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This paper presents a model which estimates the economic significance of preference nonhomotheticity in international trade. Tastes are assumed to be identical, but budget shares depend on per capita income. A linear expenditure system is estimated for 34 countries over 11 commodity aggregates. A counterfactual exercise is conducted to estimate the volume of trade caused by deviations from homotheticity. The results indicate that nonhomothetic preferences contribute to 27.2% of interindustry trade flows. I regard this level of trade, caused only by systematic differences in demand due to differences in per capita income, as a significant result.

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I. INTRODUCTION

International trade theory has tended to focus on differences in production between countries. The classical or Ricardian theory of trade cites differing technologies between nations as the source of trade and gains from trade. The neoclassical or Heckscher-Ohlin model examines trade arising out of divergent factor endowments. More recently, the trade literature has focused on scale economies and monopolistic competition as a cause of trade. Most models of trade have assumed that preferences are identical and homothetic and paid little or no attention to the role of demand in determining trade patterns.[1]

Furthermore, models that have attempted to examine the relationship between preferences and trade have been scarce and used very different approaches. There is no cohesive body of literature addressing the issue of how demand patterns affect trade. This may be due to the fact that, although most economists agree that preferences are not identical or homothetic, it is unclear whether demand patterns significantly affect trade patterns.

The purpose of this paper is to address the economic significance of nonhomothetic preferences in determining trade patterns. Section II describes a counterfactual exercise, called <u>demand homogenization</u>, which measures the vector of trade flows caused by nonhomotheticity of demand. This approach is as follows. Demand systems for a group of countries are estimated. These demand systems determine the current vector of trade flows. Demand is then homogenized and new consumption values are established. The process of homogenizing demand involves aggregating individual demand curves throughout the world, then disaggregating demand so that countries consume goods in the same proportion (i.e. demand is homothetic). The changes in consumption that occur from homogenization are transformed into changes in the volume of trade. It is then possible to examine the differences between the original trade vector and this new homogenized trade vector. This defines the quantity of trade caused by nonhomotheticity of preferences.

Section III describes the results from the demand homogenization exercise. A simple Linear Expenditure System (LES) using cross section data is estimated. The demand homogenization exercise is then conducted on the LES model. The results indicate that nonhomothetic preferences contribute significantly to current trade flows. Furthermore, net flows would increase if preferences were homothetic. Preferences play an important role in determining trade volumes.

In section IV I analyze several implications of this study to other models that attempt the examine the role of preferences in trade. Hunter and Markusen (1987) discuss the relationship of preferences and trade in work by Linder (1961), Prebisch (1964) and Singer (1950), Leamer (1984), Leontief (1953, 1956), and Markusen (1986). The results presented in this paper provide stronger evidence supporting the model developed by Markusen (1986). Recent empirical studies on the gravity equation support the view that demand plays a role in determining trade. This literature includes work by Thursby and Thursby (1987) and Bergstrand (1989). On the other hand, Bowen, Leamer and Sveikausus (1987) find that nonhomothetic preferences do not significantly contribute to trade. I examine the reasons for our opposing results.

Finally, in section V I conclude and reiterate the significance of the results presented in this paper. Economists often make unrealistic assumptions. This may be a valid thing to do, as long as these unrealistic assumptions do not greatly affect the ability of economic models to predict behavior. However, I find that the assumption of homothetic preferences significantly affects trade models' predictive capability of interindustry trade flows.

II. DEMAND HOMOGENIZATION

There are two important stages in examining the importance of nonhomothetic preferences in international trade. First, the statistical significance of preference nonhomotheticity must be tested. That is to say, the null hypothesis that preferences are homothetic must be empirically invalidated. This issue is addressed in Hunter and Markusen (1987). We reject the hypothesis of homothetic preferences at a statistically significant level. Many previous studies also provide support for the view that preferences are neither homothetic nor identical.[2]

Even though preferences are found to be nonhomothetic, it is difficult to understand the relevance of this finding with respect to international trade. Preferences may not play an important role in determining trade patterns. I propose a method of estimating the economic significance of preferences to trade. This second stage involves measuring the volume of trade caused by preference nonhomotheticity. This section describes the counterfactual exercise devised to address this issue.

First, a general equilibrium model of trade is defined. Equilibrium trade flows from this model are compared with the trade flows of a more restrictive model. The restrictive model contains demand curves that are identical and may include homothetic preferences. The discrepancy between the equilibria in the two models defines the contribution of trade resulting from the restrictions.

The method by which demand curves of the restrictive general equilibrium model are derived is called demand homogenization. Demand homogenization is the process by which demand is aggregated and then disaggregated so that it is identical throughout the world. The disaggregation may be done in several ways, depending on the interests of the investigator. Demand homogenization is conducted independently of the supply side of the model. That is to say, the structure of production does not change.

This definition of demand homogenization is very general. As stated above, the restrictions which are placed on the demand functions depend on the interests of the investigator. For the purposes of this study, there are several desirable properties the homogenized demand functions should fulfill. First, the homogenized demand functions must be identical. Second, since the interests of this study are the effects of nonhomothetic preferences on trade, the homogenized demand functions must reflect homothetic preferences.

Another important property of the homogenized demand functions is that these new consumption levels be attainable. In other words, once demand is homogenized, individuals' budget constraints must still be met. A fourth and final desirable quality is that world demand for each good remains constant after homogenization. If the homogenized demand functions fulfill this property, prices will not vary after homogenization. The reason this property is desirable is that it allows the investigator to estimate solely a demand system and ignore the supply side of the model since prices are unaltered. Due to data constraints, it is not possible to examine cross country demand and supply systems simultaneously.

The method of demand homogenization proposed for this paper fulfills all of the desirable properties given above. Formally, this proposed system of homogenized consumption points of m countries for the jth good is:

$$q_1 C^h_{1j}(p_1,\ldots,p_n,I_1,\ldots,I_m) = \frac{q_1 I_1}{\sum_{i=1}^{m} q_i I_i} \sum_{i=1}^{m} q_i D_{ij}(p_1, \ldots, p_n, I_i)$$

$$\vdots \qquad (1)$$

$$q_m C^h_{mj}(p_1,\ldots,p_n,I_1,\ldots,I_m) = \frac{q_m I_m}{\sum_{i=1}^{m} q_i I_i} \sum_{i=1}^{m} q_i D_{ij}(p_1, \ldots, p_n, I_i).$$

where D_{ij} is the original demand function of a representative individual in the ith country for the jth good, p_j $(j=1,\ldots,n)$ is the price of the jth good, q_i $(i=1,\ldots,m)$ is the population of the ith country, and I_i $(i=1,\ldots,m)$ is the per capita income of the ith country.

First of all, although it may not be clear at a glance, the underlying preferences of the homogenized demand system are identical. The method of homogenization given in (1) defines consumption points for a single demand function. Total world demand is redistributed according to each country's share of world income. Thus, the weights allocated to each country sum to one. The homogenized demand function given by the consumption points in (1) defines Engle curves which are linear and go through the origin.

Secondly, the underlying preferences represented by the consumption points in (1) are homothetic. In general, an individual is said to have homothetic preferences if at all levels of income he or she consumes the same proportion of his or her budget on each good. In other words, if an individual's income is doubled, his or her consumption of each good will double. In this case I am concerned that preferences be homothetic across countries. Thus, a country which has double the income of another country must consume twice the value of each commodity. It is easy to see that this condition holds with the proposed homogenized demand functions in (1). A country with double the income of another country will consume twice as much of each good (i.e. its share of world income will be twice as large.) Given current levels of income, consumption is homothetic across the world. This property will be discussed further in Section III.

The third desirable property is that the homogenized consumption points be attainable. If the homogenized consumption points for each country are summed across all goods, the result is that each country receives its weighted share of total world demand for all goods. Since initial demands are attainable and each country is given its share of world income, then total homogenized consumption for each country must be attainable as well. Once demand is homogenized, individuals in each country still meet their budget constraints.

Since the actual demands of each country are averaged and the weights allocated to each country sum to one, total world demand for the jth good remains constant. In this case, the supply side of the model may be ignored. Net changes in trade for each good will sum to zero (i.e. changes in exports will equal the changes in imports). The final desirable property is fulfilled by the homogenized demand functions as defined above.[3]

This homogenization method may be seen graphically in Figures 1 and 2. OC_j^h defines the homogenized consumption path. C_i^h defines the homogenized consumption point of country i given its income. One can see that the homogenized consumption vector is derived by adding demand points $(C_1^* + C_2^*)$, then reallocating consumption relative to each country's share of income.

Individual demand functions do not receive equal weight in the process of homogenization -- they receive a weight relative to their share of total income.

Figure 1 shows the case of two countries with different and homothetic preferences. Figure 2 gives the case of two countries with different and nonhomothetic preferences. It can be seen that this method of demand homogenization always yields demand functions which represent identical and homothetic preferences. OC_j^h will always go through the origin (i.e. represent homothetic preferences) because each country's demand function is weighted according to its share of world income. Also notice that since this method of demand homogenization is the sum of actual consumption points ($C_1^* + C_2^*$), the resulting homogenized consumption path will vary depending on the income levels of the two countries.

III. PROPOSED MODEL AND RESULTS

As discussed in the section II, previous work by Hunter and Markusen (1987) concludes that preferences are statistically not homothetic. Thus, the next step is to examine the economic significance of preference nonhomotheticity. This involves the application of the demand homogenization exercise described above. I begin with the LES derived from a simple Cobb-Douglas (also known as Stone-Geary) utility function. The consumer's utility function is given by:

$$U(C) = \prod_{i=1}^{n} (C_i - \bar{C}_i)^{\beta_i}$$

$$\sum_{i=1}^{n} \beta_i = 1 \qquad (2)$$

where C_i denotes the consumption of good i and $\overline{C}_i$ is the minimum consumption requirement of good i. The income-consumption path for a given set of prices is linear but does not go through the origin. When the above utility function is maximized subject to the standard budget constraint, the resulting demand functions permit perfect aggregation into a market demand function of the folowing form:

$$p_i C_i = \sum_{j=1}^{n} \alpha_{ij} p_j + \beta_i I_i \qquad (3)$$

where p_i is the price of good i and I_i is per capita income of country i.

The demand system in equation (3) is estimated using Ordinary Least Squares (OLS). Cross section data for 34 countries is used to include a wide range of per capita incomes and so as not to exclude possibly large variations due to differences in tastes. The problem with international data, however is that exchange rate converted numbers are often different from the real or purchasing power parity comparisons. In other words, official exchange rates do not take into account the differing powers of exchange rates. For example, Kravis, Kenessey, Heston and Summers (1975) point out that in 1970 U.S. dollars converted to sterling could buy a bundle of U.K. goods that was 52% greater than the dollars could have purchased in the U.S. To get around this problem, real exchange rate figures for 1975 derived by Kravis, Heston and Summers (1982) are used. Data for 11 commodity aggregates for the 34 countries are used. The list of countries is given in Table 1 and the results of the OLS estimation are given in Table 2 in the Appendix.

It should be noted that the data include solely consumption expenditures and do not provide information regarding the decision to divide income between consumption and savings. "Income" is defined as the sum of expenditures in each of the 11 goods categories. Because of this restriction, independent OLS estimation of (3) for each commodity will generate estimates that automatically satisfy adding-up restrictions.

To examine the economic significance of nonhomothetic preferences on trade, demand is homogenized and the resulting trade flows are compared to current trade. The fitted consumption values from the LES system for the 11 goods are homogenized in the following manner:

$$p_{ij}c^h_{ij} = S_j \sum_{k=1}^{m} q_k p_{ik} \hat{c}_{ik}$$

$$S_j \equiv \frac{I_j}{\sum_{i=1}^{m} q_t I_t} \tag{4}$$

where $\hat{C}_{ik}$ is the fitted consumption value of country k (k=1,...,m) for good i (i=1,...,n) and S_j is the income share of country j. The difference between the fitted consumption values and the homogenized levels of consumption is calculated. This indicates the change in consumption caused by forcing preferences to be homothetic. The purpose of beginning with the fitted consumption values is to remove the effects of differences in preferences and random noise and to focus strictly on nonhomotheticity of tastes.

This procedure for homogenizing demand is derived by collapsing the LES into Cobb-Douglas preferences (the limiting case of the LES as the $\bar{C}_{ij}$'s approach zero) subject to preserving the total world consumption level of each good. In other words, all countries have demand functions of the form

$$p_{ij}c^h_{ij} = \tilde{\alpha}_i I_j. \tag{5}$$

In order to preserve the total world consumption levels, the $\tilde{\alpha}_i$ are not the marginal shares α_i from the estimated LES but rather the average shares implicitly defined from the data. That is, the $\tilde{\alpha}_i$ are defined by

$$\tilde{\alpha}_i = \frac{\sum_{k=1}^{m} q_k p_{ik} \hat{C}_{ik}}{\sum_{i=1}^{m} q_i I_i}. \tag{6}$$

Substituting (6) into (5) results in equation (4)

$$\begin{aligned} p_{ij} C^h_{ij} &= \left(\frac{I_j}{\sum_{i=1}^{m} q_i I_i}\right) \sum_{k=1}^{m} q_k p_{ij} \hat{C}_{ik} \\ &= s_j \sum_{k=1}^{m} q_i p_{ik} \hat{C}_{ik}. \end{aligned} \tag{7}$$

Note that, due to the fact that expenditures (price times quantity) depend only on income, homogenization as defined here does not require the assumption that prices are equalized across countries. Relative price differences are preserved in the move from fitted to homogenized demand so that trade due to price differences is not mixed in with trade due to nonhomotheticity of tastes.

These changes in consumption values caused by demand homogenization are then converted into changes in trade flows. The consumption goods categories are converted into the trade goods classification (SITC -- Standard International Trade Classification) for the available data. First consumption goods are mapped into production goods (ISIC -- International Standard Industrial Classification) using a conversion matrix derived by Ballard, Fullerton, Shoven and Whalley (1985) for 1973 U.S. data. Individual country conversion matrices are created for mapping ISIC categories into SITC categories from input-output tables for the 21 countries denoted by an asterisk in Table 1. Input-output data availability reduces the number of countries from 34 to the subset of 21 countries. The 11 consumption categories are mapped into 13 trade goods. Changes in consumption from demand homogenization, as well as those changes caused by moving from actual to fitted consumption, are mapped into these 13 trade goods.

In order to measure the significance of changes in trade flows resulting from demand homogenization, the following statistic is estimated:

$$Q = \frac{\sum_{i=1}^{21}\sum_{j=1}^{13}|\delta\hat{T}_{ij}|}{\sum_{i=1}^{21}\sum_{j=1}^{13}|\delta\hat{T}_{ij}| + \sum_{i=1}^{21}\sum_{j=1}^{13}|T^{h}_{ij}|} \qquad (8)$$

where $\delta\hat{T}_{ij}$ is the change in trade from homogenization and T^{h}_{ij} is the homogenized net trade vector. The homogenized trade vector is calculated as net trade vector which would result if consumption is forced to its homogenized values. The estimated Q is .272.[4]

This definition of Q measures the contribution of nonhomothetic preferences to trade. The purpose of demand homogenization is to neutralize the effects of demand in determining trade flows. Homogenizing both demand and supply in the manner defined in this paper would result in zero trade.[5] This is because all countries would be identical, except for population, and there would be no reason for trade. The first term in the denominator of Q is the change in trade caused by neutralizing demand, and the second term of the denominator is the change in trade which would occur if supply were also homogenized. Demand homogenization leads to trade vector T^h; if supply was then homogenized, trade flows would be eliminated.

The definition of Q can be further understood by examining specific examples. If demand were the sole cause of trade, then homogenizing demand would lead to zero trade. Q would equal one in this case $(\sum_{i=1}^{21} \sum_{j=1}^{13} |T_{ij}^{h}| = 0)$. If demand were already identical and homothetic (i.e. preferences did not contribute to trade), then trade would not change upon homogenization. Q would equal zero in this case $(\sum_{i=1}^{21} \sum_{j=1}^{13} |\delta T_{ij}| = 0)$.

If demand-induced trade reinforces supply-induced trade, the values of Q are obvious. For example, let demand-induced trade reinforce trade flows to be twice that of supply-induced trade. Homogenizing demand cuts trade flows in half. In this case Q equals one-half. This is because supply-induced trade flows equal trade caused by non-neutral demand $(\sum_{i=1}^{21} \sum_{j=1}^{13} |T_{ij}^{h}| = \sum_{i=1}^{21} \sum_{j=1}^{13} |\delta T_{ij}|)$. If demand-induced trade dampens trade flows caused by supply, the values of Q become less obvious. For example, let nonhomothetic preferences dampen trade to be half of what it would be if demand were neutral. Homogenizing demand would double trade flows. Q, however, would equal one-third. This is because supply-induced trade flows are twice as large as trade flows caused by demand $(\sum_{i=1}^{21} \sum_{j=1}^{13} |T_{ij}^{h}| = 2(\sum_{i=1}^{21} \sum_{j=1}^{13} |\delta T_{ij}|))$. In this case demand contributes to one-third of current trade flows.

Due to data limitations one single LES system is estimated across countries. This means that I must begin with the assumption of identical preferences. I homogenize the fitted consumption points to remove the effects of differences in preferences and random noise in the data. Homogenizing the fitted consumption values solely neutralizes the effects of nonhomothetic preferences. Furthermore, since I am examining net trade flows, intra-industry trade is not examined in this paper. I use actual net trade flows to avoid any concern that trade is not balanced within this 21 country subset. Thus, the value of Q as calculated in this paper measures the contribution of nonhomothetic preferences to interindustry trade. The estimated Q indicates that nonhomothetic preferences contribute to 27.2% of net trade flows. I regard this level of trade, caused only by systematic differences in demand due to differences in per capita income, as an economically significant result.

Because Q is defined in terms of the absolute value of trade and changes in trade, it is impossible to know what has happened to the direction of trade by examining Q alone. One needs to know the relationship between the fitted trade vector and the homogenized trade vector. The correlation between the changes in trade resulting from homogenization and the homogenized trade vector across the 13 goods is estimated. The results indicate this correlation to be .605. A positive correlation implies that positive net trade flows are on average associated with positive changes in trade upon homogenization and vice versa. The correlation between the fitted and the homogenized trade vectors is estimated to be .919.

These results indicate that the direction of trade has been reinforced -- positive net trade values in the fitted model are on average associated with positive homogenized net trade flows. Figure 3 displays this general relationship between consumption and trade flows. $\overline{C}_1\hat{C}$ defines the fitted consumption vector and OC^h defines the homogenized consumption vector. At income levels less than I^*, for a given p^*, homogenization of demand will move consumption from $\hat{C}'$ (the fitted consumption point) to $C^{h'}$ (the homogenized consumption point). If production occurs at S', the initial fitted trade vector is equal to $S' - \hat{C}'$. This implies that the lower income countries in general would export C_1, the necessity good. Once demand is homogenized, the direction of trade is reinforced. The final homogenized trade vector for this country would be $S' - C^{h'} = \hat{T}^{h'}$. Similarly, for income levels higher than I^*, countries which initially tend to export C_2 will increase their level of trade once demand is homogenized.

Previously it was explained how under a given interpretation of demand homogenization (the limiting case of Cobb-Douglas preferences) prices need not be equalized across countries. In this case, the fitted consumption values are already free of relative price effects. One method to generalize the above results is to begin with fitted consumption values in which price differences have been explicitly removed. The volume of trade and correlation exercises have been repeated for this more general situation. The new fitted consumption values are calculated by giving every country the relative prices of the U.S. (which equal one since U.S. prices were used as the numeraire). It is then possible to add the coefficients on the relative prices into the constant. The new fitted values become income times the coefficient on income plus this new adjusted intercept term. Demand is then homogenized from those new fitted values. The results are very similar to those described previously. Q is equal to .267; the correlation between the changes in trade resulting from homogenization and the homogenized trade vector is .678; and the correlation between the fitted and the homogenized trade vectors is .908. In this case the estimated Q indicates that nonhomotheticity of preferences contributes to 26.7% of net trade.

IV. IMPLICATIONS

The results of this study have a number of interesting applications. Hunter and Markusen (1987) discuss work by Linder (1961), Prebisch (1964) and Singer (1950), Leamer (1984), Leontief (1953, 1956), and Markusen (1986). The homogenization exercise in this paper provides further support for studies which examine the role of preferences in determining trade, particularly Markusen's model. Markusen constructs a model which integrates the theories of trade based on factor endowments, economies of scale and nonhomothetic demand. First, the world is divided into two regions, North and South. The North is subdivided into East and West. The North is relatively capital abundant and the South is relatively labor abundant. A modification of the monopolistic competition model of trade is utilized to explain intra-industry East-West trade of the differentiated manufactured good, while North-South interindustry trade is explained by neoclassical theory.

In Markusen's model the labor abundant South produces labor-intensive homogeneous goods which it trades for capital-intensive differentiated manufactured goods from the North. He assumes that preferences are not homothetic and that the labor intensive goods have high minimum consumption requirements. The South then specializes in both consuming and producing the same set of goods and trade is accordingly reduced below what would be predicted if preferences were homothetic.

According to Markusen's model, the industrialized countries are also relatively specialized in both consuming and producing the same set of goods. But these are differentiated manufacturing goods. Goods are sold to both domestic and foreign consumers and are cross-hauled among the industrialized countries. While net trade flows may be small, the gross flows may be quite large. In Markusen's model increases in the degree of nonhomogeneity lead to reductions in North-South trade, but to increases in East-West trade.

In examining the correlation between changes in trade resulting from demand homogenization and the homogenized net trade vector, support is provided for Markusen's explanation for the relatively low volume of North-South trade.

The correlation between these changes in trade and net homogenized trade flows is .605. This finding suggests that positive net exports are in general associated with positive changes in trade resulting from making demand homogeneous. Removing income effects (i.e. forcing the preferences to be homothetic) leads to a larger volume of interindustry trade. Figure 3 displays this relationship between consumption and trade flows and shows how these results support the above hypothesis. If lower income countries are initially net exporters of the "necessity" good and higher income countries export the "luxury" good, the volume of trade will increase once demand is homogenized. Because preferences are not homothetic, each country initially spends a greater proportion of its income on its own export good.

Authors in the gravity equation literature have begun to examine the role of demand in trade. Bergstrand (1989) includes both factor-endowment variables and taste variables into the following gravity equation:

$$PX_{ij} = \psi_0 (Y_i)^{\psi_1} (Y_i/L_i)^{\psi_2} (Y_j)^{\psi_3} (Y_j/L_j)^{\psi_4} (D_{ij})^{\psi_5} (A_{ij})^{\psi_6} e_{ij} \qquad (9)$$

where PX_{ij} is the U.S. dollar value of trade from country i to country j, Y_i is the U.S. dollar value of nominal GDP in i, L_i is the population in i, D_{ij} is the distance from the economic center of i to that of j, A_{ij} is any other factor either affecting trade between i and j, and e_{ij} is a log-normally distributed error term. Bergstrand estimates a generalized version of equation (9) which includes a "nested" CES-Stone-Geary utility function -- a bilateral version of the one in Markusen (1986). He finds that manufactures tend to be luxuries and that raw materials, fuels, and chemicals tend to be necessities in consumption.

Thursby and Thursby (1987) test the Linder hypothesis using bilateral trade flows in a gravity equation framework. The Thursby and Thursby bilateral interpretation of the Linder hypothesis is that trade in manufactures will be inversely proportional to the differences in per capita incomes. Their sample includes seventeen countries over the period 1974-1982. They find "overwhelming" support of the Linder hypothesis.

Both the Bergstrand and Thursby and Thursby studies conclude that differing demand patterns arising out of differences in per capita income contribute to trade flows. It should be noted that since their studies examine bilateral trade flows, they are including both intra-industry and interindustry trade. I am examining solely interindustry trade since my data set contains net trade flows.[6]

Bowen, Leamer, and Sviekauskas (1987) test the Heckscher-Ohlin-Vanek (H-O-V) theorem, a multi-dimensional extension of the Heckscher-Ohlin hypothesis, and more general versions allowing for nonhomothetic preferences, technological differences, and measurement errors. Bowen, et. al., define country i's consumption of commodity j by:

$$C_{ij} = \lambda_j L_i + \psi_j((Y_i - B_i) - L_i y^o) \qquad (10)$$

where λ_j is per capita autonomous consumption of commodity j, ψ_j is the marginal budget share, y^o is total per capita autonomous consumption ($y^o = \sum_{j=1}^{m} \lambda_j$), L_i is population of country i, Y_i is GNP, and B_i is the trade balance. Note that equation (10) defines linear Engel curves, assuming that income is equally distributed within each country.

Bowen, et. al., regress factor content of U.S. net trade flows to other countries on each country's factor supplies, population, GNP minus the trade balance ($Y_i - B_i$), and an estimate of measurement error using an iterative maximum likelihood procedure. The authors further estimate and compare different combinations of assumptions regarding preferences, technologies and measurement errors. They show that assuming identical and homothetic preferences imposes restrictions on the values of certain parameters which they estimate. If preferences are identical and homothetic then the parameter on country population (L_i) equals zero and the parameter on total expenditure (Y_i -B_i) equals the fraction of factor supply to GNP (E_{ki}/Y_i). The data consist of the following 12 resources for 27 countries: net capital stock, total labor, professional/technical workers, managerial workers, clerical workers, sales workers, service workers, agricultural workers, production workers, arable land, pastureland, and forestland.

In comparing the combinations of assumptions, Bowen, et. al., conclude that the model which best fits the data is one in which preferences are assumed to be identical and homothetic. In other words, the authors conclude that nonhomotheticity of preferences does not significantly determine net trade flows. The results of this paper are in conflict with the Bowen, et. al., conclusions.

There are several reasons why the Bowen, et. al., results might disagree with the conclusions presented in this paper. The most obvious explanation is that both studies use quite different data sets. Bowen, et. al., do not estimate preferences from consumption data. They note that the assumption of homothetic preferences (i.e. consumption being proportional to income) imposes restrictions on the parameters which they estimate. The preference structure is reflected through the trade data by assuming full employment. I estimate preferences directly and infer the effects on trade of the imposition of homothetic preferences. This is a very likely reason for the conflicting results, since trade data and consumption data are gathered so differently. Furthermore, both studies differ in the year of estimation. Bowen, et. al., examine 1967 data and I use 1975 data. This, however, is a less likely candidate for explaning the differing results. It seems highly implausible that nonhomothetic tastes would significantly contribute to trade during 1975 and not during 1967.

Another explanation is that nonhomothetic preferences may not affect trade in enough of a systematic manner to appear as a statistically significant factor in an econometric model of trade. I calculate that the correlation between the changes in trade from homogenization and the homogenized trade vector is .605. This suggestst that, although on average preference nonhomotheticity strengthens trade, this does not occur in every case. This may be a weak enough correlation that the parameters affected by preferences will neither strengthen nor weaken trade flows at a statistically significant level. Perhaps there is more complex relationship between preferences and trade that both studies are overlooking. One final possibility is that the assumption of full employment by Bowen, et. al., biases the results which they attain. I do not veture to understand the likelihood of this occurence, I only pose it as a possibility.

V. CONCLUSION

Although many previous studies reject the hypothesis that preferences are homothetic, this does not imply that the deviations from homotheticity are significant in economic terms. The homogenization exercise presented in this paper addresses this issue. I regard the result of a 27.2% share of trade in the case of homogenized demand to be very significant in economic terms. That is, I conclude that differences in demand due to differences in per capita income probably do contribute in a significant way to the overall volume and direction of trade. Furthermore, a positive correlation between the changes in trade resulting from homogenizing demand and the homogenized trade vector implies that trade is, on average, reinforced by forcing tastes to be homothetic. The results indicate that nonhomothetic preferences significantly dampen interindustry trade flows.

FOOTNOTES

1. It should be noted that differing preferences are indirectly included in the price definition of factor abundance.

2. The study of consumer behavior is centuries old. Perhaps the most well known study is by Engel in 1857 (see Phlips (1974)). Other studies include those by Stone (1954), Prais and Houthakker (1955), and Jureen (1956). Single country studies have found, in general, that preferences are not homothetic, while cross-country analyses conclude that demand patterns differ across nations.

3. It can be shown with with simple algebra that budget constraints are met and that world demand remains unchanged after demand homogenization.

4. Research assistance was provided by John Sciortino.

5. It can be shown with simple algebra that trade flows will be eliminated if demand and supply functions are both homogenized using the method given in this paper.

6. It is worth mentioning that recent work is being published which addresses the role of preferences in intra-industry trade. Two examples to this are Dinopoulos (1988) and Donnenfeld (1988).

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APPENDIX

TABLE 1: Real Per Capita Income (Income), Food Expenditure Per Capita (Food), Share of Food Expenditures (FS)

Country	Income	Food	FS
Malawi	285.56119	150.95821	0.52864
India*	352.67599	212.78401	0.60334
Kenya	379.53186	139.91690	0.36866
Zambia	431.98636	163.84352	0.37928
Pakistan	459.34641	260.92471	0.56803
Sri Lanka	532.61249	319.40000	0.59969
Philippines*	720.64258	390.10645	0.54133
Thailand*	726.23615	311.12503	0.42841
Malaysia*	975.66388	333.04099	0.34135
Korea*	1065.69629	473.47644	0.44429
Brazil*	1267.28625	430.08286	0.33937
Colombia*	1324.71680	447.63895	0.33868
Syria	1347.55298	640.13635	0.47504
Jamaica	1385.28772	436.25723	0.31492
Iran	1398.34375	452.10315	0.32331
Romania	1498.07898	526.81580	0.35166
Yugoslavia	1782.39795	505.66327	0.28370
Mexico*	1921.08337	707.48615	0.36827
Poland	2240.15161	642.37122	0.28675
Uruguay*	2323.31738	740.02887	0.31852
Ireland*	2394.14746	552.30054	0.23069
Hungary	2410.90991	635.12610	0.26344
Italy*	2742.31934	795.93829	0.29024
Japan*	3033.02954	675.71954	0.22279
Spain*	3117.61816	930.52264	0.29847
United Kingdom*	3296.31860	540.70721	0.16403
Netherlands*	3530.42017	588.25000	0.16662
Austria*	3828.98071	638.28845	0.16670
Belgium*	3861.73926	725.77979	0.18794
Germany*	3887.29395	591.41577	0.15214
France*	3891.01294	734.84668	0.18886
Denmark*	4041.83789	637.92981	0.15783
Luxembourg*	4086.55054	767.55859	0.18783
United States*	5159.62012	658.25000	0.12758

* Indicates countries in the 21-country subset. Belgium and Luxembourg were combined for the subset.

TABLE 2: Full Estimated Les Coefficients (T-Statistics)

	R^2	LLF	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	Income
FOOD	.89	-192	248.7	-98.9	-29.6	-85.0	-21.0	265.9	-116.7	-48.0	34.8	62.8	77.6	.099
			(2.85)	(-2.28)	(-.38)	(-1.29)	(-.57)	(3.54)	(-1.16)	(-.77)	(.38)	(.45)	(.45)	(3.11)
BEV AND TOBACCO	.76	-172	15.7	21.0	21.8	-2.2	-20.7	17.6	-58.5	30.7	-24.4	-27.2	-47.8	.60
			(.32)	(.85)	(.50)	(-.06)	(-.99)	(.41)	(-1.02)	(.87)	(-.47)	(-.34)	(-.49)	(3.33)
CLOTH AND FOOT	.91	-166	48.1	-15.2	12.5	-52.9	-6.6	7.4	14.8	21.6	-6.9	-14.5	-7.3	.076
			(1.16)	(-.74)	(.34)	(-1.69)	(-.38)	(.21)	(.31)	(.73)	(-.16)	(-.22)	(-.09)	(5.00)
GROSS RENT	.93	-180	-55.3	47.9	-47.6	133.3	-20.3	-93.7	-86.0	-20.1	112.1	-54.7	-67.4	.149
			(-.89)	(1.55)	(-.86)	(2.85)	(-.77)	(-1.75)	(-1.20)	(-.45)	(1.72)	(-.54)	(-.55)	(6.59)
FUEL AND POWER	.92	-145	-38.2	8.7	6.5	8.1	9.4	2.9	-18.0	-15.2	19.8	74.6	-13.7	.027
			(-1.71)	(.79)	(.33)	(.48)	(1.0)	(.15)	(-.70)	(-.95)	(.85)	(2.07)	(-.31)	(3.38)
HOUSE FURN	.95	-163	-27.1	-35.7	84	-47.6	16.1	-2.5	25.5	-14.3	-12.8	110.0	12.4	.056
			(-.71)	(-1.88)	(2.48)	(-1.66)	(1.00)	(.08)	(.58)	(-.52)	(-.32)	(1.79)	(.16)	(4.01)
MEDICAL	.93	-174	-54.9	10.9	-23.1	-36.9	26.7	-36.9	200.7	10.0	-85.9	-204.1	66.0	.137
			(-1.06)	(.42)	(-.50)	(-.94)	(1.22)	(-.83)	(3.35)	(.27)	(-1.58)	(-2.44)	(.64)	(7.26)
TRANS AND COMM	.97	-163	-37.3	12.5	-.3	34.4	15.1	-78.8	43.2	33.2	42.0	-52.6	-133.1	.146
			(-.99)	(.66)	(-.01)	(1.21)	(.95)	(-2.42)	(.99)	(1.23)	(1.06)	(-.86)	(-1.77)	(10.63)
RECREATION	.94	-156	-49.0	20.3	-12.6	-4.5	2.0	-3.1	4.1	-4.9	-59.5	-51.7	116.1	.073
			(-1.61)	(1.33)	(-.47)	(-.20)	(.16)	(-.12)	(.12)	(-.23)	(-1.86)	(-1.05)	(1.91)	(6.53)
EDUCATION	.91	-171	-32.7	22.8	-23.4	8.3	-15.4	-33.4	-19.8	-19.2	-34.4	-99.2	145.6	.055
			(-.69)	(.96)	(-.55)	(.23)	(-.76)	(-.81)	(-.36)	(-.56)	(-.69)	(1.29)	(1.54)	(3.15)
OTHER	.92	-181	-17.9	5.8	11.8	44.9	14.6	-45.5	10.9	26.1	15.2	58.1	-148.5	.123
			(-.28)	(.19)	(.21)	(.94)	(.55)	(-.83)	(.15)	(.58)	(.23)	(.57)	(-1.18)	(5.32)

IMPLIED INCOME ELASTICITIES OF DEMAND AT MEAN INCOME AND MEAN CONSUMPTION LEVELS

FOOD	0.452	FUEL AND POWER	0.806	RECREATION	1.422
BEV & TOB	1.225	HOUSE FURN	0.758	EDUCATION	0.870
CLOTH & FOOT	1.004	MEDICAL	1.907	OTHER EXP	1.249
GROSS RENT	1.741	TRANS & COMM	1.722		