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RELATIVE PRICES, CAPITAL GOODS IMPORTS AND THE FOREIGN EXCHANGE CONSTRAINT: A CASE STUDY OF ARGENTINA

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NOTE

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I. Introduction

Recent studies by UNCTAD and the U.S. Agency for International Development designed to project foreign aid requirements have relied heavily on two-gap theoretical models [4, 5]. These models have been questioned on various grounds, but mostly for making rigid theoretical assumptions on many issues and in particular on those relating to international trade. In some instances, the very possibility that a separate trade gap can theoretically arise has been questioned [3, 13].

For a trade gap to exist, it is necessary that the rate at which a developing country can expand exports over time fall short of the rate at which imports must be expanded in order to attain a given growth rate of output. This implies that a developing country can neither expand its exports beyond a specified maximum nor reduce its imports beyond a specified minimum through substitution from domestic production. This study will attempt to explore the empirical foundations of the second of the above two assumptions -- that imports cannot be reduced below a specified minimum without repercussions on the output growth attained by the developing country. The analysis will concentrate on capital goods imports, as these are presumably crucial for development purposes. Specifically we will be concerned with one limited question: Do developing countries' tariff and exchange policies, as these are reflected in the domestic price of imported and domestic capital inputs, affect the distribution of investment between the two types of inputs? And if they do, what are the

implications for the trade gap analysis? The empirical analysis will be based on data from Argentina for the period 1949-1965. The choice of Argentina was primarily dictated by data availability. The analysis, as will be seen, requires data on the composition of capital stock by type of equipment which are not available for most developing countries.

II. The Theoretical Framework

Underlying the minimum import assumption in two gap models is a host of other assumptions rarely spelled out in trade gap or related discussions. These are assumptions which ultimately deal with production relationships in a developing country and, more specifically, with the elasticity of substitution between domestic and imported inputs.

In order for it to be said that a country must have certain imports to obtain a certain output growth rate, it is clear that these imports must be used in the production process as inputs. Only a certain kind of imports czn be considered essential, namely capital goods inputs used in production as well as intermediate inputs necessary for the utilization of existing productive capacity and future additions to it.

Certain analysts [9, 16] have argued that the ability of developing countries to substitute domestic for imported inputs is extremely limited and that domestic imported inputs have to be used in fixed proportions. This implies that either production must be undertaken with the use of a given technology that utilizes domestic and imported capital goods in fixed proportions, or that if alternative technologies are available, they all utilize some imported capital goods in fixed proportions. If domestic inputs can be substituted for imported ones at various relative prices, then capital goods imports can be reduced to zero, through the pursuit of an exchange rate or commercial policy that increases the domestic price of imported capital goods. Similarly, if alternative technologies are available, some using no imported inputs, then such a technology can be used and the minimum import amount could theoretically be zero. In addition, for a minimum amount of imports to be required

it is also necessary that there are limits to substitution of imports through variations in the composition of final demand.

These assumptions about fixed production coefficients and inability to substitute domestic inputs by variations in final demand are sufficient in the sense that if they are met, a certain growth rate could not be sustained without a certain minimum amount of imports. However, they are not strictly necessary. An alternative interpretation of the minimum import requirement may also be given which avoids making the extreme assumptions of fixed technology or fixed coefficients: It could, instead, be assumed that substitution between locally produced and foreign inputs can occur, but that domestic inputs are increasingly inferior substitutes for imports. Thus, raising the domestic price of imported inputs would encourage the channeling of developing countries' domestic resources to areas in which these countries are relatively inefficient -- such as the production of capital goods. Within the context of two-gap analysis such an allocation would have an adverse impact on the incremental-capital output ratio (ICOR), leading to a higher gap of resources as calculated from the investment-savings side. As a result, a foreign exchange constraint might perhaps be replaced by a more limiting savings constraint [10].

Thus, the minimum import requirement lends itself to two interpretations as far as the presumed elasticity of substitution between domestic and imported capital goods is concerned: either it can be assumed that the elasticity through both direct and indirect substitution is small or zero, or that it is large but that a certain amount of imported inputs is necessary in order to maintain a given ICOR. However it is clear that if the latter is the case, domestic and imported capital goods could not be good substitutes for one another.

To my knowledge, no empirical tests of the magnitude of this elasticity have been made, although assumptions about it are crucial in the determination of trade gaps and foreign exchange needs of LDCs. The lower this elasticity is, the more rigid are the import "requirements" calculated through two-gap models; and, if a foreign exchange constraint is effective, the more rigid the import requirements, the less the amounts of foreign

capital inflow needed to attain target growth rates may vary.

The attention that has been devoted to these assumptions has varied considerably. Most of the discussions, however, have been undertaken outside the specific framework of trade and aid analysis. Substantial work has been undertaken in the area of technology with writers emphasizing that developing countries employ borrowed technology, that this technology employs factors in combinations not compatible with relative factor scarcities in developing countries and that they experience difficulties in adapting this technology to local relative factor endowments or devising their own technology [12].

Although there is little agreement on the degree to which production inputs are variable, most of the discussion has been in terms of substitution between capital and labor. A large number of empirical studies have been undertaken using CES or Cobb-Douglas type production functions in developing countries. 1/ The vast majority of this empirical work deals with production functions in two factors: Capital and labor. In an ordinary CES function output may be shown to be related to capital and labor inputs in the following fashion:

$$X = \left[a K^{-b} + (1-a) L^{-b} \right]^{-1/b} \qquad (1)$$

where X stands for output, K and L stand for capital and labor inputs

1/ CES refers to that group of production functions with a constant elasticity of substitution between production inputs. This simply means that as output expands the ratio of the percentage change in inputs to the percentage change in their relative prices is constant. Cobb-Douglas is one type of function in this group in which the elasticity of substitution is assumed to take the value of unity.

respectively, and a and b are constants.

However, to lump all capital into one and examine its elasticity of substitution with labor implies that all types of capital inputs are perfect substitutes for one another. This is the very assumption which trade gap analysis does not make. It assumes that in fact there are two types of capital goods inputs: some domestically produced (K_d) and some imported (K_m), and the two are not perfect substitutes.

One way of viewing the relationship between K_d, K_m, and K is as follows:

$$(2) \qquad K = \left[c\, K_d^{-f} + (1-c)\, K_m^{-f} \right]^{-1/f}$$

where K is a CES function of its two components and c and f are constants. 1/ In this case the elasticity of substitution between the two kinds of capital goods, s_m, would be defined as in (2) by:

$$(3) \qquad -1 \qquad f = \frac{1-s_m}{s_m} \qquad < \infty$$

The estimation of s_m could proceed as follows: with given prices of different capital goods, entrepreneurs could determine the optimum combination of these goods employed in production. The optimum combination would be the one that equates the ratio of their marginal products to their price ratio. This condition may be derived from

1/ Combining (1) and (3) we can get a two-stage CES production function as follows:

$$(2a) \qquad X = \left[a \left(c\, K_d^{-f} + (1-c)\, K_m^{-f} \right)^{\frac{b}{f}} + (1-a)\, L^{-b} \right]^{-\frac{1}{b}}$$

This is similar to the function used by Sato in [14], except that capital is disaggregated into imported and domestic capital goods.

(3) and can be shown to be:

$$(4) \qquad \frac{P_m}{P_d} = \left[\frac{1-c}{c}\right]^{-f} \left[\frac{K^*_m}{K^*_d}\right]^{-f-1}$$

$$cr$$

$$(4a) \qquad \frac{K^*_m}{K^*_d} = \left[\frac{1-c}{c}\right]^{s_m} \left[\frac{P_m}{P_d}\right]^{-s_m}$$

where K^*_d and K^*_m denote equilibrium ratios and P_m and P_d are respectively prices of imported and domestic capital equipment.

Let us define

$$(5) \qquad Q^* = \frac{K^*_m}{K^*_d}, \quad P = \frac{P_m}{P_d} \quad \text{and} \quad C = \frac{1-c}{c}$$

Inserting these definitions in (4a) we get that in each time period t:

$$(6) \qquad Q^*_t = C^{s_m} P_t^{-s_m}$$

Producers can not adjust immediately the composition of their capital stock to the equilibrium one dictated by relative prices in each time period. They can do so only with a certain time lag, so that the effect of changing relative prices on the capital stock is spread out over time. Following Sato [14] let us also assume a lag mechanism such as shown in (7) for adjustment of the actual capital stock distribution (Q_t) to the equilibrium one, (Q^*_t).

$$(7) \qquad Q_t = Q_{t-1}^{1-r} Q^{*r}_t \quad \text{where } 0 < r < 1$$

In (7) the actual stock in period t can be viewed as the weighted geometric mean of the equilibrium stock composition in the previous time period. The lag factor (r) determines the weight given to equilibrium stock and previous year stock composition. The higher the value of r, the faster the adjustment of actual to equilibrium stock. At the limit, a value of r close to unity would imply that all the adjustment is made in one year. On the other hand, a value near zero would imply a long adjustment period, with current year stock composition not much different from that of the previous year.

Substituting (7) into (6) and adding an error term (e^u) in view of the stochastic nature of the equation we get:

$$(8) \qquad Q_t = C \; P^{s_m r} \; P^{-s_m r} \; Q_{t-1}^{1-r} \; e^u$$

which can be used to estimate s_m.

As noted earlier, the estimates will be based on capital stock data for Argentina for the period 1949-1965. The method for constructing the capital stock estimates as well as a description of the variables employed are described in the Appendix. A few comments, however, are appropriate at this point on some major questions that arise from employing the method of analysis described above.

One argument that has been raised against aggregate analysis involving relative prices is that such analysis is likely to include heterogeneous capital goods whose prices are not comparable. This might suggest that imported inputs are in some way different from

domestically produced ones, and that changes in the effective exchange rate at which they are imported will not affect materially the amounts imported. If that were the case, we would expect little relation between the aggregate price indices and the composition of capital goods. However, if a strong relation between prices and investment composition is uncovered, this would suggest that there are considerable opportunities of substitution despite the heterogeneity in the composition of capital stock. While a higher degree of disaggregation that that presented here might be useful, data are not available. Besides, this discussion will disaggregate capital goods more than most previous studies which usually lump all capital together.

A related question concerns the meaning of relative price indices of aggregates on which quality and relative weights may change over time. If changes in quality are reflected in relative prices then the tests proposed will take account of the quality factor. If they are not, then the tests designed here are likely to be biased against discovering a relationship between relative prices and the composition of investment. If, despite that, a relationship is shown to exist, then the findings would be that much strengthened. The problems of changing weights is more difficult to deal with. However, in the case of Argentina there is outside evidence that fixed weights indices of similar aggregates showed similar trends [6].

III. Capital Stock in Argentina

A. Past Trends

The structure and evolution of capital formation in Argentina has been the subject of a number of investigations [6, 7]. In part, interest in this subject has been generated by the observation that while fixed capital formation accounted for a large share of GNP (about twenty percent in most post-war years), GNP growth was slow, implying a very high incremental capital output ratio. However Diaz has shown that in real terms capital formation averaged only about 13% of GNP. Thus the high ICOR, in large part, can be attributed to increases in the prices of capital goods relative to the general price level [6].

It is instructive to note that the prices of domestically produced equipment barely changed relative to the overall price level as reflected in the GNP price deflator. On the other hand prices of imported capital goods and investment in construction rose drastically over the period as a whole.

The increased prices of capital goods imports were primarily the result of exchange rate policies of the Argentine government resulting from chronic shortages of foreign exchange. These policies relied heavily on exchange controls until 1955. Since 1955 the price mechanism, through the use of exchange rate adjustment, tariffs and surcharges has been used more prominently. However, the policy mix since 1955 and at least until the 1967 reforms, has had similar effects in raising prices of imported capital equipment.

In recent years various analysts have brought attention to the fact that developing countries have used the exchange rate mechanism and trade controls to encourage the cheap importation of capital goods. Such practices, it is argued, have resulted in an understanding of the scarcity cost of capital and the use of excessively capital intensive techniques with adverse effects on employment objectives [18, pp. 68, 87]. Argentina is an exception to this pattern. "Argentina is one country where this policy was not only not used but the prices of equipment goods were kept artificially high by the imposition and levying of very high tariffs" [18, p. 68].

The impact of this price policy on the composition of investment is quite striking. Imported capital goods declined from 30.1% of gross fixed capital formation in 1935-38, to 10.6% in 1965. Similarly, investment in building and structures declined from 74.0% of total GFC in 1935 to 38.7% in 1965. These changes were paralleled by rapid increases in the domestic output of machinery and equipment. By the early 1960's Argentina produced domestically more than 60% of the machinery and equipment used in GFC.

These changes in composition of GFC in turn led to considerable adjustments in the composition of the capital stock by type of asset. Except for the immediate post-World-War II years when the economy was restocking equipment from foreign sources cut off during the war, installed imported equipment declined continuously as a proportion of total capital stock (equipment plus structures) and as a

TABLE 1

ARGENTINA

RELATIVE PRICES OF CAPITAL GOODS

Year	Imported/ Domestic Equipment 1959-61 = 100	Structures/ Imported Equipment 1960 = 100
1949	39.2	-
1950	45.0	177.36
1951	57.8	199.49
1952	46.3	198.20
1953	48.4	161.16
1954	57.9	140.78
1955	71.7	120.56
1956	82.6	118.71
1957	91.9	100.86
1958	97.2	114.10
1959	91.7	75.81
1960	122.8	100.00
1961	91.6	120.16
1962	85.5	119.69
1963	97.4	112.56
1964	96.2	140.49
1965	81.8	-

Source: Banco Central de la Republica Argentina, "Origen del Producto y Composicion del Gasto Nacional." Boletin Estadistico, Suppl. July 1966.

proportion of total equipment stock. In 1949, imported equipment accounted for 20.5% of total stock and 67.8% of total equipment stock. In 1965, the imported component fell to 17.0% of total stock and 44% of total equipment (see Table 2).

B. Statistical Analysis

The focus of the investigation is on the fitting of equation (8) (page 8) to various components of capital stock in Argentina. The primary objective is to determine the elasticity of substitution between imported and domestically produced equipment (s_m), and the implications of this elasticity for the foreign exchange situation in Argentina during the period examined.

A secondary objective is to determine the elasticity of substitution between imported equipment and investment in buildings and structures (s_c). In a developing country setting, conditions of foreign exchange stringency may induce an adjustment in the sectoral composition of investment with a larger amount of savings directed to private housing construction whose foreign exchange component can be assumed to be minimal. This effect would introduce additional flexibility into the economic system but at the expense of increasing the share of investment in the construction sector, where the incremental capital-output ratio is generally higher than average. 1/

Using (8) and taking logs we estimated two equations for Argentina for the period 1949-1965. Equation (9) investigates the relationship of the ratio of investment in imported relative to domestic equipme

1/ In terms of the model, this test implies a further disaggregation of capital stock into two domestic omponents, equipment and construction. Logs to the base e were employed.

TABLE 2

ARGENTINA

COMPOSITION OF CAPITAL STOCK
in billions of 1960 pesos

Year	Imported Equipment	Domestic Equipment	Structures	TOTAL
1945	162.57	103.67	807.97	1074.21
1946	147.87	103.83	826.87	1078.57
1947	190.25	111.88	854.07	1156.20
1948	229.45	119.33	880.29	1229.07
1949	265.72	126.71	905.57	1298.00
1950	276.63	133.54	943.90	1354.07
1951	278.48	141.16	985.54	1405.18
1952	298.08	150.84	1030.99	1479.91
1953	304.61	158.68	1068.13	1531.42
1954	306.62	166.91	1105.33	1578.86
1955	304.66	177.73	1138.81	1621.20
1956	311.17	196.10	1173.90	1681.17
1957	322.55	217.78	1206.62	1746.95
1958	331.56	242.30	1245.63	1819.49
1959	335.55	269.19	1295.74	1900.48
1960	328.69	293.46	1325.21	1947.36
1961	347.89	345.18	1368.79	2061.86
1962	380.64	410.54	1414.89	2206.07
1963	411.76	454.90	1448.56	2315.22
1964	420.05	480.42	1474.38	2374.85
1965	416.21	523.89	1501.95	2442.05

(Q_t) and changes in their relative prices (P). Equation (10) investigates the same relationship but disaggregates investment into structures and imported equipment (Q'_t). 1/

(9) $$\log Q_t = .95548 - \underset{(.10770)}{.22424 \log P} + \underset{(.08681)}{.90090 \log Q_{t-1}}$$

$$*R^2 = .973 \qquad DW = 2.039$$

(10) $$\log Q'_t = 1.39232 - \underset{(.11343)}{.10284 \log P'} + \underset{(.67965)}{.31497 \log Q'_{t-1}}$$

$$*R^2 = .658 \qquad DW = 1.077$$

The fit in (9) is quite good, all coefficients are statistically significant at the .01 level and there is no significant autocorrelation. The elasticity of substitution between domestic and imported equipment (s_m) and the lag parameter (r) calculated were as follows:

$$s_m = 2.263 \quad r = .099$$

The fit in (10) is not as good, and although the price variable is of the hypothesized sign, it is not statistically significant. The following parameters were estimated from (10)

$$s_c = .150 \quad r = .685$$

The main finding of this analysis is that elasticity of substitution between imported and domestic equipment is not only different

1/ Figures in parenthesis are standard errors. The R^2 has been adjusted for degrees of freedom and DW stands for the Durban-Watson autocorrelation statistic.

from zero, but in fact of considerable magnitude. 1/ The substitution parameter computed can be assumed to reflect the effect of both the direct and indirect substitution mechanisms discussed above (pp. 2-3). In addition, while there may be a relationship between imported equipment and investment in buildings and structures the relationship is quite weak and likely to be swamped by other effects.

The implications of these findings for Argentine investment and foreign exchange outlays can be illustrated by the use of a simple example. Assume a 10% increase in the relative price of imported to capital equipment in 1966. Also assume that total equipment stock in 1966 rose at the same rate that prevailed in the period 1960-1965. Using equation (9), it is estimated that K_m and K_d in 1966 would be 444.33 and 576.31 billion pesos (1960 prices) respectively. By comparison, if relative prices remained constant, K_m would be 449.81 billion and K_d 570.83 billion.

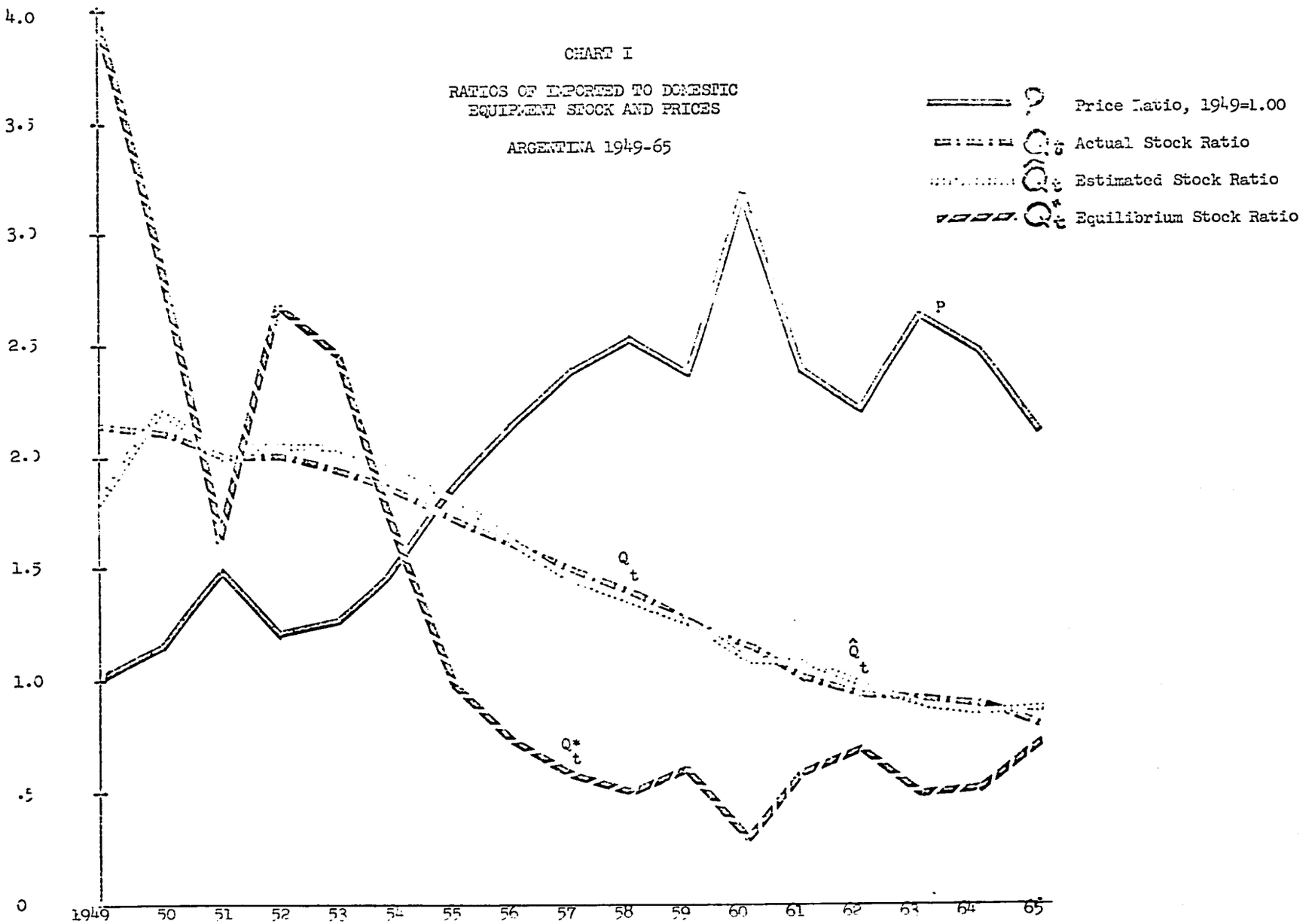
The postulated price change would result in a decline of 5.48 billion pesos, or 16% of the estimated net capital formation in imported equipment for that year. In current prices and 1966 exchange rates, this amounts to $37 million. This is equivalent to about 57% of the mean annual trade deficit incurred by Argentina in the period 1950-1965.

1/ These findings are very close to estimates of the elasticity of substitution between equipment and structures and the adjustment lag obtained for the U.S. by Sato through the use of essentially the same model. He estimates $s_k = 2.75$ and $r = .095$ [6, p. 210]. However, estimations of this elasticity for Argentina did not yield statistically significant results.

CHART I

RATIOS OF IMPORTED TO DOMESTIC EQUIPMENT STOCK AND PRICES

ARGENTINA 1949-65



Inserting in (6) the value of s_m estimated from (8) we obtain the following expression:

$$(11) \qquad Q^*_t = (71.1)^{2.263} P_t^{-2.263}$$

This can be used to estimate the value of the equilibrium composition of capital stock (Q^*_t) as between imported and domestic equipment. These values are plotted in Chart I, and compared with the actual values (Q_t), the values ($\hat{Q}_t$) estimated from equation (8) and the ratio of relative prices (P). The values of the equilibrium distribution vary considerably from the actual, exceeding them in the earlier part of the period and falling short in the later years. However, there is considerable convergence of the two towards the end of the period examined. This relationship could be expected in light of the considerable adjustment lag implicit in the low value of the estimated lag parameter (r = .099). If we assume that the equilibrium ratio at the base period is twice the actual ratio ($Q^* = 2Q_o$) and remains constant thereafter, for an r = .1, it will take about 20 years for the actual ratio to equal the equilibrium one. 1/

1/ From (7) we obtain:

$$(7a) \qquad Q_t/Q^* = (Q_o/Q)^{(1-r)}$$

This can be solved for t to obtain the number of years required for Q_t/Q^*_o to equal Q_o/Q^* for a given r.

IV. Implications for Two-Gap Models

A. Argentina

The finding of a substantial elasticity of substitution between imported and domestic equipment in Argentina represents no more than a simple empirical confirmation of the import substitution process Argentina went through in the capital goods sector. It provides strong evidence that domestic supply responded to changing relative prices of equipment. Diaz [6] has argued that the short-run supply elasticity for domestic equipment has been extremely small and for all intents and purposes could be viewed as zero. He acknowledges, however, that in the longer run the supply schedule has shifted. Our analysis suggests that the long run shift has been substantial. While producers will spread the adjustment of the composition of their stock over time, even the short term response to changes in relative prices resulting from exchange and trade policies is considerable and can not be ignored. Diaz also argues that the uncertainty surrounding government foreign exchange policies has acted as a disincentive to domestic investment in capital equipment. While it is difficult to dispute this assertion, the responsiveness of domestic supply is nevertheless remarkable; perhaps it would have been greater in the absence of such uncertainties.

It should be added, of course, that the Argentine experience may not be easily duplicated in other countries. Argentina, at the beginning of the period, possessed a substantial industrial sector. If industrial development is in its infancy and the developing country is only producing the most simple capital equipment, quite likely the

response of domestic supply to price stimuli will be much more sluggish.

The responsiveness of the Argentine economy to changing relative prices combined with foreign exchange difficulties implies that substantial resources were allocated to the capital equipment sector. This in no way implies that such an allocation pattern was efficient. On the contrary it can be argued that the overall Argentine policy of industrial protection which included substantial protection to the capital goods sector led to considerable inefficiencies. It is not clear from available evidence whether the Argentine capital goods industry is any less efficient by comparison to other industral sectors. Rather, the inefficiencies seem to have resulted from overall discrimination against the traditional agricultural sector and the allocation of substantial resources to manufacturing including capital goods production. Through most of the period examined, the policy of industrialization cum protection discouraged investment and technological improvements in agriculture, Argentina's most important and traditional export sector [18, pp. 374-6]. There has been a considerable switch away from exports to production of non-exportables for the home market. But the growth rate of total agricultural output has been very low, around 1 per cent per annum since the 1930's [18, p. 106].

Foreign exchange difficulties may thus have led Argentina into a trap: in response to foreign exchange shortages resources were channeled to inefficient manufacturing activities including the production of

capital goods. This made it possible for a rate of investment to be maintained and not be limited by availability of foreign inputs, but the inefficiencies involved led to a low growth rate of output. The situation seems to parallel exactly the theoretical analysis of alternative interpretations of the foreign exchange constraint in Section II, page 3.

This analysis is consistent with the findings of a recent investigation of the constraints on growth of various developing countries in the recent past [15]. In this study Weisskopf showed that in Argentina for the period 1954-1965, both a savings and a foreign exchange constraint held simultaneously at the expense of full capacity output. This may have resulted, as argued above, from the ability of Argentina to adjust to foreign exchange shortages, but at the cost of allocative efficiency.

B. General

For reasons explained above, it is difficult to generalize the Argentine experience to all developing countries. However, for developing countries with an industrial infrastructure, the finding that in Argentina the distribution of the capital stock is responsive to changing relative prices raises doubts about the validity of rigid complementarity assumptions in two-gap models relating to minimum level of imports. Perhaps for these countries the usefulness of two-gap model medium term projections, e.g., 5 years, lies simply in pointing out prospective bottlenecks and suggesting policy measures designed to affect relative prices of imported and domestic inputs.

Similarly, for these countries one may question the usefulness of two-gap models based on rigid complementarity assumptions in projecting levels of foreign assistance "needed" to attain long term development objectives on the basis of a projected foreign exchange constraint distinct and separate from a savings constraint.

However it should be stressed that while the analysis suggests that there was a high degree of substitution between domestic and imported inputs, it occurred at the expense of efficiency. Substitution has been achieved but apparently at a considerable cost.

It would then appear appropriate to relax the complementarity assumptions implicit in many two-gap models. But when this is done, it is extremely important to investigate the consequences of the implied import substitution on the efficiency of resource allocation.

Additional research in this area is needed to determine the extent to which the Argentine experience has been duplicated in other countries. A recent investigation in Turkey [11], for example, also showed considerable responsiveness of the composition of investment as between domestic and imported equipment to changes in the relative user cost of such equipment. However, the same study concluded that policies which stimulate investment in sectors with a high component of domestic equipment investment will increase aggregate employment and value added. This conclusion appears to be in contrast to the Argentine experience, although the limits of the present investigation do not make it possible to demonstrate this

conclusively.

Argentina is unique in that, unlike other developing countries, it did not subsidize capital goods imports by the use of an artificially low exchange rate or low duties for the importation of such commodities. Yet the resultant expansion of the domestic capital goods industry can not be considered to have led to an optimal resource allocation pattern. Of course, one should not conclude from this that other developing countries are justified in pursuing trade policies which consistently under price capital by encouraging the cheap importation of capital goods. Rather it should be stressed only that the results show that pricing of inputs has an important impact on the input mix employed. The use of protection to avoid real or perceived foreign exchange difficulties can provide a strong price stimulus to domestic expansion of manufacturing activities even in the capital goods sector. Foreign exchange outlays could well be reduced but possibly at the cost of reduced overall efficiency, which may result in a net negative contribution of such policies to the attainment of growth objectives.

APPENDIX

Data and Sources

A. Prices

The price indices have been constructed by comparing the valuation of imported and domestic capital at current and at constant prices. One drawback of such indices is that they do not give any weight to capital goods whose import prices were raised so high that no imports came into the country. This is a common problem which can not be avoided.

An added problem with the use of these indices results from the fact that Argentina employed quantitative controls to restrict imports of capital goods. Under this system importers of the commodities who were also users, and were lucky enough to secure the permission to import, can pay a price much lower than the scarcity value of the equipment. Since most importers in fact also were users, the price index of imported equipment would seriously understate its scarcity price. The understatement appeared to be extreme in the period 1952-1955, and for this period the import price index was adjusted by linear interpolation based on values at the beginning and the end of the subperiod. The source for the price data is the Argentine Central Bank [2].

B. Stocks

The stock estimates were arrived at as follows: on the basis of unpublished CONADE data reported in Diaz [6], it was possible to arrive at an estimate of equipment and construction stock in 1935,

valued at 1960 prices. These stock estimates are compatible to those published by Balboa and Fracchia in [1], which express Argentine stock at 1950 prices.

Then, gross investment and depreciation data by type of equipment (imported vs. domestic) and construction were used to obtain e estimates of capital stock in subsequent years. The investment data for the period prior to 1950 were reported in [6]; for the period after 1950 the source is [2].

The rates of depreciation available related only to either equipment or construction; thus, it was assumed that the rates of depreciation for imported and domestic equipment were identical.

After the research for this study was substantially completed, it was possible to obtain the original CONADE stock estimates. A comparison of these estimates with the ones used in this study yielded only minor discrepancies.

It should be stressed that while in the text a sharp distinction is drawn between domestic and imported equipment, this distinction is in fact less precise. The stock estimates were based on investment estimates where the imported equipment is valued at the point of installation. As such it includes certain amounts of value added domestically in the form of internal transport costs, margins for intermediaries, etc. Similarly, domestic equipment as well as construction includes a considerable, but unquantifiable component of imported inputs which is ignored. Despite the obvious data difficulties, it is believed that the indices constructed do not reflect systematic biases which would cast serious doubt on the validity of the statistical analysis.

REFERENCES

1. M. Balboa and A. Fracchia "Fixed Reproducible Capital in Argentina, 1935-1955", in R. Goldsmith and C. Saunders, Measurement of National Wealth, Chicago, 1959.

2. Banco Central de la Republica Argentina, "Origen del Producto y Composicion del Gasto Nacional". Boletin Estadistico, Suppl. July 1966.

3. H. Bruton, "The Two-Gap Approach to Aid and Development", and H.B. Chenery, "Reply", American Economic Review, June 1969.

4. H.B. Chenery, "Targets for Development", Economic Development Report #153, Harvard University, 1970, (Mimeo).

5. H.B. Chenery and A. Strout, "Foreign Assistance and Economic Development", American Economic Review, September 1966.

6. C. Diaz-Alejandro, Essays in the Economic History of the Argentine Republic, Ch. 6, Yale University Press, New Haven, 1970.

7. R. Hayn, "Capital Formation and Argentina's Price-Cost Structure", The Review of Economics and Statistics, August 1962, pp. 340-343.

8. I. Little, T. Scitovsky, M. Scott, Industry and Trade in Some Developing Countries - A Comparative Study, Oxford, 1970.

9. R. McKinnon, "Foreign Exchange Constraints in Economic Development and Efficient Resource Allocation", Economic Journal, June 1963.

10. C. Michalopoulos, "Foreign Exchange Constraint, Tariffs and Import Substitution", Kyklos, June 1970.

11. J. McCabe and C. Michalopoulos, "Investment Composition and Employment in Turkey", A.I.D. Discussion Paper #22, Washington, D.C., 1971.

12. H. Pack and M. Todaro, "Technological Transfer, Labor Absorption and Economic Development", Oxford Economic Papers, November 1969.

13. G. Ranis and J. Fei, "Foreign Assistance and Economic Development Revisited", and H.B. Chenery and A.M. Strout, "Reply", American Economic Review, September 1968.

14. K. Sato, "A Two Level CES Production Function", Review of Economic Studies, 1967.

15. T.E. Weisskopf, "An Econometric Test of Alternative Constraints on the Growth of Underdeveloped Countries", Harvard University, 1970.

16. J. Vanek, Estimating Resource Needs for Economic Development: Theory, Method and a Case Study of Colombia, New York, 1967.