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Appendix B

Calculation of Effective Exchange Rates (EERs) and Effective Protective Rates (EPRs)

My purpose in this appendix is to discuss the main principles involved in the construction of estimates of EERs and EPRs for the years 1949–62. The estimates for later years (1963–71) were based on similar principles, although the instruments used in export promotion (from 1966 on) were somewhat different from the methods pursued in earlier years, thus leading to some differences in estimating procedures.

ESTIMATES OF EFFECTIVE EXCHANGE RATES IN EXPORTS

Rates for Value Added and Total Value.

The data on effective exchange rates in this volume are for *value added* in exports, not for total value. For economic analysis, this is the only useful concept in the case of Israel. Through a slight transformation, which is explained below, it yields the effective rate of protection in production for exports. This would also be the concept to use for time-series analyses of factors affecting the size of exports in comparisons with, for instance, time series of GNP prices or wage levels, etc.

The value-added rate does not yield the local price of finished export goods. But a separate calculation of the effective exchange rate for total value, designed to correct this omission, would not be warranted in the case of Israel. For the most part, sales of potential export goods in the local market

constitute only a small fraction of total sales in that market; the higher the degree of aggregation in the classification of goods, the more evident this is. The local market price is thus a function of the exchange rate for *imports* of the good rather than for its exports.[1] This does not hold for the two large, traditional export goods—citrus fruits and polished diamonds. But there, too, the exchange rate for total value would be mostly irrelevant for the purpose of determining the local price. In the case of diamonds, this is because there are practically no local sales of the product (in the government's handling of the industry, it is always assumed that all of the imported raw material—the unpolished diamonds—is re-exported). In citrus fruit, on the other hand, local sales are primarily dictated by physical factors which determine the fraction of the crop which, due to its quality, cannot be exported, that is, exports and local sales are not of exactly the same product. Economic forces are not absent here altogether: some substitution does exist, and so the level of export prices does marginally affect the fraction exported. Still, the home price and the export price diverge radically from each other.

It should be pointed out that the combined use of the drawback system in exports (which has been in force all along, except for the special import levy of August 1970) and the premium-payment plan of 1956–61 for net value added, leads to the establishment of a shadow exchange rate for the import component in exports which is equal to the exchange rate for value added. Thus, under such a system, the exchange rate for *total* value will also be equal to the exchange rate for value added. This may be explained as follows: Suppose the producer maintains a given level of exports, but reduces the level of imported input by one dollar, thus increasing value added by this amount. This would yield him a saving of expenditure on imports equal to the value of the formal exchange rate for imports *and* an increase in premium receipts equal to the size of the premium rate. Thus, the net revenue created by the reduction of imports valued at one dollar would be equal to the formal exchange rate plus the premium rate; that is, to the effective exchange rate for value added in exports. The same result follows symmetrically if we suppose that imported input is *increased* by one dollar.[2]

Let

X = exports (total value in dollars);
M_X = import component in exports (value in dollars);
R_F = formal rate of exchange (Israeli pounds per dollar);
R_P = rate of export premium (Israeli pounds per dollar of value added);
Y = revenue from export transaction (Israeli pounds).

$$\begin{aligned} Y &= (X - M_X)(R_F + R_P) + M_X R_F \\ &= X(R_F + R_P) - M_X R_P \end{aligned}$$

It appears, therefore, that the revenue is the same as if the exporter received the effective exchange rate per value added for his *total* exports (X) and was fined by a payment at the premium rate (R_P) on the import component. That is, the effective exchange rate for value added in exports is the shadow price for the import component, and this equals the formal rate plus the premium rate (the rate of the "fine"). In other words, this method is entirely equivalent to one in which an existing uniform rate is used for exports and the import component in exports, and which equals the effective exchange rate for value added in exports.

Rates of Exchange Using Pamaz Rights.

As was stated in the text, the effective exchange rate implied by taking account of the compensation of exporters in the local market was not estimated systematically and was not incorporated into the exchange rate calculations. The most important compensating device was created by the Pamaz plan, during the period 1953–59. For the years 1956–59, however, when both the Pamaz plan and the comprehensive premium plan were in effect, this omission is only slightly relevant if the effective exchange rate has to be estimated *at the margin,* as it would be for most purposes in economic analysis.

It will be recalled that during those years, exporters who were entitled to Pamaz rights could opt, instead, for premium payments. If rational behavior is assumed, an exporter would be expected to use his Pamaz rights up to the point at which the marginal revenue derived from use of this right is equal to the premium, and to sell the rest of his export proceeds (i.e., of his value added) to the Treasury, at a price equal to the formal rate plus the premium rate. If an exporter avails himself at all of the premium plan, this would mean that at the margin the effective exchange rate, using the Pamaz right, equals the premium rate. The data indicate that in the large majority of export industries, some use of the premium plan was indeed made. In the estimates, it was assumed that the effective rate involved in the use of Pamaz rights was equal to the effective rate created in selling the receipts to the Treasury. This, then, is not a gross distortion of the correct estimate so far as the rate at the margin is concerned.

ESTIMATES OF EFFECTIVE EXCHANGE RATES IN IMPORTS: TARIFF DUTIES

Two alternative methods can be used to estimate the exchange rate element involved in the tariff level for each good. One is to divide tariff revenue by the

dollar value of imports, thus obtaining tariff duties in Israeli pounds per dollar of imports. The other is to apply the formal exchange rate to the tariff rates specified in the tariff schedule, thus again yielding the tariff in pounds per dollar. In the estimates constructed here, the second method was used rather than the first, for two reasons.

One is the well-known problem of timing. Tariff revenues are recorded when the duties are paid, not when the dutiable imports arrive; that is, they are recorded on a cash rather than an accrual basis. Dividing the revenues recorded in one calendar year by the imports recorded in the same year would thus not be justified in principle; and when long intervals of time elapse between clearance and payment and the value of imports is not constant—circumstances which are the rule rather than the exception—the error may be considerable.

But even were there no timing problem, the two alternative methods would not have yielded the same result, because some imports of dutiable goods enter duty free. As was explained in the text, this applies to two categories: imports destined for use in export production (which are entitled to drawbacks, and on which in effect no duty is charged to begin with) and imports (such as those of the government, or certain institutions, during parts of the period) that enjoy "conditional exemption." If the first method of estimating the tariff level were used, it would have yielded the *average* tariff imposed on all three categories: "normal" imports for domestic use, imports for exports, and duty-free imports under conditional exemption. The inclusion of imports for exports would patently be a wrong procedure: this category should not be included in this estimate just as it is not in the estimate of the effective exchange rate in exports. As was just shown, under the plan in effect during part of the period the shadow rate of exchange applying to this category was equal to the effective exchange rate for value added in exports rather than to the formal rate of exchange, as would be implied by including this category and assigning it a zero tariff rate. Inclusion would make the estimates invalid for use in economic analysis. Similarly, imports subject to conditional exemption should be excluded if the purpose of the estimate is, as it should be, to obtain the rate *at the margin.* For an analysis of protection, for instance, it is of no consequence that an institution has been granted the right to import some goods free of duty, as long as *these are not resold* in the local market, a condition that has usually been fulfilled.

The estimates used here refer, therefore, only to "normal" (i.e., non-duty-free) imports for domestic use. For this reason, as well as the timing problem, the method adopted for estimating was based on tariff schedules. In aggregating, the weight given to each good was determined by the level of non-duty-free imports only; these data were available for most of the period. When tariff schedules changed within a calendar year, annual averages were

computed by using as weights not imports within each subperiod of the year, but the length of time to which each schedule applied. This was done as a short cut, and because monthly data on imports are not fully reliable and weekly data do not exist at all. The error involved in this procedure is probably small.

For most other components of the import exchange rate (except the formal rate), the *first* method—that of using actual, recorded revenue or expenditure—was followed. This is because these components are not usually based on any given, predetermined schedule: the profit or loss of the government's commercial account, for instance, could not be replaced by some schedule of profit or loss margins; no such ex-ante schedule is to be found. Thus, these estimates necessarily suffer from the discrepancies introduced by the timing problem.

TRANSFORMATION OF EFFECTIVE EXCHANGE RATES INTO EFFECTIVE RATES OF PROTECTION

Effective exchange rates for exports refer directly, as has just been explained, to value added. For import-competing goods, effective exchange rates for value added have been derived in the way explained in the text; that is, by use of input-output data, which include import components in each industry detailed by import group, and data on exchange rates for total value (i.e., value of final good) of each import group. The exchange rate for value added in industry j (R_{vj}) is obtained as follows:[3]

let

a_{ij} = coefficient of import i in industry j;
R_i = exchange rate for total value (final good) of import i;
R_j = exchange rate for total value of import j.

Then

$$R_{vj} = \frac{R_j - \sum_i a_{ij} R_i}{1 - \sum_i a_{ij}}$$

These are the values presented in the import-substitution columns in Table 4-6 in the text. As is explained in the text, the values arrived at in this way, through the use of aggregated input-output data, suffer from a few deficiencies. In particular, they are biased downward, probably to a substantial degree.

The transformation from the effective exchange rate for value added to

effective rates of protection is technically simple; but it rests on a crucial assumption. If g_j is the effective protective rate for value added in industry j, and R_{vj} is the effective exchange rate for value added in j (whether for exports or in import substitution), then:

$$g_j = \frac{R_{vj}}{\overline{R}} - 1$$

or

$$g_j = \frac{\left(\frac{R_j}{\overline{R}} - 1\right) - \sum_i a_{ij}\left(\frac{R_i}{\overline{R}} - 1\right)}{1 - \sum_i a_{ij}}$$

The crucial assumption concerns the definition and size of $\overline{R}$. If this is taken as the formal rate of exchange, the outcome could have little meaning. If a positive g_j should indicate the existence of positive protection, then $\overline{R}$ must be the equilibrium rate of exchange, or, in practice, as good an approximation of the equilibrium level as can be conceived. If elasticities were known, $\overline{R}$ could be estimated from the data on the system of exchange rates, by calculating an average weighted by both the size of exports or imports of each good and its price elasticity of domestic supply or demand (assuming, as could probably be done for Israel without much distortion, fixed foreign prices).[4] In fact, these elasticities are not known; and making arbitrary assumptions about them would yield an estimate which is more arbitrary and less defensible than the one yielded by the procedure adopted here.

It is assumed here, instead, that the government continuously determines an exchange rate system for exports such that it will yield just the amount of foreign exchange at which, at the margin, the market value of imports of a unit of foreign exchange equals the domestic cost of obtaining that unit. On this assumption, the equilibrium rate of exchange is always the highest exchange rate (for value added) granted to exporters. However, it is obvious that some particularly high rates were accorded to individual industries on specific and particular grounds, rather than being motivated merely by the wish to obtain foreign-exchange proceeds for the economy. Therefore, in this calculation, the value actually selected in each year to represent the equilibrium foreign exchange rate was the highest rate granted to a significant part of total exports.[5] The rates thus taken as equilibrium levels were as follows: 1956, IL 2.40 per dollar; and 1957–60, IL 2.65 per dollar.

It should be noted that this derivation of EPRs involves two deviations from the appropriate definition and estimate of the concept. The a_{ij}'s stand for the fractions of total (direct and indirect) import components, whether

the indirect component is an input to a tradable or to a nontradable input, whereas only the latter should have been included. On the other hand, they stand for coefficients of *imports* rather than of *tradables;* that is, they exclude inputs of exportable materials. It may be assumed that in the case of Israel, these errors of commission and omission do not affect the result in a significant manner.

NOTES

1. Were products completely homogeneous, no product could be both exported and imported in a country like Israel, where local transportation costs are very low in comparison with international transportation costs. No classification of goods is, however, detailed enough to lead to complete homogeneity; and certainly not a classification, such as the one used here, of all goods into eighty groups.

2. This presentation, as well as the explanation, is based on David Pines, *Direct Export Premiums in Israel, 1952–1958* (Jerusalem: Falk Project for Economic Research in Israel, 1963; in Hebrew), pp. 78–79.

3. The coefficient a_{ij} is from Michael Michaely, *Israel's Foreign Exchange Rate System,* Part III, *Appendixes* (Jerusalem: Falk Institute, 1970; in Hebrew), pp. 152–159. The data were prepared by the research department of the Bank of Israel on the basis of the 1958 input-output estimates.

4. See the discussion in W. M. Corden, "The Effective Protective Rate, the Uniform Tariff Equivalent, and the Average Tariff," *Economic Record* 42 (June 1966): 200–216.

5. A somewhat broader discussion of this procedure, in a different context, may be found in Michael Michaely, *Israel's Foreign Exchange Rate System* (Jerusalem: Falk Institute, 1971; in English), pp. 66–70.