Inequality and Endogenous Trade Policy Outcomes

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Abstract

An enduring puzzle in international economics is why trade interventions are biased in favor of import-competing rather than export sectors and therefore restrict trade. In this paper, we show that if the government's objective reflects a concern for inequality then trade policy generally exhibits an anti-trade bias. Importantly, under neutral assumptions, the mechanism that we analyze generates the anti-trade bias independently of whether factors are specific or mobile across sectors. The mechanism also generates an anti-trade bias between large countries even after they sign reciprocal trade agreements that eliminate any terms-of-trade motivation for the use of trade protection.

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1. Introduction

An enduring puzzle in international trade is why trade policy has an anti-trade bias (Rodrik, 1995).[1] The conventional explanations focus on some motive to redistribute income but fail to address why the policy makers would prefer to redistribute in favor of the import rather than the export sector. Ironically, the current leading political economy model–Grossman and Helpman (1994) (GH)–actually predicts a pro-trade bias (Levy, 1999).

In this paper, we demonstrate that if the government objective reflects a preference for equity then its trade policy will exhibit an anti-trade bias (ATB) on average. Although trade policy is not the first-best instrument to reduce inequality it is one with a relatively low political cost. In the opinion polls, it continues to receive substantial public approval. This is true not only in the US (Freeman, 2002) but in other countries as well. In fact, the perception that trade causes inequality is often used as one of the central arguments of the "anti-globalization" movement (Sen, 2002; Ravallion, 2003). Moreover, the fact that import protection is often higher in sectors with a large share of low-skill, low-wage workers, strongly suggests that many governments take inequality into account when setting trade policy.[2]

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[1] The anti-trade bias in developing countries is apparent from the observation that trade reform by them has been followed by an expansion of their trade and more generally for other countries by the focus of the GATT/WTO negotiations on the removal of trade *barriers* rather than trade stimuli. Rough estimates of tariffs versus subsidies in industrial goods for the United States do point to an anti-trade bias: the estimated ad valorem equivalent of the main tax incentives for US exporters, such as the Foreign Sales Corporation Tax, was 1% in 1996 (Desai and Hines 2000, p.34) whereas the ad valorem equivalent tariff was 2.2% <www.usitc.gov>. As Panagariya (2005) has pointed out recently, contrary to popular perceptions, even agriculture turns out to be subject to much higher levels of tariffs than export subsidies world wide.

[2] See for example Baldwin (1985) for evidence on the US and Ray (1981) for the US, Canada, UK, Germany, Belgium, Italy, France and Japan. Goldberg and Pavcnik (2004) report a similar finding for many developing countries. Baldwin (1985) concludes that "models [of trade policy] that include behavior based either on long-run self-interest or concern for the welfare of other groups and the state are also necessary to account for the actions of voters and public officials." (p.174) Dutt and Mitra (2002) find that lagged inequality has a positive and significant effect on the tariff level for capital-abundant

As a prelude to our basic argument, consider the thought experiment that Levy (1999) uses to establish a pro-trade bias in the GH model. Assume two non-numeraire goods, 1 and 2, completely symmetric in consumption and production. Let their initial prices in terms of the numeraire good equal unity. When the world prices are also unity, there is no trade. If we now decrease the specific factor endowment of good 1 and increase that of good 2 by the same proportion the economy will import 1 and export 2. As GH show, if capital owners in sectors 1 and 2 are organized, they lobby and obtain a tariff and an export subsidy respectively. However, given the larger output in the export sector, the subsidy is larger than the import tariff and thus exports expand by more than imports contract implying a pro-trade bias.[3]

Our analysis differs from GH in two key respects. First, we employ the standard two-sector general-equilibrium model that admits the usual substitution possibilities between the import and export sectors. This is important because the ATB puzzle is inherently a general equilibrium issue about redistribution across these sectors.[4] Second, we model a concern for inequality in the government's objective. As we show in Limão and Panagariya (2004), the first modification by itself introduces the possibility of ATB when, as in GH, the government assigns a larger weight to the specific factors in its objective function. If the government weighs all factors equally, however, the general-equilibrium model generally leads to neither anti- nor pro-trade bias. In the

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countries in a cross-section. They find the opposite for labor-abundant ones. More broadly, in a review of the literature on fairness Fehr and Schmidt (2001, p.1) conclude that there is now "overwhelming [experimental] evidence that systematically refutes the self-interest hypothesis [that all people are exclusively motivated by their material self-interest]. The evidence suggests that (…) concerns for fairness and reciprocity cannot be ignored in social interactions."

[3] The GH model does not rule out the *possibility* of ATB. For instance, if there is only one non-numeraire good, the only factor that lobbies is the one specific to this sector. If this good is imported then there is an ATB. But this is generated by denying the export sector the right to lobby since it uses only labor, which is assumed not to lobby.

[4] In the GH quasi-linear setup all substitution occurs between the numeraire and non-numeraire goods. According to Dixit, Grossman and Helpman "the assumption of quasi-linearity makes the model unsuitable for analyzing distribution and transfer policies that are of the essence in public finance and political economy." (1997, p.754)

present paper, we show that incorporating the concern for inequality introduces ATB even when the government does not favor one or more factors over others.

Thus, begin with a standard two-sector specific-factors economy that is a replica of the world. To neutralize any other motives for ATB assume that the economy is small and the two sectors are initially symmetric. This implies that the relative price of good 1 under autarky is unity at home and abroad and there is no incentive for trade. If the autarky distribution of income among the three production factors is equal, there is initially no incentive to set a tariff or import subsidy even if the government has an inequality concern.[5]

Next, allow an exogenous reduction in the relative price of good 1 in the rest of the world so that the small country now imports good 1 and exports good 2. In the absence of any intervention, the price change causes a decline in the share of K_1 (the factor specific to the import sector 1) in GDP and a rise in the share of K_2. The share of labor in GDP may rise or fall but its change is bounded by the changes of the specific factors. As a result, in the free trade equilibrium, K_2 has the highest share, followed by labor and then K_1. The introduction of a tariff increases the domestic price of the import and this reverses some of the inequality. Thus trade policy exhibits ATB if the government has some concern for inequality.

Perhaps less obviously, a tariff will be the outcome even if the trade shock is not a price change. We demonstrate that other common trade shocks (e.g. shocks to endowments or Hicks-neutral technical change) also lead a government with a concern for inequality to adopt a protectionist policy. The intuition is simple. All these shocks reduce the income of the factor used specifically in the import sector and increase it for the one used in the export sector. The change for the mobile factor share is generally bounded by these two changes. The tariff has the exact opposite effect so it can undo the inequality generated by a variety of shocks. We develop our results in parallel for the specific-factors and the Heckscher-Ohlin (HO) model. This is important because the HO model may be more relevant in determining trade policy preferences in some countries and certainly in longer time horizons, as recent evidence shows (Scheve and Slaughter, 2001; O'Rourke, 2003).

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[5] Unless otherwise stated, we assume throughout that the ownership of each factor is equally divided among equal number of individuals so that the equality of factor shares leads to an entirely equal income distribution.

The role of inequality in generating an ATB is best shown in a small symmetric economy where all other motives are neutralized. However, these exact size and symmetry conditions are unlikely to be met in practice. Therefore, to determine whether inequality can explain the ATB observed in a majority of countries, we analyze the case of countries that are large or have any arbitrary initial income distribution. The results extend to a two-country context after we neutralize for the terms-of-trade motive for protection. In the general case where preferences, technologies and endowments are unrestricted and therefore permit any initial distribution of income, we may obtain either a pro- or an anti-trade bias. However, we can still establish a likelihood result. We show that if all autarkic income distributions are equally likely, the probability of ATB exceeds 0.5.

One interesting point about the ATB result in the asymmetric case is that it does not require that opening to trade will increase inequality. This is important because in theory moving from autarky to free trade can increase or decrease inequality. Moreover, the recent evidence of increases in trade volumes on inequality is ambiguous.[6] Our results also highlight the potentially important endogeneity problem with recent studies that try to estimate the effect of trade policy reforms on inequality.[7]

The existing literature on ATB in trade policy is sparse. Eaton and Grossman (1985) show that ATB can result when a government uses trade policy as insurance to maximize expected welfare across different realizations of the terms-of-trade (TOT). The role for trade policy arises due to the absence of perfect insurance markets and ex-post differences in individual welfare resulting from the irreversible allocation of capital between the sectors based on ex-ante TOT. The insurance motive and hence ATB in their model disappears if capital is mobile across sectors, i.e. in the long run.[8] We view the insurance motive for protection as more

[6] Barro (2000) finds a positive correlation between openness and inequality in a panel of countries. Dollar and Kraay (2004) find small or no effects. For a survey of the effect of trade on wage inequality see Feenstra and Hanson (2003).

[7] Goldberg and Pavcnik (2004) report that most recent work on developing countries finds that trade reforms coincide with increases in relative inequality. Milanovic and Squire (2005) find some evidence that tariff reductions increase inequality in poor countries and the reverse in rich ones.

[8] Eaton and Grossman (1985) appeal to moral hazard and adverse selection to justify the absence of insurance markets. However, as Dixit (1989) shows, when the underlying failure that leads to the missing markets is explicitly modeled the

appropriate for explaining short-term contingent protection, e.g. safeguards, rather than the long-term bias of trade policy towards import protection. As such our model is motivated by a concern for inequality. To sharpen this distinction, our model has no uncertainty and the factor owners have constant marginal utility of income. Moreover, we show that ATB is present even in the long run when capital is freely mobile across sectors.

Mayer (2002) relies on a revenue motive to generate ATB. Although the high administrative cost of raising revenue from domestic taxes is an important reason for the use of tariffs in the early stages of development its importance is negligible for developed countries. Moreover, the revenue motive cannot explain the frequent use of quantity constraints, which generally do not generate revenue. Tovar-Rodriguez (2005) shows that the pro-trade bias prediction in the GH model is reversed if individuals are sufficiently loss averse.[9]

Conceptually, it is also important to distinguish between a government objective that exhibits concern for inequality and one that exhibits a status quo bias, such as Corden's "conservative social welfare function" (1974, pp 107-9). As Corden puts it, the latter requires that "any significant absolute reductions in real incomes of any

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welfare effects of trade policy as insurance can be ambiguous. The social welfare maximization in Eaton and Grossman can be given further micro-foundations in a political economy framework. For example, Rotemberg (2003) assumes that individuals are altruistic and so vote on a trade policy as if maximizing a social welfare function. He then shows that a tariff emerges if the mobile factor is unaffected by a tariff and is the median voter. The result relies on capital immobility and decreasing marginal utility, as in Eaton and Grossman.

[9] Building on the informal argument in Olson (1983), a recent body of literature (e.g. Grossman and Helpman 1996) formally analyzes the incentives to lobby for protection in sunset versus sunrise industries. In the sunrise industries, the incentive to lobby declines since new entrants would share in the rents so created without having to pay the costs of lobbying. In sunset industries, the only way to maintain normal profit even in the absence of entry may be protection so that free riding on the cost of lobbying may be overcome. This literature does not directly address the issue of ATB, however, unless we equate the sunset industries with import-competing industries and sunrise industries as export industries. But at least within a model that assumes perfect competition, this equation is uncomfortable since in equilibrium, both types of industries make normal profit. Other models, notably Mayer (1984) and Ethier (2004), predict ATB under certain conditions. But these are possibility results since in neither case is there a *presumption* that those conditions are more likely to be satisfied.

significant section of the community should be avoided." He attributes the *maintenance*, rather than the *introduction*, of many tariffs to such an objective function. The government objective we model differs from a conservative objective function along at least two important dimensions. First, it exhibits symmetry across different individuals with identical incomes. Second, it places a positive value on the decrease in incomes of some groups if this helps to redistribute income towards lower-income groups. Therefore, the two objective functions generate quite different implications for ATB, as we show in the appendix.[10]

The paper is organized as follows. In Section 2, we outline the model and provide general conditions for ATB. In Section 3 we prove the basic result that the same shock that leads a country to trade also causes ATB if the government has a concern for inequality. In section 4 we extend the result to the large and asymmetric economy. In Section 5, we conclude.

2. The Model

2.1 Economic structure

Consider an economy with two goods, i = 1, 2, produced according to a constant returns technology. We label the import good (determined endogenously) as 1 and let t denote the import tariff (t > 0) or subsidy (t < 0). By choice of units, we set the world price of each good equal to unity so the domestic price of the import is 1+t. The supply-side is summarized by the standard revenue function $R(1+t,1;\bar{\mathbf{J}})$, where throughout, the first two arguments refer to the prices of goods 1 and 2 respectively. The factor endowment vector—denoted by $\bar{\mathbf{J}}$—is equal to $(\bar{K}_1, \bar{K}_2, \bar{L})$ for the specific factors model and $(\bar{K}, \bar{L})$ for the HO model.

There is specialization in the ownership of each factor and we represent the utility of individuals that own factor j by $U^j = U\left(\mathbf{C}^j\right)$ where $\mathbf{C}^j$ denotes the consumption vector of group j. Preferences are identical for all groups and U(.) is linear homogeneous. The consumption decision of group j is summarized via a standard

[10] The importance of the conservative social welfare function in perpetuating tariffs once granted for revenue reasons can be easily overstated. Changes in technology, domestic policies, endowments, etc, constantly shift the fortunes of individuals. It is difficult to argue under such shocks that tariffs are held in place for decades to maintain the status quo.

expenditure function, $e(1+t,1)U^j$. Finally, we assume that tariff revenue is redistributed in exact proportion to each group's earned factor incomes in order to neutralize its use for redistribution purposes.[11] The expenditure-revenue equality for each group j is then given by

$$e(.)U^j = \theta^j \left[R(.) + t\left(e_1(.)\sum_j U^j - R_1(.) \right) \right] \quad \forall j \tag{1}$$

where $e_1(.)$ and $R_1(.)$ are the partial derivatives with respect to the domestic price of good 1. The term in square brackets represents total income, which is equal to the sum of revenue from production, R(.), and trade taxes. We denote the share of factor j in earned income by θ^j. It is defined as

$$\theta^j \equiv R_j(.)\bar{J} / R(.) \quad \forall j \tag{2}$$

where $\bar{J}$ is an element of the endowment vector $\bar{\mathbf{J}}$ defined above and $R_j(.)$ is the partial derivative of R(.) with respect to factor j and therefore the return received by its owner.

For any given tariff, we can solve the equations in (1) for each group's utility level to obtain

$$U^j = \theta^j \left[R(.) - tR_1(.) \right] \Big/ \left[e(.) - te_1(.) \right] \quad \forall j \tag{3}$$

The key question we address next, therefore, is how t is determined.

2.2 Equilibrium trade policy

We describe the political economy side of the model via a political support function (Hillman, 1982; Long and Vousden, 1991), which, as GH and others have shown, can be obtained by modeling the interaction of lobbies and the government from first principles. This representation allows us to focus directly on the conditions for ATB and has the advantage of accommodating alternative theories of demand for trade policy.[12]

Thus, taking **U** as the vector of utilities implied by (3), we denote the government's objective by

$$G = G(\mathbf{U}(t)) \tag{4}$$

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[11] Symmetrically, if the outcome is a subsidy, each factor owner bears a burden in proportion to its earned income.

[12] Most models do not explain why trade policy is chosen for redistribution (Rodrik, 1995). The same is true of this model. However, trade policy may be the optimal redistribution instrument. Feenstra and Lewis (1991) show this when the government is uncertain about individual endowments.

The equilibrium tariff maximizes (4). To determine if there is ATB we examine the first order condition at t = 0

$$\left[dG/dt\right]_{t=0} = \left[R(.)/e(.)\right]_{t=0}\left[\sum_j G_j(.)\theta_t^j\right]_{t=0} \tag{5}$$

where θ_t^j is the partial derivative of the share in (2) with respect to t. The marginal contribution of each factor owners' utility to the government's objective is denoted by the partials denoted by G_j. The latter play a key role in determining the ATB and henceforth we refer to $G_j(t=0,.)$ as the **political weight** of factor j. So, a tariff is preferred to an import subsidy if the political weighted sum of the changes in factor shares due to the tariff is positive. In the next section we show that a concern for inequality generates endogenous political weights that satisfy this condition and thus such a concern yields a trade policy with ATB. To do so it is useful to re-write (5) in a form that highlights the redistribution effects of a tariff by noting that the factor shares sum to unity, and so the sum of their partials with respect to t is zero.

$$\left[dG/dt\right]_{t=0} = \left[R(.)/e(.)\right]_{t=0}\left[\sum_j \left(G_j - G_L\right)\theta_t^j\right]_{t=0} \tag{6}$$

Combining (6) with the standard result that a tariff increases the income share of the factor used intensively in the import sector and lowers it for the factor used intensively in the export sector, we obtain sufficient conditions for ATB. We summarize these in lemma 1, on which we rely to analyze the effect of inequality on ATB. This lemma could similarly be used to investigate if an ATB arises under alternative government objectives.

Lemma 1. (General conditions for anti-trade bias) *In a two-sector economy where the government maximizes a political support function* G(**U**(t)) *the trade policy has an anti-trade bias if either (a) the factor that is used intensively in the import sector has a larger political weight than the factor used intensively in the export sector and the two factors are fully mobile across sectors or (b) the specific factor used in the import sector has a larger political weight than the specific factor used in the export sector and the political weight of the mobile factor is bounded by the two.*

Proof: Labeling the import as i=1, t>0 represents an import tariff and it increases the domestic price of 1. When capital is sector-specific the tariff simultaneously increases the return to K_1 and decreases the return to K_2 and thus $\theta_t^{K1}>0>\theta_t^{K2}$, a standard result of the specific factors model. When both factors are mobile then the tariff increases the return to the factor used intensively by the import good and reduces it for the other factor—the standard Stolper-Samuelson effect—thus $\theta_t^{K}>0>\theta_t^{L}$ if the import good is K-intensive and $\theta_t^{K}<0<\theta_t^{L}$ otherwise. From (6) it is then obvious that the sufficient conditions for the government to choose t>0 are the following

(a) When factors are mobile and the import good is capital-intensive the political weights must satisfy

$$\left[G_K > G_L\right]_{t=0} \tag{7}$$

or $G_K < G_L$ if the import is labor-intensive. With two mobile factors this condition is also necessary for t>0.

(b) When capital is sector-specific, L is mobile and good 1 is the import the political weights must satisfy

$$\left[G_{K1} \geq G_L \geq G_{K2}\right]_{t=0} \tag{8}$$

with at least one strict inequality.□

3. Inequality and anti-trade bias

We now show that if the government's objective reflects a concern for inequality then the resulting endogenous political weights satisfy the conditions in lemma 1 and the trade policy exhibits an ATB.

3.1 Inequality and the government's objective

We model the government's political support function as follows.

$$G(\mathbf{U}) \equiv \alpha(-I(\mathbf{U})) + (1-\alpha)W(\mathbf{U}) \tag{9}$$

where I(**U**) measures inequality and we define its properties below. The level of overall utility is measured by W(**U**). To focus on the role of inequality in generating ATB we assume throughout that W(**U**) is free of any distributional considerations and takes a simple form: the sum of individual utilities.[13] We next introduce

Definition 1: A government has a concern for inequality if G(**U**) and I(**U**) in (9) satisfy the following properties:

[13] In the longer version of the paper we allow W(.) to take a more general form, which explicitly incorporates other political-economy considerations and give rise to different political weights across factors even if the government has no concern for inequality. For expositional simplicity and clarity, we exclude these considerations here and focus on the simpler case. The longer version is available upon request.

(a) **Relevance**: The government places a strictly positive weight on reducing inequality. Formally, $\alpha \in (0,1]$.

(b) **Anonymity**: The inequality measure is independent of the identity of individuals and thus symmetric in its arguments. Formally, $I(U^j = a, U^{j'} = b,.) = I(U^j = b, U^{j'} = a,.)$ for all $j \neq j'$.

(c) **Dalton Principle**: Any regressive transfer increases inequality. Formally, $I(U^j - \delta, U^{j'} + \delta,.) > I(U^j, U^{j'},.)$ whenever $U^j \leq U^{j'}$ for all $\delta>0$ and $j \neq j'$.

(d) **Relative Income Principle**: Equal proportionate changes in the utilities of all individuals leave the inequality measure unchanged. Formally, $I(\beta \mathbf{U}) = I(\mathbf{U})$ for $\beta>0$.

In sum, a government has a concern for inequality if it values reductions in a "good" measure of inequality, i.e. one that satisfies the textbook requirements given by the anonymity, Dalton and relative-income principles. Throughout we assume that an identical and constant number of individuals own each factor.[14]

The political weights now reflect the impact of a change in the utility of factor owners on the inequality and aggregate welfare measures. However, since W(.) is the sum of utilities the marginal effect, W_j , is identical for all factors j. So when the government has a concern for inequality the condition for ATB in (6) is:

$$\left[dG/dt\right]_{t=0} = \left[R(.)/e(.)\right]_{t=0} \left[\sum_j \alpha\left(I_L - I_j\right)\theta_t^j \right]_{t=0} \tag{10}$$

Clearly a deviation from free trade occurs only when the government has a concern for inequality. But to show that this implies a tariff rather than an export subsidy we must prove that the endogenous political weights satisfy the conditions in lemma 1. We first focus on the case of a small symmetric economy in order to neutralize any other possible motives for ATB and then generalize to the large and the asymmetric economy cases.

[14] We can normalize this number to unity without loss of generality provided we invoke the population principle, which is also a common requirement for a good inequality measure. This principle requires the inequality measure to remain unchanged when we multiply the number of individuals in each income group by the same number.

3.2 Inequality and anti-trade bias in a small, symmetric economy

We model the initial equilibrium such that the country has no incentive either to trade or to use trade policy. We then introduce shocks either to prices, endowments or technologies that generate an incentive to trade and ask whether they also cause the government to adopt a trade policy that exhibits ATB.

The decision to use a tariff depends on its effect on inequality. More precisely, it depends on the effect on inequality of a small redistribution from factor j to L—the term I_L-I_j in (10). Inequality increases if labor has a higher utility than j and decreases otherwise, as we show in the following lemma.

Lemma 2: *If* I(**U**) *is differentiable and satisfies the anonymity and Dalton principles then* $\partial I/\partial U^{j'} - \partial I/\partial U^{j} > 0$ *if* $\theta^{j'} \geq \theta^{j}$ *for all* $j \neq j'$.

Proof: See the Appendix.

This lemma shows how the Dalton principle, that a regressive transfer increases inequality, can be used to derive the marginal effect of trade policy on inequality. One point to note is that the utility of j is a multiple of his factor share and that multiple is common to all factors (see (3)). This and the assumption of a constant number of individuals implies that throughout we need only compare the factor shares in income to determine if a transfer between two types of factor owner increases inequality.[15] With this we can demonstrate

Proposition 1. (Inequality and anti-trade bias): *Consider a small economy that initially has identical factor income shares and is identical to the rest of the world. If the government has a concern for inequality then shocks to the following variables generate trade and a trade policy that exhibits anti-trade bias: (a) world price (SF and HO), (b) Hicks neutral technology (SF and HO); (c) endowments in the HO model, and (d) specific factor endowments provided the elasticity of substitution between factors in each sector is at least unity.*

[15] The common multiple in (3) linking factor shares to utilities and the relative income principle ensure that I(**U**) is equal to I(**θ**) and therefore we can focus on the factor shares.

Proof: Complete symmetry with the rest of the world in the initial equilibrium ensures that, at $t=0$, there is no trade. Moreover, equal income shares imply that initially $t=0$ is optimal. The shocks in (a)-(d) cause the country to trade if $t=0$. Thus we need only show that those shocks also cause the endogenous political weights to satisfy the conditions for ATB in lemma 1. For the HO model we require (7) to hold if the import is capital-intensive, which is equivalent to $\alpha(I_L-I_K)>0$ when the government maximizes (9) since $W_L=W_K$. If the government has a concern for inequality then $\alpha > 0$ (relevance) and I(.) satisfies the Dalton principle. Therefore if $\theta^K<\theta^L$ after the shock we can apply lemma 2 and obtain $I_L-I_K> 0$. As we describe below the shocks (a)-(d) lead to a reduction in θ^K relative to θ^L if the import is K- intensive, so when the initial factor shares are identical, these shocks imply that $\theta^K<\theta^L$. An analogous argument applies if the import is labor intensive (due to the anonymity principle).

Similarly, in the case of the SF model we require the weights to satisfy (8), which simplifies to $\alpha(I_L-I_{K1}) \geq 0 \geq \alpha(I_L-I_{K2})$ (with at least one strict inequality). These conditions are satisfied since, when good 1 denotes the import, the shocks in (a)-(d) lead to $\theta^{K1}<\theta^L<\theta^{K2}$, as we show below.□

Starting from a no-trade equilibrium characterized by equal factor shares, a shock to prices, technology or endowments will generate trade and also generate inequality. The question is whether that inequality is reduced through the use of a tariff or import subsidy. To see the result within the HO model, consider first the effect of shocks to the relative world price of good 1 or endowments. If the world price of good 1 falls then it is imported and, if it is K-intensive, then $\theta^K<\theta^L$ in the new equilibrium because of the Stolper-Samuelson effect. A similar pattern of inequality results if there is an increase in the labor endowment such that the K-intensive good is imported.[16] Therefore, after either of these trade shocks the government will set a tariff to reduce inequality. An analogous argument applies if the import is L-intensive.

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[16] The increase in endowments in the small country does not affect world prices and therefore the domestic prices also remain unchanged. This implies that the wage to rental ratio remains constant (provided the country does not specialize) and thus the share of labor to capital income rises if the labor endowment increases. Recall that we maintain the number of individuals constant throughout so an increase in labor endowment refers to effective units of labor.

In the case of a Hicks-neutral technology shock the change in the factor shares depends only on the change in the relative factor price at given world prices. An improvement in the production technology of good 2 increases the supply of 2 and decreases that of 1 at constant prices (Johnson, 1955) so 2 becomes the export and 1 the import. The relative demand for the factor used intensively in the import decreases and so does its relative price. So the income share of the factor used intensively in good 1 falls due to the improvement in technology in 2. The resulting increase in inequality is reduced by a tariff.

Consider next the specific-factors model. Because there are three groups and the effect of the tariff on the mobile factor is generally ambiguous it is no longer obvious that the government can use it to offset inequality due to the trade shocks. However, we now show that it will generally be able to do so because these trade shocks affect the specific factors' income by more than labor's and the same is true of the tariff. In the case of a reduction in the world price of good 1 it is evident that a tariff can reverse the resulting inequality because it works as the price change itself. We now turn to the less obvious case of technology and endowment shocks.

A positive Hicks-neutral shock to good 2 leads to its export and increases the share of labor. It also induces some workers to move out of sector 1 thus reducing θ^{K1}. The labor movement partially offsets the initial increase in wages due to the technical change, which implies that θ^{L} does not rise by as much as θ^{K2}. The latter increases both because of the technical change and the increased labor supply to sector 2. Thus after this shock we have $\theta^{K1}<\theta^{L}<\theta^{K2}$. This pattern of inequality generates endogenous political weights that satisfy condition (8) in lemma 1. So the government imposes a tariff on good 1 to reverse some of this inequality. Finally, we also obtain this ordering of income shares and ATB if there is a shock to the specific factors. In this case we require an additional restriction on the elasticity of substitution between factors to ensure that the change in the labor share does not exceed the change in the share of the specific factor whose endowment changes.[17]

[17] For example if K_2 increases then θ^{K2} increases at given prices and so does θ^{L}. As labor moves to sector 2, θ^{K1} falls. The proportionate change in the share of K_2 is greater than that of labor's after an increase in the endowment of K_2 if and only if $\sigma_2 \geq 1-\sigma_1 L_1/L_2 - \theta^{L2}(p_2Q_2/R)/\theta^{L}$ where σ_i is the elasticity of substitution in production, L_i is the labor in sector i, θ^{Li} is labor's share in producing i and p_2Q_2 is the value of good 2. Therefore, $\sigma_i \geq 1$ is sufficient to ensure that $\theta^{K1}< \theta^{L}< \theta^{K2}$ after the

The basic insight from proposition 1 is that all the standard shocks that generate trade in the SF and HO models tend to reduce the income of the factor used intensively (or specifically) in the import sector and do the opposite for the export sector. An import tariff has the reverse effects. Therefore a concern for inequality provides an explanation for the ATB of trade policy. The result is clear and unambiguous for a small economy when we rule out initial asymmetries across factors but it extends to more general cases.

4. Extensions

The key reason to focus on a small economy with income shares that are initially symmetric was to neutralize any other motives for ATB and highlight the role of inequality. However, the exact size and symmetry conditions in proposition 1 are unlikely to be met in practice. Therefore, to determine whether inequality can explain the ATB actually observed in a majority of countries we extend proposition 1 to cases when countries are not small and can have any initial income distribution.

4.1 Anti-trade bias in large countries with reciprocal trade liberalization

There is increasing evidence that even small countries have some effect on the prices at which they trade.[18] Therefore we now relax the assumption that world prices are exogenous. For simplicity we consider a world with two identical countries, home and foreign, that are initially completely symmetric and have identical income shares of all factors. The equilibrium relative price of good 1 is then unity. Because of the initial symmetry there is no motive for trade and the identical income shares of all factors imply that there is initially no motive for a tariff or subsidy.

Endowment and technology changes are now the relevant trade shocks since world prices are endogenous. Since analogous arguments apply to the HO and SF models here we describe only one, an endowment shock in the SF model. Suppose we transfer a fraction of K_2 from foreign to home and a similar fraction of K_1 from home

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endowment shock. The condition follows from algebraic manipulation of these expressions, which can be found, for example, in Bhagwati, Panagariya and Srinivasan (1998).

[18] For example, Broda, Limão and Weinstein (2006) estimate that both large *and* small countries face finite foreign export supply elasticities for many of their imports.

to foreign. Given the symmetry in technology between the sectors, the integrated world equilibrium is unchanged and the free trade price is again unity with home exporting 2 and importing 1. Because the increase of K_2 is exactly offset by the reduction in K_1 and the free trade price remains unity, the real wage and thus the total labor income is unchanged. With the price and wage unchanged, the real return to capital in each sector is also unchanged. So, we have $\theta^{K1}<\theta^{L}<\theta^{K2}$ at home and $\theta^{K1*}>\theta^{L*}>\theta^{K2*}$ in foreign at $t=t^*=0$. It is simple to establish that a symmetric Hicks-neutral technology shocks lead to a similar ranking of shares. For the small economy case this ranking of factor shares was sufficient to establish the conditions for political weights required for ATB in lemma 1. But we must show whether those are also the relevant conditions for ATB in a large economy.

Given that the countries can now affect world prices their governments have a unilateral incentive to set a tariff. To suppress this motive for an ATB we assume that the tariffs are chosen cooperatively, i.e. to maximize the sum of the objective function in (9) for the two countries. This assumption implies that the governments internalize the costs imposed on each other from using a tariff to try to improve their terms-of-trade. Moreover, symmetry ensures that the equilibrium tariffs the countries choose are identical and thus leave the world price unchanged at unity. It is then clear that the tariffs are determined by purely internal considerations and precisely as though each country were small. Therefore the conditions for ATB in lemma 1 and the basic analysis in Subsection 3.2 apply here as well. Since the result is quite similar to proposition 1 we omit it.[19]

4.2 Anti-trade bias in a small economy: the asymmetric case.

We now demonstrate how inequality generates ATB in a more general setting. We show that if initially any factor owner in a small country is as likely to be better or worse off than any other then the probability of using a tariff when trade starts exceeds 0.5. The large country extension can be done along the lines of the last section.

As before, we choose an initial equilibrium with no trade by letting the economy be a replica of the rest of the world. We denote the probability density function (p.d.f.) of the possible initial distribution of factor shares

[19] We state and prove the result for the large countries more formally in our working paper, Limão and Panagariya (2002).

by $f(\theta)$.[20] Assuming the p.d.f. is continuous, the probability of an economy starting with perfect equality is exactly zero and we must focus precisely on the cases characterized by initial inequality. To ensure that there is an identical probability that any factor is better or worse off than any other we assume that $f(\theta)$ is symmetric. We also assume that the p.d.f. has positive mass on any interval over its support so that its associated cumulative density function $F(\theta)$ is strictly increasing. We can now state

Proposition 2. (Anti-trade bias with initial inequality): *Consider a small economy that is initially identical to the rest of the world and has initial factor income shares that are characterized by a continuous and symmetric p.d.f.,* $f(\theta)$, *and a strictly increasing c.d.f.,* $F(\theta)$. *If the government has a concern for inequality and neutral expectations about the effect of trade policy on the mobile factor's share in the SF model then shocks to the following variables generate trade and a trade policy that exhibits an anti-trade bias with probability higher than 0.5: (a) world price (SF and HO), (b) Hicks neutral technology (SF and HO); (c) endowments (HO) and (d) specific factor endowments.*

Proof: See the Appendix.

The intuition for the result is simple to illustrate graphically. Consider the initial p.d.f. $f(\theta)$ represented by the dashed line in figure 1. For the HO model this represents the full distribution. It is continuous, initially symmetric and its density is strictly increasing, but otherwise arbitrary. As we have noted previously a shock that leads good 1 to be imported decreases the share of the factor that it uses intensively, say capital. If initially the share of capital was lower than labor's then that will also be the case after the shock. Moreover, even if the capital share was initially slightly higher than labor's, its share after the shock will be lower. Therefore the post-shock density, labelled $f(\tilde{\theta})$, reflects the increased probability that $\theta^K < \theta^L$. This probability now exceeds one

[20] Since we are not restricting the initial distribution it is possible that the government of this economy would try to induce trade through the use of subsidies. We rule this out by assuming that trading costs are initially prohibitive. In our working paper we examine the case where it is precisely the reduction in such costs that causes trade.

half. As we show in section 3 this relationship between the shares is the necessary and sufficient condition for the government to set t>0 in the HO model. Therefore the probability that the trade policy exhibits ATB also exceeds one half—so an ATB is more likely than a pro-trade bias.[21]

Two comments are in order to explain the result in the context of the SF model. First, recall from lemma 1 that one of the conditions for ATB is for the political weight to be higher for the factor in the import relative to the export sector. According to lemma 2 this occurs when the factor share in the import sector is lower. To see that the probability of this event is greater than one half we can use the simplex in figure 2 that represents the domain for all possible distributions. After any shock (a)-(d) that leads to trade we have seen that the change in the share for the specific factor in the export sector increases the most followed by labor's and finally by θ^{K1}, which always declines. So for an arbitrary economy with initial distribution at point S^0 the distribution moves in the direction of the arrow. If we were to represent the joint density on the simplex the symmetry requirement would imply that the probability would initially be identical for economies left and right of the θ^L axis. Therefore *all* economies that are initially characterized by $\theta^{K1}<\theta^{K2}$ will remain so, and their density increases after the shock because of economies such as the one represented by S^0.

[Figure 1 here]

The second point to note is that knowing the relative shares of the specific factors is sufficient (and necessary) to determine the ATB in the SF model if the government has neutral expectations about the effect of the tariff on the return to the mobile factor. This neutrality condition implies that the government assumes the effect of the tariff on the labor share, θ_t^L, is zero in deciding on the trade policy stance and therefore uses the tariff only if it reduces inequality between the specific capital owners, as is clear from (10). Thus, since the probability that $\theta^{K1}<\theta^{K2}$ after the shock is greater than one half so is the probability of an ATB in the SF model.[22]

[21] The proof does not require the support to be fixed nor the mass change to be "smooth" as illustrated in figure 1.

[22] Note that, unlike proposition 1, the endowment shock in proposition 2 does not require a constraint on the elasticity of substitution. This is due to the government's neutral expectations about the effect of the tariff on the mobile factor share.

There are two reasons for focusing on the neutral expectations case. First, it is a natural baseline given that it is the most neutral assumption. Second, it may be the relevant case in the setting of policy. Unlike the effect of the tariff on the share of capital income the effect of the tariff on the labor share for a given economy may change over time and the government may not know it at any particular point. It may therefore make its decision based on its expected value of θ_t^L. If it assigns identical probabilities to an increase or decrease and identical absolute values once they are realized then the expected value is zero.[23]

[Figure 2 here]

We conclude this subsection by noting the important point that ATB does not depend on the initial trade shock increasing inequality. To see this start again at point S^0 in figure 2 and consider a shock that inverts the capital shares but maintains labor's unchanged. Inequality has remained unchanged but the government now sets t>0. Similarly we can find cases when inequality falls or increases due to the trade shock and the government still sets a tariff. The intuition is simple. Under autarky there is a latent demand for redistribution but, since only trade policy is available and the economy does not trade, no redistribution occurs. Once the economy starts to trade the government can deploy trade policy. It is important that our results do not hinge on a particular direction of the effect of trade on inequality because the empirical evidence on that issue is mixed, particularly when we look across different countries.

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[23] If the realized value of θ_t^L in the economies discussed above were not always zero there would be cases in which the trade policy would reduce the government's objective ex-post. If governments were extremely averse to this outcome they may choose only to use trade policy if the sufficient conditions in lemma 1, which are independent of θ_t^L, are satisfied. In this case the probability of ATB is still higher than a pro-trade bias. To see this note that the sufficient conditions for ATB correspond to the shaded triangle in Figure 2 and those for a pro-trade bias correspond to the mirror image left of the θ^L axis. The shocks (a)-(d) in proposition 2 imply a movement in the direction described for an economy such as S^0. Therefore if an economy is not initially in the region where a pro-trade bias necessarily exists, it cannot be there after the shock. Moreover, some economies in that region are displaced from it by the shock (assuming a continuous and strictly increasing distribution). Conversely, the economies initially in the shaded area where there is necessarily ATB must remain there and its density will in fact increase as the shock pushes others in that direction.

5. Conclusion

In this paper, we show that if the government has an inequality concern then trade policy will generally exhibit an ATB. Despite the existence of more efficient policies to redistribute income, there is considerable empirical evidence that trade policy, which often favors low-skill, low-wage workers, continues to be used for this purpose. Therefore the motive we focus on appears to be an important determinant of trade policy.

A concern with inequality is obviously not the only reason behind the ATB and if we want to address other questions, such as the variation in protection *within* industries in the import sector, we must model the demand side of protection explicitly. Given that ATB is one of the most prominent and nearly universal features of trade policy its motive is likely to interact with other determinants and have important implications in explaining other empirical regularities in the structure of protection. Therefore it is important to ensure that the models that guide such estimation can also predict ATB.

Our analysis is based on inequality across the income shares of various factors of production, which translates into inequality across individuals only if they own equal amounts of a single factor. However, it is possible to extend this framework to analyze the effects of concentrated ownership of factors, as we show in Limão and Panagariya (2002). We believe that our analysis may have interesting implications for the current debate on the effect of trade liberalization on inequality. This literature has generated a considerable amount of conflicting evidence. Our focus on the effect of inequality as a cause for an important feature of trade policy suggests that more attention needs to be given to reverse causality.

Appendix

A.1. Proofs

Lemma 2

If I(.) is differentiable then the second order expansion around the equilibrium prior to a transfer from j to j' is

$$I(U^j - \delta, U^{j'} + \delta) = I(U^j, U^{j'}) - \left[I_j(U^j, U^{j'}) - I_{j'}(U^j, U^{j'})\right]\delta + \varphi \quad \text{all } j \neq j' \tag{A1}$$

Where $I_j = \partial I/\partial U^j$ and φ represents the second order terms.

If $U^j \leq U^{j'}$ then, according to the Dalton principle in part (c) of definition 1, we have

$$I(U^j - \delta, U^{j'} + \delta) - I(U^j, U^{j'}) > 0 \tag{A2}$$

Combining (A2) with (A1) and rearranging we obtain

$$I_j(U^j, U^{j'}) - I_{j'}(U^j, U^{j'}) < \varphi/\delta = (I_{jj} + I_{j'j'})\delta/2 - I_j I_{j'}\delta \tag{A3}$$

Where the last equality uses the definition of the second order terms in φ.

Because the Dalton principle applies for all δ it must also apply as $\delta \to 0^+$. The RHS of the last expression in (A3) approaches 0 as $\delta \to 0^+$ whereas the LHS is unchanged (recall that the derivatives of I(.) are taken around U^j and $U^{j'}$, which are independent of δ). Thus $I_j - I_{j'} < 0$ if $U^j \leq U^{j'}$, which is equivalent to requiring that $\theta^j \leq \theta^{j'}$ (see (3)). This applies to all $j \neq j'$ due to the anonymity principle in definition 1.□

Proposition 2: Anti-trade bias with initial inequality

When t=0, there is no trade in the initial equilibrium. Ruling out the initial use of trade policy to induce trade, the shocks in (a)-(d) cause the country to trade. To show that Pr(t>0)>1/2>Pr(t<0) we must first calculate the probability for any given trade shock, which we denote by Δx, and sum it over all the possible economies.

$$\Pr(t > 0|\Delta x) = \int_{\boldsymbol{\theta}\in\Theta} \Pr(t > 0|\Delta x, \boldsymbol{\theta}) f(\boldsymbol{\theta}) d\boldsymbol{\theta} \tag{A4}$$

We then subtract the value for $\Pr(t<0|\Delta x)$ and show that the difference is positive for any given shock so that if we integrated over all types of shock (i.e. $\Delta x>0$ or $\Delta x<0$ for the different possible shock variables x indicated in (a)-(d)) we would obtain Pr(t>0)>1/2>Pr(t<0). With more than two factors the term $d\theta$ indicates integration over the shares over which the initial distribution is defined and Θ represents its support. Thus we define $\Delta\Pr$ as $\Pr(t>0|\Delta x) - \Pr(t<0|\Delta x)$. It is equal to

$$\Delta\Pr = \int_{\boldsymbol{\theta}\in\Theta} [\Pr(t > 0|\Delta x, \boldsymbol{\theta}) - \Pr(t < 0|\Delta x, \boldsymbol{\theta})] f(\boldsymbol{\theta}) d\boldsymbol{\theta} \tag{A5}$$

Using (10) we can relate the probability of ATB to factor shares. In the HO model we require

$$\text{sign}\left[dG/dt\right]_{t=0} = \text{sign}\left[\alpha\left(I_L - I_K\right)\theta_t^K\right]_{t=0} > 0 \tag{A6}$$

From lemma 1 we know that t>0 if $\text{sign}\,(I_L - I_K)_{t=0} > 0$ when the import is K-intensive. This condition is not only sufficient but also necessary for t>0 since when the import is K-intensive we have $\theta_t^K > 0$. Both signs are reversed if the import is L-intensive. For the SF model the government's decision depends on its expectation of θ_t^L. Since the true value may be positive or negative if the government does not know it and places identical weight on both alternatives then on average it expects $\theta_t^L = 0$.[24] This implies that $\theta_t^{K1} = -\theta_t^{K2}$ because $\theta_t^{K1} + \theta_t^{K2} = -\theta_t^L$. Using this we can simplify (10) to obtain

$$\text{sign}\left[dG/dt\right]_{t=0} = \text{sign}\left[\alpha\left(I_{K2} - I_{K1}\right)\theta_t^{K1}\right]_{t=0} > 0 \tag{A7}$$

According to lemma 2 $I_{K2} > I_{K1}$ iff after the shock we have $\tilde{\theta}^{K1} < \tilde{\theta}^{K2}$. Therefore, we can write ΔPr as

$$\Delta \Pr = \int_{\boldsymbol{\theta}\in\Theta} [\Pr(\tilde{\theta}^{K1} < \tilde{\theta}^{K2} | \Delta x, \boldsymbol{\theta}) - \Pr(\tilde{\theta}^{K1} > \tilde{\theta}^{K2} | \Delta x, \boldsymbol{\theta})] f(\boldsymbol{\theta}) d\boldsymbol{\theta} \tag{A8}$$

A similar expression applies for the HO model if we relabeled K_1 and K_2 to represent the factors used intensively in the import and export sectors respectively. A shock that causes good 1 to become the import ensures that all economies with $\theta^{K1} < \theta^{K2}$ in the initial equilibrium have $\tilde{\theta}^{K1} < \tilde{\theta}^{K2}$ in the post-shock equilibrium but the shock causes some economies with $\theta^{K1} = \theta^{K2} + c$ initially to have $\tilde{\theta}^{K1} < \tilde{\theta}^{K2}$. This is clear if we take $c \to 0^+$. The existence of such economies is assured by the assumption that $f(\boldsymbol{\theta})$ is continuous and $F(\boldsymbol{\theta})$ is strictly increasing. The symmetric initial distribution of economies then implies that, once we integrate over the full support, the mass of economies with $\tilde{\theta}^{K1} < \tilde{\theta}^{K2}$ after any shock (a)-(d) is higher than the one with $\tilde{\theta}^{K1} > \tilde{\theta}^{K2}$.□

A.2. Status quo bias vs. inequality concern

In proposition 1 we start from a symmetric situation and the tariff partially moves the income distribution back to it. Therefore, we may question whether the same result can be obtained by a government's desire to maintain the status quo, i.e. the utilities prior to the trade shock. We now show that a status quo bias (SQB) is not sufficient to generate ATB in the same situations where ATB is generated by an inequality concern. To do so assume that now –I(.) in (9) reflects the governments concern for the status quo. More specifically,

Definition 2: A government has a status quo bias if (a) $\alpha \in (0,1]$ and (b) $-I(U^j=U^{jsq},.) > -I(U^j=U^{jsq}-\delta,.)$ for each j and $\delta \in (-\infty,\infty)$.

There are three key differences relative to the government with a concern for inequality. First, a government with a SQB does not necessarily weight utilities across different groups symmetrically even when they have identical incomes. Second, the government now favors transfers even if they are regressive provided that they

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[24] Limão and Panagariya (2004) show that $\theta_t^L < 0$ if $\theta^{L1}\sigma_1/\theta^{11} < \theta^{L2}\sigma_2/\theta^{22}$ and non-negative otherwise, where θ^{ji} represents factor j's share in the production of good i and σ_i represents the factor elasticity of substitution in the production of i.

move each group involved towards its respective status quo utility. Third, the government's objective is lowered if all utilities change relative to the status quo even if they do so in the same proportion. Thus, the three key properties of the inequality function are not satisfied by a government with a status quo bias—it does not imply symmetry and it violates the Dalton and relative income principles.

To compare the outcome under a SQB with the inequality result in proposition 1 consider first a shock to world prices. Since the tariff can exactly offset the change in the world price it can move each factor towards the initial status quo utility. So taking the pre-trade utilities as the status quo a shock to world prices that leads the country to trade also causes ATB if the government has a SQB. This holds whether factors are mobile or not and therefore the outcome when the trading shock is external is similar to the one under an inequality concern.

An important aspect of proposition 1 was that the inequality concern led to ATB for various shocks that lead to trade and not simply a shock to world prices that can be undone by a tariff. A SQB is not sufficient for ATB precisely because these other shocks that cause ATB under an inequality concern do not necessarily cause it under a SQB. There are two fundamental reasons for this. First, a government with a SQB would like to move individuals back towards their original utility levels and a tariff (or subsidy) will change the utilities of at least a pair of factor owners in different directions. So if the initial trading shock does not change the utilities of that pair of factor owners in opposite directions the tariff or subsidy cannot bring both towards the status quo. To illustrate this consider the case of an increase in an endowment, e.g. labor, in the HO model as analyzed in proposition 1. At constant world prices factor prices are constant and so is income for capital owners. Therefore the utility for capital owners is unchanged at the status quo after the trade shock and that of workers increases. A tariff will increase U^K and lower U^L given that the country now imports the capital intensive good. But it is possible that for a government with a SQB a small increase in utility towards the status quo is much more valuable if close to it then a similarly small increase when already far removed. This is possible because a SQB places no restriction on symmetry and it allows for the marginal cost from moving away from the status quo to be diminishing.[25] Given this we cannot determine if the same endowment shock that lead to ATB under the inequality concern causes an anti or pro-trade bias under a SQB.

The second, and somewhat related, reason is that in the SF model the tariff has an ambiguous effect on the utility of the mobile factor. So, if a particular shock, e.g. an increase in a specific factor, leads to an increase in labor's utility, and the conditions were such that a tariff decreased it, then the tariff would move labor towards the status quo but a subsidy would be required if the shock were a decrease in the specific factor. So, again the SQB is not sufficient to determine the bias of trade policy.

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[25] Research on reference dependent utilities finds experimental evidence of diminishing sensitivity for individuals.

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Figure 1: Initial and post-trade shock share distributions
(K-intensive import)

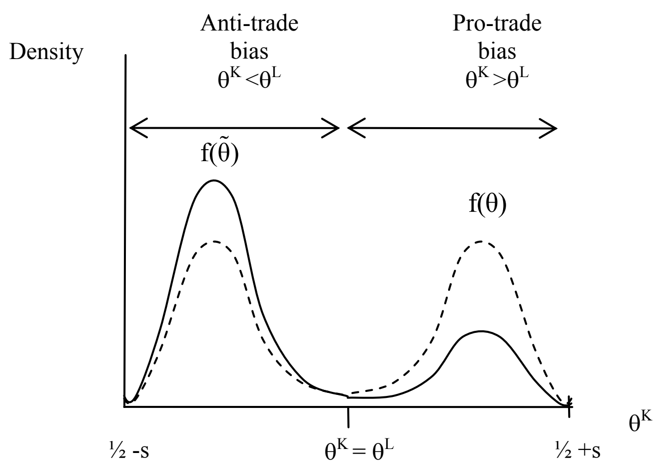

Figure 2: Income distribution and anti-trade bias in the SF model