INEQUALITY AND RELATIVE RELIANCE ON TARIFFS: THEORY AND EVIDENCE

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Abstract

In this paper we construct a Ricardian model of trade in vertically-differentiated products between a developing country and the (developed) rest of the world. Despite labour being the only factor of production in this model, tariffs (in addition to income taxes) have distributional consequences because the high-quality imported varieties are consumed only by high-income households. The model predicts a U-shaped relationship between income inequality and the median-voter's preferred reliance on tariffs versus income taxes in order to effect the desired redistribution. Using data from 44 countries we test for the existence of this U-shaped relationship by estimating a cross-sectional regression relating the ratio of the tariff rate over the tax rate to inequality and a set of control variables such as GDP per capita, openness, the degree of democracy and area dummies. We find that the model's predictions are supported by the data.

JEL Code: F13, H23.

Keywords: inequality, tariffs, median-voter, trade, vertical differentiation.

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1 Introduction

Following the in‡uential contributions of Romer (1975) and Meltzer and Richard (1981), it is now commonly accepted that higher income inequality among voters leads to increased government redistribution. The intuition behind this result is that the greater is the gap between median and mean income, the higher will be the level of spending preferred by the median income voter and - since Downsian-type political competition (Downs (1957)) drives policy decisions toward the ideal point of the median income voter - the higher will be the equilibrium amount of redistribution. For practically every paper that deals with this issue (see also, for example, Alesina and Rodrik (1994), and Persson and Tabellini (1994)), redistribution usually involves the imposition of a linear income tax, and a lump-sum disposition by the government to all citizens (cum voters) of the tax proceeds.[1] Nevertheless, governments usually have at their disposal (and actually use) many tax instruments. One of the "stylized facts" about tari¤s is that trade taxes typically contribute a larger share of government revenue in developing countries. The usual explanation (see, Rodrik (1995)) is that in countries with poor administrative capabilities, trade taxes may be the easiest way to raise the necessary revenue, since tari¤s have lower collection costs than other tax instruments (see also Corden (1974)).

Although the above explanation has some merits, it also fails to provide satisfactory answers to questions pertinent to the issue under consideration.[2] First, if revenue consid-

[1] For a review of this literature and of alternative ways in which the issue of redistribution can be modeled, see Harms and Zink (2003).

[2] For more details, see Moutos (2001).

erations are of paramount importance why do developing countries let a large proportion of their imports be duty free? According to GATT (1994), before the Uruguay Round the proportion of trade in developing countries that was duty free stood at 39 percent (it now stands at 42 percent). Second, if administrative costs are the deciding factor in the choice of a tax handle, why don't taxes with lower administrative costs than tari¤s (an annual tax on land holdings, for example) assume greater importance? Furthermore, as far as administrative costs are concerned one should not underestimate the labyrinthine tari¤ codes of many developing countries. Third, a corollary of the administrative costs explanation is that trade taxes typically contribute a large share of government revenue in each nation's early history when a well-functioning bureaucracy is not yet in place (Hinrichs, 1966). The United States experience in the nineteenth century is often used as an example supporting this hypothesis. Nevertheless, Hansen (1990, p.548) after examining the political economy of tari¤s in the nineteenth-century United States, concluded that "... the distributive characteristics of the tari¤ put their stamp on policy change both in the short-run and in the long-run". Moreover, as Balassa (1971) and his associates document (for Brazil, Chile, Mexico, West Malaya, Pakistan, Philippines and Norway) distributional and protectionist considerations were far more important determinants of trade policy than revenue considerations. For example, in Brazil trade policy was used both as a way to stem the depletion of foreign exchange reserves, and as a way to tax "inessential" goods (pp. 109-112).

The previous paragraph implies that distributional issues should be an integral part of any explanation regarding the heavier reliance on tari¤ revenue by developing-country gov-

ernments. In the present paper we enquire about the relative reliance on income and trade taxes as instruments of raising revenue in order to e¤ect the desired redistribution. To this purpose we construct a model of trade in vertically-di¤erentiated products.[3] The domestic country is a developing one and is assumed to have comparative advantage and to export to high-income countries (the rest of the world (ROW)), low-quality varieties of the di¤erentiated product. Thus the country's imports are high-quality varieties which are produced in the ROW. Low-income households in the developing country consume low-quality varieties which are domestically produced, and thus -ceteris paribus- they are impervious to the imposition of tari¤s but not to income taxes. Nevertheless, even if the household with the median income (i.e. the median voter) consumes domestically-produced varieties, it will still have a preference that both tari¤s and income taxes are imposed. This is a consequence of the standard argument for redistribution; as long as median income is smaller than average income, the imposition of an income tax whose proceeds are distributed lump-sum to all households bene…ts the median voter. Our argument, thus, implies that both income taxes and tari¤s will be instituted, but that there will be a heavier reliance on tari¤s than income

[3] Fontagne and Freudenberg (2002) and Schott (2003) present evidence that testi…es to the importance of vertical intra-industry trade in the world economy. Schott shows that low-income countries tend to export low-quality, low-price varieties. His most striking example of this tendency is that, regarding United States imports, men's cotton shirts exported from Japan are roughly thirty times as expensive as the identically classi…ed variety exported from the Philippines. Across all U.S. manufacturing imports, he …nds that the mean high-to-low unit value ratio in 1994 was 24. He also …nds that "... the relationship between unit values, exporter endowments and exporter production techniques supports the view that capital- and skill-abundant countries use their endowment advantage to produce vertically superior varieties, i.e. varieties that are relatively capital or skill intensive and possess added features or higher quality, thereby commanding a relatively high price" (Schott (2003), p.658) Thus, along with Bowen et al. (1987) and Tre‡er (1995) he concludes that there is no evidence of endowment-driven specialization across products.

taxes in a developing country.[4]

Consider now the e¤ects of inequality on a developing country's relative reliance on tari¤s. Our model predicts a U-shaped relationship: when inequality is low to begin with, the income tax rate rises more than the tari¤ rate in response to an increase in inequality, whereas the opposite happens when inequality is high. As mentioned earlier, an increase in inequality increases the total tax revenue available for lump-sum redistribution which the median voter prefers. This implies that the median voter will prefer that both income tax rates and tari¤ rates are raised.[5] But what is (from the median voter's point of view) the best weight that should be placed on each of the two tax instruments in order to e¤ect such an increase in tax revenue? Note that an increase in inequality - while keeping average income constant - decreases the proportion of households (cum voters) which have incomes high-enough so that they can a¤ord (i.e.choose) to buy the imported, high-quality varieties. At a high level of inequality, the proportion of individuals buying imported varieties is low.

[4] In this sense, the present paper provides a "public …nance" answer to the question "...why is international trade not free?" (see, Rodrik (1995)). This question relates to the well-known argument that trade policy is a highly ine¢cient tool for redistributing income (see, Dixit (1985)). Accordingly, if either the majority of voters or politically-in‡uential groups wanted to institute policies which would redistribute income in their favour, they could do so with more e¢cient policies (for earlier attempts to provide answers s to this question see, for example, Rodrik (1986), Mayer and Riezman (1990) and Feenstra and Lewis (1991)).. We note that in the present paper even though income taxes is a more e¢cient way of raising tax revenue (labour supply is inelastic in our set-up), the median voter prefers that both ways of raising revenue are used.

[5] This prediction, regarding the tari¤ rate, should be contrasted with the one emanating from Mayer's (1984) extension of Heckscher-Ohlin model: in that model an increase in inequality, which is re‡ected in unequal endowments of capital, makes the import tari¤ more positive in capital-abundant countries, while in capital-scarce countries an increase in inequality makes the import tari¤ more negative. Dutt and Mitra (2002) argue that in the real world other factors or considerations may, nevertheless, make the tari¤ rate to be positive in all countries independently of the degree of capital abundance. Thus they use the the Mayer–Heckscher–Ohlin framework to obtain the prediction that an increase in inequality (the di¤erence between the mean and the median capital-labor ratio), holding constant the economy's overall relative endowments, raises trade barriers in capital-abundant economies and lowers them in capital-scarce economies. They …nd that this prediction is supported by the data.

This implies that a large rise in the tari¤ rate will not reduce to a large extent the relevant tax base (i.e. the number of households buying imported varieties). Thus, in addition to the rise in the income tax rate, large increases in the tari¤ rate can be used to generate the extra revenue required in order to e¤ect the desire for more government revenue which an increase in inequality generates (the relative reliance on tari¤s increases). In contrast, when inequality is low to begin with, the proportion of individuals buying the imported varieties is larger, and the revenue-increasing demands that a rise in inequality engenders can not be met by relying too much on tari¤ rate increases, since in such a case there would be a larger fall in the proportion of households buying imported varieties (the relative reliance on import taxes decreases).

We test the main implication of our model by using data from 44 mostly developing countries. Our theoretical model postulates a U-shaped relationship between inequality and relative reliance on tari¤s. We identify endogenously from our data set the level of inequality above which a rise in inequality increases the relative reliance on tari¤s. In order to do this, we estimate a cross-sectional regression relating the ratio of the tari¤ rate over the tax rate to inequality and a set of control variables such as GDP per capita, openness, the degree of democracy and area dummies. Our empirical results suggest that, in line with the predictions of our model, in countries that specialize in the production of low quality varieties and are characterized by some degree of political competition there is strong evidence for a U-shaped relationship between inequality and the tari¤ per tax rate ratio.[6]

[6] In addition to Dutt and Mitra (2002), who …nd that the impact of inequality on the level of the tari¤ rate depends crucially on a country's capital-labour ratio, Hwang and Jung (2002) also …nd empirical support

The remainder of the paper is as follows: Section 2 develops the theoretical model and derives the median- voter's equilibrium level of tari¤ rate and tax rate. The empirical analysis is presented and discussed in section 3. The last section concludes.

2 The model

Consider a small open economy which produces and consumes two goods (X and Y). We assume that only one of the goods is internationally traded (Y), and that both goods are produced with labour only. This Ricardian type economy features two-way international trade in a vertically-di¤erentiated good, with the domestic country producing (and exporting) low-quality quality varieties of good Y,and importing high-quality varieties of it. We assume that perfect competition prevails in all markets and that all households (citizens-cum-voters) are endowed with one unit of labour, which they o¤er inelastically. There are, however, di¤erences in skill between households, which are re‡ected in di¤erences in the endowment of each household's e¤ective labour supply. This is in turn re‡ected in an unequal distribution of income across households.[7] We assume that …rms pay the same wage rate per e¤ective unit of labour - thus the distribution of talent across …rms does not a¤ect unit production costs. We shall assume that the politico-economic equilibrium is determined according to the Downsian model of electoral competition.

for a positive e¤ect of the Land Gini Index on the level of the tari¤ rate. Although not directly comparable, our results can be interpreted as providing further evidence that inequality is an important determinant of trade policy.

[7] It is this feature of the model that allows trade policy to have distributional e¤ects in a Ricardian model.

2.1 Firms

Good X (the non-traded good) is a homogeneous good produced under linear technology,

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

where L_X stands for the e¤ective units of labour used. Using labour as the numeraire, we get that $P_X = w = 1$.

Good Y is a vertically di¤erentiated product (VDP) which is produced at various quality levels in both the domestic economy and in the rest of the world (ROW). We assume that quality is measured by an index $Q > 0$, and that there is complete information regarding the quality index. Following Flam and Helpman (1987) and Malley and Moutos (2002) we write the production function for the VDP in the domestic country as

$$Y_Q = \frac{L_Y}{\delta + \beta Q} \tag{2}$$

where Y_Q denotes the number of units of quality Q, and δ and β are positive parameters. Equation (2) implies that although costs per unit in terms of quantity are constant , costs are increasing per unit of the quality index. This assumption can be motivated by the fact that increases in quality – for a given state of technological capability – require that more workers must be used for the production of a higher number of features attached to each good (e.g. electric windows, air bags, ABS, security devices, etc. in the case of automobiles). Since perfect competition prevails, the price at which each unit of quality Q will be o¤ered

by domestic producers is

$$P(Q) = AC = \delta + \beta Q. \tag{3}$$

Similarly, we assume that the price at which each unit of quality Q will be o¤ered by ROW producers is

$$P^{¤}(Q) = AC^{¤} = \delta^{¤} + \beta^{¤} Q$$

We assume that $\delta^{¤} > \delta$, and $\beta^{¤} < \beta$. These assumptions ensure that producers in the domestic country charge lower prices for low -quality varieties than ROW producers, whereas the ROW o¤ers higher-quality varieties at a lower price than domestic producers.[8] In other words we assume that the domestic country has comparative advantage in the production of low-quality varieties of the Y good. This is depicted in Figure 1, which shows the price-quality schedules for domestic and ROW producers. There obviously exists a quality level for which the costs (and prices) of domestic and ROW producers are equal. We term the quality level for which this is the case, the "dividing" quality level, Q_d. For varieties involving quality levels $Q < Q_d$, consumers will purchase the VDP from domestic producers, whereas varieties with quality levels $Q > Q_d$ will be purchased from ROW producers. In the absence of any trade taxes this implies that varieties with $Q < Q_d$ will be exported by the domestic country, whereas varieties with $Q > Q_d$ will be imported by the domestic country. Let τ be the tari¤

[8] In essence, we assume that there are two regions (countries) which trade with each other: the rich North (identi…ed here with the ROW) and the poor South (identi…ed with the domestic country). We abstract from South-South trade since it is quantitatively far less important than the North-South trade. For example, in 1977 the South-South trade was approximately 3 percent of of the North-South trade if OPEC was considered as part of the North, and approximately 25 percent of the North-South trade if OPEC is de…ned as part of the South (see, Whalley (1985)).

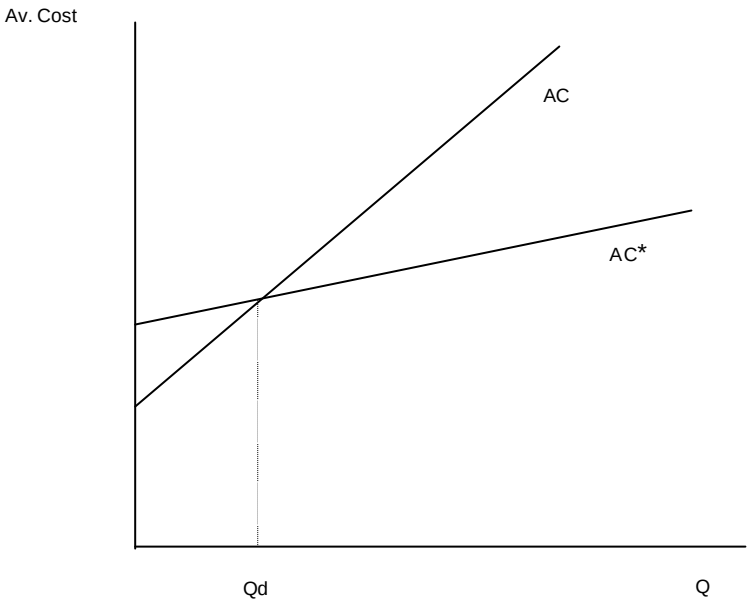

Figure 1: Price-quality schedules for domestic and ROW producers

rate per unit applied by the domestic country on its imports. Then, the dividing quality level as far as domestic consumers are concerned is found by setting $\delta + \beta Q_d = \delta^{¤} + \beta^{¤} Q_d + \tau$, which implies that

$$Q_d = \frac{\delta^{¤} + \tau \ ¡ \ \delta}{\beta \ ¡ \ \beta^{¤}} \tag{4}$$

This shows that a rise in the tari¤ imposed by the domestic country , results in an expansion of the range of varieties which domestic producers can o¤er at a lower price to domestic consumers.

2.2 Households

All households are assumed to have identical preferences. Following Flam and Helpman (1987) we assume that the homogeneous good is divisible, whereas the quality-di¤erentiated product is indivisible and households can consume only one unit of it. For simplicity we write the utility function as

$$U_i = Q_i + \ln X_i \tag{5}$$

where Q_i and X_i stand for the quality of good Y (the VDP) and the quantity of the homogeneous good (respectively) consumed by household i.

Let e_i stand for the endowment of e¤ective labour units owned by household i. Since the wage rate per e¤ective unit of labour is unity, e_i stands also for household income. Assume that there is a continuum of households, $i \in [0, 1]$, with Pareto distributed incomes. The Pareto distribution is de…ned over the interval $e \geq b$, and its CDF is

$$F(e) = 1 - \left(\frac{b}{e}\right)^a \tag{6}$$

where $a > 1$.

Parameter b stands for the lowest income, and parameter a determines the shape of the distribution (higher values of α imply greater equality). The mean of the Pareto distribution is equal to

$$\mu = \frac{ab}{a - 1} \tag{7}$$

and the income of the median voter (household) is

$$m = 2^{\frac{1}{a}} b \tag{8}$$

The budget constraint of a household depends on whether it consumes the domestic or the foreign variety of the VDP. The budget constraint of a household which buys a domestically-produced variety is,

$$e_i(1 - t) + s = X_i + \delta + \beta Q_i \tag{9}$$

whereas the budget constraint of a household buying an imported variety is,

$$e_i(1 - t) + s = X_i + \delta^{\alpha} + \beta^{\alpha} Q_i + \tau \tag{10}$$

where t stands for the income tax rate, s for the lump-sum transfer which the government makes to each household, and τ for the tari¤ rate per (physical) unit of imports. (Assuming an ad-valorem tari¤ rate would not change the qualitative nature of our results). The utility maximizing demands for the two goods if the household chooses to consume a domestically-produced variety are,

$$X_i^D = \beta \tag{11}$$

and

$$Q_i^D = \frac{e_i(1 - t) + s - \delta - \beta}{\beta} \tag{12}$$

whereas if the household chooses to consume an imported variety the demands are,

$$X_i^F = \beta^{¤} \tag{13}$$

and

$$Q_i^F = \frac{e_i(1 ¡ t) + s ¡ \delta^{¤} ¡ \tau ¡ \beta^{¤}}{\beta^{¤}} \tag{14}$$

In deriving the above we have assumed that for all households income is high enough to generate positive demands for both goods. The resulting indirect utility functions in the two cases are then,

$$V_i^D = \frac{e_i(1 ¡ t) + s ¡ \delta ¡ \beta}{\beta} + \ln \beta \tag{15}$$

$$V_i^F = \frac{e_i(1 ¡ t) + s ¡ \delta^{¤} ¡ \tau ¡ \beta^{¤}}{\beta^{¤}} + \ln \beta^{¤} \tag{16}$$

Household i will buy a foreign produced variety if $V_i^F > V_i^D$. We note that $\frac{\vartheta(V_i^F ¡ V_i^D)}{\vartheta e_i} > 0$, i.e. the di¤erence between V_i^F and V_i^D is increasing in household income. Thus, only households with large incomes will be willing to buy the high-quality varieties that are imported from the ROW.

Let θ denote the income of a household that is indi¤erent between consuming the domestically produced variety and the foreign variety, i.e., for this household it holds that

$$V^D = \frac{\theta(1 ¡ t) + s ¡ \delta ¡ \beta}{\beta} + \ln \beta = \frac{\theta(1 ¡ t) + s ¡ \delta^{¤} ¡ \tau ¡ \beta^{¤}}{\beta^{¤}} + \ln \beta^{¤} = V^F$$

We term θ the dividing level of income (ability). Solving for θ we …nd that

$$\theta = \frac{\varphi - \tau\beta - s(\beta^{\alpha} - \beta)}{(1-t)(\beta^{\alpha} - \beta)} \tag{17}$$

where $\varphi \equiv \beta\beta^{\alpha} \ln(\frac{\beta^{\alpha}}{\beta}) + \delta\beta^{\alpha} - \delta^{\alpha}\beta$.

The Pareto distribution implies that the proportion of households with incomes larger or equal to θ (that is, the proportion of households which choose to consume the foreign-produced varieties), is $(b/\theta)^{\alpha}$. Thus, the government's budget constraint is

$$s = t\frac{ab}{a-1} + \tau(\frac{b}{\theta})^{a} \tag{18}$$

The government budget constraint implies, as usual, that the government's transfers to households (for given tax and tari¤ rates) depends on the proportion of households consuming the imported varieties. What is new in our analysis is that, for a given tari¤ rate, the tari¤ revenue collected by the government is a function of the degree of income inequality.

2.3 Median-voter equilibrium

In what follows we concentrate on the median voter, which we assume to have an income which induces her to buy domestically produced varieties, i.e. we assume that $\theta > 2^{\frac{1}{a}}b$.[9] It can be easily established that although there is more than one issue over which voters express their preferences, all the conditions required for the median-voter theorem to apply are satis…ed since the indirect utility function of each voter can be written in the form

[9] In our context the median voter is most likely to be an urban worker or a poorly paid civil servant - both of whom do pay income taxes in developing countries (see, Bates (1981) and Moore (1993)).

$V(q;e_i) = J(q) + K(e_i)H(q)$ where q is a vector of policies, and $K(e_i)$ is monotonic in e_i, for any $H(q)$ and $J(q)$ common to all voters (see, Grandmont (1978) and Persson and Tabellini (2000)). In the politico-economic equilibrium considered in this paper, all candidates for o¢ce (or political parties) announce a policy package which maximizes the utility of the median voter. That is they propose to the electorate a …scal package $[s, \tau, t]$ which maximizes

$$U_{MV} = \frac{2^{\frac{1}{a}} b(1 - t) + s - \delta - \beta}{\beta} + \ln \beta \tag{19}$$

subject to the government budget constraint given by equation (18) and equation (17).

The maximization problem implies the following …rst-order conditions (λ denotes the Lagrange multiplier):

$$\frac{1}{\beta} + \lambda\left[\frac{ab}{1 - a} - \frac{a\tau b^a (1 - t)^a ((\beta^{\alpha} - \beta)^{a+1})}{(\varphi - \tau\beta - s(\beta^{\alpha} - \beta))^{a+1}}\right] = 0 \tag{20}$$

$$-\frac{2^{\frac{1}{a}} b}{\beta} + \lambda\left[\frac{ab}{1 - a} - \frac{a\tau b^a (1 - t)^{a-1} (\beta^{\alpha} - \beta)^a}{(\varphi - \tau\beta - s(\beta^{\alpha} - \beta))^a}\right] = 0 \tag{21}$$

$$\lambda\left[b^a \left[\frac{(1 - t)(\beta^{\alpha} - \beta)}{\varphi - \tau\beta - s(\beta^{\alpha} - \beta)}\right]^a + \frac{a\beta\tau b^a (1 - t)^a (\beta^{\alpha} - \beta)^a}{(\varphi - \tau\beta - s(\beta^{\alpha} - \beta))^{a+1}}\right] = 0 \tag{22}$$

Manipulation of these conditions (see Appendix) allows us to eliminate λ and to re-express them in a way that allows us to solve them numerically for various parameter values of $\beta^{\alpha}, \beta, \delta^{\alpha}, \delta$, b, and a that are empirically relevant and satisfy the models restrictions

[e.g. $Q_{MV} < Q_d$] and the second order conditions for a maximum.[10] We …nd -as expected- that increases in inequality result in higher tax and tari¤ rates. In Figure 2 we depict the relationship between inequality ($\frac{1}{a}$) and the relative reliance on tari¤s (τ/t) for a given level of average income (we adjust b as α varies so that average income remains constant and equal to 6; the values of the other parameters are, δ = 1, β = 1, $\delta^{¤}$ = 1.1, $\beta^{¤}$ = 0.9).[11] The relationship between the relative reliance on tari¤s, ($\frac{\tau}{t}$), and inequality, ($\frac{1}{a}$), is U-shaped.[12] This appears to be a robust result in the sense that it does not depend on the particular set of parameter values used, i.e., the U-shaped relationship kept emerging for all the variations in parameter values we experimented with. This relationship shows that for low levels of inequality the tax rate responds more than the tari¤ rate to changes in inequality, whereas for high levels of inequality there is a positive relationship between inequality and the relative reliance on tari¤s.

The U-shaped relationship can be explained by …rst noting that in a median–voter model increases in inequality are associated with more redistribution, i.e. both taxes and transfers will be higher. However, a mean-preserving increase in inequality decreases the proportion of households (cum voters) which choose to buy the imported, high-quality varieties. Thus, the tax base on which the tari¤ is applied shrinks. At a high level of inequality, the proportion of households buying imported varieties is low. This implies that a large rise in the tari¤ rate

[10] An alternative institutional arrangement is to think that the income tax rate is …xed for a long period of time, and the electoral process involves the determination of the tari¤ rate (and the associated lump-sum transfers). Although such a set-up reduces the dimensionality of the problem, we could not still obtain closed form solutions.

[11] For example when α = 2, the implied tax rate is 40% and the implicit ad valorem tari¤ rate is 7%.

[12] Empirical estimates of the value of α range between 1.7 and 3.0 (see, Creedy (1977)).

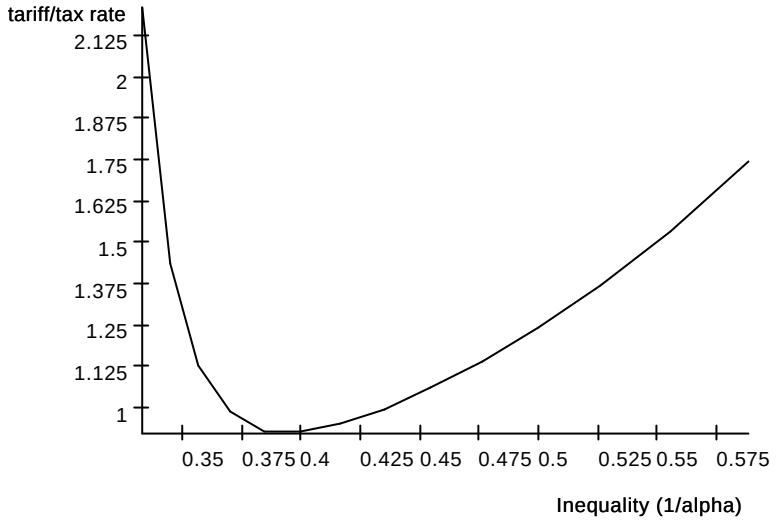

Figure 2: Inequality and relative reliance on tari¤s

will not reduce to a large extent the relevant tax base (i.e. the number of households buying imported varieties). Thus, in addition to the rise in the income tax rate, large increases in the tari¤ rate can be used to generate the extra revenue required in order to e¤ect the desire for more government revenue which an increase in inequality generates (the relative reliance on import taxes increases). In contrast, when inequality is low to begin with, the proportion of individuals buying the imported varieties is larger, and the revenue-increasing demands that a rise in inequality engenders can not be met by relying too much on tari¤ rate increases, since in such a case there would be a larger fall in the number of households buying imported varieties (the relative reliance on tari¤s decreases).[13]

[13] In principle, the government could raise tax revenue by using excise taxes on high-quality goods instead of tari¤s. But, as Corden (1974) observed, di¤erential collection costs may weight the scales heavily in favour of tari¤s. The problem with excise taxes is the di¢culty of collecting them from small-scale establishments. In contrast, foreign trade usually ‡ows through a few ports, and even when it does not, it is easier to police a border and collect taxes on goods passing across it than to seek out a large number of owners of small

3 Empirical investigation

3.1 The econometric model

Our theoretical model suggests a U-shaped relationship between relative reliance on tari¤s and inequality: In countries with low levels of inequality, tax rates will increase more with inequality than tari¤s and vice versa. In order to test for the existence of this U-shaped relationship, we follow a similar methodology to that used by Dutt and Mitra (2002).[14] To this purpose, we …rst estimate the following regression:

$$RT_i = c_0 + c_1 IN_i + c_2 IN_i^2 + dX_i + u_i \tag{23}$$

where RT_i is the relative reliance on tari¤s in country i measured by the average tari¤ rate over the average tax rate, IN_i is the level of inequality and X_i is a vector of control variables. Inequality is de…ned as the inverse of parameter α in our theoretical model. All variables are in natural logs. We introduce the squared term, IN_i^2, in equation (23) in order to capture the non-linearity predicted by our model. Taking the partial derivative of RT_i with respect to IN_i, we obtain

$$\frac{\vartheta RT_i}{\vartheta IN_i} = c_1 + 2c_2 IN_i$$

Therefore, $\frac{\vartheta RT_i}{\vartheta IN_i} > 0$ if $IN_i > ¡\frac{c_1}{2c_2}$. The existence of a U-shaped relationship requires that $c_1 < 0$ and $c_2 > 0$. For countries with inequality levels above $¡\frac{c_1}{2c_2}$ (countries with low

…rms or ensure that they produce accurate tax returns.

[14] See also Kalaitzidakis and Kalyvitis (2005) for using a similar method to estimate the public investment/maintenance e¤ect on growth.

α), the relationship between the level of inequality and relative reliance on tari¤s will be positive. Similarly, for lower levels of inequality (countries with high α) the average tari¤ to average tax ratio will depend negatively on the level of inequality.

Our sample consists of 44 countries over the period 1989-1995. Our sample is limited by the need to include countries that produce and export low-quality varieties, whereas they import high-quality varieties. We assume that this production pattern holds mainly for developing countries as well as for some lower income developed countries. Indeed, both Schott (2003) and Adam and Moutos (2004) …nd that there is a high degree of correlation between a country's per-capita income and its trade pattern, i.e. developing and lower-income developed countries tend to export lower-quality (i.e. lower-priced) varieties of a particular product than high-income developed countries. Even for two of the highest per-capita income countries in our sample, Greece and Portugal, the proportion of their exports in 1980 which could be classi…ed as high-quality relative to the exports of the high-income OECD countries is small: 17 percent for Greece and 15 percent for Portugal (see, Adam and Moutos (2004) for more details).[15] We restrict our attention to the 1989-1995 period since the number of countries with a political system that is broadly consistent with the assumptions of the median-voter model is signi…cantly larger for this period. Moreover, in an e¤ort to increase our sample size even more, we also include some countries that during this period could not be characterized as democratic (i.e. China, Indonesia)[16] since, one

[15] We lack similar data for Israel, which is the highest per-capita country in our sample. In any case, the inclusion of Israel in our sample has no in‡uence on our results.

[16] See Appendix B.

can argue that even dictators may have an incentive to implement policies preferred by the median voter, thereby decreasing the probability of political con‡icts.[17] We control for di¤erences in the level of democracy among countries by including a democratization index in the vector of control variables in equation (23).

Our measure of inequality is the Gini-coe¢cient from the data set of Deininger and Squire (1996). This data set is to our knowledge the most complete and reliable source of inequality data. Alternative measures of inequality such as the median quintile's share in national income would reduce our countries sample signi…cantly. RT_i is constructed as the ratio of the average tari¤ rate over the average tax rate, where the …rst is de…ned as total import duties as a percentage of total imports and the latter is de…ned as taxes on income, pro…ts and capital as a percentage of GDP. Our vector of control variables includes GDP per capita (YP), imports as percentage of GDP (MY), a democracy index (DEM) and area dummies. All data are from the Word Development Indicators and the Summers-Heston data set apart from the democracy index for which we use the Gastil index for political rights from the Freedom House. The Gastil index is an inverse index for democracy: It takes values from 1 to 7 with lower values indicating a more democratic regime.

Equation (23) is initially estimated by OLS. However, both GDP per capita and imports per GDP may be endogenous with respect to the tari¤ to tax rate ratio (i.e., both the level of the tari¤ rate and the level of the tax rate are likely determinants of the level of imports and of the level of GDP). Hence, in a second step we test for endogeneity and estimate the

[17] In fact, Mulligan et al (2004) do not …nd empirical evidence for di¤erent public economic policies in democracies than in nondemocracies.

model parameters using instrumental variable methods.

Finally, we re-estimate our model by dropping non-democratic countries from our sample. Speci…cally, we exclude from our sample all countries with a Gastil index higher than 5.[18] Given that in this case our sample consists only of countries for which the assumptions of the median voter model should, in principle, approximate the political process better, our results should provide a stronger support to our theoretical model.

3.2 Results

Columns (1)-(3) of Table 1 report estimation results of equation (23) using OLS for the full sample of countries.[19] In line with the prediction of our model, inequality a¤ects the tari¤-to-tax ratio negatively whereas squared inequality a¤ects the tari¤-to-tax ratio positively. However, only the coe¢cients reported in column (2) are statistically signi…cant at the 5% level, providing evidence for a U-shaped relationship between inequality and relative reliance on tari¤s. In all speci…cations, the coe¢cient of the inverse index of democracy is negative and statistically signi…cant. The higher the Gastil index for political rights (i.e. the lower the level of democracy), the further away we move from the median voter assumption of our model. One explanation for this result is that in the absence of democratic conditions, policies are implemented from a group of high-in‡uence, high-income individuals who consume the imported varieties of the VDP and thus favour a low relative level of tari¤s.

[18] Alternatively to the Gastil index we have also used political variables from the Poility IV dataset without any signi…cant changes in our results. Note that even according to the values of Polity IV variables, we would have excluded the same countries from our sample as the most non-democratic.

[19] Alternatively, one could use non-linear estimation methods such as threshold estimation [see Hansen (1998)]. However, the small number of our observations makes the use of these methods infeasible.

In accordance with our theoretical model, this behaviour could justify the positive impact of democracy on the tari¤ rate/tax rate ratio.[20] In order to test the robustness of our results under alternative speci…cations we estimate equation (23) by including GDP per capita and imports per GDP as additional control variables in the regression in columns (2) and (3). The coe¢cient of GDP per capita is negative and statistically signi…cant, indicating that richer countries rely less on import duties as a source of revenue. As mentioned in the introduction, this result may re‡ect the fact that these countries have more developed tax systems and, therefore, they face a lower cost of collecting income taxes than poor countries (see Rodrik (1995)). Openness (measured by the level of imports over GDP) also has a negative impact on the relative reliance on tari¤s. A possible explanation for this is that policymakers in economies with high levels of imports take into account that increasing tari¤ rates will have a signi…cant e¤ect on the level of in‡ation. Another probable reason, as mentioned above, is that the endogeneity between trade restrictions and the volume of imports is the culprit.

In order to control for the e¤ect of economic unions on the level of tari¤s, we include two area dummies in the regressions: EU for the European Union countries and CEE for the countries of Central and Eastern Europe. The coe¢cient of the EU is negative and statistically signi…cant, indicating the low reliance on tari¤s of the European Union countries. The same holds true for the CEE countries that as former members of the Council for Mutual Economic Assistance were trading mostly with each on the basis of inter-country agreements (the clearing system) and were, during our sample period, characterised by (at

[20] For a discussion of other motivations for including a measure of democracy in our model see Dutt and Mitra (2002) who also …nd a positive impact of democracy on trade protection.

TABLE 1: Full sample estimation of equation (23)				
Dependent variable: Tari¤ rate per tax rate				
	OLS			IV
	(1)	(2)	(3)	
$Constant$	49.44¤ (26.96)	55.74¤¤ (23.03)	49.85¤¤ (21.90)	49.22¤¤ (21.79)
$GINI$	¡ 1.735 (1.098)	¡ 1.869¤¤ (0.928)	¡ 1.512¤ (0.881)	¡ 1.473¤ (0.878)
$GINI^2$	0.0165 (0.011)	0.018¤¤ (0.009)	0.014 (0.009)	0.014 (0.009)
GDP (percap)		¡ 0.001¤¤ (0.0002)	¡ 0.001¤¤ (0.0002)	¡ 0.001¤¤ (0.0002)
Im$ports$ (% GDP)			¡ 0.055¤¤ (0.023)	¡ 0.061¤¤ (0.028)
$Gastil$	¡ 0.658¤ (0.415)	¡ 1.226¤¤ (0.447)	¡ 1.211¤¤ (0.434)	¡ 1.209¤¤ (0.433)
EU	¡ 8.507¤¤ (2.63)	¡ 4.363¤¤ (1.675)	¡ 4.567¤¤ (1.533)	¡ 4.589¤¤ (1.519)
CEE	¡ 12.37¤¤ (4.99)	¡ 12.01¤¤ (3.903)	¡ 10.53¤¤ (3.674)	¡ 10.37¤¤ (3.667)
R^2	0.40	0.53	0.57	0.57
IN $_{CR}$	52.5	51.9	53.9	52.6
Wald test	11.15 [0.004]	14.94 [0.001]	18.69 [0.0001]	10.39 [0.005]

Standard errors in parentheses; ** signi…cant at 5% level,
* signi…cant at 10% level; P-values in brackets.

least o¢cially) unusually low levels of inequality and low relative reliance on tari¤s.[21]

Finally, we use the estimates for c_1 and c_2 in order to identify the level of inequality above which the relationship between the tari¤-tax rate ratio and the level of inequality becomes positive. The critical turning point, IN_{CR} is reported in the semi-…nal row of Table 1. One can see that the value of IN_{CR} remains fairly stable across the various speci…cations. The value of the GINI-coe¢cients in our sample range from 25.8 to 62.3 which implies that all estimated values of IN_{CR} lie within the range of observable GINI-coe¢cients in our sample of countries.

In order to test for possible endogeneity of GDP per capita and imports per GDP we perform the Hausman test as follows: We regress the variables suspected for endogeneity, namely GDP per capita and imports per GDP, on the exogenous variables and take the residuals from the two regressions. We regress our dependent variable, RT_i, on the residuals of the previous regressions as well as on YP and MY. The results are reported in the …rst column of Table 2. The coe¢cient on the residuals from the imports per GDP equation as well as the coe¢cient on the residuals from the GDP per capita equation are both insigni…cant. However, given the theoretical arguments proposed in the literature for trade protection and imports being simultaneously determined endogenous variables [see Tre‡er (1993)], we use the exports to GDP ratio, XY, as an instrument and re-estimate equation (23) with Instrumental Variables. The results are presented in the last column of Table

[21] We also experimented with other candidate control variables such as the secondary enrollment rate, the size of the shadow economy, the level of ethnic fractionalization and the number of revolution and coups per year but none of these variables yielded plausible or statistically signi…cant coe¢cients. However, the inclusion of these variables did not alter the signi…cance and the sign of the coe¢cients of GINI and GINI^2.

TABLE 2: Testing for endogeneity		
Dependent variable: Tari¤ rate per tax rate		
Constant	9.610 (5.310)	13.28 (7.110)
Residuals from the import equation [1]	0.105 (0.1380)	0.141 (0.1550)
Residuals from the GDP equation[2]	¡ 0.0004 (0.0003)	0.0005 (0.0004)
Imports per GDP	¡ 0.163 (0.370)	¡ 0.201 (0.157)
GDP per capita	¡ 0.0002 (0.0002)	¡ 0.0007 (0.0004)
Wald test	1.49 [0.47]	0.78 [0.68]

Standard errors in parentheses; ** signi…cant at 5% level;
p-value in brackets.
[1] We regress imports per GDP on all remaining variables depicted on Table 1.
[2] We regress GDP per capita on all remaining variables depicted on Table 1.

1. The IV estimates are very similar to OLS estimates, supporting the results from the Hausman test.

Next, we exclude from our sample 8 countries which are considered to have been the least-democratic during the sample-period, namely China, Cote d'Ivoire, Egypt, Ghana, Indonesia, Kenya, Tunisia and Zimbabwe. The selection of least-democratic countries has been based on two di¤erent measures of the political regime: the Gastil inverse index for democracy (Gastil index >5), and the Polity variable from the Polity IV data set (Polity<0).[22] Table 3 presents the estimation results of equation (23) using the sample of democratic countries. All variables enter with statistically signi…cant coe¢cients at the 5% level in all

[22] The Polity variable is constructed as the the level of institutionalized democracy minus the level of institutionalized autocracy.

TABLE 3: Estimation of equation (23) for democracies				
	Dependent variable: Tari¤ rate per tax rate			
	OLS			IV
	(1)	(2)	(3)	
$Constant$	59.26¤¤ (25.33)	66.41¤¤ (20.88)	59.03¤¤ (19.48)	58.56¤¤ (19.44)
$GINI$	¡ 2.151¤¤ (1.023)	¡ 2.320¤¤ (0.846)	¡ 1.891¤¤ (0.788)	¡ 1.864¤¤ (0.789)
$GINI^2$	0.020¤¤ (0.010)	0.0220¤¤ (0.009)	0.0172¤¤ (0.008)	0.0170¤¤ (0.008)
GDP (percap)		¡ 0.001¤¤ (0.0002)	¡ 0.001¤¤ (0.0002)	¡ 0.001¤¤ (0.0002)
Im$ports$ (% GDP)			¡ 0.063¤¤ (0.023)	¡ 0.068¤¤ (0.028)
DEM	¡ 0.084 (0.454)	¡ 0.892¤¤ (0.402)	¡ 0.701¤ (0.410)	¡ 0.689¤ (0.412)
EU	¡ 8.802¤¤ (2.652)	¡ 5.083¤¤ (2.113)	¡ 5.299¤¤ (1.934)	¡ 5.313¤¤ (1.928)
CEE	¡ 14.85¤¤ (4.894)	¡ 14.41¤¤ (3.735)	¡ 12.80¤¤ (3.486)	¡ 12.70¤¤ (3.486)
R^2	0.52	0.63	0.69	0.69
IN $_{CR}$	53.8	52.7	55	54.8
Wald test	14.24 [0.001]	18.55 [0.0001]	23.98 [0.0001]	23.89 [0.005]

Standard errors in parentheses; ** signi…cant at 5% level,
* signi…cant at 10% level; P-values in brackets.

cases apart from the Gastil index. This is understandable, since in this sample the inclusion of the Gastil index is less relevant as the least-democratic countries are excluded from our sample. The …rst-order e¤ect of the inequality index is negative and signi…cant, whereas the second order e¤ect is positive and also signi…cant. This empirical evidence supports the existence of a U-shaped relationship between inequality and relative reliance on tari¤s for countries that are characterized by the existence of political competition. All remaining variables have the same signs as in Table 1. Next, we perform the Hausman test for endogeneity and we report the results in the last column of Table 2. The Wald-test rejects the assumption of no–endogeneity at the 10% level. Equation (23) is re-estimated by using IV and the results are reported in the …nal column of Table 3.

Concluding, our empirical evidence supports the existence of a U-shaped relationship between inequality and relative reliance on tari¤s. The empirical support strengthens considerably when we reduce our sample by excluding the least democratic countries. Given that the derivation of our theoretical results depends crucially on the assumptions of the median voter model, one could argue that the stronger empirical evidence we …nd with the reduced sample, provides further support for the empirical relevance of our theoretical framework.

4 Conclusions

The median voter model predicts that a rise in inequality has a positive impact on the level of redistribution. In this paper, we argue that the level of inequality also a¤ects the composition of the tax package by which this higher redistribution will be …nanced. Our

explanation is based on a Ricardian-type model of trade in vertically di¤erentiated products. The evidence suggests that developing countries tend to export low-quality varieties and to import high-quality ones. The demand for these high-quality varieties and, consequently, the tari¤ elasticity of their demand will depend - ceteris paribus- on the degree of income inequality . If inequality is high, then only few high-income individuals will be able to a¤ord the imported high-quality varieties. Therefore, a rise in the tari¤ rate will not have a strong negative tax-base e¤ect. As a result, although a rise in inequality will increase both the tax rate and the tari¤ rate preferred by the median voter, it will also increase the relative reliance on tari¤s. The opposite will occur for low initial levels of inequality, i.e. levels of inequality that lay below a critical value. Our econometric analysis for 44 countries for the 1989-1995 period supports our theoretical priors, suggesting that there is a U-shaped relationship between the average tari¤-to-tax-rate ratio and the degree of inequality.

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Appendix A

We re-write equation (18) as

$$\tau b^{a}[\frac{(1 - t)(\beta^{*} - \beta)}{\varphi - \tau\beta - s(\beta^{*} - \beta)}]^{a} = s - t\frac{ab}{a - 1} \tag{24}$$

First we substitute for $\tau b^{a}[\frac{(1-t)(\beta^{*}-\beta)}{\varphi-\tau\beta-s(\beta^{*}-\beta)}]^{a}$ in equation (22).

In that way equation (22) can be written as

$$\lambda\{(s - t\frac{ab}{a - 1})(\frac{1}{\tau} + \frac{a\beta}{[\varphi - \tau\beta - s(\beta^{*} - \beta)]})\} = 0 \tag{25}$$

From equation (25) we get that for $\tau > 0$,

$$\tau = \frac{\varphi - s(\beta^{*} - \beta)}{\beta(1 - a)} \tag{26}$$

Next, we substitute for $\tau b^{a}[\frac{(1-t)(\beta^{*}-\beta)}{\varphi-\tau\beta-s(\beta^{*}-\beta)}]^{a}$ in equations (20) and (21). We then divide the two new equations in order to get rid of λ, and we substitute for τ from (26). This re-arrangements give us the following equation:

$$s(\beta^{*} - \beta) - \varphi = \frac{2^{\frac{1}{a}}b(\beta^{*} - \beta)(s(a - 1) - abt)}{M + \frac{a[s(a-1)-abt]}{(1-t)(a-1)}} \tag{27}$$

where, $M = 2^{\frac{1}{a}} b \; ¡ \; \frac{ab}{a ¡ 1}$

Equations (24), (26) and (27) are solved numerically for various parameters of $\beta^{¤}, \beta, \delta^{¤}, \delta$, b, and a that are empirically relevant and satisfy the models restrictions [e.g. $Q < Q_d$].

Appendix B

Our sample involves all countries, with the exception of high-income countries, for which the relevant data exist: Argentina, Bangladesh, Bolivia, Brazil, Bulgaria , China, Colombia, Costa Rica, Cote d'Ivoire, Czech Republic, Dominican Republic, Ecuador, Egypt, Gambia, Ghana, Greece, Hungary, India, Indonesia, Israel, Jamaica, Jordan, Kenya, Madagascar, Malawi, Malaysia, Mauritius, Mexico, Morocco, Nicaragua, Pakistan, Panama, Paraguay, Peru, Philippines, Portugal, Romania , Slovenia, South Africa, Thailand, Tunisia, Uruguay, Venezuela, Zimbabwe.

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