Quotas and the Structure of Consumer Demand

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Abstract: In the direct utility function, quantities are exogenous, while prices and total expenditure are endogenous. Consequently, this utility function is appropriate for analyzing the impact on prices and total expenditure from an exogenous change in the quantity of a commodity. Such an exogenous change in quantity could occur when quotas change. The direct translog utility function is estimated for a four commodity breakdown of U.S. expenditure. Estimates of quantity elasticities of price and expenditure indicate that domestically produced non-durables are necessities. As a result, the imposition of quotas on these goods will be particularly deleterious to lower income consumers.

1. Introduction

With the imposition of a quota, the quantity of the commodity changes exogenously, while prices and total expenditure (income) change endogenously. In this manner, quotas affect the level and distribution of expenditure among commodities. Although many domestic and imported commodities have been subjected to quotas, there have been very few empirical estimates of the influence of quotas on consumers. A utility function which allows for substitutability among commodities is required to estimate these influences. The direct translog utility function derived by Jorgenson/Lau [1975] is suitable for this purpose since quantities are exogenous, while prices and total expenditure are endogenous. The direct utility function corresponds to the indirect demand function since the ratios of prices to total expenditure (viz., normalized prices) are functions of the quantities consumed. Moreover, this utility function is sufficiently flexible that it can incorporate restrictions thereby enabling tests of hypotheses about the form of the function.

The direct translog utility function is used in this study to derive the domestic demand in the United States for domestically produced consumer non-durables (1), durables (2), services (3) and consumer imports (4). Since quotas have been applied frequently to imported varieties of consumer goods, commodities are disaggregated

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3) A quota could be placed on transportation services as well as on electric and gas utility services to consumers during an energy crisis.
into domestic and foreign. The translog utility function allows expenditure shares to vary with the level of total expenditure and enables the examination of substitution patterns among the four commodities. Arbitrary separability restrictions are not imposed. Estimates of the effects of an exogenous change in the quantity of each commodity on prices and on total and marginal expenditure are provided. The study demonstrates that an exogenous change in the volume of necessities (luxuries) has a negative (positive) impact on money expenditure. These goods are preferred by lower (upper) income consumers. Under these circumstances, an exogenous decrease in the quantity of these goods, which would occur when they are subjected to a quota, will be particularly deleterious to lower (upper) income consumers.

2. Functional Form and Estimation

Jorgenson/Lau [1975] write the direct translog utility function as:

\[-\ln U = \alpha_0 + \sum \alpha_i \ln X_i + 1/2 \sum \sum \beta_{ij} \ln X_i \ln X_j\]

where \( X_i \) is the quantity consumed of the \( j \)-th commodity. Utility maximization subject to the budget constraint \( \Sigma p_i X_i = M \) yields the expenditure share equations:

\[ p_j X_j / M = (\alpha_j + \sum \beta_{ji} \ln X_i) / (\sum \alpha_i + \sum \beta_{Mi} \ln X_i) \quad (j = 1, \ldots, m) \]

where \( \beta_{Mi} = \Sigma \beta_{ji} \), and where \( p_j \) is the price of the \( j \)-th commodity, and \( M \) is the value of personal consumer expenditure. The normalization \( \Sigma \alpha_i = -1 \) is required for estimation.

In the present case \( m = 4 \). Since the expenditure shares sum to unity, the parameters of any one equation can be obtained from the other three. The equation for imports is obtained in this manner.

The approach of this study adheres to Jorgenson/Lau's [1975, p. 56] by taking utility maximization to be "an assumption rather than an hypothesis to be tested". Utility maximization implies that the parameters satisfy fourteen equality and symmetry restrictions. The parameters \( \beta_{Mi} (i = 1, 2, 3, 4) \) must take the same values in all three equations. There are eight equality restrictions. The imposition of symmetry entails the following restrictions on the parameters: \( \beta_{ij} = \beta_{ji} \) \((i \neq j, i, j = 1, 2, 3, 4)\). There are three such restrictions for the parameters of the three equations which are estimated directly and three for the parameters of the equation which is estimated indirectly from the budget constraint. Thus, there are six symmetry restrictions. These restrictions reduce the number of unknown parameters from twenty-seven to thirteen.

\[ 4) \] The indirect utility function is not estimated. In this function, quantities are endogenous, while prices and total expenditure are exogenous. The indirect utility function corresponds to the direct demand function since quantity consumed is a function of the ratio of price to total expenditure. However, when quotas change, quantities change exogenously causing prices and total expenditure to change endogenously. Consequently, an examination of the indirect utility function lies outside the scope of this study.