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Abstract

Median voter theory applied to trade policy predicts positive tariffs in capital-abundant countries and negative tariffs in labor-abundant countries. Negative tariffs are rare, and this paper reconciles the median voter theory with observed protectionism across countries. By considering large countries, I show the optimal tariff is a sum of the median voter component and a positive terms of trade component. Positive terms of trade effects raise tariffs in all countries, and can overcome the negative median voter component in labor-abundant countries. Testing the tariff prediction with cross-section and panel data from the 1990s, I show the median voter component is negative in labor-abundant countries and positive in capital-abundant countries. As expected, terms of trade effects raise tariffs across all countries and are stronger among non-members of the WTO.

Keywords: Median Voter, Trade Policy, Heckscher Ohlin, Terms of Trade, WTO.
JEL Classification Codes: F11, F13, F59

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1 Introduction

Empirical studies show preferences over trade policy are associated with factor ownership. As predicted by trade based on factor endowments, individuals with a higher ownership of their country's abundant factor are more pro-trade and vice-versa.[1] Less is known about the linkage from individual preferences to adopted policies. This paper examines whether individual preferences based on factor ownership are reflected in actual trade policies across countries.

In a factor endowments framework, wages to labor owners rise with a tariff on labor-intensive goods and fall with a tariff on capital-intensive goods. Similarly, rents to capital owners rise with a tariff on capital-intensive goods and fall with a tariff on labor-intensive goods. This suggests factor owners would like tariffs on goods intensive in factors they own and subsidies to purchase other goods. Since labor owners are always in the majority, countries which import labor-intensive goods should adopt tariffs under majoritarian voting (Mayer, 1984). Similarly, importers of capital-intensive goods would elect to subsidize imports. However, import subsidies are rarely observed, especially in labor-abundant countries that import capital-intensive goods. Although this presents problems for the theory, Dutt and Mitra (2002) provide evidence for the relative levels of tariffs across countries. This paper revisits the prediction for absolute tariff levels across countries. I show that once terms of trade are incorporated into the theory, both the relative and absolute levels of tariffs have empirical support.

In this paper, majoritarian and and terms of trade considerations jointly determine tariff levels. According to the terms of trade argument, a large country sets positive tariffs to exploit its market power. Recent work has shown that even countries with small shares in world GDP or world imports are "large" as they set higher tariffs on account of terms of trade considerations. In particular, Olarreaga, Soloaga and Winters (1999) find that terms of trade considerations account for about 6 to 28 per cent of the explained variation in tariffs across commodities for MERCOSUR countries even though MERCOSUR's share in world imports is just one per cent. Broda, Limao and Weinstein (2008) emphasize the role of regional market power and find that countries with small shares in world GDP (e.g. Algeria, Paraguay etc.) set higher tariffs on account of terms of trade considerations.[2] To formalize this insight, I consider a large country factor endowments model where world prices are influenced by tariffs. As in the factor endowments theory, majoritarian interests

[1] E.g., Scheve and Slaughter (2001), Mayda and Rodrik (2005) and O'Rourke and Sinnott (2001).

[2] Also see Blattman, Clemens and Williamson (2003) and Williamson (2003) for historical evidence.

induce negative tariffs in labor-abundant countries and positive tariffs in capital-abundant countries. Tariffs comprise of this median voter component and a positive terms of trade component. World prices respond to domestic tariffs and large countries set higher tariffs to improve their terms of trade. When a large labor-abundant country has sufficient market power, positive terms of trade effects dominate the negative median voter component and the optimal tariff is positive.

Taking this large country prediction to the data, I test for the median voter and the terms of trade components in tariffs across countries. Individual-level studies show that human capital is related to trade policy preferences of voters. Using cross-country survey data, Mayda and Rodrik (2005) and O'Rourke and Sinnott (2001) find strong support for the link between trade preferences and human capital.[3] Consequently, I use human capital as a measure of capital ownership and test whether the link between capital ownership and trade policy preferences is reflected in adopted trade policies across countries. I examine tariff-setting for a cross-section of countries during the 1990s and a panel during 1996-2000 and 2000-2005. In line with the theoretical prediction, I show that the median voter component is negative in labor-abundant countries and positive in capital-abundant countries. Labor-abundant countries tend to be pro-trade while capital-abundant countries tend to be protectionists on account of majoritarian interests. I find empirical support for a positive terms of trade component in tariffs. Even at the highly aggregated country level, tariffs are higher on account of market power in international markets. Together, the results imply that the observed absence of import subsidies is consistent with majoritarian voting when terms of trade considerations are taken into account.

Terms of trade considerations induce large countries to unilaterally choose higher tariffs. As countries set higher tariffs, the volume of trade among them falls and the resulting tariffs are not efficient from the perspective of aggregate welfare across countries. Bagwell and Staiger (1999) show that large countries can enter into trade agreements to reduce and eventually eliminate these terms of trade externalities. The World Trade Organization (WTO) enables its members to negotiate reciprocal tariff cuts to mitigate these externalities. Taking this to the data, Bagwell and Staiger (2011) find that tariff reductions among new members of the WTO are positively related to their market power. As the time period of my sample covers the formation of the WTO, I incorporate this insight and find that the positive terms of trade effect is higher among non-members of the WTO. Members show

[3]Other studies that consider skills include Scheve and Slaughter (2001). Balistreri (1997) also finds support for the link between workers' occupations and the voting preferences of Canadians regarding the Canadian-US Free Trade Agreement.

a weaker but positive terms of trade component, and it remains to be seen whether future negotiations will eliminate this, resulting in import subsidies in labor-abundant members.

Empirical findings of this paper contribute to the sparse work examining whether implemented trade policies are in line with majoritarian interests. Besides Dutt and Mitra (2002) mentioned earlier, I am unaware of empirical work focusing on the relation between factor ownership and majoritarian voting on trade policy.[4] The paper is organized as follows. Sections 2 and 3 contain the theoretical and empirical models respectively. Section 4 briefly summarizes the data while Section 5 lays out the empirical results. Section 6 concludes.

2 Theoretical Model

This Section lays out the Mayer Heckscher-Ohlin theory (MHO hereafter). I start with a description of production and incomes in the economy. Next, I discuss individual preferences and trade policy choices. Finally, I determine how individual tariff choices translate into trade policy adopted in the economy. This gives the large country level prediction which is tested in a subsequent Section.

Production and Income

Following the MHO framework, I consider a standard Heckscher-Ohlin model with heterogeneity in capital ownership across individuals. There are two goods (1 and 2) and two factors (labor L and capital K) in the economy. Both factors are used in the production of each good. Production functions are homogeneous of degree one and factors are perfectly mobile across the two industries. As a result, a unit of labor earns a wage rate w and a unit of capital earns a rental rate r, irrespective of the industry of employment.

Each individual i owns a unit of labor ($L^i = 1$) and an amount K^i of the capital stock in the economy. Individual i earns total factor income equal to $w + rK^i$ and her share in national factor rewards is $\phi^i \equiv (w + rK^i)/(wL + rK)$. In addition to factor earnings, individuals receive a part of the national tariff revenue. Suppose the domestic country imports M units of good 1. Let t be the tariff rate imposed on good 1 and π be the world relative price of good 1 in terms of good 2. Then the domestic country obtains national tariff revenue $T = t\pi M$. Mayer assumes tariff sharing is neutral with respect to

[4] In earlier work, Beaulieu and Magee (2004) use Political Action Committee (PAC) contribution data and find that the factor represented by the PAC is more important than industry in determining support for NAFTA and GATT in the US. This is consistent with the Mayer model in that capital owners favor tariff reductions while labor owners favor tariff increases in a capital-abundant country.

the overall distribution of income. If individual i earns ϕ^i of the total factor rewards in the economy, then she receives ϕ^i of the total tariff revenue T. Individual i's total income is $y^i = w + rK^i + T^i = \phi^i(wL + rK + T) = \phi^i Y$.

Preferences

On the demand side, all individuals have identical and homothetic preferences over goods. The utility function is strictly concave. Both goods are normal and traded in competitive markets. Let the domestic price of good 1 in terms of good 2 be $p = \pi(1 + t)$. Individual i in the home country chooses a tariff level t^i to maximize her indirect utility function, $\max_{t^i} U^i\left(p(\pi, t^i), y^i\right)$.

I consider large countries so the world price π can be affected by changes in the domestic tariff rate t. In particular, a country is "large" if it has the ability to manipulate its terms of trade. Holding foreign tariff t^* constant, if the change in world price with respect to a change in domestic tariff is non-zero ($\pi_t \neq 0$) then the domestic country is "large". In contrast, a small country cannot affect world prices through its own tariff and has $\pi_t = 0$. Following Bagwell and Staiger (1999), I assume an increase in the domestic tariff of a large home country has a strictly negative impact on world relative price and vice-versa for tariff imposed by the foreign country (t^*):

Large Country Assumption (1). $\pi_t < 0 < dp/dt$ and $\pi_{t^*} > 0 > dp^*/dt^*$.

Individual Trade Policy Choices

Individual i maximizes her utility by choosing a tariff rate with $dU^i/dt = 0$. Under the assumptions made earlier and given t^*, home tariffs affect individual welfare through price changes for goods and through changes in income of the individual:

$$\frac{dU^i}{dt} = \frac{\partial U^i}{\partial y^i}\left[\left(\frac{\partial U^i}{\partial p} \Big/ \frac{\partial U^i}{\partial y^i}\right)\frac{dp}{dt} + \frac{dy^i}{dt}\right] = 0. \tag{1}$$

Let D_1 denote the aggregate demand for good 1 in the economy. By Roy's identity and homotheticity of utility, i's demand for good 1 is $\phi^i D_1 = -(\partial U^i/\partial p)/(\partial U^i/\partial y^i)$. As $p = \pi(1 + t)$, the change in price with respect to the tariff is $\pi + (1 + t)\pi_t$. The income of individual i varies with national income and her share in national income: implying $dy^i/dt = \phi^i\left(dY/dt\right) + Y\left(d\phi^i/dt\right)$. Substituting for these changes in Equation (1), the

optimal tariff of individual i is given by

$$\frac{dU^i}{dt} = \frac{\partial U^i}{\partial y^i}\left[-\phi^i D_1(\pi + (1+t)\pi_t) + \phi^i \frac{dY}{dt} + Y\frac{d\phi^i}{dt}\right]. \tag{2}$$

The national income consists of revenues from goods 1 and 2 and the tariff revenue from imports of good 1, $Y = pX_1 + X_2 + t\pi M$. Substituting in Equation (2), i's optimal tariff is given by

$$\frac{dU^i}{dt} = \phi^i \frac{\partial U^i}{\partial y^i}\left[\underbrace{t\pi\frac{dM}{dt}}_{\text{Tariff-weighted Imports}} + \underbrace{\frac{Y}{\phi^i}\frac{d\phi^i}{dt}}_{i\text{'s Income Share}} + \underbrace{-M\pi_t}_{\text{Terms of trade}}\right] = 0. \tag{3}$$

Equation (3) highlights three elements determining individual i's optimal tariff: the effect of tariff on imports, income share and terms of trade. While the change in tariff-weighted imports is negative for all individuals, the income share may rise or fall depending on individual i's ownership of capital (as explained shortly). The terms of trade effect is the same for all individuals and is positive in a large country. The standard MHO model assumes a small country so its tariff does not affect world prices ($\pi_t = 0$). On the other hand, I consider a large country which has an impact on world prices. When a large country imposes a tariff, world price for its imported good falls ($\pi_t < 0$) implying the terms of trade effect is strictly positive.

Adopted Trade Policy

Having determined individual trade policy preferences, I discuss the implications for adopted trade policies across countries. With single-peaked preferences, the median voter theorem implies the adopted tariff ($\tilde{t}$) corresponds to the median voter's optimal tariff ($\tilde{t}^{mv}$). From Equation (3), the adopted tariff is

$$\tilde{t} = \tilde{t}^{mv} = \left(\frac{Y}{\pi(-dM/dt)}\right)\left(\frac{d\phi^{mv}/dt}{\phi^{mv}}\right) + \left(\frac{M\pi_t}{\pi dM/dt}\right). \tag{4}$$

The first term in Equation (4) is the median voter component while the second one is a terms of trade component. The latter can be written in more familiar terms. Let E^* denote foreign exports to the home country. Then the terms of trade component is the inverse of the export supply elasticity of home country's imports of good 1, i.e. ToT $=$

$1/[(\pi/E^*)(d\pi/dE^*)] \equiv 1/\eta^*$, implying the adopted trade policy is

$$\tilde{t} = \underbrace{\left(\frac{Y}{\pi(-dM/dt)}\right)\left(\frac{d\phi^{mv}/dt}{\phi^{mv}}\right)}_{\text{Median Voter Component}} + \underbrace{\frac{1}{\eta^*}}_{\text{ToT Component}} . \tag{5}$$

I discuss each component of the optimal tariff in Equation (5). As in the small country MHO model, the first term in Equation (5) is the median voter component. The sign of the median voter component depends on how the median voter's income share is affected by a domestic tariff ($d\phi^{mv}/dt$). From the factor ownership share $\phi^i = (w + rK^i)/(wL + rK)$, the change in income share of the median voter is

$$\frac{d\phi^{mv}}{dt} = \left[\frac{wL}{(wL + rK)^2}\right] r(K/L - K^{mv}) \left(\frac{1}{w}\frac{dw}{dt} - \frac{1}{r}\frac{dr}{dt}\right). \tag{6}$$

Equation (6) shows that the sign of $d\phi^{mv}/dt$ depends on two elements, the median voter's capital share relative to the nation ($K/L - K^{mv}$) and the relative factor intensity of imports which determines relative wage changes ($(1/w)(dw/dt) - (1/r)(dr/dt)$).

In Equation (6), the first element $(K/L - K^{mv})$ is positive since the median voter owns less of the country's capital stock than the mean capital owner.[5] The sign of the second element $((1/w)(dw/dt) - (1/r)(dr/dt))$ depends on the country's relative factor abundance. In particular, this change in relative wage is positive in a capital-abundant country and negative in a labor-abundant country. An increase in tariff raises the domestic price of the imported good (p). In a capital-abundant country, an increase in the price of the imported labor-intensive good will lead to a higher factor reward for labor and a lower factor reward for capital. Thus, the relative factor reward of the median voter in a capital-abundant country increases with a rise in tariff. On the other hand, the relative factor reward of the median voter in a labor-abundant country falls with a rise in tariff.[6] To summarize, trade barriers and income share of the median voter are positively related in a capital-abundant country ($d\phi^{mv}/dt > 0$) and negatively related in a labor-abundant country ($d\phi^{mv}/dt < 0$). Therefore, the median voter component is positive in a capital-abundant country and negative in a labor-abundant country.

[5] I confirm this assumption in the empirical work. For further discussion, see Alesina and Rodrik (1994).

[6] These results follow from the Stolper-Samuelson and Heckscher-Ohlin theorems. By the Stolper-Samuelson theorem, a rise in price of the imported good results in a higher income share for the individual if she is relatively well-endowed with the factor used intensively in the production of the imported good. From the Heckscher-Ohlin theorem, a capital-abundant country imports the labor-intensive good while a labor-abundant country imports the capital-intensive good.

The second term in Equation (5) is a terms of trade component. A small country faces a perfectly elastic export supply. As a result, in the small country MHO model, the ToT component in Equation (5) is zero. Tariffs only have a median voter component implying tariffs are positive in capital-abundant countries and negative in labor-abundant countries. This is the unrealistic import subsidization result of the MHO model. In order to reconcile observed protectionism with the lack of import subsidies, I consider large countries that do not face a perfectly elastic export supply and hence use tariffs to improve their terms of trade.

In a large country, the optimal tariff is a sum of the median voter component and a positive terms of trade component. As in the small country MHO model, the adopted tariff is positive in a capital abundant country (as both the median voter and the terms of trade components are positive). However, unlike the small country MHO model, the adopted tariff is positive in a sufficiently large labor-abundant country due to the presence of terms of trade considerations. In particular, let $e_{\phi t}$ be the median voter's income share elasticity with respect to a domestic tariff and let $e_{\pi t}$ be the world price elasticity with respect to a domestic tariff. Then as long as the share of imports to GDP exceeds the ratio of median voter's factor share elasticity to world price elasticity ($\pi M/Y > e_{\phi t}/e_{\pi t}$), a labor-abundant country will impose positive tariffs on its imports. In this case, a labor-abundant country has sufficient market power in its import market implying that the positive terms of trade component outweighs the negative median voter component. The adopted tariff is positive and reflects the observed protectionism across countries. I summarize this result in a Proposition below.

Proposition: Large Country Tariff Levels. *The optimal tariff is a sum of the median voter component and a terms of trade component. When a large labor-abundant country has sufficient market power, the positive terms of trade component outweighs the negative median voter component implying positive tariffs.*

Thus the unrealistic result of import subsidization is overturned while the relationship between tariffs and the median voter component is preserved. Olarreaga, Soloaga and Winters (1999) remark that "the relevance of the "small" country assumption may be limited to a small number of cases, as MERCOSUR represents only 1 per cent of world markets, but terms-of-trade effects seem to be relatively important" (pp. 23). This suggests several countries can be considered sufficiently large implying the MHO level of tariff prediction may not be unrealistic after all.

Before proceeding to test the large country tariff prediction, I show that it preserves the relative tariff prediction supported by Dutt and Mitra (2002). Leaving the level of tariff

prediction aside, Dutt and Mitra (DM hereafter) examined how adopted tariffs vary with a rise in inequality. Holding other things equal, the MHO model implies higher inequality in capital ownership (i.e. a higher $K/L - K^{mv}$) causes tariff rates to rise in capital-abundant countries and to fall in labor-abundant ones. This clear relationship between tariffs and inequality is in contrast to other political economy models of trade policy.[7] Therefore, evidence of the relative tariff prediction shows the median voter model explains trade policy patterns that cannot be easily attributed to other theories (Gawande and Krishna, 2003). The large country MHO model preserves the inequality-tariff implication as terms of trade considerations do not affect the individual-specific income effect of preferred tariffs. Consequently, DM's findings regarding the validity of the inequality-tariff implication of the MHO model apply to the large country MHO model as well. For ease of reference, the absolute and relative tariff predictions for the small and large country MHO theory are summarized in Table 1.

Table 1: Absolute and Relative Tariff Predictions of the MHO Model

Country Type	Assumptions	MV	ToT	Absolute $\tilde{t}$	Relative $\partial\tilde{t}/\partial$Inequality
Small K-abundant	$\pi_t = 0$	(+)	0	(+)	(+)
Small L-abundant	$\pi_t = 0$	(-)	0	(-)	(-)
Large K-abundant	$\pi_t < 0 < dp/dt$	(+)	(+)	(+)	(+)
Large L-abundant	$\pi_t < 0 < dp/dt$	(-)	(+)	(+/-)	(-)
	$\pi M/Y > e_{\phi t}/e_{\pi t}$	(-)	(+)	(+)	(-)

3 Empirical Model

This Section provides an empirical model to test the large country level of tariff prediction. From Equation (5), the optimal tariff can be written as:

$$\tilde{t} = \underbrace{\left(\frac{Y}{\pi(-dM/dt)}\right)\left(\frac{d\phi^{mv}/dt}{\phi^{mv}}\right)}_{\text{Median Voter Component}} + \underbrace{\frac{1}{\eta^*}}_{\text{ToT Component}} = \theta^{mv}\text{MV} + \text{ToT}$$

[7] Dutt and Mitra (2002) remark that when a lobbying approach is used in a similar two-sector two-factor constant returns to scale framework such as Rodrik (1986), the opposite prediction follows. An increase in capital inequality results in lower protection in capital-rich countries and vice-versa. On the other hand, when a lobbying or median voter approach is used in a specific factors model, there is no clear cross-country prediction. The impact of an increase in inequality on trade barriers is highly sensitive to the costs of forming lobbies or the elasticity of substitution between mobile and specific factors (Feenstra, 2004, pp. 311-15).

where $\theta^{mv} \equiv (dw/dt - (w/r)(dr/dt)) / |\pi dM/dt|$ is the median voter coefficient which switches signs depending on factor-abundance.

The median voter term can be written in terms of capital inequality as

$$\text{MV} \equiv \frac{Y}{Y-T} \frac{r(K/L - K^{mv})}{w + rK^{mv}} L.$$

MV is the relative earning of the majority population and captures the shortfall in the median voter's capital ownership relative to the average voter. Specifically, it is the population-weighted percentage deviation of the median voter's capital earnings after adjusting for tariff revenue. I examine whether the median voter component is negative (positive) in labor-abundant (capital-abundant) countries and whether the terms of trade component is positive, as predicted by the large country level prediction.

For brevity, let $k_c \equiv (K/L)_c$ denote the mean capital-labor ratio of country c and k^* denote the threshold capital-labor ratio that divides countries into labor-abundant and capital-abundant categories. Then the level of tariff prediction implies that majority considerations exert a negative influence on tariffs in labor-abundant countries and a positive influence in capital-abundant countries. In other words, $\theta^{mv} < 0$ for all countries with $k_c < k^*$ and $\theta^{mv} > 0$ for all countries with $k_c > k^*$. The large country level prediction implies that terms of trade considerations exert a positive influence on tariffs in all large countries. In order to test these predictions, I follow Dutt and Mitra (2002) and estimate the following equation where Z and ε denote a vector of controls and error terms:[8]

$$\tilde{t}_c = \theta_1 \text{MV}_c + \theta_2 \text{MV}_c \cdot k_c + \theta_3 k_c + \theta_{tot} \text{ToT}_c + Z_c' \zeta + \varepsilon_c. \tag{7}$$

The interaction term $(\text{MV} \cdot k)$ in Equation (7) allows the coefficient on the median voter term $(\theta_1 + \theta_2 k_c)$ to vary across subgroups of countries. This provides an endogenous split in the sample that groups countries into capital-abundant and labor-abundant. In particular, if $\theta_1 < 0$ and $\theta_2 > 0$ then the critical capital-labor ratio (k^*) is defined by $\theta_1 + \theta_2 k^* = 0$. The threshold k^* implies labor-abundant countries have a negative median voter component $([\theta_1 + \theta_2 k_c]\text{MV}_c < 0$ for $k_c < k^*)$ while capital-abundant countries have a positive median voter component $([\theta_1 + \theta_2 k_c]\text{MV}_c > 0$ for $k_c > k^*)$. The capital-labor ratio (k_c) is included as a RHS variable in Equation (7) to allow the sign of the interaction term coefficient (θ_2) to differ from the sign of the capital per worker coefficient (θ_3).

[8] Dutt and Mitra examined if $\gamma_1 < 0$ and $\gamma_2 > 0$ for $\tilde{t}_c = \gamma_1 \text{Inequality}_c + \gamma_2 \text{Inequality}_c \cdot k_c + \gamma_3 k_c + Z_c' \xi + \epsilon_c$, as implied by the tariff-inequality relationship of the Mayer median voter model. Using adopted tariff rates, they found support for this relationship with physical capital and unskilled labor in the 1980s.

The ToT component increases adopted tariffs in all large countries implying $\theta_{tot} > 0$. In the absence of cross-country export supply elasticities, there are no direct measures for ToT in Equation (7). Consequently, I use demand and supply relationships to construct the ToT variable from available data. Two distinct methods are used to construct ToT measures. First, I follow Chacholiades (2006) and measure ToT using import elasticity data. Second, I use import shares to proxy for ToT as proposed by Olarreaga, Soloaga and Winters (1999).[9] These methods are described below.

Elasticity Method

Following Chacholiades (2006), I consider the relation between exports and imports in a two-good general equilibrium to express export supply elasticities in terms of import demand elasticities. In equilibrium, the value of exports of a foreign country j equals the values of its imports, $\pi E_j^* = M_j^*$. Let η_c^* be the elasticity of export supply to home country c and $e_j^* = (\pi / M_j^*)(dM_j^*/d\pi)$ be the elasticity of import demand of a foreign country j. For brevity, let the share of goods imported by the home country from foreign country j be $\lambda_j \equiv M_j^* / \sum_k M_k^*$. Then using $\pi E_j^* = M_j^*$, the export supply elasticity is $\eta_c^* = \left(\pi / \sum_j E_j^*\right)\left(d \sum_j E_j^* / d\pi\right) = -(1 + \sum_j \lambda_j e_j^*)$. The terms of trade component of tariffs is $\text{ToT}_c = 1/\eta_c^* = -1/(1 + \sum_j \lambda_j e_j^*)$. I observe import shares λ_j and measures for import demand elasticities e_j^*. Consequently, ToT can be constructed with available data on imports and import elasticities.

Import Share Method

Olarreaga, Soloaga and Winters (1999) propose an alternative method to construct the ToT variable. Let M_j^* denote the import demand of a foreign country j, E_c^* denote the export supply to country c and E_W^* denote the total export supply to the world. In equilibrium, export supply to country c is $E_c^* = E_W^* - \sum_j M_j^*$. Denoting country j's share of world imports by $\lambda_j^W \equiv M_j^* / E_W^*$ and differentiating the equilibrium relationship with respect to world price yields the export supply elasticity η_c^* faced by country c as a function of its import share λ_c^W: $\eta_c^* = \left(\eta_W^* - \sum_j \lambda_j^W e_j^*\right) / \lambda_c^W$. Using this relationship, Olarreaga, Soloaga and Winters (1999) argue that a "preferred" proxy for the terms of trade component $(1/\eta_c^*)$ is the import share of country c in world markets λ_c^W since it avoids availability and

[9] Elasticity and import data are not available for all countries in the world. So the ToT variable will vary by the same amount for all countries in the sample. Hence, θ_{tot} is not expected to be exactly one.

measurement problems associated with trade elasticities. I use import shares as a proxy for ToT to supplement the first method which uses elasticity data.

Having constructed the ToT variable, I estimate Equation (7) and test whether signs on the key variables agree with those predicted by the large country MHO model (as summarized in Table 2).

Table 2: Large Country Level Prediction Test

Variable description	Variable	Coef.	Expected Sign
Majority's relative earning	MV	θ_1	(-)
Majority's relative earning· (K/L)	MV·k	θ_2	$(+)$
Terms of Trade	ToT	θ_{tot}	$(+)$

4 Data Sources and Description

Using cross-country variation, I estimate Equation (7) to test the optimal tariff prediction of Equation (5). Estimation of Equation (7) requires measures of trade barriers $\tilde{t}$, majority's relative earnings MV, terms of trade ToT and capital-labor ratios k. A brief summary of these variables is provided below and details are explained in the Appendix.

For the dependent variable $\tilde{t}$, I use trade restrictiveness indices (TRIs) estimated by Kee, Nicita and Olarreaga (2009) for the period 1993-2004. TRI is defined as the uniform tariff that would maintain imports of a country at the same level as its existing tariff structure. The indices are composite measures of trade protection which account for tariffs, duties and non-tariff barriers (see Anderson and Neary, 2003). Data on tariffs for the indices are from 2000 onwards while most of the non-tariff barriers are from 1995 onwards (see Kee, Nicita and Olarreaga, 2009 for details).

For the RHS, I construct the median voter component using data on labor shares, taxes and inequality. The median voter component is MV $= [r(K/L - K^{mv})/\phi^{mv}]\, LY/(Y-T)^2$ which measures the majority's relative earnings, net of government revenue. As in DM, I use shares of the third quintile in national income as a measure of the median voter's capital ownership rK^{mv}. As a robustness check, I also use direct measures of human capital inequality in a separate first-differences specification, but data constraints prevent their use in all specifications. Data on GDP, labor, total tariff revenue and third quintile's share in national income are from the World Development Indicators (WDI) 2006. The median voter term is highest in Norway and lowest in Madagascar.

I construct the ToT variable using data on imports and import elasticities. Elasticities

were estimated by Kee, Nicita and Olarreaga (2008) using HS 6-digit product-level import data for each country during the period 1988-2002. I use the trade-weighted average import demand elasticity across all products to construct e_j^* for each country j. The import elasticities (e_j^*) and import values are from the Trade and Production Database of the World Bank. To construct the ToT term, I use elasticity data on all available countries including those which are not in the regression (due to lack of data on other variables). Import demand elasticity is lowest in Nicaragua and highest in USA (in absolute terms). It is noteworthy that import demand elasticities are less than -1 for all countries, implying that the ToT variable is positive across all countries in the sample.

As the constructed ToT measure captures the inverse export supply elasticity of a country, I compare the constructed variable with direct measures of inverse export supply elasticities estimated by Broda, Limao and Weinstein (2008) using disaggregated product-level data. For a set of fifteen countries, Broda, Limao and Weinstein estimate export supply elasticities from a system of import demand and export supply equations following the methodology of Feenstra (1994) and Broda and Weinstein (2006). Due to the large variation in elasticity estimates across products within a country, Broda, Limao and Weinstein report three sets of elasticities for every country (low, medium and high). Low inverse elasticities refer to the median inverse elasticity for low market power products (in the bottom 33 percentile of the inverse elasticity estimates within a country), and so on. I compare each of these elasticities with the ToT variable There are twelve common countries in my sample: Algeria, Belarus, Bolivia, China, Czech Republic, Lebanon, Latvia, Lithuania, Oman, Paraguay, Saudi Arabia and Ukraine. The correlation between the ToT variable and median estimates for low, medium and high inverse export supply elasticities are 0.4, 0.5 and 0.67. Thus the constructed ToT variable captures market power from export supply elasticities well.[10]

To proxy for capital-labor ratio k in the Mayer model, I use human capital from Baier, Dwyer and Tamura (2006). Human capital is an average of 1990 and 2000 values and I use logs following DM. Human capital is low in Ethiopia and Madagascar and high in USA and Canada. All other explanatory variables also correspond to the same time period. Summary statistics for key variables are provided in Table 3.[11]

[10] Own correlation between median estimates of low, medium and high inverse export supply elasticities are 0.6 (low, high), 0.77 (low, medium) and 0.9 (medium, high).

[11] I use the largest possible set of observations but the intersection of countries with data on tariffs and its components is limited.

Table 3: Summary Statistics

Variable		Obs	Mean	S.D.	Min	Max
Cross-section of countries in 1990s						
$\tilde{t}$	Trade Restrictiveness Indices	35	0.17	0.1	.045	.465
MV	Majority's relative earning: Income Q3	35	0.012	0.013	.0003	0.054
ToT	Elasticity Method	35	10.97	0.075	10.9	11.23
M	Imports (billion USD)	35	596	1,700	6.25	9,920
e_j^*	Import demand elasticity	35	-1.1	0.065	-1.33	-1.03
k	Human Capital Index	35	1.5	0.289	0.878	1.988
Panel of countries in 1996-2000 and 2001-2005						
$\tilde{t}$	Average tariff rates	99	0.14	0.1	0	0.53
MV	Majority's relative earning: Human K gini	99	0.022	0.036	.0001	0.226
ToT	Import share (% of world imports)	99	0.013	0.023	.0001	0.14
k	Years of schooling	99	6.01	2.38	0.876	11.85

Notes: Years of schooling refers to average years of schooling of the population aged 15 years and over.

As a robustness check, I use first-differences estimation to minimize country effects arising from other factors. This sample consists of thirty different countries during the five-year periods between 1996-2005. Trade barriers $\tilde{t}$ are proxied by world-trade weighted average tariff rates (ATRs). Importantly, I use a direct measure of capital inequality to construct the median voter term. In particular, human capital ginis are used instead of income inequality measures (see Castelló and Doménech, 2002 for details on the human capital ginis). For this extended sample, the first method for ToT construction is not feasible due to lack of import elasticity data. Consequently, terms of trade effects are measured by the second method using import shares in the world market.

5 Empirical Results

I examine the validity of the large country level prediction (Equation 5) by testing whether the median voter component is negative in labor-abundant countries but positive in capital-abundant countries and whether the terms of trade component is positive across all countries. The first part of this Section contains results for the baseline model of Equation (7) while the second part discusses an alternative first differencing specification to test the level of tariff prediction.

5.1 Baseline Results

I start with a summary of the baseline results. Then I discuss endogeneity issues, the role of WTO membership and the robustness of the baseline results. Results from estimation of Equation (7) are provided in Table 4.

Table 4: Absolute and Relative Levels: Trade Restrictiveness Indices (TRIs)

	Level of TRI			TRI and Inequality	
	(a) OLS	(b) OLS	(c) IV		(d) OLS
MV	-15.619**	-16.758**	-17.239**	Q3	0.109†
	(3.521)	(3.698)	(3.513)		(0.062)
MV·k	10.061**	10.950**	11.326**	Q3·k	-0.071†
	(2.264)	(2.386)	(2.254)		(0.038)
ToT (Elasticity)		0.322‡	0.458*		
		(0.201)	(0.219)		
k	-0.288**	-0.314**	-0.324 *	k	0.997†
	(0.077)	(0.083)	(0.079)		(0.569)
Intercept	0.635**	-2.863	-4.340†	Intercept	-1.349
	(0.141)	(2.192)	(2.396)		(0.901)
k^*	1.55	1.53	1.522	k^*	1.535
N	35	35	35	N	35
R^2	0.283	0.335	0.326	R^2	0.166
		Endogeneity Test Statistics			
Endog Variables	All	All	ToT	Endog Variables	All
Hansen J-stat	12.829	10.165	2.706	Hansen J-stat	8.892
Hausman-stat	2.015	0.488	2.015	Hausman-stat	2.841
Stage 1 F-stat	75, 86, 21	43, 50, 35, 31	7	Stage 1 F-stat	73, 20, 21
Endog N	34	34	35	Endog N	34

Notes: **, *, † and ‡ denote 1, 5, 10 and 15 per cent significance levels respectively. Endogeneity tests refer to MV, MV·k, k in Column (a), MV, MV·k, k, ToT in Column (b), only ToT in Column (c) and Q3, Q3·k and k in Column (d).

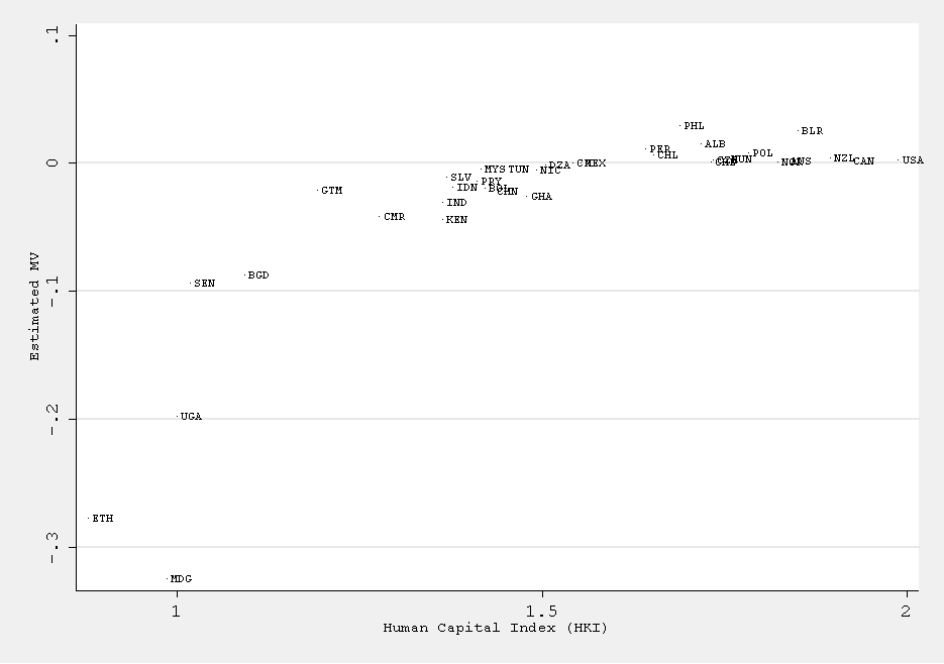
Column a of Table 4 contains results without the ToT term to show the median voter estimates under the assumption of small countries ($\pi_t = 0$). Column b contains results for the level prediction including the ToT term which need not be zero for large countries. Columns a and b of Table 4 show the median voter variable and the interaction term are statistically significant and have the expected signs. This implies the median voter component is negative in all countries with human capital lower than k^* but positive in all

countries with human capital higher than k^*. The critical k^* is similar across the different specifications, implying the same categorization of countries by human capital abundance. Table 5 and Figure 1 show the list of countries and the estimated median voter component by human capital index.

Table 5: Countries by Human Capital Index (k^*)

Human Capital Scarce		Human Capital Abundant	
Ethiopia	Indonesia	Costa Rica	Norway
Madagascar	Paraguay	Mexico	Australia
Uganda	Malaysia	Peru	Belarus
Senegal	Bolivia	Chile	New Zealand
Bangladesh	China	Philippines	Canada
Guatemala	Tunisia	Albania	United States
Cameroon	Ghana	Switzerland	
India	Nicaragua	Czech Republic	
Kenya	Algeria	Hungary	
El Salvador		Poland	

Figure 1: Countries by Human Capital Abundance ($k^* = 1.53$)



Tariffs of large countries also contain a terms of trade component, and inclusion of terms of trade considerations increases the R^2 from 0.28 (Column a) to over 0.33 (Column b).

Column b of Table 4 reports the estimates for the terms of trade variable (ToT), which has been constructed using the elasticity method. As expected, the coefficient on ToT is positive and significant, implying market power induces higher tariffs across countries.[12]

As a check of theoretical consistency, I present results for the tariff-inequality relationship tested by DM in Column d of Table 4. The median voter model implies that a fall in inequality is positively associated with trade barriers in labor-abundant countries and vice-versa. Using the third quintile's share in national income, the tariff-inequality relationship is empirically valid. In fact, estimates from the tariff-inequality relationship yield the same critical value for human capital as the large country level of tariff prediction. Consequently, these results are in line with the relative tariff prediction of Dutt and Mitra (2002). In summary, the baseline results support the large country level prediction and the remainder of this section discusses issues of endogeneity, interpretation and robustness of the results.

Endogeneity

One concern with the estimates in Column b is endogeneity bias from reverse causality. While I use lagged values of the explanatory variables, reverse causality could arise due to other effects of trade policy on inequality, human capital accumulation or imports. To address this, I follow the approach taken by Li, Squire and Zou (1998) and used in DM to test for endogeneity bias. The suspected endogenous variables are MV, MV$\cdot k$, k and ToT. As in DM, instruments for MV, MV$\cdot k$ and k are population growth rates, saving rates (measure of credit requirements), ratio of money (M2) to GDP (measure of financial development), civil liberties (measure of political factors as a structural variable) and their interactions with each other. In order to account for the effect of tariffs on ToT, I use GDP and population as instruments to capture market power in the world market. Broda, Limao and Weinstein (2008) find a positive relationship between GDP and their estimates of inverse export supply elasticities. The correlation between TRI and (GDP, Population) is (0.01, 0.29). The correlation between ToT through the elasticity and import share methods and (GDP, Population) is (0.7,0.66) and (0.97,0.52) respectively.

I do not encounter endogeneity problems so results for the endogeneity tests are reported

[12]The ToT variable is based on import demand elasticities which are estimated values. This implies the standard errors in Columns b and c of Table 5 should be corrected for the sampling error introduced due to an estimated regressor. Unfortunately, the World Bank does not provide data on the covariance matrix of the import demand elasticities and standard corrections are infeasible. However, sampling error is unlikely to be a concern for these results because the ToT variable is an average of an average. The ToT variable is based on import demand elasticities averaged across all countries and the country-specific import demand elasticity is also an average of import demand elasticities across products.

along with OLS results. The Hansen J-statistics and the Durbin-Wu-Hausman statistics are statistically insignificant at the 10 per cent level for each regression. The F-Statistics under heteroskedasticity-robust standard errors are large and statistically significant at the one percent level for every variable in each regression.

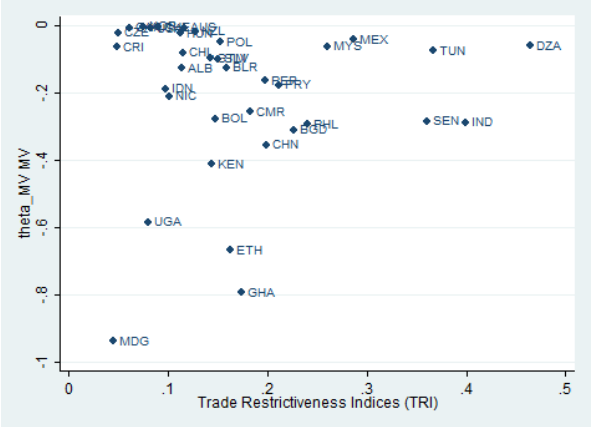
For completeness, I report the instrumental variable (IV) results when only ToT is suspected to be endogenous. As expected, the OLS and IV estimates are similar so the large country level prediction continues to be valid under IV estimation reported in Column c of Table 4. Similar results hold using the import share method for ToT, although the Hansen J test statistic is marginally significant in one specification (see Table 8 in Appendix).

Predicted Tariff Components

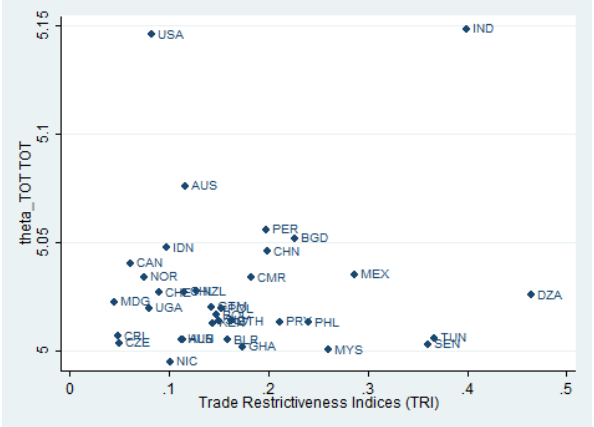
Having estimated the key coefficients, I can relate the observed tariffs with the predicted tariff components. Taking the estimates from Column c, Figure 2 plots the predicted values of the median voter component of tariffs ($[\hat{\theta}_1 + \hat{\theta}_2 k]$MV) and the terms of trade component of tariffs ($\hat{\theta}_{tot}$ToT) with respect to observed tariffs. Panel a shows the median voter component can be negative or positive across countries and Panel b shows the positive terms of trade component of tariffs for all countries in the sample.

Figure 2: Observed Tariffs and Predicted Median Voter and Terms of Trade Components

(a) MV Component



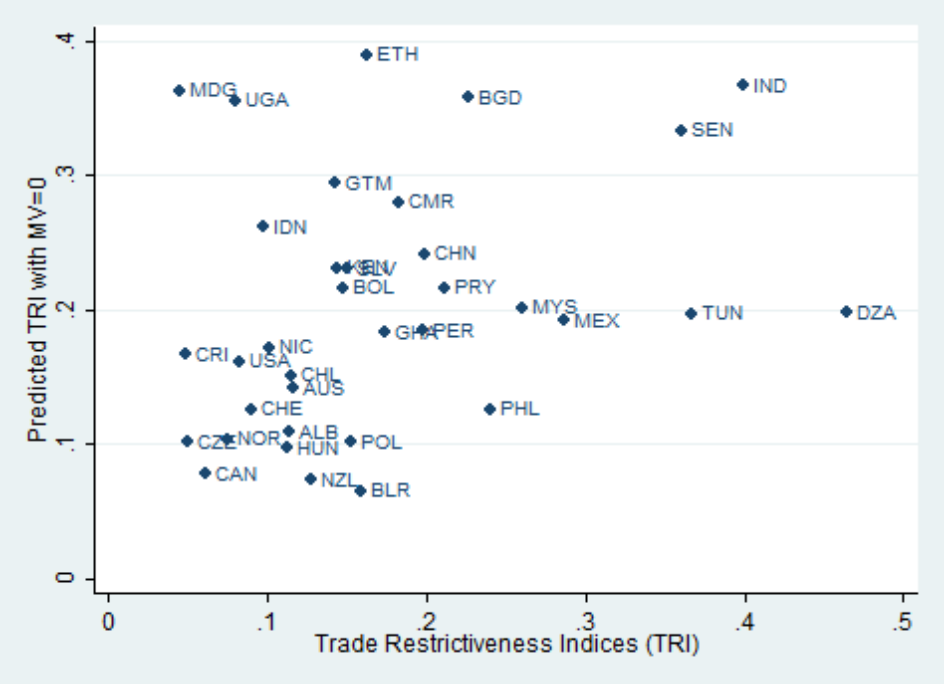
(b) ToT Component



Following Magee and Magee (2008), I also predict the estimated tariffs in the absence of median voter considerations to examine whether the results reflect positive tariffs on account of terms of trade. Figure 3 plots the predicted tariffs when the median voter component is

zero. As in Magee and Magee, I find that the United States is not the highest tariff country but India continues to be a high tariff country due to terms of trade considerations.

Figure 3: Predicted Tariffs in the Absence of the Median Voter Component



Terms of Trade and WTO Membership

The baseline results show that the terms of trade coefficient is less precisely estimated. One prominent reason could be membership in the World Trade Organization (WTO). The time period under consideration covers the formation of the WTO so members may have engaged in a mutual re-adjustment of their tariffs to overcome the terms of trade externality. To account for differences in terms of trade effects across members and non-members of the WTO, I include an interaction term for WTO members and ToT on the RHS. Tariff bindings lower the ability to manipulate terms of trade so I expect a negative coefficient on the interaction term for members. Members of the WTO may engage in tariff adjustment for reasons other than terms of trade externalities (such as solving time-inconsistency or commitment problems as in Staiger and Tabellini, 1987 and Maggi and Rodriguez-Clare, 2007 respectively). Consequently, I include a dummy for WTO membership as well. The member dummy is categorized as one for countries that were members of the WTO during the time period 1995-2002.

Table 6: Level Test: Trade Restrictiveness Indices (TRIs)

	Without Controls	With Controls	
	(a) OLS	(b) OLS	(c) OLS
MV	-16.758**	-19.078**	-21.029*
	(3.698)	(3.721)	(8.098)
MV·k	10.950**	13.063**	13.004*
	(2.386)	(2.426)	(5.658)
ToT (Elasticity)	0.322‡	5.458**	0.466**
	(0.201)	(0.915)	(0.148)
Member·ToT		-5.092**	
		(0.940)	
Member		55.578**	-0.101**
		(10.285)	(0.034)
k	-0.314**	-0.302**	-0.281
	(0.083)	(0.085)	(0.176)
Oil Exporter			-0.180**
			(0.025)
Pol. Rights			-0.005
			(0.012)
De Facto Member			0.142**
			(0.045)
Tax Revenue %			0.003
			(0.002)
Intercept	-2.863	-58.951**	-4.233*
	(2.192)	(10.118)	(1.616)
Regional Effects			yes
k^*	1.53	1.46	1.61
N	35	35	35
R^2	0.335	0.556	0.796

Notes: **, *, † and ‡ denote 1, 5, 10 and 15 per cent significance levels respectively.

After accounting for differences across members and non-members, I find the ToT coefficient is positive and highly statistically significant (Columns b and c of Table 6). As expected, the terms of trade component of tariffs is lower among WTO members (Column b of Table 6), reflecting that multilateral negotiations can enable countries to alleviate the terms of trade consideration in tariff setting. The net coefficient on ToT for WTO members is 0.365 as opposed to 5.458 for non-members.[13] As predicted by Bagwell and Staiger

[13]The difference between the coefficients is statistically significant at the one per cent level. During the 1990s, developing and least developed member countries did not have to bind their tariffs to the extent

(1999), trade agreements enable members to reduce their terms of trade externalities.

It is reassuring that the coefficient on ToT is larger in magnitude than the coefficient on the interaction term (Member·ToT). The membership coefficient however is positive and statistically significant. This needs cautious interpretation because there are only three non-members in the sample (Algeria, Ethiopia and Belarus). Of these three non-members, Algeria may be considered a "de facto" member as pointed out by Tomz, Goldstein and Rivers (2007).[14] In Column c of Table 6, I include a dummy for de facto membership and focus on the overall effect of WTO membership. The overall effect of WTO membership is negative and statistically significant. De facto membership is positive and statistically significant but it acts like a dummy variable for Algeria so it cannot be interpreted as a membership effect. In a subsequent subsection, I will return to these membership effects with an expanded sample.

Robustness Checks

I discuss the robustness of baseline results by including more controls and changing the estimation method. Following DM, Column c of Table 6 controls for oil export status, political rights and regional effects (through region-specific dummies). The large country level prediction continues to hold with inclusion of these controls. In addition, I find that oil exporters tend to have lower tariffs while the effect of political rights on tariffs is statistically insignificant. Finally, I control for total tax revenue (as a percentage of GDP). The public finance literature argues that governments may prefer tariffs over other forms of taxation as they can be collected more easily. So the results may be driven by the differential ability of high-income and low-income countries in finding alternative sources of revenue.[15] However, controlling for these RHS variables does not alter key qualitative results for the level prediction.

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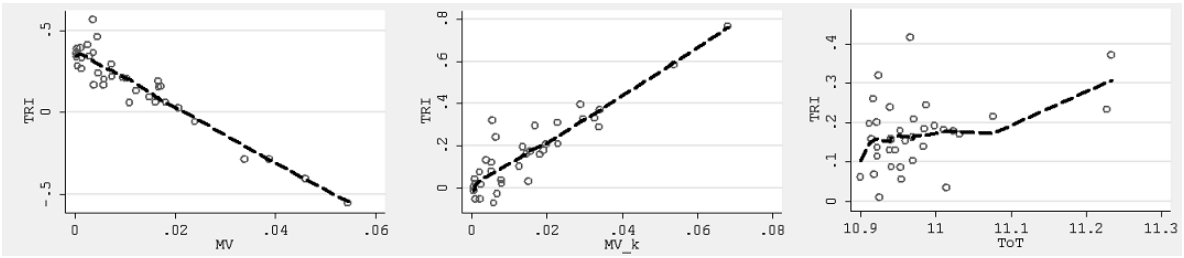
required of the developed member countries. Including a dummy for developing/least developed members (Dev) and an interaction Dev·ToT does not change key results. As expected, the coefficient on Dev is negative and the coefficient on Dev·ToT is positive but both are statistically insignificant (Available on request).

[14] I also tested for endogeneity of WTO membership. Following Rose (2004), when a polity variable (civil liberties) is used as an instrument for membership, I cannot reject the null hypothesis that endogeneity of Member, Member·ToT and ToT is not severe. The test statistic is 0.42 in a sample of 34 countries which is statistically insignificant at the 15 per cent level.

[15] See Baunsgaard and Keen (2010) and Gehlbach (2008) for discussion and empirical evidence.

Figure 4: Local Estimates for TRI, MV and ToT



N = 35, $R^2 = 0.41$

Next, I change the estimation method from OLS to local linear regression. Using locally weighted least squares smoothing for Equation (7), the relationship between trade barriers and key variables has the signs of large country level prediction. Figure 4 plots the smoothed TRIs and their values for each key variable adjusting for other explanatory variables (MV, MV·k, k, ToT). The local TRI-MV curve is negatively sloped (left panel) while the TRI-MV·k curve is positively sloped (middle panel). The TRI-ToT curve is positively sloped (right panel). The right panel seems to be driven by the two countries with the highest ToT levels. However, excluding these two countries (USA and India) from the sample does not affect the qualitative results reported in Tables 4 and 6. I check the robustness of the baseline results further by changing the sample and the estimation method to first differences.

5.2 First Differences Estimation

In the remaining part of this Section, I consider a first differences regression of trade barriers on median voter and terms of trade considerations. This enables a testing of the large country level prediction with different data and using an estimation method that accounts for time-invariant country-specific factors in tariff setting.

The large country level prediction states that $\tilde{t}_c = \theta_{mv}\text{MV}_c + \theta_{tot}\text{ToT}_c$ where $\theta_{mv} \gtreqless 0$ for $k_c \gtreqless k^*$ and $\theta_{tot} > 0$ for all c. Consider two distinct time periods t and $t+1$ and let $\triangle x \equiv x_{t+1} - x_t$. The level prediction in differences is $\triangle\tilde{t}_c = \theta_{mv}\triangle\text{MV}_c + \theta_{tot}\triangle\text{ToT}_c$. To operationalize this, I estimate the following equation:

$$\triangle\tilde{t}_c = \theta_1(\triangle\text{MV}_c) + \theta_2(\triangle\text{MV}_c)\cdot k_c + \theta_{tot}\triangle\text{ToT}_c + \epsilon_c. \tag{8}$$

According to the median voter model, the expected signs of key coefficients are $\theta_1 < 0$, $\theta_2 > 0$ and $\theta_{tot} > 0$.

The data to test this first differences specification varies from that for the baseline results. In the absence of TRIs for more than one period, I use world trade-weighted average tariff rates (with fixed weights) to measure trade barriers over the two 5-year periods between 1996 to 2005. For these 5-year periods, I use lagged data on human capital ginis (for the population aged 15 years and over) to construct the median voter term. This direct measure of capital inequality brings theory and empirics more in line with each other. Human capital is proxied by average years of schooling for the population aged 15 years and over.

Estimating Equation (8), I find that support for the level prediction is remarkably strengthened. Column (a) of Table 7 shows a negative relationship between median voter considerations and tariffs in labor-abundant countries and a positive relationship between median voter considerations and tariffs in capital-abundant countries.[16]

This expanded sample contains eleven non-members of the GATT/WTO so the membership coefficients can be interpreted more easily.[17] As expected, I find that members have lower tariffs relative to non-members. Importantly, the membership dummy is negative but statistically insignificant while the interaction between ToT and membership is negative and highly significant. Additionally, the coefficient on the interaction term is reasonable as it does not exceed the coefficient on the ToT term. The results for the interaction between membership and ToT lend support to the terms of trade theory of trade agreements and are consistent with empirical evidence provided by Broda, Limao and Weinstein (2008) and Bagwell and Staiger (2011). The key results are not sensitive to inclusion of changes in tax revenue and political rights, and better political rights are associated with lower tariffs. Similar results hold when countries in the bottom quantile of political rights are dropped or when an intercept and/or human capital is included on the RHS (Available on request).[18]

[16] Note that the magnitude of the estimates reported here differ from the cross-sectional estimates since average years of schooling and import shares are used instead of human capital indices and elasticity based ToT measures.

[17] Since this sample covers the time period before and after the formation of the WTO, I define a country to be a member of the GATT/WTO if it was a "formal" or "informal" member in the 5-year period before the year of the tariffs (see Tomz, Goldstein and Rivers, 2007 for details). For example, a country that was not a member of the GATT but becomes a member of the WTO in 1995 is considered a non-member in the period 1991-95 but a member in the period 1996-2000.

[18] In the results reported here, I drop two observations from the original sample (India and Pakistan which are clear outliers). Adding the two observations gives qualitatively similar but imprecise estimates. Using robust regression techniques on the full sample strongly supports the level prediction and yields estimates similar to those reported here.

Table 7: Robustness: Average Tariff Rates (△ATR)

	(a) First Diff	(a) First Diff	(b) First Diff
△MV	-93.369**	-102.321**	-95.626**
	(20.566)	(19.795)	(19.708)
(△MV)·k	15.997**	17.471**	16.436**
	(3.269)	(3.145)	(3.134)
△ToT	0.123**	0.208**	0.213**
	(0.040)	(0.040)	(0.040)
△(ToT)·Member		-0.131*	-0.123*
		(0.051)	(1.363)
△Membership		-0.005	0.004
		(0.014)	(0.017)
△Political Rights			-0.008‡
			(0.005)
△Tax Revenue %			0.001
			(0.002)
N (Differences)	48	48	48
R^2	0.48	0.534	0.546
N (Levels)	99	99	99

Notes: **, *, † and ‡ denote 1, 5, 10 and 15 per cent significance levels respectively.

Thus during the last two decades, I find strong evidence for both the Mayer median voter hypothesis and the terms of trade argument for tariff-setting. Capital-abundant countries tend to have higher tariffs while labor-abundant countries tend to have lower tariffs on account of general interest politics. Terms of trade considerations exert a positive influence on tariff levels across countries. Membership in multilateral trade agreements reduces this terms of trade component of tariffs.

6 Conclusion

This paper considers a large country median voter model to examine whether majority concerns and terms of trade considerations play a role in tariff-setting across countries. I show that tariff in a large country is a sum of the median voter component and a positive terms of trade component. The median voter component has a negative impact on tariffs in labor-abundant countries and a positive impact in capital-abundant countries. The terms of trade component has a positive effect on tariffs across all large countries. Thus the import subsidization result of Mayer (1984) is overcome for large labor-abundant countries.

I test the large country level prediction and find support for it during the last two decades.

Even at highly aggregate cross-country levels, I find a positive terms of trade component in tariffs. As expected, the terms of trade component of tariffs is lower among members of the GATT/WTO. In line with the median voter theory of trade policy, I find a negative median voter component in tariffs of countries with scarce human capital and a positive median voter component in tariffs of countries with abundant human capital. The results reveal that labor-abundant countries set lower tariffs while capital-abundant countries set higher tariffs on account of majority considerations. Thus labor-abundant countries tend to be pro-trade while capital-abundant countries tend to be protectionist on account of majoritarian interests.

It remains to be tested whether the level test results generalize to additional countries and time periods. Future work in this regard can shed more light on the importance of majoritarian and terms of trade considerations in determining the direction of tariffs adopted across countries.

References

Alesina, Alberto and Dani Rodrik. 1994. "Distributive politics and economic growth." *The Quarterly Journal of Economics* pp. 465–490.

Anderson, James E. and Peter J. Neary. 2003. "The mercantilist index of trade policy." *International Economic Review* pp. 627–649.

Bagwell, Kyle and Robert W. Staiger. 1999. "An economic theory of GATT." *American Economic Review* pp. 215–248.

Bagwell, Kyle and Robert W. Staiger. 2011. "What do trade negotiators negotiate about? Empirical evidence from the World Trade Organization." *The American Economic Review* 101(4):1238–1273.

Baier, Scott L., Gerald P. Dwyer and Robert Tamura. 2006. "How Important are Capital and Total Factor Productivity for Economic Growth?" *Economic Inquiry* 44(1):23–49.

Balistreri, Edward J. 1997. "The performance of the Heckscher-Ohlin-Vanek model in predicting endogenous policy forces at the individual level." *Canadian Journal of Economics* 30(1):1–17.

Baunsgaard, Thomas and Michael Keen. 2010. "Tax revenue and (or?) trade liberalization." *Journal of Public Economics* 94(9):563–577.

Beaulieu, Eugene and Christopher S. Magee. 2004. "Four simple tests of campaign contributions and trade policy preferences." *Economics & Politics* 16(2):163–187.

Blattman, Christopher, Michael A. Clemens and Jeffrey G. Williamson. 2003. "Who Protected and Why? Tariffs the World Around 1870-1938." *Harvard Institute of Economic Research Discussion Paper No. 2010* .

Broda, C. and D. E. Weinstein. 2006. "Globalization and the Gains from Variety*." *Quarterly Journal of Economics* 121(2):541–585.

Broda, Christian, Nuno Limao and David E. Weinstein. 2008. "Optimal Tariffs and Market Power: The Evidence." *American Economic Review* 98(5):2032–2065.

Castelló, Amparo and Rafael Doménech. 2002. "Human capital inequality and economic growth: some new evidence." *Economic Journal* pp. C187–C200.

Chacholiades, Miltiades. 2006. *The pure theory of international trade*. Aldine Transaction.

Dutt, Pushan and Devashish Mitra. 2002. "Endogenous trade policy through majority voting: an empirical investigation." *Journal of International Economics* 58(1):107–133.

Feenstra, Robert C. 1994. "New product varieties and the measurement of international prices." *American Economic Review* 84:157.

Feenstra, Robert C. 2004. *Advanced international trade: theory and evidence*. Princeton University Press Princeton, NJ.

Gawande, Kishore and Pravin Krishna. 2003. *The political economy of trade policy: Empirical approaches*. Wiley-Blackwell.

Gehlbach, Scott. 2008. *Representation through Taxation*. Cambridge University Press.

Kee, Hiau L., Alessandro Nicita and Marcelo Olarreaga. 2008. "Import demand elasticities and trade distortions." *The Review of Economics and Statistics* 90(4):666–682.

Kee, Hiau L., Alessandro Nicita and Marcelo Olarreaga. 2009. "Estimating Trade Restrictiveness Indices*." *The Economic Journal* 119(534):172–199.

Li, Hongyi, Lyn Squire and Heng-Fu Zou. 1998. "Explaining international and intertemporal variations in income inequality." *Economic Journal* pp. 26–43.

Magee, Christopher S. P. and Stephen P. Magee. 2008. "The United States is a Small Country in World Trade*." *Review of International Economics* 16(5):990–1004.

Maggi, Giovanni and Andres Rodriguez-Clare. 2007. "A political-economy theory of trade agreements." *American Economic Review* 97(4):1374–1406.

Mayda, Anna M. and Dani Rodrik. 2005. "Why are some people (and countries) more protectionist than others?" *European Economic Review* 49(6):1393–1430.

Mayer, Wolfgang. 1984. "Endogenous Tariff Formation." *The American Economic Review* 74(5):970–985.

Olarreaga, Marcelo, Isidro Soloaga and Alan L. Winters. 1999. "What's Behind Mercosur's Common External Tariff?." *World Bank Policy Research Working Paper No. 2231* .

O'Rourke, Kevin H. and Richard Sinnott. 2001. The Determinants of Individual Trade Policy Preferences: International Survey Evidence. In *Brookings Trade Forum*. Brookings Institution Press pp. 157–206.

Rodrik, Dani. 1986. "Tariffs, subsidies, and welfare with endogenous policy." *Journal of International Economics* 21(3-4):285–299.
URL: *http://ideas.repec.org/a/eee/inecon/v21y1986i3-4p285-299.html*

Rose, Andrew K. 2004. "Do WTO members have more liberal trade policy?" *Journal of International Economics* 63(2):209–235.

Scheve, Kenneth F. and Matthew J. Slaughter. 2001. "What determines individual trade-policy preferences?" *Journal of International Economics* 54(2):267–292.

Staiger, Robert W. and Guido Tabellini. 1987. "Discretionary trade policy and excessive protection." *The American Economic Review* pp. 823–837.

Tomz, Michael, Judith Goldstein and Douglas Rivers. 2007. "Membership has its privileges: the impact of GATT on international trade." *American Economic Review* 97(5):2005–2018.

Williamson, Jeffrey G. 2003. "Was It Stolper-Samuelson, Infant Industry or Something Else? World Trade Tariffs 1789-1938." *NBER Working Paper No. 9656* .

A Data and Results

To estimate Equation (7), I use the following variables:

1. Data on instruments, saving rate, population growth rate, money (M2/GDP), GDP and population are from the WDI 2006. Unlike DM, I do not use land ginis as an instrument due to several missing values.

2. Political rights and civil liberties scales are available from the Freedom House. Low values indicate better political rights and civil liberties.

3. Tax revenue (as a percentage of GDP) is from WDI 2006 while oil export status and de facto membership status are from Dutt and Mitra (2002) and Tomz, Goldstein and Rivers (2007) respectively.

4. Regional dummies correspond to the categorization of Baier et al. (2006) which separates countries into Western Countries, Southern Europe, Eastern Europe, NICs, Asia, Sub-Saharan Africa, Latin America, Middle East and Northern Africa.

To estimate Equation (8), I use data on countries for which both tariffs and human capital ginis are available. These are Algeria, Brazil, Canada, China, Ecuador, Egypt, Ghana, Guatemala, Indonesia, India, Iran, Jordan, Japan, Kenya, Korea, Mexico, Mauritius, Malaysia, Nicaragua, Pakistan, Peru, Philippines, Papua New Guinea, Sri Lanka, Switzerland, Tunisia, Uruguay, Venezuela, Zambia, Zimbabwe. About half of the observations (22 out of 48) is from the time period 1996-2000 while the others are from 2000-2005. The variables to estimate Equation (8) are as follows.

1. World-trade weighted average tariff rates are computed using tariffs and world imports from the UNCTAD-TRAINS database (available through the WITS utility). An average over each five-year period between 1996 to 2005 is taken.

2. For MV, data on GDP, labor and total tariff revenue are from WDI 2007 while human capital ginis are from Castelló and Doménech (2002).

3. For ToT, import shares (as a percentage of world imports) are from WDI 2007. I use import percentages in logarithmic form.

4. Human capital is proxied by average years of schooling for persons 15 years and over taken from Castelló and Doménech (2002). To convert into logs, I first scaled the years by hundred to obtain all positive values. Similar results hold when average months of schooling are used instead.

5. Political rights are from the Freedom House (compiled by Professor Pippa Norris and available on her website) while tax revenue is from WDI 2007.

6. All countries that were "out" of the GATT/WTO according to Tomz, Goldstein and Rivers (2007) were coded as non-members. Only three countries in the sample changed their membership status (from non-members to members), Guatemala, Tunisia and Venezuela.

7. I use lagged values (corresponding to the previous 5-year period) for each RHS variable. Averages of all available years over the 5-year period are taken.

8. For human capital ginis, the data is available at intervals of five years. For tariff rates corresponding to 1995-2000, I use ginis for 1995 (rather than 2000).

Table 8: Level Test: TRIs and Import Share Method for ToT

Level of TRI		
	(a) OLS	(b) IV
MV	-15.954**	-15.938**
	(3.295)	(2.904)
MV·k	10.776**	10.742**
	(2.229)	(2.106)
ToT	0.014†	0.014‡
	(0.008)	(0.009)
k	-0.335**	-0.333**
	(0.082)	(0.069)
Intercept	0.432**	0.441**
	(0.164)	(0.173)
k^*	1.481	1.484
N	35	35
R^2	0.323	0.323
Endog Variables	All	ToT
Hansen J-stat	11.396	2.829†
Hausman-stat	5.416	0.626
Stage 1 F-stat	447.5, 49.7, 34.6, 30.5	212.97
Endog N	34	35

Notes: **, *, † and ‡ denote 1, 5, 10 and 15 per cent significance levels respectively. Endogeneity tests refer to MV, MV·k, k and ToT in Column (a) and only ToT in Column (b).