Middle East, a study of Egypt, Syria and Iraq, Second Edition, Oxford University Press, London, 1962, pp. 15 - 16.

the problem is to endeavour to explore and specify the possible combinations of the existing available enterprises which give the greatest net income, considering the fixed resources available and various other restrictions. The analysis of this problem is however, confined to an important Egyptian region, namely, Northern Egypt. Besides, the main crops which are going to occupy the central concern in this study are cotton (menoufi), summer rice, summer maize, peanut, sesame, summer potato, summer tomato, wheat, barley, horse beans, flax, winter onion, and clover. These crops represent—by far —the most important part of total production in Northern Egypt and they constitute the major and most systematic source of demand for cultivated land.

A basic purpose of this study is to provide an empirical foundation for analysing and advising agricultural policy and in particular for estimating the needed adjustments in the Northern Egyptian farming industry. However, the findings reported here represent only one phase or step in the longer-run and broader study that should be done.

The study has two main objectives the first is to get a preliminary insight into the nature of the input-output relationships for these main crops. Derivation of physical production relations will help focusing more light on the production possibilities and factors that significantly limit crops output. The second and most important objective is to determine some possible and most profitable cropping systems. That is, to provide answers to the following main questions: what are the most profitable enterprises that should be expanded and what are the others that must be contracted or even eliminated ? and how should these crops be combined in order to utilize the available limited land area and the given quantities of fertilizer, irrigation-water, man-labour animal and machine-services and other means of production to the best advantage ?

Sources of data

Relevant data were compiled from the published records issued by the Ministry of Agriculture along with its various unpublished articles.

Input-output relationships and the input-coefficients used in the programming analyses were obtained from a random sample of Northern Egyptian farms. The sample consisted of 100 farms (in each governorate 8 to 12 farms were taken). The original data were collected by the survey method and included all the data necessary about the farm operations, transactions and financial statement for the twelve months extending from the 1st of November 1968 to the end of October 1969. The approach is therefore, based on cross-sectional data obtained by personal interview.

Methodology

Least squares regression and correlation analyses of the influence of physical inputs upon output have been made for each crop. Firstly ; by deriving the production relation for each individual crop. Secondly; by pooling the appropriate observations for all crops and computing a regression for the pooled data. Four algebraic equation forms are used. These forms were the linear, quadratic and cubic polynomial-types and cobb-Douglas[1] :

When linear programming was used the simplex method was found to be appropriate for selecting the most profitable combination of activities feasible with a given set of resources and restrictive conditions. The related procedure consists of completely or partially substituting for the input-coefficients a different combination of input-coefficients and of checking the effects of changes made on the net regional revenue[2] from the corresponding combination. In this respect three approaches are adopted ;

First : by using a set of input-coefficients obtained from published records and other secondary sources.

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(1) No hypotheses about the form of function that may describe satisfactorily the production relation for a given crop are formulated, and hence the sample data are subjected to statistical analysis leading to the selection of the algebraic model which evidently provides the best fit. The statistical guide used is the magnitude of residual variance.

(2) Net regional revenue or gross profit being defined as the margin between gross returns and variable costs. It represents the function which must be maximized to give the highest profit.

Second : by using a set of input-coefficients obtained from the whole sample.

Third : by using a set of input-coefficients obtained from the best farms[1] in the sample.

Assumptions : The region is considered as the producing unit or economic entity with aggregative relationships which had been directly estimated for it. The analyses are conducted with all farmers being considered as aggregated to the regional level. It is assumed that, regarding the crops to be studied, the differences[2] between the various farm units (producers) are negligible and the emphasis is placed rather on the differences between crops from the aspect of their technical-coefficients and net revenues.

Constructing the programming models : The models presented in this study deal with the entire agricultural industry in Northern Egypt as an aggregate of all producers. The question to be posed is this-under what conditions is it possible to group micro-units into large aggregates in such a way that the output of the industry, as derived from the solutions found in the aggregate analyses, will be identical with the appropriate sum of the solutions for micro-units ? Yaron[3] stated that "such an ideal aggregation exists when applied to micro-units with :

a — Identical proportion between the limiting resources levels ;

b — sets of activities with identical or proportional input and net income coefficients. The greater the deviation from these conditions, the more inaccurate will be the aggregate analysis".

According to the 1961 Agricultural Census, about 80% of all Northern Egyptian farms are classified as under-sized farms, that is, farms of less than 5 feddans each. Further, agricultural

(1) The farm having a net per feddan profit higher than the per feddan rental value is considered as best farm. (1 Feddan = 0.42 hectare).
(2) According to agro-climatic conditions and farm types.
(3) Yaron D., «Application of Mathematical programming to National planning in Agriculture» The Farm Economist Vol. X No. 6, 1963. The Agricultural Economics Research Institute, Oxford, Parks Road, 1963, pp. 256 - 264

production in this region is governed by three dominating factors ; a stable and relatively uniform climate, uniform conditions of drainage and irrigation and the uniform of the chemical composition of the heavy clay soils. Therefore, it appears that according to the above criterion of aggregation, it is possible, as a first approximation, to conduct the analysis at a regional level of aggregation. In the same time it is also possible to break up the industry to smaller groups, more homogeneous from the point of view of farm types and agro-climatic conditions.

I — **Enumeration of the crops (activities) to be included in the model and specification of their net revenues.** The objective function for these crops may be stated mathematically as below:

$$\text{Max. } z = \sum_{i=1}^{18} c_i \quad x$$

where c_i refers to the net per feddan revenue of the i — th crop, and x_i refers to the area (activity level) of the i — th crop. The symbols $x_1, \ldots, x_{18}$ correspond to the areas of cotton, s. rice, s. maize, peanut, s. potatoes, s. tomatoes, wheat, barley, horse beans, flax, w. onion, and clover, respectively. The main concern is to assign values, determine magnitudes, of the x's which will maximize net regional revenue.

II — **Specification of the per feddan — requirements of crops for resources, namely, input-coefficients, and constructing the conditions and restrictions surrounding the plan (choices) to be followed.**

While the availability of the actual supply of several physical resources at the disposal of Northern Egyptian agriculture represents the main type of restrictions, there are also physical capacity of markets for certain products, subjective, institutional or crop rotation restrictions.

(A). The available area of cropland is—by far—the most limited agricultural resource in Northern Egypt.

$$\begin{aligned} 1 &— X_{11} + X_{12} + \ldots + X_{1\ 18} \leq b_1 \\ 2 &— X_{21} + X_{22} + \ldots + X_{2\ 18} \leq b_2 \\ 3 &— X_{31} + X_{32} + \ldots + X_{37} \leq b_3 \end{aligned}$$

Each of the above equations reflects production possibilities for the land resource. The first states that the total land requirements of several crops must be equal to or less than the supply of cropped area (b_1) in Northern Egypt. The second states that the winter area requirements of cotton plus winter crops must be equal or less than the supply of winter area (b_2). The third states that the summer area requirements of cotton plus summer crops must be equal or less than the supply of summer area (b_3).

(B). Upper-attainment restriction for the wheat area,

4. $X_4 \geqslant b_4$

where $b_4 = .33\, b_2 = .33\,(X_{12} + X_{22} + \ldots X_{n2})$.

(C). Under-attainment restriction for the cotton area.

5. $X_{11} \leqslant b_5$

where $b_5 = .33\, b_2 = .33\,(X_{11} + \ldots + X_{n1})$.

Accordingly, b_4 and b_5 are the minimum and maximum national area constraints in producing wheat and cotton respectively, to conform with food, exports, and related goals of the national policy(1).

(D). Though vegetable crops were always permitted to be cultivated, on condition that they do not disturb the rotation, the percentage of the cultivated area under vegetables was small. In the vicinity of beg cities, vegetable crops occupied 10% of the cultivated area, in all the other regions the percentage fluctuated between 1 — 1.5%. Besides, throughout the fifties a diversification of agricultural production was attempted and measures were taken to stimulate the cultivation and export of vegetables. However, the area planted in vegetables does not exceeded 4% of the total cropped area in 1960. The low level of vegetable production was reported to be the result of the lack of marketing opportunities and sometimes of the isolated position of farms not effectively linked to main roads. Correspondingly, the combined area that would be alloted to s. potatoes and s. tomatoes

(1) Already during the II world war a maximum area for cotton production was fixed, together with a minimum area for wheat, and the latter have been maintained during the whole post-war period, though there have been large evasions because of the higher profitability of cotton.

is not permitted to exceed 4% of the total summer area.

6. $X_{c_3} + X_{s_7} \leq b_6$

(E). The clover area should not be greater or less than a certain limit that allows the production of clover as a green and reserved fodder necessary for feeding working animals. The inclusion of the clover row or restriction is intended so as to prevent clover production to fall short of its consumption by working animals. On the other hand, this restriction indirectly implies that the final production plan must be compatible with the practices of good husbandry for the conservation of soil fertilities.

7. $X_{7\ 13} = b_7$

where b_7 refers to the equality-attainment restriction for the clover area imposed on the final plan in order to derive clover production to the level of its consumption by working animals.

(F). In early stages of development in Egypt as with other developing countries, foreign exchange restrictions and limited domestic production capacity often limit the production of inorganic fertilizers. Therefore, the cropped area requirements of inorganic fertilizers, phosphoric and nitrogenous, should not exceed the respective annual supplies available.

8. $P_{n1} X_1 + \ldots + P_{n13} X_{13} \leq b_8$

9. $P_{p1} X_1 + \ldots + P_{p13} X_{13} \leq b_9$

Other part of fertilizers used are home made and they, to a great deal, composed of natural manure. For this latter the input-output analysis has shown that it is not likely to represent a limiting factor to agricultural production. Hence, this part of fertilizers is omitted.

(G). According to an investigation made to estimate the balance between irrigation water requirements and river water resources per year, water requirements were estimated for every Egyptian crop according to Bleny and Criddle Formula for consumptive water use for the average annual crop area[1]. Consider-

(1) Eid, M.T., and Associates, «Preliminary Estimated Balance Between Irrigation Requirements and River Resources in UAR.» in Ministry of Agriculture, Agricultural Research Review, Vol. 44 — No. 1, Editing, Publication and Bibliography Control, Cairo 1966, pp. 131-134.

ing the water irrigation efficiency, the total water requirements were estimated at 52,384 x 10^6 m^3 per year. Meanwhile, the net river available water for irrigation per year[1] was found to be around 46,200 x 10^6 m^3. Consequently, water balance was found negative with awter shortage of 6,184 x 10^6 m^3 per year. As a result, recommendations have been made for immediate measures to minimize water losses as well as to furnish basic scientific information that leads to better and more efficient use of water of irrigation for crops under local soil and climatic conditions. The available water supply is, therefore, believed to be a limiting resource. Firstly, the quantity of irrigation water available from mid-November to mid-May is considered to be a restriction to cotton and winter crops. Secondly, the quantity of irrigation water available from mid-May to mid-November is considered to be a restriction to cotton and summer crops.

10. $P_{10}\ X_1 + P_{10,2}\ X_2 + \ldots + P_{10,7}\ X_7 \leq b_{10}$
11. $P_{11,1}\ X_1 + P_{11,2}\ X_2 + \ldots + P_{11,7}\ X_7 \leq b_{11}$

(H.) Though there is a definite trend towards mechanizing irrigation and the preparation of seed-beds, animals are still used as an important source of draught power for performing farm work in Egyptian agriculture. The available animal working hours, either in winter or in summer, are therefore, considered to constitute a limiting factor to the production of the corresponding crops.

12. $P_{12,1}\ X_1 + P_{12,2}\ X_2 + \ldots + P_{12,12}\ X_{12} \leq b_{12}$
13. $P_{13,1}\ X_1 + P_{13,2}\ X_2 + \ldots + P_{13,7}\ X_7 \leq b_{13}$

(I). From a quantitative standpoint man-labour is not conceived to constitute any restriction to Northern Egyptian farming. However, it is included in order to determine the amount of man-labour, expressed in adult-equivalent working days, which is required annually for producing the prospective crops. Two rows are employed. One for cotton (from mid-November to mid-May) and the appropriate winter crops and the other for cotton (from mid-May to mid-November) and the appropriate summer crops.

(1) After making allowance for overall losses estimated at 4% of the total annual river discharge.

14. $P_{14,1} X_1 + P_{14,4} X_4 + \ldots + P_{14,13} X_{13} \leq b_{14}$
15. $P_{15,1} X_1 + P_{15,2} X_2 + \ldots + P_{15,7} X_7 \leq b_{15}$

(J). Mechanization[1] is introduced to Egyptian agriculture at a relatively slow rate. Thus, the per feddan requirements of the combination of the prospective crops for the services of tractors, threshing and irrigation sets should not be greater than is actually available.

16. $P_{16,1} X_1 + P_{16,2} X_2 + \ldots + P_{16,13} X_{13} \leq b_{16}$

III. — Since a programme which just exactly exhausts all resources may not be mathematically or physically possible, or even if it is possible, it need not be the most profitable, disposal activities are added. These activities are numbering to 16, in consistence with the number of production restrictions. Designating the respective quantities by $X_{14}, \ldots, X_{29}$, the production possibilities can be redefined by a new system of equations. Still the set of production possibilities lacks a diagonal set of positive 1's. For this reason, two artificial activities are added, meantime specifying that these artificial activities should not come into the final plan. The wheat area, X_1, has an over-attainment weak inequality[2], and the clover area, X_{13} has no positive unity attached to its disposal activity[3]. Thus, for either an artificial activity is used. They are designated Q_1 and Q_2 and their areas q_1 and q_2 for wheat and clover respectively. A large negative net revenue, or $-m$, is assigned to the artificial activities to be certain that they would not be included in the final plan [4].

Inserting numerical values for the c's, b's and P's used above, the programming problem to be solved can be stated: Fined non-negative values of the x's, such that $Z = 46.09 x_1 + 33.93 x_2 + 39.20 x_3 + 57.12 x_4 + 26.29 x_5 + 98.28 x_6 + 132.96 x_7 + 34.80 x_8 - 25.38 x_9 + 31.89 x_{10} + 34.86 x_{11} + 35.06 x_{12} + 45.44 x_{13} + 0x_{14} + \ldots + 0x_{29} - mq_1 - mq_2$.

is a maximum subject to the functional constraints below:

(1) Mechanization has to be defined here in its restricted sense, i.e., to the replacement of animal-drought power with tractors and irrigation pumps.
(2) Its disposal activity is attached a negative unity coefficient.
(3) Its disposal activity is attached a zero coefficient.
(4) The net revenues of $-m$ magnitude will be always dominated by any other net revenue.

1. $1x_{11} + 1x_{12} + \ldots + 1x_{113} + 1x_{114} - 0q_{11} - 0q_{12} = 4844129$ Feddans

2. $1x_{21} + 1x_{28} + \ldots + 1x_{213} + 1x_{215} + 0q_{21} - 0q_{22} = 2533928$ Feddans

3. $1x_{31} + 1x_{32} + \ldots + 1x_{37} + 1x_{316} + 0q_{31} - 0q_{32} = 2310201$ Feddans

4. $1x_{40} - 1x_{417} + 1q_{41} + 0q_{42} = 836192$ Feddans

5. $1x_{51} - 1x_{518} + 0q_{51} + 0q_{52} = 1405928$ Feddans

6. $1x_{66} - 1x_{67} = 1x_{619} + 0q_{61} + 0q_{62} = 92408$ Feddans

7. $1x_{713} - 0x_{720} + 0q_{71} + 19_{71} = 979600$ Feddans

8. $100x_{81} - 100x_{82} + 0x_{83} + 200x_{84} + 100x_{85} - 200x_{86} - 100x_{87} - 0x_{88} - 0x_{89} + 100x_{810} + 100x_{811} + 100x_{812} - 100x_{813} - 1x_{8,1} - 0q_{81} - 0q_{82} = 220500000$ Kgs.

9. $225x_{91} - 200x_{92} + 262x_{93} + 100x_{94} - 100x_{95} - 200x_{96} - 200x_{97} - 237x_{98} - 100x_{99} - 200x_{910} + 200x_{911} + 300x_{912} - 0x_{913} - 1x_{9,2} - 0q_{91} + 0q_{92} = 1086750000$ Kgs.

10. $1440x_{101} - 1100x_{108} + 1000x_{109} - 800x_{1010} - 1200x_{1011} - 1700x_{1012} - 2500x_{1013} + 1x_{1023} + 0q_{101} - 0q_{102} = 11140 \times 10^6$ m^3

11. $1560x_{111} - 7550x_{112} + 2500x_{113} - 2500x_{114} - 2500x_{115} - 2640x_{116} - 2640x_{117} - 1x_{1134} + 0q_{111} + 0q_{112} = 18350 \times 10^6$ m^3

12. $21.9x_{121} - 70.0x_{128} + 54.6x_{129} + 54.7x_{1210} + 31.7x_{1211} - 41.0x_{1212} - 58.8x_{1213} + 1x_{1227} + 0q_{121} + 0q_{122} = 503 \times 10^6$ Hours

13. $34.2x_{131} - 83.9x_{132} + 44.5x_{133} - 50.7x_{134} - 28.8x_{135} + 35.8x_{136} - 38.8x_{137} + 1x_{1326} + 0q_{131} + 0q_{132} = 503 \times 10^6$ Hours

14. $32.0x_{141} - 26.4x_{148} + 18.5x_{149} - 19.6x_{1410} - 40.2x_{1411} - 65.7x_{1412} - 22.7x_{1413} + 1x_{1427} + 0q_{141} - 0q_{142} = 241.4 \times 10^6$

15. $50.1x_{151} - 49.9x_{152} - 27.3x_{153} + 55.4x_{1514} - 28.0x_{1515} - 59.8x_{1516} - 86.6x_{1517} - 1x_{1528} + 0q_{151} - 0q_{152} = 397.6 \times 10^6$ Days

16. $3.36x_{161} - 5.14x_{162} - 2.68x_{163} - 3.08x_{164} - 2.02x_{165} - 2.00x_{166} - 2.00x_{167} - 2.57x_{168} - 2.04x_{169} - 1.91x_{1610} - 2.28x_{1611} - 2.33x_{1612} - 3.60x_{1613} - 1x_{1629} + 0q_{161} - 0q_{162} = 13092 \times 10^3$ Hours

Having inserted the appropriate numerical values of the c' s, b' s, and p' s, a normative[1] plan can be made out for Northern Egyptian agriculture, indicating the manner in which resources should be used, and the products which should be

(1) By normative it is meant such a plan which explains what ought to hold true if the stated objective is to be attained. It does not explain why producers in fact provide a somewhat different pattern of production and resource use.

produced. The optimum, or maximum feasible programme should be consistent with the relevant set of resource supplies, or restrictions defined by the linear equations, and for which no further improvement in the objective; that is the net regional revenue cannot be increased.

Empirical Findings

(1) **Input-output relationships** have been derived for cotton S. rice, S. maize, wheat, barley, horse beans, clover, and S. tomatoes. Data were also computed for sesame, flax, W. onion and S. potatoes but due to limited sample observations and lack of significant results, they have not been included. But it appears unlikely that a single mathematical form is most appropriate in describing the production relation involved. For this reason, out the four forms computed two are choosen to represent the best derived forms (table 1).

Table 1 : The best derived forms for various crops

Crop	Best derived form	Residual variance
Cotton	$\hat{Y} = 8.6 - .08\,x_1 + .0007\,x_1^2 + .00015x_3$ (.03) (.0002) (.00009) (R^2 .24)	3.45
	$\hat{Y}$ 3.5 + .029 x_5 (R^2 .15)	3.58
S. Rice	$\hat{Y}$ 3.8 — .007 x_4 − .40 x_6 + .000017$x4^2$ + (.002) (.19) (.000009) .048 x_6^2 (R^2 - .27) (.018)	.30
S. Maize	$\hat{Y}$ 6.5 − .024 x_3 (.008) (R^2 — .17)	15.85
	$\text{Log}\,\hat{Y} = \log .05 + .44 \log x_2$ (R^2 — .22) (.13)	16.16
Wheat	$\text{Log}\,\hat{Y} - \log .66 - .030 \log x_1 + .21$ (.007) (.06) $\log x_3 + .30 \log x_5$ (R^2 - .41) (.12)	3.56
	$\hat{Y} = 6.6 + .0011\,x_3 - 76 \times 10^{-9}\,x_3^2 - .0216\,x_1$ (.0004) (37×10^{-9}) (.0062) (R^2 — .32)	3.82

Crop	Best Derived form	Residual variance
Barley	$\log \hat{Y} = \log 5.34 + .147 \log X_2 - 1.18 \log X_5$ (.032) (.31) $(R^2 = .65)$	7.51
Horse Beans	$\hat{Y} = 7.2 - .348\ X_6$ (.234) $(R^2 = .10)$	5.19
Clover (long-lived)	$\hat{Y} = .115 - .03\ X_1 + .28\ X_3 + 1.11\ X_6 - .0014\ X^2_1 + .0042\ X^2_3 - .24\ X^2_6$ (.01) (.11) (.42) (.00003) (.0018) (.09) $(R^2 = .51)$	1.47
	$\hat{Y} = 31.2 - .0016\ X_3 - 2.05\ X_5 + .057\ X^2_5 - .00049\ X^2_6$ (.0005) (.69) (.020) (.00018) $(R^2 = .44)$	1.67
S.Tomatoes	$\hat{Y} = 1.5 + .040\ X_1 + .050\ X_6$ (.007) (.014) $(R^2 = .63)$	6.47
	$\log \hat{Y} = \log .91 + .07 \log X_1 + .58 \log X_5$ (.01) (.19) $(R^2 = .56)$	8.30
Pooled Function	$\hat{Y} = 134.6 + .172\ X_2 + 1.65\ X_4 - .0009\ X^2_2 + .0028\ X^2_4 - .00049\ X^2_5 - .0046\ X^2_6$ (.135) (.45) (.00006) (.0006) (.00035) (.0013) $(R^2 = .79)$	

Note 1 : All coefficients are significant at the 5% level.
Note 2 : Figures between brackets refer to the standard deviations.
Note 3 : In every instance Y refers to yield in the appropriate unit; X_1 to phosphorus fertilizer in Kgs.; X_2 to nitrogenous fertilizer in Kgs.; X_3 to irrigation water in Feddans; X_4 to animal services in standardized animal working hours; X_5 to man-labour in adult-equivalent days; X_6 to machine-services in hours; X_7 to manure in m³. In the pooled function, however, X_1 refers to man-labour; X_2 to aggregated machine and animal-services in standard animal working hours, and X_6 to manure.

From the preceding trials of using a production functions analysis to determine the role of each factor it is possible to draw some tentative conclusions :

1 — The functions reported were estimated by least squares single equation methods. While some functions have yielded somewhat unacceptable results, the correlation coefficients with related coefficients of determination were generally low and some productivity coefficients bore absurd relationships to each other. However, the results achieved do not seem to be varied from what could have been expected on theoretical grounds. The non-homogeneity of farm techniques and practices experienced on Northern Egyptian farms ; the parent population from which the sample has been drawn, as with other Egyptian regions, may be considered as a straightforward explanation to such results. In point of fact, variations among individual farms are so many that only individual farms can represent a homogeneous population. In reference to irrigation, for instance, quietly diversified techniques are employed. According to 1960 — 61 Agricultural Census(1), 50% of the total area was irrigated with Archimedean screws (tambours), 27% with water wheels (sakias), 10.8% with (tambourhas), 8.8% with (tabouts) and 3.4% with mechanical draught power (mobile and stationary irrigation pumps). Besides, where the level of irrigation water is high enough, the free gravity irrigation is usually used. Not only that but within each irrigational technique, different procedures are used which in turn give rise to the heterogeneity character. This characteristic is not restricted to irrigation but is also extended to tillage, manuring, fertilization, seeding, cultivation, harvesting, threshing, and all other farm operations as well.

A lack of homogeneity as such implies that over the whole sample, it becomes possible to produce the same quantity of a given product with much different levels of various inputs which is reflected indirectly through the use of different techniques.

(1) U.A.R., The Fourth Agricultural Census, 1961, Co-operative Printing Establishment, Cairo, 1961, pp. 338 — 339.

Hence, yield response to different levels of factors input is weakened by the non-homogeneity of the production process.

Besides it is to be noted that the intercorrelation among some of the explanatory variables is evident. Theoretically, the regression coefficient of any one variable is affected by how closely it can be estimated from other independent variables. The more highly the independent variables are interrelated among themselves, the less reliably can the net regression of y upon any one of them be determined. Under the Egyptian agricultural conditions, the farmer can either use animal or machinery draught power in performing the most important farm operations. These two origins of power are, in large part, substitutes, and thus highly interrelated. Further, the quantity of either is interrelated with the quantity of irrigation water. On the other hand, animal and machinery-services are in some sense interrelated with man labour. In respect to phosphoric and nitrogenous fertilizers, either has, of course, a specific influence upon crop production, even though they are intercorrelated due to the farmers' more or less ignorance about the distinct use of each nutrient. The fact that similar yield increases can be attained with different combinations of these nutrients causes them to serve as substitutes in the decision making framework of the farmer.

2—In general the marginal productivity of any resource depends on the quantity of it that is already being used and on the levels of the other resources with which it is combined in the production process. In examination of table 2 it is obvious that phosphoric and nitrogenous fertilizers and irrigation water are in every instance attached a positive marginal product. But while man-labour is attached a positive marginal product in two out of three, both animal and machinery-services are attached only one positive against three negative marginal products. However, organic manure is the only factor having only a negative marginal product. Since a negative marginal product of a specific factor implies that it is relatively available in surplus amount, or that its level is high as compared to the levels of the other resources with which it is combined, it is probably true that a positive marginal product is a preliminary indication of

Table 2. — Sign of the marginal product of each resource included in the crop function which has the smallest residual variance.

Resource		Cotton	S. Rice	S. Maize	Wheat	Barley	Clover	S. Tom.	Pooled data
Phosphoric fertilizer	(X_1)	+			+		+	+	
Nitrogenous fertilizer	(X_2)			+		+			+
Irrigation water	(X_3)	+			+				
Man-labour	(X_4)				+	—			+
Animal services	(X_5)		—				—	+	—
Machine services	(X_6)		—				+		—
Organic Manure	(X_7)								—

the scarcity of such resource. Consequently, all the factors considered except manure may be looked upon as restrictions to agricultural production in Northern Egypt.

Results of the programming analyses : Based on the habitual combination of the crops under consideration the net regional revenue from these crops according to their disposition in 1966 is estimated at about L.E. 160.4 million. This amount of net revenue is secured from a total area of 4.260.389 Feddans of which cotton occupied 13.7%, S. rice 19.4%, S. maize 18.6%, peanut 0.6%, sesame 0.3%, wheat 18.1%, barley 1.5%, horse beans 3.8%, flax 0.5%, W. onion 0.1%, clover 21.8%, S. potatoes 0.5%, and S. tomatoes 1.1%.

Reviewing the results of the first model, it will be observed that the chief return; i.e., the net regional revenue forthcoming from the new combination of enterprises amounts to L.E. 194.6 million. As contrasted to its counterpart secured under the habitual (customary) combination it will also be observed that an increase of L.E. 34.4 million has been generated. That is an increase of 21.3% above the initial net regional revenue. In this proposed crop disposition, while all other crops have been completely eliminated the maize area has been expanded to 34.1%, peanut area to 11.7%, wheat area to 25.8%, clover area to 20.2%, and s. tomatoes area to 1.9% of the total cropped area (table 3).

One of the chief features of the new plan is that the available quantities of irrigation water, draught animal services, man-labour, and nitrogenous fertilizer far exceed the actual requirements of the proposed cropping system (table 3). The only three resources which have been entirely exhausted are the area, phosphoric fertilizer, and machine-services. Thus the programming analysis reveals that, at the margin, a typical farm's most urgent investment needs are additional cropland and capital in the form of phosphoric fertilizer and machinery.

The optimum solution not only gives the new plan which will maximize returns but it also indicates the marginal return obtainable by increasing these restrictions which are fully utilized in that plan. Table 4 lists these together with their marginal return figures for the optimum plan described above.

Table 8.—Results of the optimum plan of the first programming model.

Activity or Resource	Units	Activity level or unused resource capacity	% of activity level to total crop area	% of unused resource capacity
Summer maize	Fedd.	1651297	34.09	—
Peanut	Fedd.	566496	11.69	—
Wheat	Fedd.	1249160	25.79	—
Clover	Fedd.	979600	20.22	—
Summer tomato	Fedd.	92408	8.21	—
Winter area	Fedd.	0	0	0
Summer area	Fedd.	0	0	0
Total area	Fedd.	0	100.00	0
Phosphoric F.	Ton	0	--	0
Nitrogenous F.	Ton	215000	—	19.38
Winter irrig. water	Million m^3	7000	—	62.70
Summer irrig. water	Million m^3	12562	—	68.46
Winter ani. services	000 hours	340060	—	66.92
Summer ani. services	000 hours	397487		79.02
Winter labour	000 days	178738	—	73.79
Summer labour	000 days	313115	—	78.75
Machine services	hours	0	--	0

This table clearly indicates how the shortage of summer area effectively limits the net return which can be attained. This is especially true with respect to the summer tomatoes area since the marginal return to its maximum area restriction is L.E. 98.72 reflecting the high rent which the farmer would be justified in paying for extra summer land for growing vegetables if this could be attained. The stock of phosphoric fertilizer is fully utilized and has a fairly high marginal return of L.E. 62.52 per ton. The marginal return to the clover area equality-attainment restriction is negative and it stands at L.E. 23,02. Clover, therefore, might not come into the final plan had its area equality-attainment restriction not been set. Though machine services needed for various crops were set at only 22% of their actual requirements, the marginal return to machinery is L.E. 13.54 for each extra hour.

Table 4. : Marginal returns per unit to effective restrictions and marginal cost per unit to activities not entering the plan (first optimum plan).

Restriction or Activity	Units	Marginal return per unit (L.E.)	Marginal cost per unit (L.E.)
Summer area	Fedd.	2.9105	
Vegetables area	Fedd.	96.7160	—
Clover area	Fedd.	23.0190	
Phosphoric fertilizer	Tons	62.5200	-
Machine-Services	Hours	13.5410	
Cotton	Feed.	--	8.56460
Rice	Fedd.	—	44.83200
Sesame	Fedd.	—	11.22500
Barley	Fedd.		2.24330
Flax	Fedd.	—	0.22486
Horse beans	Fedd.	-	2.26500
W. onion	Fedd.	-	2.74200
S. potatoes	Fedd.		40.93200

To follow strictly the rule of comparative advantage, all agricultural resources, land, water, labour, and capital of different types, should be used entirely for the one or the few enterprises which yield the highest net regional returns. In actual farming, however, it is highly desirable to follow a well-balanced pattern of farming systems composed of several enterprises. Because of the hazards involved in farming, such as crop failures due to weather and a drop in the price of farm product, it is usually advisable to include more than one major income-yielding enterprises in the plan. This desirable requirement is satisfied by the inclusion of peanut and S. tomatoes as cash-income crops. Peanut is also an important crop due to its high price and demand in foreign markets. Apart from the major income-yielding enterprises, it is highly desirable also to undertake other enterprises which have a complementary relationship with them. This complementary relationship exists when the one adds to the production of the other. The inclusion of clover adds nitrogen and organic matter to the soil and thus increases the yields of the major crops. Besides clover is essential as feed material for the working and productive animals. On

the other hand, livestock manure can be used to increase the yield of cash crops. Wheat and maize are essential as foodstuffs for human purposes, and they do not compete with each other in the use of land, labour and major other resources.

With the restrictions and activities of the second model, an optimum plan was computed and found to give a net regional revenue of L.E. 193.1 million. This compares favourably with an actual figure of L.E. 183.7 million for 1966.

The cropping in the new plan, table 5, is based on a combination of cotton, S rice, peanut, wheat, horsebeans, clover, and S. Potatoes. Meanwhile, all other crops have gone out entirely. According to this optimum plan, the entire area should have been occupied by cotton, three winter crops, and three summer crops. This cropping programme was identified by the second model as the one giving a higher net regional revenue than its alternative dominated in 1966. The comparison of the programming results with the actual crop composition in 1966 brings to light fairly good compatibility in S. rice, and good compatibility in cotton, wheat, and clover. This is because s. rice should have been occupied 19.83% of the total area according to the new plan; against 19.42% in 1966, cotton 14.54%; against 13.70%, wheat 19.77%; against 18.14%, and clover 23.16%; against 21.78%. However, considerable changes exist with respect to other crops. While peanut occupied a very small area of 0.63% of the total area in 1966, the new plan indicates that 18.07% of the total area should have been occupied by peanut. Thus, the elimination of some crops and the inclusion of nearly 764.270 feddans of peanut in the optimum plan are the most radical departures from the prevailing crop disposition. In respect to peanut, there may be several reasons for this discrepancy among which is that producers often prefer to devote that percentage of total area to maize production rather than to peanut, since maize constitutes he stable food grain of the majority of the rural population. At the same time, the cash-income generated by peanut can be sacrificed by substituting either cotton, the traditional cash crop, or rice for peanut. It is also very likely that there are irrational producers growing maize instead of peanut because the agrotechnics of growing maize are simple than those of growing peanut. These producers grow maize dis-

pite the fact that economic potential of peanut under prevailing conditions on their farms is higher than that of maize. With respect to horse beans and s. potatoes their areas according to the new plan should have been, respectively, 2.44% and 2.19% of the total area as contrasted to 3.7% and 0.51% in the actual crop composition in 1966.

The optimum plan reveals that resources which have been fully utilized by the combination of crops produced are : winter area, summer area, phosphoric fertilizer, and summer irrigation water. An interesting point about this plan as table 6 shows is the high marginal return to s. potatoes maximum area restriction, L.E. 73.164 per feddan. This table also shows that the per feddan marginal return to winter area and to summer area L.E. 47.473 and L.E. 38.914, respectively. The above figures show that these restrictive factors have a drastic effect on the net regional revenue. Meanwhile, the marginal return to phosphoric fertilizer is L.E. 11.16 per ton, and that to summer irrigation water is L.E. 0.25 per thousand cubic meters, showing that there is no great deal to be gained from an increase in the accomodation of an extra unit of either resource. In contrast, however, the marginal returns to wheat and clover are negative. Thus, an extra feddan allocated to wheat would result in a reduction of L.E. 11.282 in the net revenue, while if allocated to clover the resultant reduction would be bigger, L.E. 21.789. This indicates that these crops would have not included in the plan had no upper-attainment restriction for wheat and an equality-restriction for clover been imposed

Alongside the imputed values of the scarce resources, table 6 gives the marginal cost of producing one unit of crops not included in the optimum plan. The extra cost of producing one feddan of these crops amounts to L.E. 27.85 for sesame, L.E. 21.62 for barley, LE. 11.53 for flax, LE. 7.24 for maize, L.E. 5.53 for S. tomatoes and L.E. 3.8 for winter onion.

As has been pointed out, the increase in the net regional revenue forthcoming from the new plan over that generated in 1966 is L.E. 9.42 million, which is not more than 5.12%. This improvement in the net revenue is, comparatively, not high. It is quite certain that information derived from enterprise studies

is naturally more representative of actual farm conditions and is, therefore, more reliable for farm planning than does information obtained from experiments or other secondary sources. These empirical results, on the whole, seem reasonably consistent with those expected from the assumption that producers tend to act rationally and generally grow the crop combination which, in the short-run maximizes producers income. Being rational, their behavior is open to normative analysis. Accordingly, it may then be concluded that, in the area of agricultural policy the new plan which is based on the actual farm operating conditions, might provide a basis for the development of revised and improved explanations of producers economic behavior.

It should also be noted that producers tend to maintain a diversified crop pattern so as to eliminate as far as possible risk aversion. This is true since the second model calls for the production of seven as opposed to only five crops envisaged by the first model.

Having computed the third programming model, a net revenue maximizing programme has been determined.

This programme calls for the production of s. rice, 14.8% of the total area ; s. maize, 29.3%; sesame, 1.9%; wheat, 17.3%; w. onion, 14.8%; clover, 20.2%; and s. tomatoes, 1.9%. The net regional revenue generated by this optimum plan amounts to L.E. 228.3 million, or an increase of 4% above the original figure secured under the habitual crop combination. Again this slight income change may ascertain the belief that producers falling into the group of best farms are nearly optimizers. However, the final plan has emerged with unused capacities of most of the variable resources even though the actual per feddan input requirements used by those farmers are relatively high, which might imply that their behavior is still irrational. In a sense that, they usually use too much of these resources even though the net regional revenue could be increased by 4% if they would have followed the crop disposition envisaged by the final plan and used fewer quantities of resources (table 7).

The values of marginal products are set out in table 8. Their magnitudes are of interest since they indicate possible

gain in net revenue through acquisition of scarce resources. The limited supplies of land, phosphoric fertilizer, and summer irrigation water are exhausted in producing the optimum plan.

Table 5 : Results of the optimum plan of the second programming model.

Activity or Resource	Units	Activity level or unused resource capacity	% of activity level to total crop area	% of unused resource capacity
Cotton	Fedd.	615.012.9	14.54	—
S. rice	"	838.510.4	19.83	
Peanut	"	764.269.7	18.07	—
Wheat	"	836.196.0	17.77	
Horse beans	"	103.119.1	2.44	—
Clover	"	979.600.0	23.16	
S. Potatoes	"	92.408.0	2.19	-
Winter area	"	0	-	0
Summer area	"	0	-	0
Total area	"	0	100.00	0
Phosphoric f.	Tons	0		0
Nitrogenous f.	Tons	702.556.5	—	64.64
W. irrig. water	Million m^3	6.323.4		32.52
S. irrig. water	Million m^3	0		0
W. anl. services	000 hours	459.831.1		91.14
S. anl. services	"	391.672.8		78.16
Winter labour	000 days	150.837.8	-	62.48
Summer labour	"	242.119.3		60.89
Machine services	hours	1.294.9		9.20

Also the under-attainment restriction for the vegetables area has a very high marginal return. In contrast, however, the upper-attainment restriction for the wheat area and the equality-attainment restriction for the clover area are imposed on the plan, and for that reason either has a negative influence on the net regional revenue.

Table 6 : Marginal returns per unit to effective restrictions and marginal cost per unit to activities not entering the plan (second optimum plan).

Restriction or Activity	Units	Marginal return per unit (L.E.)	Marginal cost per unit (L.E.)
Winter area	Fedd.	47.437	-
Summer area	"	38.914	
Wheat area	"	- 11.282	
Vegetables area	"	73.164	-
Clover area	"	–21.789	-
Phosphoric f.	Tons	11.160	-
S. irrig. water	000 m^3	00.250	-
S. Maize	Fedd.	—	7.2446
Sesame	"	—	27.8470
Barley	"	- -	21.0210
Flax	"	—	11.5170
W. onion	"	-	3.7966
S. tomatoes	"	-	5.5304

Table 7 : Results of the optimum plan of the third programming model.

Activity or Resource	Units	Activity level or unused resource capacity	% of activity level to total crop area	% of unused resource capacity
S. rice	Fedd.	705.639	14.57	.
S. maize	Fedd.	1.419.913	29.31	—
Sesame	Fedd.	92.240	1.90	—
Wheat	Fedd.	836.196	17.26	
W. onion	Fedd.	718.132	14.82	
Clover	Fedd.	979.600	20.22	—
S. tomatoes	Fedd.	92.408	1.91	-
W. area	Fedd.	0	-	0
S. area	Fedd.	0	—	0
Total area	Fedd.	0	100.00	0
Phosphoric f.	Tons	0	—	0
Nitrogenous f.	Tons	150.010	-	13.80
W. irrig. water	Million m^3	3.098	-	27.81
S. irrig. water	Million m^3	0	—	0
W. unit. services	000 hours	487.315	-	96.89
S. unit. services	000 hours	311.813	-	61.99
W. labour	000 days	124.064	—	51.39
S. labour	000 days	282.035	—	70.93
Machine-services	hours	7.164.503*		54.72

(*) This unused quantity of machine-services is a result of applying a calculating device by which each activity is subdivided into 2 processes having identical input-coefficients except the power input. Thus where the first process is allowed to get its power requirement from animal-services only, the second process is allowed to get its requirement from machine-services.

Table 8 : Marginal returns per unit to effective restrictions and marginal costs per unit to activities not entering the plan (Third optimum plan).

Restriction or Activity	Units	Marginal return per unit (L.E.)	Marginal cost per unit (L.E.)
W. area	Fedd.	643.300	—
S. area	Fedd.	56.447	—
Wheat area	Fedd.	-281.480	—
Vegetables area	Fedd.	2.091.400	—
Clover area	Fedd.	-699.210	—
Phosphoric f.	Tons	3.914.800	—
S. irrig. water	000 m^3	21.000	—
Cotton	Fedd.	—	11.410
Peanut	Fedd.	—	44.819
Barley	Fedd.	—	34.410
Horse beans	Fedd.	—	47.831
Flax	Fedd.	—	22.670
S. potatoes	Fedd.	—	120.650

Conclusion

In this work, some possible and most important programming models disigned to device an equilibrium solution for an essential section of the agricultural industry in Northern Egypt have been analysed.

It has become clear that the net regional Northern Egyptian revenue can be raised substantially above its present level by reshuffling the existing activities into a new plan. Three alternative profit maximising models have been determined. Each model has envisaged a different cropping System. However, the choice of the one to be applied is obviously an executive decision. The concerned authorities can select and modify the plan which is most nearly consistent with farmers values, subjective conditions, and supplies of physical resources available be them.

It should be emphasized, of course, that the net regional revenues reached in these plans are not necessarily the highest which can be attained given the restrictions operative on farms of that region. Larger net revenues could be attained by widening the choice of activities. Besides, in providing these linear programming models and in making recommendations based on them, the main assumption was that farming is undertaken to obtain the highest possible income, so long as this is compatible, first, with the practices of good husbandry for the conservation of soil fertilities, and secondly, with the main subjective and institutional restrictions. This assumption is reasonable even though farmers or planners may follow some simpler motive in their resource allocation. In a sense that profit or income may not be the only motive for farming.(1) The health and hapiness of the farmer and his family and the state may, in certain circumstances, supersede, the profit motive in the selection of production lines. Therefore farmers or planners may merely search for a pattern of resource use and crop combination that is satisfactory behaving as satisficers rather than optimizers. However, the real-world decision-makers might be expected to shift their aspiration to a level commensurate with profit maximization Moreover, we must recognise the possibility that the profit motve is so strong that a hypothesis which ignores other goals will, nonetheless, prove to fit facts pretty well.

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ECONOMIC EFFICIENCY IN EGYPTIAN AGRICULTURE

By

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Introduction :

Egyptian agriculture is one of the fundamental bases for Egyptian economy. It is still the leading industry in Egypt. This fact is supported by its major role in the national economy.

This paper is dealing with economic efficiency in agriculture. It measures and compares certain aspects of efficiency in selected agricultural areas.

The main purpose of this study is to analyse the existing combinations of different resources and their services used at different farming regions, and to predict the effects of combinations and quantities of resources on the value of product produced. The study is aimed to be advantageous to the policy making process in Egypt, through its emphasis on the available alternatives open to the national economy by resources uses allocations. It indicates the extent of differentials in resource productivity throughout agricultural areas. One of the main objectives of this paper is to suggest the solutions for attaining efficiency. The main statistics at this study are based on random stratified samples of farms in various producing areas in Egypt during the period (1966-1968). These farming producing areas are : Kafr-El-Sheikh, El-Gharbia, El-Kalyubia, Beni Suef and El-Menia governorates.

Methodology :

Cobb-Douglas function was used to derive the production coefficients.

Input of resources and output of products have been classified on the basis of the preliminary analysis. The variables included in this study are :

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* Ministry of Planning.

1 — Farm output, which is the dependent variable, and

2 — Land, labor, and capital, which are independent or explanatory variables. Management inputs could not be included due to the difficulty of its measurement.

The regression equation is of the form below.

$$Y = a\ x_1^{\beta_1}\ x_2^{\beta_2}\ x_3^{\beta_3}$$

Where,

Y, refers to the value or quantity of gross output of crops.

x_1; refers to the land inputs. This figure is measured in terms of physical terms (feddan). The authors try to standardise land input by using annual land tax which was recorded separately for each farm. But this measure could not be used due to the insignificance of land tax index for land holdings as indicator for fertility.

x_2; refers to the labor inputs. It is measured in terms of man-day and included hired and family labor. It does not comparisons of the productivity of labor used at different times of the year. For the purposes of the standardisation men, women and children labor-days are converted into men-days according to the daily wage rates, on the assumption that these wage differentials reflect the differences in the productivity of labor input.

x_3; refer to the capital input. It is expressed in value terms. It includes such items as fertilizers, seeds, tractor fuels, repair, oil, depreciation on machinery and all other capital items used directly or indirectly in producting crops.

The study was divided into two parts. The first part provides the basis to measure productivity of resources used in crop farm enterprises. Four crop production functions have been estimated for each farming region. One production function for cotton farm enterprises, and the others for rice, maize and wheat farm enterprises. The ratio of marginal value pro-

duct to the opportunity cost for each input was estimated and was tested statistically for its equality to unity. This ratio was used as a criterion to know whether or not farm resources are efficiently used in farming areas. Resources might be efficiently used if the criteria of the marginal productivity to opportunity cost ratios are equal to unity.

The second part provides the basis for certain intra-area comparisons of resource productivities. While the investigation is aimed particularly at some inter-regional productivity and efficiency comparisons, it also gives an insight into intra-regional productivity conditions. For testing the hypothesis that there are no differences in productivity of resources between different farming regions, we estimated the elasticity coefficient necessary for each resource in one area, considering the mean quantity of product and resource in the area of comparison, to give a marginal productivity equal to that computed for that resource in the area of contrast.

The figures of these two parts show the returns of resources and predicted contributions of specific resources to farm production when rather board categories of resources are used in varying quantities and proportions.

Part (1) : Productivity of Resources Used in Crop Farm Enterprises

(A) : Cotton Production Functions :

In cotton farm enterprises, diminishing returns are indicated for individual production factors since the elasticity of production is less than one as shown in table (1). Most of the elasticities of production for land appear to be higher than the elasticities of other factors. All the regression coefficients for land are significant.(1)

Some of labor production elasticities reflect very low productivity and others show negative productivity. None of these negative elasticities are statistically significant. It was observed that elasticities of capital services were very low. Low productivity of capital in cotton farms was due to the fact that there are more capital used in cotton production.

The variability of the independent variables explains nearly between 83-97% of the variability of the value of output of cotton (R^{-2} — 0.83-0.97).

The analysis of returns to scale for cotton farm enterprises indicates that constant returns to scale takes place in cotton production in El Gharbia, El Kalyubia governorates; the sum of the elasticities being about 1.03, 1.09 respectively. This might be due to the land consolidation programs in these areas. This finding does not highly recommend agricultural expansion in these areas. But returns to scale for cotton farm enterprises on other governorates indicates decreasing returns to scale; the gross of elasticity of cotton production were 0.88, 0.92 in Kafr-El-Sheikh, and Beni Suef governorates respectively.

(1) We accept the regression coefficients which are significant at 5 percent level.

Table (1) : Production elasticities, marginal products and opportunity costs of resources, marginal return to opportunity cost ratios in cotton farm enterprises.

Item	Units	Kafr El-Sheikh	El Gharbia	El Kalyubia	Beni Suef	El Menia
Number of farms		152	166	77	170	164
Elasticities :						
Land		0.0180*	0.7193*	0.5981*	0.7673*	0.2480
Labor		-0.0619	0.1878*	0.3272*	0.0348	-0.1108
Capital		0.1285	0.1269	0.0683*	0.1152	0.8531
Sum of Elasticities		0.8846	0.0340	1.0936	0.9173	0.9903
R^{-2}		0.83	0.96	0.97	0.91	0.94
Marginal Products						
Land	L.E. / feddan	56.445	60.974	89.604	75.588	21.62
Labor	L.E. / man-day	-0.053	0.219	0.701	0.031	-0.08
Capital	L.E. / L.E.	0.272	0.318	0.415	0.524	4.24
Opportunity Costs :						
Land	L.E. / feddan	13.321	19.300	21.900	23.180	22.32
Labor	L.E. / man-day	0.275	0.256	0.300	0.200	0.14
Capital	L.E. / L.E.	0.050	1.050	1.050	1.050	1.05
Marginal Return to Opportunity Cost Ratios :						
Land		4.269*	3.159*	3.091*	3.260*	1.06
Labor		-0.192*	0.855	2.336	0.155*	-0.55
Capital		0.259*	0.302*	0.396	0.499	4.04*

(1) Feddan = 1.08 acre

* Significant at 5 percent level of probability.

When the criteria of marginal values product to opportunity costs are studied for cotton farm enterprises at different farming regions, it was observed that the marginal values of product for land input are significantly higher than the land rental value (marginal factor costs) table (1). This indicates that as size of cotton farm enterprises increases, net farm income increases. But since the supply of land is generally limited, the potentiality of increasing farm size dependens on the land consolidation programs.

The marginal return of labor to opportunity cost ratios are less than unity on most cotton farms. These findings, however, recomend that there are too many labor inputs in cotton production in all governorates except on cotton farming regions at El Kalyubia governorate.

The marginal return of capital to opportunity cost ratios are less than unity on most cotton farms, and more than unity on El Menia cotton farming areas.

In conclusion, marginal returns to opportunity cost ratios indicate that some resources were used inefficiently. However, profits on the average farm could have increased substantially by expanding the cotton area or by reducing the labor force and capital inputs on Kafr-El-Sheikh, El-Gharbia and Beni-Suef cotton producing areas. But on cotton farm enterprises in Kalyubia it was found that more capital services and little land and labor inputs are used. Therefore, equilibrium resources would be attained by substituting land and labor for quantities of capital inputs. Also, on cotton farming areas in El Menia more capital inputs and little labor inputs are used. The analysis of production efficiency in the use of inputs for cotton in El Menia shows that returns can be increased by substituting capital for labor inputs.

(B) : **Rice Production Functions :**

The analysis of rice production functions on the sample areas in the farming regions under consideration shows that land elasticities of production are higher than that observed for other factors. In these farming areas, production elasticities of land input show significant decreasing productivity. The labor elas-

ticities reflect very low decreasing productivity (table 2). It is observed that capital elasticity of production shows, in general, low productivity, for rice farm enterprises in the rice farming regions. These elasticities are not statistically significant except for rice farming areas in Kafr-El-Sheikh. These findings might be interpreted by the fact that rice farm enterprises in these areas may use more labor and capital inputs. The over-all effect of the independent variables explains nearly between 91%-96% of the variability of the rice production. i.e. R^{-2} = 0.96, 0.91 and 0.92 for rice farm enterprises in Kafr-El-Sheikh, El Gharbia and El Kalyubia respectively.

The analysis of returns to scale in rice production function in the governorates under consideration indicates that decreasing returns to scale exists in rice farm enterprises in the El-Kalyubia (the gross elasticity of rice production was 0.94). Besides constant returns to scale exist in farm enterprises in Kafr-El-Sheikh (the gross elasticity of production is about 1.0). This is due to the land consolidation programs. But scale relation on rice farms in El-Gharbia area shows that the sum of the elasticities of rice production in this area is equal to 1.17 This means that increasing returns to scale exists in the process of the price production in that area. This finding recommends agricultural expansion of rice farm enterprises in that area.

The analysis of marginal productivities for sample rice farms in different governorates indicates that the marginal product of land input is about 1.5, 1.8 and 2.5 dariba per feddan in Kafr-El-Sheikh, El-Gharbia and El-Kalyubia respectively. All marginal returns of land resources in rice farm enterprises were higher than the rental values. It was also observed, that the marginal productivity of both land and labor inputs in rice farm enterprises in El-Kalyubia governorate were higher than other areas. These findings indicate that disequilibrium of resources are evident as to land and labor inputs.

It is observed that the marginal returns of capital inputs are about 0.026, 0.006 dariba per L.E. 1 for rice farm enterprises in Kafr-El-Sheikh, El-Gharbia, and El-Kalyubia governorates respectively.

For rice farm enterprises, the marginal return to opportunity cost ratios indicate that little land, more labor and capital

services being used. Equilibrium resources would be attained by substituting land for labor and capital. But if the land input is to remain fixed, optimum quantities of labor and capital inputs might be used.

(C) : **Maize Production Functions :**

The analysis of maize production functions gives interesting findings. It is observed that the elasticity of production of land input is less than one in the governorates under focus. That is, in the governorates of Beni Suef, El Menia, and El Gharbia, it is observed that the elasticity of production of land input are 0.9401, 0.7667 respectively and these elasticities are statistically significant. While these technical production coefficients are 0.0733 and 0.0027 at El-Kalyubia and Kafr El-Sheikh farming regions respectively. These elasticities are not significant (table 3). When the labor factor of maize production is analyzed, elasticities of production are found to be 0.52, 0.06, 0.10, and 0.07 at Kafr-El-Sheikh, El-Gharbia, El-Kalyubia, Beni-Suef governorates, and —1.08 at El Menia farming area. All these elasticities are not significant except these elasticities in Kafr-El-Sheikh and El-Menia. However, the elasticity of production of capital factor in maize farm enterprises, estimated in this study, were 1.1822, 0.9386 and 0.5361 per cent at El-Menia, El Kalyubia, and Kafr-El-Sheikh governorates respectively, while it were 0.1185, —0.0601 at the governorates of El-Gharbia and Beni-Suef respectively. These figures might reflect the difference between the levels of capital inputs used in these governorates. Therefore, it may be concluded that more capital can be recommended to be used in the governorates of the first group. It is observed that almost decreasing returns to scale are taking place in maize production at these farming areas. These findings could not recommended more land consolidation in maize production.

The analysis of the marginal productivities shows many significant findings. The values of marginal productivities of land for maize production are significantly higher than the land rental values in the governorates under focus except for Kafr-El-Sheikh region. Therefore, using more land input for maize farm enterprises at these farming areas help to attain efficiency of land input.

The analysis of the marginal value of labor productivity shows that the marginal return to opportunity cost ratios are

Table (2) : Production Elasticities, Marginal Products, and Opportunity costs of resources, marginal return to opportunity cost ratios in rice farm enterprises.

Item	Units	Kafr-El-Sheikh	El-Gharbia	El-Kalyubia
Number of Farms		142	83	22
Elasticities :				
Land		0.6514*	0.9241*	0.8022*
Labor		0.0429	0.2267	0.1633
Capital		0.3046*	0.1048	-0.0260
Sum of Elasticities		0.9983	1.1659	0.9295
R^{-2}		0.96	0.91	9.81
Marginal Products :				
Land	Dariba/(1) feddan	1.539	1.779	2.479
Labor	Dariba/man-day	0.001	0.007	0.009
Capital	Dariba/L.E.	0.026	0.000	-0.006
Opportunity Costs :				
Land	L.E./feddan	8.080	6.313	15.550
Labor	L.E./man-day	0.235	0.235	0.300
Capital	L.E./L.E.	1.050	1.050	1.050
Marginal Return to opportunity cost Ratios :				
Land		4.931*	7.296*	4.140*
Labor		0.010*	0.760*	0.776*
Capital		0.640*	0.024*	-0.147*

(1) Dariba = 0.945 kg. * Significant at 5 percent level of probability.

less than unity in all maize farm enterprises at the governorates under focus. All these ratios are statistically significant. This means that more labor is used in maize production in all cases. Therefore, production efficiency of labor input couldn't be attained.

When the marginal values of capital productivity are estimated, it is observed that the ratios of value of marginal productivity of capital to the opportunity cost are less than unity at all farming areas except for El Menia region which the marginal returns to opportunity cost ratio is more than unity. These findings indicate that too little capital services are used at El-Menia farming area, and too many capital services are used at other farming areas. Therefore, disequilibrium of capital resources is evident at the governorates under focus. Equilibrium resources would be attained by substituting land inputs for labor and capital at El-Gharbia, El-Kalyubia, and Beni-Suef governorates and by using lower level of land, labor, and capital services at Kafr-El-Sheikh. Substituting land and capital inputs for labor in maize farm enterprises at El-Menia farming area are helpful for attaining equilibrium of resources.

(D) : **Wheat Production Functions** :

The analysis of wheat farm enterprises in this study shows that land elasticities of production are high in general. It is about 0.8028, 0.7158, 0.6966, 0.6596 at the governorates of El-Gharbia, El-Kalyubia, Beni Suef and El-Menia respectively, while it is about 0.1576 at Kafr El-Sheikh governorate. All these elasticities are statistically significant.

When the elasticities of production for labor input are estimated, they are generally low. That is, the labor elasticities of production are 0.1655, 0,1237 and 0.0456 in Beni-Suef, Kafr-El-Sheikh and El-Gharbia respectively, while it is about —0.2905, and 0.0651 in El-Kalyubia and El-Menia respectively. The elasticity of production of labor input at El-Kalyubia and El-Menia farming areas are statistically significant.

Capital elasticities, estimated in different governorates were about 0.6758, 0.4196, and 0.4125 in Kafr-El-Sheikh, El-Kalyubia,

Table (8) : Production elasticities, marginal product and opportunity costs of resources, marginal return to opportunity costs in maize farm enterprises.

Item	Units	Kafr-El-Sheikh	El-Gharbia	El-Kalyubia	Beni-Suef	El-Menia
Number of Farms		92	131	97	164	136
Elasticities :						
Land		0.0027	0.7667*	0.0733	0.9401*	0.9184*
Labor		0.5233*	0.0588	0.0951	0.0745	-1.0827*
Capital		0.5361*	0.1195*	0.9386	-0.0601	1.1322*
Sum of Elasticities		1.0621	0.9450	1.1070	0.9545	0.9679
R^{-2}		0.83	0.96	0.82	0.88	0.96
Marginal Products						
Land	Ardab/feddan	0.023	0.769	0.601	8.283	9.663
Labor	Ardab/man-day	0.130	0.011	0.029	0.010	-0.202
Capital	Ardab/L.E.	0.216	0.055	0.627	-0.053	0.865
Opportunity Costs :						
Land	L.E./feddan	7.345	5.590	10.590	7.510	2.951
Labor	L.E./man-day	0.275	0.213	0.300	0.200	0.140
Capital	L.E./L.E.	1.050	1.050	1.050	1.050	1.050
Marginal Return to Opportunity Costs Ratios						
Land		0.014*	5.521*	0.260*	5.029*	6.333*
Labor		0.214*	0.234*	0.440*	0.230*	-0.346*
Capital		0.938*	0.238*	0.722*	-0.230*	3.756*

* Significant at 5 percent level of probability.

and El Menia and less in the governorates of Beni Suef and El-Gharbia (about 0.2472 and 0.2443). All these technical coefficients are statistically significant. These findings might be in favour of more capital to be used in the governorates of the first group than that in the governorates of the second group in the process of wheat production.

It was observed that almost decreasing returns to scale took place in wheat production for all governorates under the focus. The sum of the elasticities of production of wheat are 0.81, 0.93, 0.87, 0.90 and 0.95 in the governorates of Kafr-El-Sheikh, El-Gharbia, El-Kalyubia, Beni-Suef and El-Menia respectively.

When the ratios of the marginal productivities of land to the opportunity cost for wheat production are estimated in the same locations the following figures are observed, 0.545, 2.060, 2.020, 1.525 and 2.190 respectively. These findings are significant at 5% probability level, which implies that land inputs in wheat production are not used according to the economic efficiency conditions.

The ratios of marginal productivity of labor to opportunity cost in wheat production are only 0.356, 0.162, - 1.411, 0.565 and —7.025 in the governorates of Kafr-El-Sheikh, El-Gharbia, El-Kalyubia, Beni Suef and El Menia respectively. These figures are significant at 5% probability level.

These findings indicate that more capital inputs were used in wheat farming enterprises at Beni Suef, El-Gharbia, and Kafr El-Sheikh.

These findings can be of great value in setting up the national agricultural policy when dealing with resource allocations in order to realise production efficiency in Egyptian agriculture.

Our investigations support the conclusion that crop production in Egypt may be increased by the reallocation of resources between various farm enterprises on different agricultural production areas. It was believed that if our limited resources are optimally allocated between various production regions according to the marginality principles, agricultural production efficiency can be improved.

TABLE 4.—Production elasticities, marginal product and Opportunity costs of resources, marginal return to opportunity costs in wheat farm enterprises.

Item	Units	Kafr-El-Sheikh	El-Gharbia	El-Kalyubia	Beni Suef	El-Menia
Number of Farms		128	156	75	89	137
Elasticities :						
Land		0.1578*	0.8028**	0.7158**	0.6966	0.6596**
Labor		0.1237	0.0455	—0.2005**	0.1655	—0.0651*
Capital		0.6758**	0.2413**	0.4196**	0.2472**	0.4125**
Sum of Elasticities :		0.9573	1.0896	0.9349	1.1093	1.0070
R^{-2}		0.89	0.93	0.87	0.90	0.95
Marginal Products :						
Land	Ardab/feddan	0.977	5.669	5.350	4.531	5.959
Labor	Ardab/man-day	0.020	0.008	—0.069	0.023	—0.200
Capital	Ardab/L.E.	0.193	0.070	0.245	0.103	0.232
Opportunity Costs :						
Land	L.E./feddan	8.814	13.500	13.030	14.610	13.382
Labor	L.E./man-day	0.275	0.243	0.300	0.200	0.140
Capital	L.E./L.E.	1.050	1.050	1.050	1.050	1.050
Marginal Return to Opportunity Costs Ratios :						
Land		0.545*	2.060*	2.020*	1.525*	2.190*
Labor		0.356*	0.162*	—1.411*	0.515*	—7.028*
Capital		0.904*	0.326*	1.147*	0.482*	1.106*

* Significant at 5 percent level of probability.
** Significant at 1 percent level of probability.

Part (2) Intra-area Comparisons of Resource Productivities :

For the purposes of national policies and guidance to individual farmers, we would like to ask : Are there significant differences in productivity of resources in each farm enterprise among regions ? If there are, it is necessary to reallocate resources between various regions in such a manner so as to maximize farm returns for given resources.

The figures in table (5-8) indicate the elasticities coefficients which would be necessary to give a marginal productivity for each resource in one area equal to that computed in the area of contrast. These coefficients can be derived as follows :

$$\frac{d\bar{y}_a}{d\bar{x}_a} \quad \frac{d\bar{y}_b}{d\bar{x}_b} \quad \frac{B'_a \bar{y}_a}{\bar{x}_a} \quad \frac{B_b \bar{y}_b}{\bar{x}_b} \qquad \ldots (1)$$

$$B_a = B_b \frac{y_b \bar{x}_a}{\bar{y}_a \bar{x}_b} \qquad \ldots (1)$$

Where,

B'_a is the elasticity necessary to give the marginal product of region b, when x_a, y_a are those of region a.

B_b is the elasticity of resource x_b in region b.

$\bar{y}$ & $\bar{x}_a$ are the mean quantities of product and resource in the region a.

$\bar{y}_b$ & $\bar{x}_b$ are the mean quantities of product and resource in region b.

Now, we will discuss intra-region comparison of resources productivities for cotton, rice, maize, and wheat

A) Intra-area Comparison of Resources Productivities in Cotton farm Enterprises :

The analysis of resource productivities in cotton production in various regions under consideration shows (as can be seen from table 5). that the mean of marginal productivity of land significantly differ only in El-Menia than that in other areas. The mean marginal productivities of land resources in cotton farm enterprises in other governorates are not significantly different from each other. This indicates that withdrawal of one feddan per farm under a control program in these farming areas would have greater effect in lowering cotton production in El-Kalyubia and the least in El-Menia.

These findings indicate that it would be better to keep one feddan in either cotton production area than El-Menia.

For labor input, considering the quantity of resource used. the marginal productivity of labor in Kafr-El-Sheikh cotton farming area is not significantly lower than that in El-Gharbia, Beni-Suef and El-Menia cotton farming areas, while the marginal product of labor in cotton farming areas in Kafr-El-Sheikh is significantly differ than that in cotton farming areas in El-Kalyubia. This findings shows that it would be better to transfer (shift) labor inputs from Kafr-El-Sheikh to El-Kalyubia cotton farming areas.

The analysis indicates that the mean marginal productivity of labor in cotton production in El-Kalyubia is not significantly different from farming areas in El-Gharbia, Also, it indicates that, considering the quantity of resources used, the marginal productivity of labor in cotton farming areas in Beni-Suef is significantly different from that in El-Gharbia and El-Kalyubia farming areas. These figures indicate that adding one man-day per farm in cotton production would have the greater return in El-Kalyubia and the least in cotton farming areas in Beni-Suef. But the analysis shows that the mean marginal productivity of labor in cotton farming areas in Beni-Suef is not significantly different from that in cotton farming areas in Kafr-El-Sheikh. Also, it indicates that shifting labor inputs from cotton farming areas in El-Menia to cotton farming areas in El-Kalyubia would

TABLE 5.—Elasticity coefficients necessary to equate resource productivities on cotton farms in different governorates.

Resource and the governorate against which test is made	The governorate for which test is made				
	Kafr-El-Sheikh	El-Gharbia	El-Kalyubia	Beni-Suef	El-Menia
Land :					
Kafr-El-Sheikh	—				
El-Gharbia	0.8843	—			
El-Kalyubia	1.3004	1.0552	—		
Beni-Suef	1.0979	0.8898	0.5050	—	
El-Menia	0.3135**	0.2545*	0.1442*	0.2191*	—
Labor :					
Kafr-El-Sheikh	—				
El-Gharbia	-0.2558	—			
El-Kalyubia	0.8183**	0.6007	—		
Beni-Suef	0.0366	0.0269	0.0380**	—	
El-Menia	-0.0900	-0.0361*	0.0660*	-0.1108	--
Capital :					
Kafr-El-Sheikh					
El-Gharbia	0.1478	--			
El-Kalyubia	0.3818	0.0328	-		
Beni-Suef	0.2472	0.2123	0.1090		
El-Menia	1.9995*	1.7167*	0.8814*	0.8531	—

Significance level of probability :
* $0 < p < 5$.
** $5 < p < 10$.

increase the efficiency of cotton production because the mean marginal productivity of labor in cotton production in El-Menia is significantly differ than that in El-Kalyubia and El-Gharbia, but it is not significantly differ than that in Kafr-El-Sheikh and Beni-Suef.

By comparing the differences in capital productivities in different areas, we conclude that, considering the quantity of capital resource used, the mean marginal capital productivity in Kafr-El-Sheikh is not significantly lower than that in El-Gharbia, El-Kalyubia and Beni-Suef, but it differs significantly than the marginal capital productivity in El-Menia. Also, the analysis indicates that the mean marginal productivity of capital in cotton farming areas in El-Menia differs significantly than that in other cotton farming areas. These figures show that it would be better to add more capital inputs in cotton farm enterprises in El-Menia by transfering these inputs from other cotton farming areas.

B) **Intra-area Comparison of Resources Productivities in Rice Farm Enterprises :**

All figures in table (6) show that all the elasticities of production of various resources which are necessary to give a marginal productivity in one area equal to that computed in the area of contrast are not significantly differ from each other.

Therefore, the agricultural policy couldn't recommend to reallocate farm resources used in rice production among the regions so as to attain economic efficiency.

C) **Intra-area Comparison of Resource Productivities in Maize Farm Enterprises :**

The figures in table (7) show the estimated elasticities of production of different resources which would be necessary to give the marginal productivity in one area equal to that computed from maize production function in the area of contrast.

The analysis shows that there is no significant difference in the marginal productivity of land in maize farming areas between Kafr-El-Sheikh and other governorates except in El-

Table (6) : Elasticity Coefficients Necessary to Equate Resource Productivities on Rice farms in different Governorates

Resource and the Governorate against which test is made.	The governorate for which test is made		
	Kafr-El-Sheikh	El-Gharbia	El-Kalyubia
Land :			
Kafr-El-Sheikh	—		
El-Gharbia	0 7526	--	
El-Kalyubia	1 0501	1 2883	—
Labor :			
Kafr-El-Sheikh	--		
El-Gharbia	0.1994	--	
El-Kalyubia	0.2684	0.3050	—
Capital :			
Kafr-El-Sheikh	—		
El-Gharbia	0.1069	-	
El-Kalyubia	0.0702	0.0688	—

Kalyubia. The mean marginal productivity of the latter area does not differ significantly than that in maize farming area in Kafr-El-Sheikh. Besides, the analysis indicates that the mean marginal productivity of land in maize farming areas in Beni-Suef significantly different from that in Kafr-El-Sheikh and El-Kalyubia and, it does not significantly different from that in El-Gharbia. Also, the figures show that the mean marginal productivities of land in maize production in El-Menia differs significantly than that in Kafr-El-Sheikh, El-Gharbia and El-Kalyubia farming areas. But it does not differ significantly than that in Beni-Suef farming areas. Therefore, it would be better to keep one feddan in maize production in El-Menia, El-Gharbia, and Beni-Suef than that in other farming areas.

The analysis of labor input shows that there are significant differences of resource productivity in various regions. Considering the quantity of resource used, the mean of marginal productivity of labor in maize farming areas at Kafr-El-Sheikh differs significantly than that in other maize farming areas in various regions. Also, the figures in table(7) show that productivity of labor resource in maize production at El-Menia is

significantly different from that in maize farming areas at various regions.

The mean marginal productivity of labor in El-Kalyubia and Beni-Suef are significantly different from that in maize farming areas in Kafr-El-Sheikh, while these coefficient are not significantly differ than that in other maize farming areas. Therefore the agricultural policy recommends to shift labor resource from farming areas which reflect lower marginal productivity to other farming areas which reflect greater marginal productivity until the value of marginal product be equal. Since the productivity of labor in maize faming area at El-Menia reflects lower marginal productivity than that in other farming areas, it is necessary to shift labor inputs from El-Menia to other maize farming areas in various regions especially to Kafr-El-Sheikh.

For capital inputs, the study indicates that the mean marginal productivities of maize capital was significantly much greater in El-Menia as compared to other farming areas in various regions. The empirical evidence obtained through this analysis loads to the conclusion that shifting capital inputs from maize farm enterprises at Beni-Suef to El-Menia and El-Kalyubia will be helpfull to attain the necessary and sufficient conditions for optimum resource allocation between regions in maize production.

D) **Intra-area Comparison of Resources Productivities in Wheat Farm Enterprises :**

The figures in table (8) show the elasticities of production which are necessary to give a marginal productivity equal to that computed in the area of contrast. The analysis indicates that the mean marginal productivity of land in wheat farming areas in Kafr-El-Sheikh differs significantly than that in other farming areas in various regions. This findings highly recommend wheat expansion in El-Menia, El-Gharbia, El-Kalyubia and Beni-Suef farming areas than in Kafr-El-Sheikh so as to attain economic efficiency in wheat production. The analysis shows that it would be better to keep one feddan per farm under wheat program in El-Menia and El-Gharbia and El-Kalyubia farming areas than in Kafr-El-Sheikh.

TABLE 7. —Elasticity coefficients necessary to equate resource productivities on maize farms in different governorates.

Resource and the governorate against which test is made	The governorate for which test is made				
	Kafr-El-Sheikh	El-Gharbia	El-Kalyubia	Beni-Suef	El-Menia
Land :					
Kafr-El-Sheikh	—				
El-Gharbia	0.7502*	—			
El-Kalyubia	0.0667	0.0681	—		
Beni-Suef	0.9378	0.9180	1.0098*	-	
El-Menia	1.0708*	1.0943*	1.1770*	1.0917	—
Labor :					
Kafr-El-Sheikh					
El-Gharbia	0.0460*				
El-Kalyubia	0.1164**	0.1489	—		
Beni-Suef	0.0416*	0.0532	0.0340	—	
El-Menia	0.8117	—1.0382*	- -0.6630*	1.4535*	—
Capital :					
Kafr-El-Sheikh	—				
El-Gharbia	0.1401*	—			
El-Kalyubia	1.5804	1.3483*			
Beni-Suef	- 0.1355	- 0.1156	—0.0804*		
El-Menia	2.1787	11.8588	1.2839**	0.9666*	

Significance level of probability :
* $0 < p < .5$.
** $.5 < p < .10$.

The analysis of labor productivities indicates that the marginal productivity of labor in wheat farming area at Kafr-El-Sheikh differs significantly than that at El-Kalyubia and El-Menia farming areas. While the mean marginal return of labor in wheat production in Kafr-El-Sheikh does not differ significantly than that in El-Gharbia and Beni-Suef farming areas. Also, the figures show that considering the quantity of resource used the mean of marginal productivity of labor in El-Kalyubia differs significantly than that in Kafr-El-Sheikh and El-Gharbia.

Therefore, it would be better to reallocate labor resources available in wheat production between regions in such a manner to attain economic efficiency. The analysis indicates that shifting labor inputs from wheat farming areas at El-Menia and El-Kalyubia to other wheat farming areas would increase wheat production.

The analysis of capital productivity in wheat production shows that the mean of marginal capital productivity on wheat displays significant differentials expected from the Capital/labor ratios and resource quantities used. For mean resource combinations, the mean of marginal productivity of capital in Kafr-El-Sheikh is significantly greatest than that in wheat farming areas at El-Gharbia, and Beni-Suef. Capital returns on wheat farms in Kafr-El-Sheikh does not significantly different from that in El-Kalyubia and El-Menia. Returns are even higher for these farming areas because of the structure of resources used in wheat production. The figures in table (8) show that the marginal returns of capital is significantly high in El-Kalyubia area as compared to the marginal returns on wheat farm in El-Gharbia. Also, return of capital on wheat farms in El-Menia is significantly higher than that in El-Gharbia and Beni-Suef farming areas, while marginal capital returns in El-Menia is not significantly different from that in El-Kalyubia and Kafr-El-Sheikh farming areas. The reallocation of resources policy suggests that it is expected to get greater wheat production by shifting capital inputs from other farming areas to El-Menia, El-Kalyubia and Kafr-El-Sheikh farming areas.

TABLE 8.--Elasticity coefficients necessary to equate resource productivities on wheat farms in different governorates.

Resource and the governorate against which test is made	The governorate for which test is made				
	Kafr-El-Sheikh	El-Gharbia	El-Kalyubia	Beni-Suef	El-Menia
Land :					
Kafr-El-Sheikh	—				
El-Gharbia	0.9152*	—			
El-Kalyubia	0.8638*	0.7578	—		
Beni-Suef	0.7320*	0.6421	0.6065	—	
El-Menia	0.9626*	0.8444	0.7977	0.9159	—
Labor :					
Kafr-El-Sheikh	—				
El-Gharbia	0.0488	—			
El-Kalyubia	—0.4122*	—0.3840*			
Beni-Suef	0.1398	0.1303	0.0680*		
El-Menia	—0.1855*	1.1043*	—0.5767*	—1.4030*	—
Capital :					
Kafr-El-Sheikh	—				
El-Gharbia	0.2459*	—			
El-Kalyubia	0.8588	0.8418**	—		
Beni-Suef	0.3638*	0.3570	0.1778*	—	
El-Menia	0.8259	0.8104*	0.4035	0.5612*	—

Significance level of probability ;
* $0 < p < 5$.
** $5 < p < 10$.

Conclusion

These findings can be of great value in setting up the national agricultural policy when dealing with resource allocations. This investigation supports the opinion that in Egyptian Agriculture, farmers are not aware of efficient use of traditional inputs. This implies that agricultural production may be increased by efficiently reallocating agricultural resources. In other words, resources might be efficiently allocated in order to attain a rapid increase in agricultural production if such reallocation is done according to the marginality principles.

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THE QUALITY OF LABOUR AND ITS INCIDENCE ON THE SOCIO-ECONOMIC DEVELOPMENT IN THE A.R. EGYPT

By

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The main hypothesis treated in the study states as follows : "The improvement in the quality of labour contributes to the economic and social development of a nation".

Taking this hypothesis as a starting point, the study was devoted to test the case of the A.R. Egypt during the sixties to see the relationship between changes in the quality of her labour and the socio-economic changes, i.e. development.

As it can be noticed from the title, such a topic implies the analysis of the relationship between two main variables, development as an independent variable and the quality of labour as a dependent one. The clarification and determination of these two variables was a precondition of applying them in the case of Egypt as an example of the developing countries. Hence, the subject is divided into three main steps :

Firstly : determining of the aspects of development and measuring it.

Secondly : determining the elements and determinants of the quality of labour and its measuring.

Thirdly : correlating the changes in the second variable, i.e. quality of labour, to the changes in the first variable, i.e. development, taking the case of Egypt in the sixties into consideration.

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In the light of the division set above, development was considered as a far-reaching and long-term process of socio-economic changes, of quantitative and qualitative character aiming at the abolition of the state of underdevelopment and at the same time improving the level of the living of the population. The aspects of development are social and economic, both are interrelated and interacting : while economic development exerts a welfare effect on the social development, the latter exerts a productivity effect on the former. In drawing up a development policy, the balance and interaction of those two aspects should be taken into account according to the following considerations :

1 — The capacity to create wealth;

2 — Economic progress with built-in social objectives has a first priority;

3 - Social services influencing directly the capacity of a man rank higher than those which have no direct intangible effects on his productive capacity;

4 — Social investments should be related to the needs and levels of economy and its ability to sustain it;

5 — Investments in social services should aim at widenning the productive sectors of the economy and breaking social and economic barriers to increase the productive and absorptive capacity of the economy;

6 — The use of the cost benefit analysis in distributing investments;

Any development plan or model must take into account that raising the level of living is both the objective and the instrument of development. Improvement in the people's level of living can be achieved directly (social development) or indirectly (economic development), and a rational development policy must look at those two things as a single entity.

After elucidating the concept of development and drawing up its strategy, it is necessary to find out an index to measure the changes that take place through space and time. The most

popular index for measuring development is the per capita national income. This index is an aggregate one and is the outcome of the interaction of production, consumption, and population growth. However, it is not an efficient one neither from the economic point of view nor from the social one. Irrespective of its shortcomings, it can be accepted to reflect the changes in the economic development, but it should be supported by another index to reflect social development. This latter one is presented by the level of living index which measures the degree of satisfying the basic and higher needs of the population. By defining the minimum and maximum norms of the satisfaction of needs, a country's level of living index can be constructed by taking into consideration, the weights given to different indicators and the degree of their distribution among population.

Development in Egypt during the sixties revealed that the rate of growth of the level of living index was 2.5 per cent annually, as it was 47.9 in 1960 and became 58.0 in 1970, at the same time per capita national income grew by 2.6 per cent annually. At the same time, the national income rate of growth was 4.6 per cent annually, the difference between the two rates has to be attributed to the high rate of growth of the population. In Poland, the level of living index grew by 2.0 per cent annually, the per capita national income by 5.0 per cent and the national income by 6.2 per cent. In both cases, social development lagged behind the economic one.

However, the level of living index is still in need of many improvements especially in determining the maximum and the minimum norms and the weights given to the indicators. But it fulfills the need for a social indicator as a counterpart for the economic indicator. In a later stage and by improvements in the statistical tools and techniques, there can be a unitary index to measure the whole process of development.

The second step is to shed some light on the concept of the quality of labour and its measurement. As a matter of fact, this concept is a relatively recent one, and emerged from the general conviction that natural resources and size of population are not sufficient factors to explain differences in the rates of growth among different countries.

Taking labour as to mean the productive expenditure of human brains, nerves, and muscles of this part of the population which contributes to the self-maintenance of a society by a contribution of physical energy, and human intelligence to the productive process, labour can be divided into two main dimensions;

a) The first is a quantitative dimension and concerns labour supply. This dimension plays two functions : in the first, to replace the withdrawals from the labour force to keep the level of the economic growth and the productive of a nation at a constant level; while the second function is to meet the new and increasing requirements of labour as a result of accelerating the tempo of development. This can be presented by the function of simple and expanded reproduction. The following factors influence the first dimension :

— The rate of population growth.
— The number of educational years.
— The policy of retirement and entry into labour force.
— The female participation.
— The drawings from agriculture and non-farm self employment.
— The average expectancy life.
— The immigration policy and
— The level of labour productivity.

The quantitative dimension is measured by either (man/hours) or (the gainfully occupied persons) or both of them.

b) The qualitative dimension or quality of labour. This dimension is responsible for increases in labour productivity. The poor physical and intellectual qualities and unfavourable composition of labour and the shortage of skills are responsible for the state of underdevelopment prevailing in the developing countries.

Quality of labour can be considered or described as the distinctive inherent physical and intellectual features of workers expressed in their level of education, skill and health resulting

from social and economic factors which affect the worker's energy, capacity and will to work. This understanding excludes any biological or racial differences.

There are many factors or elements which can be included under this meaning of quality of labour such as the level of education and skill, health, nutrition, mutual trust, organisational ability ..... etc. but owing to the problem of quantifying and measuring all of the elements, three elements only have been analysed, namely, education, health and nutrition. However, the importance of other elements should not be underestimated as they are of no less importance than the chosen ones.

Education, besides its economic aspect as a determinant of skill and occupational structure, is also of a social value especially its role in family planning and the uprooting of social, political, religious and cultural prejudices. It also smoothes to a great extent, the process of social changes and transformations, but still some types of it impede such changes and even oppose them.

Health and nutrition act through three main fields :

i. deaths or complete loss of productive asset.

ii. debility which decreases the productive capacity at work,

iii. disability.

These phenomena — deaths, debility and disability — have direct effects on labour productivity and they result from bad health conditions, undernutrition and malnutrition.

The factors affecting the quality of labour are as follows :

1 — Demographic :

age-structure,
male-female structure,
occupational structure.

2 — Social :

housing conditions,
social security,
cultural and recreational activities,
working conditions.

3 — Others : such as climatic conditions, attitudes and incentives.

As for measuring the quality of labour, it can be noticed that this concept is a complex, recent and heterogeneous one. Since, its direct measurement is not free from critics, indirect measuring may be more plausible. This means that the different determinants of the quality of labour can be represented by indicators which raises the problem of the number and the criteria on which the components or indicators are selected. Another problem consists in the interaction of the components and factors of the quality of labour. The latter problem can be solved by including both the elements and components in one measure. To avoid the problem of selecting the indicators and their number, it has been proposed that the components, of hence the indicators, of the level of living index can be used after the exclusion of the higher needs, especially if it is noticed that the determinants are of a social character. In addition, the demographic indicators can be also used as a complementary set.

Having fulfilled the task of explaining the two variables, the final step consists in measuring the incidence of the dependent variable on the independent one, or in other words the incidence of labour quality on socio-economic development in Egypt.

Taking the quantitative aspect of labour, it could be seen that the Egyptian labour force is characterised by :

1 — Generally low participation rates (about 28% of active population);

2 — A very low female participation rates (around 8 per cent) :

3 — An age-structure characterised by its youthfulness;

4 — The predominance of agriculture labour force;

5 — A relatively high rate of population growth (2.5 per cent annually).

Concerning the qualitative dimension, the analysis of its influence on development in Egypt was undertaken by two methods. The first method consists in analysing the impact of health, nutrition, and education individually on development, while the other method consists in correlating the changes in

the level of living to changes in productivity and rates of growth of the national income (G.N.I.).

According to the first method, development is gained from the improvements in education, health, and nutrition. There were great changes in these fields. Although these changes were not completely satisfactory especially the quality of nutrition is far from the norms recommended by the scientific authorities, putting apart the problem of its distribution. At the same time no substantial occupational changes took place.

The main results of the analysis conducted by the second method are :

a) there is a high and positive correlation between the rate of growth of Gross National Income (G.N.I.) and the labour and capital inputs individually (0.8 and 0.9 respectively).

b) the rate of growth of the G.N.I. during the sixties was higher than that expected from the rate of investments, which leaves a margin of 0.5 per cent to be attributed to other factors or namely the quality of labour. The improvement in the quality of labour was at a rate of 1.1 per cent.

c) the correlation coefficient of the rate of growth of labour productivity and labour input was 0.4, while that with the capital input was 0.5 during the sixties.

d) prospects for the future revealed that the quality of labour should be at least 1 per cent higher if the national income is to be doubled every ten years under the prevailing increase in population and insuring a 25 per cent of the national income to be allotted to investments.

However, improving the level of living of the population, and consequently increasing the quality of labour, leads to improvements in the productivity which, by its turn, increases the rate of growth of the national income.

The limitations of this study should be considered and the results are only tentative since the reliability of data can be questioned. However, for future studies sectoral and regional analysis can be of a great usefulness.

Finally, it must be stated that in calculating the supply or demand of labour, the manpower planner should take into consideration the quality of the available labour. The abundancy of labour in the developing countries converts the attention to the quantitative problems rather than the qualitative ones. If these countries were suffering a shortage of labour supply greater pressure would have been generated on the improvement in the productive capacity and efficiency of labour through improving its quality. However, adequate attention should be paid to the quality of labour, not only from a humanistic point of view, but also from an economic one as raising this quality will accelerate the rates of development.

THE EFFECT OF MISSPECIFICATION ON THE RELATIVE PERFORMANCE OF ECONOMETRIC ESTIMATORS

W. M. MIKHAIL*

Antithetic-variate and control-variate techniques are used, together with straightforward simulation, to study the effect of misspecification on the small-sample properties of some econometric estimators. Autocorrelated disturbances seemed to affect the behaviour of the estimates more than the heteroskedastic or the uniformly-distributed disturbances. Wrong a priori restrictions have greatly increased the single-equation bias in the misspecified equation and the full-information bias in all equations in the model. Three-stage least squares was the least affected, among joint-estimation methods, by misspecification. Including an extra exogenous variable did not have much effect on the properties of the estimators or on their relative standing.

1. INTRODUCTION

In a recent article [14], the author has shown that the two-antithetic method was better than straightforward simulation for estimating the biases of econometric estimators, and that the control/antithetic method was better for estimating their dispersions. In a later paper [16], the two methods were tried along with direct simulation on a hypothetical two-equation model in which the basic assumptions of the standard classical model are met. It was found that joint estimation methods are superior to single-equation techniques in correctly-specified models.

This paper tries to use these techniques to simulate the effect of two kinds of specification error on the performance of the estimators, first, the effect of relaxing some of the assumptions

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on the disturbance term is studied by conducting three experiments which differ from the basic experiment reported in [16] only in the way the disturbances are generated. The first experiment deals with autocorrelated disturbances, the second with heteroskedastic disturbances and the third considers disturbances drawn from the uniform distribution. The second kind of misspecification is in the form of the model. In view of the fact that the nature of econometric models makes it inevitable to have a certain degree of misspecification, it is certainly of considerable importance whether a misspecified equation or set of equations will seriously affect the full information estimates in the whole model. To this effect, two experiments were run, the first of which considers the case of an excluded exogenous variable while the second investigates the case of an extra exogenous variable being wrongly included in one of the equations.

The details on the antithetic-variate method and the control antithetic method are given in [14], and the basic experiment to which the results of the present paper are compared, is the second experiment reported in [16]. The following model was used :

$$y_{1t} - \alpha_{12}y_{2t} + \beta_{11}x_{1t} - \beta_{12}x_{2t} + \beta_{13}x_{3t} - \beta_{10} - u_{1t} \qquad (1.1)$$

$$y_{2t} - \alpha_{21}y_{1t} + \beta_{24}x_{4t} + \beta_{25}x_{5t} + \beta_{26}x_{6t} + \beta_{20} + u_{2t}$$

Twenty observations on the exogenous variables and the disturbances were used to generate the endogenous variables, and the process of estimation was repeated a hundred times, using the following methods :

Ordinary Least Squares (OLS),
Two-Stage Least Squares (2SLS),
Three-Stage Least Squares (3SLS),
Iterative Three-Stage Least Squares (IT3S),
Three-Stage via OLS (3S OLS),
Limited-Information Single Equation (LISE),
Linearized Maximum-Likelihood (LML),
Full-Information Maximum-Likelihood (FIML),
Ordinary Least Squares on Reduced Form (OLS RF).

2. AUTOCORRELATED DISTURBANCES

The structural disturbances used in this experiment were generated as follows. The approximately normally distributed numbers were obtained as discussed in [14], and these were manipulated to produce disturbances that follow a first-order Markov scheme. If u_t are the random normal deviates, then

$$v_t = \rho v_{t-1} + (1 - \rho)u_t \qquad (2.1)$$

and ρ was given the value of 0.8 in order to produce reasonably highly autocorrelated disturbances.

In addition to looking at the relative performance of the various methods under the condition of autocorrelated errors, special attention should be paid here to the magnitude of the dispersion, the efficiency of the predictions and the reliability of the standard errors.

We start by examining the structural parameters of the various estimators. Direct simulation and two-antithetic simulation both show FIML and LISE to produce the smallest biases, and 3S/OLS, OLS and LML to produce the highest biases. 2SLS, 3SLS and IT3S were very close to one another. If we consider the biases obtained by direct simulation, we find that the results of this experiment, do not differ in essence from what was found in the basic experiment, but two-antithetic sampling reveal a little discrepancy between the two experiments as regards the relative standing of FIML and IT3S. By this sampling technique, IT3S gave the least biases in the basic experiment and FIML was ranked fifth, while in the autocorrelation experiment the ranks of the two methods were reversed, and the magnitude of the FIML-biases was of smaller order than the IT3S-biases for most of the coefficients. Again in this experiment, the signs of the biases of 2SLS, 3SLS and IT3S agreed with the signs of OLS-biases, and LISE and FIML gave biases of opposite sign. Median biases showed LML to be marginally better than 3S/OLS and OLS.

The number of significant biases would not give a clear ranking of the methods. OLS and 3SLS gave significant biases for all the ten coefficients, 3S/OLS and IT3S both gave nine significant biases, FIML and LISE gave eight and 2SLS seven

significant biases. Pairwise comparisons using the t-test produce the results presented in table 2 a. For many pairs of estimators, the numbers of significant t-values are not different from those obtained for the basic experiment. Leaving LML apart, the differences between row-totals and column-totals of table 2 a give exactly the same ranking of the methods as that obtained by direct ranking and presented in table 1.

The variances, mean-square errors and mean-absolute errors still favour the full-information methods. Judging by the variances, and leaving LML aside, the best methods in this group will be 3S OLS. The rank-totals for IT3S, FIML and 3SLS are very close, being second, third and fourth, but the t-test used in pairwise comparisons shows IT3S and FIML to be on equal standing and to be superior to 3SLS[1]. In the other group, OLS is the best, followed by 2SLS and LISE. Again the ranking of the variances is only slightly different from the ranking in the basic experiment. Also the mean-square errors and the mean-absolute errors give rankings which are identical both to one another and to the rankings according to these two criteria in the basic experiment, namely dividing the methods into two groups with FIML, IT3S, 3SLS and 3S OLS in the first and 2SLS, LISE and OLS in the second, all in ascending order.

This ranking seems most plausible from the point of view of the asymptotic theory, based on serially independent disturbances. The fact that it is not different from the ranking in the basic experiment indicates that the presence of autocorrelation in the disturbances either does not affect the estimators, or has more or less the same effect on them. The second suggestion, as seen below, is of course the case.

The very small biases of LISE did not help much in improving its standing, and the very small variances of 3S OLS could not overpower its large biases. FIML'S smaller biases have helped it gain its marginal superiority over IT3S and 3SLS, as the differences between the variances of the three methods were extremely small. The biases, though of very small magnitude,

(1) It should be borne in mind that the t-values used in the analysis of the results in this section are not very precise.

were the determining factor in ranking these three methods according to the mean-square errors. Pairwise comparisons of the significant differences between the mean-square errors did not, however, show FIML to be better than IT3S.

Control/antithetic simulation was more conclusive on the better standing of 2SLS relative to LISE than it was on the performance of FIML and 3SLS relative to one another, and the rank-totals for the first two methods were much higher than the rank-totals for the other two, which emphasized that in the presence of autocorrelation in the disturbances the full-information methods are still much better than single-equation methods. The variance, the MSE and the MAE all put 2SLS ahead of LISE, but the variance gives equal ranking to 3SLS and FIML, the MSE slightly favours 3SLS and the MAE considerably favours FIML.

Closeness to true values puts IT3S, 3SLS and FIML on top, being very close to each other. Next comes 3S/OLS, LISE and 2SLS, and finally OLS and LML. Kendall's W statistic for this ranking was .757.

The results on the reduced-form parameters are much clearer than the results on the structural parameters. This could be immediately seen by comparing table 1 with table 3. The ranking of the biases by two-antithetic simulation follows the ranking in the basic experiment, except that FIML here fares slightly better than LISE. LISE has produced many more significant biases in this experiment than it did in the basic experiment.

All the other statistics used in this study show FIML to be the best method on the reduced-form, with a considerable lead in many cases. The ranking identical to that of the basic experiment for the mean-square and mean-absolute errors, putting IT3S as second best and 3SLS as a close third. The ranking by closeness to true values is exactly like the ranking by MSE or MAE, but on the variance LISE was as good as OLS and both were better than 2SLS. The other statistics do not show any remarkable deviations from the findings of the basic experiment.

TABLE 1.—Ranking of the structural parameters of the autocorrelation experiment

	OLS	2SLS	3SLS	IT3S	3S/OLS	LISE	LML	FIML	W
By Direct Simulation									
Mean Biases	7	5	4	3	6	1	8	2	.830**
Median Biases	8	5	3	4	7	2	6	1	.476**
Closeness to True Values	7	6	2	1	4	5	8	3	.757**
Variances	5	6	4	2	1	7	8	3	.714**
Mean-Square Errors	7	5	3	2	4	6	8	1	.728**
Mean-Absolute Errors	7	5	3	1.5	4	6	8	1.5	.756**
Inter-Quartile Range	5	6	3	1	4	7	8	2	.722**
Range	5	6	1	3	2	7	8	4	.619**
By Two Antithetics									
Mean Biases	7	3	4.5	4.5	6	2	8	1	.702**
No of Significant Biases	7.5	2	7.5	5.5	5.5	3.5	1	3.5	—
Closeness to True Values	7	6	3	1	4	5	8	2	.788**
By Control/Antithetics									
Variances	—	3	1.5	—		4	—	1.5	.612**
Mean-Square Errors		3	1			4	—	2	.700**
Mean-Absolute Errors	—	3	2	-		4	—	1	.720**

** Significant at the .01 level.

TABLE 2(*a*).—Pairwise comparisons between means by two-antithetic simulation structural parameters of the autocorrelation experiment

	OLS	2SLS	3SLS	IT3S	3S/OLS	LISE	LML	FIML
OLS	—	0	0	0	3	0	0	0
2SLS	10	—	4	4	9	4	0	1
3SLS	10	4	—	4	9	1	0	0
IT3S	9	4	4		9	2	0	1
3S/OLS	7	0	0	0	—	1	0	0
LISE	10	6	9	8	9	- -	0	2
LML	1	0	0	0	1	0	-	0
FIML	10	7	10	9	10	5	0	—

Each row gives the number of coefficients for which the method produced a statistic which was significantly smaller than thoseproduced by the other methods, at the .05 level, using the t-test.

TABLE 2(*b*). Pairwise comparisons between variances by direct simulation structural parameters of the autocorrelation experiment

	OLS	2SLS	3SLS	IT3S	3S/OLS	LISE	LML	FIML
OLS	—	4	0	0	0	4	0	0
2SLS	0	—	0	0	0	2	0	0
3SLS	6	7	—	1	0	7	0	0
IT3S	6	7	2	—	2	7	0	0
3S/OLS	7	9	5	3		9	0	3
LISE	0	0	0	0	0	—	0	0
LML	0	0	0	0	0	0	—	0
FIML	6	7	1	0	2	7	0	—

TABLE 2(*c*).—Pairwise comparisons between mean-square errors by direct simulation - structural parameters of the autocorrelation experiment

	OLS	2SLS	3SLS	IT3S	3S/OLS	LISE	LML	FIML
OLS		0	0	0	1	0	0	0
2SLS	3		0	0	2	1	0	0
3SLS	9	8	—	1	5	7	0	0
IT3S	9	8	2	—	4	7	0	0
3S/OLS	9	7	0	0	--	7	0	0
LISE	2	0	0	0	2		0	0
LML	0	0	0	0	0	0	-	0
FIML	9	8	1	0	3	7	0	—

TABLE 3. - Ranking of Reduced-form parameters of the autocorrelation experiment

	OLS	2SLS	3SLS	IT3S	3SOLS	LISE	LML	FIML	OLS/RF	W
By Direct Simulation										
Mean Biases	9	5	4	3	7	1	8	2	6	.487**
Median Biases	9	5	3	4	8	2	7	1	6	.345**
Closeness to True Values	7	6	3	2	4	5	9	1	8	.721**
Variances	6	7	3	2	4	5	9	1	8	.858**
Mean-Square Errors	7	6	3	2	4	5	9	1	8	.766**
Mean-Absolute Errors	7	6	3	2	4	5	9	1	8	.794**
Inter-Quartile Range	5	6	3	2	4	7	9	1	8	.743**
Range	6	7	2	4	3	5	9	1	8	.591**
By Two Antithetics										
Mean Biases	8	4	5	6	7	3	9	2	1	.766**
No of Significant Biases	8	5.5	8	5.5	8	4	2	3	1	—
Closeness to True Values	7	6	3	2	4	5	9	1	8	.721**

** Significant at the .01 level.

TABLE 4. Ranking of the predictions of the autocorrelation experiment

	OLS	2SLS	3SLS	IT3S	3SOLS	LISE	LML	FIML	OLS/RF	W
By Direct Simulation										
Mean Biases	9	5	3	4	8	1	6	2	7	.701**
Median Biases	8	5	1	4	7	3	9	2	6	.787**
Closeness to True Values	8	7	1	3	2	5	9	4	5	.848**
Variances	5	7	3	1.5	4	8	9	1.5	6	.784**
Mean-Square Errors	6	7	2	3	4	8	9	1	5	.789**
Mean-Absolute Errors	8	6	2	3	4	7	9	1	5	.661**
Inter-Quartile Range	2	7	5	3	4	8	9	1	6	.362**
Range	5	6	2	3	1	7	9	4	8	.485**
By Two Antithetics										
Mean Biases	8	6	5	4	7	3	9	2	1	1.000**
No of Significant Biases	6.5	6.5	6.5	6.5	6.5	6.5	2	2	2	—
Closeness to True Values	8	7	1	2	3	5	9	4	6	.796**

** Significant at the .01 level.

The biases of the predictions obtained by direct simulation gave a ranking of the estimators which was quite different from the ranking of the basic experiment, but the ranking of the biases simulated by the two-antithetic technique was similar to that of the basic experiment, except that FIML here was better than LISE. This ranking was the same for each of the eight predictions giving a value of 1.00 for the W statistic. OLS RF gave zero biases and LML gave the largest biases of all, but their standard errors were too big to allow us to see any significance in the figures. FIML produced very small biases, none of which was significantly different from zero. All the other methods gave significant biases for all the predictions, and the biases of 3S, OLS and OLS were of a much greater magnitude than the others.

The ranking of the variances of the predictions put FIML and IT3S on equal standing followed by 3SLS and 3S/OLS, and the single-equation group had OLS, OLS RF, 2SLS and LISE in ascending order. The main changes brought forward by the MSE's and the MAE's are the following. 3SLS was shown by the two statistics to be better than IT3S. OLS RF was the best single-equation method while it was the worst in the basic experiment, and OLS was better than both 2SLS and LISE on the mean-square error criterion.

3SLS gave predictions which were closest to the true values and was followed on this by 3S/OLS, IT3S and FIML respectively. Among single-equation methods LISE was the closest to the true values and OLS was the most remote.

So much for the relative standing of the methods, we now look at the direction of the changes in the biases and the dispersions with respect to the basic experiment. The biases of the structural parameters, the reduced-form parameters and the predictions, simulated by the two-antithetic methods, showed FIML, OLS and 3S/OLS to have always produced smaller biases on the introduction of autocorrelation in the disturbances. On the other hand, the biases of the predictions of IT3S and LISE have always increased. The differences in the biases of the structural parameters and reduced-form parameters of the other methods alternated between positive and negative, but there were more decreases than increases.

The variances, mean-square errors and mean-absolute errors have all gone down for the structural parameters and the reduced-form parameters, but have all gone up for the predictions. An average cut between 30 and 60 per cent was reported for the dispersions of the structural and reduced-form parameters, and an increase varying between 10 and 340 per cent was reported for the dispersion of the predictions. The increases in the first four predictions were, however, much higher than those in the other four. As the first four predictions are based on values of the exogenous variables which are equal $\overline{X}_i \quad \sigma X_i$ and the other four are based on $\overline{X}_i \pm 2\sigma X_i$, it might be concluded that, in the case of autocorrelated disturbances, the nearer the values of the exogenous variables are to those used in the estimation process, the less efficient predictions we get, and vice versa.

The increase in the dispersions of the predictions in full-information methods was significantly higher than the increase in single-equation methods. About the same percentage of change were reported for FIML and IT3S, and slightly smaller increases were produced by 3SLS. Also, the dispersions of the predictions of 2SLS, LISE and OLS increased by more or less the same factor. The variances of OLS/RF were the least affected. The first four predictions by this estimator produced variances which showed an increase, over those of the basic experiment, of about 50 to 60 per cent, and the other four indicated a decrease in the variances of about 10 to 30 per cent.

Looking at the standard errors of the structural coefficients, it was surprising to see that their reliability was not affected much by the introduction of autocorrelation in the disturbances. Both the standard deviations and the asymptotic standard errors have gone down in this experiment from what they are in the basic experiment, but the percentages of change differed widely from one coefficient to another. While in the basic experiment the asymptotic standard errors never overestimated the sampling variations it was seen in this experiment that all the estimators gave higher asymptotic standard errors than the corresponding standard deviations for at least two or three parameters out of eight.

If we rank the methods according to the closeness of the estimates of the asymptotic standard errors to the standard deviations, we find that IT3S, 3S/OLS and FIML produce the closest of such estimates respectively, and OLS and 2SLS produce the farthest. As in the basic experiment, the standard deviations of FIML and IT3S fell in quantiles of the distributions of the asymptotic standard errors which were very close.

Using the t-ratios, with 10 degree of freedom, for testing the hypothesis that the true values fall within limits in 95 per cent of the cases, it was found that the percentages of estimates falling outside the confidence intervals were significantly higher than .05 for two parameters only in the case of LISE and 3SLS, three parameters in the case of FIML, IT3S, 3S/OLS and 2SLS, and six parameters in the case of OLS. This result should not be given much importance, however, as the values computed for the t-ratios in this experiment are far from being precise.

If, on the other hand, we compare the sampling estimates of the asymptotic standard errors and the standard deviations to the 'true' values of the asymptotic standard errors, we find that the gap is quite wide. The sampling asymptotic standard errors were smaller by a factor of roughly one third, and there were no great differences in this between the various methods or between the parameters. The standard deviations were smaller by a factor which varied widely and ranged between 1 and 43 per cent.

Estimates of the elements of the variance matrix of the disturbances all underestimated the true values, producing very large negative biases for all the methods. The rankings according to both mean- and median-biases were exactly the same as the rankings in the basic experiment, but all the biases here were significantly larger than those of the basic experiment. LML is again the worst method according to mean-biases, and the best method according to median-biases, and if allowance for this is made the two rankings agree that FIML, IT3S and 3SLS are respectively the methods that give the least biased Σ-matrix, and that LISE, 2SLS and OLS give the most biased Σ-matrix; OLS being the worst.

The variances, the MSE's and the MAE's of the elements of the λ-matrix also give the same rankings of the estimators as those obtained for the basic experiment. According to the variances, the best methods are OLS, 2SLS and 3S/OLS, and the worst are IT3S, FIML and LML respectively. The MSE's and the MAE's put IT3S, FIML and 3SLS on top, while give the last ranks to 2SLS, OLS and LML. The W statistics were very high for all these rankings, which were also emphasized by the Wilcoxon test in pairwise comparison.

3. HETEROSKEDASTIC DISTURBANCES

The random normal deviates have been transformed here in order not to have a constant variance for the successive observations. Five different values for the variance were chosen and the first five disturbances were multiplied by their square roots, and this was repeated four times over, for the twenty observations in the series. These values for the variance were :

1 2, 3 4, 1, 5/4, 3/2

and the estimation process was then carried out on the various methods as before.

Comparing the relative standing of the methods in this experiment and the basic experiment, and also comparing the magnitudes of the biases and variances and the other criteria of goodness, will show that there are very little differences between the results of this experiment and those of the basic experiment

TABLE 5.—Ranking of the structural parameters of the heteroskedasticity experiment

	OLS	2SLS	3SLS	IT3S	3S/OLS	LISE	LML	FIML	W
By Direct Simulation									
Mean Biases	7	3	5	4	6	2	8	1	.808**
Median Biases	8	5	6	4	7	2	3	1	.613**
Closeness to True Values	7	6	2	3	4	5	8	1	.681**
Variances	5	6	3	1	2	7	8	4	.794**
Mean-Square Errors	7	5	2.5	1	4	6	8	2.5	.719**
Mean-Absolute Errors	7	5	3	1	4	6	8	2	.679**
Inter-Quartile Range	5	6	3.5	2	1	7	8	3.5	.626**
Range	5	6	3	1	2	7	8	4	.602**
By Two Antithetics									
Mean Biases	7	2.5	1	2.5	6	5	8	4	.720**
No of Significant Biases	7.5	2.5	2.5	4	7.5	5.5	1	5.5	—
Closeness to True Values	7	4	1	2	5	6	8	3	.678**
By Control/Antithetics									
Variances	—	3	1	—	—	4	—	2	.796**
Mean-Square Errors	—	3	1	—	—	4	—	2	.700**
Mean-Absolute Errors	—	3	1	—	—	4	—	2	.852**

** Significant at the .01 level

TABLE 6.—Ranking of reduced-form parameters of the heteroskedasticity experiment

	OLS	2SLS	3SLS	IT3S	3SLOS	LISE	LML	FIML	OLS/FR	W
By Direct Simulation										
Mean Biases	8	5	6	4	7	2	9	1	3	.456**
Median Biases	9	6	4	5	8	3	7	1	2	.310**
Closeness to True Values	8	6	3	2	5	4	9	1	7	.619**
Variances	5	6	2	3	4	7	9	1	8	.807**
Mean-Square Errors	8	6	3	2	4	5	9	1	7	.765**
Mean-Absolute Errors	7.5	6	3	2	4.5	4.5	9	1	7.5	.729**
Inter-Quartile Range	6	5	3.5	3.5	1	7	9	2	8	.583**
Range	6.5	5	2	3	4	6.5	9	1	8	.795**
By Two Antithetics										
Mean Biases	8	5	4	6	7	2	9	3	1	.786**
No of Significant Biases	7.5	5.5	5.5	7.5	9	3	2	4	1	—
Closeness to True Values	8	5	3	2	4	6	9	1	7	655**

** Significant at the .01 level.

TABLE 7.—Ranking of the predictions of the heteroskedasticity experiment

	OLS	2SLS	3SLS	IT3S	3SOLS	LISE	LML	FIML	OLS/RF	W
By Direct Simulation										
Mean Biases	8	4	1	2	7	5	9	3	6	.897**
Median Biases	9	4	2	1	8	5	6	3	7	.699**
Closeness to True Values	7	6	3	1	4	5	9	2	8	.828**
Variances	5	7.5	3	1	4	7.5	9	2	6	.889**
Mean-Square Errors	8	5	3	1	4	6	9	2	7	.905**
Mean-Absolute Errors	8	5	3	1	4	6.5	9	2	6.5	.903**
Inter-Quartile Range	5	6.5	3	1	4	6.5	9	2	8	.899**
Range	5	6	4	1	2.5	7	9	2.5	8	.896**
By Two Antithetics										
Mean Biases	8	6	5	4	7	2	9	3	1	1.000**
No of Significant Biases	7	7	7	7	7	2.5	2.5	2.5	2.5	—
Closeness to True Values	7	6	3	2	4	5	9	1	8	.856**

** Significant at the .01 level.

Rather than describing the relative behaviour of the various estimators in detail, we are going to outline the main differences between the findings of this experiment and the basic experiment. The biases of the structural parameters show FIML to be better than LISE. This was reported by both direct simulation and two antithetic simulation, but the latter method showed the difference to be less pronounced than did the first method. The ranking of the other estimators by the structural biases remained unchanged. The biases of the reduced-form parameters obtained by two-antithetic sampling, also give the same ranking as in the basic experiment, except that 3SLS is shown here to be as good as 2SLS. The predictions gave biases, the ranking of which is identical to that of the basic experiment, again with the W statistic being equal to unity. Almost all the biases of the structural parameters, the reduced-form parameters and the predictions were of the same sign and the same magnitude as those of the basic experiment, whether simulated by direct or two-antithetic sampling.

The variance and the range give the structural parameters the same ranking again, with magnitudes very close to those of the basic experiment. The mean-square error and the mean-absolute error give identical ranking which is different from that of the basic experiment only in that IT3S is here better than FIML on both criteria. Using control antithetic simulation, no discrepancy was seen between the results of the two experiments, whether on the rankings or the magnitudes of the variances, MSE's or MAE's.

In the case of the reduced-form parameters, some differences of minor significance were reported. The relative standing of 3SLS and IT3S on the variance was reversed, changing from favouring IT3S to slightly favouring 3SLS. Also, the relative standing of OLS and OLS RF on the mean-square error changes to slightly favouring OLS RF. However, the differences between the rankings in both cases remain insignificant.

More changes from the findings of the basic experiment were seen in the behaviour of the dispersions of the predictions. On the variance criterion, IT3S was found in this experiment to be better than FIML, and OLS RF was marginally better

than both 2SLS and LISE. The variances have, in general, increased for all the methods by up to 28 per cent. The methods whose predictions produced variances that were least affected by heteroskedastic disturbances were OLS/RF, 3SLS and 3S/OLS respectively; and the methods with predictions giving variances that were affected most were IT3S, LISE, FIML, 2SLS and LML, the last displaying the greatest increases. It was also noticed that FIML and IT3S changed by the same factor, and 3SLS and 3S/OLS also had the same percentage of change. The variance of OLS/RF showed a decrease for three predictions.

The reliability of the asymptotic standard errors was not affected much by the introduction of heteroskedastic disturbances. They still under-estimated the variations in the coefficient estimates by more or less the same factor reported for the basic experiment, namely between five and thirty per cent, and LISE was still the method that gave the most reliable estimates of the standard errors.

The elements of the Σ-matrix were analysed in the same way as in the basic experiment. Their mean- and median-biases gave the same ranking for the methods, but they were smaller than the biases of the basic experiment for all the estimators. Also, the variance, the range and the inter-quartile range gave the same rankings, but the dispersions were always greater than those of the basic experiment. The decrease in the square of the bias was roughly proportionate to the increase in the variance, so that the means-square errors were very close to their counterparts in the basic experiment.

4. UNIFORMLY DISTRIBUTED DISTURBANCES

The structural disturbances used here were taken from the uniformly distributed random numbers generated on ATLAS, after applying a simple transformation to make them range between -1.73205 and 1.73205, which will give a zero mean and unit variance.

Two-antithetic sampling shows the biases to be of the same magnitude as the biases of the basic experiment, with perhaps small and mostly insignificant decreases for the structural and reduced-form parameters. The significant biases also had the

same signs as before. The biases of the predictions behaved in a different way. There were increases in the biases of 3SLS, IT3S, 3S/OLS and LISE for the eight predictions, but FIML showed decreases in the biases for all the predictions varying between 50 and 70 per cent and its signs were always opposite to the signs of the FIML-biases in the basic experiment. The method that produced the smallest structural biases was LISE, and was followed by FIML, IT3S and 3SLS respectively. For the reduced-form biases the first ranks were given to OLS RF, LISE, FIML, 3SLS and 2SLS with 2SLS as good as 3SLS. The biases of the predictions put FIML and LISE on equal standing next to OLS/RF, while IT3S, 2SLS and 3SLS took the next three ranks.

The variances obtained by direct simulation have all decreased for all the methods by a factor between 10 and 40 per cent and the mean-square errors have decreased by about the same factor. The relative standing of the different methods according to the mean-square errors and the mean-absolute errors is different from that of the basic experiment only in putting IT3S ahead of FIML. Control/antithetic sampling gives the same ranking as in the basic experiment, but the dispersions simulated by that metohd did not show the differences reported by direct simulation.

5. AN EXCLUDED EXOGENOUS VARIABLE

The a priori restriction $\beta_{11} = 0$ was here assumed in the estimation process. While the coefficient of x_1 in the second equation was 0.8 in the 'true' model that generated the endogenous variables, the various methods were applied to the model with x_1 not present in that equation. The first equation remained correctly specified, and it would therefore be necessary in the present analysis to look at the behaviour of the coefficients of each equation separately.

5.1 Structural Parameters

The biases of the structural Parameters, obtained by two-antithetic sampling displayed a ranking of the estimators which was distinctly different for the two equations. In the first equation, the correctly specified one, the consistent single-equation methods, 2SLS and LISE, gave smallest biases, while FIML,

TABLE 8.—Ranking of structural parameters - disturbances uniformly distributed

	OLS	2SLS	3SLS	FT3S	3S/OLS	LISE	LML	FIML	W
By Direct Simulation									
Mean Biases	8	5	3.5	3.5	7	2	5	1	.607**
Median Biases	8	4	5	6	7	2	3	1	.594**
Closeness to True Values	8	5	1	3	6	4	7	2	.546**
Variances	4	6	3	2	1	7	8	5	.714**
Mean-Square Errors	7	5	3	1	4	6	8	2	.699**
Mean-Absolute Errors	7	5	2.5	1	4	6	8	2.5	.605**
Inter-Quartile Range	4	6	3	2	1	7	8	5	.732**
Range	5	6	3	2	1	7	8	4	.779**
By Two Antithetics									
Mean Biases	8	5	4	3	6	1	7	2	.667**
No of Significant Biases	8	6.5	4.5	3	6.5	2	1	4.5	—
Closeness to True Values	8	5	1	3	4	6	7	2	.577**
By Control/Antithetics									
Variances	—	3	1	—	—	4	—	2	.844**
Mean-Square Errors	—	3	1	—	—	4	—	2	.844**
Mean-Absolute Errors	—	3	1	—	—	4	—	2	.612**

**Significant at the .01 level.

TABLE 9. Ranking of reduced-form parameters - disturbances uniformly distributed

	OLS	2SLS	3SLS	IT3S	3SOLS	LISE	LML	FIML	OLS/RF	W
By Direct Simulation										
Mean Biases	8	6	4	2	7	3	9	1	5	.547**
Median Biases	9	7	2	4	7	5	3	1	6	.330**
Closeness to True Values	9	5	3	2	6	4	7	1	8	.643**
Variances	5	6	4	2	3	7	9	1	8	.833**
Mean-Square Errors	7.5	6	3	2	4	5	9	1	7.5	.769**
Mean-Absolute Errors	8	6	3	2	4	5	9	1	7	.786**
Inter-Quartile Range	5	7	4	2	3	6	9	1	8	.600**
Range	5	6	3	2	1	7	9	4	8	.754**
By Two Antithetics										
Mean Biases	8	4.5	4.5	6	7	2	9	3	1	.878**
No of Significant Biases	8.5	6	6	6	8.5	2.5	2.5	2.5	2.5	-
Closeness to True Values	9	5	3	2	6	4	7	1	8	.673**

** Significant at the .01 level.

TABLE 10.—Ranking of the predictions - uniformly distributed disturbances

	OLS	2SLS	3SLS	IT3S	3SOLS	LISE	LML	FIML	OLS/RF	W
By Direct Simulation										
Mean Biases	8	5.5	3.5	2	7	3.5	9	1	5.5	.983**
Median Biases	9	6	5	3	8	2	7	1	4	.718**
Closeness to True Values	8	6	2	3	5	4	9	1	7	.907**
Variances	5	6	3	1	4	8	9	2	7	.919**
Mean-Square Errors	8	6	3	2	4	5	9	1	7	.936**
Mean-Absolute Errors	8	5.5	3	2	4	5.5	9	1	7	.923**
Inter-Quartile Range	5	6	4	2.5	2.5	7	9	1	8	.832**
Range	5	6	4	2	3	7	9	1	8	.920**
By Two Antithetics										
Mean Biases	8	5	6	4	7	2.5	9	2.5	1	.967**
No of Significant Biases	7	7	7	7	7	2.5	2.5	2.5	2.5	—
Closeness to True Values	7	6	2	3	4	5	9	1	8	.818**

** Significant at the .01 level.

3S, OLS and IT3S produced the largest biases (leaving LIML aside). The difference in the magnitude of the biases between consistent single-equation methods and full-information methods was so great that although 3SLS came only next to LISE in the ranking, its biases were 5 to 25 times larger. The IT3S-biases were twice as large as the 3SLS-biases.

If we look at the biases of the misspecified equation, we find that IT3S and 3SLS produced the smallest biases, and were followed by 2SLS and 3S/OLS. LISE, FIML and OLS were the methods with the largest biases. The differences in the magnitudes of the biases were less pronounced than in the first equation. As distinct from ranking the estimators according to their behaviour in all the ten structural parameters, which is given in table 11, the rank-totals for certain criteria are split up in table 12 to give separate ranks for each equation. From that table, we see how the relative standing of IT3S, 2SLS and LISE greatly differed in the two equations. Also, recomputing the W statistic separately for each equation, it was found to be insignificantly at .217 in the misspecified equation, while in the first one it was equal to .846, a value significant at the .01 level.

The ranking given above for the biases of the two equations was also supported by pairwise comparisons. The biases were significantly different from zero for all the parameters and all the methods except for two coefficients estimated by 2SLS. It was also noticed that x_5, the variable that was left out of the second equation, produced a coefficient in the first equation that gave a very large bias for the full-information methods.

In comparison with the basic experiment, the biases have increased for all the methods and all the parameters in both equations. OLS and 3S/OLS were the least affected, with 2SLS and LISE coming next, while the biases of 3SLS, IT3S and FIML were the most affected; FIML having the greatest relative increase. But despite this fact, the biases of the second equation indicated that OLS was still at the bottom of the list and IT3S was still at the top. The Wilcoxon matched-pairs signed-ranks test showed that all the differences with the basic experiment were significant except for estimates by single-equation methods of some parameters of the first equation.

The analysis of the biases thus shown clearly that while the biases of the single-equation methods increased greatly for the misspecified equation but only very slightly for the first one, the biases of the full-information methods increased immensely for both equations. The fact that single-equation methods produced higher biases for the correctly specified equation than those obtained in the basic experiment could probably be explained by the change in the true model that generated the endogenous variables, and the corresponding change in the correlation coefficient between the structural disturbances and the reduced-form disturbances, as it is known that the bias depends on its value. However, this should not affect the validity of the results reported here, as the increases in the biases of the second equation were so great as to make those of the first equation negligible.

Ranking the methods according to the variances of the ten structural coefficients taken together gives exactly the same ranking as that of the basic experiment, but taking the coefficients of each equation separately gives a different picture for some of the estimators. In the first equation, the joint estimation methods, IT3S, FIML, 3SLS and 3S/OLS gave the smallest variances respectively, and OLS, 2SLS and LISE were identically ranked fifth, sixth and seventh for every parameter. In the misspecified equation, 3S/OLS was the method with the smallest variance, IT3S has done slightly worse and FIML went down to the sixth place. Both rankings were very strong as demonstrated by the values of the W statistic in table 12.

The variances of all the methods remained of the same magnitude as the variances of the basic experiment, and for some of the parameters the variances decreased in this experiment even for full-information methods. LISE and FIML were the only methods that gave a systematic increase in the variances of the misspecified equation. These results were confirmed by the z-values produced by the Wilcoxon test. However, importance should be attached here to the relative standing of the methods rather than to the change in the variances with respect to the basic experiment, in view of the fact that the structure generating the data is a bit different and the changes in the variances are not considerable.

Both the inter-quartile range and the range agree with the

variance on the relative performance of the methods in the separate equations. In particular, they emphasize the good standing of FIML in the first equation and how it was reversed in the second. They also show that in the second equation 3S OLS and IT3S gave the smallest dispersions. Ranking by closeness of the estimates in each replication to the true values puts 3SLS as the best method, followed by 2SLS, and give the last four ranks to IT3S, LISE, FIML and LML respectively.

The mean-square errors and the mean-absolute errors give identical ranking for the methods if the ten coefficients are taken together, and they too put 3SLS and 2SLS as the best methods. The two criteria also give very close rank-totals to IT3S and FIML, being fourth and fifth, and put LISE in the seventh place. If we consider each equation separately we find that in the correctly specified equation, the method with the best performance is undoubtedly the two-stage least squares. Its much smaller biases have made up for its relatively large variances. The large biases have also pushed IT3S to the bottom of the MAE- and MSE-lists (next only to LML), although it was the best on the variance. Indeed, we could say that the ranking of the methods by these two criteria, in the first equation, was very much the same as the ranking according to the bias. But while the bias was the determining factor in the first equation, the variance was so in the second. Both single-equation and joint-estimation procedures had large biases in the second equation, which were not very far apart, that their dispersions became the decisive element in their relative standing. The rankings in this equation according to the mean-absolute errors and the mean-square errors followed more or less the ranking by the variances, but they were a little weaker.

The results just reported were confirmed both by the t-test in pairwise comparisons and by control antithetic sampling. In the second equation, the four estimators considered by this simulation technique were ranked : 3SLS, 2SLS, FIML and LISE respectively, by the variance, the MAE and the MSE. For the correctly specified equation, the MAE and the MSE rank them 2SLS, 3SLS, LISE and FIML, in ascending order, although FIML was the best method on the variance. The rank-totals are all given in table 18.

TABLE 11.—**Ranking of structural parameters with excluded exogenous variable**

	OLS	2SLS	3SLS	IT3S	3S/OLS	LISE	LML	FIML	W
By Direct Simulation									
Mean Biases	6	2	3	5	7	1	8	4	.190
Median Biases	7	2	3	6	8	1	5	4	.079
Closeness to True Values	4	2	1	5	3	6	8	7	.366**
Variances	5	6	3	1.5	1.5	7	8	4	.790**
Mean-Square Errors	6	2	1	4	3	7	8	5	.400**
Mean-Absolute Errors	6	2	1	4.5	3	7	8	4.5	.389**
Inter-Quartile Range	4	6	3	1	2	7	8	5	.632**
Range	5	6	2.5	1	2.5	7	8	4	.629**
By Two Antithetics									
Mean Biases	5	1	3	4	7	2	8	6	.270**
No of Significant Biases	5.5	2	5.5	5.5	5.5	5.5	1	5.5	—
Closeness to True Values	5	3	1	4	2	6	8	7	.399**
By Control/Antithetics									
Variances	—	3	1	—	—	4	—	2	.668**
Mean-Square Errors	—	2	1	—	—	3.5	—	3.5	.396**
Mean-Absolute Errors	—	1.5	1.5	—	—	3.5	—	3.5	.288**

** Significant at the .01 level.

TABLE 12. Rank-Totals of the structural parameters for each equation separately
(With an excluded exogenous variable)

	OLS	2SLS	3SLS	IT3S	3S/OLS	LISE	LML	FIML	W
Mean Biases*									
First Equation	21	7	20	32	28	8	40	24	.846**
Second Equation	26	22	16	12	24	25	29	26	.217
Variances									
First Equation	25	30	13	9	18	35	40	10	.927**
Second Equation	17	28	14	14	5	34	40	28	.933**
Mean-Square Errors									
First Equation	23	12	16	28	26	17	40	18	.525*
Second Equation	24	22	14	13	11	32	40	24	.663**
Mean-Absolute Errors									
First Equation	23	11	16	29	26	17	40	18	.558**
Second Equation	23	22	15	12	14	31	40	23	.588**

* Computed by the two-antithetic method
* Significant at the .05 level.
** Significant at the .01 level.

TABLE 13.—Rank-totals for the dispersions by control/antithetic simulation for each equation separately (with an excluded exogenous variable)

	2SLS	LISE	3SLS	FIML	W
Variance					
First Equation	15	20	9	6	.928**
Second Equation	11	19	5	15	.856**
Mean-Square Error					
First Equation	8	14	11	17	.360
Second Equation	11	18	6	15	.648*
Mean-Absolute Error					
First Equation	8	14	12	16	.280
Second Equation	11	17	7	15	.472

* Significant at the .05 level.
** Significant at the .01 level.

5.2 Reduced-Form Parameters

In analysing the results on the reduced-form parameters, we note that the two equations suffer from the misspecification in one of the structural relations. The a priori restriction $\beta_{21} = 0$ affects the coefficients of x_1 in both reduced-form equations and also, but less directly, affects the other elements of the Π matrix (of reduced-form coefficients) through the behaviour of the structural estimates. Even for single-equation methods, whose estimates of the structural coefficients in the first equation were not affected, the misspecification is carried over to their matrices of reduced-form coefficients through those elements of the matrix of structural parameters that were submitted to misspecification. The OLS/RF is not subject to any specification error here, and its inclusion in this analysis in only for the sake of completeness of our comparisons.

On examining the bias, the first striking thing is the magnitude of the biases corresponding to the coefficients of x_1 in both equations, with respect to the true parameter values. From the structure generating the endogenous variables, the true value of π_{11}, the coefficient x_1 in the first reduced-form equation, is —0.1611. The various methods produced estimates for it that

were biased by a value ranging between —0.3449 for LISE to —0.6016 for IT3S. The true value for π_{11} was 0.9128 and its biases varied from —0.3546 for FIML to —0.6301 for OLS. Contrary to what was found for the structural parameters, the reduced-form biases in both equations were of about the same magnitude for all methods.

Although it was seen that, on the bias criterion, full-information methods have in general done better in the second equation than in the first, while consistent single-equation methods have been worse, it was decided in presenting the relative standing of the estimators to consider their rank-totals based on all the fourteen reduced-form parametrs. This was done because it was thought that there are no good theoretical reasons for joint-estimation methods to have smaller biases in the second equation, or for single-equation techniques to have smaller biases in the first. One might, at first thought, think that single-equation estimates of the coefficients of x_1 and x_2 (which are the exogenous variables that appear in the first relation of the true structural form and do not appear in the second) should have smaller biases than full-information estimates, and this has indeed happened in the first equation. However, this depends very much on the value of α_{12} and on how much its bias is affected by misspecification. Also, in real econometric models, where the number of equations in the system is usually more than two and specification error is present in almost every equation, it would be rather difficult and probably of little importance to investigate which coefficients produced more biases than which as a result of specification errors which the model-builders are mostly unaware of where existed.

Granted that OLS/RF gives, by definition, zero biases, FIML and 3SLS are found to have the smallest rank-totals, being followed closely by IT3S. 2SLS and LISE were ranked fifth and sixth. The main discrepancies with the basic experiment are the following. The relative standing of 3SLS and IT3S has improved as a consequence of the bad performance of LISE and 2SLS in the second equation. Compared with the basic experiment, all the biases have significantly increased. LISE-biases were the most affected by this kind of misspecification.

We now turn to the dispersions of the estimators. The variances still give the lead to full-information methods, both for the overall ranking of the fourteen parameters and for each equation separately. The rank-totals for the four methods (excluding LML) were too close to one another to allow for any distinction to be made between them, with the W statistic being as low as .022, if they were considered in isolation.

The relatively large variances which FIML produced for the structural parameters of the second equation have withered away on transforming the estimates to the reduced-form, and the somewhat erratic behaviour on the tails of the distribution of the structural parameters of that equation has given way to well-behaved reduced-form coefficients. The range and the inter-quartile range confirm that full-information estimates were less dispersed than single-equation estimates with little variations from which it is seen that 3S OLS has relatively thicker tails while the opposite was true for IT3S and to a less extent for FIML.

On the other hand, there was a large gap between the rank-totals for the joint-estimation methods and those of single-equation methods. 2SLS was slightly worse than OLS, and LISE was much worse than both. The ranking inside this group was identical to the ranking in the basic experiment.

According to both mean-square errors and mean-absolute errors FIML, 3SLS and IT3S came on top. 3SLS was here very close to FIML and in contrast with the basic experiment it was better than IT3S. It was no surprising to see that OLS/RF comes next in the ranking in a situation where the various estimators produce such considerable biases. Also different from the finding of the basic experiment is the result that 2SLS is better than LISE and that 3S OLS has taken the seventh place. These results could all be explained in the light of what was reported on the behaviour of the estimators on the bias criterion.

If the methods are ranked according to the closeness of the reduced-form estimates in each sample to the true parameter

TABLE 14.—Ranking of reduced-form parameters with excluded exogenous variable

	OLS	2SLS	3SLS	IT3S	3SOLS	LISE	LML	FIML	OLS/RF	W
By—Direct Simulation										
Mean Biases	8	6	4	3	7	5	9	2	1	.552*
Median Biases	9	7	5	4	8	6	2	3	1	.485*
Closeness to True Values	8	6	3	4	7	5	9	1	2	.504*
Variances	5	6	2.5	1	2.5	7	9	4	8	.714*
Mean-Square Errors	8	5	2	3	7	6	9	1	4	.579*
Mean-Absolute Errors	8	5	2	3	7	6	9	1	4	.546*
Inter-Quartile Range	6	5	3	4	1	7	9	2	8	.612*
Range	7	5	3	2	4	6	9	1	8	.622*
By Two Antithetics										
Mean Biases	8	5	2.5	4	7	6	9	2.5	1	.557*
No of Significant Biases	7.5	7.5	7.5	4	4	7.5	2	4	1	--
Closeness to True Values	8	6	3	4	7	5	9	1	2	.493*

* Significant at the .01 level

values, we find that FIML and OLS/RF give the greater probability of being nearest to those values. This result emphasizes the superiority of OLS/RF over other single-equation methods in the presence of the kind of specification error considered in this experiment. Next in the ranking came 3SLS, IT3S then LISE and 2SLS.

5.3 Predicted Endogenous Variables.

The results on the predictions are, for some estimators, quite different from the results reported for the basic experiment, particularly for the MAE's and the MSE's. Their properties did not follow the reduced-form properties as closely as in the basic experiment.

Although the reduced-form biases of LISE have given it the sixth rank, the biases of the predictions have put LISE in the second place, next only to the unbiased OLS/RF. FIML was third, followed by 2SLS and 3SLS having equal ranks, while IT3S was ranked sixth. Examining the rankings by the variance, we find that the only discrepancy with the basic experiment is that 3SLS is here slightly better than IT3S, sharing top rank with FIML. The mean-square errors give the same ranking as the closeness to true values. According to these criteria, FIML is the best method on the predictions, but it is followed immediately by LISE and OLS/RF. 3SLS and 2SLS were fourth and fifth while IT3S was relegated from the first rank in the basic experiment to the sixth place in the present experiment, and 3S/OLS went down from the fourth rank to the seventh.

5.4 Asymptotic Standard Errors.

In general, the sampling asymptotic standard errors slightly underestimated the variations in the estimates of the coefficients of the first equation, and slightly overestimated the variations in the second. LISE was here, as it was in the basic experiment, the method that gives the most reliable standard errors. The averaged asymptotic standard errors of 3SLS and FIML were also very close to the corresponding standard deviations, and IT3S and 3S/OLS gave the most unreliable estimates.

TABLE 15.—**Ranking of the predictions - experiment with excluded exogenous variable**

	OLS	2SLS	3SLS	IT3S	3SOLS	LISE	LML	FIML	OLS/RF	W
By Direct Simulation										
Mean Biases	7.5	4.5	4.5	6	7.5	2	9	3	1	.833*
Median Biases	8.5	4	6	7	8.5	2	5	3	1	.702*
Closeness to True Values	8	5	4	6	7	2	9	1	3	.832*
Variances	5	6	1.5	3	4	7	9	1.5	8	.906*
Mean-Square Errors	8	5	4	6	7	2	9	1	3	.583*
Mean-Absolute Errors	8	4	5	5	7	2	9	1	3	.686*
Inter-Quartile Range	5	6	3	1	4	8	9	2	7	.891*
Range	5	6	1	3	2	7	9	4	8	.900*
By Two Antithetics										
Mean Biases	7	4.5	4.5	6	8	2	9	3	1	.783*
No of Significant Biases	6	6	6	6	6	6	2	6	1	
Closeness to True Values	8	5	4	6	7	1	9	3	2	.776 *

* Significant at the .01 level.

Examining the quantiles of the distributions of the asymptotic standard errors where the standard deviations fell, it was found that FIML was the only method whose standard deviations always fell in the upper half of those distributions, and the quantiles corresponding to the standard deviations of IT3S were the nearest to whose of FIML. The standard deviations of LISE were all in the vicinity of the fiftieth quantiles of the asymptotic standard errors.

The reliability of the LISE-estimates of the asymptotic standard errors was also confirmed by using the t-ratios to test the hypothesis that the true values fall within limits in 95 per cent of the cases. The hypothesis was accepted for seven parameters out of eight for LISE, four parameters for FIML, three for IT3S, two for both 2SLS and 3SLS, and only one parameter for OLS and 3S/OLS. Full-information methods have also produced very unreliable estimates for the variation in the coefficient of x_1 in the first equation. With ten degrees of freedom, the use of the t-ratios showed that the true value for that coefficient fell outside limits in 71 samples for IT3S, 64 samples for FIML and 30 samples for both 3SLS and 3S/OLS.

5.5 Elements of the Σ-Matrix

The three distinct elements of the Σ-matrix have, as in the basic experiment, given negative biases for OLS, 2SLS and 3S OLS. As a result of the a priori restriction imposed in this experiment, the other methods gave positive biases for σ_{22} ; and IT3S and FIML also overestimated the covariances between the two disturbance terms. The methods with the smallest biases here were 3SLS, IT3S and 3S OLS respectively, and the methods that produced the largest biases were LISE and OLS. The variances were significantly larger than those of the basic experiment, but the relative standing of the methods according to this criterion remained the same.

The mean-square errors and the mean-absolute errors both show IT3S and FIML to have the worst estimates for the Σ-matrix, while they were the best in the basic experiment. 3S/OLS and 3SLS have here come on top and the standing of single-equation methods has considerably improved.

6. AN EXTRA EXOGENOUS VARIABLE INCLUDED

While in the true model generating the data, the variable x_4 does not enter the first equation, it is here admitted in that equation in the model being estimated, in order to study the effect of wrongly including an extra exogenous variable, by the model-builders. The second equation remains correctly specified.

By comparing the results given in tables 16, 17 and 18 with those of the basic experiment, it was found that there is very little difference between the relative standing of the methods in the two experiments, either on the structural parameters, the reduced-form parameters or the predictions, on most of the criteria considered. There would be little reason in the present analysis to differentiate between the misspecified equation and the correctly specified one.

As the true value for β_{11}, π_{41} and π_{21} is zero, the means estimated by the various methods for these coefficients are also the estimated biases. Both the magnitude and the signs of the biases were the same as in the basic experiment for all the parameters except for the three referred to, which were significantly smaller for all the methods. Only their estimates by 2SLS and FIML were, however, insignificantly different from zero. The variances have also remained very close to those produced in the basic experiment, but decreased considerably for those parameters. The Wilcoxon test produced only very few significant z-values for the differences in mean-square errors and mean-absolute errors between this experiment and the basic experiment.

7. CONCLUSION

The introduction of disturbances that do not conform with the assumptions of the standard classical model, has led to results which are only slightly different from the findings of the basic experiment. This might be due to the large value given to R^2, the asymptotic reduced-form multiple correlation coefficient, which was about .84 in the first equation and .87 in the second.

TABLE 16. –Ranking of structural parameters - an extra exogenous variable included

	OLS	2SLS	3SLS	IT3S	3S/OLS	LISE	LML	FIML	W
By Direct Simulation									
Mean Biases	8	3.5	5	3.5	7	2	6	1	.604*
Median Biases	8	4	5	6	7	3	2	1	.644*
Closeness to True Values	7	6	3	2	4	5	8	1	.723*
Variances	5	6	3	1	2	7	8	4	.826*
Mean-Square Errors	6.5	5	3	1	4	6.5	8	2	.810*
Mean-Absolute Errors	7	5	3	2	4	6	8	1	.752*
Inter-Quartile Range	5	6	3	2	1	7	8	4	.737*
Range	5	6	4	1	2	7	8	3	.762*
By Two Antithetics									
Mean Biases	7	3	5	4	6	2	8	1	.757**
No of Significant Biases	7.5	2	3.5	3.5	7.5	5.5	1	5.5	—
Closeness to True Values	7	5	3	1	4	6	8	2	.715**
By Control/Antithetics									
Variances	—	3	1.5		—	4	—	1.5	.792*
Mean-Square Errors	—	3	1.5	—	—	4	—	1.5	.792*
Mean-Absolute Errors	—	3	1	—	—	4	—	2	.756*

* significant at the .01 level.

TABLE 17.—Ranking of reduced-form parameters - an extra exogenous variable included

	OLS	2SLS	3SLS	IT3S	3SOLS	LISE	LML	FIML	OLS/RF	W
By Direct Simulation										
Mean Biases	8	4	6	4	7	2	9	1	3	.416*
Median Biases	9	6	4	3	7.5	2	7.5	1	5	.214*
Closeness to True Values	7	5	3	2	4	6	9	1	8	.594*
Variances	5	6	3	2	4	7	9	1	8	.848*
Mean-Square Errors	7	6	3	2	4	5	9	1	8	.738*
Mean-Absolute Errors	7	5.5	3	2	4	5.5	9	1	8	.739*
Inter-Quartile Range	6	5	3.5	1.5	3.5	7	9	1.5	8	.720*
Range	7	5	3	1	4	6	9	2	8	.749*
By Two Antithetics										
Mean Biases	8	4	5	6	7	3	9	2	1	.766*
No of Significant Biases	7.5	5	9	6	7.5	4	2	3	1	-
Closeness to True Values	7	5	3	2	4	6	9	1	8	.610*

* Significant at the .01 level.

TABLE 18. Ranking of the predictions - an extra exogenous variable included

	OLS	2SLS	3SLS	IT3S	3SOLS	LISE	LML	FIML	OLS/RF	W
By Direct Simulation										
Mean Biases	8	2	1	4	6	3	9	5	7	.892*
Median Biases	9	5	1	2	6	7	4	3	8	.631*
Closeness to True Values	7	6	3	2	4	5	9	1	8	.835*
Variances	5	6	3	1.5	4	7	9	1.5	8	.985*
Mean-Square Errors	5	6	3	1.5	4	7	9	1.5	8	.960*
Mean-Absolute Errors	5.5	5.5	3	1.5	4	7	9	1.5	8	.926*
Inter-Quartile Range	5	6	3	1	4	7	9	2	8	.905*
Range	6	6	2	2	4	6	9	2	8	.886*
By Two Antithetics										
Mean Biases	8	6	4.5	2.5	7	2.5	9	4.5	1	.983*
No of Significant Biases	8	8	6	3	8	3	3	3	3	—
Closeness to True Values	7	6	3	2	4	5	9	1	8	.828*

* Significant at the .01 level.

A smaller value of R^2 would have given the disturbance terms a greater effect on the behaviour of the estimates, and would probably have allowed the misspecification in them to cause more pronounced deviations from the results of the correctly specified disturbances.

The first experiment, dealing with autocorrelation, produced more discrepancies with the basic experiment than the second or the third experiment. Autocorrelated disturbances appear to affect the properties of the estimators more than the heteroskedastic or the uniformly distributed disturbances, and the predictions were more hard-hit by this kind of misspecification than were the structural parameters or the reduced-form parameters.

In the three experiments with misspecified error terms, the dispersions of the predictions have increased for all the methods with only one exception, namely the dispersions of FIML in the case of uniformly distributed errors. With autocorrelated disturbances, the increase in the dispersions of full-information methods was higher than the increase in single-equation methods. Estimates of the asymptotic standard errors in that experiment were not less reliable, than they were in the basic experiment, in estimating the corresponding standard deviations, but both underestimated the 'true' asymptotic standard errors.

In contrast with the findings of the basic experiment, it was found that when misspecification in the form of the model is present, a distinction should be made between the estimators based on whether we were interested in estimating the structural coefficients, the reduced-form coefficients or the predictions. The performance of the methods varied considerably for the three kinds of parameters.

When misspecifying a zero restriction a priori, the biases of the structural parameters have vastly increased for the misspecified equation when single-equation methods were applied, and for both equations for joint-estimation methods. x_3, which was left out of the second equation, had a coefficient for the first equation for which full-information estimates produced exceptionally large biases.

The variances did not change much in magnitude but, considering the relative standing of the methods by this criterion, FIML and IT3S did better in the first equation than in the second, and the opposite was true for 3S/OLS and OLS. The MSE's and the MAE's show that 2SLS was the best method to estimate the parameters of the correctly specified equation, while IT3S and 3S/OLS gave the best performance on the parameters of the misspecified one.

It also became clear from the findings of this experiment that 3SLS was the full-information method the least affected by misspecification. It not only was ranked first on the overall ranking of the ten structural parameters by the MSE's and MAE's but its standing was also good on each equation separately.

On the reduced-form parameters, consistent joint-estimation methods were better than single-equation methods, with FIML once again on top. OLS/RF was the best single-equation technique, as it was free of specification error. For all the methods, the coefficients of x_4 had very large biases in both equations. On the predictions, FIML was still the best method with LISE and OLS RF coming next. IT3S has done particularly badly compared with all the other consistent methods.

Including an extra exogenous variable in one of the equations when it should not be there, did not have much effect on the properties of the estimators. This kind of misspecification appears to be far less serious than the wrong a priori restrictions.

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THE POLITICAL AND SOCIAL BASES FOR THE DEVELOPMENT OF SELF-GOVERNING INSTITUTIONS IN EGYPT, 1883-1914

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The development of representative and semi-official institutions in Egypt during the period 1883-1914 tended to favour the involvement of an increasing number of native large landowners in the political system of the country. Heads of leading families and notables of social and financial standing in the rural areas were keenly interested in securing for themselves positions of political prominence through their membership in these institutions. This process gained further impetus by the reform of the Provincial Councils in 1909, which resulted in the active participation of a still larger number of notables in the administration of the provinces. Furthermore, the creation of a Legislative Assembly and the modification of the Organic Law in 1913, considerably added to the political powers and functions of the existing self-governing institutions. The new measures consolidated the political position of the large landowners, and increased their numerical strength in the newly-formed Assembly. It also encouraged them to assert their relative political independence from the British authorities, and focussed their attention on the necessity of entrusting the new Assembly with wider powers of legislation.

Before the British occupation, the 'umda (village headman) was formally appointed by the Government, but the Khedival decree of 10 March 1886, regulated the procedure for the selection of the 'umda and defined his functions.(1) Accordingly when a vacancy occured, names of suitable candidates were submitted to a special commission (Shiakhate Commission) in the province concerned, consisting of the mudir (Governor of the province)

(1) See text of the 'umda law of 1883 in al-Waqā'i' al-Miṣriyya, 18 March 1886.

or his deputy as president, a representative of the Ministry of Interior (who was usually the British Inspector), the district attorney, and four notables or 'umdas of local standing selected by the mudir from among a number of delegates elected by the 'umdas of each district in the province. The Commission's choice was then subject to the confirmation of the Minister of Interior. This Commission was also responsible, at the direction of the Ministry, for prosecuting the 'umdas, with powers to impose upon them specific penalties and fines, or even cause their dismissal.

In fact, however, the appointment of the 'umda remained the prerogative of the Government, and, in many cases, more specifically that of the British Inspector. Yet by virtue of the wide powers which the Shiakhate Commissions possessed, their individual members enjoyed a privileged status in their provinces. It was, therefore, not without significance that the provincial notables attached great importance to their own membership in these Commissions. Evidently the large landowners were concerned with the appointments made to the post of 'umda in their provinces. But, while they were prepared, under the British occupation, to gradually forego the post of 'umda in favour of notables of lower-standing, they were, nevertheless, keenly interested in becoming members of the Shiakhate Commissions. During the uprising of 1919, the British Inspectors of Interior were unable to retain their control over the Commissions, or to secure the appointment of candidates who were amenable to British advice. Consequently, under the influence of the new nationalist movement, members of the Commissions became considerably involved in the political struggle.(2) Thus, the large proprietors in the rural areas not only participated in the administration of the provinces, but were able, as members of the Commissions, to manipulate these institutions to achieve their own political ends.

According to Baer, the socio-economic position and the political power of the 'umda declined under the British occupation.(3) His earlier functions in the assessment and collection of taxes,

(2) Milner Mission, F.O. 848 19, Draft Memo. on the administration of the Ministry of Interior.

(3) G. Baer 'The Village Shaykh in Modern Egypt, 1800-1950', (ed.) U. Heyd. Studies in Islamic History and Civilization, Jerusalem 1961 pp. 121-153.

leasing of state land, and recruitment of the peasants for the corvée and army service were either abolished or restricted in scope. Similarly, the movement of large landowners to the towns and the effects of Muslim inheritance law, undermined the 'umda's position. In 1904, Cromer observed that though some of the 'umdas were very wealthy men with incomes of as much as L.E. 20,000 a year, yet in certain districts it was difficult to find candidates who satisfied the property qualification of 10 feddans.(4) Simultaneously, as the 'umda became the object of local intrigue and official scrutiny his local prestige would appear to have suffered. In 1903, some 900 'umdas were accused of committing various offences. All the charges were investigated, but only in 96 cases were convictions obtained.(5)

However, the decline in the 'umda's position was only relative. Although he was not a salaried official, he was responsible to the authorities for every branch of the administration in matters touching his village. He was called upon to implement, in his village, all the laws and regulations issued by the Government, and to render the central and provincial authorities every possible assistance. In fact, in some way the authority of the 'umda was even strengthened. Before 1883, he had depended for the enforcement of the laws on his own personal influence and on the assistance of the mudir and rural police, but the establishment in 1884 of a Khafir force strengthened his hand. The Khedival decree of 10 November 1880, provided for the attachment of this force to the Village Council (Majlis al-Balad).(6) The Council consisted of the 'umda as president, the shaikhs of the village, the Ma'zun (religious shaikh), four to eight 'umad al-muzari'in (local agricultural experts) and a shaikh or more of the Khafar. As head of the Council, and with the Khafir force under his control, the 'umda's decision not only acquired the force of law but also the means of implementing it. Most important among the 'umda's privileges were the exemption of the 'umda and his sons from military service, and from the payment of a land-tax on 5 feddans of his property within the circumscription of the village. On the

(4) Egypt No. 1 (1905) Cd. 2408.

(5) Ibid.

(6) See text of the Khafir Law in al-Waqa'i' al-Misriyya, 27 November 1884.

other hand, other factors contributed to the retention of the office by some rich farmers. Cromer noted that.

> It frequently happens that a man of wealth or position, though he cares little for the advantages offered by the Government, is unwilling that a rival should occupy a position of greater administrative and to a certain extent, of greater social importance than himself.[1]

However, in spite of the advantages of the office, and in some respects the relative increase in the 'umda's political influence, the interest of the large landowners in the retention of the office for themselves declined. But as the minimum property qualification for the post was 10 feddans, the great majority of 'umdas were recruited from the middle and large landholders. The creation of the Provincial Councils and the national representative institutions further tempted the upper sections of the class of provincial notables to exchange the 'umdaship for membership in these politically more influential bodies.

Lord Dufferin in 1883, had recommended the creation of the Provincial Councils. Their main function was to assist the rulers in the administration of the provinces. Their rule was purely consultative, but their advice touched on a wide range of matters of vital economic and political importance to the provinces. They were empowered to recommend extraordinary expenditure on projects of public utility, and were invited to give their views on questions pertaining to irrigation, communications, public security, public health and education. Membership of the Councils was confined to the class of notables who paid a minimum of L.E. 50 annually as a land tax. Since, under the British occupation, the average tax per feddan in Egypt did not exceed the sum of L.E. 0.84, it could be safely assumed that almost all the members of the Provincial Councils were drawn from the class of large landowners.

During the Consul-Generalship of Lord Cromer, the functions of the Councils were greatly restricted by the infrequency of their meetings, which were only held at the invitation of the

(1) Egypt No. 1 (1905) Cd. 2409

mudirs. But as Britain increasingly relied for governing the country on the assistance of a group of Egyptian notables who belonged to Shaikh Muhammad 'Abdu's school of thought, and who were organised in the Ummah Party, Cromer appeared to appreciate the necessity of granting more powers to the Councils. Before leaving Egypt in 1907, he advised his successor to introduce changes in this particular direction. He wrote : "One of the last proposals I made before leaving Egypt was that the Provincial Councils should be re-organised, their powers somewhat increased ....."(6)

The new Consul-General, Sir Eldon Gorst, amended the Organic Law in 1909 in the direction of conferring greater power both in appearance and reality on the Councils. Substantial changes in the functions, as well as in the structure, of these Councils were introduced. In addition to their previous consultative role, the new amendments authorised the Councils to vote municipal taxes and prepare an annual budget for the province. The mudirs were bound to take their opinion in respect of the following : changes in the boundaries of the provinces and the districts; the creation or suppression of local commissions in the provincial towns; the establishment or transfer of Government Schools; buildings or hospitals; the construction of agricultural railways and canals, and the granting of concessions to companies or individuals. The decisions of the Councils were, however, binding in matters relating to the application of certain local regulations, the authorisation of religious fairs and markets, and in determining the number of khafirs required in the whole province. In addition to being the responsible authorities for elementary education, the Councils were now empowered to spend 30% on secondary and higher education from the total funds devoted to public instruction.

The new reforms had a far-reaching impact on the political situation and administrative conditions in the provinces. Firstly, as a result of the relaxation of central Government control on the Councils, these bodies began to show more initiative in the provincial administration. Consequently, influential rural families became more interested than ever in securing for themselves a

(6) Cromer, Modern Egypt, Vol. 2, London, 1908, p. 277.

predominant influence in the Councils. In Asyut, the two prominent families of Mahmūd Pasha Sulaimān, president of the Ummah Party, and Mustafā Khalīfa contested for three consecutive years the seat of Abū Tīj district (markaz), and in each year the case was taken to court for a final decision.(9) Secondly, a larger number of councillors were involved in the administration of the province. Each markaz was invited to elect two representatives to the Council of the province. Consequently, while before 1909 the number of councillors ranged between 3 to 8 for a single province, the introduction of the new reforms in 1909 raised the number to range between 6 to 20 councillors. Furthermore, representation in the Councils tended to become more localized. Candidates were no longer elected upon a common list for the whole province, but on the basis of two representatives from each markaz, where they had for the last two years paid the necessary taxes. But perhaps the most important aspect of the reform was the opportunity it offered for an increasing number of the prominent members of the Ummah Party in the administration of the provinces. Even for someone like Ahmad Lutfī al-Sayyid, an intellectual and managing editor of al-Jarīdah, the post of provincial councillor seemed to have a special attraction. In 1911, he represented the Simbillawīn district in the Daqahlīa Council, but soon resigned due to the pressure of his work in al-Jarīdah.

Throughout the period 1883-1913, membership in the Councils served as a stepping-stone to the entry into the Legislative Council and General Assembly. Each Council elected from among its members one delegate to represent it on these bodies.

The General Assembly created in 1883 consisted of 82 members. It comprised of all the thirty members of the Legislative Council, the Council of Ministers, and forty-six delegates chosen for six years by electors throughout Egypt. Candidates were requested to be 30 years of age or over, literate, and paying a minimum annual direct tax of L.E. 20. The duties of the Assembly were purely consultative, and it only met when summoned by decree, subject to a provision which was not always respected, that it must be held at least once every two

(9) F.O. 371 0858, R. Graham to Kitchener, 20 March 1913

years. It had a decisive voice only in one respect, that of approving certain forms of new taxation or negotiation of fresh loans. But since it was one of Cromer's major policies to relieve the Egyptian landowner of the burden of heavy taxation, the Assembly tended to accept most of the measures proposed by the Consul-General. It endorsed the Government's decision to suppress the corvée, and approved in 1899 the scheme for the general reassessment of the land tax. But apart from these two cases, this particular aspect of the functions of the Assembly was "particularly inoperative, inasmuch as up to the present time (1906)."(10)

However, during Gorst's term in Egypt, the attitude of the Assembly towards the occupation underwent considerable change. It assumed some political importance on the occasion of its rejection of the Government's recommendation to sanction the extension of the concession of the Suez Canal Company. But normally the Assembly was more concerned with the current national and local issues raised by the Ummah Party. These included proposals for the extension of the powers of most of the existing representative institutions, the promotion of secondary and higher education, the creation of a municipality in Cairo, and the sale of Government uncultivated land. At the same time, the Assembly rejected the plans of the Government which were particularly unfavourable to the interests of the landowners. In 1907 it defeated a proposal made by the Government to impose a new land tax for the aid of the kuttâbs (village mosque schools), and opposed a scheme which aimed to restrict the area planted with cotton to one third of the property of any landholder.(11) In 1909, the Assembly passed a resolution reiterating the demand advocated by the Ummah Party calling upon the Government to grant the nation a constitution.(12) However, following the assassination of the Coptic Prime Minister, Butrus Ghâlî in 1910, the political influence of the Assembly declined, and at the request of the Consul-General, the policy of extending the political powers of self-governing institutions was abandoned.(13)

(10) F.O. 371/68, Cromer's Memorandum, 8 September 1906.

(11) F.O. 371/245, Cromer to Grey, 5 March 1907, Inclosure 1 and 4.

(12) F.O. 371/660, Gorst to Grey, 6 February 1909.

(13) Reference here is to Gorst's Memorandum respecting self-government in Egypt, in F.O. 371/890, 22 May 1910.

A politically more important representative body which existed during the period 1883-1913 was the Legislative Council. It consisted of 30 members, sixteen of whom were elected by the 14 Provincial Councils and the two Governorates of Cairo and Alexandria, the remaining members being nominated by the Khedive and his Ministers. The Council met six times a year, or on further occasions when it was summoned by Khedival decree. All the laws and Khedival decrees as well as the annual budget were necessarily submitted to it for discussion, but its recommendations were not binding on the Government.

The relation between the British authorities and the class of large landowners practically governed the deliberations and behaviour of the Council. According to Cromer's annual report for 1905, the Council passed through three phases since its inception. While in the early years of its existence it attracted little political attention, in later years it became hostile to the Government, but eventually Cromer recognised that its attitude towards the occupation was a good omen for the future.

Obviously these stages in the political development of the Council corresponded to the general political and economic progress of Egypt. In the first decade of the occupation the country witnessed the achievement of political stability and financial solvency under a British administration which paid little attention to the wishes of the Legislative Council. In the early 1890's the Khedive took the initiative in opposing the occupation and momentarily swayed the opinion of the Council against the British. At that point however, the benefits accruing to the large landowners from the economic policies of the Consul-General and the desire of the latter to check the Khedive's activities by summoning the support of Abdu and his associates combined to consolidate the alliance between Cromer and the Council. Though the small number of the Khedive's supporters in the Council continued to be a source of nuisance for the Consul-General, the majority of the members, however, showed a friendly disposition towards the occupation authorities.

The departure of Cromer in 1907 ushered in a new phase in the development of the Council. It was characterised by the persistent demand of its members for a constitution and a parliament. Undoubtedly members of the Council were anxious to retain the position they had acquired under Cromer's rule, and

which was being undermined by the rapprochement between the new Consul-General and the Khedive. On his return from Constantinople in the summer of 1908, the Khedive described the demand for a Constitution as "absurd", but at the same time he felt that such a demand would unite the opposition. "It was true" he said "that the extreme Nationalist party appeared to be moribund, but other and more dangerous parties (meaning the Ummah) were growing in power." He advised Gorst to make some nominal concessions in the Legislative Council, which would make the Egyptians imagine that "they were in Paradise.(14) Accordingly, the Prime Minister promised the Council that the ministers would attend the sessions and take part in the discussions.(14)

However, this evasive method of meeting the requests of the Council failed to satisfy the majority of its members, who felt that the new privilege was nothing but a right which the Council already possessed.(15) The Khedive and the Consul, consequently, resorted to more devious measures to eliminate from the Council the undesirable elements who opposed their policies. Members of the Khedive's household frequently interfered in favour of the election of his supporters to the Council, while the British officials in the Ministry of Interior encouraged the mudirs to oppose the election of anti-British candidates.(17)

However, the Legislative Council regained much of its previous political influence under the Consul-Generalship of Lord Kitchener. This followed the gradual dissolution of the earlier understanding between the Khedive and the British authorities and the gradual deterioration of political and personal relations between Kitchener and the Khedive. By the early months of 1912, the new Consul expressed his desire to grant the Egyptians a greater measure of self-government. He noted that the work of the Council since his arrival in Egypt "has to be recorded with satisfaction." He, in addition, felt that previous experience showed that there were organic defects which militated against the success of the Council. He therefore proposed to abolish the General Assembly and Legislative Council, and institute on diffe-

(14) F.O. 371/453, R. Graham to Grey, 18 September 1908.
(15) Ibid., Gorst to Grey, 10 December 1908.
(16) F.O. 371/864, Gorst to Grey, 23 November 1909.
(17) F.O. 371/1114, M. Cheetham to Grey, 29 July 1911.

rent lines in their place the Legislative Assembly. The new arrangement he thought would "give the Egyptians a fresh chance of working out their own future representative institutions by proving that they are worthy of the confidence reposed in them."(18)

However, this act of benevolence on the part of the Consul-General was largely inspired by his appreciation of the existing political situation in Egypt. Kitchener sought to undermine the position of the Khedive by resorting to a greater measure of British control over the machinery of the state and reverting to Cromer's policy of personal Government. Similarly he appeared to afford the Ummah Party some encouragement to counter the activities of the Khedive.

Many of the measures he introduced were inspired by his admiration for Cromer's earlier policy in Egypt, and in fact on several occasions he invited the latter's advice. The total effect of his policies in Egypt strengthened the political position of the native large landowners. In the hope of winning the local support of the Ummah Party and the provincial notables, Kitchener pressed the Foreign Secretary to approve the introduction of a scheme for constitutional reform in Egypt. He explained that underlying the demand of the "better classes" for reform was

> "a general belief that the creation of a public opinion which will effectively support Ministers, is the only means of checking the undue demoralizing influence of the Khedive. It is realized that the Ministers unaided are quite unable to control him, and that this Agency alone can do so. Respectively natives are satisfied that we shall not allow any overt act of tyranny, as long as we are here, but they are frolicsome at having to rely on the unregularized interference of a foreign Power in their affairs, particularly as regards semi-religious matters and cognate subjects, in the direction of which the Khedive is supreme, and I fear systematically appropriates religious endowment funds bequeathed for public benefactions."

(18) Egypt No. 1 (1911) Cd. 5585.

Kitchener then pointed out that, since his arrival in Egypt, he had attempted with some success to recover the confidence of the Egyptians in Britain, but felt that this confidence "will be rudely shaken if constitutional reform is put on one side without an alternative policy." Kitchener added, "those who now locally support us will absolutely lose hope for the future." He would then have to establish a protectorate over the country, a course which he presumed was far from the Secretary's views, and entirely out of the question.(19)

Evidently the Consul-General took special personal interest in the creation of a new legislative body, which led some of the British officials in Egypt to refer to it as Kitchener's "child."(20) Accordingly, in his opening speech to the General Assembly in 1912, the Khedive announced that his Government was carefully considering changes in the Organic Law to allow for the introduction of a better system of political representation.

The new Organic and Electoral Laws of 1913 abolished the Legislative Council and General Assembly and constituted instead the Legislative Assembly. The new Assembly was composed of 82 members, 17 of whom were nominated by the Government, while the remaining 65 were elected from the Governorates and the provinces. The majority of the members of the new Assembly were drawn from the Egyptian rich landowners. The examination of the list of its members showed that, at least, 71 of them were landowners, and with the exception of 'Ali Shamal who owned some 20 feddans, they were all proprietors of 50 feddans or more.(21) The greatest concentration of their landholdings was in the range of 200 feddans or more, which clearly indicated that the membership in the Assembly tended to favour the representation of the upper sections of the large landowning class. In terms of occupation, apart from 59 members who

(19) F.O. 800/48, Kitchener to Grey, 2 March 1913.

(20) Wingate Papers, Box 466/5, Clayton to Wingate, 29 December 1913.

(21) F.O. 371/1964, 'Note on the First Election for the Egyptian Legislative Assembly, R. Graham, 29 December 1913. Most of the information in this section pertaining to the size of the properties of the members of the Legislative Assembly is drawn from the above-mentioned report. Graham estimated that the number of landowners in the Assembly was 59, and thus overlooked the fact that some of those listed as merchants or members of the liberal professions were also landowners.

were exclusively classified as landowners, the rest included 9 lawyers, 4 merchants, 4 'ulamā' and heads of religious sects, 3 engineers, 2 doctors and an ex-army officer.

The new law widened the basis of national representation in the country, but still confined it to the upper sections of the large landowning class. At the same time, it tended to perpetuate on a political level, the process of social differentiation by the separation of the membership in the Assembly from that of the Provincial Councils. Compared to the old Legislative Council, the number of the members of the new Assembly was almost three times as large, while the proportion of the elected to the nominated members was greater than that of the Legislative Council. The eligibility age was raised from 30 years to 35, while the amount of tax payable as a qualification, except for a slight reduction in the case of those who paid a house tax or were holders of higher educational diplomas, was maintained at L.E. 50. On the other hand, the requisite amount of land tax for candidates to the Provincial Councils was reduced from L.E. 50 to L.E. 35, and for candidates of higher education it was further reduced to L.E. 14. The new Electoral law categorically emphasised the abolition of the earlier procedure of combining the post of provincial councillor with that of the membership in the Assembly and established the principle of the separation of the two functions.(22)

These measures resulted in the increase of the numerical strength of the Assembly, and, consequently, the introduction of a larger number of provincial notables into the political administration of the country. In the old Council, each of the provinces was represented by only one member, but in the new Assembly the provinces returned a total of 59 representatives many of whom abandoned their seats in the provincial Councils to become members of the Assembly. On the other hand, the reduction of the tax qualification for candidates to the Provincial Councils led, during the elections of 1913-1914, to the introduction of a large number of provincial councillors who were drawn from the class of middle landowners.

(22) See text of the Organic and Electoral Laws of Egypt, 21 July 1913, in Egypt No. 8 (1913) Cd. 6876.