INEQUALITY AND THE IMPORT DEMAND FUNCTION

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Abstract

In this paper we build a model of trade in vertically differentiated products and find that income inequality can affect the demand for imports even in the presence of homothetic preferences. The empirical importance of changes in inequality on the demand for imports is then assessed by examining panel data for 36 developing and developed countries for the 1980-1997 period. We find significant evidence supporting our prediction that inequality has a large influence on the demand for imports. Moreover we find that, in line with the predictions of our theoretical model, this influence is positive for high-income countries (countries that produce the high quality variety of the vertically differentiated product) and negative for low-income countries (countries that produce the low quality variety of the vertically differentiated product).

JEL Code: F13, H23, O24.

Keywords: inequality, import demand, vertically differentiated products, panel data.

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1 Introduction

In this paper we argue that the effect of a country's income inequality on its demand for imports is dependent on the level of economic development: for high-income countries the -ceteris paribus- effect of a rise in income inequality is positive, whereas for low-income countries increases in income inequality reduce the volume of imports. The econometric evidence supplied in the paper supports this argument.

Standard specifications of import demand functions are usually based on the imperfect substitutes model, in which imports and domestically produced goods are not perfect substitutes (see, for example, Armington (1969), Goldstein and Khan (1985), Rose (1991), Hooper and Marquez (1995)). In this model, the demand for imports is usually thought of as the result of a representative households maximization of utility (which depends on the consumption of a domestic and an imported good) subject to a budget constraint.[1]

In the present paper the -ceteris paribus- effects of changes in income inequality on the demand for imports are examined in a model of trade in vertically-differentiated products. The idea underlying this paper can be understood by means of a simple example. Consider the case of a high-income country (e.g. Germany) which produces and consumes two goods: a non-traded homogeneous good and a vertically-differentiated product (e.g. automobiles). Let there be only two varieties of automobiles: a low-quality, low-price, imported variety and a high-quality, high-price domestically produced (and exported) variety. Similarly, let there be two income classes within the country: a low-income class and a high-income class. We assume that there are no differences in preferences between the high-income households, whereas among low-income households there are differences in the degree to which the consumption of the differentiated good affects their utility. These assumptions imply, that under standard preference structures, high-income households will be consuming the high-quality variety, whereas among low-income households only those with strong preferences for the differentiated good will be consuming the high-quality variety (i.e., the liking of fancy cars among some low-income households may be so strong that they may be willing to reduce their consumption of "necessities" like food and shelter in order to avail themselves of a BMW).

Let us now consider the effects of a rise in the income of high-income households accompanied by a fall in the income of low-income

[1] The (aggregate) volume of imports is thus specified as an increasing function of aggregate income and of the ratio of domestic to imported goods prices. Implicit in this derivation of the import demand function is the idea that the distribution of income is not a determinant of the demand for imports.

households such that average income remains constant (a ceteris paribus clause). This decrease in the income of low-income households will increase the proportion of low-income households consuming the imported, low-quality variety of the differentiated good.[2] The result of this -ceteris paribus- increase in income inequality is thus an increase in the volume of imports. By the same token, if the domestic country is the least-cost producer of the low-quality variety, an increase in income inequality which results in a switch in demand towards low-quality varieties will be import-reducing.

On the basis of the above example we would expect that for developed countries (which are usually producers of high-quality varieties -see Grossman (1982), Schot (2003)) the relationship between income inequality and the volume of imports would be positive, whereas the opposite would be true for developing countries (which are usually producers of low-quality varieties). Although this is just an example, there exists a large theoretical and empirical literature examining the effects of inequality on trade patterns (e.g. Markusen (1986), Hunter(1991), Francois and Kaplan (1996), Mitra and Trindade (2003), Kugler and Zweimueller (2006). A common thread of this literature is its reliance on the assumption of non-homothetic preferences. Linder (1961) was the first to argue that if the differences in consumption patterns between low-income and high-income households are taken into account, the trade pattern is not only determined by inter-country differences in technology and factor endowments, but also by the intra-country distribution of income.

Given the undisputed empirical relevance of the assumption of non-homothetic preferences, the theoretical example we present in Section 2 involves non-homothetic preferences. However, the effect of income inequality on the demand for imports derived in this section would arise even if preferences were homothetic. Indeed, Section 2 also demonstrates that even if preferences were homothetic, the effect of inequality on the demand for imports described earlier would remain intact. The key factor responsible for generating this result is that changes in household income do not simply affect the quantity of goods consumed, but they may also engender a switch in demand between the domestically-produced and the imported variety.

In the empirical section of the paper we augment the standard import demand equation by including income inequality (along with aggregate income and relative prices) as a determinant of the volume of imports. More specifically, we investigate the existence of a relationship

[2] The rise in the income of the high-income households will not alter their spending pattern.

between real imports, real income, relative prices and income inequality for a panel of 36 developing and developed countries for the 1980-1997 period. Our estimates suggest a significant impact of inequality on import demand. Moreover, we find that there exists a positive effect of inequality on the demand for imports in high-income countries, whereas for low-income countries a rise in inequality is associated with a reduction in import demand. We also perform a number of robustness checks which include different ways of grouping the countries and of dealing with endogeneity problems (eg, the idea that imports may be the reason for the rise in income inequality). The results of these tests provide further confirmation regarding the validity of our findings.

The remainder of the paper is as follows: Section 2 develops the theoretical model, and demonstrates that the influence of income inequality on the demand for imports is dependent on a country's economic development. The empirical analysis is presented and discussed in section 3. The last section concludes.

2 The model

We present a simple theoretical framework capable of illustrating the influence of income inequality on the demand for imports. The framework is akin to Katsimi and Moutos (2006), which has in turn borrowed from Malley and Moutos (2002) and Flam and Helpman (1987). We will consider the case of a small open economy, which produces (and consumes) two goods: a homogeneous non-traded good (X) and a vertically-differentiated product (Y) that is traded with the rest of the word (ROW). The model features two-way international trade in the vertically-differentiated good, with the domestic country and the ROW specializing in different quality segments.

Good X (the non-traded good) is a homogeneous good produced under perfectly competitive conditions in the domestic country with the use of labour services (L). We conceive of L as being the simple aggregate of effective labour services provided by perfectly substitutable workers with each of them possessing different units of effective labour.[3]We assume

[3]Alternatively, we could conceive of L as a function of the quantities of labour provided by imperfectly substitutable groups of workers, e.g., $L = f(L_S, L_U)$, where L_S and L_U stand for the effective units of skilled and unskilled labour. Under the interpretation adopted in the text, changes in (income) inequality can be the result of changes in the effective number of labour units each worker (cum household) is endowed with. Under the skilled-unskilled workers interpretation, changes in inequality can be the result of changes in the relative wage of skilled workers – the so-called skill premium. Although empirically the second interpretation may be more relevant (especially for the United States – see, for example, Acemoglu (2002)), it is ana-

that firms pay the same wage rate per effective unit of labour - thus the distribution of talent across firms does not affect unit production costs. For simplicity, we assume that each unit of L produces one unit of the homogeneous good under linear technology,

$$X = L \tag{1}$$

Using labour as the numeraire, we get that the price of the homogeneous, non-traded good is, $P_X = 1$. We assume that all prices in the domestic economy and in the ROW are expressed in a common currency (the exchange rate is fixed at unity).

The vertically-differentiated good (Y) is produced by perfectly competitive firms in both the domestic country (denoted by the subscript D) and the ROW (denoted by F). We assume that quality is measured by an index $Q > 0$, and that there is complete information regarding the quality level inherent in all varieties produced at home and abroad. Moreover, for simplicity,[4] we assume that there are only two quality levels that can (potentially) be offered by domestic and foreign firms: q_1 and q_2 , with $q_1 > q_2$.We further assume that, in both the domestic country and the ROW, average costs depend on quality, and that each (physical) unit of a given quality is produced at constant cost. The dependence of average costs on quality is motivated by the fact that increases in quality – for a given state of technological capability – involve the "sacrifice" of an increasing number of personnel which must be allocated not only to the production of a higher number of features attached to each good (e.g., electric windows, air bags, ABS, etc. in the case of automobiles) but also to the development and refinement of these features as well.

2.1 The home country produces the low quality variety of the verically-differentiated product

We first assume that the domestic country has comparative advantage in the production of the low-quality variety (q_2) of the differentiated good. This implies that the least cost producers of the variety with quality q_2 are domestic producers (that is, $AC_D(q_2) < AC_F(q_2)$) , whereas the least cost producers for the high-quality variety are foreign producers (i.e., $AC_D(q_1) > AC_F(q_1)$). For simplicity, we set $P(q_2) = AC_D(q_2) = q_2$, and $P(q_1) = AC_F(q_1) = q_1$.

Following Rosen (1974) and Flam and Helpman (1987) we assume that the homogeneous good is divisible, whereas the quality-differentiated

lytically far simpler to consider the first case of perfectly substitutable workers with unequal endowments of effective labour units.

[4]Katsimi and Moutos (2005) present a model in which there is a continuum of domestic and foreign varieties offered to the domestic country consumers.

product is indivisible and households can consume only one unit of it. For simplicity, and in order to be consistent with the substantial literature suggesting that preferences are not homothetic,[5] we write the utility function of household i as

$$U_i = \delta_i Q + \ln X_i \tag{2}$$

where Q stands for the quality (either q_1 or q_2) of the differentiated product and X_i stands for the quantity of the homogeneous good consumed by household i.[6] δ_i denotes the household's i relative preference for Q.

All households are endowed with one unit of labour, which they offer inelastically. There are, however, differences in skill between households, which are reflected in differences in the endowment of each household's effective labour supply. This is in turn reflected in an unequal distribution of income across households. Let y_i stand for the income of household i. We assume that there are just two levels of income in the economy so that households can be classified according to their income either as high-income, y^H, or as low-income, y^L . We define by κ the proportion of low-income households in the economy. Consequently, average income, y^m, is defined as

$$y^m = \kappa y^L + (1-\kappa) y^H \ . \tag{3}$$

In line with Acemoglou and Robinson (2005) we can define the low and the high level of income as a function of average income and the level of inequality:

$$y^L = \frac{\gamma}{\kappa} y^m \tag{4}$$

and

$$y^H = \frac{1-\gamma}{1-\kappa} y^m \tag{5}$$

where $\gamma < \kappa$ measures the level of income inequality while a rise (fall) in γ represents a fall (rise) in inequality.

[5] An implication of Krugman's (1989) derivation of the import demand function, is that with homothetic preferences, changes in inequality will not have any effect on the demand for imports if trade is conducted in horizontally differentiated products, since changes in household income would not alter the proportion of spending that either poorer or richer households spend on imported varieties.

[6] We implicitly assume that there is a fixed (and common across households) disutility of work effort which enters additively in the utility function. We also assume that the lowest ability household gets a higher level of utility (due to consumption) from working rather than from sitting idle.

We assume that $\delta = 1$ for all high-income households whereas for low-income households δ is distributed according to a continuous uniform distribution in the interval $[a, b]$, with $a < 1 < b$. The CDF is given by

$$D(\delta) = \begin{cases} 0 & \text{for } \delta < a \\ \frac{\delta - a}{b - a} & \text{for } a \leq \delta \leq b \\ 1 & \text{for } \delta > b \end{cases} \tag{6}$$

We assume that all high-income households consume the imported variety, q_1.[7] The budget constraint of a high-income household is,

$$y^H = X^H + q_1 \tag{7}$$

As a result, the utility maximizing demand for the homogeneous good of the high-income household is,

$$X^H = y^H - q_1. \tag{8}$$

Figure 1 displays the choices of a low-income household. The two quality levels of the differentiated good are depicted on the horizontal axis, and the quantity of the homogeneous good (as well as household income given that $P_X = 1$) is depicted on the vertical axis. Given that only the two quality levels are available, the "budget constraint" of the household comprises just points 1 and 2. Low-income households select between points 1 and 2, the one giving them the highest utility. At the initial level of income, y_0^L, the household with the highest value of $\delta (= b)$, has a map of "steep" indifference curves (one of which is denoted by u) and achieves maximum utility by consuming bundle 1, whereas the household with the lowest value of $\delta (= a)$ has a map of "flat" indifference curves (one of which is denoted by v) and chooses to consume bundle 2. In Figure 1 we also present the case of a household which is indifferent between bundles 1 and 2, as depicted by indifference curve z; for this household $\delta = \theta$, $a < \theta < b$.Thus, a low-income household may consume either q_1 or q_2 depending on the household's taste parameter δ. The budget constraint of a low-income household is,

$$y^L = X_i + q_2 \tag{9}$$

[7] This feature of the model can arise under standard preference structures as long as both the homogeneous and the differentiated goods are normal; the importance of this assumption will be discussed later.

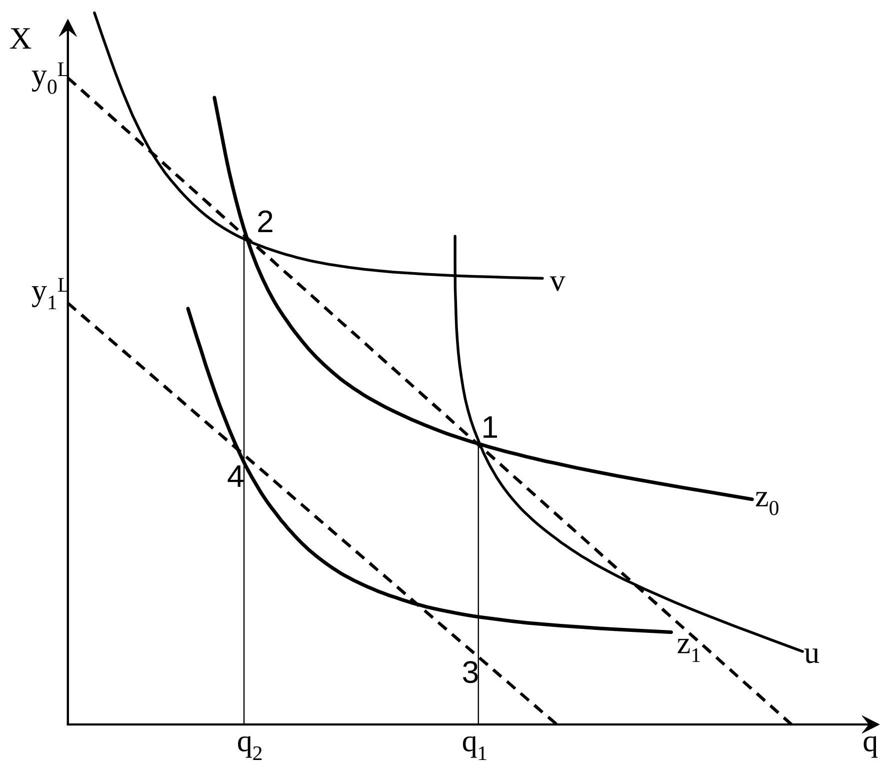

Figure 1: Consumption of a low-income household

if it buys the domestically-produced, low-quality variety and

$$y^L = X_i + q_1. \tag{10}$$

if it buys the foreign (ROW) variety. Accordingly, the utility maximizing demand for the homogeneous good is,

$$X_D^L = y^L - q_2 \tag{11}$$

if the household chooses to consume the domestically-produced variety, whereas if the household chooses to consume the ROW-produced variety the demand for X is,

$$X_F^L = y^L - q_1. \tag{12}$$

In deriving the above we have assumed that for all households income is high enough to generate positive demands for both goods (i.e., $y^L > q_1$). The resulting indirect utility functions for the low-income household in the two cases are then,

$$V_D^L = \delta_i q_2 + \ln(y^L - q_2) \tag{13}$$

$$V_F^L = \delta_i q_1 + \ln(y^L - q_1) \tag{14}$$

Household i will buy a foreign produced variety if $V_F^L > V_D^L$. We note that $\vartheta(V_F^L - V_D^L)/\vartheta\delta_i > 0$, i.e. the difference between the maximum utility which the household could achieve if it were to buy the imported variety and the one that it could be achieved if it bought the domestic variety is increasing in household's relative preference for the differentiated product. This implies that among low-income households only those with a high preference for Q will be willing to buy the high-quality variety which is is imported from the ROW.

Let θ denote the relative preference for Q (i.e. the value of δ) of a low-income household that is indifferent between consuming the domestically produced variety and the foreign variety, i.e., for this household it holds that

$$V_D^L = \theta q_2 + \ln(y^L - q_2) = \theta q_1 + \ln(y^L - q_1) = V_F^L. \tag{15}$$

We term θ the dividing level of the taste parameter δ_i. Solving for θ we find that

$$\theta = \frac{\ln(y^L - q_2) - \ln(y^L - q_1)}{q_1 - q_2}. \tag{16}$$

After substituting for y^L from equation (4) we note that

$$\frac{\vartheta\theta}{\vartheta\gamma} = \frac{-y^m}{\kappa(\gamma y^m - \kappa q_1)(\gamma y^m - \kappa q_2)} < 0. \tag{17}$$

This means that as the level of income inequality increases (γ decreases), the proportion of low-income households which choose to buy the high-quality (imported) variety decreases. This is also illustrated in Figure 1: bundles 3 and 4 correspond now to the lower level of income y_1^L, and the household which at the higher level of income was initially indifferent between the high-quality and the low-quality bundles, achieves now higher utility by switching his demand from the high-quality to the low-quality, imported variety.

The uniform distribution implies that the proportion of low-income households with relative preference for Q higher or equal to θ (that is, the proportion of low-income households which choose to consume the foreign-produced variety), is equal to $\frac{b-\theta}{b-a}$. Thus, the real value (volume) of total imports is

$$M = [\kappa\frac{(b-\theta)}{(b-a)} + (1-\kappa)]q_1. \tag{18}$$

Given our interest in the effect of mean preserving changes in income inequality, we can use equation (18) to find the effect of changes in the inequality measure β while keeping average income y^m constant[8]. We find that

$$\frac{\vartheta M}{\vartheta\gamma} = -\frac{q_1\kappa}{(b-a)}\frac{\vartheta\theta}{\vartheta\gamma} > 0. \tag{19}$$

As inequality rises (y^L falls), some low-income households will be induced to switch their demand from the high-quality, imported variety to the domestically-produced, low-quality variety(θ rises), and the demand for imports decreases.

2.2 The home country produces the high quality variety of the vertically-differentiated product

Let us now assume that the domestic country has comparative advantage in the production of the high quality variety of the differentiated good. This implies that domestic(ROW) firms produce the high(low)-quality variety at a lower cost. $AC_D(q_1) < AC_F(q_1)$ and $AC_D(q_2) > AC_F(q_2)$).

As in the previous case, high-income households will consume the high-quality variety that is now domestically produced, whereas low-income households with a relative preference for Q higher than θ will also consume the domestic, high-quality, variety. The proportion of low-income households consuming the low-quality imported variety is now

[8]In fact, the rise in the income of the high-income households has no impact on the demand for imports since these households are now more inclined than before to keep consuming the imported, high-quality variety.

given by $\frac{\theta - a}{b - a}$. Thus, the real value of total imports is

$$M = \kappa \frac{(\theta - a)}{(b - a)} q_2. \tag{20}$$

From equations (4), (17) and (20) we get that

$$\frac{\vartheta M}{\vartheta \gamma} = \frac{\kappa q_2}{b - a} \frac{\vartheta \theta}{\vartheta \gamma} < 0 \tag{21}$$

As in the previous section, an increase in income inequality (γ falls which implies that y^L falls and y^H increases with constant y^m[9]) will decrease the proportion of households with relative preference greater than $\theta-$ i.e., there will be some low-income households which find it in their interest to switch their demand from the high-quality, domestically-produced, variety to the low-quality variety. However, given that the low-quality variety is now imported, this implies that the demand for imports will increase.

2.3 Discussion

The simple model presented above has provided us with a stark result: The effect of a rise in inequality on the demand of a country's imports depends on the country's level of economic development. If the country has comparative advantage in the production of the high-quality varieties (high-income, high-productivity countries usually do), the rise in inequality will increase the demand for imports. On the other hand, if the country has comparative advantage in the production of low-quality varieties (a characteristic of lower-income countries), a rise in inequality will have a negative effect on the volume of imports. To what extent can this conclusion survive in other settings?

We first note that the above conclusion would obtain under homothetic preferences as well.[10]To give the intuition for this result, let us (again) examine the standard imperfect substitutes model in which the (composite) domestically produced good is an imperfect substitute of the (composite) imported good. Consider, for example, that there is an equal number of low and high income households and that there is an offsetting change in the income of the two groups (say, a drop in the income of the low-income households), so that aggregate income stays

[9]In fact, the rise in the income of the high-income households has no impact on the demand for imports since these households are now more inclined than before to keep consuming the domestically-produced, high-quality variety.

[10]This is easy to verify; moreover, one could redraw Figure 1 with homothetic preference maps and the transparency of the conclusion would be apparent.

constant. Under homothetic preferences, the increase in the volume of imports of the second group of households will exactly offset the reduction of imports of the first group and the aggregate volume of imports will not be affected; income distribution has no independent influence on the (aggregate) volume of imports and its absence from both theoretical and empirical specifications of import demand functions is (implicitly) attributed to homothetic preferences. In contrast, in the present model, and as long as the (vertically) differentiated good is normal, the change in the income of the households will not produce offsetting changes in the demand for imports. If, for example, the domestic country has comparative advantage in the production of high-quality varieties of the differentiated good, the high-income group will continue to demand the high-quality, domestic variety. The behaviour of this group leaves the demand for imports intact. But, there will also be at least some households of the low-income group (among those that were previously purchasing the domestically-produced variety), which will be induced by their wish to reduce their spending on the vertically differentiated good to switch their demand towards the low-quality, low-price imported variety. Thus, unlike the imperfect substitutes model of open-economy macroeconomics in which, e.g., a fall in household income decreases the demand for both the domestic and the imported good, in the present model the fall in household income may engender a switch in demand from domestic to imported goods (varieties).

However, the relaxation of other assumptions would lead to ambiguous outcomes. Consider, first, the case that there are many vertically-differentiated products, and the domestic country had comparative advantage in the production of high-quality varieties for only a subset of them. In this case the domestic country would import both high-quality varieties of some products (consumed by its high-income households), and low-quality varieties of other products (consumed by its low-income households). In this case, an increase in inequality resulting from a rise in the income of high-income households and a decline in the income of low-income households, would have an ambiguous effect on the demand for imports: For products in which the domestic country has comparative advantage in the production of low-quality varieties the increase in inequality may cause a reduction in imports (as argued in the previous subsection), whereas for products in which the domestic country has comparative advantage in the production of high-quality varieties, the increase in inequality may cause a reduction in the demand for imports. The net effect on the aggregate volume of imports is thus, apriori, ambiguous, although one may be justified in thinking that the proportion of sectors in which the domestic country has comparative advantage in high-quality varieties is higher (lower) in high-income (low-income) countries, and thus the effect of changes in inequality may empirically conform to the results derived in the previous subsections.

The same, apriori, ambiguity would also be present if the function describing income distribution is continuous. Katsimi and Moutos (2006) have shown that if income is distributed according to the Pareto distribution, then changes in income inequality have an ambiguous effect on the demand for imports (for both low–income and high-income countries). The reader may also verify that if we relax the assumption that high-income households always consume the high-quality variety, then again, changes in inequality have an ambiguous effect on the aggregate demand for imports. We may thus conclude that amendments to the model presented in this paper will, most likely, reduce the starkness of our results. Nevertheless, the evidence presented in the following section provides support for the predictions of our "minimalist" model.

3 Econometric Analysis

3.1 Empirical Literature Review and Data

We aim at investigating empirically the impact of inequality on the demand for imports. The majority of empirical studies on the macroeconomic determinants of the demand for imports estimate a standard real import demand function according to which imports depend on real income and some measure of competitiveness. We expand on this traditional specification since international trade is conducted not only in vertically differentiated goods but in horizontally differentiated and homogeneous goods as well. The main empirical implication of our theoretical model that allows for trade in VDP is that inequality may be an important determinant of the demand for imports. As a result, omitting the level of inequality may lead to the estimation of a misspecified equation. Thus, in line with the predictions of our theoretical model, we will augment the standard import function by adding a measure of household income inequality.

A large body of empirical literature has estimated price and income elasticities of imports and much of it focused on US trade.[11] Goldstein and Kahn (1985) survey the empirical estimates of long-run income and price elasticities for imports and exports of major industrial countries.[12] Nevertheless, the existing empirical work on import demand estimation

[11] For surveys of literature on this topic see Chinn (2005a,b) and Sawyer and Sprinkle (1996).

[12] For estimates of relative price and income elasticities for G7 countries see Hooper, Johnson and Marquez (1998).

based on panel data is rather limited compared to the empirical literature using time-series techniques. Khan and Knight (1988) estimate a system consisting of imports and exports equations for 34 developing countries in the 1971-1980 period. Including a measure of reserve stringency they find that import compression has a significant effect on exports. Using more sophisticated econometric techniques, Kinal and Lahiri (1993) estimate a similar system of exports and imports equations for 31 developing countries for the 1964-1987 period and find that the short-run income elasticity and price elasticity of imports are both rather low. Harb (2005) uses panel cointegration techniques in order to estimate long-run price and income elasticities for 40 countries for the 1971-1999 period. He finds an income elasticity of about 1.7 (1.0)and a relative price elasticity of about –0.8 (-0.4) for developed (developing) countries. Panel data estimation of aggregate imports equation has also been used in analysing the effect of exchange rate volatility on imports in Pugh et al (1999) and Anderton and Skudelny (2001) as well as the effects of the reduction of tariff and non-tariff barriers on imports of developing countries in Santos-Paulino (2002). According to our knowledge, Kugler and Zweimueller (2005) is the only paper that investigates the impact of inequality on the demand for imports. Based on a panel of 58 countries for 1970, 80, 90 and 92, they find that a rise in inequality in the importing country will decrease the demand for imports with an elasticity of 0.65. However, the analysis of Kugler and Zweimueller (2005) differs significantly from ours since they use an unbalanced panel of bilateral trade data in order to estimate a gravity model. Instead, we are going to estimate the standard work-horse model of aggregate imports demand augmented by the level of inequality using a balanced panel of aggregate imports data.

Our sample consists of 36 countries, developing and developed ones, for the 1980-1997 period. The analysis is based on annual data since there are no higher frequency data for inequality. Moreover the time period of our sample is restricted by the (un)availability of data for the relative price of imports and/or the level of inequality in developing countries. We model the (log of) real imports of country i (Mi) as a function of the (log of) real income of i (Yi), the (log of) relative price of imports (RPi) and the (log of) household income inequality within i ($INEQi$). Our estimated equation has the form:

$$M_{i,t} = \beta_1 Y_{i,t} + \beta_2 RP_{i,t} + \beta_3 INEQ_{i,t} + \beta_4 LY * INEQ_{i,t} + \mu_i + \lambda_i + e_{i,t} \quad (22)$$

where μ_i and λ_i are country and time specific fixed effects and $e_{i,t}$ is the error term. According to our theoretical priors the sign of the coefficient on $INEQ$ should depend on the quality of the vertically differentiated product that each country produces: If the country produces the high (low) quality variety of the VDP the effect of inequality on real imports is expected to be positive (negative). According to Schott (2003), Adam and Moutos (2004), and Hummels and Klenow (2005) there is a high degree of correlation between a country's per capita income and its trade pattern, i.e. low (high) income countries tend to import higher (lower) quality varieties of a particular product than high (low) income countries. For this reason we allow the coefficient of $INEQ$ to vary across high income and low income countries, by introducing the multiplicative dummy variable LY which takes the value of $one(zero)$ when a country is classified as having low (high) income. The classification of countries is given in Table A1 of the appendix. Our theoretical model then suggests that β_3 will be positive and β_4 will be negative and greater (in absolute value) than β_3[13].

Our measure of inequality is taken from the EHII dataset of the UTIP project (UTIP, 2005). This dataset is to our knowledge the most complete source of household income inequality data, as it provides a dataset for the Theil index of inequality (Theil, 1976) for a wide range of countries over an extended time period, which differs however across countries.[14] The Theil index has the advantage that it requires less data in order to be computed (Conceicao and Ferreira, 2000) thus making it easier for us to have values over long time periods even for developing countries. Moreover the Theil index has all the desirable properties of an inequality measure (symmetry, replication invariance, mean independence and satisfies the Pigou- Dalton property[15]). Finally there is evidence (see, Braun (1988)) that the Theil index is highly correlated with other measures of inequality, including the Gini index. Real Imports are the Real 2000 US dollar value of imports as reported in the UNCTAD Handbook of Statistics (online version)[16]. Real income is the real GDP in 2000 US Dollars, as taken from World Bank's World Development Indicators (WDI). Following Hooper et. al. (1998) we use

[13] Since LY is a dummy variable that takes the value of 1 when i is a low income country (and zero otherwise), it follows that a change in inequality by one percentage point will change imports by β_3 when $LY = 0$ (high-income country), and by $\beta_3 + \beta_4$ when $LY = 1$ (low- income country). Our theoretical framework predicts that $\beta_3 > 0$ and $\beta_3 + \beta_4 < 0$, which can be the case only if $|\beta_4| > |\beta_3|$.

[14] The choice of our sample ensures that we have used the maximum number of available observations.

[15] An index of inequality is symmetric when it is invariant under permutations of individuals. Replication invariance implies that the index is independent of population replications. Mean independence states that the index is invariant under scalar multiplication. Finally the Pigou- Dalton property is satisfied when the inequality measure increases when income is transferred from a poorer person to a richer person (see Conceicao and Galbraith, 1998 for the relevant discussion).

[16] Available at http://stats.unctad.org/handbook/ReportFolders/ReportFolders.aspx

the price of imports (taken from IMF's IFS database) over the GDP deflator (taken from the WDI), as our measure of relative prices and competitiveness.

3.2 Estimation

First we test for the existence of unit roots for each of the individual variables in equation (22). We use two tests for stationarity, the Levin-Lin (1992, 1993) (LL test) and the Im et. al. (2003) (IPS test) test. Both tests are for the model:

$$\Delta y_{i,t} = \rho y_{i,t-1} + \sum_{j=1}^{p_i} \zeta_{ij} \Delta y_{i,t-j} + z_{i,t} + e_{i,t} \tag{23}$$

where $y_{i,t}$ is the variable we test for stationarity and $z_{i,t}$ is a deterministic component which could be either zero, or one, or the fixed effect μ_i, or μ_i and a time trend (see Baltagi, 2001). Finally to exclude serial correlation lagged first differences are included in equation (23), with p_i the lag length.[17]

The fundamental difference between the two tests rests on the null hypothesis that they specify. The LL test specifies the null H_0 and alternative H_1 as:

$$\begin{aligned} H_0 &: \ \rho_1 = \rho_2 = ... = \rho = 0 \\ H_1 &: \ \rho_1 = \rho_2 = ... = \rho < 0 \end{aligned} \tag{24}$$

The IPS test specifies the null and alternative as:

$$\begin{aligned} H_0 &: \ \rho_i = 0 \text{ for } \forall \ i \\ H_1 &: \ \rho_i < 0 \text{ for at least one } i \end{aligned} \tag{25}$$

In the following table we present the results for both tests first by assuming that $z_{i,t}$ includes only the fixed effect and then assuming that $z_{i,t}$ includes the fixed effect and a time trend.

[17] In both tests pi may differ across i. In the table that follows we chose pi for each i, optimally according to the Akaike Information Criterion.

TABLE 1: Unit Root Tests

		LL test	IPS test
M	Constant	-1.85*	1.53
	Constant + Trend	-3.21*	-2.02*
Y	Constant	-1.89*	2.73
	Constant + Trend	-6.48*	-1.57*
RP	Constant	-6.03*	-3.90*
	Constant + Trend	-29.38*	-6.62*
$INEQ$	Constant	-2.43*	0.24
	Constant + Trend	-5.10*	-2.61*

Note: * Reject the null of non-stationarity at the 5% level

Table 1 shows that the LL test rejects the hypothesis of non-stationarity in all cases. On the other hand, according to the IPS test we reject the hypothesis of non- stationarity for M, Y and $INEQ$, only when a deterministic trend is not included in the test. Given that the deterministic trend is found to be significant, we may conclude that the correctly specified test is the one with the trend included.

Since all variables are stationary, the traditional panel data techniques can be used to estimate the import demand function. The results are given in Table 2.

TABLE 2: Estimation of equation (22)

Depend. var	Real imports, M	
	(1)	(2)
Y	1.072^{***} (20.13)	0.987^{***} (14.34)
RP	-0.023^{***} (−3.97)	-0.035^{***} (−6.08)
$INEQ$		0.648^{***} (3.580)
$LY * INEQ$		-1.428^{***} (−5.78)
R-squared	0.823	0.836
obs	648	648
F-test	116.67	153.32
F-test country	157.33	156.20
F-test time	7.88	7.99

Note: t-statistics in parenthesis.

We first estimate equation (22) without $INEQ$. As can be seen by column (1), the coefficients both of Y and RP have the expected sign and are statistically significant at any relevant level of statistical significance. The estimated income elasticity of imports is 1.07, which is lower than the income elasticity of imports obtained in various time-series analyses (see Goldstein and Khan (1985) and Chinn (2005a) for surveys of the literature). In column (2) of Table 2, we assume that the coefficient β_3 differs between low and high income countries[18]. In line with the predictions of our theoretical model, the coefficient for high-income countries turns out to be positive and statistically significant, whereas the coefficient for the low-income countries is also statistically significant but negative. Moreover, our results suggest that $\beta_4 > \beta_3$. Next, we perform an F-test for the difference of β_3 between high and low income countries. The value of the F-test suggest that we can reject the hypothesis of β_3 being equal among the two group of countries at all levels of statistical significance. Moreover, the inclusion of $INEQ$ does not affect the statistical significance of the coefficients on Y and RP.

3.3 Sensitivity Analysis

In this section we inquire into the robustness of our results. First we examine the sensitivity of our results with respect to individual outliers, as well as with respect to country outliers. Then, we re-estimate our model allowing for all the coefficients to vary between high- and low-income countries. Moreover, we examine the case where the division of countries in high and low-income countries is determined endogenously. Next, we test for the exogeneity of our explanatory variables. Finally, we want to see if our results depend on the static form of our model.

3.3.1 Outliers

As our sample of 36 countries is quite heterogeneous, we want to ensure that the results of Table 2 are driven neither by individual outliers nor by the inclusion of specific countries.

To control for the effects of individual outliers we re-estimate the equations presented in the last column of Table 2 by excluding all observations with estimated error in the upper or lower end 5 percentile range (i.e. we drop 10% of our sample). The results are reported in Table 3.

[18] The classification of countries according to high and low income is given in Table A1 in the appendix.

TABLE 3: Estimation of equation (22) excluding outliers

Depend. var	Real imports, M
	(1)
Y	1.128^{***} (22.434)
RP	-0.035^{***} (-6.56)
$INEQ$	0.568^{***} (3.79)
$LY * INEQ$	-1.263^{***} (-6.11)
R-squared	0.913
obs	583
F-test	260.68
F-test country	339.13
F-test time	11.08

Note: t-statistics in parenthesis.

As expected, the R- squared of the model is significantly improved by the exclusion of the outliers. Nevertheless, neither the sign nor the level of statistical significance of any of the variables has changed. This allows us to conclude that the results in Table 2 are not affected by individual outliers.

Next, we proceed to a further robustness check by assessing the importance of cross sectional and time outliers. For this reason we perform a Jackknife analysis (see, Efron and Tibshirani (1993)). This method involves estimating the initial equation by excluding in each replication one cross sectional unit. In Table 4 we report the maximum and the minimum estimated coefficients as well as the excluded countries which exert the extreme identified impact. In the middle column of the table we report the estimates as presented in Table 2.

In general, we can conclude that our specification indicates a robust relationship between real imports and inequality. Moreover, the estimated coefficient in our full sample lies in the middle of the minimum and the maximum estimated coefficients.

TABLE 4: Jackknife analysis

	Country	Min Coeff.	Average	Country	Max Coeff
Y	Malaysia	0.91^{***} (13.03)	0.99^{***} (14.34)	Egypt	1.07^{***} (16.82)
RP	Israel	-0.04^{***} (-6.65)	-0.04^{***} (-6.08)	Bolivia	-0.03^{**} (-2.50)
$INEQ$	Iceland	0.38^{**} (2.03)	0.65^{**} (3.58)	Sweden	0.79^{***} (4.21)
$LY * INEQ$	Hungary	-1.92^{***} (-7.44)	-1.43^{***} (-5.78)	Egypt	-1.10^{***} (-4.76)

Note: t-statistics in parenthesis.

3.3.2 Heterogeneous Coefficients

In the estimations presented in Table 2 we have assumed that the effect of $INEQ$ on M is the only source of heterogeneity in our sample. We now examine what happens if we assume that all the coefficients of the import function are different among the two groups of countries. In Table 5 we present the results from estimating equation (22), separately for high-income countries and for low-income countries.

Table 5 confirms our previous results about the relationship between $INEQ$ and M. With respect to the other two variables, according to Table 5, the negative relationship between RP and M exists only for the low income countries, whereas for the high income countries it is statistically insignificant (and positive).

TABLE 5: Estimation of equation (22) with heterogenous coefficients

Depend. var	Real imports, M	
	High-income	Low-income
Y	1.137^{***} (11.77)	1.013^{***} (10.23)
RP	0.014 (1.42)	-0.051^{***} (-7.25)
$INEQ$	0.404^{***} (2.60)	-0.842^{***} (-3.88)
R-squared	0.895	0.836
obs	306	342
F-test	200.49	82.83
F-test country	224.18	115.77
F-test time	3.11	6.47

Note: t-statistics in parenthesis.

3.3.3 Endogenous Division

So far we have separated the countries in our sample according to the classification of theWorld Bank. Specifically we have assumed that the low income countries are those considered as "Low and Very Low Income Countries" by the World Bank. However, this clssification is rather arbitrary. In this section, we follow Dutt and Mitra (2002) and allow the data to determine the exact location of the change in the coefficient of INEQ. We do so by estimating the following auxiliary equation:

$$M_{i,t} = \beta_1 Y_{i,t} + \beta_2 RP_{i,t} + \beta_3 INEQ_{i,t} + \gamma INEQ_{i,t} GDPcap_{i,t} + \mu_i + \lambda_i + e_{i,t} \quad (26)$$

Equation (26) is the same as equation (22), with the additional term of $INEQ_{i,t}GDPcap_{i,t}$ which is the (log of) inequality multiplied by the level of each country's GDP per capita. We want to find the dividing level of GDP per capita, $GDPcap^*$, so that $\frac{\vartheta M}{\vartheta INEQ} > 0$ (< 0) if $GDPcap > GDPcap^*$ $(< GDPcap^*)$. For that reaon we take the partial derivative of M with respect to $INEQ$ in equation (26) and we find the level of $GDPcap$ for which $\frac{\vartheta M}{\vartheta INEQ} = 0$. This implies that the dividing level of GDP per capita determined endogenously by our data is equal to $\frac{-\beta_3}{\gamma}$. Our estimates of equation (26) are presented in the second column of Table 6. Note that for $\frac{\vartheta M}{\vartheta INEQ} > 0$ (< 0) if $GDPcap > GDPcap^*$ $(< GDPcap^*)$, we need that $\beta_3 < 0$ and $\gamma > 0$. Next, we re-estimate equation (22), assuming that the turning point level of income is the one derived by the above analysis. The results are presented in the last two columns of Table 6.

TABLE 6: Endogenous division

Depend. var	Real imports, M		
	Equation (26)	High-income	Low-income
Y	0.293^{**} (2.9)	1.810^{***} (22.24)	0.862^{***} (8.97)
RP	-0.044^{***} (-6.09)	0.089^{**} (5.58)	-0.029^{***} (-4.56)
$INEQ$	-2.210^{***} (-8.97)	0.589^{**} (4.72)	-0.693^{**} (-3.44)
$INEQ * GDPcap$	0.228^{***} (8.37)		
R-squared	0.844	0.904	0.803
obs	648	180	468
F-test	152.8	258.95	81.54
F-test country	145.28	506.18	102.32
F-test time	13.34	1.62	7.83

Note: t-statistics in parenthesis.

Comparing Table 6, with Table 5, we may ascertain that our results about the different effect of the $INEQ$ on M do not depend on the ad hoc division of our country sample.

3.3.4 Endogeneity

So far we have assumed that all explanatory variables are strictly exogenous. In the present section we examine the validity of this assumption, and the robustness of our results under the assumption that some of the explanatory variables are endogenous. There are two potential sources of endogeneity: First, and most important for our testable hypothesis, there have been some economists (e.g. Wood (1994), Freeman (1995)) which have claimed that increased imports from developing countries was an important determinant for the rise of income inequality in developed countries. Although there have been some disagreements about the empirical importance of the "trade" explanation (as opposed to the biased technological change explanation), the consensus view is that trade did play a role (albeit small) in the rise in income inequality in developed countries (see, Krugman (1995)). The other (and well known) potential source of endogeneity is due to the fact that one of the components of aggregate demand are net exports, thus GDP depends on the volume of imports.

To test whether our results are affected by the above considerations, we estimate equation (22) with Instrumental Variables (IV). The results are presented in Table 7. In the first column we replicate column (1) from Table 2. Then in the second column we present the estimation results of the IV regression, assuming that $INEQ$ (and $LY * INEQ$) is endogenous. Finally, in column (3) we assume that both $INEQ$ and Y are endogenous variables. In both cases the instruments used are lagged values of the variables.

The comparison of columns (2) and (3) (IV regressions) with column (1) shows that the qualitative nature of our results does not change. All variables retain their sign and statistical significance. According to a Durbin- Wu- Hausman test (Hausman, 1978) we reject the assumption of exogeneity of all the regressors only when we assume that both $INEQ$ and Y are endogenous. The rejection of the null in column (3) however is due to small changes in the coefficients and standard errors of all variables and not due to a significant change in one of them. Moreover our main argument remains valid: in both columns (2) and (3), β_3 is positive and β_4 is negative and greater (in absolute value) than β_3.

TABLE 7: Endogeneity (IV Regression)

Depend. var	Real imports, M		
	(1)	(2)($INEQ$)	(3)($INEQ, Y$)
Y	0.987^{***} (14.34)	1.000^{***} (14.26)	0.950^{***} (13.02)
RP	-0.035^{***} (−6.08)	-0.039^{***} (−5.92)	-0.039^{***} (−4.84)
$INEQ$	0.648^{***} (3.58)	0.787^{**} (2.93)	0.729^{**} (2.71)
$LY * INEQ$	-1.428^{***} (−5.78)	-1.657^{***} (−5.76)	-1.657^{***} (−5.76)
R-squared	0.836	0.568	0.557
obs	648	612	612
F-test	153.32	146.55	144.01
F-test country	156.20	175.86	175.61
F-test time	7.99	7.26	7.24
Durbin-Wu-Hausman		2.07	3.16[a]

Note: t-statistics in parenthesis.*,**,*** denote statistical significance at 1%,5,10%. a denotes rejection of null of exogeneity at 5%

3.3.5 Dynamics

The import demand equation we have estimated so far is static. However, many empirical studies (e.g. Khan and Knight (1989), Santos-Paulinho (2002)), assume that imports at period t adjust partially between equilibrium imports and imports in t-1. This partial adjustment model of the import demand can be written as:

$$M_{i,t} = a_0 M_{i,t-1} + a_1 Y_{i,t} + a_2 RP_{i,t} + a_3 INEQ_{i,t} + \mu_i + \lambda_i + e_{i,t} \quad (27)$$

In this case the long- run income and price elasticities (β_1, β_2) will be equal to $a_1/(1-a_0)$ and $a_2/(1-a_0)$,respectively.

Application of the standard within estimator in equation (27) renders the results biased and inconsistent even when $e_{i,t}$ is serially uncorrelated (see Baltagi (2001)). Nickell (1981) has derived an exact expression for the inconsistency of the within estimator, which is a function of a_0 and the variance of $e_{i,t}$, σ_e^2. As an alternative, a number of consistent Instrumental Variables (IV) and Generalized Method of Moments (GMM) estimators have been proposed. A weakness of all these estimators is that their properties hold for large number of cross sectional units, so they can be severely biased when the number of countries is small, as in the present setting. Moreover many Monte Carlo studies (Arellano and Bond (1991), Kiviet (1995) and Judson and Owen (1999)) demonstrate that the OLS estimator of equation (27) even though inconsistent has a relative small variance compared to IV and GMM estimators.

As an alternative approach Kiviet (1995, 1999) proposed to use a consistent estimator (such as the Arellano Bond (1991) estimator) to estimate a_0 and σ_e^2 and then to plugg the estimates into the bias formula as derived by Nickell (1981). As a result, the consistent estimator is the within estimator of equation (27) minus the estimated bias. Monte Carlo evidence in Bun and Kiviet (2003) shows that the resulting bias corrected estimator often outperforms the IV and GMM estimators in terms of bias and root mean squared error.

TABLE 8: Estimation of a dynamic imports equation (27)

Depend. var	Real imports, M	
	AB	Bias Corrected
$M_{(t-1)}$	0.765^{***} (173.65)	0.788^{***} (22.24)
Y	$0.393^{**}[1.674]$ (21.51)	$0.286^{***}[1.348]$ (7.49)[5.29]
RP	$-0.021^{***}[-0.089]$ (−11.18)	$-0.020^{***}[-0.093]$ (−4.18)[−3.26]
$INEQ$	$0.476^{***}[2.024]$ (5.32)	$0.229^{*}[1.090]$ (1.79)[1.59]
$LY * INEQ$	$-0.578^{***}[-2.459]$ (−7.99)	$-0.326^{**}[-1.552]$ (−2.35)[−1.95]
R-squared		0.93
Wald	551175.01	
obs	629	576
F-test		376.15
F-test country		4.31
F-test time		4.57
AB test of autocor. of order 1	-2.42***	
AB test of autocor. of order 2	-0.55	
Sargan test	34.83	

Note: t-statistics in parenthesis.

In Table 8 we present the results of the dynamic import demand equation. Next to each estimated coefficient we present in square brackets the underlying long- run elasticity. In column (1) we present the results when we apply the standard Arellano Bond GMM estimator. According to the Arellano and Bond (1991) specification testing, the model is correctly specified, as the Arellano- Bond first order serial correlation test rejects the hypothesis of autocorrelation whereas the test for second order serial correlation cannot reject the null of autocorrelation and the Sargan test of over- identifying restrictions cannot reject the hypothesis that the instruments are valid. All the estimated coefficients have the correct signs and they are statistically significant. In terms of magnitude it seems that the GMM dynamic equation predicts higher elasticities for all variables.

In column (2) we present the results using the Kiviet (1999) bias correction. Again next to each coefficient, in square brackets we present the long- run elasticities. Also next to the standard t- statistics we present in square brackets, the t- statistic estimated with the parametric bootstrap procedure of Kiviet and Bun (2001), using 5000 replications. According to the Monte Carlo simulations of Kiviet and Bun (2001), when a_0 is large the analytical variance estimator, used to compute standard t-statistics, performs rather poorly. In that case they suggest a bootstrap procedure which is relative accurate. However, in both cases the statistical significance of the coefficients does not change (with the exception of $INEQ$ which is marginally insignificant under the bootstrap t- statistic). Moreover the long- run elasticities are much closer to those in Table 2.

4 Concluding Remarks

The results of this paper provide evidence for both the significance of income inequality as a determining factor in aggregate import demand equations and for its differential effects in high-income and low-income countries. This finding provides yet another example that changes in the degree of heterogeneity among economic agents may have important macroeconomic implications.Consider, for example, a two country world in which the two countries grow at the same rate and their import and export elasticities are identical; in this case, and ignoring the inequality developments, one would think that there is no need for the real exchange rate to adjust in order for their current account deficits (or surpluses) to be sustainable. Our findings indicate that this conclusion hangs on the absence of changes in income inequality: if, say, there is a rise in income inequality in the domestic country which results -ceteris paribus-in a rise in its imports, sustainability of the current account requires a depreciation of the domestic country's real exchange rate. The potential presence of this mechanism for the United States economy implies that the recent rise in income inequality reinforces the implications of the Houthakeer-Magee asymmetry (see, Houthakeer and Magee (1969)) that there be must be continuing real exchange rate depreciation of the dollar in real terms if the US is to keep growing at the same rate as its trading partners.

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5 Appendix

TABLE A1: Countries classification

High-income	**Low-income**
Australia	Barbados
Austria	Bolivia
Canada	Bulgaria
Cyprus	Chile
Denmark	Colombia
Finland	Ecuador
Greece	Egypt
Iceland	Hungary
Ireland	India
Israel	Indonesia
Italy	Kenya
Japan	Korea (Republic of)
Kuwait	Malaysia
Malta	Mauritius
Netherlands	Philippines
New Zealand	Poland
Norway	Singapore
Panama	South Africa
Spain	Syrian Arab Republic
Sweden	Turkey
USA	Venezuela
	Zimbabwe

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