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A Survey of Import Substitution Measures

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INTRODUCTION

The term 'import substitution' has gained extensive coverage in development literature. Many alternative meanings happen to be attached to it. Further, many studies have estimated the contribution of import substitution to industrial growth. The actual measures devised and deployed in making the statistical calculations are so diverse that the resulting estimates often lack comparability, and there is no unanimity on the appropriate technique to measure import substitution.

Considering the importance of various analysis of import substitution, this article is devoted to a scrutiny of these alternative measures.

CHENERY, LEWIS AND SOLIGO'S MEASURE

According to Chenery (1960: 640) import substitution is defined as the "difference between growth in output with no change in the import-ratio and the actual growth." This is the measure of import substitution that is most widely used. The magnitude of import substitution between two periods 1 and 2 is denoted as:

$$IS = \frac{(\sum_{i=1}^{n} Q2^i / \sum_{i=1}^{n} S2^i) - (\sum_{i=1}^{n} Q2^i / \sum_{i=1}^{n} S2^i) \cdot \sum_{i=1}^{n} S2^i}{\sum_{i=1}^{n} \Delta Q^i} \qquad \text{(i)}$$

Where Q_1, S_1, Q_2, and S_2 represent sectoral output and supply in periods 1 and 2, respectively. It is clear that Chenery's formula ignores individual industries and employs directly the sum of imports, supplies, and domestic production for the group as a whole.

Lewis and Soligo (1965: 94 - 139), on the other hand, made certain modifications in Chenery's equation. They decomposed output growth for each industry into that ascribed to import substitution, aggregated these import substitution effects

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into the group import substitution effect, and then divided the total group effect by the growth of output for the group. These successive operations produce the measure of import substitution for the group as a whole. This is written as

$$\frac{\sum^{n}[\{(Q_2^i / \sum^{n} S_2^i) - (Q_1^i / S_1^i)\} \cdot S2^i]}{\sum_{i=1}^{n} Q_i} \qquad \text{(ii)}$$

The result of the above two measures will diverge; and the ranking of different groups can be reversed by the choice of a different kind of aggregation. Moreover, these measures do not assist in analysing sectors where there is a fall in production, imports and import/supply ratio.

DESAI'S MEASURE

According to Desai (1969: 312 - 23), there prevail two types of import substitution measures: (i) those referring to some notion of optimality, and (ii) those which are purely descriptive of changes in the actual pattern of imports and domestic production.

The following notations are used to illustrate these measures:

$C_1^aM_1^a$ = actual import of commodity Y in period 1;
$C_1^OM_1^O$ = optimal import of commodity Y in period 1;
$C_2^aM_2^a$ = actual import of commodity Y in period 2;
$C_2^OM_2^O$ = optimal import of commodity Y in period 2;
$C_1^aS_1^a$ = actual supplies of commodity Y in period 1;
$C_1^OS_1^O$ = optimal supplies of commodity Y in period 1;
$C_2^aS_2^a$ = actual supplies of commodity Y in period 2; and
$C_2^OS_2^O$ = optimal supplies of commodity Y in period 2.

There are four measures of import substitution out of which one relates to description of actual the other there involve optimality.

Import substitution, according to measure I Which is known as 'actual' import substitution, exists if

$$\frac{C_2{}^aM_2{}^a}{C_2{}^aS_2{}^a} < \frac{C_1{}^aM_1{}^a}{C_1{}^aS_1{}^a}$$

This is the fundamental measure which takes into account the actual situations in periods 1 and 2.

In Measures II, there is positive import substitution if the following equation holds true:

$$\frac{C_1{}^oM_1{}^o}{C_1{}^oS_1{}^o} > \frac{C_2{}^oM_2{}^o}{C_2{}^oS_2{}^o}$$

Optimal policies are pursued in each period. This is known as 'optimal' import substitution.

Measure III compares the optimal solution in the second period with the actual of the first period. The first-period actual is assumed as a given initial condition and the second period optimal solution is a target to be reached by suitable policies (for instance, by unified exchange rate policy, if no distortions prevail). Import substitution is positive if

$$\frac{C_1{}^aM_1{}^a}{C_1{}^aS_1{}^a} > \frac{C_2{}^oM_2{}^o}{C_2{}^oS_2{}^o}$$

This is known as 'target' import substitution.

In measure IV, a static concept is formulated that is based on a comparison of the actuals with the optimal for any period by itself. Hence, if the actual ratios of imports to total supplies is less than that corresponding to the optimal solution, there is import substitution. Hence if.

$$\frac{C_1{}^aM_1{}^a}{C_1{}^aS_1{}^a} < \frac{C_1{}^oM_1{}^o}{C_1{}^oS_1{}^o} \text{ and } \frac{C_2{}^aM_2{}^a}{C_2{}^aS_2{}^a} < \frac{C_2{}^oM_2{}^o}{C_2{}^oS_2{}^o}$$

then there is positive import substitution in periods 1 and 2, respectively.

Measure I constitutes a pure statistical description, and the other three measures are subject to serious limitations. One principal variant of this measure is to estimate import substitution by taking the difference between the directly observed import-availability ratios. Suppose M_1 and S_1 are the imports and total supplies during period 1, and M_2 and S_2 are the imports and total supplies during period 2, then

$$M_2/S_2 - M_1/S_1 \qquad \text{(iii)}$$

gives the actual measure of import substitution. Similarly,

$$\frac{M_2/S_2 - M_1/S_1}{M_1/S_1} \qquad \text{(iv)}$$

is the relative measure.

However, the limitation of these absolute and relative measures is that the impact on production due to a change in the import/supply ratio cannot be ascertained. Moreover, these measures are important tools for evaluating import dependence rather than import substitution.

MORLEY AND SMITH'S MEASURE

According to Morley and Smith (1970: 728 - 35), import substitution measures which do not incorporate intermediate demands can be very misleading. They maintain that import of a final product in effect comprises imports of all the intermediate goods constituting the product. These implicit or indirect imports can be consolidated in a comprehensive domestic input-output table as follows. Suppose A denotes such a table and a_{ij} represent constant over the relevant range. Thus,

$$[I - A]x + m = f$$
$$x + [I - A]^{-1}m = [I - A]^{-1}f$$
$$m^* = [I - A]^{-1}m \text{ the vector of redefined imports}$$
$$z^* = x + m^* = \text{the new vector of total supply}$$
$$IS_i = (m_i{}^{o*} / z_i{}^{o*} - m_i{}^{t*} / z_i{}^{t*})\, z_i{}^{t*}$$

where m_i = imports, x_i = gross production, f_i = final demand, both domestic and foreign, and a_{ij} = observed input-output coefficient; m^* converts imports to a gross production basis and allocates them to their respective domestic sectors.

FANE'S MEASURE

Fane (1973: 251 - 61), points out that both the Chenery measure and the Morley-Smith measure of import substitution can produce incompatible results since there could be positive import substitution in each industry and still negative import substitution for all industries as a group.

Fane agrees with Chenery's concept of import substitution that positive import substitution relates to an increase in the ratio of domestic gross output to total supply -

and develops a technique for reconciling the different results which can be obtained using aggregated or disaggregated data. Import substitution for industry i is evaluated in two parts : (i) import substitution within the industry, denoted by M_i, and (ii) the extra contribution, M_i^* of growth in industry i to import substitution in all industries. The total contribution of industry i to import substitution, M^T_i is then difined using

$$M^T_i = M_i + M_i^*$$

Suppose X_i = domestic gross output in industry i; I_i = imports competing with industry i; S_i = total supply (= Demand) of output of industry i; and $U_i = X_i/S_i$. Hence $S_i = X_i + I^i$.

Using formulas appropriate for small changes dM_i and dM_i^* are defined by :

$$dM_i = S_i dU_i \qquad \text{(vi)}$$

$$dM_i^* = (U_i - U)\, dS_i \qquad \text{(vii)}$$

Where $X = X_i$; $S = S_i$; and $U = x/S$. M_i and M_i^* are obtained from dM_i and dM_i^* by integration.

The rationale for the definition of dM_i^* is that growth in an industry with a higher than average ratio of domestic production to total supply leads to an augmentation in this ratio for the whole group.

The contribution of import substitution to the growth of all industries, denoted by M, may be defined by applying equation (vi) to aggregate data.

$$dM = SdU \qquad \text{(viii)}$$

GUILLAUMONT'S MEASURE

Guillaumont points out that the solution proposed by Fane does not seem quite appropriate, and thus develops another measures of import substitution at the product level and at the global level. He has suggested that the average import coefficient at a global level as a criterion of import substitution should be discarded. For the economy as a whole, the significance of variations in the import coefficient is not very clear,it can arise not only from the import substitution of different goods, but also from a change in the structure of demand.

Import substitution at a global level is defined in terms of relative value and absolute value: in relative value, through the difference between the value of the average import coefficient which would have prevailed if the import coefficients by product had been unchanged and the actual value of the import coefficient; in absolute value,

through the difference between the value of imports which would have prevailed if the import coefficients by product had been unchanged and the actual value of imports. The contribution of import substitution to growth is then assessed by the ratio of this absolute value to the increase in production.

The difference in the import coefficient of a product and that of an economy is that the ratio of imports to gross supply will not be the same as the ratio of imports to its net supply as would be the case at the global level.

The most consistent procedure to obtain a definition of the import coefficient of a sector is to begin from the final demand for each product and then weight the import coefficient by the relative shares of the final demands. The actual import coefficient of a given product i purchased at the final demand stage is the relative import content of this demand. In other words, it is the proportion of this demand, both of the amount of good i directly imported to satisfy it, and of all imported inputs used for the local production of the product i and embodied in it.

Suppose, in matrix notation, Q, M, and F stand for the column vectors in which the elements are the sector levels of output, import, and final demand, respectively, A the square matrix of technical coefficients, and the diagonal matrix in which the elements are

$\mu i = m1/(1-mi)$. Thus,
$Q + M = F + AQ$,
$(I - A) Q + M = F$
$(I - A + \mu\hat{}) Q = F$
Thus, $Q = (I - A + \mu\hat{})^{-1} F$

Let d_{ij} denote the elements of the inverse matrix $(I - A + \mu\hat{})^{-1}$.
Hence $Q_i = \sum^{i.} d_{ij} F_i$, and the import content coefficients are $mi" = \sum^{i} d_{ij} \mu_i$.

Measured in relative value, the actual import substitution is

$$ri" = -\Delta m_i$$

For the whole economy, the measure is

$$r" = -\Sigma \Delta m_i" . \infty_i" = \Sigma r_i" . \infty_i"$$

with a weighting coefficient $\infty_i" = F_i/Z'$, that is the relative share of the final demand of the product i in the total final demand or net global supply (with $\infty_i" = 1$). In absolute value, import substitution is denoted as

$$R" = r" Z' = \Sigma r_i "F_i$$

where Z' is the net supply of the product.

Moreover, if there are no input-output tables, there are two other possible but approximate solutions. The first method is to define the import coefficient of each sector by the ratio of imports of product i to the gross supply of the product. The sum of the gross supplies of each product being larger than net global supply, the sum of the weighting coefficients used to pass from the sectoral coefficients to the global coefficients used to pass from the sectoral coefficients to the global coefficient is superior to one. The second solution calls for the definition of the import coefficients by product in the same way as the global coefficient, that is, the ratio of the imports of product i to the sum of imports plus the added value in the sector i. This is called the 'net supply' of the product i.

Whichever method is chosen the variation in the average import coefficient can be divided into two parts: (i) change in the structure of demand: and (ii) import substitution.

$$m = \sum^{i}(m_{io} \cdot \Delta\infty_i) - r$$

(where m_{io} is the sector import coefficient in the base period). The term on the left-hand side of the above equation is the variation of the average import coefficient. The first term on the right-hand side ($[m_{io} \cdot i]$) is the change in structure of demand and r reflects import substitution.

$$\Delta Q' = (1-m_o)\Delta Z' - \Sigma (m_{io} \cdot \Delta\infty_i)Z' + R$$

(where m_{io} is the average import coefficient in the base period). The term on the left-hand side of the above equation represents the increase of output. The first term on the right-hand side denotes the effect of variation of final demand. The second term portrays the change in structure of demand, and the last term stands for import substitution.

One limitation of Guillaumont's measure is based on teh fact that changes in final demand of a sector affect output level of the corresponding sector. But changes in final demand of a sector affect output not only of that sector, but also other sectors as well.

CONCLUSION

Various measures of import substitution were discussed. None of the measure are impeccable. The choice of an appropriate measure depends on the purpose of the study and the availability of data.

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BOOK REVIEW

Mrigendra Lal Singh and Sanu Babu Sayami (1990): An Introduction to Mathematical Demography (Kathmandu: J.M. Singh and B.D Manandhar) PP. V+ 218, Student Price Rs. 100.00.

After 1950's rapid population growth became a crucial problem to the world, especially for the developing countries. Thus, now a days, population study is given much more stress in the world to propagate awareness among the people about the consequences of rapid population growth. Nepal is no exception from this problem. Planners and policy makers through the government and non-government organizations are engaged to find out the way of reduction in population growth rate.

The book under review is the first attempt in Nepal published to accquaint to the readers of demographic studies with mathematical approaches and to give knowledge of some indirect techniques to estimate population parameters with suitable UN definition and example from Nepalese censuses. The book is divided into nine chapters and several sub-chapters. First chapter starts with the introduction of population statistics and its historical development, definition and branches of demography. This chapter also tries to give a short description about the sources of demographic data.

Second chapter of this book deals with theoretical as well as practical aspects of sex and age composition. On sex composition the authors explained quality of sex data, masculinity proportion and masculinity ratio (sex ratio) with example of Nepal from 1981 population census. Dealing with age composition they tried to cover the concepts and types of errors in population data obtained from either population census or surveys, evaluation of age data through different indices of age and digit preferences (Index of age preference, Whipple's Index, Age Ratio, Age Accuracy Index). From the analysis of all these indices it can be conclude that population data of Nepal obtained from population census are not reliable and are not suitable for direct estimation of population parameters. The population of Nepal is younging in each censuses since 1952/54, consequently the dependency ratio is increasing in every census.

Generally birth data can obtained from vital registration system of the country. But most of the developing countries have not reliable system of vital registration. Thus, birth data may be collected either through national population censuses or demographic sample surveys. In Nepal fertility and direct and indirect standardization of birth data are obtained from 1981 population census of Nepal.

Chapter IV of this book is concentrated to explain the observed and adjusted death rates computed by various methods. Life table provides the most complete statistical description of mortality in many countries. On the basis of reference year life table can be categorised into two types the current or period life table and the generation or cohort life table. The former type of life table is common, and again these two types

of life tables can be classified into two kinds (complete and abridged) according to the length of the age interval.

Chapter V also deals with construction of life tables by Reed-Merrell method and Greville's method with the meaning of each column and their relationship to each other. First part of the chapter VII explains some of the model life tables such as: UN's life tables, Coale and Demeny regional life tables (East, West, North and South Model), Leaderman's system of life table, Brass Logit Life table system and the second part deals with component method of population projection.

Generally population models (Chapter VI) are of two types. One is the deterministic model and the other is stochastic model. The first model further divided into time Series model and Demographic model. Again Time Series model is classified into Linear and non-linear. The eighth chapter deals general concepts and methods of Population indices and last chapter of this book deals indirect techniques of demographic measures such as estimation of fertility, mortality by different methods.

Though the book under review is prepared on the basis of syllabus of statistics is equally useful to the master level students of Population Studies and to those who are taking demography in economics and other decipline to know the theoretical as well as practical knowledge on different aspects of population analysis. Finally, I believe that this book will be able to fulfil the lackings faced by the students of the concerned subjects as well as planners, policy makers and general readers of population.

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