V

This next chapter, which originally appeared in *The American Economic Review* in 1959 is similar to "Monopoly and Resource Allocation" in trying in some sense to quantify the resource-allocation costs stemming from various distortions, in this case those operating to reduce the efficiency of the Chilean economy. It is different in the sense that it does not operate with a specific body of consistent data, but rather with impressions buttressed by piecemeal fragments of information. It is also different in the sense of focusing on distortions related to factor markets.

The need to use fragmentary and often unreliable data is one of the crosses that economists working on less-developed countries (along with economic historians looking far into the past for almost any country) have to bear. This places a high premium on finding the appropriate conceptual apparatus for dealing with a particular problem and then "filling in the boxes" with as plausible estimates of the relevant parameters and variables as one can find. The latter part of section I of the paper is one example of this kind of interplay. The initial observations or impressions were that distortions were very substantial in both the labor and capital markets and also among sectors in the product market. And the conceptual apparatus into which the observations were fed was a Cobb-Douglas utility function (as a homogeneous-of-degree-one measure of welfare) into which sectoral Cobb-Douglas production functions were grafted.

The end result, then, expressed welfare as a direct function of the amounts of labor and capital used in each sector. In this sense it foreshadowed, obliquely but still quite clearly, the development in "The Measurement of Waste" of the idea that for any given set of product taxes, general factor taxes, sectoral factor taxes, etc., one can find an equivalent system

composed only of sectoral factor taxes. In the context of the model of Chapter 5, how else can a final-product tax on X_1 reduce the efficiency with which resources are used except by reducing the labor and capital resources devoted to producing X_1? Thus when assumptions were made as to how badly (in the extreme) labor and capital resources were misallocated in Chile, the effects of product-market distortions (of which monopoly is one type) as well as factor-market distortions were taken into account.

This chapter is also the only place in this volume where I make the distinction between price distortions and quantity distortions. It is obvious from simple supply-and-demand analysis that the welfare cost of a tax at a given percentage rate is higher, the higher are the underlying elasticities of supply and demand. On the other hand, the welfare cost of a quota which restricts consumption and production (say by sale of production licenses) to, say, 10 percent below what would otherwise be the equilibrium quantity will be greater, the smaller are the underlying elasticities of supply and demand. These distinct properties of "price distortions" and "quantity distortions" gave the exercise of section I a curious robustness. Making the typical elasticity of substitution higher than the 1.0 implied by the Cobb-Douglas exercise will have the effect of increasing our measure of welfare cost if we keep price distortions (represented by the differences among sectors in the "marginal productivity of labor" row of Table 5.1) the same, but consistency would then require us to increase the dispersion of quantity distortions. On the other hand, raising the same typical elasticity will reduce our measure of welfare costs if we keep quantity distortions (represented by the differences among sectors in the "quantity of labor" row of Table 5.1) the same, but then consistency would require us to reduce the degree of price distortions implied by the exercise. So we do not even know the direction in which a higher typical elasticity of substitution would take us; what's more, if the patterns of both price and quantity distortions given in Table 5.1 are accepted as plausible extremes of dispersion among sectors, then the effects of a change in the assumed elasticity of substitution could *only* be to lower the estimated welfare cost.

Section II discusses Chile's growth rate and its possible decomposition into sources, together with the sorts of contributions to increased growth that might be expected from each source. The treatment here is sketchy, but a later and more elaborate treatment of the same problem can be found in Arnold C. Harberger and Marcelo Selowsky, "Key Factors in the Economic Growth of Chile," in Arnold C. Harberger,

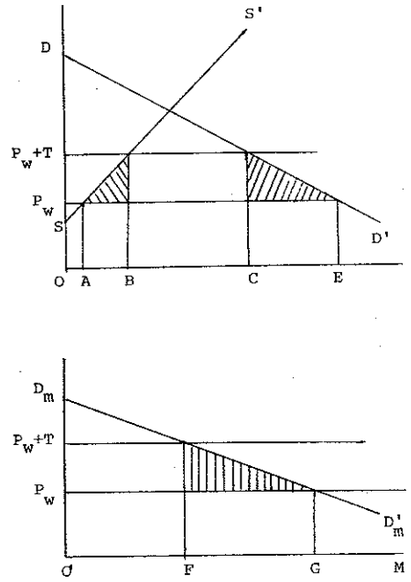

FIGURE 5A2

Papers in Economic Development (London: Macmillan, and Chicago: Markham, 1973).

There is one point on which I have had serious second thoughts since writing the following article: namely, my treatment of the distortions to international trade involved in the Chilean case. The approach I took was derived from the standard treatment of small countries in international trade theory. In Figure 5A1, the world price of a given import product, M, is denoted by P_w, and its tariff-inclusive price by $P_w + T$. SS' is the domestic supply curve of the good, and DD' its domestic demand curve. When no tariff protection exists, domestic production will be OA, total domestic demand OE, and imports AE. With protection, domestic production expands to OB, with domestic demand contracting to OC and imports to BC. The welfare cost of the tariff is then the sum of the two shaded triangles in Figure 5A1, the left-hand one representing the excess resource cost (production cost) of expanded production, and the right-hand one representing the loss in consumer surplus (consumption cost) stemming from the tariff-induced reduction in demand.

In Figure 5A2 the curve D_mD_m' represents the demand function for imports, derived as the horizontal excess of DD' over SS'. The point D_m thus has the same ordinate as the intersection of the domestic demand and supply curves in Figure 5A1, and the lateral distances $O'G$ and $O'F$ correspond to AE and BC, respectively. By construction, then, the area of the shaded triangle in Figure 5A2 equals the sum of the two shaded areas in Figure 5A1.

My procedure of estimating the welfare loss due to trade restrictions was based on the assumptions that FG was less than or equal to $O'F$, i.e., that the reduction of trade resulting from trade restrictions was not greater in absolute amount than the amount of trade actually remaining, and, implicitly, that there would be some domestic production of each importable good in the absence of restrictions. My doubts mainly concern this latter assumption, for it does not adequately capture the phenomenon of high-cost "hothouse" industries that never would have come into existence in the absence of trade restrictions. This phenomenon remains to this day a significant one in most Latin American countries, and it certainly was present in Chile during the period when the paper was written.

Figure 5B illustrates two variants of this case. The curve QQ' represents the average cost of domestic production of the good in question, and once again OE represents the free-trade equilibrium, here with demand being fully met by imports. In Figure 5B1, it is assumed that a just barely prohibitive tariff is imposed, which raises price to the point (K) where the domestic average cost curve intersects the domestic demand curve. The welfare costs now consist of a triangle of consumption costs as before, but a substantial rectangle of production costs, in place of the left-hand triangle in Figure 5A1.

Figure 5B2 represents a case in which the costs are even greater. Here tariff protection is set so high as to enable the domestic producer to behave as a monopolist, restricting

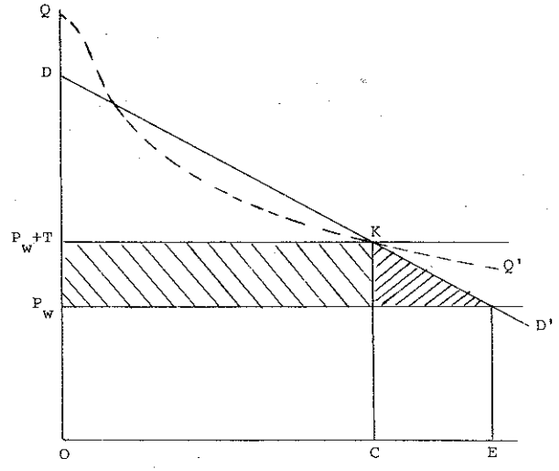

FIGURE 5B1

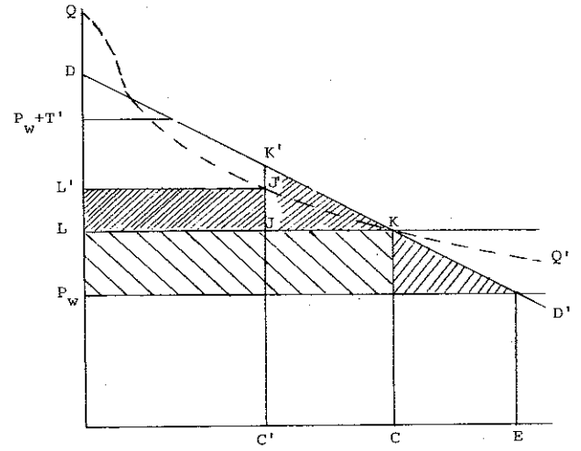

FIGURE 5B2

production to OC' and charging that price $C'K'$ which maximizes monopoly profits. The sum of the consumption-cost triangle and the production-cost rectangle in this case exceeds the total shaded area in Figure 5B1 by the amount JKK' plus $LJJ'L'$.

The cases depicted in Figure 5B have relevance for the estimation of the welfare cost of trade restrictions, especially in the light of recent studies of effective protection, which have revealed that not infrequently the rates of such protection rise above 100 and even 200 percent. For the sake of illustration, let us assume that 10 percent of total national production [i.e., value added at world prices] is thus protected, divided evenly between effective rates of protection of 200, 150, 100, 75, and 50 percent. This would yield a total production cost of protection equal to 11.5 [$= (200 \times .02) + (150 \times .02) + (100 \times .02) + (75 \times .02) + (50 \times .02)$] percent of national production [measured at world prices]. To this would have to be added a consumption cost that could easily be of similar magnitude, amounting to some 8 percent of the national product in the case where the relevant domestic demand schedules are unit-elastic.[1]

[1] Elimination of 200 percent protection would cause demand to expand by 200 percent, or by 4 percent of the national income, generating a triangle whose area equals 1/2 (.04) (200), or 4 percent of national income. For the other categories the corresponding areas are [1/2 (.03)(150) = 2.25 percent], [1/2 (.02)(100) = 1 percent], [1/2 (.015)(.75) = 0.57 percent], and [1/2 (.01)(.50) = 0.25 percent]. [In this calculation we assume that the rate of protection relevant to demanders (i.e., the nominal rate applying to the final product) is equal to that used above (i.e., the effective rate of protection of domestic value added) for measuring production costs. Where this is not the case, the estimated consumption costs should be reduced by the proportion which imported input costs (valued at world prices) bear to the world price of the protected product.]

The example just presented, yielding a welfare cost of trade restrictions approaching 20 percent of the national income, stands in marked contrast to my original estimate of 2 1/2 percent of national income, and I want to emphasize that it probably substantially overstates that cost. One way to see this is to note that, in this example, elimination of restrictions on trade would automatically cause imports to rise by the amount of "hothouse" domestic production initially displaced, that is, by 10 percent of national production. In addition there would be a further rise in imports induced by the reduction of their prices to world-market levels. This, on the assumption of unit-elastic domestic demand schedules, would amount to an additional 11.5 [$= (.04) + (.03) + (.02) + (.015) + (.01)$] percent of the national output. Exports, reflecting the country's comparative advantage, would have to be found to generate the additional revenue to buy all these added imports, and there can be no doubt but that these new exports would come only at increasing real cost. The full equilibrium of trade would thus doubtless be reached with a lower expansion of imports (and exports) than the 21.5 ($= 10.0 + 11.5$) percent of national product implied by the example just given; and the resulting welfare cost would accordingly be lower than the nearly 20 percent of national product that the example implies.

Still, it is quite plausible that the welfare costs of protection in Chile and a number of other Latin American countries could be as high as 10 to 15 percent of national product, which is still a far cry from the 2 1/2 percent estimated in the following article. I take pains to point out this fact because it emphasizes the potential gains from the process of trade liberalization (and its corollary, export expansion) that has gained significant momentum in Latin America and in other less-developed parts of the world in recent years. If its end result were an increase in welfare of only 2 1/2 percent, this effort might not be thought worth the candle; with a potential gain of perhaps 10–15 percent, it surely is.

With this modification, my conclusion in section I that the elimination of distortions in resource allocation might raise national income by probably no more than 15 percent should now be changed to "by probably no more than 25 percent or so." The basic analysis of domestic distortions which occupies most of section I remains unaltered, as does the main message of section II, to the effect that the main key to improvement of welfare lies in accelerating the various forces (most particularly the speed of adoption of available technical knowledge) involved in the process of economic growth.

Chapter 5

Using the Resources at Hand More Effectively

In this paper I attempt to explore the possible results of eliminating misallocations of resources in economies like Chile, Brazil, and Argentina.[1] In section I, a static framework is adopted; the conclusion is reached that reallocating existing resources, while maintaining the existing production functions in each line of activity, would raise national welfare by no more than 15 percent. Section II focuses on the rate of growth; here it is concluded that policies aimed at eliminating "distortions" in the price mechanism can raise the long-term rate of growth of national income, but not spectacularly. It is argued that spectacular advances in the growth rate will come, if at all, from improvement in the quality of the labor force and from an increased pace of technical advance.

I

The principal sources of misallocation in the countries in question are: (a) a rapid rate of inflation, (b) a rate of interest on bank loans below the rate of inflation and hence negative in real terms, (c) substantial barriers to foreign trade, through a number of different devices, (d) considerable monopoly, usually in protected industries, (e) a sluggish and disequilibrated labor market, in which "equivalent" labor may get as little as two-thirds or three-fourths the average wage in some sectors (e.g., agriculture), and as much as one and one-fourth or one and one-half times the average wage in others (e.g., the large foreign-owned enterprises), and (f) a system of taxes and tax evasion which in various ways draws resources into a pattern in which the value of marginal product of similar resources differs quite substantially among activities and sectors. To try to estimate precisely the welfare costs of each type of distortion would at the present stage be hopelessly difficult. I have contented myself with

[1] This paper summarizes the main lines of a more extensive study done at the Centro de Investigaciones Economicas of the Catholic University of Chile. Space limitations have made it necessary to eliminate much of the supporting argument at several points. The author will provide further information on request.

Reprinted with permission from Arnold C. Harberger, "Using the Resources at Hand More Effectively," *The American Economic Review* (May, 1959), pp. 134–146.

trying to overestimate the welfare costs of each of two broad categories of distortions: external and internal. I try to overestimate in the sense that at the many places where more-or-less arbitrary assumptions were necessary, I have leaned toward those leading to a higher rather than a lower estimate of welfare cost. I divide the internal from the external distortions because it is convenient to attempt to measure their costs in somewhat different ways.

To estimate the welfare costs of trade restrictions, I utilize the concept of an equivalent tariff. There must exist some rate of ad valorem duty on all imports which would restrict imports to their present overall level. I judge this rate to be around 50 percent in the case of Chile.[2] This judgment is based on the fact that most of the protected industries could maintain present levels of output with this amount of protection. A few industries would have to curtail output if given only 50 percent protection, but counterbalancing them would be a number of industries for which 50 percent protection would be more than they currently enjoy, and which would expand output at the expense of imports if given such protection.

Assuming, then, that a 50 percent tariff would restrict trade about as much as the present restrictions, we proceed to estimate the welfare costs of such a tariff. The foreign trade sector is sufficiently small (some 10 percent of national income) that we can employ Marshallian methods without serious error. Initially, I assume that Chile has no influence over the world price of either her exports or her imports. With a 50 percent tariff, the marginal dollar's worth of exports will buy import goods worth $1.50 internally; on the first dollar's worth of expanded exports, accordingly, the net gain is $.50. On the last unit of expanded trade following the elimination of the tariff, the net gain would be zero. Our measure of the welfare cost of a 50 percent tariff is thus a triangle whose altitude is $.50 and whose base is the number of dollars by which exports (and imports) under free trade would exceed their levels under the tariff. I assume that trade would not more than double as a result of the introduction of free trade. The base of the triangle in question is thus taken to be not more than the present dollar value of exports, which amounts, in the countries in question, to some 10 percent of the national income; and the area of the triangle, which is our measure of the welfare gain which would result from eliminating present restrictions, is estimated to be no more than 2 1/2 percent of the national income.

Why is it reasonable to suppose that trade would not more than double as a consequence of removing a 50 percent tariff? Let us consider an example in which the freeing of trade leads to a 20 percent rise in the relative price of the dollar. Internal prices of export-type goods thus rise 20 percent. Internal prices of import-type goods, which would have fallen from index 150 to index 100 as a result of the tariff repeal if the exchange rate had remained unchanged, actually end up at 120, having fallen in the net by 20 percent. In these circumstances a doubling of trade would reflect elasticities of import demand and

[2] My own experience has been largely with the Chilean economy. I have the feeling and several knowledgeable experts have assured me that the situations of Argentina and Brazil are roughly similar to Chile in the matters treated in this section.

xport supply equal to 5. Neither a commodity-by-commodity approach, sking where one might expect additional imports or exports to appear as a esult of price changes in, say, the Chilean economy, nor an examination of ow imports and exports appear to have responded to price changes in the past uggests that the elasticities in question are as high as this.[3]

Two considerations would operate to modify our estimate that trade restrictions might cost the Chilean economy up to 2 1/2 percent of its national income. The first is that an across-the-board tariff at 50 percent for all commodities ends to have less welfare cost than a set of different tariffs whose average rate s 50 percent, since the welfare cost of a tariff varies with the square of the ate. This consideration, which would lead us to raise our estimate of the velfare costs of restrictions, is unlikely to be serious except in the cases of a few ommodities (e.g., automobiles) on which the present restrictions operate with xtreme severity, and which account for only a very small fraction of total rade. The second consideration is that to the extent that Chile has some nonopoly power in the markets for its exports, the expansion of trade should ptimally stop somewhat short of the free-trade point. This would lead us to ower our estimate, but again probably not to a serious extent. The only plausible instances of monopoly power are in copper and nitrates, and even here Chile's power to influence world market prices is probably quite small, specially in the longer run relevant to this discussion.

In estimating the welfare costs of "internal" distortions, I have chosen to focus on the basic resources: labor and capital. By comparing their actual distribution among sectors with that which would emerge in an optimum situation, we get an idea of the quantity distortions prevailing in the economy. Alternatively, by comparing the values of the marginal product produced by given resources in different sectors, we get an idea of the price distortions in the economy. This device is highly convenient for a problem as complicated as ours. A sector can have "too little" labor because of monopoly power of its producers, or because its output is subject to excise taxation, or because of an artificially high wage rate; yet the welfare costs of having a given amount less labor than the optimum are to a first approximation the same, regardless of the cause.

[3] A 20 percent fall in the internal prices of imports and a 20 percent rise in the internal prices of exports represent only one of the possible sets of price changes that might result from eliminating a 50 percent tariff. If the exchange rate rose by 35 percent, there would be a 35 percent rise in the internal price level of exports, but only a 10 percent fall in the internal price level of imports. In this case a doubling of trade would entail an elasticity of export supply of roughly 3, and an elasticity of import demand of 10. If the exchange rate rose only by 5 percent, there would be a 30 percent fall in import prices, and a 5 percent rise in export prices, requiring elasticities of around 3 for import demand and around 20 for export supply in order to produce a doubling of trade. In all of these cases at least one of the elasticities necessary for a doubling of trade is implausibly high. In arriving at my judgments as to the elasticity of import demand, I have in mind that the relevant elasticity is long run and should take into account the curtailment of domestic production of import-type goods following a reduction in their internal price. Suppose that at present the total demand for import-type goods is 100, and that it is supplied half by domestic production and half by imports. A doubling of imports could then emerge if domestic production were cut from 50 to 25, while total demand expanded from 100 to 125. I believe that it is pressing towards the limits of plausibility to assume that this result would come from a price change as small as 20 percent. It might quite plausibly result from a price reduction of a third, but then the rise in export prices would not be sufficient to generate the necessary doubling of the level of exports.

Viewed from the price distortion side, the story is the same. The welfare costs of a given sector's having a marginal productivity of capital 10 percent above the level which would equalize net rates of return in all sectors do not in the first instance depend on the reason why too little capital is used in the sector.

Needless to say, a focus as broad as ours requires a general-equilibrium approach. I have chosen to divide the economy into ten sectors producing equal values of product and to use initially as my measure of welfare a utility index of the Cobb-Douglas form:

$$U = X_1^{1/10} X_2^{1/10} X_3^{1/10} X_4^{1/10} X_5^{1/10} X_6^{1/10} X_7^{1/10} X_8^{1/10} X_9^{1/10} X_{10}^{1/10}.$$

This index has the property that it says people are y percent better off in any instance in which each of the goods and services they use has increased by y percent. It furthermore implies a unitary elasticity of demand for the product of each of the sectors; in the case given, 10 percent of the national income is spent on the product of each of the sectors regardless of the relative price structure. This assumption will be defended later, as will the arbitrary division into ten sectors.

Within each sector, I assume a production function of the form $X_i = L_i^{1/2} K_i^{1/2}$, where X_i is the output of the sector (measured in value-added terms), and L_i and K_i the quantities of labor and capital it uses. This function implies that if labor and capital were paid the value of their marginal product, half of the value added of each sector would go to each. These production functions can be substituted into the utility function to express utility directly as a function of the allocation of resources. Thus:

$$U = L_1^{1/20} K_1^{1/20} L_2^{1/20} K_2^{1/20} \cdots \quad \cdots \quad \cdots L_{10}^{1/20} K_{10}^{1/20}.$$

If labor in any sector were paid the value of its marginal product, it would receive 1/20 of the national income; thus in a competitive optimum situation labor would be equally distributed among the sectors. The same goes for capital. If we set the available amounts of labor and capital at 1000 each, we conclude that the optimal allocation would be 100 of each factor in each sector.

We are now in a position to impose a set of distortions on this model economy. Table 5.1 shows a possible allocation of labor, different from the optimum, together with indices of the value of marginal product of labor in each sector. In this case, sector 1 has only a third of the optimum quantity of labor, while sector 10 has two-thirds "too much." The marginal product of labor in sector 1 is five times that in sector 10, and that in sector 2 more than three times that

TABLE 5.1

Sector	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
Quantity of labor	33 1/3	50	75	90	100	100	110	125	150	166 2/3
Marginal productivity of labor	300	200	133 1/3	111	100	100	91	80	66 2/3	60

in sector 10. I feel quite confident that the situation depicted in Table 5.1 is substantially more distorted than that actually prevailing in the labor market in Chile. Wages for labor of equivalent quality there may differ by a factor of two, but probably not much more and not in a very large fraction of the total market. The example thus allows for substantial effects from other influences, such as monopoly and taxes, which would cause differences between wages and the value of marginal product, and might make for more variance among sectors in marginal productivity than there is in wages.[4]

Under the optimum distribution of labor and capital (100 units of each factor in each sector), our welfare index would be 100; if capital were allocated optimally but labor were distributed as in Table 5.1, the welfare index would be 95. If labor were distributed as in Table 5.1, and capital likewise, the welfare index would be 91.[5] I believe that this last case allows for distortions in both the labor and capital markets which are more extreme than any likely distortions in the actual Chilean economy. My conclusion is accordingly that eliminating the internal, intersectoral distortions in the Chilean economy would raise the level of welfare by probably no more than 10 percent.

I now turn to a brief defense of the assumptions underlying the above model, followed by an indication of how sensitive the result obtained is to changes in the assumptions.

The elasticity of demand for each sector's product was assumed to be unity. I take this to be a reasonable central value for the range of price elasticities that have been reliably estimated in demand studies. The price elasticity of demand for food appears to be about −.4, and this is almost surely at the low end of the scale; at the other extreme, price elasticities for housing and for refrigerators appear to be in the range between −1 and −2. Higher elasticities have been measured only in cases where the good in question has been so narrowly defined as to exclude an obvious close substitute.[6] I define my sectors as sets of products such that for no member of a set is there an obvious close substitute outside the set; thus guarding almost by definition against extremely high sector elasticities. On this definition there would be many more sectors than ten, but the sectors can then be reaggregated, putting those with similar resource distortions in one group.

The elasticity of substitution between labor and capital was assumed to be unity. In the absence of strong empirical evidence on this point, I defend my assumption by assuming alternatively very low (say .25) and very high (say 4.0) values for the elasticity of substitution. If capital were a very poor substitute for labor, the marginal product of capital would fall rapidly as extra capital was absorbed; we should have to conclude that Chile's capacity to absorb capital profitably was quite severely limited. On the other hand, if capital and labor were extremely good substitutes, the idea of Chile being seriously short of capital would make little sense. Labor, production-wise, could do practically the same jobs as capital would, and even adding greatly to the stock of capital relative to labor would have little effect on real wages. Even elasticities as low as .5 or as high as 2.0 appear to me to have implausible implications as to the consequences of a doubling of the capital stock in a country like Chile.[7]

The result obtained is only mildly sensitive to some of the assumptions made. It is, for example, not necessary that all the demand elasticities be unity, but only that they average to unity, in order to yield roughly the same result, provided that the sectoral demand elasticities are not highly correlated with the sectoral distortions. A similar situation prevails in the case of the sectoral elasticities of substitution between labor and capital. The result is quite insensitive to the division of the product of each sector between labor and capital; indeed it is mathematically invariant to changes in the exponents of the Cobb-Douglas function in the set of cases where the exponents are the same in all sectors.

The sensitivity to changes in the average demand elasticity and average substitution elasticity is a bit curious, because if we keep the price distortions the same as assumed earlier and reduce the amount of substitution in the model, the quantity distortions have to be reduced; while if we keep the quantity distortions the same as earlier and reduce the amount of substitution, the price distortions have to be increased. The welfare costs of a set of price distortions vary directly with the elasticities assumed, while the costs of a set of quantity distortions vary inversely with the elasticities. Thus, saying that the average demand elasticity and the average substitution elasticity "ought" to have been assumed to be 1/2 rather than unity does not get one very far; one must decide whether to maintain the old set of price distortions or the old set of quantity distortions in the new situation in order to know whether the

[4] The much-discussed case of zero marginal productivity of labor in agriculture does not exist in the economies of southern South America. The bulk of the agricultural labor force in these countries is voluntarily hired by entrepreneurs who are free to adjust the size of their labor force over time, in accordance with their notions of profit possibilities. It may indeed be possible in these countries to reduce the agricultural labor supply and at the same time maintain or increase output, but these possibilities entail either adding to the capital employed in agriculture and/or changing the production functions along which entrepreneurs are operating. This analysis takes the production functions currently "in use" as given, and measures the marginal product of any resource on the basis of given amounts of cooperating resources. I take sectors 9 and 10, where labor's marginal productivity is low relative to the rest of the economy, to represent agriculture in the Chilean case. Note that in our example these sectors account for almost a third of the labor force.

[5] I assume here not that the same sector will have one-third the optimum amount of capital as has one-third the optimum amount of labor, etc., but only that there be one sector with one-third the optimum amount of capital, another with one-half, etc. In our example, the result is invariant with respect to shifts in the location of distortions, so long as the percentages of the labor force and capital stock subject to given amounts of distortion remain unchanged.

[6] The elasticity for prime beef, holding the price of choice beef constant, or that for Fords, holding the price of Chevrolets constant, would surely be greater than 2, but the elasticities of beef of all types, and for automobiles as a group, appear from existing studies to be substantially less than 2. Likewise, there is evidence that elasticities of import demand are sometimes greater than 2, but not that elasticities of demand for import-type goods (imports and their domestic substitutes) are as high as 2.

[7] Assuming that initially capital gets half the national income and has a marginal net productivity of 20 percent, a doubling of the capital stock while keeping the labor force constant would lead to a fall of capital's marginal productivity to 17 percent in the case of an elasticity of substitution of 2, to 14 percent if the elasticity were 1, and to 8 percent if the elasticity were one-half. Wages would rise only a little more than 20 percent in response to the doubled capital stock if the elasticity were 2; they would rise by 50 percent if the elasticity were 1, and by 90 percent if it were one-half. These calculations assume a perpetual capital stock; if depreciation is allowed for, the implied changes in the net marginal productivity become even more markedly different under the alternative elasticity assumptions. In the calculations, arc elasticities were evaluated at the midpoint of the range of each variable.

new elasticity assumption will cut our earlier estimate in half or double it. If, however, one is prepared to say that neither more extreme price distortions nor more extreme quantity distortions than those assumed are likely to prevail in the Chilean economy, then no changes in the assumed average elasticities can yield a higher estimate of welfare cost.

The principal sensitivity of the estimate is to the extreme distortions assumed. If, for sector 5 in Table 5.1, we had assumed the same quantity and price distortions as for sector 1, and if for sector 6 we had assumed the same quantity and price distortions as for sector 10, and if a similar augmentation of extreme distortions were made in the case of capital, our welfare index would have been 86 rather than 91. I feel reasonably confident that the assumed distortions are sufficiently extreme but indicate this sensitivity in the event that the judgments of others may differ.

Thus far we have not considered the possibility of distortions within sectors. Here I shall allow for 30 percent of the national income to be affected by such distortions. Within this 30 percent, I allow for one-half of each set of close substitutes to be priced 50 percent "too high" relative to the other half of the set, and I allow for the cross-elasticities of demand between the two halves of each set to be 5 (to my knowledge, no reliable estimate of this high a cross-elasticity has yet appeared). These extreme allowances lead to an estimate of the welfare cost of within-sector distortions equal to 3 percent of the national income. (The derivation of this result will be provided on request.)

In summary, I have estimated that the welfare costs of external distortions are less than 2 1/2 percent of the national income, the welfare costs of internal distortions among sectors less than 10 percent of the national income, and the welfare costs of within-sector distortions less than 3 percent of the national income. I reach the judgment that eliminating resource misallocations while maintaining existing production functions might raise the level of national welfare by some 15 percent, but probably not more.

II

Section I suggests that policies to improve resource allocation in economies like Chile may have effects which are substantial but would probably not lead to spectacular changes in the level of living. In this section we test the possibility that better allocation policies might lead to a substantial increase in the rate of growth of national income; thus having a spectacular dynamic effect on living standards.

The percentage rate of growth, g, of national income can be expressed as follows:

$$g = s_L l + im + r + q_L + t,$$

where s_L is the share of labor in the national income, l the percentage rate of growth of the (employed) labor force, i the fraction of national income devoted to net investment, m a weighted average of the net marginal productivities of capital in the various segments of the economy, r the contribution to the rate of income growth of reallocations of the resources of the economy, q_L the contribution of improvements in the quality of the labor force, and t

the contribution of technological advance. I shall consider each of the five components of the rate of growth in turn, defining it in more detail, indicating its possible order of magnitude, and attempting to judge its sensitivity to improved allocation policies.

The contribution of labor force growth to income growth is measured by $s_L l$. If the aggregate employed labor force grows at 2 percent per year, we estimate its potential contribution to national income by assuming that the new entrants have a similar quality distribution as the existing labor force and that they distribute themselves among industries and activities in the same proportions as the existing labor force. Taking the wage rate in each activity as our indicator of marginal productivity, we estimate the dollar contribution of this year's labor force growth to be 2 percent of last year's aggregate wage bill. Expressing this as a percentage of last year's national income yields $s_L l$. In Chile the labor force has grown at around 2 percent or slightly more per annum and the share of labor in the national income has been a little over one-half. Hence we reach the conclusion that labor force growth contributes slightly more than 1 percent per annum to the rate of income growth. Presumably neither the share of labor in the national income nor the rate of growth of the labor force would be affected by improved allocation policies.

The contribution of increased capital can be measured analogously with that of labor, yielding an expression $s_K k$, where s_K is the share of capital in the national income and k is the percentage rate of growth of the capital stock. Improved allocation policies would presumably not influence the share of capital but might influence the rate of growth of the capital stock through their effect on savings. Eliminating inflation would be the principal mechanism through which savings might be influenced; presumably voluntary savings would increase with less inflation, but "forced" savings would decline. To get an idea of the present magnitude of $s_K k$, it is convenient to express s_K as mK/Y, and k as I/K, where K is capital stock, I is net investment, and Y is national income. Thus $s_K k$ is equal to mI/Y, or im, which appeared in the formula given earlier. Net investment in Chile appears to have averaged somewhat less than 5 percent of the national income in recent years, and the marginal productivity of capital (in real terms) appears to be somewhere between 10 and 20 percent. The contribution of net investment to the rate of income growth thus probably lies between 1/2 and 1 percent per year. My judgment is that the low level of income of Chile would itself prevent net domestic investment from reaching a figure as high as 7 percent of the national income; hence I conclude that even in the event that the stopping of inflation leads to greater savings and investment, the resulting increase in the rate of income growth would be small, probably less than 1/2 percent per year.[8]

[8] Foreign investment does not help to raise the per capita income of the host country to the extent that the marginal product of the investment accrues to foreigners. The host country gains to the extent that part of the return on the foreign capital can be siphoned off, principally by taxes, and also through such technical advances as may be embodied in the foreign investment. Technical advance will be considered separately below. For the moment I shall write off as negligible the amount that could be siphoned off by the government out of the return on such extra foreign investment as might be made as a result of improved allocation policies.

In isolating the influence of increased labor and capital, we hypothetically held the distribution of each resource among industries and activities constant. The actual distribution will of course typically change over time, making for increases in national income if resources have moved from less productive to more productive uses, and for decreases in income if the opposite sort of movement has occurred. The potential increase of up to 15 percent in national welfare, which we estimated in section I might result from policies leading to improved resource allocation, would be reflected in r, the reallocation component of the growth rate. Since the job of reallocation clearly takes time, the whole gain would not be reflected in the income growth of a single year but would presumably be spread over several years, contributing, say, 1 or 2 percent to the annual growth rate for a series of years. Once this process of adjustment was completed, there would presumably be no further significant influence of improved policies on the reallocation component of the growth rate.[9]

Improved quality of labor makes a contribution q_L to the growth rate, which could be measured with reasonable accuracy if we had statistics on the distribution of the labor force by stable and well-defined quality categories. In the absence of such data, let me note (a) that policies to improve resource allocation would presumably have no direct effect on the improvement of labor quality; (b) that improvement in labor quality at present appears to contribute only a relatively small component to the rate of income growth in Chile; and (c) that additional expenditures on technical training and education in Chile might have substantial effects on the growth rate.[10]

The contribution of technical advance to the rate of growth of income works via changes in production functions which reduce unit costs (or improve quality for given cost). These changes can be organizational or technical, and may or may not entail additional net expenditures on capital equipment. We do not

[9] There is always some reallocation being called for, because of the changes in tastes and technology that steadily take place. However, the amount of reallocation newly called for in any given year would be only a small fraction of the total amount needed to move from the present highly distorted situation to an optimum. The normal contribution of r to the growth rate would thus probably be quite small once the transition toward an optimal allocation was substantially completed. This small contribution might be lower than the present normal contribution of r, because at present some of the reallocation which takes place is in response to price or wage disequilibria, which presumably would be smaller (or absent) in an optimal situation. On the other hand, some of the reallocation which now occurs may actually take resources from uses of higher to uses of lower marginal productivity (e.g., because of a subsidy on the latter uses). Such negative contributions to r would presumably not occur under a set of optimal policies.

[10] Statement (b) is based on the fact that over the last five or so years the rate of income growth has been at about the same rate as the rate of growth of population and can be largely explained on the basis of the incremental capital and labor that have been fed into the productive machine. There is thus little room for a substantial contribution from q_L. Because of Chile's high rate of population growth, relatively large expenditures on education and training are necessary in order to keep the average quality of the labor force constant, counteracting, so to speak, a potential decline in labor quality. Statement (c) is based on the fact that a year of technical training will raise an unskilled laborer's earning power by 50 percent or more, while four years of technical university training will about treble a high school graduate's earning capacity. The rate of return on investment in technical training is in the neighborhood of 20 percent per year, in real terms; this counts both foregone earnings and costs of providing instruction as components of the sum "invested."

have measures of the contribution of technical advance to the rate of economic growth in Chile, but, as in the case of improvement in the quality of labor, we infer from the low rate of per capita income growth that the contribution of technical advance has been small. I would not expect policies leading toward better resource allocation to have a substantial effect upon t, the contribution of technical advance to the growth rate. Incentives to reduce costs are just as strong in the present distorted price structure as they would be in an optimal one. Possibly, however, the elimination of inflation would produce a minor increment in t, because rapid inflation blurs people's perceptions of the relative price structure and may prevent them from being aware of some of the possibilities of reducing real costs.

I conclude from this evaluation of the possibilities of increase in the different components of the growth rate that policies aimed at improving resource allocation might help somewhat but would probably not provide the spectacular "take off" into economic development which most countries in Chile's position hope for. I would think of improved allocation policies as being an important component of any well-planned effort at achieving such a take off but not as the key factor. In the case of Chile, the potential gain of up to 15 percent in national income, indicated in section I as the static effect of improved resource allocation, would probably add a percent or two to the growth rate over a period of years. As the reallocation of resources neared completion, the contribution of r to the growth rate would fall back to its normal low level, but there might be some longer term influence of improved allocation policies on the growth rate via the increased saving and the increased precision of cost calculations which might result from stopping or greatly reducing inflation.

If there is any key factor at all for achieving rapid development, I believe it is technical advance. The possibilities of increasing the rate of saving are quite limited in poor countries, as are the possibilities of reducing the rate of population growth. The limited changes in these factors that seem plausible would not have a drastic effect on the growth rate of income. Technical advance, on the other hand, seems to be capable of contributing substantially to the growth rate for fairly long periods. According to Kendrick's estimates, technical advance (i.e., real cost reduction) in U.S. manufacturing went on at an average rate of over 3 percent per year from 1919 to 1929 and at an average rate of over 2 percent per year from 1929 to 1937.[11] Brazil, in spite of being poorer than Chile and in spite of having equally severe distortions in internal resource allocation, has enjoyed a growth rate of between 2 and 3 percent per year in per capita real income in recent years, as compared with Chile's rate of close to zero. I find the only plausible source of this difference to be a differential rate of technical progress.

[11] John W. Kendrick, "Productivity Trends: Capital and Labor," *Rev. of Econ. and Statis.*, Aug., 1956, p. 254. Kendrick's measure was essentially of $(q_L + t)$. He netted out of the observed growth the effects of added labor and capital, assuming that labor quality remained unchanged. Effects of reallocations were largely removed by his measuring growth rates for thirty-three industry groups separately. Kendrick's median measure for the 1919–29 period was 3.9 percent per year and for the 1929–37 period 2.6 percent per year. I use somewhat lower figures to make allowance for possible improvement in labor quality.

One way of viewing technical advance which may help rationalize its variations as among time periods and places is to treat it as a process of adaptation to possibilities. Let Z be the maximum income that could be produced with a country's existing resources if the best techniques possible with today's level of scientific knowledge were used. Define $G\,(=(Z-Y)/Y)$ as the percentage gap between today's income and its potential, Z. Let A be the coefficient of adaptation, telling the fraction of previously unutilized possibilities which are put to use in a year. If G were 50 percent, indicating a potentiality of raising income levels by 50 percent, and A were 2 percent, then technical advance would contribute 1 percent to the rate of income growth this year, the formula being $t = AG$.

Even the most casual observation suggests that the percentage gap between actual and potential use of existing resources is much greater in Chile than it has been in the United States — probably easily twice as big. If Chile were to achieve a coefficient of adaptation equal to that of the United States, she would thus probably obtain a level of t two or more times as high as prevails in the U.S. The long-term average level of t for the whole U.S. economy appears to have been somewhere between 1.0 and 1.5 percent per year.[12] We are thus suggesting that raising the Chilean coefficient of adaptation to the U.S. level might lead to a rate of technical advance of 2 or 3 percent per year. This would give Chile a rate of per capita income growth comparable to those which Brazil and Mexico appear to have had in recent years.

The disturbing thing about focusing on the rate of technical advance and on the coefficient of adaptation is the possibility that these key factors may be largely beyond the influence of policy decisions. An energetic and acquisitive society is likely to have a high coefficient of adaptation, but it is hard to see how public policy can create such a society. Furthermore, as Kendrick's work shows, even in a given society the rate of technical advance is subject to substantial fluctuations, for which no satisfactory explanation has yet appeared. Yet there are surely ways in which public policy can accelerate the rate at which available knowledge is applied to use resources more efficiently. This can be done in part by promoting the international flow of technical knowledge (e.g., fostering foreign direct investment or co-operative technical arrangements between domestic and foreign firms and technical training of nationals abroad) and in part by spreading knowledge internally.

In the Chilean case, I would emphasize the possibilities to be achieved from spreading technical knowledge internally. The rewards given by the market to engineers, technically trained managers, agronomists, and other technicians themselves justify the investment in their training at a rate of real return which compares favorably with the best returns on investment in physical capital equipment. Yet these are the very people who make it their business to reduce costs, and the benefits of cost reduction accrue largely to the general

[12] Kendrick, *op. cit.*, estimates $(r + q_L + t)$ for the U.S. private domestic economy to have averaged 1.7 percent per year from 1899 to 1953. A figure of about 1.6 percent is estimated by Abramovitz in "Resource and Output Trends in the United States since 1870," *A.E.A. Papers and Proceedings*, May, 1956, p. 8 (Table 1, Row 18). My lower figures attempt to make plausible allowance for the contributions of r and q_L.

public. Between the reward of these cost-reducers and their real social productivity we probably find divergences far more extreme than those which occur between private and social benefits in any other significant area of the economy. So long as the rate of private return on investment in technical training remains at or near the normal rate of return on capital, we have evidence that the social rate of return must be much higher, and an indication that public policy efforts to expand the supply of technically trained people have a high place on the list of policies to promote economic development.[13]

[13] Most of the physical investment projects which are justified on the basis of external economies have a private rate of return well below the normal rate; in addition, many of the external economies alleged to exist in these cases turn out on close examination to be questionable or of small magnitude. I feel that public investment in technical training represents a more advantageous use of public funds than a goodly fraction of the physical investments which have been carried out in Latin America either by the state or through direct or indirect subsidies.

In terms of the breakdown of the growth rate given earlier, the training of engineers, managers, etc., presents a problem. Should it be classified as contributing to q_L or to t? In principle the increment in quality of labor as measured by improvement in productivity along existing production functions belongs in q_L, while the effect of shifting production functions belongs in t. Faced with the need of making a practical choice, I would allocate the increment in market earning power of the people trained to q_L, and the excess of their total social productivity over their earnings to t. The issue is, however, in any case not substantive.