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Effective protection, domestic resource costs, and shadow prices: a general equilibrium perspective (English) Abstract. Simple general equilibrium models are built, linearized about their initial equilibrium, and then used to analyze the economic effects of various changes in policy.

Srinivasan and Jagdish N. T. OCT 13 ! Thanks are due to Peter Diamond for helpful conversations. This is puzzling since the bulk of the project evaluation literature attempts to derive shadow prices to replace the market prices that, in distorted situations, clearly will not reflect true opportunity costs whereas the major advances in the welfare theory of international trade have consisted precisely in the analysis of issues in trade and welfare when the market is characterized by a number of alternative endogenous or policy-imposed distortions. The only attempts to date by international economists in the direction of project evaluation of a sort were by the proponents of the so-called DRC 2 domestic resource cost and ERP effective rate of protection measures. The question principally addressed by these proponents was the following: As is now well-understood, the answer to this question is in the negative. For example, Findlay, using a 1 Cf. But project analysis asks a somewhat different question: As our departure point, we take the simple model of trade theory, with primary factors producing traded goods including the project output, with no intermediates and with fixed international prices for the goods. This is also the model deployed by Findlay and Wellisz in an elegant paper on the subject of shadow prices for project evaluation, whose analysis we parallel in some respects, while complementing and "correcting" it in critical ways. Following them, we will focus the analysis in Section I on trade distortions: For definition of DRC in this context, refer to the preceding footnote. It is assumed that the planner is working with a well-behaved social utility function. The problem of project analysis then is to evolve suitable prices, for the primary factors and output X in the project, which would enable the analyst to decide whether the project should be accepted or rejected. The problem would be straightforward indeed if there were no distortions in the system: But the situation we must now introduce is one where the domestic price-ratio between commodities X . The problem then, as noted by Findlay-Wellisz, p. Turn now to Figure 1. This is readily done as follows. First, since capital supply is fixed K , we have: So, assuming that X is K -intensive at P , i. But then this paradox is only yet another instance of "immiserizing growth" the presence of the marginal labour is immiserizing, given the distortion; and this the paradox is readily resolved. In their derivation of shadow factor prices for the above problem, however, Findlay-Wellisz bypass this possibility of negative factor prices by deriving these prices instead via the solution to the following programming problem: Bhagwati; Johnson who deals with the precise distortion in our model here; and Bhagwati who states the general theory of immiserizing growth that explains and ties together the different instances of immiserizing growth. As such, the Findlay-Wellisz procedure amounts to cf. Figure 3 is the all-too-familiar Samuelson diagram and needs no explanation. Now, movement along the unrestricted production possibility curve APB in Figure 2 corresponds to movement along the curve OPR in Figure 3, relating the commodity price-ratio to the corresponding factor price-ratio. To put the same point in another way, the Findlay-Wellisz procedure could be made accurate, i. An alternative analysis of the inappropriateness of the Findlay-Wellisz procedure, in programming terms. Is provided in the Appendix; naturally, it only corroborates what is stated in the text above. We have thus deduced, in the preceding section, the precise shadow prices that must be used, in a distorted situation, for project appraisal. We are therefore now in a position to cast light on the inconclusive and confusing debate among the ERP and DRC proponents-as typified, for example, by the controversy in the Journal of Political Economy among Bruno 19 72, Krueger and Balassa-Schydrowsky, as to their relative merits as techniques of project appraisal. Since these and other economists distinguish among direct and indirect inputs, thus including intermediates which were not included in the analysis in Section I above, we should first state that our project-acceptance criterion, suitably amended, is the following: What the criterion says, of course, is that the project, to be accepted, must produce

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output which, when evaluated at international prices, exceeds or equals the cost of production evaluated at the second-best shadow factor prices. But, it can equivalently be written in the form including direct plus indirect primary factors, i . By second-best, we will denote instead the factor valuations, w , Y that reflect the second-best optimal situation, given the distortion. Finally, by "private", we will denote the factor valuations, w, Y , that actually obtain in the distorted situation at P . Next, we should also note that the debate includes additionally a distinction between "direct plus indirect" versus only direct primary factors. Again, for "total" measures, we will distinguish among two ways of formulating them: The former, we will denote as the "decomposed" into primary factors measure; the latter, as the direct "intermediates" Thus, if we are dealing with the garment industry on a total basis, we can decompose the intermediate factors into primary factors producing them or take the factors directly into account. First-best, Total, Decomposed Measure: These are also the shadow prices suggested by Bacha and Taylor In this case, we define: First-best Total, Intermediates Measure: First-best, Direct, Intermediates Measure: Here, we shift to net valuation, to yield: Second-best, Total, Decomposed Measure: Here, we utilise second-best shadow prices, with gross value of output and decomposed primary factor use: Second-best, Total, Intermediates Measure: Here, we have the equivalent of DRC: Second-best, Direct, Intermediates Measure: Private, Total, Decomposed Measure: Private, Total, Intermediates Measure: Here, we have using intermediates at domestic prices: Here, we then have: By comparing the above with our project acceptance criterion, we then see right away that, if we do have the distorted situation, the measures DRC to DRC will be unity for the existing activities and less than unity for the project if the project is acceptable. A For an interesting analysis of the problem as to when a project accepted rejected by the incorrect use of first-best factor prices would be rejected accepted by the correct use of second-best factor prices, see Findlay-Wellisz Note however that this analysis is based on their inappropriate procedure for deriving second-best factor prices and therefore should be correspondingly recast. It is also evident that it makes absolutely no difference whether one takes total or direct DRC measures, as long as second-best shadow prices are used for project appraisal as indeed they ought to be when the initial 2 distorted situation has to be taken as given. If, on the other hand, the total DRC measure is used in the absence of second-best shadow prices, e. Balassa and Schydrowsky contend that, in view of the problem about shadow prices that the DRC proponents have always noted, the ERP measure be replaced by a so-called "social" ERP measure I Quite aside from the fact that it is somewhat strange to hold onto an inappropriate concept by tagging on new prefixes to it, the so-called "social" ERP, to be correct, must be converted into DRC. But this implies revaluing domestic factor inputs directly at the second-best shadow prices in the numerator whereas the essence of the ERP approach surely is to arrive at the numerator indirectly as the difference between the values of outputs and inputs. Thus, the assertion that merely taking the last-stage fabric project by itself and evaluating the garment input at its international price would be enough, i. And, as argued immediately earlier, if such second-best shadow prices are used, it is irrelevant whether one uses total or direct measures anyway. If such is indeed the case, we would naturally wish to redefine and consider, as a project, the vertically-integrated project involving both the garments and the fabrics that are produced for the garments. And then, the correct project appraisal would be along exactly the same lines as before, with DRC to DRC, all using second-best shadow factor prices, providing the correct method for doing 2 project appraisal for this re-defined project. Such a rule or variations thereof can be found in the context of input-substituting industrialization in many less developed countries. Bhagwati and Desai and Bhagwati and Srinivasan for India and Bhagwati for more extended discussion of such rules and the associated policies of "automatic" protection. Alternative Factor Market Distortions and Second-Best Shadow Factor Prices In this section, we briefly extend our analysis to three standard factor-market distortions, deriving second-best shadow prices in each case in the manner set out in Section I. The three distortions are: The expected wage is defined as the sticky manufacturing wage, w , multiplied by the probability of a worker in the manufacturing sector obtaining employment therein. The major papers on this distortion, initially analyzed by Haberler, are by Lefeber and Brecher a b. The model as set out in Harris-Todaro is misspecified on the demand side.

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See therefore the correct specification, as set out in Bhagwati- Srnivasan and followed here. Note also that the shadow wage is positive, instead of zero, despite the unemployed labour; this is because any withdrawal of labour from the labour force L , while initially reducing unemployment, will simultaneously raise the expected wage in manufacturing and hence result in reduction of agricultural employment and output. K and L respectively, i . At points to the left right of P . For the price-ratio tangent to APB at P , the production equilibrium however may be anywhere between P and Q , the different production equilibria implying different labour availabilities. Finally, for all commodity price-ratios steeper than the price-ratio tangent at P , there will be complete specialization on X at Q and the corresponding actual wage will be w while the shadow wage will be zero. Hence, unlike in the sector-specific wage stickiness case, the unemployment of labour can indeed be taken to imply a zero shadow wage for labour. However, associated with this, the shadow rental of capital will exceed its market rental: In this case, it is well known that the production possibility curve will shrink to AQB , in Figure 5. Furthermore, AQB need not be concave to the origin, the market equilibrium need not be unique for any commodity price-ratio, and the commodity price-ratio will not equal the marginal rate of transformation along AQB . Let the market equilibrium in the initial, distorted situation be at Q . Jones calls the differential-weighted intensities the "value" as against the Samuelsonian "physical" factor-intensities. Concluding Remarks A few concluding observations are in order. First, it is clear that, for the distortions that we have examined, the criterion of "border-pricing", recommended by Little and Mirrlees in their celebrated Manual is clearly the correct one, provided of course that the primary factors are priced at appropriate shadow rates as indeed Little-Mirrlees would seem to appreciate. Third, while we have confined our analysis to "small" projects, drawing infinitesimal resources away from the existing distorted situation, it is equally clear from our analysis that the results will hold also for "large" projects. Given the Rybczynski-line properties of the different models, the shadow prices of factors will be identical for small and large shifts of factors into the project. Fourth, we might as well note explicitly that our analysis could be readily extended to models involving non-traded goods; this would permit the introduction of the exchange rate in a meaningful manner into the analysis. On the other hand, the extension to models with many goods and factors, or to 2 sector-specific factors, is not merely readily done; it will introduce no special insights that qualify what has been learnt from the present paper. However, if the losses can be covered only by some form of distortionary taxation, then the shadow prices for both inputs and outputs have to be calculated reflecting this fact. It is also clear that implicit in our analysis is the assumption that problems of income distribution and savings can be tackled through the deployment of appropriate non-distortionary instruments. Obviously, if this is not possible, the shadow prices will have to be calculated afresh by introducing additional constraints which reflect the feasible set of public policy instruments. If with these values, A . This is exactly equivalent to evaluating the project through the second-best shadow prices as derived in the text; and either of these prices can be negative. Suppose, however, that one admits other direct ways of disposing of factors than the indirect one of using them in the project. Then the constraints A .

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