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Strategy Assessment

December 1981

# COMPARATIVE ADVANTAGE
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# EXECUTIVE SUMMARY ON
# COMPARATIVE ADVANTAGE

Report Submitted to U.S. A.I.D.
by
Robert E.B. Lucas
Boston University

The Egyptian Manufacturing Sector is likely to experience very substantial investment and expansion over the next few years. Such expansion is certainly essential both for raising general levels of income and for insuring provision of employment for Egypt's growing labor force.

But in pursuing this expansion, several elements must be borne in mind for effective use of limited investment resources. Certainly the current planning practice of assuming investment must be directed to closing all gaps between domestic production and consumption is woefully inadequate. High priority must be given to job creation through investment, particularly recognizing the skill composition of the Egyptian economy. But these jobs must be productive ones or the economy will stagnate.

In turn, this brings us to the difficult issue as to what is meant by productive. Essentially, the Egyptian economy should be directed to some healthy balance of import substitution and export promotion. Import substitution is the replacement of current imports by domestic production with a view to both employment creation and saving on foreign exchange. Export promotion is the development of export products and markets with the same aim in mind. Both are worth pursuing both because they expand employment and hence incomes, and because they ssve or earn foreign exchange. Thus "productive" jobs should be defined as ones which both keep the costs of job creation down and are effective in replacing current imports or furthering exports.

The system of prices existing within the domestic economy of Egypt is not a good guideline to such notions of "productivity." This is true of commodity prices which do not reflect the amount of imports which would be displaced by domestic production or of foreign exchange earned through exports, because of the pervasive system of price controls, subsidies, import duties, and taxes. But in addition, the price or wage of labor does not really reflect its true cost to society, for at present wages in manufacturing there are several applicants for each job and not all find jobs.

It is consequently important to direct future investment to productive job creation where productivity is defined in terms of real social prices (shadow prices) which reflect relative scarcities of goods, labor and capital, rather than in financial terms defined by prevailing prices.

In most developing countries, it is common practice to evaluate the costs and benefits of projects in terms of real social (or shadow) prices. Egypt

appears to be quite unusual in this respect. Little or no use seems to be made of social (or scarcity or shadow) prices in deciding on investment projects or in framing policies in the industrial field, although such analysis can be very revealing and constructive. There can be, and usually are, very high costs to an economy if investment and policy decisions are made in financial terms at prevailing prices, rather than at social prices.

In a companion paper, we have examined some of the potential areas for investment in Egypt in terms of social prices. That paper, "Comparative Advantage in Egyptian Manufacturing," draws both on results from other studies and undertakes new calculations. Both have been severely restricted by limited access to existing data. If such data were made available, far more reliable estimates could be undertaken, but meanwhile the results discussed here, although of varying quality, seem to be our main source of guidelines for future investments.

Before proceeding to discussion of the implications of those calculations on a sector by sector basis, I may however note two additional points. First, our evidence applies only to existing industries in Egypt. Socially attractive investments may exist in fields where Egypt is not now producing (toys, calculators, etc.), but to examine this would require detailed information on products now produced--information not made available to this study. In addition, new investments even in existing lines but adopting different technologies or practices from those in existence may prove socially profitable though current practices do not appear so.

Second, it is important for Egypt to consider investment in a diversified range of industries. Why not invest only in that one sector which has the highest social returns? At least three reasons may be cited:

(a) However good one's information, one can never be quite such that this single industry is indeed best.

(b) Since world markets, technology and other factors may shift in unpredictable ways, it is worth spreading the risks by developing a range of industries.

(c) Expansion of one sector alone may incur diminishing returns in that sector, for example as some material input comes into increasingly short supply.

With this in mind the next section examines each sector in turn. The results indicate that there are existing sectors in the Egyptian economy which warrant further investment when viewed in appropriate prices, even though the reported financial rate of return may be low--such as the case of cement. On the other hand, a product such as aluminum is so expensive to produce when viewed in appropriate prices as to certainly not warrant expansion, even though it now successfully exports.

Individual recommendations cannot be made with great confidence owing both to the very restricted access to data and to the uncertainties in such calculations, but our best approximations may be divided into three main classes: recommended, marginal and not recommended.

I. Areas where further investment seems warranted.

i) Food industry
   - food flavors
   - vegetable oils
   - jams and marmelades
   - biscuits
   - confectionary
   - starch

ii) Soft drinks/sodas

iii) Textiles
   - rayon filament
   - nylon carpets

iv) Leather products (especially bags)

v) Cotton underwear

vi) Cosmetics

vii) Cement

viii) Bicycles

2. Areas where further investment probably is worthwhile though some may be marginal cases or uncertain.

i) Food industry
   - sugar
   - preserved beans
   - juices and sherbets

ii) Cigarettes

iii) Cotton textiles, but only if based on imported short staple cotton.

iv) Acrylic and polyester fibres
v) Final wear in general
vi) Wooden furniture
vii) Paper production
viii) Chemicals
phosphate fertilizer
perfumed oils
PVC
synthetic leather
polymers and paints
ix) Nonmetallic products
tiles
cement bricks
sanitary ware
x) Engineering products
televisions
refrigerators
washing machines
air conditioning wall units
sewing machines
enamel ware
batteries
oil, fuel and air filters
electric cables
automatic bakery lines
xi) Rubber tires

3. Areas not recommended for expansion.
tomato products
frozen products
canned fish
ii) Artificial fibres
nylon filament
rayon staple
iii) Nitrogen fertilizer
iv) Iron and steel plants at least of the Helwan type
v) Aluminum
vi) Steel structures for construction
vii) Automobiles

As in studies of many other countries, the advantageous group of products is generally based either on local materials (vegetable oils, confectionary, leather, cement) or is labor intensive (bicycles).

Moreover, again in line with studies of other countries, we find the least advantageous most protected by the price structure or subsidised (iron and steel, automobiles) and the most advantageous discouraged through price controls on outputs and taxes on inputs (cement, leather). In turn, the protection of less advantageous sectors can make it very difficult for industries using their products as inputs to compete. Such is the case with the protection of domestic steel harming the engineering sector, and possibly the inefficiency and low quality of output in cotton textiles in retarding the final wear sector.

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# FUTURE DIRECTIONS FOR INVESTMENT IN EGYPTIAN MANUFACTURING: COMPARATIVE ADVANTAGE

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Robert E.B. Lucas
Boston University

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SECTORAL REVIEW

Two concepts will be used at a number of points in the following discussion and should therefore perhaps be explained at the outset.

The first is the domestic resource cost of foreign exchange (DRC), which measures the social cost of the resources required to generate one unit of foreign exchange either through import substitution or export promotion. If foreign exchange earned is measured in Egyptian Pounds, then a DRC between 0 and 1 certainly indicates a worthy investment potential. For instance a DRC of 0.5 indicates that it costs only L.E. 0.5 at appropriate prices to earn L.E. 1 of foreign exchange. On the other hand, a DRC much higher than 1 or below 0 indicates unattractive areas.

The second measure is the effective rate of protection (ERP) which measures the degree of encouragement or discouragement to a sector resulting from the prevailing price structure of outputs and material inputs. A positive value indicates encouragement, a negative value discouragement (except a negative value below 100% which again indicates encouragement). For instance an ERP of 0.5 indicates that producers receive protection which really means a subsidy paid for by consumers or Government, of 50%. On the other hand an ERP of -0.5 means they have negative protection, which means they pay an implicit tax of 50%.

## 1. THE FOOD INDUSTRY

The food manufacturing industry is the single largest manufacturing sector in terms of its contribution to GNP. In 1977, it contributed about 17 percent of that portion of GNP coming from manufacturing. The range of activities is quite diverse -- sugar production, oils and soaps, canned products, starch and yeast, biscuits and confectionary, dairy products, and food flavours being most important in descending order of output value.

About 80 percent of output by value was in the public sector at least as of the mid-1970's, with a few large public enterprises and many small private firms. Food and live animal imports as of 1979 were about 20 percent of all imports, more than half of this being cereals imports. Thus, some degree of import substitution would on these grounds seem feasible. On the other hand exports of food and live animals constituted less than ten percent of commodity exports by value. Some sugar, fruit juices and rice are exported to the Arab Countries and dehydrated onions particularly to Britain.

On average, the food industry is one of the most attractive in social terms for future investment according to our findings on DRC. There is however some variation within the sector as one might expect. Such products as vegetable oils, jams and marmelades, biscuits, confectionary and starch certainly seem socially profitable, and probably such items as preserved beans, juices and sherbets. On the other hand, tomato products, frozen products and canned fish are found to be quite unattractive for further pursuit. The information we have on the sugar industry is now somewhat dated, but it would seem the sugar mills are socially profitable, though they may not appear so in certain years owing to quite wide fluctuations in world market prices.

Whether the food industry can be expanded easily is another matter. Most of the processed products use as inputs locally grown items and the potential for overall expansion in agriculture is not obvious though of course some switching amongst individual crops is feasible. To expand would therefore require liberalization of imports of food materials to be processed by the food industry either as substitutes for processed imports or indeed for export. Those material inputs which have high transportation costs may prove prohibitive to import and hence limit expansion potential in these areas. Such is the case of sugar cane where the gap between CIF and FOB price of cane sugar is 15 percent.

In fact, material availability is cited as the main cause for existing excess capacity in certain food lines, such as the dairy industry which in 1977 operated at 20 percent capacity. In such contexts, investment alone will not help.

Besides material availability, however, at least two elements currently discourage investment by enterprises in the food industry. The first is that the effective protection given to this sector is negative, a result of the price controls on outputs. Thus, although it is socially worth investing selectively in the food industry, the price structure discourages enterprises from so doing. The second is a difficulty in the export of processed foods, namely that the quality of tin cans available domestically for such items as fruit juices is very low indeed.

## 2. THE BEVERAGE INDUSTRY

The beverage industry is comparatively small — about 2 percent of the GNP contributed by manufacturing in 1977. Based to some extent on a higher stage of processing local sugar and fruits as sodas it may seem to have a natural potential. On the other hand, that portion which deals with alcoholic beverages (some of which are exported) is unlikely to be expanded. As of 1977 about 85 percent of output contributed by the beverage industry was in the public sector. There are, of course, already joint ventures in Egypt such as the production of Pepsi Cola by the Misr Company for soft drinks.

Certainly, the estimates of DRC for beverages would support further investment in this sector, though private incentives to do so are very low, the effective rate of protection being low compared to other sectors, mainly because of the low controlled price on output.

Given differences in quality, it is not clear much of an export market exists for beverages, and imports are negligible. On the other hand, it seems there may be an excess domestic demand for soft drinks at the controlled prices despite the lack of imports, and these drinks are apparently consumed by a fairly wide range of income classes.

## 3. THE TOBACCO INDUSTRY

Egypt imports both raw tobacco and cigarettes, and exports a small quantity of cigarettes to the Arab Countries. The tobacco processing industry is the fifth largest manufacturing sector in terms of its contribution to GDP — about 7 percent of total manufacturing contribution — almost all being in the public sector.

On the whole, estimates suggest the tobacco industry is a marginal candidate for further expansion even though there is some room for import substitution and constraints of total dependence on local crops are not present. However, there is at least some evidence to suggest that cigarette manufacturing in particular may be worth further expansion. See Handoussa "Time for Reform: Egypt's public sector industry," mimeo undated.

## 4. SPINNING AND WEAVING

Spinning and weaving is second only in size to the food industry in its contribution to GNP, being about 17 percent of manufacturing's total contribution. It is also the oldest modern industry in Egypt founded largely on local cotton. One result of this is that equipment is frequently very old. In 1975, 75 percent of looms and 44 percent of spindles were reported to be more than 25 years old. About 95 percent of the cotton input is locally grown and about 49 percent of textile production locally consumed. Imports of competing materials are effectively prohibited. Of manufactured goods exports, the spinning and weaving sector provided about 43 percent in 1975-1976.

But the spinning and weaving sector is in trouble. Before 1974, a large portion of exports went to the COMECON Countries, and this market has dwindled rapidly since the break with the Soviet Union. Textile import quotas imposed by the EEC countries are not on the whole filled though they are for some individual countries. Thus, one might expect the potential to exist for export to other EEC countries. But difficulties exist. First, there is a quality problem after switching from the less demanding East European market. Secondly there is a productivity problem.

That equipment is very old lowers productivity certainly, and one might consequently think that new investment would overcome this. But a second problem is at hand. Egyptian grown cotton is long staple, which can be used in the production of finer cloths and is relatively expensive on the world market. But in Egypt, it is woven into low grade textiles. The result, naturally, of using expensive materials to produce inexpensive outputs is that the DRC estimates reported in the companion paper make spinning and weaving on the whole look unattractive.

Either of two directions or some combination might be considered, making updating of equipment and even expansion worthwhile. The long staple local cotton could be used to produce higher quality cloth domestically. There are, however, two disadvantages to this namely that higher quality textiles are more demanding in their production and that local demand is mostly for coarser clothes. Since a portion of these coarse cloths are rationed and sold locally at greatly subsidised rates, to discontinue production could be difficult unless these cloths are subsequently imported. The alternative would be to export the long staple raw cotton, import short staple and use the latter for locally produced textiles. Despite repeated recommendations to the latter effect over more than 10 years, nothing has changed. The original reason for banning imports of short staple cotton was a fear of disease in the local cotton crop, but it is unclear whether this is still a serious possibility. A second potential problem might be encountered in increasing exports of long staple cotton which may lower their price on the world market somewhat. However the extent of this danger is not clear.

Unless one alternative or the other is seriously followed, further investment at least in spinning does not seem worthwhile. Yet other branches of the weaving industry could be worth expansion. For example, some of the results on carpeting would suggest this is worth expansion, though some improvement in designs might be necessary to penetrate a substantial export market.

There is increasing use also of artificial fibres. Results here are, however, very mixed. For example, at least one result on acrylic and polyester fibres suggests only marginal acceptability, and a report on Misr Rayon undertaken for the World Bank shows low social rates of return on nylon filament, rayon staple and weaving and finishing. The same report, however, shows high social returns on rayon filament, nylon carpets and spinning.

## 5. FINAL WEAR

As one moves up the stages of production in textiles, the role of the public sector diminishes. In spinning and coverting all is public, in weaving 70 percent, in knitting 45 percent and in garments 30 percent. The final wear sector is, however, suprisingly small in Egypt — less than 8 percent of manufacturing contribution to GNP and about the same contribution as tobacco.

The final wear sector is certainly one of the more labor intensive sectors and our results on DRC at least place it in the marginally acceptable group of industries as a whole with items such as cotton underwear having a low positive DRC suggesting it is particularly worth expansion.

Until 1974 or 1975 Egypt was exporting clothes to the COMECON Countries but this market has subsequently diminished. Meanwhile, local demand seems to be shifting more toward garments which are partially artificial fibres.

Thus for Egypt to expand substiantially its production particularly of cotton garments would probably require penetrating the hard currency export markets. To do so would require substantially raising quality in two directions -- first in moving to higher quality materials used (which could produce a backward linkage for using long staple cotton for higher quality textiles) and second in design.

The final wear industry is one which is highly dependent upon producing the right designs at the right time.This is true today even of quite simple garments. To develop local expertise in design for the European and American market could take a considerable period. Thus, one may wish to consider some form of joint venture with designs being supplied from abroad. Probably the only serious alternative would be expansion for sale in the African market, though increasingly design matters here also.

## 6. WOOD PRODUCTS

This sector is almost entirely dependent on imported wood, produces mostly furniture and is faily small. Again, some of this furniture was previously exported to the COMECON Countries and this market has lapsed. In 1979 about 4 million dollars' worth of furniture was exported. The carved wooden furniture, for which Egypt is famous, is suffering seriously from loss of skilled workers, in part through migration to the Gulf.

The industry apparently survives behind high effective protection walls. The evidence on this industry in terms of social advantage is really too mixed to be sure, but it would seem at least some of the wooden furniture enterprises are doing a good job in terms of social profitability.

## 7. PAPER PRODUCTS

The paper products industry is mostly in the public sector but is being transferred to Law 43 status. Although currently quite small — about 2 percent of manufacturing contribution to GNP — it is nonetheless of interest as a potential expansion area. The industry is founded largely on local materials — rice straw and to some extent bagasse (a waste from sugar cane). The alternative uses for these materials is as animal feed and as fuel and certainly there seems considerable potential for futher conversion of these materials into paper. One difficulty is that the local materials permit only production of low quality paper. Even news print continues to be entirely imported. The production of higher qualities of paper requires inputs of imported pulp along with local materials. Given these quality problems and pricing policy on some outputs the local industry has had difficulty competing with liberalized imports over the last 5 years.

The paper mills are particuarly capital intensive activities and at least the initial mills were probably built on a scale too small to take advantage of economies of size.

Earlier measures of DRC for the paper industry appear quite unfavourable in the 1960's. However, since then world prices of paper have risen by more than of inputs, and more recent calculations suggest expansion of the paper industry via import substitution may be marginally socially worthwhile. This depends more than in most industries on one's view of the real social cost of capital because this is such a capital intensive sector.

## 8. LEATHER PRODUCTS

The leather products sector is again very tiny — less than 1 percent of manufacturing's contribution to GNP. The chief products are clothes, bags and shoes. Clothes and shoes were exported to the COMECON countries until the mid-70's, and the loss of this market has cut back on production. On the other hand, bags have been fairly successfully exported to EEC Countries for some time now.

The shoe portion of this industry has been greatly discouraged by very low prices being set on shoes via price controls at least until 1979. But recognizing this, the industry seems to be really quite efficient in social terms from such evidence as we have, and probably is worthy of further expansion.

If expansion is to be in the direction of exports, however, as with final wear design plays a very major role and current products would need to be substiantially revised.

9. RUBBER INDUSTRY

The rubber industry is not much larger than the leather sector, producing rubber tires and mechanical rubber parts, with 95 percent of production in the public sector.

The sector was originally established consciously as an import substitution policy behind high protection walls. The sector is actually quite labor intensive, however, and whereas earlier estimates suggested only marginal advantage some tentative recent evidence indicates a more clear social advantage at least in tire production.

10. CHEMICALS

The chemical industry is the third largest sector in terms of contribution to GNP —— about 11 percent of manufacturing's total contribution. However, this one sector covers a very wide range of products —— fertilizers, pharmaceuticals, PVC, cosmetics, etc. —— about 80 percent of production being in the public sector.

On the average, the chemicals sector is at best marginally socially profitable. But such averages can be deceptive for such a diverse sector.

Within chemicals, by far the most attention has been given by various authors to the fertilizer subsector, producing both nitrogen and phosphate. Phosphate fertilizers are produced from relatively low grade Egyptian deposits and the nitrogen fertlizers as a by-product of oil refining and natural gas. Sufficient fertilizer has been produced for some exports at various times to the Middle East and Africa. Both forms of fertilizer production were found to be socially efficient in the 1960's. But nitrogen fertilizer production in Egypt uses an electrolytic technique which is particularly electricity intensive. As pressure on Aswan to deliver electricity has mounted, so has the real cost of using electricity, and the most recent estimates for 1977 - 1979, suggest that nitrogen fertilizer production is no longer socially profitable. More recent estimates for phosphate fertilizer production do not seem to exist.

Other results for the chemicals sector are rather piecemeal, but it would seem cosmetics probably have a strong social advantage in local production and quite probably also perfumed oils, PVC, synthetic leather, and polymers and paints.

Unfortunately, no data on the pharmaceuticals sector could be obtained, but products are reputed to be of exportable quality though packing is generally not.

## II. NON METALLIC PRODUCTS

Chief amongst this sectors' products is cement, though glass, tiles and other products are also manufactured. In total, the sector amounts to about 5 percent of manufacturing's contribution to GNP. At times, Egypt has been an exporter of cement but from 1976 on imports of cement have increased steadily. Based almost entirely on large quantities of local materials (including paper for packaging) the industry is one of Egypt's oldest.

There is uniform agreement in the estimates of DRC that cement has been and is one of Egypt's most profitable products in social terms.

Further investment in this sector would certainly seem warranted, if only for import substitution in these years of high construction rates, and hopefully leading to exports later. However, since several of the Arab Countries are also developing cement industries, long term export prospects will probably have to look elsewhere, such as the Mediterranean Basin.

## 12. BASIC METALS

This sector is moderately large — about 6 percent of the manufacturing sector's contribution to GNP. Its major products are iron, steel and aluminium, though some amounts of other metals are also produced.

The aluminium plant uses imported alumina, processes it in a very electricity intensive technique and the resulting aluminium is to some degree exported. The original argument for such a procedure was that Aswan was providing very cheap electricity. However, as noted in connection with nitrogen fertilizer, electricity is now a scarce commodity with a high social price. As the aluminium plant became financially unprofitable, the reaction has been to lower the price of electricity used by the plant, thus subsidising exports of aluminium. All estimates on the social worth of this process are uniform in rejecting its viability.

Recent evidence on the iron and steel subsector has not been made available, but through the 1960's this sector was certainly extremely inefficient in social terms. The source of this inefficiency was really the large Helwan plant and it is possible the three smaller plants were far more efficient. Helwan's inefficiency has been blamed on skilled labor shortages, the low grade of ore shipped from Aswan to Helwan for blasting, and failure to be large enough to exploit the full economies of size particularly in the blasting process. Japanese technology has rendered world trade in steel quite ferociously competitive, and even the U.S. steel industry is in serious trouble. It certainly seems unlikely the efficiency of at least this type of steel processing has kept pace in Egypt.

On the whole, the basic metals sector is found to have a very high DRC, and future investments in this energy and capital intensive sector must be in serious doubt. Indeed, the high degree of protection granted to the Helwan plant has proved to be a major problem for some of the engineering sectors which could neither obtain the required grades of steel from Helwan nor permission to import.

## 13. THE ENGINEERING GROUP OF SECTORS

The engineering group of sectors is closely interconnected and includes metal products, non electrical machinery, electrical machinery and means of transport. Together they represent about 11 percent of manufacturing's contribution to GNP, three being of approximately equal size and non-electrical machinery much smaller. On the whole they are quite capital intensive. By value contributed they range from 62 percent in the public sector for metallic products to 92 percent in electrical machinery as of 1977. This private sector includes a large number of small workshops often with poor or outdated equipment but apparently displaying great adaptability and ingenuity. Imports of engineering products continue to be substantial — about 38 percent of commodity imports in 1979 — and exports are negligible.

On the whole, the metallic products and non electrical machinery are probably too costly in social terms for general expansion though they might be considered marginal candidates. Unfortunately, since reliable price data have not been made available it is difficult to be too specific about products within these sectors. Some evidence does however exist to suggest that steel structures for construction and aluminium kitchenware are not good prospects, though aluminium window frames and furniture and automatic bakery lines may be.

In electrical machinery, so many price controls exist as to substantially complicate the picture, though it would appear at least certain items are socially profitable -- such as televisions, refrigeratirs, washing machines, airconditioning wall units, sewing machines, batteries and electric cables. On the other hand, such items as electric heaters appear to be quite inefficiently produced when measured in appropriate prices.

Finally, the means of transport sector produces a range of products from bicycles, to cars, buses and trucks, to ships. There is quite strong and systematic evidence that most of the sector is strongly disadvantageous and only exists because of high protection. However, there is one exception, namely bicycle production which according to our best evidence appears to be strongly advantageous. In Egypt, donkeys seem generally to be preferred over bicycles in rural areas and bicycling in Cairo is not popular. This may mean domestic demand is quite limited, but this is one area in which Egypt could seriously consider producing for export.

(For interpretation of bias, uncertainty and source indicators, see notes at end)

| | ERP | | | DRC | | |
|---|---|---|---|---|---|---|
| | Value or range | Indication of likely direction of bias or great uncertainty | Source | Value or range | Indication of likely direction of bias or great uncertainty | Sour |
| Food Industry: Overall | - .92 | | 7 | .25 | | 7 |
| jams & marmelades | | | | .27/39 | | 2 |
| preserved beans | | | | .51/.55 | | 2 |
| juices and sherbet | | | | .66/1.19 | | 2 |
| preserved vegetables | | | | .79/333.33 | ? | 2 |
| tomato products | | | | -.82/-1.38 | | 2 |
| frozen products | | | | 1.81 | | 2 |
| canned fish | | | | 1.67 | | 2 |
| food canning | .03/.15 | | 1 | .77/.79 | | 1 |
| biscuits | .06 | | 1 | .54 | | 1 |
| vegetable oil | - .92 | | 1 | .10 | | 1 |
| confectionary | - .20 | | 1 | .60 | | 1 |
| starch and glucose | - .50 | | 1 | .27 | | 1 |
| food flavor | - .58 | | 1 | .40 | | 1 |
| sugar | .14 | | 3 | .77 | | 3 |
| dairy products | | | | .31 | - | 8 |
| ice cream | | | | .50 | - | 8 |

| | ERP | | | DRC | | |
|---|---|---|---|---|---|---|
| Beverage: Overall | .24 | ? | 7 | 1.87 | + | 7 |
| soft drinks | - .53 | | 1 | .34 | | 1 |
| cola | | | | .10/.17 | - | 8 |
| Tobacco: overall | - .97 | - | 1 | .61 | | 1 |
| cigarettes | | | | 0./ 1.0 | ? | 1 |
| Spinning and Weaving: | | | | | | |
| Overall | .91 | ? | 7 | 1.46 | ? | 7 |
| cotton spinning | .92 | | 1 | 1.0/27.0 | | 1/2 |
| cotton fabrics | | | | - .93 | | 2 |
| canvas | | | | .37 | - | 8 |
| acrylic, poly. fibres | | | | 1.06 | ? | 8 |
| polyester staple | | | | 1.0 | + | 10 |
| rayon staple | | | | - ve | | 10 |
| polyester filament | | | | 0./1. | | 10 |
| rayon filament | | | | 0./1. | | 10 |
| nylon filament | | | | - ve | | 10 |
| rayon spinning | | | | - ve | | 10 |
| rayon weaving | | | | - ve | | 10 |
| carpets | .14 | | 1 | .80 | | 1 |
| Final wear: overall | .44 | ? | 7 | 1.89 | + | 7 |
| cotton knitwear | .01 | | 1 | 1.00 | | 1 |
| cotton underwear | - .04 | | 1 | .63 | | 1 |
| Wood products: overall | 3.39 | ? | 7 | 3.68 | ? | 7 |
| furniture | | | | 12 /.55 | - | 8 |

| | ERP | | | DRC | | |
|---|---|---|---|---|---|---|
| Paper: overall | .01 | ? | 7 | .11/1.62 | ?? | 8/7 |
| Leather: overall | - .81 | ? | 7 | .27 | ? | 7 |
| Rubber: tires | 2.62 | ?? | 3 | .68/1.0 | | 8/3 |
| Chemicals: overall | .24 | ? | 7 | 1.89 | + ? | 7 |
| nitrogen fertilizer | - .72 | | 1 | 1.34/- ve | | 6/11 |
| phosphate fertilizer | .07 | ?? | 3 | .72 | | 3 |
| food flavors | | | | .22 | | 2 |
| perfumed oils | | | | 1.10 | | 2 |
| cosmetics | | | | .50 | | 2 |
| PVC | | | | .08/.09 | - | 8 |
| synthetic leather | | | | .03/.32 | - | 8 |
| polymers and paints | | | | .13 | - | 8 |
| baby products | | | | .53 | - | 8 |
| Non-Metallic Products: | | | | | | |
| overall | - .80 | ? | 7 | .36 | | 7 |
| cement | - .71/-.84 | | 5 | .40/.48 | | 5 |
| tiles | | | | .06/.17 | - | 8 |
| concrete products | | | | .46/1.14 | - ? | 8 |
| cement bricks | | | | .15 | - | 8 |
| sanitary ware | | | | .19 | - | 8 |
| Basic Metals: overall | 0.38 | - ? | 7 | 3.38 | - | 7 |
| iron and steel | 5.99 | ?? | 3 | 4.80 | | 3 |

| | ERP | | | DRC | | |
|---|---|---|---|---|---|---|
| aluminium | .69 | - | 1 | 1.31/- ve | | 2/11 |
| Metallic Products: overall | .34 | ? | 7 | 2.05 | ? | 7 |
| steel structures | | | | .17 | - | 8 |
| aluminium kitchenware | | | | .01 | - | 8 |
| aluminium furniture | | | | .54 | - | 8 |
| enamel table ware | | | | 0./1. | | 9 |
| Non-Electrical Mach: | | | | | | |
| overall | .30 | ? | 7 | 1.89 | ?? | 7 |
| cranks, mach. parts | | | | .16 | - | 8 |
| oil, fuel, air filters | | | | .16 | - | 8 |
| automatic bakery lines | | | | .16 | - | 8 |
| sewing machine | | | | 0./1. | | 9 |
| Electrical mach: Overall | 5.86 | + ? | 7 | 9.81 | ++ ? | 7 |
| electric cables | | | | .08 | - | 8 |
| televion. receiver | | | | 0./1. | | 9 |
| batteries | | | | 0./1. | | 9 |
| airconditioner, wall unit | | | | 0./1. | | 9 |
| refrigerator | | | | 0./1. | | 9 |
| washing machine | | | | 0./1. | | 9 |
| electric heaters | | | | 6.95 | ? | 8 |
| Means of transport:overall | 3.54 | ? | 7 | 6.33 | | 7 |
| automobiles | 3.05 | ?? | 3 | 1.85 | | 3 |
| bicycles | | | | 0./1. | | 9 |

Industrial Sector
Strategy Assessment

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# COMPARATIVE ADVANTAGE IN EGYPTIAN MANUFACTURING

Report Submitted to U.S. A.I.D.
by
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We should like to thank four persons in particular for their help in preparing data for this study: Miss Mona El Ibyari, Mr Ahmed M. Galal, Miss Swati Muckerjee and Mr Ananth Madhavan.

## I. INTRODUCTION

The purpose of the present paper is to present such information as has been made available for this brief study of potential areas for further investment in Egypt. In doing so, the paper moves away from the current major tool of investment planning in Egypt, namely the allocation of planned investment to close the gaps between current consumption and current production in particular areas. Rather, our focus is on providing productive employment.

Since prevailing prices of both commodities and such inputs as labor, capital and electricity do not reflect relative scarcity in the Egyptian economy owing to extensive use of subsidies, taxes and price controls, some notion of productivity other than financial returns must be sought in determining the best use of scarce investment resources for productive job creation.

No matter whether a strategy of import substitution or of export promotion is followed, what matters is the real cost of displacing imports or the real cost of promoting exports. A measure designed specifically for such contexts is the domestic resource cost of foreign exchange (DRC). This measures the cost to society of resources required to save one unit of foreign exchange through import substituion or to earn one unit of foreign exchange through export promotion.

The elements which enter this measure are essentially the cost of labor and capital required in a particular production process, measured in appropriate prices. These prices are termed shadow prices reflecting the opportunities foregone elsewhere in assigning labor or investment in capital to this activity. The foreign exchange saved or earned is measured by the amount the commodity would cost if bought from abroad (the CIF price) or if sold abroad (FOB price) minus the cost of importing or foregoing exports of all

materials used (in CIF or FOB Prices). This net earnings of foreign exchange is called the value added at world prices.

Most of the DRC results in this paper measure the value added in world prices in terms of L.E. Thus both costs of capital, labor and so forth (the numerator) and the benefits (the denominator) are measured in Egyptian Pounds. If the exchange rate at which the net foreign exchange earnings are computed approximates the real value of foreign exchange to Egypt in the near future, then the ratio of costs to benefits should not exceed 1 for a worthwhile undertaking. In a few cases it is possible that value added at world prices is negative, in which case operation of such activities actually involves a loss of foreign exchange. In such cases, the DRC ratio becomes negative and certainly the project becomes undesirable. In short the DRC may be divided into three ranges.

DRC greather than 1: activity is not advantageous to society.
DRC between 0 and 1: activity is advantageous.
DRC less than 0 : activity again disadvantageous -- foreign exchange is lost.

For instance a DRC ratio of 0.5 means that it costs 50 piasters for the resources, measured in appropriate prices, to save or earn L.E. 1 worth of foreign exchange. If the true value of foreign exchange is somewhat greater than the exchange rate at which foreign currency earnings are measured, then the cut-off between desirable and undesirable activities is defined by a DRC somewhat greater than 1.

A second concept used in this paper is the effective rate of protection given to an activity. This is not a measure of productivity or desirability of an activity, but rather gives an indication of the direction in which resources are likely to be attracted by the prevailing price structure. The measure has two components: value added at world prices met above; and value added at domestic prices. The latter is the sume of all payments to workers, to profits, to rent, etc. The effective rate of protection is then measure by:

$$ERP = \frac{\text{Value added at domestic prices}}{\text{Value added at world prices}} - 1$$

If workers' wages and profits in total are higher than they would be if prices competitive with foreigners wre paid, then resources essentially are attracted to the activity -- this production process is said to be protected.

Thus again the ERP has three ranges of measurement:

| | |
|---|---|
| ERP greater 0 | : the activity is protected. |
| ERP between - 1 and 0 | : the activity is actually discouraged. |
| ERP below - 1 | : the activity is again encouraged because at world prices neither workers nor profit receivers could be paid. |

For instance an ERP of 0.5 means that the production process is essentially subsidised by consumers and/or Government at a rate of 50 percent. An ERP of-0.5 means the process is effectively taxed at a rate of 50 percent.

Two types of results on DRCs and ERPs are presented in this paper. Section II summarized the work of several other authors in this field. Section III presents new calculations undertaken for the purpose of this project.

One of the chief limitations of both measures is that they can be no better than the data which enter them. The methodology is difficult enough even given reasonable data. But the data limitations in this field in Egypt are far worse than in most LDCs where calculations have been or are regularly undertaken. It is not that the data do not exist, only that the data are not available to researchers.

Ideally one would use information on individual plants, enterprises or production processes. Some of the results summarized in part II are based on partial data of this type. For the purposes of the present study, only three types of data were available. First the 1977 input-output table, second some application data from private firms, and third an engineering study on a set of engineering products. Calculations based on an input-output table are far from ideal, being too

aggregated in both outputs and inputs and having no direct capital stock figures. Moreover, in all of our calculations, lacking access to existing price data, we have been forced in many instances to assume the gap between world and domestic prices is mostly explained by trade taxes which is known not always to be the case.

Since the data are so tenuous, one must interpret results with considerable caution. But some pattern does seem to emerge from the combined results, and the broad meaning of this pattern is discussed in a companion paper, "Future Directions for Investment in Egyptian Manufacturing: Comparative Advantage, report presented to U.S.AID, August 1981.

Beyond the data, two other comments are in order on limitations of the general DRC methodoloy. First, results are normally based on observed existing practices, which imposes two somewhat stringent limitations: (i) that no information is provided on commodities not already in production in the country, but in whose production the country may have a comparative advantage; (ii) that new techniques or new equipment may make a process more (or sometimes less) socially attractive than the existing practice. In the latter case, however, the onous is really on the proposed extension to argue its case if today's practice is found to be disadvantageous. Second, DRC measures are entirely static. In particular they usually involve no risk measure associated, for example, with fluctuation in world prices -- an omission that may mean one wants to adopt a fairly wide range of advantageous activities to spread any risk. Moreover, the static, restriction omits any learning process inherent in initiating domestic production -- the so-called infant industry argument. But all too often infant industries are protected and never grow up. Thus again, the onous is really on those activities which believe they have a large dynamic improvement component, but which are disadvantageous on static measure, to make their case.

## II Existing Studies

A number of studies have already examined aspects of comparative advantage of Egyptian industry employing the general technique of domestic resource cost of foreign exchange. Some of these studies will be reviewed in this section, arranged by author of the study.

### A. Dr. Heba Ahmed Handoussa:

In a series of papers, Dr. Handoussa has examined the performance of individual public enterprises from a comparative advantage perspective.* The combined results are reproduced in table 2.1.

Even if one adopts a shadow price of foreign exchange no higher than the parallel exchange rate -- $ 1 = L.E. 0.65 at the time -- all but one instance in table 2.1 shows a domestic resource cost of foreign exchange below the value of that foreign exchange or only slightly above. That one instance is aluminium. With this exception, this would indicate that all other sectors are socially viable propositions -- that the social cost of resources used is below the value of foreign exchange generated through export promotion or saved through import substitution.

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* "Policy Study on Issuing Shares of Public Sector Companies", Ministry of Economy, Foreign Trade and Economic Cooperation, Economic Studies Unit March 1979.
"Public Sector Employment and Productivity in the Egyptian Economy", Report prepared for the ILO comprehensive employment strategy mission, September 1980.
"Time for Reform: Egypt's Public Sector Industry", undated, (mimeo).

Table 2.1

## Handoussa's DRC & ERP measures for Public Sector Companies

| Sector: Company/product | ERP | DRC (L.E. per $) |
|---|---|---|
| **Food** | | |
| Food canning | 0.03 | 0.54 |
| Food canning (Edfina) | 0.15 | 0.55 |
| Biscuits (Biscomisr) | 0.06 | 0.38 |
| Vegetable oil (Alexandria Oil &Soap) | -0.92 | 0.07 |
| Alexandria Confectionary | -0.20 | 0.42 |
| Egyptain Starch and Glucose | -0.50 | 0.19 |
| Food flavour | -0.58 | 0.28 |
| **Beverages** | | |
| Soft drinks (Sico) | -0.53 | 0.24 |
| **Tobacco** | | |
| Tobacco | -0.97 | 0.43 |
| **Spinning & Weaving** | | |
| Cotton spinning (Misr/Shebin El Kom) | 0.92 | 0.70 |
| Carpets (Arab Carpets) | 0.14 | 0.56 |
| **Final wear** | | |
| Cotton Knitwear (Cairo Clothing/Tricona) | 0.01 | 0.70 |
| Cotton underwear (Nasr Clothing/Kabo) | -0.04 | 0.44 |
| **Chemicals** | | |
| Nitrogen Fertilizer (Kima) | -0.72 | 0.51 |
| **Nonmetalic products** | | |
| Cement Enterprise No. 1 | -0.79 | 0.44 |
| 2 | -0.84 | 0.48 |
| 3 | -0.72 | 0.42 |
| 4 | -0.71 | 0.40 |
| **Basic metals** | | |
| Aluminium (National Metal Industries) | 0.69 | 1.22 |

Given this set of low and attractive DRC estimates, we may ask whether there are reasons to suppose the estimates to be biased downwards.

i) Principal among these is that capital costs are based on historic cost of fixed capital rather than replacement cost. In essence this assumes the real depreciation in capital is at about the same rate as the inflation in capital goods' prices. On the whole, the former is likely to have been lower, rendering a downward bias to this cost.

ii) Electricity costs are appropriately raised about threefold at least in calculations for cement and fertilizer, as discussed in section III below, so this should not be a source of serious downward bias.*

iii) On the other hand, there are some reasons to argue the estimates in table 2.1 are upward biased. Labor is costed at full wage cost as opposed to the shadow wages employed in section III below. Moreover, both depreciation and costs of capital are added to costs for each sector.

In addition to the aluminium production being rejected as socially attractive in table 2.1, it is noteworthy that two others are at least borderline cases. These are cotton spinning and cotton knitwear, and if indeed the estimates in table 2.1 are rather low, then these sectors would more certainly appear unattractive.

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* See Ahmed M. Galal,"Economic Efficiency in Public Sector Enterprises, a case study of Cement Industry, Egypt," unpublished M.A. Thesis, A.U.C., May 1980. And Amr Ameen Alee," The Economic Efficiency of the Eyptian Company for Chemical Fertilizers," unpublished M.A. Thesis, A.U.C., May 1981.

Table 2.1 lists also Dr. Handoussa's estimates of effective protection (ERP) given to each enterprise. More will be said on effective protection in section III but essentially a positive figure is ususally assumed to say that the overall domestic price structure of materials and outputs works on balance to encourage production in such sectors. The opposite is true for negative ERP. However, a number of the enterprises in table 2.1 are making financial losses, which are ultimately paid by the Government. Such losses, or even low returns, are in effect production subsidies and would make the ERPs look higher and more positive if included in the table 2.1 measures.

B. Dr. Hanaa Kheir El Din:

In " Policy Study on Potential and Problems in Expanding Selected Manufactured Exports", Ministry of Economy Foreign Trade and Economic Cooperation, Economic Studies Unit, October 1979, Dr. Kheir-El-Din presents estimates of DRC reciprocals for a number of separate products for particular firms. These are reproduced as DRC ratios in table 2.2.

The results in table 2.2 have some overlap with table 2.1, but the product breakdown in 2.2 reveals a wider range of DRC ratios (here measured in L.E. per L.E.). For example, in the food sector, the jams and preserved legumes are certainly within the acceptable range. If the shadow price of foreign exchange is slightly higher than the parallel

Table 2.2

Kheir-El Din's DRC Measures for Products of Individual Enterprises

| Sector | | DRC (L.E. per L.E. of foreign exchange) |
|---|---|---|
| **Food** | | |
| Jams & marmelades: | El Nasr Preserved Food | 0.27 |
| | Edfina | 0.39 |
| Preserved legumes: | El Nasr | 0.55 |
| | Edfina | 0.51 |
| Juices and sherbets: | El Nasr | 0.66 |
| | Edfina | 1.19 |
| Preserved vegetables: | El Nasr | 0.79 |
| | Edfina | 333.33 |
| Tomato products: | El Nasr | -0.82 |
| | Edfina | -1.38 |
| Frozen products | Edfina | 1.81 |
| Canned fish | Edfina | 1.67 |
| **Spinning & Weaving** | | |
| Cotton yarn: | Misr/Shebin EL-Kom | 26.95 |
| | Kafr-El- Dawar | -10.00 |
| Cotton fabrics: | Kafr-El-Dawar | -0.93 |
| **Essential oils & cosmetics** | | |
| Food flavours | | 0.22 |
| Perfumed oils | | 1.10 |
| Cosmetics | | 0.50 |
| **Aluminium metal** | | |
| Misr Aluminium Co. | | 1.31 |
| **Cement** | | |
| National Cement | | 0.48 |
| Alexandria Cement | | 0.59 |

rate, so that the acceptance criterion in 2.2 becomes a ratio somewhat higher than 1, then juices and sherbets are also within the acceptable boundary for both companies observed. On the other hand, tomato products (with a negative value added at world prices), frozen products and canned fish do not enter the acceptable range.

The results on spinning and weaving differ somewhat from those in table 2.1, despite a similar approach to measurement in both cases, presumably because of the greater degree of disaggregation in the second table. Whereas cotton spinning is marginally acceptable in social terms in table 2.1, both cotton yarn and cotton fabrics are well outside of the permissible range in 2.2, being either negative or very high.

The results on aluminium and cement again reject the former and accept the latter as being in the social interest as in table 2.1. And finally, whereas food flavours and cosmetics are well within the acceptable range, perfumed oils are marginal depending upon whether foreign exchange is believed at a premium.

## C. BENT HANSEN AND KARIM NASHASHIBI

In two works, these authors have examined Egypt's comparative advantage both in agriculture and manufacturing: Bent Hansen and Karim Nashashibi, Foreign Trade Regimes and Economic Development: Egypt, Columbia University Press, New York, 1975. B. Hansen and K. Nashashibi, "Protection and competitiveness in Egyptian Agriculture and Industry," NBER working paper series No. 48, 1974.

Here we shall focus on the results for manufacturing. The data employed by Hansen and Nashashibi are from individual enterprise or industry surveys over several time periods Table 2.3 summarises these results for the latest year in which calculations are reported by these authors. It should be noted that these results refer to a somewhat earlier period than most of the results in the present paper, t[illegible] latest figures in 2.3 refering to 1969-70.

Relative to the official exchange rate, only one sector displays a comparative advantage from these results -- cement and its production is discouraged by a negative ERP. At the IMF suggested "realistic" rate of 0.61 L.E./$, sugar, rubber tires and both types of fertilizer also join the advantageous list.

From these earlier results it is again found that cotton weaving and spinning are both disadvantageous using prevailing techniques, supporting the more recent results of Kheir El Din and (to a lesser extent) Handoussa. Hansen and Nashashibi also find a very high rate of effective protection on spinning a rate of 213 percent -- encouraging production in this socially unprofitable activity.

Three sectors display strong social disadvantage from these results: the very capital intensive paper producing sector, the Helwan iron and steel plant and automobile production. Each of these receives very high positive protection from the prevailing price structure -- an ERP of 599 percent being measured for Helwan.

Table 2.3 Hansen and Nashashibi's DRC and ERP measures for manufacturing

| Sector / Product | Year | ERP | Year | DRC (L.E. per U.S.$) |
|---|---|---|---|---|
| Sugar | 1969-70 | 0.14 | 1969-70 | 0.54 |
| Cotton Textiles: Fabric | 1965-66 | 0.68 | 1965-66 | 0.70 |
| Cotton Textiles: Yarn | 1969-70 | 2.13 | 1969-70 | 0.86 |
| Paper | 1963-64 | 2.40 | 1963-64 | 2.08 |
| Rubber tires | 1963-64 | 2.62 | 1963-64 | 0.59 |
| Fertilizers:Nitrogen | 1965-66 | 0.12 | 1965-66 | 0.62 |
| Phosphate | 1965-66 | 0.07 | 1969-70 | 0.50 |
| Cement | 1965-66 | -0.28 | 1965-66 | 0.31 |
| Iron and steel | 1965-66 | 5.99 | 1965-66 | 4.80 |
| Automobiles | 1963-64 | 3.05 | 1963-64 | 1.13 |

| | |
|---|---|
| Official exchange rate L.E. per U.S.$ | 0.435 |
| IMF suggested "realistic rate" for 1966 | 0.610 |

Hansen and Nashashibi's measures of DRC employ historical cost of capital minus depreciation rather than replacement value, which causes a downward bias particularly in enterprises with older capital -- such as the textile industry-- making these look more advantageous. A 10 percent rate of return on this historical cost is adopted in table 2.3.

Labor costs are included at market wage, on the other hand, which causes an upward bias, particularly in the more labor intensive sectors, if the social cost of labor is really below the market wage.

Finally Hansen and Nashashibi do adjust for the gap between domestic cost of electricity and the cost of fuel oil used for generation, when fuel oil is used. This correction is presumably much smaller than some of the conversion factors used for electricity in more recent studies, helping to make the nitrogen fertilizer sector more attractive in particular.

## D. MAURICE GIRGIS

In Industrialization and Trade Patterns in Egypt, 1977, Maurice Girgis computes both DRC and ERP measures from a 1966-67 input - output table and 1963 tariff rates. His results are reproduced in table 2.4. The ERP measures are apparently based on nominal tarrifs rather than attempting to correct for price controls and the particular DRCs listed are those with no correction for differences between market and shadow prices.

Girgis's DRC ratios are high, but as we shall see shortly this tends to be true of input-output table calculations more generally. Focussing however on the relative ranking, most of his results are consistent with those of Hansen and Nashashibi. Thus, the basic metal products, and paper and printing are among the most disadvantageous. It is, however, somewhat surprising to see the transport equipment sector with such a low DRC, but this could result from low financial profitability of the sector and hence low estimated capital costs.

The most advantageous sector found by Girgis is the beverage industry, and indeed this is the only sector actually estimated to have a comparative advantage (a DRC between 0 and 1). However, cement (other non-metallic products) again shows up as one of the most advantageous of the sectors.

Table 2.4 Girgis' DRC and ERP Measures for Manufacturing

| | ERP | DRC (L.E. per U.S.$) |
|---|---|---|
| Food | 1.56 | 1.622 |
| Beverage | 1.91 | 0.719 |
| Tobacco | -- | - 0.916 |
| Textile | 0.08 | 1.554 |
| Clothing | 1.50 | 1.829 |
| Leather | 0.35 | 1.498 |
| Shoes | 1.89 | 1.714 |
| Wood and furniture | 0.51 | 1.312 |
| Paper and printing | 1.79 | 39.291 |
| Chemicals | 0.32 | 2.214 |
| Rubber products | 0.33 | 3.384 |
| Pottery | 0.53 | 1.171 |
| Glass products | 1.47 | 1.923 |
| Other non-metallic prod. | 0.23 | 1.130 |
| Basic metal prod. | 0.43 | 5.416 |
| Machinery | 0.50 | 1.268 |
| Transport equipment | 0.37 | 1.004 |

E. AHMED M. GALAL

Galal's M.A. Thesis at A.U.C., "Economic Efficiency in Public Sector Enterprises, a Case Study of Cement Industry Egypt," May 1980 examines four public cement companies performance in 1978. These appear to be the same results as those discussed in connection with Dr. Handoussa's tables and will not be discussed separately.

F. AMR AMEEN ALI

Another A.U.C. M.A. Thesis, "The Economic Efficiency of the Egyptian Company for Chemical Fertilizers. A Case Study of the Egyptian Nitrate Fertilizer Industry," May 1981, by Ali updated our information on nitrogen fertilizer production. Examining the operations for Kima for 1977, 1978 and 1979. Ali concludes that the DRC per U.S.$ was:

| | |
|---|---|
| 1977 | 1.154 |
| 1978 | .940 |
| 1979 | .957 |

which exceeds his adopted shadow exchange rate in each year. In other words, Ali concludes Kima would not be worth further expansion. Ali also shows that this is not a consequence of existing excess capacity in Kima (about 12% at the time), but is mostly attributable to its electricity intensive process.

G. PETER DAVIS AND JIM NORRIS

In "Egypt's food and energy subsidies", U.S.AID report, 1979, Davis and Norris again look at Egypt's two most electricity intensive activities -- aluminium and nitrogen fertilizer production --- in the light of more careful computations on the shadow price of electricity generation and transmission.

In the case of both Nag Hammadi and Kima they find a negative value added at world prices, thus suggesting these sectors are even more disadvantageous than some other authors had concluded. The main reason for the strenghtening of this disadvantageous position appears to be the adoption of a higher conversion coefficient from market to shadow prices for electricity.

## III. New calculations:-

For the purposes of the present study, calculations have been undertaken on three main sets of data: the 1977 input-output table, data provided by the D.I.B. and Investment Authority on individual enterprises, and on specific products within the engineering sector. The nature of these calculations is here reported in turn. Our original intent to examine data from the public sector was thwarted by lack of data availability.

### A. The Input-Output Table:-

The calculations of this section adopted the 1977 English language version of the input-output table for Egypt.* Working from an input-output table for such studies has both advantages and disadvantages. A major advantage is that non-tradable inputs, such as transport or services, may be decomposed into their tradable inputs and primary factor inputs, thus permitting estimates of indirect use of foreign exchange and primary factors by manufacturing sectors via purchase of non-tradables. On the other hand, the input-output table comprises a relatively high degree of aggregation.

In particular, the Egyptian input-output table has 32 sectors in total. Of these, 4 are in agriculture, 2 in mineral extraction and 7 are non-tradables or services (electricity, construction, transport,communication and storage, Suez Canal, housing, tourism, other services). This leaves 19 manufacturing sectors, whose total value added in domestic prices represents about 19 percent of total value

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* A revised version of this table exists in the Arabic, but this version became available in tractable form too late for adoption in thisportion of the work. In most instances the revision is not, however, major.

added by the 32 sectors. The 19 sectors and their relative contribution to value added at domestic prices are listed in table 3.1.

As of 1977, about one third of all manufacturing was thus concentrated in two sectors, the food industry and spinning and weaving. These two sectors are followed in size by chemicals, final wear and tobacco, of which only chemicals is over 10 percent of manufacturing value added.

Of the 19 sectors, two do not warrant investigation in terms of comparative advantage. First, whether the miscellaneous industry sector has or does not have a comparative advantage would not tell us too much owing to the great heterogeneity of the sector. Second, it is very difficult to establish a meaningful world price comparison for newspapers and books produced by the publishing and printing sector. The remaining 17 sectors are, however, studied here.

1. Tradeable Material Inputs:-

As noted in section I, the Domestic Resource Cost approach to comparative advantage requires evaluation of value added by a process in terms of border prices in order to estimate net-foreign exchange gained through import substitution or export promotion.

As a first step towards this, material inputs must be estimated in terms of world prices. The input-output table contains two such sets of material inputs -- the domestically produced and those imported.

Table 3.1.

Relative contribution of 19 manufacturing sectors to value added at domestic prices

| Sector | % |
|---|---|
| Food industry | 17.4 |
| Beverage industry | 2.0 |
| Tobacco industry | 7.0 |
| Spinning and weaving | 17.0 |
| Final wear | 7.6 |
| Wood and wood products | 2.9 |
| Paper and paper products | 1.7 |
| Publishing and printing | 1.5 |
| Leather and leather products | 0.7 |
| Rubber industry | 0.9 |
| Chemical industry | 10.7 |
| Oil products and coal | 5.2 |
| Non-metallic products | 4.2 |
| Basic metals | 5.8 |
| Metallic products | 2.6 |
| Non-electrical machinery | 0.9 |
| Electrical machinery | 3.5 |
| Means of transport | 4.2 |
| Miscellaneous industry | 4.3 |
| | 100.0 |

Source: 1977 Input-Output Table.

a. Imported materials:-

The input-output table has just one row of imported material inputs into each sector -- a row recorded in domestic prices. Some method has to be used to disaggregate this row in order to establish a plausible basis for conversion to world prices. In fact, the procedure adopted here is to first disaggregate this row into a matrix of product imports.

The 1979 Yearbook of International Trade Statistics, U.N., New York, 1980, reports imports by Egypt for 1977 on a commodity basis valued at c.i.f. prices in U.S. dollars. From this list, only certain items are likely to be material inputs. These items were aggregated into 18 commodity groups dictated by the reported data. To the c.i.f. values was added the import duty on each of the commodity imports and the relative amount of each commodity in this total value calculated. These relative contributions were then used to disaggregate total material inputs as reported in the input-output table across the commodity classes. In the matrix of commodity material inputs by sectors we now had the sums of each row and of each column. To assign these sums to individual cells three methods were used. First a few commodities were likely to be used almost entirely by one sector: rubber by the rubber industry, tobacco by the tobacco industry and so on. The commodity row sums were accordingly assigned to these cells with zeros elsewhere in the row. In other cases, commodities are likely to be used by just a few sectors, and these commodities were assigned to these sectors in proportions measured from relative sectoral material imports within this group of sectors (after deducting previously assigned imports).

Finally, some commodities were of quite general use-- such as chemicals -- and these were assigned to cells in proportion to relative sectoral material imports (after deducting prior assignments). The columns of the resulting matrix were then used to compute a weighted average import duty on materials for each sector. In doing so, nominal tariffs were taken from the 1980 Customs Rates Schedule, the 1977 rates not being available, and to these were added 16 percentage points and 3 percent of the nominal tariff to allow for consolidation duty, stamp duty, etc. prior to 1980. Finally, the weighted tariff rates for imports by each sector were used to deflate imports of materials to a world price estimate in Egyptian pounds. To the extent that the gap between world price and value as recorded in the input-output table for material inputs differs drastically from the import duties on such items, this obviously represents a potential source of error.

b. Domestically produced materials:-

The values in domestic prices reported in the input-output table were deflated to world prices simply using the nominal tariff plus consolidation and other duties for the major outputs of each sector. To these were added the deflated material imports to obtain an estimated total of tradable raw materials used by each sector valued in world prices.

2. The Non-tradable Inputs:-

Electricity, transport and communication, construction, and other services each sell part of their product to the manufacturing sectors. Being essentially non-tradeable, their outputs cannot be evaluated directly at world prices.

instead their tradeable material inputs were calculated as for the other sectors above. The value of these materials at world prices per unit of total output by the particular service sector is then multiplied by expenditure on the service by each manufacturing sector. This calculation is carried further to a second round, to include the materials used by one service in producing output for sale to another service and hence to manufacturing. Thus oil used in the production of electricity is charged to textile production to the extent that textiles purchase electricity, and to the extent textiles use transportation and transportation in turn uses electricity.

3. Evaluation of Outputs:-

The products of the 17 manufacturing sectors were estimated at world prices, with 3 exceptions, using import duties including consolidation and other duties on the principal products. The three exceptions were instances where price controls obviously existed and, consequently, import duties could not be expected to approximate the gap between domestic and world prices.

Controls on food prices are widespread in Egypt. Thus some direct comparison of world and domestic prices seemed essential. The IFC Report on the Delta Sugar Company contains world and domestic prices on comparable rice grain showing domestic price well below world price. This comparison is therefore adopted for the food industry. In spinning and weaving, textile prices are again known to be held below world price. From the World Bank Staff Appraisal Report on NSWC

Textile Project, March 1980, a domestic price for materials is obtained and from the Boston University Report on Comparative Advantage of Bangladesh a world price on comparable material obtained. Thirdly, from An Assessment of Egypt's Industrial Sector, by A.D. Little Associates, comparable domestic and world prices of cement are obtained. In these three cases, tariff equivalents are computed and reported in table 3.2.

4. Effective Protection:-

By subtracting materials at world prices from output estimated at world prices, one obtains a figure for value added at world prices (VAWP). Together with the value added at domestic prices (VADP) in the input-output table, this permits a calculation of the effective rate of protection granted to each sector, given by: $ERP = \frac{VADP}{VAWP} - 1$

The results are reported in table 3.2*. It is well-known that in a general equilibrium framework, effective rates of protection are not easy to interpret. However, it is generally true that competitive industries with higher positive ERP would probably have resources drawn into them by the overall structure of protection, those with ERP between -1 and 0 have resources squeezed out, and those with ERP below -1 again receive net protection.

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* These measures are biased downwards in that VAWP subtracts only materials used by the service inputs whereas VADP subtracts the full cost. The fact that purchases of oil as a material input are not corrected for the very low domestic price change also acts to raise VAWP estimates and hence cause downward bias in the ERP measures.

The results in table 3.2 accord with general findings on other countries. In particular, nominal protection (as measured in column 1) and effective protection are quite highly correlated. The three traditional manufacturing sectors -- food, textiles and nonmetallic products (cement) -- apparently receive the least protection. Indeed estimates are negative in each case, suggesting that competative firms in these sectors would be discouraged from production. In the case of spinning and weaving, this is probably a low estimate, however, for it does not recognize the subsidized price at which raw cotton is sold to this sector, nor the low domestic price of internal transfers within the sector. If both of these are corrected, raw cotton being taken to have a world price about 2.5 times domestic price, then the ERP on the textile sector rises sharply to about 0.91, a quite high positive rate.

In the case of the food industry, the computed VAWP is certainly quite unreasonably large. If one assumes sales by one food sector enterprise to another are at prices equal to 30% of world prices, ERP does rise but only by 1 percentage point. Moreover it is known that material inputs from agriculture to the food industry are not on the whole subsidized (with the possible exception of wheat). Thus, the unreasonably large VAWP must result from too high a domestic to world price inflator on the output. Yet even if domestic prices of outputs were as high as world prices, which is known not to be true, effective protection on the food industry would still be negative.

Only one sector exhibits a negative value added at world prices -- the leather and leather products sector. The meaning of this negativity will be discussed in more detail later, but in essence this would mean the leather sector's material inputs cost more on the world market than does its output. But in 1977, domestic controls were particularly pervasive on shoes. If, for example, one assumes that 75 ercent of the leather industry output is shoes and that world price is about 2.5 times domestic, then ERP shifts radically to -0.81, representing discouragement of production. Certain items of output from the electrical machinery sector also had domestic prices so newhat below world prices owing to price controls -- televisions, refrigerators, etc. Owing to substantial quality differences it is very difficult to say how large or how pervasive these gaps are, but this would tend to lower the ERP measure for electrical machinery.

Besides leather, four other sectors are found to have very high rates of effective protection, suggesting that they are much favoured by domestic price formation of outputs relative to inputs. These are the beverage industry, which has quite high nominal protection on imported sodas, wood and wooden products, electrical machinery, and means of transport (including automobiles). Such high rates of protection are normally warranted only for a short period on nontraditional items during an infant industry stage of leaming, and even this

Table 3.2.

Effective Protection Measures

(See discussion in Text)

| Sector | Implicit duty used to deflate output | VADP ('000 L.E.) | VAWP ('000 L.E.) | ERP |
|---|---|---|---|---|
| Food | -0.70 | 232,900 | 2,911,250 | -0.92 |
| Beverage | 1.70 | 27,100 | 3,016 | 7.99 |
| Tobacco | 0.37 | 93,000 | 67,723 | 0.37 |
| Spinning & Weaving | -0.20 | 226,800 | 482,553 | -0.53 |
| Final wear | 0.68 | 101,200 | 70,432 | 0.44 |
| Wood | 1.19 | 38,900 | 8,861 | 3.39 |
| Paper | 0.21 | 22,900 | 22,689 | 0.01 |
| Leather | 1.19 | 8,900 | -3,304 | -3.69 |
| Rubber | 0.42 | 11,800 | 8,233 | 0.43 |
| Chemical | 0.31 | 143,100 | 115,026 | 0.24 |
| Oil products & Coal | 0.26 | 69,766 | 54,202 | 0.29 |
| Nonmetalic products | -0.60 | 55,700 | 278,500 | -0.80 |
| Basic metals | 0.42 | 77,100 | 55,769 | 0.38 |
| Metalic products | 0.26 | 34,900 | 26,034 | 0.34 |
| Nonelectical machinery | 0.37 | 12,400 | 9,514 | 0.30 |
| Electrical machinery | 0.93 | 46,600 | 6,797 | 5.86 |
| Means of transportation | 0.93 | 55,500 | 12,237 | 3.54 |

As with leather, however, our estimate for beverages is probably too high in using the nominal protection measure to convert to world prices. Dr. Handoussa, March 1979, op cit, tentatively suggests for example some sodas may be priced domestically at about 70 percent of world price. Using this as our output correction factor, ERP remains positive but falls to only 0.24.

On the whole, the effective protection granted to other nontraditional manufactures is not extremely high, these nine sectors ranging from 1% on paper and paper products to 44% on final wear.

Whether the measured ERP in fact act in the indicated directions for resource pull is not obvious. Since such a large fraction of industry is in the public sector, where pressures to be responsive to price signals are normally less, this may not be the case. Yet even in a public sector, high effective protection means that it is easier to hire a large labor force and yet turn a profit. If there are strong pressures for the public enterprises to make a profit but not necessarily to maximize profits, this means the public sector will on balance be somewhat responsive to effective protection levels but not as responsive as competitive firms would be.

One other issue with regard to the public enterprises may also be mentioned. To the extent financial losses or even low returns on capital are permitted to persist on public enterprises without forcing them out of business, this really is an additional form of protection not incorporated in our present measures.

## 5. Primary Factor Inputs:-

In order to extend this analysis toward a comparative advantage analysis, it is necessary to split domestic value added in each sector into wage and nonwage components.

The data to do so were most kindly provided by Prof. Amr Mohie Eldin. In fact these data refer to a somewhat revised version of the input-output table, but the ratios of wages to nonwages were used to divide up value added in the input-output table.

As with materials, indirect use of labor and nonlabor factors through service inputs and through service inputs into services were included as primary factor requirements for each of the manufacturing sectors in the input-output table.

From these figures we may view the relative labor intensity of the various sectors in the table as measured in market prices. In particular, table 3.3 presents the ratio of direct and indirect labor costs to direct and indirect nonlabor primary costs for each sector.

Table 3.3

Relative Direct and Indirec
"Labor Intensity"

| | Direct and indirect labor to nonlabor costs. |
|---|---|
| Food | .36 |
| Beverage | .22 |
| Tobacco | .45 |
| Spinning & Weaving | 13.36 |
| Final wear | .67 |
| Wood | 20.18 |
| Paper | .25 |
| Leather | .59 |
| Rubber | .41 |
| Chemical | .55 |
| Oil products & Coal | .40 |
| Nonmetalic products | .41 |
| Basic metals | .51 |
| Metalic products | .42 |
| Nonelectrical machinery | .36 |
| Electrical machinery | .29 |
| Means of transportation | .62 |

It is immediately apparent from this table that the most labor intensive sectors are spinning and weaving and the wood and wood products. Indeed, no other sector is even close. At the opposite extreme the most "capital intensive" are beverages, paper, and electrical machinery.

Comparing tables 3.3 and 3.2 it is noteworthy that of the three most "capital intensive" sectors, two have the highest and second highest rates of effective protection. The exception to this rule is paper which is reported to be "capital intensive" yet estimated to have very low protection.

At this juncture, we might note that since no data on actual capital stock are available by sector in this input-output context, it has to be assumed that nonlabour value added at market prices is proportional to underlying capital stock. It must be recognized that in an economy with pervasive price controls and so many public enterprises, this is certainly not a trivial assumption.

6. Shadow prices of capital and labor.

Systematic computations of shadow prices (social worth) do not seem to have been undertaken, though some are now under way in the World Bank.

For unskilled labor, the Greater Cairo Wastewater Report, Vol. 6, Ministry of Housing and Reconstruction adopts a conversion factor of 0.7. That is the shadow cost of unskilled labor is taken to be about 0.7 times its market wage. Elsewhere in this report, a rate somewhat below this is suggested -- in the neighborhood of 0.6. Essentially, the arguments for a shadow wage below the market wage hinge on the fact that even if today's labor market is showing some signs of tightness (rising real wages, opening of more jobs to women), job creation must receive high priority for the near future as the labor force expands. Of course, use of shadow wage below market wage will tend to cause recommendation of the relatively more labor intensive sectors.

In general, if the shadow price of labor is below market wage the shadow price of capital is normally above its market cost. In the context of the present input output table, no capital stock figures are available. Rather, capital costs must be based on nonlabor value added as mentioned above. If profits represent say a 10 percent private rate of return on book value of capital and the social rate of return is 10 percent on replacement cost of capital, social cost would be twice market profits if replacement cost is double the book value. That replacement cost is much higher than book value stems from the historic cost basis of book valuation and intervening years of rising prices. If the social rate of return is greater than 10 percent the conversion factor would be higher still. On the other hand, nonlabor value added probably includes some pure economic rents from monopoly positions or restricted markets rather than just returns to capital and this would argue for a somewhat lower conversion factor.

Given the uncertainty as to the true conversion factors, a wide range of alternatives is considered in the present calculations, with the shadow price of labor ranging from 0.4 to 0.8 and that of capital from 1.0 to 1.5. Fortunately, the choice of shadow prices does not make a great difference to the results.

7. Social Cost of Electricity, and other Services:-

The gap between the social cost of generating and transmitting electricity and the prices charged to industry is well-known to be very large. A close examination of this issue in, USAID "Economic Cost of Electricity", drafted by P. Davis and J. Norris, indicates a cost of electricity 3.12 times

its price for most manufacturing and as much as 20.27 for aluminium where a lower market price is charged. These conversion factors are therefore adopted here.

Since electricity is thus valued directly at shadow cost it enters the numerator of our DRC Formulation and correspondingly the vlaue added at world prices must be increased for each sector by no longer subtracting the imported content of electricity generation.

Other service sector inputs continue, however to be decomposed into primary factor and tradeable inputs as for the ERP calculations.

8. Domestic Resource Cost of Foreign Exchange Measures:-

With this background we are now in a position to measure the domestic resource cost of foreign exchange for each sector. This is given by:

DRC = (social cost of direct and indirect labor and capital required + social cost of electricity used)/ value added at world prices.

In this measure both numerator and denominator are in Egyptian pounds. Thus it is a measure of the cost in terms of labor, capital and electricity of saving 1 L.E. through import substitution or through export promotion on average in that sector. The lower (positive) the value of this ratio, the more attractive is that industry in terms of Egypt's comparative advantage. In other words, it is generally better to pursue industries with low DRC ratios and to use the foreign exchange saved/earned in so doing to import the products of higher DRC

Industries with negative value added at world prices exhibit negative DRC ratios, meaning that production not only uses labor, capital and electricity but actually uses up foreign exchange on a net basis. Such industries are not normally worth pursuing unless some overriding argument can be made, such as anticipated rapid movement to positive VAWP as learning proceeds.

Industries with a DRC greater than 1 require more than 1 L.E.'s worth of resources to generate 1 L.E.'s worth of foreign exchange. Such industries may however be worthy of expansion if it is felt that foreign exchange is at a premium -- that 1 L.E.'s worth of foreign exchange has a social value in excess of 1 L.E.. At present, the Egyptian balance of payments is quite healthy. Yet some of the major items of foreign exchange earnings are either likely to be depleted (oil), to ultimately decline (foreign aid flows) or are uncertain (future remittances from Egyptians working abroad). Thus, despite a currently healthy balance of payments, the capacity of the manufacturing sector to generate foreign exchange in the near future may reasonably be felt to be at a premium, warranting expansion of sectors with DRCs at least somewhat above 1.0.

The DRCs for a central set of shadow prices are tabulated in 3.4. In particular, the shadow price of labor is 0.6 and that of capital 1.5

The results fall into three main classes. Three sectors have DRCs between 0 and 1 -- food industry, spinning and weaving, and nonmetallic products -- seemingly suggesting that they are very attractive propositions. In at least

Table 3.4

DRC Ratios for Median Primary factor shadow prices

(See discussion in Text)

| Sector | DRC ratio |
|---|---|
| Food | 0.11 |
| Beverage | 13.49 |
| Tobacco | 1.90 |
| Spinning and weaving | 0.35 |
| Final wear | 1.89 |
| Wood | 3.68 |
| Paper | 1.62 |
| Leather | -3.77 |
| Rubber | 2.26 |
| Chemicals | 1.89 |
| Oil products & Coal | 2.09 |
| Nonmetallic products | 0.36 |
| Basic metals | 3.38 |
| Metalic products | 2.05 |
| Nonelectrical machinery | 1.89 |
| Electrical machinery | 9.81 |
| Means of transportation | 6.33 |

the spinning and weaving sector some reservations must be expressed. In particular, the input of raw cotton to textiles was at a heavily subsidized rate, a fact not embodied in the calculations of table 3.4. In fact if the world price or raw cotton were some 60% higher than the domestic price used for evaluation in the input-output table, and sales within the textile sector are adjusted as in the ERP case, the DRC for spinning and weaving would rise to 1.46. This suggests at best marginal social advantage from the existing spinning and weaving sector. On the food industries we might note that sales ofmaterials within the sector have in table 3.4 been valued at domestic price less duty. If instead the implicit rate in table 3.2 were used, the DRC of the food industry rises somewhat but only to 0.252, remaining well within the attractive range.

The next group of industries are 8 nontraditional sectors having DRCs ranging from 1.62 to 2.26. In descending order of estimated attractiveness they are:

i) paper
ii)- iv) final wear, chemicals, nonelectrical machinery
v) tobacco
vi) metallic products
vii) oil products and coal
viii) rubber.

If foreign exchange is held to be at a premium, or if our estimates are somewhat on the high side, then this group of industries would seem to be the next most attractive targets. Given that the range of DRCs is quite narrow and given reasonable confidence intervals on the estimates there is not too much to choose between these from the present data.

The third group is those 6 sectors which seem quite unattractive for expansion along existing lines: beverages, wood prod ..s, leather, basic metals, electrical machinery, and means of transport. About at least two of these we must however express considerable reservation on judgement.

First, in the light of evidence to be presented subsequently and of prior results, this result on the beverage industry is probably too high. This may result from having estimated world price by subtracting import duty, whereas controls on domestically produced beverages -- such as sodas -- probably held prices even below world prices. Thus, if we adopt Dr. Handoussa's 70 percent conversion mentioned earlier, the beverage DRC falls to 1.87 and joins the marginal second group.

Also, in 1977 controls still existed on leather shoes' prices though a 100% nominal tariff exists. If instead, one assumes 75 percent of the leather industry output is shoes and that world price is about 2.5 times domestic then not only does value added at world prices become positive for this sector but indeed the DRC becomes 0.267 making this an attractive proposition.

Finally, as noted earlier, VAWP is probably higher in electrical machinery than is assumed for table 3.4, thus lowering that DRC, though by quite how much we cannot be certain.

9. Sensitivity to Shadow Prices:-

As mentioned earlier, estimates of shadow prices are rather arbitrary, and so it would seem desirable to examine the sensitivity of our DRC measure to variations in shadow prices. This is undertaken in table 3.5 which reports figures comparable to those in table 3.4 but for four permutations of shadow prices. -- that of labor at 0.4 and 0.8 and that of capital at 1.0 and 2.0

It is at once striking that the grouping of DRCs is remarkably insensitive to the shadow prices chosen, though of course the same reservations and adjustments hold as for table 3.4.

10. Sensitivity to World Price Estimates:

If the DRCs are relatively independent of shadow prices adopted, the same is not true of the world prices of outputs as seen for some cases in section 3.8. Unfortunately our study was not given access to those trade data which would have allowed more reliable estimates, and although we have tried to allow for gaps other than those caused by import duties, particularly in the text, sufficient data simply were not made available to allow for all subsidies and price controls intrinsic to the Egyptian system.

However, we may at least pose a slightly different question of the data. For those sectors which do not suggest a resource caost below value added at world prices -- i.e. having a DRC above 1 or below 0 -- what gap between world price and domestic price of the output would generate a new DRC which would advocate further investment.

Table 3.5

## Sensitivity to Shadow Prices

(See Discussion in Text)

| | Shadow prices | | | |
|---|---|---|---|---|
| | Labor 0.4 | | labor 0.8 | |
| | Capital 1.0 | Capital 2.0 | Capital 1.0 | Capital 2.0 |
| Food | 0.08 | 0.14 | 0.09 | .15 |
| Beverages | 9.04 | 17.24 | 9.74 | 17.95 |
| Tobacco | 1.28 | 2.33 | 1.47 | 2.52 |
| Spinning and Weaving | 0.24 | 0.28 | 0.43 | 0.47 |
| Final wear | 1.27 | 2.25 | 1.53 | 2.52 |
| Wood | 2.61 | 2.84 | 4.52 | 4.75 |
| Paper | 1.12 | 2.03 | 1.21 | 2.21 |
| Leather | -2.53 | -4.53 | -3.01 | -5.01 |
| Rubber | 1.61 | 2.73 | 1.80 | 2.91 |
| Chemicals | 1.36 | 2.23 | 1.55 | 2.42 |
| Oil products and Coal | 1.42 | 2.58 | 1.60 | 2.77 |
| Nonmetalic products | 0.26 | 0.43 | 0.28 | 0.45 |
| Basic metals | 2.78 | 3.78 | 2.98 | 3.98 |
| Metalic products | 1.45 | 2.48 | 1.62 | 2.65 |
| Nonelectrical machinery | 1.30 | 2.33 | 1.44 | 2.47 |
| Electrical Machinery | 6.70 | 12.28 | 7.35 | 12.92 |
| Means of transport | 4.33 | 7.54 | 5.13 | 8.34 |

Let R be the shadow price of foreign exchange conversion factor. For any sector to warrant investment, generally requires that

$$R \geq C/(Q - A)$$

Where C is the social cost of resources, Q the value of output in world prices and A the cost of materials in world prices. If we write the gap between domestic value of output Qd and Q as

$$Qd = Q \cdot (1 + t^*)$$

then if

$$R \geq \frac{C}{\frac{Qd}{1 + t^*} - A}$$

The sector warrants investment. Rearranging provides

$$t^* \leq \frac{R \cdot Qd}{R \cdot A + C} - 1 \qquad \text{if } Q - A > 0.$$

Calculations on the values of t* which just satisfy this constraint are presented in table 3.6* . In particular, solutions for the instances when the shadow price of labor is 0.4 or 0.8 and of capital 1.0 or 2.0, with R -- the conversion factor for foreign exchange -- set equal to 1.0 are tabulated.

---

* All satisfy the constraint Q - A > 0 at t*.

Table 3.6

Marginal Acceptable Gaps Between World and Domestic Prices to Render DRC Estimates Equal to 1.0

| Sector | Shadow prices | | | |
|---|---|---|---|---|
| | Labor 0.4 | | Labor 0.8 | |
| | Capital 1.0 | Capital 2.0 | Capital 1.0 | Capital 2.0 |
| Food | 0.16 | 0.02 | 0.14 | 0.01 |
| Beverages | 0.35 | -0.09 | 0.29 | -0.12 |
| Tobacco | 0.19 | -0.01 | 0.15 | -0.04 |
| Spinning & Weaving | 0.45 | 0.41 | 0.26 | 0.23 |
| Final wear | 0.49 | 0.13 | 0.37 | 0.06 |
| Wood Products | 0.62 | 0.57 | 0.28 | 0.25 |
| Paper | 0.10 | -0.17 | 0.06 | -0.19 |
| Leather | 0.25 | 0.04 | 0.19 | 0.00 |
| Rubber | 0.12 | -0.16 | 0.06 | -0.19 |
| Chemicals | 0.11 | -0.14 | 0.04 | -0.18 |
| Oil products & Coal | 0.07 | -0.09 | 0.04 | -0.11 |
| Nonmetalic Products | 0.09 | -0.17 | 0.04 | -0.21 |
| Basic metal | -0.06 | -0.19 | -0.09 | -0.22 |
| Metalic Products | 0.05 | -0.15 | 0.01 | -0.18 |
| Nonelectrical Machinery | 0.18 | -0.09 | 0.13 | -0.12 |
| Electrical Machinery | 0.23 | -0.06 | 0.19 | -0.08 |
| Means of transport | 0.29 | 0.02 | 0.21 | -0.04 |

As an example of how to interpret this table, the first figure for the food sector says that as long as the domestic price in which output is recorded in the input-output table is no more than 16 percent above the world price, the DRC for this shadow price combination will certainly be in the acceptable range of 0 to 1. Of course the higher is the number, the greater the chance this condition will be met in general. On the other hand a negative number says that only if the domestic price is actually below the world price for that sector will the DRC be as low as 1.

A number of sectors are acceptable at the higher shadow price of capital only if domestic price is below world price in the recorded data. For the basic metals, this requirement is necessary over the whole range of shadow prices.

For sectors such as metalic products, oil products and coal, paper and paper products, chemicals, and rubber, the DRC falls to 1 only if the gap between domestic and world price is no more than 10 to 12 percent even at the lowest shadow price permutation.

On the other hand, the reason the DRCs are not as low as 1 for beverages and final wear (both particularly at the lower shadow cost of capital) and of wood products (particularly at the lower shadow cost of labor) is that gaps resulting from import duties used in earlier computations exceeded the fairly high permissible gaps.

If better data were made available it would be possible to say with more authority whether such gaps were indeed met for particular sectors.

Separate calculations on sensitivity with respect to material input conversion to world prices are not undertaken here, but note that whether VAWP is downward biased because domestic output is deflated too much or domestic materials too little is essentially the same, so that the foregoing may in some degree stand in place of such a separate study of sensitivity.

B. Data on Individual Firms:-

Some information on individual firms(almost entirely private) was kindly made available to this study through:

Mr. A. Kaboudan at the Development Industrial Bank,
Mr. Ismail Ghanem at the Investment Authority,
and through U.S.AID records.

In particular, data on some 35 firms were compiled in sufficient detail for comparative advantage analyses.

The advantages of such data are really two-fold. First they permit a far more disaggregated view than, say, looking at chemicals as a whole. Second, one has estimates of capital stock for these firms as opposed to the very heroic assumption above that profits in a sector reflect the amount of capital used.

The essential procedure is to form a series of aggregate numbers for each firm.

i) the value of output in world prices, using direct information on world prices where possible and deflation by import duties otherwise.
ii) the value of tradeable materials used in world prices, obtained as in (i)
iii) the number of unskilled workers employed.
iv) the number of professional and skilled workers employed.
v) the book value of real capital, including inventories.
vi) expenditure on electricity.
vii) expenditure on services.

All value figures are referred to a common 1979 basis using the Egypt wholesale price index for all items.

As before DRCs are computed for a range of shadow prices. However two different versions of these prices are needed. On the one hand expenditure on services is broken down into labor, profit and tradeable goods cost using ratios taken from the 1977 input-output table. These figures are in value terms and to these the previous conversion factors -- 0.4, 0.6, 0.8 for labor, 1.0, 1.5, 2.0 for profits -- are applied. But labor and capital employed directly by the firms are in numbers of workers and book value respectively. The flow conversion equivalents of the previous ratios were taken to be for unskilled labor:

| Conversion (ratio) | Shadow wage (L.E. per month) |
|---|---|
| 0.4 | 20 |
| 0.6 | 30 |
| 0.8 | 40 |

for capital:

| Conversion ratio | Shadow rate of return on book value |
|---|---|
| 1.0 | 0.2 |
| 1.5 | 0.3 |
| 2.0 | 0.4 |

At first sight it may seem that 20 to 40 percent rates of return are high, but it must be remembered that these are returns on book value, which is normally well below replacement cost. However, for those firms reporting newer capital in the applications, the lower figure is more reasonable.

The shadow wages of skilled and professional workers are assumed to average twice those of unskilled workers, and the shadow cost of electricity to be as in section A.

Two types of calculation are undertaken, for sectoral averages and for each firm separately.

1. Sectoral averages:-

These averages are computed by simply summing across firms all of the direct and indirect labor, capital and electricity costs in the numerator and dividing by the sum of values added at world prices. The results are presented in table 3.7.

On the whole the DRCs are much lower than those estimated from the input-output table and indeed all but one sector lies in the 0 to 1 definitely acceptable range. These lower values may result from at least 4 main sources.

a) the data are far more disaggregated and detailed in table 3.7, presumably permitting better estimates
b) some of the sectors with high DRCs from the input-output table are not represented in table 3.7, such as means of transport or basic metals.
c) since each of the 35 firms is applying for expansion or to be newly established, the sample is biased, presumably towards those firms which may be more dynamic and use newer equipment.
d) being extracted from application data, one might expect lower DRCs as simply inherent in the application process.

Table 3.7

## Sectoral Average DRCs From Firm Level Data

| Sector | Shadow price | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Labor 0.4 | | | Labor 0.6 | | | Labor 0.8 | | |
| | Capital | | | Capital | | | Capital | | |
| | 1.0 | 1.5 | 2.0 | 1.0 | 1.5 | 2.0 | 1.0 | 1.5 | 2.0 |
| Spinning & Weaving | 0.46 | 0.48 | 0.50 | 0.51 | 0.53 | 0.55 | 0.56 | 0.58 | 0.60 |
| Food | 0.17 | 0.19 | 0.22 | 0.21 | 0.23 | 0.26 | 0.25 | 0.27 | 0.30 |
| Chemicals | 0.11 | 0.12 | 0.13 | 0.12 | 0.14 | 0.15 | 0.14 | 0.15 | 0.16 |
| Engineering | -0.20 | -0.24 | -0.27 | -0.25 | -0.29 | -0.32 | -0.30 | -0.34 | -0.37 |
| Metal Products | 0.37 | 0.43 | 0.49 | 0.48 | 0.54 | 0.60 | 0.59 | 0.65 | 0.70 |
| Nonmetallic Products | 0.17 | 0.20 | 0.23 | 0.21 | 0.24 | 0.27 | 0.25 | 0.29 | 0.32 |
| Furniture | 0.13 | 0.14 | 0.15 | 0.16 | 0.17 | 0.18 | 0.19 | 0.19 | 0.20 |
| Paper & Publishing | 0.17 | 0.20 | 0.22 | 0.22 | 0.25 | 0.27 | 0.27 | 0.30 | 0.32 |

Yet despite the almost uniform acceptability of the sectoral DRCs in table 3.7, the engineering sector fails to pass, indeed displaying a negative value added at world prices on average across its sampled firms.

It is interesting to note also, that although below 1 the spinning and weaving sector and metal products sectors have DRCs 2 or 3 times higher than the other sectors' firms, making them at least relatively less attractive. This result on metalic products is consistent with the finding in table 3.6 that metallic products have a DRC as low as 1 from the input-output table only if domestic price is very close to or below world price. The result on spinning and weaving is also consistent with the relatively low attractiveness found from the input-output table once the subsidy on raw cotton is recognized.

The low DRCs on both food and nonmetallic products in table 3.7 reconfirms the argument for Egypt's comparative advantage in these general fields.

The low DRCs on chemicals and paper sectors also strengthen the argument from above that these are among the more attractive nontraditional sectors.

Finally, the low DRC for furniture suggests that at least this portion of the wood products sector is worthy of pursuit. If this could be generalized it would argue that the output deflator used in computing the DRCs from the input-ouput table was too high and certainly a high acceptable deflator was found in table 3.6 at least for low shadow prices of labor.

2. Individual enterprises:-

The sectoral averages may hide considerable variation within sectors whether by product or by firm. DRCs for all 35 firms are therefore reported separately in table 3.8.

Examining the products/firms within sectors we indeed find in some sectors a considerable range of DRCs and also the definition of sectors is so heterogeneous as to overlap other sectors in some instances.

Among the 3 observations on firms in the textile sector there are no cotton textile firms per se. The firms producing carpets and canvas indeed seem desirable but the data on that producing acrylic and polyester fibers suggests the social cost of earning foreign exchange is too high at most of the shadow prices tried.

In the food sector all but one firm have DRCs well below 1. The exception is a fruit juice firm, which reports an extremely high inventory -- more than 6 times fixed capital. Such inventory levels, if correct, must generally make any undertaking quite unattractive since a large amount of capital is thus tied up. At the opposite end we might note the two colas -- really in the beverage sector -- with very low DRCs. This would lend support to the above argument that the basic deflator adopted in our input-output work on beverages is too high.

Table 3.8.

## DRC Estimates for Individual Firms

| Sector/firm's products | Shadow price | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Labor 0.4 | | | Labor 0.6 | | | Labor 0.8 | | |
| | Capital | | | Capital | | | Capital | | |
| | 1.0 | 1.5 | 2.0 | 1.0 | 1.5 | 2.0 | 1.0 | 1.5 | 2.0 |
| **Spinning & Weaving** | | | | | | | | | |
| 1. Acrylic & Polyester fibers | 0.98 | 1.00 | 1.03 | 1.04 | 1.06 | 1.08 | 1.10 | 1.12 | 1.14 |
| 2. Mechanical carpet pieces | 0.11 | 0.12 | 0.14 | 0.14 | 0.15 | 0.17 | 0.17 | 0.18 | 0.19 |
| 3. Dyed and nondyed canvas | 0.27 | 0.30 | 0.33 | 0.34 | 0.37 | 0.40 | 0.41 | 0.44 | 0.47 |
| **Food.** | | | | | | | | | |
| 1. Fruit juices | 3.46 | 3.89 | 4.32 | 4.42 | 4.84 | 5.27 | 5.37 | 5.80 | 6.23 |
| 2. Sweets and candies | 0.31 | 0.36 | 0.42 | 0.38 | 0.44 | 0.49 | 0.46 | 0.51 | 0.56 |
| 3. Milk, yogurt, dairy products | 0.21 | 0.26 | 0.30 | 0.36 | 0.31 | 0.35 | 0.31 | 0.36 | 0.40 |
| 4. Cola | 0.07 | 0.08 | 0.08 | 0.09 | 0.10 | 0.10 | 0.11 | 0.12 | 0.12 |
| 5. Cola | 0.13 | 0.14 | 0.15 | 0.15 | 0.17 | 0.18 | 0.18 | 0.19 | 0.21 |
| 6. Ice cream | 0.35 | 0.41 | 0.48 | 0.43 | 0.50 | 0.56 | 0.51 | 0.58 | 0.64 |
| **Chemicals** | | | | | | | | | |
| 1. PVC and masterbatch | 0.06 | 0.07 | 0.09 | 0.07 | 0.09 | 0.10 | 0.09 | 0.10 | 0.11 |
| 2. Tires, rubber products | 0.51 | 0.56 | 0.61 | 0.63 | 0.68 | 0.73 | 0.75 | 0.80 | 0.85 |
| 3. Natural & synthetic shoe soles | 0.02 | 0.02 | 0.03 | 0.03 | 0.03 | 0.03 | 0.04 | 0.04 | 0.04 |
| 4. Synthetic leather | 0.24 | 0.27 | 0.29 | 0.30 | 0.32 | 0.35 | 0.36 | 0.38 | 0.40 |
| 5. Shoes | 0.15 | 0.16 | 0.17 | 0.20 | 0.22 | 0.23 | 0.26 | 0.27 | 0.28 |
| 6. Polymers, latex pair lastic cont. | 0.11 | 0.12 | 0.13 | 0.12 | 0.13 | 0.14 | 0.13 | 0.14 | 0.15 |
| 7. PVC pipes | 0.07 | 0.07 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.09 |
| 8. Baby products. | 0.36 | 0.43 | 0.51 | 0.46 | 0.53 | 0.60 | 0.55 | 0.63 | 0.70 |

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Table 3.8 (Continued page - 2 -)

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Engineering** | | | | | | | | | |
| 1. Cranks, Spa e parts for textiles mach., moulds. | 0.1. | 0.13 | 0.13 | 0.16 | 0.16 | 0.16 | 0.20 | 0.20 | 0.20 |
| 2. Oil, fuel and air filters | 0.11 | 0.13 | 0.15 | 0.14 | 0.16 | 0.18 | 0.17 | 0.19 | 0.21 |
| 3. Insulated & electric cables | 0.06 | 0.07 | 0.08 | 0.07 | 0.08 | 0.09 | 0.08 | 0.09 | 0.11 |
| 4. Steel structures for construction | -0.13 | -0.14 | -0.16 | -0.15 | -0.17 | -0.18 | -0.18 | -0.19 | -0.21 |
| 5. Automatic bakery lines | 0.12 | 0.14 | 0.16 | 0.15 | 0.16 | 0.18 | 0.17 | 0.19 | 0.21 |
| 6. Aluminum kitchenware | -0.00 | -0.01 | -0.01 | -0.01 | -0.01 | -0.01 | -0.01 | -0.01 | -0.01 |
| 7. Electric heaters | 4.84 | 5.57 | 6.23 | 5.22 | 6.95 | 7.67 | 7.60 | 8.32 | 9.05 |
| **Metal products** | | | | | | | | | |
| 1. Aluminum doors, windows, furniture | 0.37 | 0.43 | 0.49 | 0.48 | 0.54 | 0.60 | 0.59 | 0.65 | 0.70 |
| **Nonmetalic products** | | | | | | | | | |
| 1. Mosaic floor tiles | 0.04 | 0.05 | 0.05 | 0.05 | 0.06 | 0.06 | 0.06 | 0.07 | 0.07 |
| 2. Concrete products for construction | 0.36 | 0.39 | 0.42 | 0.43 | 0.46 | 0.49 | 0.50 | 0.53 | 0.56 |
| 3. Housing prefab. conc. units | 0.76 | 0.94 | 1.12 | 0.96 | 1.14 | 1.32 | 1.15 | 1.33 | 1.52 |
| 4. Cement bricks | 0.11 | 0.12 | 0.12 | 0.15 | 0.15 | 0.16 | 0.19 | 0.19 | 0.20 |
| 5. Tiles | 0.13 | 0.14 | 0.14 | 0.17 | 0.17 | 0.18 | 0.21 | 0.21 | 0.22 |
| 6. Sanitary ware, wall tiles | 0.13 | 0.15 | 0.18 | 0.17 | 0 19 | 0.22 | 0.20 | 0.23 | 0.25 |
| **Furniture** | | | | | | | | | |
| 1. Wooden Furniture | 0.09 | 0.10 | 0.10 | 0.12 | 0.12 | 0.13 | 0.14 | 0.14 | 0.15 |
| 2. Wooden & metal beds | 0.41 | 0.46 | 0.51 | 0.50 | 0.55 | 0.60 | 0.59 | 0.64 | 0.69 |
| **Paper & Printing** | | | | | | | | | |
| 1. Paper, aluminum foil, cellophane | 0.08 | 0.08 | 0.09 | 0.10 | 0.11 | 0.11 | 0.13 | 0.13 | 0.13 |
| 2. Books, magazines | 0.35 | 0.41 | 0.47 | 0.45 | 0.51 | 0.57 | 0.55 | 0.61 | 0.67 |

The chemicals sector unfortunately has no pharmaceuticals. Indeed, it would certainly seem to overlap with the rubber and leather industries. The two PVC firms certainly have very low DRCs suggesting high social returns to investments there. On the other hand, both the tire and rubber firms and the baby product firm although with DRCs below 1 are relatively less attractive compared to most other firms in the list.

It is in the engineering sector, however, that the widest range of DRCs appears. Although the firms producing cranks, filters, cables, and bakery lines have very attractive DRCs, those producing steel structures and aluminum kitchenware have negative value added at world prices and that producing electric heaters a very high positive DRC. The last is certainly consistent with our input-output result on electrical machinery. In fact, the aluminum kitchenware/firm has such a large negative value added at world prices as to dominate in taking the sectoral averages in (J) above.

Most of the nometalic products (building materials) are socially profitable, which is consistent with the input-output table findings. Only the firm producing prefabricated concrete housing units looks less efficient in social terms, and that mostly because of a very high capital (fixed and inventory to output ratio. This firm has a ratio over 2 for book value capital relative to output at world prices, as compared to about 0.5 for the cement brick firm.

In the remaining sectors, we see that aluminum products are somewhat high though below 1 in DRC. The two furniture firms both show DRCs well below 1 though the bed firm is somewhat higher. Finally, the paper products firm has very low DRCs though the publishing firm looks relatively less attractive according to these figures.

C. Engineering Products:-

Given the diversity of the engineering sector, and noting the mixture of social returns estimates in the foregoing section, it seems worth taking a closer look at this sector where possible.

In particular, data for this section are taken from "Strategic Planning Study for Engineering Industries, Report No. 1, Current Status of Engineering Industries in Egypt" Ministry of Industry, October 1976. In appendix 39 are presented data on 39 products from the metal fabrication, nonelectrical machinery equipment and apparatus, and transport equipment sectors - data collected by questionnaires.

This appendix reports costs of labor, factory overheads and materials. The material costs distinguish between imported and Egyptian materials, and note the amount of duty paid. To deflate materials to world prices, the import duty rate is therefore computed and subtracted from all materials. In the case of four types of electrical machinery, the distinction between imported and Egyptian materials is not given, so the average for electrical machinery is used for the division.

Unfortunately, no method of comparing world price and domestic price is reported. Consequently, adopting similar shadow prices to those above, we have again calculated the marginal gap between world and domestic prices which at a maximum would allow the product to have a DRC as low as the shadow exchange rate conversion factor -- as at the end of section 3.A.

The results are reported in table 3.9 (Again Q-A is checked for positivity at $t^*$ and satisfied everywhere).

Table 3.9

Maximum gap between domestic and world price rendering individual engineering products socially desirable given reported domestic values

| Shadow price: labor / capital / foreign exchange | 0.6 | | | | 0.8 | | | |
|---|---|---|---|---|---|---|---|---|
| | 1.0 | | 1.5 | | 1.0 | | 1.5 | |
| | 1.0 | 1.25 | 1.0 | 1.25 | 1.0 | 1.25 | 1.0 | 1.25 |
| Sector/product:- | | | | | | | | |
| Metal Fabrication | | | | | | | | |
| Steam boiler | 0.17 | 0.31 | -0.03 | 0.11 | 0.12 | 0.26 | -0.06 | 0.07 |
| Heavy steel structure | 0.23 | 0.32 | 0.09 | 0.20 | 0.18 | 0.28 | 0.06 | 0.16 |
| Overhead crane | 0.25 | 0.32 | 0.17 | 0.25 | 0.20 | 0.27 | 0.12 | 0.21 |
| Storage tank | 0.32 | 0.43 | 0.24 | 0.36 | 0.21 | 0.32 | 0.15 | 0.26 |
| Helical springs | 0.07 | 0.20 | -0.16 | -0.03 | 0.06 | 0.19 | -0.16 | -0.04 |
| Leaf springs | 0.09 | 0.19 | -0.07 | 0.03 | 0.08 | 0.18 | -0.08 | 0.02 |
| Tin cans | 0.21 | 0.30 | 0.08 | 0.18 | 0.16 | 0.26 | 0.04 | 0.14 |
| Nuts and bolts | 0.61 | 0.79 | 0.32 | 0.49 | 0.59 | 0.77 | 0.30 | 0.48 |
| Electricity meter | 0.26 | 0.40 | 0.12 | 0.26 | 0.17 | 0.31 | 0.05 | 0.19 |
| Water meter | 0.30 | 0.39 | 0.19 | 0.28 | 0.26 | 0.35 | 0.15 | 0.25 |
| Enamel table ware | 0.22 | 0.32 | 0.07 | 0.18 | 0.18 | 0.28 | 0.04 | 0.15 |
| Nonelectrical machinery | | | | | | | | |
| Lathe | 0.15 | 0.27 | -0.02 | 0.10 | 0.12 | 0.23 | -0.04 | 0.07 |
| Vertical drill | 1.30 | 1.79 | 0.67 | 1.04 | 1.21 | 1.68 | 0.62 | 0.98 |
| Diesel generator | 0.34 | 0.46 | 0.13 | 0.25 | 0.34 | 0.45 | 0.12 | 0.25 |
| Sewing machine | 0.16 | 0.30 | -0.06 | 0.08 | 0.12 | 0.26 | -0.08 | 0.05 |
| Pistol | 0.24 | 0.54 | -0.11 | 0.11 | 0.16 | 0.45 | -0.15 | 0.06 |

Table 3.9 (continued)

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Electrical machinery** | | | | | | | | |
| Television | 0.15 | 0.22 | 0.02 | 0.11 | 0.12 | 0.20 | 0.00 | 0.09 |
| Battery, lead acid | 0.16 | 0.19 | 0.10 | 0.14 | 0.14 | 0.18 | 0.09 | 0.13 |
| Air conditioner wall unit | 0.16 | 0.21 | 0.07 | 0.14 | 0.14 | 0.19 | 0.05 | 0.12 |
| Compressor | 0.11 | 0.29 | -0.14 | 0.02 | 0.08 | 0.25 | -0.16 | -0.01 |
| Electric motor 5 HP | 0.15 | 0.24 | -0.00 | 0.09 | 0.14 | 0.23 | -0.01 | 0.08 |
| Transformer 200 KVA | 0.13 | 0.21 | -0.02 | 0.07 | 0.13 | 0.21 | -0.02 | 0.07 |
| Control switch panel | 0.12 | 0.21 | -0.06 | 0.05 | 0.11 | 0.21 | -0.07 | 0.04 |
| Cable, MR paper insulation | 0.31 | 0.37 | 0.18 | 0.26 | 0.31 | 0.37 | 0.18 | 0.25 |
| Refrigerator | 0.21 | 0.24 | 0.17 | 0.21 | 0.18 | 0.21 | 0.14 | 0.19 |
| Washing machine | 0.22 | 0.27 | 0.15 | 0.22 | 0.17 | 0.23 | 0.11 | 0.18 |
| Telecommunic. Handset | 0.18 | 0.31 | -0.01 | 0.11 | 0.15 | 0.28 | -0.03 | 0.09 |
| relayset | 0.15 | 0.21 | 0.05 | 0.12 | 0.13 | 0.20 | 0.03 | 0.11 |
| switch racks | 0.03 | 0.11 | -0.11 | -0.02 | 0.02 | 0.10 | -0.12 | -0.03 |
| Flourescent lighting tubes | 0.08 | 0.22 | -0.15 | -0.02 | 0.08 | 0.22 | -0.16 | -0.03 |
| Battery, dry | 0.20 | 0.25 | 0.13 | 0.20 | 0.16 | 0.22 | 0.10 | 0.16 |
| **Transport equipment** | | | | | | | | |
| Ship 800DWT | 1.13 | 1.23 | 1.02 | 1.13 | 1.05 | 1.16 | 0.95 | 1.07 |
| Railway coach/wagon | 0.17 | 0.22 | 0.11 | 0.17 | 0.13 | 0.18 | 0.08 | 0.14 |
| Car | 0.19 | 0.22 | 0.14 | 0.18 | 0.18 | 0.21 | 0.13 | 0.17 |
| Lorry | 0.16 | 0.19 | 0.11 | 0.15 | 0.15 | 0.18 | 0.10 | 0.14 |
| Bus | 0.20 | 0.25 | 0.12 | 0.19 | 0.17 | 0.23 | 0.10 | 0.16 |
| Utility car | 0.19 | 0.24 | 0.12 | 0.17 | 0.18 | 0.22 | 0.11 | 0.16 |
| Motor cycle | 0.16 | 0.25 | -0.00 | 0.10 | 0.14 | 0.23 | -0.02 | 0.08 |
| Bicycle | 0.79 | 1.05 | 0.40 | 0.64 | 0.74 | 1.00 | 0.37 | 0.60 |

For example, the results show that at a show price of labor equal to 0.6, of capital at 1.5 and foreign exchange 1.0, steam boiler production is socially advantageous only if the ex-factoty price of steam boilers is no higher than 3 percent below the world price.

Looking down this particular shadow price combination (which probably represents our best guess) it is seen that many of the engineering products are socially advantageous only if the ex-factory price used in this data construction is below world price. However, under price controls some items are indeed held below world prices.

Although detailed data are not available for this study on any of these products, it is known that certain items are sold below duty free prices. In many cases, domestic product quality is also lower, but it seems likely that the low domestic price and positive price differential requirement probably means production of the following items is socially advantageous: television receivers, batteries, airconditioner wall units, refirgerators, washing machines and enamel ware. In addition although sewing machine production is found to be socially profitable only if domestic prices are below world prices for certain shadow price combinations, the required gap is probably small enough to be satisfied.

Finally, we may make special mention of bicycle production. In table 3.9, this is estimated to be socially advantageous even though recorded domestic prices are well above world price, and this is almost certainly satisfied. (The nominal import duty on bicycles is about 30 percent). Combined with the fact bicycle production is so commonly found to be advantageous in LDCs, this means we can be reasonably sure this is an area worthy of expansion from its current very low levels.