An Empirical Investigation into the Determinants of Bias in Trade Policy

by

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Abstract

Limao and Panagariya (L&P, 2007) modify Grossman and Helpman's (1994) lobbying model in an attempt to understand why anti-trade bias is the predominant pattern in observed trade policy. L&P (2007) propose that governments seek to reduce inequality between sectors by modifying trade policies in a way that reallocates income from the smaller to the larger sector. We assess the empirical validity of L&P's (2007) theory by exploiting the World Bank Distortions to Agricultural Incentives database (Anderson and Valenzuela, 2008), using their measure of trade bias as our dependent variable. We find little empirical support for L&P's (2007) theory, and estimated coefficients on most control variables are insignificant. Lagged trade policies are significant determinants of current trade policy, suggesting the presence of policy persistence. We conclude that it is difficult to generalise L&P's (2007) theory across a wide and unbalanced panel of countries that extends from the 1950s to the 2000s.

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Chapter 1: Introduction

One of the topics in international trade theory that continues to receive attention is the identification of factors that determine a country's choice of domestic trade support mechanisms. As Rodrik (1995) points out, one of the specific puzzles within this topic is why policies that are biased against trade (in support of import-competing sectors) are used more than policies that are biased in favour of trade (in support of exporting sectors). This specific puzzle is an important one. If bilateral and multilateral trade negotiations are aimed at reducing restrictions on trade, it should be helpful to gain a better understanding of the reasons that countries put into place policies that restrict trade. A better understanding of the issue may improve the ability of negotiators to focus on reducing restrictions on goods that countries have less preference for supporting. Such information may also provide insight into what countries make good matches for negotiating bilateral agreements. To see this, consider the case where a country aims to gain market access for a certain product, through bilateral trade agreements. With this information, that country may be able to identify which other countries will be most likely to agree to reducing trade restrictions for that good, based on those countries' perceived preference for protecting the good. If the opposite is also true, and the original country has a low preference for protecting a different good that the potential trading partner wants to increase its market access in, there may be an opportunity to reach a bilateral agreement.

One of the most frequently cited theories about how governments set their trade policy is the one proposed by Grossman and Helpman (G&H, 1994). Their theory suggests that a government's utility function is formed linearly from the summation of societal welfare and the level of financial and other contributions received from lobby groups (G&H, 1994). However, the predicted trade bias arising from this theory (which is trade-promoting, as shown by Levy (1999)), is perceived to be inconsistent with observed trade bias (which is trade-restricting, as argued by Rodrik (1995) and Limao and Panagariya (L&P, 2004; 2007)).

A theory proposed by L&P (2007) presents an interesting theoretical explanation of anti-trade (trade-restricting) bias in similar framework to G&H (1994). L&P (2007) show that by converting G&H's (1994) approach to a general equilibrium model, and by defining the government utility function in a way that the government desires to reduce income inequality among factors, as opposed to desiring greater contributions, a predicted result of anti-trade bias, on average, can be achieved. L&P (2007) show anti-trade bias to be the predicted result of their theoretical model more often than pro-trade bias[1], and thus their theory provides a factor in policy choice that could push trade policy in an anti-trade bias direction.

We are aware of no previous empirical attempt to analyze inequality of L&P's (2007) form as a determinant of trade policy. Thus, this project attempts to assess whether inequality between import-competing agricultural goods and exporting

[1] It can be shown that the probability of anti-trade bias resulting from the theory is higher than the probability of pro-trade bias resulting from the theory. This is discussed further in chapter three.

agricultural goods is a realistic solution to the puzzle of anti-trade bias, using a reduced form empirical model. As we explain in chapter three, we view trade sector (import-competing and exporting) inequality as being analogous to factor inequality, as each sector is relatively intensive in one of two factors, and thus equalizing sector incomes equalizes factor incomes by extension. We use agricultural data because agricultural industries remain heavily supported, thereby providing an interesting case study upon which to test L&P's (2007) theory.

Our empirical model is estimated using panel data for a wide range of countries (63 in total), and over a time series that dates as far back as the 1950s for some countries. Our dependent variable is the Trade Bias Index (TBI) obtained from a World Bank-produced database, Distortions to Agricultural Incentives (Anderson and Valenzuela, 2008). We also control for a number of other factors including market power, welfare effects, preferential trade agreements (PTAs), and development level. We have the advantage of being able to utilize panel estimation techniques. The use of panel data differentiates us from many previous empirical studies regarding the formation of trade policy[2], and allows us to take full advantage of variance in policy, both across countries and over time. It also allows us to estimate the model using country fixed effects which controls for a number of invariant and unobservable,

[2] For example, Dutt and Mitra (2002; 2005), Broda *et al.* (2008), Goldberg and Maggi (1999), Gawande and Bandyopadhyay (2000), and Mitra *et al.* (2006) all utilize cross-sectional empirical models. Mitra *et al.* (2006) and Dutt and Mitra (2009) are examples of empirical models in the field that use panel data, but the former is only based on four years of Turkish data across products, and the latter is based on a different theoretical model.

country-specific political, cultural, or institutional factors that would be difficult to control for otherwise.

Another advantage of including data across a time series for individual countries is the ability to estimate our empirical model dynamically. We recognize that policy persistence is likely to be an important determinant of the level of trade bias. We control for this by introducing a lagged dependent variable into our base empirical model with country fixed effects. Though this approach brings forward a potential coefficient bias resulting from the endogeneity caused by the inclusion of a lagged dependent variable, Nickell (1981) and Roodman (2006) note that dynamic panel bias decreases as the time series lengthens. Our empirical model fits this description, as our average time series length is just under 32 observations per country. Our alternative would be to estimate a dynamic model with one of two techniques that utilize Generalized Method of Moments (GMM), those proposed by Arellano and Bond (1991), and Arellano and Bover (1995)/Blundell and Bond (1998). Unfortunately, as Roodman (2009) argues, the number of instruments created by these methods can grow very large as the time series grows. Roodman (2009) also notes that a large number of instruments can over-fit endogenous variables and result in decreased ability to control for the inherent endogeneity of dynamic panels. Thus, this results in biased coefficients. Acknowledging these two arguments, we move forward with the fixed effects model with a lagged dependent variable included.

There are seven chapters in this thesis. The second chapter reviews previous literature on the topic, including both important theoretical models and previous empirical attempts of interest. An overview of L&P's (2007) theory is provided in chapter three. This chapter includes a derivation of the marginal effect of both an import-protecting tariff and an export-promoting tariff on government utility, given L&P's (2007) proposed utility function, and our proposed sectoral inequality function. It also includes a derivation of the government's optimal import-competing tariff level from L&P's (2007) proposed government utility function, given our proposed sectoral inequality function, and analyzes the marginal effect of the government's concern for inequality on this optimal tariff. Chapter four presents our empirical estimating equations, with a discussion of our methods of estimation and the rationale for our control variables. We also discuss predicted results. Chapter five summarizes and analyzes the data, and provides the sources for those data. In chapter six, we present the results of both our static and dynamic estimations, and discuss the results. The final chapter, chapter seven, summarizes the thesis and gives concluding remarks.

Chapter 2: Literature Review

Perhaps the most important model of the political economy of trade policy in the last two decades is the one presented in G&H's "Protection for Sale" (1994). The key development in their theory is to explicitly lay out how lobbying affects the government policy making process in theoretical form. They do this by introducing the lobbying power of different groups into a model of government welfare. In this sense, groups or industries which spend more on lobbying the government will have more political sway in the policy making process.

The theory that G&H (1994) develop has roots in the notion put forth by Stigler (1971), which was developed into a theoretical model by Peltzman (1976), and adapted to help explain endogenous trade protection by Hillman (1982)[3]. The notion is that the government attempts to maximize its political support. This is done by choosing prices (affecting them through policy choices) to reach a balance between increasing the profits of firms and lowering social welfare, due to higher prices. Hillman (1982) advances the model by introducing tariffs as a policy tool by which the government can set prices in partial equilibrium.

G&H (1994) build on Hillman's (1982) partial equilibrium approach[4] by incorporating the approach of Magee *et al.* (1989) and Hillman and Ursprung (1988), which has lobby groups contributing to different electoral candidates based on

[3] Here, endogenous trade policy is assumed to mean trade policy which is set based on weighting of different economic factors, as opposed to being exogenously set by the government.

[4] As L&P (2004) point out, G&H (1994) is actually a quasi-linear approach, as substitution between production of various goods is limited to the numeraire and non-numeraire goods.

previously announced trade policy positions. This creates the effect of lobby groups competing for their desired policies with other lobby groups. G&H (1994) adapt this into the optimization function of Stigler (1971), Peltzman (1976), and Hillman (1982) by including the amount of contributions from various lobbies in the government utility function. Modelling the government objective function in this way creates a situation where, in an attempt to maximize contributions from lobbies, thus maximizing its own welfare, the government will choose policies to appease the groups which contribute the most. This implies that the government is attempting to maintain the amount of contributions received going forward, as the model does not contain a provision for the changing of contributions in reaction to policy choices.

As Levy (1999) points out, however, G&H's (1994) theory may not accurately predict observed trade policy patterns. The rationale is that, while the most common pattern of bias in trade policy is to protect imports[5], G&H's (1994) theory predicts that more support will go to exportable goods. To understand this prediction, consider the following example of Levy's (1999) thought experiment, as described by L&P (2007). Suppose that a country produces and consumes two goods (A and B), in equal proportions, with initial domestic and world prices which are equal in comparison to the price of a numeraire good, and equal to unity. These restrictions result in the country not trading either good. Factor endowments are then changed so that the country has a greater endowment of the specific factor for which A is intensive than the one for which

[5] Rodrik (1995) argues that he is unaware of any countries where trade expansion is the net effect of policy. L&P (2007) cite Panagariya (2005), who argues that in recent years, export subsidies have not been as important of a trade policy tool as import tariffs in agriculture. As we show in chapter four, within our data, the average bias in trade policy is also anti-trade.

B is intensive, with changes being equal and opposite of each other. This results in the country opening to trade, as a result of comparative advantage suggesting that the country will export A and import B. Assuming that both sets of specific factor owners are organized, they will both lobby the government for their desired policy instrument. The import good will receive an anti-trade policy, while the export good will receive a pro-trade policy as a result of their actions. However, since trade results in the exporting good being larger, the exporting good is able to afford larger contributions. Thus, more support will go to the export industry, and an overall pro-trade bias will result.

In recognition of the difference between the prediction of G&H's (1994) theory and frequently observed policies, several recent papers have attempted to modify G&H's (1994) model in order to allow for a prediction of an anti-trade bias. Levy (1999) suggests that cooperative behaviour between governments causes anti-trade bias. Pecorino (2008) argues that the welfare cost of subsidizing exports may lead to an anti-trade bias. Even if governments support exportable goods as predicted by G&H (1994), those subsidies must be financed in some way. This financing may be done through either distortionary taxes or tariff revenues. The distortionary nature of either option means that consumers will have a lower level of welfare as a result, leading a government with a high enough concern for total welfare to shift policy away from costly subsidies. In fact, even if a government's concern for welfare is relatively low, if the welfare cost is high enough, the same result will ensue.

In an alternative approach, L&P (2004) convert G&H's (1994) model to a general equilibrium framework, arguing that this allows for anti-trade bias without introducing other factors in the government's policy decision. In their model, L&P (2004) utilize a government objective function which is similar to the one used by Long and Vousden (1991) in adapting Hillman's (1982) work to general equilibrium. Using this objective function to derive an optimal tariff, and setting restrictions on a number of resulting parameters, L&P (2004) find that the resulting support structure is tariff protection, as opposed to export subsidies.

An interesting attempt at modification is further work by L&P (2007), which introduces an inequality motive into G&H's (1994) political economy structure. They argue that rather than the government being partial to special interests, it seeks to equalize the incomes of sectors within the economy (or a subsection of the economy[6]). L&P (2007) use factor owners as the basis for defining their sectors, with the two factors (in the Heckscher-Ohlin model case) being assigned to be either import-competing or exporting sectors. The result is a government objective function which includes both a concern for the overall welfare of the populace (as in G&H (1994)) and a desire to reduce sectoral income inequality, as the level of inequality enters negatively in the function. Taking the first order condition of this function with respect to the tariff level,

[6] L&P (2007) cite a number of previous empirical studies that provide support for the notion that reducing inequality is a motive in the choice of trade policy. Among them, Ray (1981) finds evidence that tariffs are higher for low skill industries in eight developed nations; Goldberg and Pavcnik (2004) find similar evidence that tariffs are higher for low skill and low wage industries; and Dutt and Mitra (2002) find evidence that capital abundant countries increase tariff levels as inequality grows, but labour abundant countries reduce tariff levels as inequality grows. Advancing their work, Dutt and Mitra (2006) find a similar result while controlling for government ideology simultaneously. Dutt and Mitra (2009) also find evidence that the relative rate of agricultural protection has the level of inequality as an important determinant. See L&P (2007) for further examples.

it is shown that the marginal effect on the government's utility is positive in situations where the net import competing sector has a smaller relative income share. The alternative is true when the net exporting sector has the smaller relative income share. This result suggests that tariff level will increase (decrease) when the import competing sector is smaller (larger), resulting in a marginal move towards anti-trade (pro-trade) bias.

The rationale that L&P (2007) provide as to why anti-trade bias will result from their theory more often than pro-trade bias is as follows. There are two possible initial orderings of relative income share prior to moving from autarky to trade: either the exporting sector has the larger relative income share, or the import-competing sector has the larger relative income share. The probability of the two shares initially being exactly equal is assumed to be zero, as the probability of any specific point under a continuous probability density function (pdf) is zero. As was explained in Levy's (1999) analysis of G&H (2004), when the country moves from autarky to trade, the exporting sector will see an increase in relative income share compared to the import-competing sector, as a result of comparative advantage. L&P (2007) argue that this means that in any case where the exporting sector already has the larger income share, the exporting sector will remain larger after moving to trade. In the case where the import-competing sector was initially larger, the effects of comparative advantage may result in either relative income share ordering being possible. Overall, assuming that each possible initial relative income situation is equally likely (L&P (2007) assume a symmetric, continuous pdf centered on perfect equality, and extending towards increasing inequality in both directions, to ensure that this is true), there is a minimum of a 0.5 probability that the exporting sector will have the larger income share after moving to trade.

The notion of the government attempting to reduce the level of inequality between sectors is what drives this project. A government's attempt to reduce inequality provides for a testable hypothesis; that the direction of trade bias will be determined by the direction of the inequality, and will grow with the magnitude of the inequality.

One of the key features of L&P's (2007) model is that it predicts the direction of support (to exportable or importable goods) in addition to the level of support. This permits the use of a trade policy variable that captures how restrictive a country's policy is, by including all types of support in its calculation, as opposed to only the level of tariff or quota. The level of tariff or quota (or, alternatively, overall level of assistance) has been used empirically by Dutt and Mitra (2002, 2005, 2006, 2009), and would be an appropriate measure to assess models following G&H (1994), such as Goldberg and Maggi (1999) or Broda, *et al*. (2008).

The idea of inequality being a determinant in trade policy is certainly not new; however, the basis for its inclusion usually follows from an alternative trade policy model, the median voter model. Dutt and Mitra (2002) provide an example of this. The logic is that if the mean income of an electorate is greater than the median, then the government, desiring more votes, will support the lower bracket of income earners in an attempt to increase the relative income level of the majority of voters[7]. This leads to the inclusion in their empirical model of an inequality measure that captures individual income levels, as opposed to inequality among sectors, as proposed in L&P's (2007) model.

While there is a lack of empirical work pertaining to the specific issue of reducing inequality among sectors, there is a significant empirical literature base looking at related models and issues. Some of this literature provides useful suggestions for important determinants of trade policy that do not fit within L&P's (2007) theoretical model. Dutt and Mitra build off of their previous work (2002) by extending their basic structure to hypothesize on a number of possible determinants for selection of trade policy, including ideology, government structure, and lobbying power, among other things (Dutt and Mitra 2005, 2006, 2008). Dutt and Mitra (2009) combine some of the notions of their previous work into an empirical test of the determinants of agricultural protection, including the notion of individual income inequality, as explained above.

Some previous literature has focused on assessing versions of the Grossman-Helpman model in terms of optimal tariffs. Examples of this include McCalman (2004), Mitra *et al.* (2002; 2006), Gawande and Bandyopadhyay (2000), Gawande and Hoekman (2006), and Goldberg and Maggi (1999). Gawande *et al.* (2009) also go through the optimal tariff process in order to isolate and estimate a parameter on governments'

[7] If the mean is greater than the median, then the distribution of income is skewed to the right, and the majority of voters have incomes below the mean. Thus, if the government introduces a policy which has a redistributive effect from high income voters to lower income voters, more voters will benefit from the policy than will lose income. These voters may be more inclined to vote for the current government, and the net effect would be an increase in votes.

concern for overall welfare. In all of these cases, two economic variables are identified as important factors in tariff formation; import to domestic production ratio, and import demand elasticity. As shown in the chapter three, a similar result can be obtained from the L&P (2007) objective function, which also includes unobserved marginal effects of tariffs on income share. The unobserved nature of the elasticity and marginal effects make them difficult to measure in this context, which makes the construction of a structural model based on an optimal tariff very difficult for our purposes. This is explained fully in chapter three.

Given the amount of literature discussed above that has worked empirically with the G&H (1994) model, it would be ideal to compare the effects of concern for inequality on policy formation to ideas drawn from that model, such as the effects of lobbying or contributions[8]. However, as Swinnen (2009) argues, empirical tests of the effects of lobbying on policy formation have historically been limited to a small number of countries because data for lobbyist spending are often not available in sufficient detail for countries outside of the United States. Furtan *et al.* (2009) are able to gather data on farm contributions to the *Comité des Organisations Professionelles Agricoles de*

[8] Goldberg and Maggi (1999), Gawande and Hoekman (2006), and Gawande and Bandyopadhyay (2000) find support for the theory of G&H (1994), that lobbying contributions carry large weight in the policy making process. Mitra *et al.* (2002) find support for G&H's (1994) theory using multiple years of Turkish data, including data from both democratic and dictatorial regimes. Mitra, *et al*. (2006) find restricted support for the model, claiming to produce more realistic weighting parameters on welfare and contributions than Goldberg and Maggi (1999) or Gawande and Bandyopadhyay (2000), by tying their empirical model more closely to the theoretical model. Gawande, *et al.* (2009) takes a slightly different approach than the others, and finds variation in the concern for welfare over a cross section of countries, with this variation depending on factors such as checks and balances, voter information, ideological attachment, and media influence. McCalman (2004) has yet a different goal, and finds evidence that determinants of trade liberalization in Australia are the portion of the population represented by lobbies, and the value the government places on welfare, with welfare carrying greater weight.

la CEE (COPA), a European Union (EU) level lobby, for twenty-five EU countries from 2000-2005. However, Furtan *et al.* (2009) point out that their intention was to gather more detailed data than they were able to obtain, but that proved exceedingly difficult. If even imperfect data are unavailable for EU countries as recently as the 1990s, then there is little possibility of gathering data for developing areas, certainly for years prior to the 1990s.

Broda *et al.* (2008) find support for the notion that large countries have a greater ability to set trade policy as they choose. They find evidence that market power is a significant determinant of tariff levels, and that market power carries similar weight in the determination of tariffs as does lobbying. This result suggests that market power may be considered as a possible control in an empirical model, something that is explored later, beginning in chapter four.

Building on the literature thread that has been extended by L&P (2007), and with recognition of previous empirical analyses, the next step is to set up the framework for an empirical assessment of the effects of concern for inequality on trade policy. The following chapter looks into the theoretical model of L&P (2004, 2007) to clarify the structural format, and illustrates how we use that format to build an empirical model.

Chapter 3: Theory

Limao and Panagariya (2007) develop a general equilibrium theoretical model which builds upon the theory proposed by G&H (1994). L&P's (2007) model modifies the G&H (1994) model by introducing a motive for reducing inequality into the government objective function, replacing the lobbying portion of the G&H (1994) model. This chapter formally describes L&P's (2007) model, deriving the marginal effect of a tariff (either import-protecting or export-promoting) on government utility, as well as the optimal tariff (in this case only an import-protecting policy) for their model. We also build on this work by including our chosen functional form for inequality that is used in the empirical model. Doing this allows us to express the marginal effect and optimal tariff in an intuitive way, while defining what a structural model might look like.

The previous chapter provides a brief look into the intuition behind L&P (2007). We now formally express how this intuition is formed theoretically. To do so, we start by developing the model as is done in L&P (2007).

The core of L&P's (2007) model is a government objective function which is a function of the vector of all individual utilities:

$$G = G\big(U(t)\big) \tag{3.1}$$

L&P (2007) show that the utility of groups *j*, at any given tariff level *t,* is given by the following function[9]:

$$U^j = \frac{\theta^j[R(1+t,1;\bar{J}) - tR_1(1+t,1;\bar{J})]}{[e(1+t,1) - te_1(1+t,1)]}, \forall_j \qquad (3.2)$$

where $\theta^j$is the share of group *j* in earned income, $R(1+t,1;\ \bar{J})$ is a standard revenue function, $e(1+t,1)$ is the expenditure portion of a standard expenditure function, t is the tariff rate, and $R_1(1+t,1;\bar{J})$ and $e_1(1+t,1)$ are partial derivatives of the revenue function and expenditure portion of the expenditure function with respect to the price of good 1, the import-competing good in L&P's (2007) model. L&P (2007) set the world price of each good in their model equal to unity, thus $(1+t)$ represents the domestic price of the import-competing good. The domestic price of the net-exported good is unity, as no domestic policies are in place for that good. $\bar{J}$ is defined in L&P (2007) as a vector of factor endowments, for capital and labour, or $(\bar{K},\ \bar{L})$, in the two factor Heckscher-Ohlin model, and for labour and the two groups of capital owners, or $(\bar{K}_1,\ \bar{K}_2,\ \bar{L})$, in the specific factors model where capital is not mobile across goods. The full expenditure function is assumed in L&P (2007) to be $e(1+t,1)U^j$, or a function of the price of the two goods, multiplied by the utility level of group j. Note that t> 0 denotes an import tariff, while t<0 denotes an export subsidy, as defined in L&P (2007). θ^j is defined in L&P (2007) as:

$$\theta^j \equiv \frac{R_j(.)\bar{J}}{R(.)}, \forall_j \qquad (3.3)$$

[9] L&P (2004) also uses the same utility function.

The first order condition of the objective function in equation (3.1) at t=0 is:

$$[dG/dt]_{t=0} = [R(.)/e(.)]_{t=0}\left[\sum_j G_j(.)\theta_t^j\right]_{t=0} \tag{3.4}$$

Similar to G&H (1994), this first order condition includes political weights for individual sectors, G_j, which are larger for sectors that carry more influence in the government policy setting process. However, instead of this being based on the amount of contributions coming from each sector, as in G&H (1994), the weights in L&P (2007) are based on how increasing a particular sector's income share would affect inequality among sectors. This result is achieved by inserting the level of inequality negatively in the place of contributions in the government objective function.

L&P (2007) model their government objective function in the following way:

$$G(U) \equiv \alpha\big(-I(U)\big) + (1-\alpha)W(U) \tag{3.5}$$

where $I(U)$ denotes inequality among economic sectors (factors, in the context of L&P), $W(U)$ is the welfare of the overall economy, and α is the relative weight a government places on reducing inequality compared to increasing overall welfare.

The objective function denoted in equation (3.5) signifies that the government desires at some level (assuming that α is not zero) to reduce the amount of inequality among sectors in order to reach a maximum level of utility. Similar to equation (3.4), we can take the first order condition of the objective function with respect to the tariff level in order to analyse how the government determines what type of policy maximizes their utility.

Following from L&P's (2007) work (and adding assumed steps for clarification purposes), we present the general specific factors version of the first order condition, at t=0. In this set up, there are three sets of factor owners, capital owners from each of two goods, where capital is not mobile across goods, and labour. As L&P (2007) note, the political weights actually measure how changes in the utility of various groups affect both inequality and aggregate welfare, but since $W(U)$ is simply the sum of utilities, the marginal effect of a change in income share of each factor on overall aggregate welfare, W_j, is identical. Thus the portion of the first order condition of the government utility function with respect to the tariff level resulting from $W(U)$ will be $[R(.)/e(.)]_{t=0}$, multiplied by the summation over j of $W_j\theta_t^j$. Since the shares sum to unity, the marginal effects of a change in tariff on the shares will sum to zero[10], as shown in equation (3.6). Since they are all multiplied by W_j, which is identical across all sectors, the overall summation across all sectors also sums to zero, and thus the portion of the first order condition resulting from $W(U)$ can be left out of the first order condition.

$$\sum_j \theta_t^j = 0 \qquad (3.6)$$

Leaving out the welfare portion of the objective function, and borrowing from equation (3.4), we get a first order condition as follows:

$$[dG/dt]_{t=0} = [R(.)/e(.)]_{t=0}\left[\sum_j(-\alpha I_j\theta_t^j)\right]_{t=0} \qquad (3.7)$$

[10] Assuming all income accrues to the sectors included in the model, the sum of shares of total income will be one hundred percent, or one. Since a tariff only distributes income from one sector to another, if the marginal effect of a tariff on one sector's income share is positive, the total marginal effects of the tariff on all other sectors' income shares must be the exact negative of that effect. Thus, the marginal effects will sum to zero.

Expanding the summation in equation (3.7), we get:

$$[dG/dt]_{t=0} = [R(.)/e(.)]_{t=0}[(-\alpha I_{K1}\theta_t^{K1}) + (-\alpha I_{K2}\theta_t^{K2}) + (-\alpha I_L\theta_t^{L})]_{t=0} \quad (3.8)$$

Next, we must note that since the marginal effects of a tariff on the income shares will sum to zero, the marginal effect of a tariff on the income share of labour is equal to the negative of the combined marginal effect of a tariff on the income share of capital owners for goods 1 and 2. Thus, inserting the negative of the summation of the marginal effects of a tariff on the income shares of capital owners into equation (3.8) and collecting like terms:

$$[dG/dt]_{t=0} = [R(.)/e(.)]_{t=0}[(-\alpha(I_{K1} - I_L)\theta_t^{K1}) + (-\alpha(I_{K2} - I_L)\theta_t^{K2})]_{t=0} \quad (3.9)$$

Simplifying to a summation over the groups of capital owners, where $j = K1$, $K2$, and pushing the negative through the multiplication, we get the result found in L&P (2007):

$$[dG/dt]_{t=0} = [R(.)/e(.)]_{t=0}\left[\sum_j \left(\alpha(I_L - I_j)\theta_t^{j}\right)\right]_{t=0} \quad (3.10)$$

Once again, we have a version of a weighting system, similar to equation (3.4). L&P (2007) note that the weight (the term $I_L - I_j$) signifies what happens to inequality as income is redistributed from j to L. In this sense, the government's weighting is based on two things – whether the policy reduces or exacerbates inequality, and how much it is concerned with inequality to begin with. Given that the concern for inequality parameter, α, will be identical for all j, the government will choose the policy that is most effective in reducing inequality[11].

Defining sectors according to types of factor owner is not the only way that sectors can be defined. In L&P (2007), the authors note how the model can be adapted to the case where factors are mobile, creating a two sector model. The analysis remains the same, save for the fact that there is only one other sector apart from labour, and that is capital in general. Thus, the only difference in this model is that $\sum_j \left(\alpha(I_L - I_j)\theta_t^j\right)$from equation (3.10) becomes $\alpha(I_L - I_K)\theta_t^K$as there are no longer other sectors in the subset j.

L&P (2007) note that the import-competing good in their model is either capital-intensive or labour-intensive. Adapting from what was stated earlier, the import-competing good (in a two good model) has the smaller income share when trade exists more often than not. In the situation where the import-competing good does have the smaller income share, the factor that the import-competing good is intensive in will be the factor with the smaller income share. The intuition is that the factor that the import-competing good is intensive in receives a higher percentage of the income earned by the good that earns less income, and a lower percentage of the income earned by the good that earns more income. Thus, that factor's total income will be lower than the factor that the exporting good is intensive in. The opposite is true for the case where the exporting good has the smaller relative income share when trade

[11] The concern for inequality is identical for all sectors, as the government is not assumed to prefer one sector over another, and thus is equally concerned about inequality in all situations, no matter which sector happens to have the smaller income share.

exists. This shows that the relative income share ordering of two factors in a two good model matches the relative income share ordering of the two goods, matching the goods to the factors in which they are intensive.

We can generalize this result to a case where there are more than two goods. Assuming that all goods are traded, they can be divided into groups of net-imported and net-exported goods. Each of these groups has average intensities of each factor (again, assuming two mobile factors). Just as is the case for two goods with two factors, each group is, on average, relatively intensive in one of the two factors. Each group of goods has a share of total income. If we consider that, as above, the factor that the group with the larger income share is intensive in on average is able to derive a greater amount of income than the other factor, then the income share ordering for the two groups of goods matches the income share ordering of the factors that they are respectively intensive in. Thus, if there is inequality among the total income accruing to groups of goods defined by their trade status, then there is a matching inequality among the total income accruing to the factors that they are respectively intensive in. This means that the theory can be applied generally to these groups of goods, just as it is to factors in L&P (2007).

As a result of this connection, we can define our sectors based on goods which are import-competing (denoted M) or exporting (X), based on net trade status, as opposed to using groups of factor owners. In simplifying the marginal effect of a change in tariff rate on government utility, we follow similar steps as above. Expanding the summation as in equation (3.8):

$$[dG/dt]_{t=0} = [R(.)/e(.)]_{t=0}[(-\alpha I_X \theta_t^X) + (-\alpha I_M \theta_t^M)]_{t=0} \tag{3.11}$$

Noting that the marginal effects of the tariff on income shares must sum to zero, as shown in equation (3.6), and collecting like terms as in equation (3.9):

$$[dG/dt]_{t=0} = [R(.)/e(.)]_{t=0}[(-\alpha(I_X - I_M)\theta_t^X)]_{t=0} \tag{3.12}$$

Finally, pushing the negative through the multiplication, we get:

$$[dG/dt]_{t=0} = [R(.)/e(.)]_{t=0}[(\alpha(I_M - I_X)\theta_t^X)]_{t=0} \tag{3.13}$$

Whether the marginal effect of increasing the tariff level is positive or negative depends on both the marginal effects of increasing income share on the level of inequality (I_M and I_X), and on whether the tariff is import-protecting or export-promoting[12]. This means that the tariff may refer to a policy that protects imports, such as an import tariff or quota, or a policy that promotes exports, such as an export subsidy. For now, we focus on the standard case where the tariff is import-protecting.

Theoretically, the marginal effect of increasing the relative income share of a sector on inequality should be clear, with the marginal effect taking on opposite signs in each relative income share situation. If import-competing goods have the smaller relative income share, then increasing their income share will have a negative effect on

[12] The revenue to expenditure ratio can be assumed to be positive, as both revenues and expenditures will be at least non-negative.

inequality, meaning I_M is negative. Similarly, I_X is positive in this scenario. Alternatively, if the exporting sector has the smaller relative income share, the opposite is true; I_M is positive and I_X is negative. To ensure that these notions are valid, we insert a specific functional form for inequality into equation (3.13). Our function for inequality is the absolute value of the difference between the utility of the exporting sector and the utility of the import-competing sector. Formally:

$$I(U) = |U^X - U^M| \tag{3.14}$$

As a result of the absolute value, we essentially have two alternate functions, $I(U) = U^X - U^M$ when the import-competing sector has the smaller relative income share, and $I(U) = U^M - U^X$ when the exporting sector has the smaller relative income share. For the former case, the marginal effect of increasing the income share of the exporting sector on inequality is equal to one, and the marginal effect of increasing the income share of the import-competing sector on inequality is negative one. For the latter case, the opposite is true. Inserting these results into equation (3.13), for the former case we get:

$$[dG/dt]_{t=0} = [R(.)/e(.)]_{t=0}[(\alpha((-1) - 1)\theta_t^X)]_{t=0} \tag{3.15}$$

For the latter case we get:

$$[dG/dt]_{t=0} = [R(.)/e(.)]_{t=0}[(\alpha(1 - (-1))\theta_t^X)]_{t=0} \tag{3.16}$$

According to L&P (2007), we can assume that α is positive. Based on an import protecting tariff, the marginal effect of a tariff on the income share of exporting goods should be negative, as a tariff will redistribute income from the exporting sector to the import-competing sector in this case. Given that negative one subtract one is negative, and one subtract negative one is positive, we have the result of a positive marginal effect of an import-protecting tariff on government utility when the import-competing sector is smaller, and a negative marginal effect of an import-protecting tariff on government utility when the exporting sector is smaller. This means that putting into place more import-protecting policies will increase the government's utility level when the import-competing sector must be protected to reduce inequality, and will decrease the government's utility level when the exporting sector must be protected to reduce inequality.

As noted above, a tariff, in this context, does not have to be an import-protecting policy; it can also be an export-promoting policy. These types of policies redistribute income from the import-competing sector to the exporting sector, and thus the marginal effect of the export-promoting tariff on the income share of the exporting sector is positive. The marginal effects on inequality with respect to the income shares remain the same in each case, as does the amount of concern placed on inequality, α. This concern remains constant because the government is not assumed have preference for protecting any specific sector, and simply desires to reduce inequality with whatever policy is required. Given that the second term on the right hand side of equation (3.16) is now positive instead of negative, the marginal effect of a tariff on the government's utility level is negative if the import-competing sector is smaller, and positive if the exporting sector is smaller. This means that using export-promoting policies reduces the government's utility level when the import-competing sector must be protected to reduce inequality, and increases the government's utility level when the exporting sector must be protected to reduce inequality.

Putting these two results together, the net effect is that the government will prefer import-protecting policies when the import-competing sector is smaller, and export-promoting policies when the exporting sector is smaller. This is consistent with the intuition behind L&P's (2007) model; that governments will choose policies that reduce inequality among factor income shares, as reducing inequality among the income shares of these groups of goods reduces the inequality among factor income shares. Given the note earlier that the import-competing sector is assumed to be smaller more often than the exporting sector, this means that import-protecting policies, or anti-trade policies, will be the policy choice preferred more often. This is precisely the result that L&P (2007) were aiming for.

The marginal effect on the left hand side of equation (3.16) is not something that can operationalised as a dependent variable in a structural empirical model. This is due to the marginal effect involving the utility level of the government, a measure that is required in order to estimate this value. Measuring a utility level is not realistic, as it is not observed, and estimating it would likely be inaccurate. The approach that other models have used is to derive an optimal tariff function, and use it as a basis for a structural estimating equation (see Goldberg and Maggi, 1999; Gawande and Bandyopadhyay, 2000; McCalman, 2004; Mitra *et al.*, 2002; Mitra *et al.*, 2006; Gawande and Hoekman, 2006). In order to thoroughly assess our empirical options, we now present what an optimal tariff would look like for L&P's (2007) objective function, using groups of goods as defined by trade status for our sectors, and with the functional form for inequality defined in equation (3.14).

For this analysis, we largely follow the process outlined in L&P (2004) in order to derive an optimal tariff. The major difference is the use of L&P's (2007) objective function, as presented in equation (3.5). In this case, the first step is to insert functional forms for the inequality and welfare functions directly into equation (3.5). In order to set functional forms, we use our own sector definitions of import-competing versus exporting sectors, assuming mobile factors, as opposed to that of L&P (2004, 2007) which use factor owners and the specific factors model. For welfare we note that L&P (2007) assume that the function is simply a summation of utilities, which is how we define the welfare function, as well. For inequality, we use our chosen functional form, as presented in equation (3.14). In order to make the analysis clearer, we work with only one ordering of relative income shares at a time, starting with the case where the import-competing sector has the smaller relative income share. We note the alternative case after the optimal tariff is determined.

Inserting the functional forms into the objective function denoted in equation (3.5):

$$G(U) = \alpha\big(-(U^X - U^M)\big) + (1-\alpha)(U^X + U^M) \tag{3.17}$$

We can now replace the utilities in equation (3.17) with the utility functions defined in equation (3.2). Factoring the revenue/expenditure portion out, and noting that the import good 1 in L&P (2007) is analogous to our import-competing sector, M, we get:

$$G(U) = \frac{(R(.)-tR_M(.))}{(e(.)-te_M(.))}\left[\alpha\left(-(\theta^X - \theta^M)\right) + (1-\alpha)(\theta^X + \theta^M)\right] \quad (3.18)$$

In order to isolate the tariff term, we take the natural log of equation (3.18) giving us:

$$\ln G(U) = \ln[-\alpha(\theta^X - \theta^M) + (1-\alpha)(\theta^X + \theta^M)] + \ln\left(R(.) - tR_M(.)\right) - \ln\left(e(.) - te_M(.)\right) \quad (3.19)$$

Taking the derivative of equation (3.19) with respect to the tariff level:

$$\frac{1}{G}\frac{dG}{dt} = \frac{-\alpha\left(\theta_t^X - \theta_t^M\right) + (1-\alpha)\left(\theta_t^X + \theta_t^M\right)}{-\alpha(\theta^X - \theta^M) + (1-\alpha)(\theta^X + \theta^M)} + \frac{-tR_{MM}}{R - tR_M} - \frac{-te_{MM}}{e - te_M} \quad (3.20)$$

The next six steps involve simplifying the revenue and expenditure portions of equation (3.20). Our analysis for this portion of the equation does not differ from L&P (2004), and we follow their simplification exactly, clarifying with intermediate steps where needed. L&P (2004) note that $R - tR_M$ is equivalent to I^*, or the value of total output at world prices, and that $e - te_M$ is equivalent to $I^*/\sum_j U^j$, or the ratio of the value of total output to the total level of utility. With this in mind, equation (3.20) can be rewritten as follows:

$$\frac{1}{G}\frac{dG}{dt} = \frac{-\alpha\left(\theta_t^X - \theta_t^M\right) + (1-\alpha)\left(\theta_t^X + \theta_t^M\right)}{-\alpha(\theta^X - \theta^M) + (1-\alpha)(\theta^X + \theta^M)} - \frac{t}{I^*}\left[R_{MM} - e_{MM}\sum_j U^j\right] \quad (3.21)$$

L&P (2004) argue that the $\left[R_{MM} - e_{MM}\sum_j U^j\right]$ from equation (3.21) is equivalent to the ratio of the imports of import-competing goods, M_M, to the tariff rate, multiplied by the absolute value of the own-price compensated elasticity of demand for imports of import-competing goods, η_{MM}. To show this equivalency, we first note that $\left[R_{MM} - e_{MM}\sum_j U^j\right]$ is the derivative of $\left[R_M - e_M\sum_j U^j\right]$ with respect to the price of import competing goods. Given this, equation (3.21) can be rewritten as follows:

$$\frac{1}{G}\frac{dG}{dt} = \frac{-\alpha(\theta_t^X - \theta_t^M) + (1-\alpha)(\theta_t^X + \theta_t^M)}{-\alpha(\theta^X - \theta^M) + (1-\alpha)(\theta^X + \theta^M)} - \frac{t}{I^*}\left[\frac{\partial R_M}{\partial p_M} - \frac{\partial e_M \sum U^j}{\partial p_M}\right] \quad (3.22)$$

This allows us to make the conversion from equation (3.21) to equation (3.26), as in L&P (2007), in four steps. The first step is to collect the contents of $\left[\frac{\partial R_M}{\partial p_M} - \frac{\partial e_M \sum U^j}{\partial p_M}\right]$ in equation (3.22) into one derivative and convert it into its negative form:

$$\frac{1}{G}\frac{dG}{dt} = \frac{-\alpha(\theta_t^X - \theta_t^M) + (1-\alpha)(\theta_t^X + \theta_t^M)}{-\alpha(\theta^X - \theta^M) + (1-\alpha)(\theta^X + \theta^M)} - \frac{t}{I^*}\left[\frac{-\partial(e_M \sum U^j - R_M)}{\partial p_M}\right] \quad (3.23)$$

Next, we multiply $\left[\frac{-\partial(e_M \sum U^j - R_M)}{\partial p_M}\right]$ from equation (3.23) by two fractions that are equal to one. The first makes use of a modification of a function defined in L&P (2004), and equivalently used in L&P (2007), as the import demand for good 1 (their import good). The function is $\left(e_1 \sum U^j - R_1\right)$, which using our equivalent for the import good, import-competing goods, is converted to $\left(e_M \sum U^j - R_M\right)$. We multiply the square brackets in equation (23) by this term divided by itself, which is equivalent to one. Secondly, we note L&P's (2004) assumption, which is also made in L&P (2007), that the world prices of all goods are equal to unity. We follow this assumption for simplicity. By making this assumption, we can set $(1+t)$ equal to the price of import-competing goods[13]. Thus, multiplying by the price of import-competing goods over one plus the tariff rate is also equivalent to multiplying by one. Thus, we can rewrite equation (3.23) as follows:

$$\frac{1}{G}\frac{dG}{dt} = \frac{-\alpha(\theta_t^X - \theta_t^M) + (1-\alpha)(\theta_t^X + \theta_t^M)}{-\alpha(\theta^X - \theta^M) + (1-\alpha)(\theta^X + \theta^M)} - \frac{t}{I^*}\left[\frac{(e_M \sum U^j - R_M)}{(1+t)} \frac{-\partial(e_M \sum U^j - R_M)}{\partial p_M} \frac{p_M}{(e_M \sum U^j - R_M)}\right] \quad (3.24)$$

Here, we note that, assuming that demand for imports of import-competing goods as defined in L&P (2004) equal actual imports of import-competing goods, we can substitute actual imports, M_M, for $\left(e_M \sum U^j - R_M\right)$ in equation (3.24):

$$\frac{1}{G}\frac{dG}{dt} = \frac{-\alpha(\theta_t^X - \theta_t^M) + (1-\alpha)(\theta_t^X + \theta_t^M)}{-\alpha(\theta^X - \theta^M) + (1-\alpha)(\theta^X + \theta^M)} - \frac{t}{I^*}\left[\frac{M_M}{(1+t)} \frac{-\partial(M_M)}{\partial p_M} \frac{p_M}{M_M}\right] \quad (3.25)$$

We can now convert equation (3.25) into a function similar to equation (10'') in L&P (2004, pp. 13) by noting that $\frac{-\partial(M_M)}{\partial p_M}\frac{p_M}{M_M}$ is the negative of the own price compensated elasticity of demand for imports of import-competing goods. Considering that the elasticity is a negative number, this is effectively the absolute value of that elasticity, or η_{MM}. Thus, equation (3.25) can be simplified as follows:

$$\frac{1}{G}\frac{dG}{dt} = \frac{-\alpha(\theta_t^X - \theta_t^M) + (1-\alpha)(\theta_t^X + \theta_t^M)}{-\alpha(\theta^X - \theta^M) + (1-\alpha)(\theta^X + \theta^M)} - \frac{t}{I^*}\frac{M_M}{(1+t)}\eta_{MM} \quad (3.26)$$

[13] If we relax the assumption that all world prices are equal to unity, and allow them to be any number, though remaining equal to each other, the price of import-competing goods will equal $W(1+t)$, where W is the world price. When we isolate the optimal tariff in equation (3.26), below, the function for the optimal tariff will now be $\frac{1}{W(1+t)}$, which does not alter the interpretation of the optimal tariff.

Now, we can simplify $\frac{-\alpha(\theta_t^X-\theta_t^M)+(1-\alpha)(\theta_t^X+\theta_t^M)}{-\alpha(\theta^X-\theta^M)+(1-\alpha)(\theta^X+\theta^M)}$ from equation (3.26) by noting that the sum of the marginal effects of a tariff on income shares is zero, and that the sum of the income shares is one[14]. This allows us to rewrite equation (3.26) as:

$$\frac{1}{G}\frac{dG}{dt} = \frac{-\alpha(\theta_t^X-\theta_t^M)}{(1-\alpha)-\alpha(\theta^X-\theta^M)} - \frac{t}{I^*}\frac{M_M}{(1+t)}\eta_{MM} \quad (3.27)$$

To find the optimal tariff that maximises government utility, we set the right hand side of equation (3.27) to zero and solve for the tariff rate:

$$\frac{t}{1+t} = \frac{-\alpha(\theta_t^X-\theta_t^M)}{(1-\alpha)-\alpha(\theta^X-\theta^M)}\frac{1}{\eta_{MM}}\frac{1}{M_M/_{I^*}} \quad (3.28)$$

As several previous empirical assessments of G&H (1994) convert a version of (3.28) into an empirically estimable form[15], an option for assessing L&P's (2007) model would be to convert equation (3.28) in a similar manner. However, some of the variables required to estimate equation (3.28) prevent us from using it as our estimating equation. Data for the ratio of imports to value of output and relative income shares would be available, and import demand elasticities have been estimated on a limited basis[16]. Thus, these variables could be obtained to some extent in order to estimate the parameters of the optimal tariff in equation (3.28) (though the elasticity requirement

[14] The intuition here is the same as it was earlier. See footnote (10) for the explanation.

[15] See Goldberg and Maggi (1999), Gawande and Bandyopadhyay (2000), McCalman (2004), and Mitra *et al.* (2002; 2006) for examples.

[16] Broda *et al*. (2008) estimate their own import demand and export supply elasticities for the limited number of countries that they use. Goldberg and Maggi (1999) borrow elasticities from Shiells *et al.* (1986), as do Gawande and Bandyoadhyay (2000). Mitra *et al.* (2002) require Turkish import demand elasticities, and use both elasticities calculated by Thomakos and Ulubasoglu (2002) and their own calculations. Mitra *et al.* (2006) use elasticities from Thomakos and Ulubasoglu (2002) and Mitra *et al.* (2002) for Turkey, as well as elasticities from the dataset used in Gawande and Bandyopadhyay (2000) for the U.S. McCalman (2004) borrows from Sawers (1988).

would likely preclude the use of longitudinal data). The real difficulty in modelling the optimal tariff into a structural empirical model in our context is the marginal effects of a tariff on income shares. Not only are these unobserved, but calculating them would likely only be possible on a cross-sectional basis. As is noted in the following chapters, we utilise panel data in our empirical model, taking advantage of country fixed effects to control for many unobservable variables. Calculating and using these marginal effects would take away the advantage of fixed effects, and they are not the only unobservable variables that we would like to control for. Given that both the optimal tariff and the marginal effect of the tariff level on government utility analyzed earlier are difficult to model structurally, we utilise a reduced form empirical model. Chapter four provides greater detail on the empirical approach.

The optimal tariff rate from equation (3.28) is useful however, as we can conduct comparative statics to gain intuition about the theoretical model. We can do this by determining the marginal effect of increasing the government's level of concern for inequality, α, on the optimal tariff level. Thus far we have only analysed the case where the import-competing sector must be protected in order to reduce inequality. Intuitively, in this case, if the concern were to increase, the government would have more incentive to increase the tariff rate, as it has an even greater desire to reduce inequality (a tariff being strictly construed as an import protecting measure in this context). In order to establish this analytically, we take the derivative of the optimal tariff rate, equation (3.28), with respect to α:

$$\frac{d(\frac{t}{1+t})}{d\alpha} = \frac{\left[\left(-(\theta_t^X-\theta_t^M)\left((1-\alpha)-\alpha(\theta^X-\theta^M)\right)\right)-(-1-(\theta^X-\theta^M)(-\alpha(\theta_t^X-\theta_t^M))\right]}{((1-\alpha)-\alpha(\theta^X-\theta^M))^2}\frac{1}{\eta_{MM}}\frac{1}{{}^{M_M}/_{I^*}} \quad (3.29)$$

Expanding equation (3.29) within the square brackets:

$$\frac{d(\frac{t}{1+t})}{d\alpha} = \frac{\left[-(1-\alpha)(\theta_t^X-\theta_t^M)-\alpha\left(-(\theta_t^X-\theta_t^M)(\theta^X-\theta^M)\right)+\alpha\left(-(\theta_t^X-\theta_t^M)(\theta^X-\theta^M)\right)-\alpha(\theta_t^X-\theta_t^M)\right]}{((1-\alpha)-\alpha(\theta^X-\theta^M))^2}\frac{1}{\eta_{MM}}\frac{1}{{}^{M_M}/_{I^*}} \quad (3.30)$$

Noting that the terms $-\alpha\left(-(\theta_t^X-\theta_t^M)(\theta^X-\theta^M)\right)$ and $\alpha\left(-(\theta_t^X-\theta_t^M)(\theta^X-\theta^M)\right)$ in equation (3.30) cancel, we are left with:

$$\frac{d(\frac{t}{1+t})}{d\alpha} = \frac{\left[-(1-\alpha)(\theta_t^X-\theta_t^M)-\alpha(\theta_t^X-\theta_t^M)\right]}{((1-\alpha)-\alpha(\theta^X-\theta^M))^2}\frac{1}{\eta_{MM}}\frac{1}{{}^{M_M}/_{I^*}} \quad (3.31)$$

We can now sign equation (3.31) to determine the direction of the marginal effect of a change in α on the tariff level. We know that α is between zero and one, so both α and $(1-\alpha)$ are positive. By definition in L&P (2004), we know that $\frac{1}{\eta_{MM}}$ and $\frac{1}{{}^{M_M}/_{I^*}}$ are both positive, as the elasticity is an absolute value, and the ratio of imports to total value of output contains two variables that are non-negative. The only question concerns the signs on the marginal effects of a change in tariff on income shares and the initial income shares themselves. We have already noted that the marginal effect of an import protecting tariff on the relative income share of the exporting sector is negative. By the same logic, the marginal effect of a tariff on the relative income share of the import-competing sector is positive. The income shares are positive, and since the exporting sector is larger in this case, the difference between the two is positive.

However, this ultimately makes no difference, as the entire denominator of the first term is squared, and thus is positive.

$$\frac{d(\frac{t}{1+t})}{d\alpha} = \left[\overbrace{\frac{\left(\overbrace{\overbrace{-\left(\overbrace{1-\alpha}^{+}\right)\left(\overbrace{\theta_t^X-\theta_t^M}^{-}\right)}^{+} \overbrace{-\left(\overbrace{\alpha}^{+}\right)\left(\overbrace{\theta_t^X-\theta_t^M}^{-}\right)}^{-}}^{+} \right)}{\left(\underbrace{\left((1-\alpha)-\alpha(\theta^X-\theta^M)\right)^2}_{+} \right)} \left(\overbrace{\frac{1}{\eta_{MM}} \frac{1}{M_M/_{I^*}}}^{+} \right)}^{+} \right] \tag{3.31'}$$

Equation (3.31') shows how this signing of equation (3.31) breaks down. We have established above that $((1-\alpha)-\alpha(\theta^X-\theta^M))^2$ and $\frac{1}{\eta_{MM}}\frac{1}{M_M/_{I^*}}$ are positive. There are two separate terms within $[-(1-\alpha)(\theta_t^X-\theta_t^M)-\alpha(\theta_t^X-\theta_t^M)]$. Both terms include $(\theta_t^X-\theta_t^M)$, and this difference is negative. Completing the math results in $[-(1-\alpha)(\theta_t^X-\theta_t^M)-\alpha(\theta_t^X-\theta_t^M)]$ being positive. This means that the entire right hand side of equation (3.31) is positive, and thus, the marginal effect of increasing the concern for inequality on the optimal tariff, in the case where the import-competing sector is the smaller sector, is positive. This suggests that the government will increase the rate of import-protecting tariffs as its concern for inequality grows, in this situation.

We can derive a similar result in the case of the import-competing sector being larger. As defined in equation (3.14), as a result of the absolute value, the function for inequality when the import-competing sector is larger is $I(U) = -(U^X - U^M) = U^M - U^X$. This results in a very similar mathematical analysis, with the only difference being that any reference to the exporting sector or import-competing sector is now reversed. This, of course, excludes $\frac{1}{\eta_{MM}}\frac{1}{M_M/_{I^*}}$, as these terms are derived from the revenue and expenditure functions, and thus are not affected by a change in the inequality function. As every step is essentially the same as when the import-competing sector is smaller, we present only the resultant optimal tariff:

$$\frac{t}{1+t} = \frac{-\alpha(\theta_t^M - \theta_t^X)}{(1-\alpha)-\alpha(\theta^M - \theta^X)}\frac{1}{\eta_{MM}}\frac{1}{M_M/_{I^*}} \tag{3.32}$$

Once again following the same steps, the comparative static on equation (3.32) works down to:

$$\frac{d(\frac{t}{1+t})}{d\alpha} = \frac{[-(1-\alpha)(\theta_t^M - \theta_t^X) - \alpha(\theta_t^M - \theta_t^X)]}{((1-\alpha)-\alpha(\theta^M - \theta^X))^2}\frac{1}{\eta_{MM}}\frac{1}{M_M/_{I^*}} \tag{3.33}$$

As stated above, any term referring to the concern for inequality, as well as $\frac{1}{\eta_{MM}}$ and $\frac{1}{M_M/_{I^*}}$, are positive. Once again, $((1-\alpha)-\alpha(\theta^M - \theta^X))^2$ from equation (3.33) is a squared value, making it positive, so even though the difference in income shares will be positive once again, as it remains the larger sector subtracted by the smaller sector, the sign on the denominator remains positive. The only change from the earlier analysis is in $(\theta_t^M - \theta_t^X)$. Now, we have the marginal effect of an increasing tariff on the income share of the import-competing sector (positive) subtracted by the marginal effect of an increasing tariff on the income share of the exporting sector (negative). This means the difference between the two will be positive.

$$\frac{d(\frac{t}{1+t})}{d\alpha} = \left[\overbrace{\frac{\left(\overbrace{\overbrace{-\left(\overbrace{1-\alpha}^{+}\right)\left(\overbrace{\theta_t^M-\theta_t^X}^{+}\right)}^{-} - \overbrace{\left(\overbrace{\alpha}^{+}\right)\left(\overbrace{\theta_t^M-\theta_t^X}^{+}\right)}^{+}}^{-}\right)}{\left(\underbrace{\left((1-\alpha)-\alpha(\theta^M-\theta^X)\right)^2}_{+}\right)}}^{-} \left(\overbrace{\frac{1}{\eta_{MM}}\frac{1}{M_M/_{I^*}}}^{+}\right) \right] \qquad (3.33')$$

As before, equation (3.33') shows how the signing of equation (3.33) breaks down. Once again, $\left((1-\alpha)-\alpha(\theta^M-\theta^X)\right)^2$ and $\frac{1}{\eta_{MM}}\frac{1}{M_M/_{I^*}}$ are positive. Since the difference between the marginal effects of a tariff on the income share of the import-competing sector and the exporting sector is now positive, completing the math results in $[-(1-\alpha)(\theta_t^M-\theta_t^X)-\alpha(\theta_t^M-\theta_t^X)]$ being negative. The resulting overall effect is thus negative, meaning that the marginal effect of increasing concern for inequality on the optimal import-protecting tariff rate, when the exporting sector is smaller, is negative. This suggests that the government desires to reduce the level of import-protecting policies as its concern for inequality increases in this situation.

These analyses support the notion that the government will put into place policies that protect the sector that has a lower income share. Thus, our theoretical results are consistent with the motivation for L&P's (2007) theory, since it was shown earlier that the most common scenario, when trade exists, is the case where the import-competing sector is smaller. Thus import protecting, or anti-trade, policies will be more common. Neither of the analytical approaches presented above, the marginal effect of a change in tariff level on government utility or the optimal tariff, provide us with a structural equation upon which we can build an empirical model. Thus, we note the effect of concern for inequality on policy choice and convert this notion into a reduced form model. The next chapter describes the empirical model in detail, motivating both the connection with the theory presented here, and the variables that we utilise to specify the model.

Chapter 4: Empirical Model

4.1. Model Specification

The estimation of a structural econometric model based on the theory in the previous chapter is difficult, as discussed earlier. The marginal effect of a change in tariff level on government utility does not provide an easily measured dependent variable, and the politically optimal tariff, which is often used in empirical assessments of theory in the G&H (1994) string of literature, includes a number of variables that are either unobservable or difficult to use in a panel framework.

Thus, in order to assess the L&P (2007) model empirically, we use a reduced form econometric model. This is done by adapting the implications of the theory derived in the previous chapter into an econometric model. The starting point is the dependent variable. Two factors determine the sign on the marginal effect of a change in tariff level on government utility; 1) whether the tariff refers to an import-protecting policy or an export-promoting policy, and 2) the ordering of the relative income shares of sectors (net-imported and net-exported goods). If a policy protects imports, then the marginal effect is positive if import-competing goods have the smaller relative income share, and negative if the exporting goods have the smaller relative income share. If a policy promotes exports, then the marginal effect has the opposite sign in each income share ordering. This means that as inequality between sectors becomes relatively larger, the governmental preferences for tariffs and export subsidies move in opposite directions. Thus, we require a dependent variable that captures both of these effects as an overall measure of relative support to import-competing and exporting goods. A trade bias index, or the ratio of support for exporting goods to the support for import-competing goods, fits this need.

To test L&P's (2007) model, we include inequality as an independent variable. Theory shows that the size of inequality partially determines the size and sign of the optimal tariff, where a positive optimal tariff is an import-protecting policy, and a negative optimal tariff is an export-promoting policy. It also shows that an import-protecting policy has a positive marginal effect on government utility when the import-competing sector has a smaller income share, and a negative marginal effect when the exporting sector has the smaller income share. The opposite is true for an export-promoting policy. Thus, we can assess whether the size and direction of inequality has the effect on trade policy that can be predicted based on the theory of L&P (2007). Inequality can be measured using the functional form defined in equation (3.14).

With this basic format in mind, we present our static econometric model. All variables are described in detail and motivated later in this chapter. The baseline estimating equation is

$$\begin{aligned} TB_{it} = {} & \alpha_0 + \alpha_1 Ineq_{i(t-\bar{J})} \cdot MSmall_{i(t-\bar{J})} \cdot Developed_{it} + \alpha_2 Ineq_{i(t-\bar{J})} \cdot XSmall_{i(t-\bar{J})} \cdot Developed_{it} + \\ & \alpha_3 Ineq_{i(t-\bar{J})} \cdot MSmall_{i(t-\bar{J})} \cdot Developing_{it} + \alpha_4 Ineq_{i(t-\bar{J})} \cdot XSmall_{i(t-\bar{J})} \cdot Developing_{it} + \\ & \alpha_5 WRI_{i(t-\bar{J})} + \alpha_6 WTO_{it} + \alpha_7 MShare_{i(t-\bar{J})} + \alpha_8 XShare_{i(t-\bar{J})} + \alpha_9 Urbanization_{it} + \alpha_{10} Year_{it} + \\ & \alpha_N PTA_{it} + \varepsilon_{it} \end{aligned} \tag{4.1}$$

The data are available in panel form for a wide range of countries and over a time series that averages nearly 32 years, with i denoting country, t denoting year, and $\bar{J}$ denoting the average of j previous lags in equation (4.1). TB_{it} denotes the trade bias of a country's agricultural policy, which is the ratio of support for exporting goods relative to support for import-competing goods. $Ineq_{i(t-\bar{J})}$ denotes the level of inequality in income share between the export sector and the import sector. $MSmall_{i(t-\bar{J})}$ and $XSmall_{i(t-\bar{J})}$ are binary variables taking the value of one if import-competing goods or exporting goods have the smaller relative income share, respectively. $Developed_{it}$ and $Developing_{it}$ are binary variables indicating whether a country is developed or developing, respectively. $WRI_{i(t-\bar{J})}$ denotes Welfare Reduction Index, a measure of the welfare cost of policy. WTO_{it} is a binary variable recording whether a country was a member of the General Agreement on Tariffs and Trade (GATT) or the World Trade Organization (WTO) in a given year. $MShare_{i(t-\bar{J})}$ and $XShare_{i(t-\bar{J})}$ measure the country's share of world imports of its import-competing goods and world exports of its exporting goods, respectively, in each year. $Urbanization_{it}$ is a measure of the urbanization of a country in a given year. $Year_{it}$ is a time trend. PTA_{it} is a vector of binary variables referring to one of five regional preferential trade agreements, the North American Free Trade Agreement (NAFTA), the Common Agricultural Policy (CAP) of the European Union (EU), the Andean Community, the *Mercado Común del Sur* (MERCOSUR), and the Association of Southeast Asian Nations (ASEAN). Each variable is described in more detail below.

The use of panel estimation methods is one of the areas where this project is a contribution to the literature. Previous empirical efforts, such as Dutt and Mitra (2002; 2005) and Broda *et al.* (2008) utilise cross-country specifications for assessing the significance of various possible determinants of trade policy. Goldberg and Maggi (1999), Gawande and Bandyopadhyay (2000), Gawande and Hoekman (2006), and Mitra *et al.* (2006) utilise cross-industry specifications as they attempt to estimate the parameters of the G&H (1994) model. Mitra *et al.* (2002) attempt to estimate the parameters of the G&H (1994) model using both single year, cross-industry estimation and panel estimation, but use only four years of Turkish data, across 37 product categories. Dutt and Mitra (2009) is also an example of panel estimation, though the model is based on the median voter model, which is briefly explained in the chapter two.

Panel estimation methods allow for a more robust assessment of the determinants of trade policy than cross-sectional or time series models. The large variation in policies among countries necessitates the inclusion of cross-sectional data. However, the time series aspect of the data allows for analysis across different institutional and regulatory eras, allowing us to include information from earlier time periods that may exhibit trade policy patterns that are somewhat different than are currently observed. Another advantage of the use of panel estimation is the ability to utilize country fixed effects. We feel that there may be a number of country specific cultural, political, or institutional factors that are invariant over time, but unique to the country in question. We would not be able to control for these in a time series model, as they are invariant over time, and controlling for them in a cross-sectional model would be difficult, as the factors are unobservable, and good proxies are not available. Thus, by controlling for their effects using fixed effects, we are able to remove their influence from the coefficients on other variables, while not creating further difficulties by measuring them improperly.

The variables that calculated for $(t-\bar{J})$ time periods are calculated as the average of the lags of the previous four or five years[17]. These variables, collectively L below, are computed using the following formula:

$$L_{i(t-\bar{J})} = \sum_{j=1}^{5} \frac{L_{i(t-j)}}{5} \quad (4.2)$$

The rationale for using lagged values for some of the independent variables is twofold. First, there is a high probability of endogeneity between these variables and the trade bias variable. Since it is plausible that changing the direction of support will alter production levels, and therefore trade levels, in the current year, variables directly tied to production or trade levels must be lagged in order to ensure that they are not affected by trade policy decisions in the current year. The Welfare Reduction Index (WRI) also falls into this category, as it is calculated directly from the amount of price distortion, and thus the same trade policy decision will affect both the measurement of the WRI and the trade bias. The second reason for lagging is that these variables can only affect policy prior to the government setting the policy. The government will make

[17] In cases where data do not exist for the variable for all of the previous five years, this average of lags may also be calculated for four years, in which case 5 is replaced by 4 in equation (4.2). This is the lowest number of observations that are used, however. Any case where less than four of the previous five years are available is excluded from the static empirical model.

its policy choice before implementing it, meaning that the government can only consider factors that are previously determined when making its choice. We can only ensure the use of predetermined factors by excluding data from the current year for these variables.

These considerations restrict us to using lagged data for most variables. The WTO/GATT variable and all of the variables representing PTAs are exceptions, as a country's status in these agreements in the year in question is known prior to the start of the year in question. The lag is calculated as a five year average to smooth some of the volatility of agricultural production[18]. Data on agricultural production and value is volatile because it can be affected by changing prices, weather conditions, disease outbreaks that close trading markets and other variables. Thus, we do not want to use only one lag to instrument for the endogenous variables since an individual year's value may be quite different than surrounding years. Using a five year lagged moving average creates a lagged value that is closer to what might be considered typical values for these variables. A government may be more likely to base their policy decision on recent typical values than on a single value from a potentially atypical year.

The two binary variables regarding the relative size of each sector are not calculated from direct lags of themselves, but do reflect lagged information. Once the inequality variable is calculated based on a lagged average, this measure is used to determine which binary variable is triggered, based on the resulting sign of the

[18]As can be inferred from this statement, we use agriculture specific data. The rationale for this is explained in chapter five.

inequality calculation. Therefore, they are not lagged averages, which would jeopardize the binary status of the variables, but rather binary variables based on information lagged for five years. This allows the variables to represent information known *a priori* to policy makers, while retaining their binary status.

The econometric model defined in equation (4.1) is a static model. A static model assumes that the value of the dependent variable is not dependent on previous values of itself. We feel that this could be an incorrect assumption in this case, as there is literature supporting the notion of policy persistence, or status quo bias, in government policy. Fernandez and Rodrik (1991) show that there is a status quo bias with regards to government policy that prevents a change in policy, even if a new policy would be more efficient than the one currently in place. A rationale for this is that there is uncertainty over who will gain or lose from the change in policy. Coate and Morris (1999) argue that policy persistence is a result of economic agents changing their behaviour in order to benefit from a policy, then using those benefits to lobby the government to keep the policy in place. Alesina and Drazen (1991) argue that delays in the adoption of even Pareto-improving policies are a result of disagreements about how to implement and distribute the policy. Given that there is a string of literature arguing that policy persistence exists, and given that it is intuitively pleasing that the policy set in one period is difficult to change in the next, we feel that we should utilize a dynamic model as an alternative econometric approach.

$$TB_{it} = \alpha_0 + \alpha_1 Ineq_{i(t-\bar{J})} \cdot MSmall_{i(t-\bar{J})} \cdot Developed_{it} + \alpha_2 Ineq_{i(t-\bar{J})} \cdot XSmall_{i(t-\bar{J})} \cdot Developed_{it} + \alpha_3 Ineq_{i(t-\bar{J})} \cdot MSmall_{i(t-\bar{J})} \cdot Developing_{it} + \alpha_4 Ineq_{i(t-\bar{J})} \cdot XSmall_{i(t-\bar{J})} \cdot Developing_{it} + \alpha_5 WRI_{i(t-\bar{J})} + \alpha_6 WTO_{it} + \alpha_7 MShare_{i(t-\bar{J})} + \alpha_8 XShare_{i(t-\bar{J})} + \alpha_9 Urbanization_{it} + \alpha_{10} Year_{it} + \alpha_{11} TBI_{i(t-1)} + \alpha_N PTA_{it} + \varepsilon_{it} \quad (4.3)$$

A dynamic approach suggests, at the minimum, the inclusion of the first lag of the dependent variable, $TBI_{i(t-1)}$, on the right hand side of equation (4.1), represented in equation (4.3)[19]. Nickell (1981) notes that the inclusion of a lagged dependent variable will create a bias in dynamic panels, which results from the lagged dependent variable being correlated with the fixed effects in the error term. An example of how this occurs is given in Roodman (2006), which describes the effect of a shock to one panel unit that occurs in a certain year as a result of a factor which is not explained in the econometric model in question. This shock will not only affect the specific fixed effects of that panel unit, but also the subsequent year's lagged dependent variable. Thus, when an ordinary least squares estimation is run on these data, the lagged dependent variable is credited with predictive power which actually results from a shock to an unobserved factor. This means that the coefficient on the lagged dependent variable is biased. Furthermore, Roodman (2006), Nickell (1981), and Bond (2002) all argue that using fixed effects does not eliminate the bias, as the transformed lagged

[19] An exploration of the inclusion of further lags of the dependent variable shows that the second lagged dependent variable is also significant, and possibly should be included, but that no further lags should be. We test whether including only one lag controls autocorrelation in the model by using the Ljung-Box test as proposed by Ljung and Box (1978), testing on individual panels. We find that after including one lag, autocorrelation is no longer present in the residuals of the majority of panels. This suggests that autocorrelation is adequately controlled without including a second lag. Given a lack of literature regarding the inclusion of a second lagged dependent variable in fixed effects models, we are unsure of what other econometric issues, such as the introduction of multicollinearity, the exacerbation of dynamic panel bias, or other issues, that may result from this approach. Thus, we choose to include only the first lagged dependent variable in our dynamic model.

dependent variable remains correlated with the transformed error, as both are transformed into deviations from the mean. Nickell (1981) also finds that if exogenous variables are related to the lagged dependent variable, then their coefficients are also biased, with an upward bias resulting from a positive relationship, and a downward bias resulting from a negative relationship.

Bond (2002) and Roodman (2006) note two related methods that are commonly used as remedies for the dynamic panel bias issue. Following from the description in Bond (2002), the roots of the first method are in the work of Anderson and Hsiao (1981, 1982), which proposes transforming the original dynamic estimating equation by taking its first difference to find a starting value that eliminates individual fixed effects. Bond (2002) notes that in the Anderson and Hsiao (1981, 1982) method, the first difference of the error term remains dependent on the lagged dependent variable. Bond (2002) notes that the second lag of the dependent variable is uncorrelated with the first differenced error term, and thus is available as an instrument for the lagged dependent variable, which results in consistent two stage least squares (2SLS) estimation. Bond (2002) also notes that further lags are available as additional instruments[20]. However, 2SLS estimation is not asymptotically efficient when using the full vector of available instruments, since if the time series is longer than three time periods, the model is then overidentified, and the first differenced error term has serial correlation in the form of a first order moving average (Bond, 2002). Holtz-Eakin *et al.* (1988), along with Arellano

[20] Though it is not noted at this point in Bond (2002), it is noted later in the paper that all endogenous variables have to be instrumented for, as they are also correlated with the error term. Bond (2002) states that the issue can be dealt with by instrumenting with lagged values, similar to the method for the lagged dependent variable.

and Bond (1991), improve upon this concept by developing a first-differenced Generalized Method of Moments (GMM) estimator, under the GMM framework of Hansen (1982), using an instrument matrix of lagged levels (second lag and further) of the dependent variable (Bond, 2002). Roodman (2006) states that when estimating with 2SLS, using this instrument matrix to instrument for the first-differenced dynamic equation improves efficiency, but the fact that the first differenced error terms are not independent remains a problem. Roodman (2006) argues that this problem can be addressed with feasible GMM methods. Arellano and Bond (1991) are credited with first proposing using first differencing with GMM, and thus the method is often referred to as Arellano and Bond (1991) Difference GMM (Roodman, 2006).

Bond (2002) states that in cases where a dynamic model has near unit root properties, for the first-differenced equation, the instrument set will likely be weak, noting that Blundell and Bond (1998) show this to be the case. Bond (2002) also notes that Arellano and Bover (1995) find that it may be reasonable to assume that the first differences of endogenous variables are uncorrelated with the error term, and thus can be used as instruments for the original dynamic equation. Roodman (2006) notes that Blundell and Bond (1998), building on these two findings, develop an alternative approach related to Difference GMM. The method creates a stacked set of equations, one using instrumented endogenous variables with their own first differences, and one retaining the Difference GMM approach (Roodman, 2006). Since both equations are assumed to have identical relationships among their variables, the stacked set of equations is then estimated as a single equation with GMM (Roodman, 2006). This approach is often referred to as System GMM (Roodman, 2006).

Roodman (2009), however, notes that in panels, as the time series length grows, the number of instruments that are created by these estimators can become quite large, as the number of instruments is quadratic in the time series length. This may overfit the endogenous variables, which reduces the amount of endogeneity that is eliminated by instrumentation, therefore generating biased coefficient estimates in the same direction that the bias would take without instrumentation (Roodman, 2009).

Roodman (2009) notes that methods for reducing instrument count while retaining the basic estimation structure include limiting the amount of lags available for the Difference GMM equation by reducing the maximum lag length available for use as an instrument, and collapsing the instrument matrix[21]. The method of limiting the available lag length results in being able to limit the instrument count as far as one per time period in the time series. The second method takes the original instrument matrix, where each column representing an instrument contains just one value, an available lagged value, in the row representing the time period for which it is available as an instrument (Roodman, 2009). For the differenced equation, this means that the instrument count is equal to the sum of individual instruments over each time period, which grows by one each additional time period (Roodman, 2009). Collapsing the

[21] Both methods are also available for the system equation, though the first method does not affect the instrument count, as there is only one available instrument per time period for this equation, the first differenced value. The second method results in a matrix of one column for the system equation, which includes each differenced level (Roodman, 2009).

matrix adds unique columns horizontally, and results in a matrix where each column (instrument) contains all the available instruments for a time period (Roodman, 2009). The first column represents the last time period, and includes all its possible instruments from lags, which is from time period one to time period $t-2$ (Roodman, 2009). Each subsequent column includes one less available lagged value, and continues until the third time period, where only the first time period's value is available as an instrument (Roodman, 2009). This results in limiting the instrument count to two less than the time series length for each instrumented variable. Roodman (2009) also argues that testing the restriction of lags for robustness is imperative in order to identify the existence of dynamic panel bias.

Furthermore, Nickell (1981) notes that as time series length grows, the amount of dynamic panel bias falls, arguing that the bias in the coefficients goes to zero as the number of time periods grows to infinity. Simulations performed by Judson and Owen (1999) on the least squares dummy variable estimator also suggest that the bias in the coefficient on the lagged dependent variable decreases as the time series lengthens, and that the bias in the coefficients of other variables is less severe than the bias in the coefficient on the lagged dependent variable. Judson and Owen (1999) also recommend the use of the least squares dummy variable procedure[22] for unbalanced panels with a time series length of at least 30; our average time series, after dropping years that have less than four lags available[23], is just under 32. This suggests that the appropriate

[22] This is the same procedure as using individual fixed effects (Roodman, 2006).
[23] See the lag procedure description, along with equation (4.2), above.

estimation method may be to simply include the lagged dependent variables in our static model (equation (4.1)), as our average time series length is similar to the length of unbalanced panels for which Judson and Owen (1999) recommend this strategy.

There are advantages and disadvantages to utilizing GMM estimation methods and including the lagged dependent variables in our fixed effects model. For GMM methods, the advantage is the elimination of any dynamic panel bias that may exist. The disadvantage is that the instrument count in our model may be very high as a result of the length of our time series, creating bias as a result of not eliminating existing endogeneity. For the non-GMM dynamic fixed effects model, the advantage is that bias from too many instruments is avoided, as no instruments are used. The disadvantage is that if dynamic panel bias exists, it is not controlled for. Since our average time series length is longer than the length for which Judson and Owen (1999) suggest using the least squares dummy variable procedure, we feel that the option that presents the lowest risk of biased coefficients is the non-GMM dynamic fixed effects model. Thus, the non-GMM dynamic fixed effects model is the only dynamic estimation that is reported.

4.2. Definition of Variables

The remainder of this chapter defines our variables and provides motivation for their inclusion.

4.2.1. Trade Bias

We measure trade bias with the TBI from the Distortions to Agricultural Incentives database (Anderson and Valenzuela, 2008) compiled by the World Bank. The variable measures the amount of assistance to net exporting goods relative to net import-competing goods (as defined by the good's trade status in the World Bank database (Anderson and Valenzuela, 2008), and is agriculture specific. The index is calculated as:

$$TB = \left[\left({(1 + NRA\_X)}/{(1 + NRA\_M)} \right) - 1\right] \tag{4.4}$$

where NRA_X and NRA_M are the overall rates of assistance, as a percentage of production, to export and import goods, respectively. These measures are weighted average aggregations of individual Nominal Rates of Assistance (NRA) for each product that falls under each trade status category (the net exporting goods and net import-competing goods, referenced above). The individual product NRAs measure support to each product through border price controls, direct producer support, and support through inputs; this will capture import taxes (tariffs and quotas), export subsidies, direct production subsidies, and any distortions in the domestic market for inputs used in the production of that commodity (Anderson *et al.*, 2008). Therefore, a situation where exports are more heavily subsidized creates a larger number, and vice-versa. Subtracting one from the ratio means that more support to exports is a positive (pro-) trade bias, and more support to imports is a negative (anti-) trade bias.

4.2.2. Inequality

The explanatory variable of concern in this model is the inequality variable. This variable is calculated as:

$$INEQ_{it} = {(X_{it} - M_{it})}/{Val_{it}} \tag{4.5}$$

X_{it} is the total production value of goods which are considered exporting goods for a country in a given year. M_{it} is an equivalent measure for import-competing goods. Val_{it} is the total value of production of both import-competing and exporting agricultural goods for the same country in that year. Production values are obtained from the World Bank database (Anderson and Valenzuela, 2008).

This measure allows for a simple comparison of production values, and thus gross income levels, of the two sectors. As we motivate earlier in the chapter three, we use sectoral income inequality in an attempt to follow L&P's (2007) theory, where the government considers income inequality among two factors of production (at least in the HO model approach), for which we assume each of our two sectors to be relatively intensive in one or the other. The greater the gap between production values for the two sectors, the greater the level of inequality. This difference is normalized by the production value of that year to control for the inherent variability of agricultural production, as well as the natural inflation in production values over time. As noted in Fossett and South (1983), a ratio of means between two groups violates only one principle of conceptually accurate intergroup inequality measures (comparing incomes of groups, as opposed to individuals), symmetry. Fossett and South (1983) argue that this can be solved by transforming the ratio into a difference between the two means and dividing by the overall total value. In essence, our measure satisfies all of the principles that Fossett and South (1983) have identified. The only difference is that we use total sector values as opposed to mean values, as we are analysing two individuals (sectors), as opposed to two categories of individuals. In this sense, the total sector values can be interpreted as means for groups of one.

The coefficients on the four variables involving inequality will be used to assess the role that the level of inequality among sectors plays in determining the level of trade restrictiveness. The coefficients can be interpreted as the responsiveness of trade policy to changes in inequality between import-competing and exporting sectors; *i.e.* the empirical version of the α parameter in L&P's (2007) model. Following from the chapter three, in a situation where the import-competing sector has the smaller relative income share, the government will desire to put into place a more anti-trade policy set, which is represented by a decrease in the TBI. Based on our formula for inequality in equation (4.5), as the value of import-competing goods becomes relatively smaller, the measure for inequality becomes more positive, prompting the government to move the TBI in a negative direction. This suggests a negative coefficient on the inequality variables for cases where the import-competing sector is smaller. Furthermore, we expect this effect to be continuous. Looking at equation (3.28) in the previous chapter, inequality is subtracted from the denominator in the optimal tariff formula, meaning that the optimal import-protecting policy grows as inequality grows when the import-competing sector is smaller. This supports the use of a continuous measure of inequality, as opposed to a binary variable depicting the direction of inequality.

$$\frac{t}{1+t} = \frac{-\alpha\left(\theta_t^X - \theta_t^M\right)}{(1-\alpha)-\alpha(\theta^X-\theta^M)} \frac{1}{\eta_{MM}} \frac{1}{{}^{M_M}/_{I^*}} \tag{3.28}$$

As was noted earlier, a positive value on inequality (import-competing sector is smaller) is only one possible result. We expect that the signs on the coefficients on inequality should be negative when the exporting sector is smaller, as well. Where the exporting sector is smaller, meaning there is a negative sign on inequality, based on equation (4.5), the government desires more export-promoting (pro-trade) policies. This prompts the government to move TBI in a positive direction. Similar to the case where the import-competing competing sector is smaller, we once again expect the effect to be continuous. Looking again to the optimal import-protecting tariff formula in equation (3.28), we note that our theoretical inequality function (equation (3.14)) is an absolute value, and thus is always positive. This means that regardless of the income share ordering, increasing inequality decreases the size of the denominator of equation (3.28), increasing the magnitude of the optimal policy. The only difference in the analysis of the optimal import-protecting tariff when the exporting sector is smaller is that the sign on the optimal import-protecting tariff is now negative as $(\theta_t^X - \theta_t^M)$

becomes $(\theta_t^M - \theta_t^X)$, due to the absolute value in equation (3.14)[24]. This means that the numerator is now negative, making the optimal import-protecting policy negative. Negative import-protecting policy can only be interpreted as export-promoting policy, since it suggests an opposite effect of an import-protecting policy. If a positive import-protecting policy redistributes income from the exporting sector to the import-competing sector, then the opposite effect would be to redistribute income in the opposite direction, which would be the effect of a policy such as an export subsidy. Together, this means that as inequality grows in a negative direction, when the exporting sector is smaller (exporting sector becomes relatively smaller) the optimal tariff becomes an increasingly large export-promoting (pro-trade) policy[25].

However, there is no *a priori* reason to believe that the marginal effects of the inequality level will be the same between the income share orderings. Governments may react more strongly when import-competing goods are the smaller sector, or vice versa[26]. This creates the need to identify the two separate income share ordering situations that may occur in the model; 1) when the import-competing sector is smaller, and 2) when the exporting sector is smaller. Two binary variables are introduced to identify these situations, as an interaction on the inequality variable. Since they are binary variables, the binary variable denoting the case where the import-competing

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[24] Neither of the marginal effects of an import-protecting tariff on the sector income shares change sign in this case. An import-protecting tariff continues to redistribute income from the exporting sector to the import-competing sector, meaning θ_t^M is positive, and θ_t^X is negative.

[25] When the import-competing sector is smaller, as the exporting sector becomes relatively smaller (inequality is decreasing), the optimal tariff only becomes an increasingly small import-protecting (anti-trade) policy.

[26] We note in the chapter three that this is not assumed, and we test this in our empirical model.

sector is smaller takes a value of one when that is the case, and zero otherwise; the opposite is true for the binary variable denoting the case where the exporting sector is smaller. Modelling the equation in this way allows for separate analyses of each situation. The hypothesis for the interaction of both of these variables with inequality is a negative coefficient; we show above why we expect this to be true.

Furthermore, we also identify that there may be differing effects of inequality among developed and developing countries. Whether developing and developed countries have equal concerns about the level of inequality is unclear. Thus, we separate the effect to estimate the difference. Separating the effects in this way does not change our expectation on the coefficients' sign, thus we predict negative coefficients on all four independent variables involving inequality.

4.2.3. Welfare Reduction Index

L&P's (2007) theory states that not only do governments desire to reduce the level of inequality, but they also gain utility from raising the societal utility level. Given the practical difficulties in measuring overall welfare level in a country, our empirical model makes use of another variable in a supplementary portion of the Distortions to Agricultural Incentives database (Anderson and Croser, 2009). The WRI is a measure that captures the loss of welfare as a result of trade policy, which is calculated for each good as being proportional to the squared level of distortion to both producer and consumer price (Lloyd *et al.*, 2009). These commodity specific indices are then aggregated into country-level values, which are used in the empirical model.

The intuitive explanation of how the WRI is calculated is as follows. A level of price distortion is estimated for both the producer and consumer prices of each good, and this distortion is weighted by the good's share of domestic production and consumption, respectively (Lloyd *et al.*, 2009). The values are aggregated into a total producer and consumer price distortion for each country, which are then weighted by the ratio of the marginal response of quantity of supply/demand to a price change to the marginal response of import quantity to a price change (for production/consumption, respectively) (Lloyd *et al.*, 2009). These total levels of distortions to producer and consumer prices are then summed to form the WRI for each country in each year (Lloyd *et al.*, 2009). All price distortions enter the calculation as squared values, so all distortions increase the index, no matter if they are positive or negative distortions of the price (Lloyd *et al.*, 2009). Notably, the WRI is estimated assuming that demand and supply functions for each good in each country are only functions of the good's own domestic price, and that domestic price elasticities of supply and demand are equal for all goods produced in a country (Lloyd *et al.*, 2009). For a full explanation of the calculation process, see Lloyd *et al.* (2009).

Lloyd *et al.* (2009) describe the resulting WRI as representing the uniform import tariff or export subsidy rate that would need to be applied to all goods in order to cause the same amount of welfare loss as the current collection of trade policies in the country in question. This means that the resulting number is a percentage, and is interpreted in the same way as a tariff rate.

Although this measure is crude, it is a measure designed to capture the welfare reducing effects in a given year due to trade policy. Since it is not realistic to obtain data that directly measures welfare, we use this measure as the best available alternative in order to assess the impacts on policy of the welfare loss due to that policy.

The expected sign on the WRI is ambiguous, as we are unsure of the direction past WRI levels will drive trade bias. We included the WRI in recognition of the suggestion in L&P's (2007) theory that the government wishes to maximize overall welfare, which is equivalent to minimizing welfare losses due to policy in this context. This suggests that if a country has high lagged WRI levels, the government will be more inclined to adjust trade policies so that the WRI falls. Based on how the WRI is measured, the only way to do this is decrease support rates, and it does not matter which sector the support is taken from, as the equivalent rate of price distortion for any good produces the same amount of welfare loss. Thus the government can increase welfare by reducing support to either sector, which means that there is no reason to believe that the trade bias is pushed in one direction or the other. This is not to suggest that we predict no effect of this variable. It is possible that reducing support to a certain sector is preferred over reducing support to the other sector when past WRI levels are high, resulting in a significant effect. We are simply unable to predict which sector may be preferred.

4.2.4. WTO/GATT Membership

International trade agreements are aimed at reducing restrictions to trade. If adhered to, signing these agreements should exogenously shift trade bias towards a more neutral level, as many types of support the country was previously engaged in will have to be reduced upon signing an agreement. Furthermore, if a country has signed a trade agreement, they face the possibility of retaliation by other members if they impose greater restrictions on trade, such as increased tariffs or more restrictive quotas. This means that being a signatory of an agreement may constrain the range of possible trade bias values. Swinnen (2009) acknowledges four possible problems with including this variable in models where data refer to specific points in time. These problems include: 1) differences in countries' policy starting points; 2) the agreement impacting the instrument choice instead of support levels; 3) changes may be a result of multiple causes for policy changes occurring simultaneously; and 4) changes occurring as a result of anticipation of signing. For the first issue, the example given by Swinnen (2009) is that European transition countries saw differences in the impact of entering the WTO on their agricultural policy, with an important difference being whether they were part of GATT (citing Anderson and Swinnen (2008) for this example). For the second issue, Swinnen (2009) argues as an example that WTO or GATT accession has had more of an impact on what support instruments are chosen by EU countries, than on the actual level of support. For the third issue, Swinnen's (2009) example is that agricultural policy changes in the EU in the 1990s may be a result of an interaction between both anticipated EU enlargement, and the signing of the Uruguay round. For the fourth issue, Swinnen (2009) argues as an example that ongoing Doha round negotiations impacted the 2003 CAP Reform, a result of anticipating having to meet Doha round commitments. While these issues undoubtedly cloud the picture when trying to assess the impact of trade agreements, the variable is a control, and its inclusion aims to separate the substantial effects of being part of an agreement.

This binary variable on WTO or GATT membership may also be seen as a control for the theory hypothesized by Levy (1999), referenced earlier. The theory that cooperative behaviour between governments could lead to increased anti-trade bias would be irrelevant if the government is required to satisfy the standards of multinational agreements that aim to reduce trade restricting policies. If the coefficient on this variable is significant with a positive coefficient, it could be an indication that governments that are not part of an agreement are engaging in cooperative behaviour in order to facilitate increasingly anti-trade policies, as those that are part of the agreement will show a more positive TBI (at least, a less negative TBI).

Overall, however, we lack a predicted sign on the variable for the WTO and GATT. The rationale is largely the same as that for the WRI. If being part of one of these agreements necessitates a change in trade policy, it is most likely to result in a lowering of support, given the general objective of liberalizing trade. Again, which sector is more affected by this possible reduction in support is unclear, but there is nothing suggesting that it is impossible that one sector sees a greater reduction than the other. Panagariya (2005) does argue that export subsidies are no longer a prominent trade distortion tool for WTO countries. This anecdotal evidence, however, does not supersede our lack of theoretical basis for forming a hypothesis on the sign of the coefficient.

4.2.5. Trade Market Share

The market shares are variables aimed at assessing the market power a country has with respect to the world trade market of the agricultural goods they trade. The use of these variables is motivated by standard trade theory, which suggests that a country with the ability to alter the world price of a good (a large country) can distort domestic prices, and pass off some of the welfare loss that would be caused by the distortion onto its trading partners. In the import market, the large country imposes a tariff, which raises the domestic price for a good. This decreases the domestic excess demand for the good, which lowers the world price, and lowers the domestic price increase as a result of the tariff, restricting the amount of welfare loss for domestic consumers. Since the world price is now lower, exporters of the good now receive lower prices, and thus lose welfare as a result of the large country's policy. A similar effect can be shown for a large exporting country which imposes an export subsidy. This raises domestic price, which increases domestic excess supply of the good, and lowers the world price. Since the world price drops, the loss in domestic consumer surplus is restricted.

This notion is supported by the work of Broda *et al.* (2008), which finds strong evidence that countries with increased market power in import markets impose higher tariff rates, at least when those countries are not restricted by multilateral agreements. Bagwell and Staiger (2011) also find empirical evidence that, for 16 countries that joined the WTO between 1995 and 2005, the pre-negotiation volume of imports has a positive relationship with the amount of tariff cuts that needed to be made to reach their bound tariff level.

While it is important to include market power when modelling trade policy, it is not immediately clear what the best method is for measuring market power. Bagwell and Staiger (2011) measure market power based on pre-agreement import quantities of 6-digit HS level industries. Broda *et al.* (2008) estimate export supply elasticities as direct measures of market power. Estimating elasticities is beyond the scope of this thesis, and we need to go further than trade quantities, as we have panel data, and thus need to normalize the market shares over time. Since our empirical structure requires that we only consider market power in the import market of import-competing goods, and the export market of exporting goods, we cannot utilize aggregate import and export market shares of agricultural goods. Our solution is to utilize the shares of imports in consumption and exports in production for each good, as reported in the World Bank database (Anderson and Valenzuela, 2008). We take these values, multiply them by the total values of consumption and production for each good, as reported in the same database, to calculate values of imports and exports of each good, for each country in each year. We aggregate the values of imports of a country's import-competing goods, and exports of country's exporting goods, individually by country, and by year. To create a share of world trade, we then add up the total value of imports/exports across all reported countries, for each country's import-competing goods, and exporting goods, again creating year and country specific values, and divide the individual country trade values by the world trade values. This method provides a value which represents the country's average market power across all goods in each sector, compared to the other countries in the database. Assuming that the database is not ignoring any significant trade supply or demand, either from other countries, or other goods within the reported countries, this measure is a good sector-specific measure of a country's ability to influence world price and pass off welfare losses resulting from agricultural support.

The expected signs on the import and export market shares reflect the types of policies that countries should be able to impose more freely if they have increased market power. Countries with greater import market share have more market power in the import market, and thus are more able to support import-competing goods. This suggests that the coefficient on the import market share should be negative. Alternatively, countries with greater export market share have more market power in the export market, and thus are more able to support exporting goods. This support shifts the TBI in a positive direction, and thus we expect the coefficient on export market share to be positive.

4.2.6. Urbanization

We include a measure of urbanization as a proxy for a country's level of economic development. The use of a proxy for development level is an attempt to include more information than simply whether a country is developed or not. Furthermore, there are few countries that switch designation over the time period, meaning that fixed effects would drop a binary variable for development status if it was included without being interacted with inequality. Other continuous measures of development, such as the Human Development Index, do not extend far enough back in time for our purposes. Examples of previous studies that provide evidence for the use of urbanization include Carlino and Voith (1992), who find that increased percentage of population in urban areas results in increased productivity for U.S. states; Ades and Glaeser (1999) conclude that the connection between urbanization and development exists as far back as the nineteenth century; and Coulombe (2000) uses urbanization as a proxy for the different economic structures of Canadian provinces.

The rationale for including a development proxy separate from the binary variables that divide the inequality effects is to ensure that we are capturing the differing effect of inequality among the two sets of countries. Without a further control for development, the results for the inequality variables may reflect the effect of low (high) development on policy choice, as opposed to the effect of inequality on policy choice in developing (developed) countries.

An advantage of using urbanization as a proxy for development level is that it may be useful in predicting the trade policy type chosen. Riezman and Slemrod (1987) find support for their hypothesis that as income and sales tax collection costs increase, a country moves towards the use of trade taxes. Kenny and Winer (2006) state that this can be extended to argue that less urbanized countries should have higher trade taxes, based on a similar notion. Kenny and Winer (2006) find support for this; they find that the level of urbanization and trade taxation are inversely related, along with a negative impact of urbanization on the trade tax rate. This result suggests that countries that have larger rural populations are more likely to use trade taxes (i.e. import tariffs and export taxes), which are anti-trade policies. This suggests that we can hypothesize that the coefficient on urbanization is positive, as more urban countries may use more pro-trade policies.

4.2.7. Time Trend

The time trend is included because there may be a difference between the policy choices made in the earlier periods of our data, and those of the later periods. As we show in Figure 5.2 in chapter five, the TBI trend for countries that are part of the WTO or GATT, which make up nearly 85 percent of our data, is moving in a positive direction. This trend provides support for a prediction of a positive coefficient on the year variable. If this trend is accurate, it may also suggest that policy choice is partially determined by the predominant policy pattern in that time period. Including a time trend represents an attempt to control for any change in predominant policy choice from the beginning of our data set to the end.

4.2.8. Preferential Trade Agreements

Being a signatory country to a PTA may also have a significant impact on policy choice, as many of these agreements require a reduction of barriers between the signatory countries. We only include major agreements that are likely to affect trade policy enough to have significant effects on the TBI.

We follow Ghazalian and Cardwell (2010), who choose five agreements: NAFTA, the CAP of the EU, MERCOSUR, the Andean Community, and ASEAN. It is worth noting here that, while they are mutually exclusive, there are many observations where the country is not part of any of the agreements, so we avoid the dummy variable trap.

We lack a prediction on the sign of the coefficient on the regional PTAs, following a similar argument to that of the WTO/GATT variable above. There is no theoretical reason to believe that support to one sector or the other will be reduced more quickly as a result of any agreement on agricultural support in these PTAs. Predicting an effect is further complicated for these agreements, as any effects stemming from an agreement are only applied to a small group of trading partners, though that group may represent a large portion of the country's trade. How these regional agreements affect trade policy with countries that are outside of the agreement is not clear.

4.2.9. Herfindahl Indices

We formulate our empirical model to incorporate G&H's (1994) lobbying hypothesis. Including a variable to control for the lobbying hypothesis is supported by empirical studies by Gawande and Bandyopadhyay (2000), and Goldberg and Maggi (1999), which find evidence that lobbying contributions carry weight in the policy making process. Mitra *et al.*, (2006) finds more restricted support, while Gawande and Hoekman (2006) find support that political organization in agriculture increases support levels to both import-competing and exporting sectors. Unfortunately, lobbying data are not widely available for most of the countries in our dataset. That suggests that our only option is to create a proxy measure of lobbying. We note below that there is a literature that supports the use of Herfindahl indices, a measure of concentration, as a proxy. However, Herfindahl indices are often used to measure the concentration of industries, not the concentration of multi-good sectors. Thus, we are sceptical about the suitability of this measure of concentration in our context. In chapter six, a model specification is presented that includes the Herfindahl indices for each sector, but it will be presented solely as a robustness check to analyse whether the indices capture any of the possible effect of lobbying on trade policy.

Herfindahl indices measure the concentration of goods in the import-competing and exporting sectors, and are calculated using the following formula:

$$Herf = \sum_{i=1}^{N} s_i^2 \tag{4.6}$$

In this formula, s denotes the share of good i of the total value of all N goods in either the import-competing or exporting sector. Because the shares are squared, the index falls as the sector becomes less concentrated and has a range of zero to one. Gawande and Bandyopadhyay (2000) and Gawande (1997) have shown empirically that trade protection is positively correlated to lobbying, using lobbyist spending of industries in the United States as a direct measure for lobbying influence. Gawande (1998) finds that spending by lobbying industries is highly correlated to the concentration of the firms in that industry[27]. Gawande (1998) uses firm concentration as a proxy for the ability of smaller firms in an industry to free ride on larger firms. The

[27] Gawande and Bandyopadhyay (2000), in a secondary model, also find support for this.

hypothesis tested in Gawande (1998) is based on theory initiated by Stigler (1971; 1974) and Olson (1965), and advanced into testable form by Magee *et al.* (1989). These studies find that lobbyist spending by firms will increase if they have less incentive to free ride and more perceived effectiveness of their spending. Gawande's (1998) results show that there is a 28 percent increase in lobbyist spending as concentration of an industry doubles. Based on these studies, there is empirical evidence for the hypothesis that increased lobbyist spending increases trade protection for the industry, and for the hypothesis that increased concentration within the industry increases the amount of lobbyist spending. Therefore, there is support for the notion that the concentration of an industry or sector can be used as a proxy for the amount of lobbyist spending, and thus may be an appropriate control for the influence of lobbies in our empirical model.

The caveat to including this measure is that it is unclear whether a sector that involves many different commodities, even if highly concentrated, will act collectively towards a common goal. There may even be differences in desires among different levels of the supply chain of each commodity, as the different levels may be facing different trade situations for their products. This is different from the industry concentration measure, where all firms are producing the same good, and thus facing the same trade policy for that good. The assumption that would need to be made here is that if, for example, there is a group of commodities defined as import-competing goods, then all commodities in that group will lobby for policies that protect import-competing goods, regardless of whether their action is cooperative or not. The opposite would be true for the exporting sector. The link with concentration would be that the set of government trade policies would shift towards the desires of the lobbying sector, possibly benefiting those in the sector which did not aggressively lobby, something of a "free rider" problem. Therefore, higher concentration lowers the size and number of free riding commodities, strengthening the lobby, and increasing the probability of a successful lobby.

This assumption is not convincing enough to directly include the Herfindahl indices in our baseline model. However, it is plausible enough, given the lack of alternatives, to use it as a robustness check for the possible effects of cooperative lobbying behaviour among goods in the same sector. Thus, we compare a model including the indices to one without them to see whether we can infer any possible support for the lobbying hypothesis from our model.

If we follow the empirical evidence of Gawande and Bandyopadhyay (2000) and Gawande (1997; 1998) that suggests a connection between sector concentration and lobbying effectiveness, we predict that more concentrated sectors are able to obtain greater support for their sectors through lobbying. This means that the marginal effect of increasing concentration of the import-competing sector on TBI is predicted to be negative, as support to the import-competing sector makes the TBI more negative. Conversely, the marginal effect of increasing concentration of the exporting sector on TBI is predicted to be positive, as that sector lobbies for policies which make the TBI more positive.

4.2.10. Lagged Dependent Variable

We motivate the use of a lagged dependent variable earlier in this chapter; here we note that our prediction for the sign on the coefficient on the lagged level of TBI is positive. Given that our motivation for including the lagged dependent variable is that policy persistence may exist, we expect that the sign on the coefficient will be positive, as this suggests the current level of TBI tends towards the past level.

This chapter summarizes the empirical model, and describes and motivates our variables in detail. The next chapter presents our data sources, and provides summary statistics.

Chapter 5: Data Sources and Summary Statistics

In this chapter, we provide an explanation of our data sources and an analysis of summary statistics for our entire dataset.

5.1. Data Sources

In the previous chapter, it is noted that our dependent variable is the TBI from the Distortions to Agricultural Incentives database compiled by the World Bank (Anderson and Valenzuela, 2008). The database calculates TBI for 70 countries[28], for varying numbers of years. We are not able to utilize seven of these countries due to the inability to collect data for other variables in the model[29]. The longest time series dates back to 1955, with the most recent observations in 2007. The shortest time series is for Kazakhstan, which only has TBI calculated from 2000 to 2004. All other countries have TBI calculated at least as far back as 1992, with a number of countries that had been politically aligned with the Soviet Union entering the dataset in that year.

[28] The included countries are Australia, Austria, Bangladesh, Benin, Brazil, Bulgaria, Burkina Faso, Canada, Chad, Chile, China, Colombia, Cote d'Ivoire, Czech Republic, Denmark, Dominican Republic, Ecuador, Egypt, Estonia, Finland, France, Germany, Ghana, Hungary, Iceland, India, Indonesia, Ireland, Italy, Kazakhstan, Kenya, Latvia, Lithuania, Madagascar, Malaysia, Mali, Mexico, Mozambique, Netherlands, New Zealand, Nicaragua, Nigeria, Norway, Pakistan, Philippines, Poland, Portugal, Romania, Russia, Senegal, Slovakia, Slovenia, South Africa, Spain, Sri Lanka, Sudan, Sweden, Switzerland, Taiwan, Tanzania, Thailand, Togo, Turkey, Uganda, United Kingdom, Ukraine, United States, Vietnam, Zambia, and Zimbabwe.

[29] The countries that we cannot use are Benin, Burkina Faso, Chad, Iceland, Mali, Taiwan, and Togo. For the five African nations, the World Bank database does not include measures of the WRI. For Iceland and Taiwan, the shares of imports in consumption and exports in production are not reported in the World Bank database, and thus we cannot calculate overall market shares.

We use the TBI as our dependent variable because it captures levels of both import-protecting and export-promoting policies simultaneously[30]. The database covers agricultural products, and thus the TBI measures the ratio of support between exporting and import-competing agricultural products. This means that the remainder of our data must be calculated or obtained from agricultural data as well.

The primary reason for the use of agricultural data is that it allows us to test the predictions of L&P's (2007) model in the context of an industry which continues to receive significant amounts of support, both in the form of border price controls and as domestic support. The Organisation for Economic Co-operation and Development (OECD) estimates that in 2009, their measure of protection for agriculture, the Producer Nominal Protection Coefficient, was 1.13 combined for all OECD countries (OECD, 2010a). The Producer Nominal Protection Coefficient is a ratio of the average price a producer receives and the border price (OECD, 2010b), and thus a number greater than one suggests that the price received by producers is higher than the border price. This value was as high as 1.50 in 1986 when the OECD began compiling the measure (OECD, 2010a). The WTO considers measures to support prices as trade distorting (WTO, 2002), and it is clear that there remain issues with agricultural trade distortions, even in a relatively highly developed group of countries, such as the OECD.

There is also evidence that agriculture receives more support than non-agricultural industries. The World Bank database (Anderson and Valenzuela, 2008) reports a Relative Rate of Assistance (RRA) for each country, as well as aggregated by

[30] See equation (4.4) in the chapter four for the precise calculation.

region. This measure is a ratio of assistance to agriculture over assistance to non-agricultural industries; thus a positive number means agriculture is more highly supported. Regional RRA data show that Europe and North America have consistently shown positive RRAs, while Africa, Asia, and Latin America have shifted from between -20 and -50 in the 1950s and 1960s to near or above 0 in recent years (Anderson and Valenzuela, 2008). The trend shows that the agriculture sector is receiving continuously higher support relative to other sectors, suggesting that agriculture continues to be a highly supported industry. This makes it an informative industry upon which to test trade policy.

There is also evidence that preference for support of small farms is a determinant of individuals' support for agricultural policy, at least in the United States. Ellison *et al.* (2010a; 2010b) find survey-based evidence that individuals have a higher preference for support directed to small farms than for support directed to very large farms. Ellison *et al.* (2010b) argue that this provides some evidence that individuals are concerned about the distribution of income. These results suggest that if a government follows the preferences of its taxpayers it will prefer supporting smaller farmers.

We calculate inequality, as defined in equation (4.5), using production values for agricultural goods. Production values for all agricultural goods which factor into the TBI are also provided in the World Bank database (Anderson and Valenzuela, 2008), and we use them to build our aggregate measure of inequality. For the binary variable on development level that is interacted with inequality, we denote countries as being developed or developing based on the International Monetary Fund's (IMF) definition in their World Economic Outlook (WEO) (countries denoted advanced economies in the WEO are considered developed, and countries denoted emerging and developing economies in the WEO are considered developing) (IMF, 2008).

The WRI variable comes from the supplementary portion of the World Bank database (Anderson and Croser, 2009). The trade shares used to calculate the difference in market power between the sectors are based on the shares of imports in consumption and exports in production for individual goods within the World Bank database (Anderson and Valenzuela, 2008). These shares of domestic consumption and production are multiplied by the values of consumption or production (for net-imported goods and net-exported goods, respectively) from the World Bank database (Anderson and Valenzuela, 2008) to calculate trade values. The import values of import-competing goods and export values of exporting goods are then aggregated by country, and then converted to shares of world imports of those import-competing goods or world exports of those exporting goods.

Our measure for urbanization is from the 2009 Revision of World Urbanization Prospects, compiled by the Population Division of the Department of Economic and Social Affairs of the United Nations (United Nations, 2010). The variable used is “Percentage urban”, and is measured or forecasted every five years from 1950 to 2050; we linearly interpolate for the missing values.

Our designations for the binary variables related to PTAs are based on information from the websites devoted to the various agreements. For the WTO/GATT variable, we use information from two different pages on the WTO website, one for

WTO membership dates, and one for GATT (WTO, n.d.a; WTO, n.d.b). For NAFTA, we designate all members as being part of the agreement from 1994, the date of implementation, as noted by the United States Department of Agriculture's Foreign Agricultural Service (FAS) (FAS, 2011). Membership in the CAP is based on dates of accession to the EU, as noted on the EU website (EU, n.d.), though since the CAP only became operational in 1962 (British Broadcasting Corporation, 2008), we only designate membership from 1962 for members that joined prior to that. The starting date for MERCOSUR membership is based on the date that a customs union was formed, the 1994 Treaty of Ouro Preto (British Broadcasting Corporation, 2010a). We use the original signing date of the Andean Community as its starting point, in lack of a clear date of trade liberalization commencement, with that date being 1969 (Andean Community, n.d.). We also use the original signing date for the starting point for ASEAN, with subsequent dates of accession for non-original member countries, as noted in a British Broadcasting Corporation profile of the agreement (British Broadcasting Corporation, 2010b).

The data for the Herfindahl indices in equation (4.6) come from the World Bank database (Anderson and Valenzuela, 2008).

5.2. Summary Statistics

We now turn to an analysis of the summary statistics based on the data defined above. Table 5.1 records the summary statistics of the entire dataset.

Table 5.1: Summary Statistics of the Entire Dataset

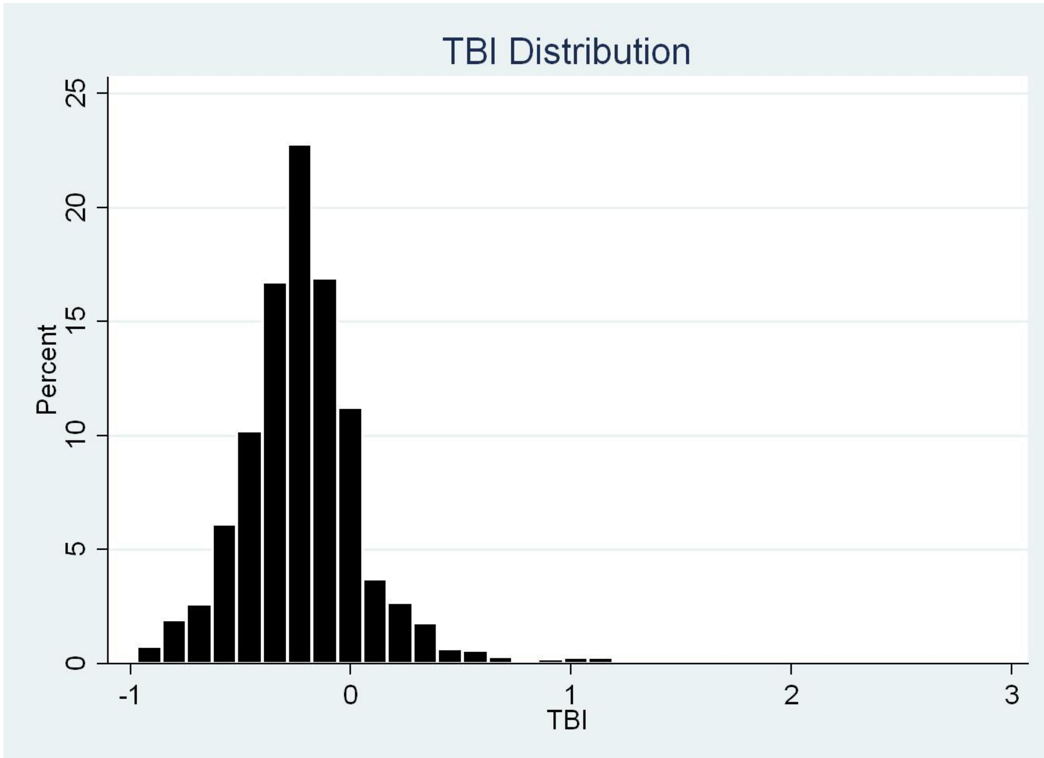
Variable	Observations	Mean	Standard Deviation	Minimum	Maximum
Trade Bias Index	2383	-0.213	0.286	-0.971	2.788
Inequality	2383	0.080	0.505	-1.000	1.000
Import-Competing Sector Smaller	2383	0.558	0.497	0.000	1.000
Exporting Sector Smaller	2383	0.441	0.497	0.000	1.000
Developed Country	2383	0.379	0.485	0.000	1.000
Developing Country	2383	0.621	0.485	0.000	1.000
Welfare Reduction Index	2383	55.991	48.188	0.064	435.629
Share of Total World Imports of Import-Competing Goods	2383	0.035	0.061	0.000	0.962
Share of Total World Exports of Exporting Goods	2383	0.093	0.140	0.000	1.000
WTO/GATT	2383	0.847	0.360	0.000	1.000
Urbanization	2383	51.469	23.079	4.620	88.550
NAFTA	2383	0.018	0.132	0.000	1.000
CAP	2383	0.170	0.375	0.000	1.000
MERCOSUR	2383	0.005	0.071	0.000	1.000
Andean Community	2383	0.030	0.171	0.000	1.000
ASEAN	2383	0.066	0.249	0.000	1.000
Herfindahl Index for the Import-Competing Sector	2383	0.442	0.279	0.000	1.000
Herfindahl Index for the Exporting Sector	2383	0.480	0.273	0.000	1.000

One of the difficulties inherent with our dataset is that length of the time series for each country is not equal. Many countries have time series lengths that stretch over 40 to 50 years. On the other hand, the countries that enter the dataset in 1992 only have 15 years worth of data. This means that the statistics reported here are weighted towards countries that have longer time series, which suggests that the presented statistics are biased slightly in the direction of those countries.

A few important points are worth noting about the data. First, the trade bias is negative, on average. This means that the average policy over our dataset restricted trade rather than promoted it. This is not necessarily surprising, considering that much of the data predates multinational trade agreements with agreements on reductions in agricultural protection. The observed anti-trade bias is also consistent with the key motivation for L&P's (2007) theory. What is more surprising is the range of values that the trade bias takes. The minimum approaches -1, signifying a policy where nearly all support goes towards protecting import goods. On the other hand, the maximum registers a situation where there is nearly three times as much assistance to export goods as import goods. Clearly, there is a diverse set of policy choices represented in the data.

Figure 5.1 shows the distribution of the trade bias variable. Note that the majority of values are negative, but the overall distribution is skewed to the right. This is expected because of the calculation of the variable limits the range of possible values from negative one to positive infinity.

Figure 5.1: Distribution of Trade Bias



An interesting way of looking at this variable is to look at the trend of trade bias in terms of membership in the WTO or GATT. Figure 5.2 shows the trade bias trend over time, separated for countries that are and are not part of the agreements (calculated as a yearly mean of individual countries' five-year moving averages). The sets of countries which form the two groups in Figure 5.2 change over time, with some countries signing on to the agreement, and both groups include countries that join the group when they enter the data. Figure 5.3 shows the trade bias trend in including only countries that are always part of the agreements (for the time series in which TBI has been calculated for them), and those that are never part of the agreements (calculated similarly to Figure 5.2). The first graph shows that countries that signed on to GATT early had higher anti-trade bias rates, and the average bias gradually becomes more positive over time. Conversely, non-agreement countries have had progressively higher rates of anti-trade bias. This representation of the TBI data may be misleading, however, because countries with relatively pro-trade biases may be signing on and changing their relative levels. However Figure 5.3 shows that when including only countries that do not join the agreement within the years of the data, the pattern for countries which are always part of the agreement is very similar to the pattern for countries in WTO and GATT in Figure 5.2.

Figure 5.2: Comparison of TBI Between Countries Part of and Not Part of the Agreements

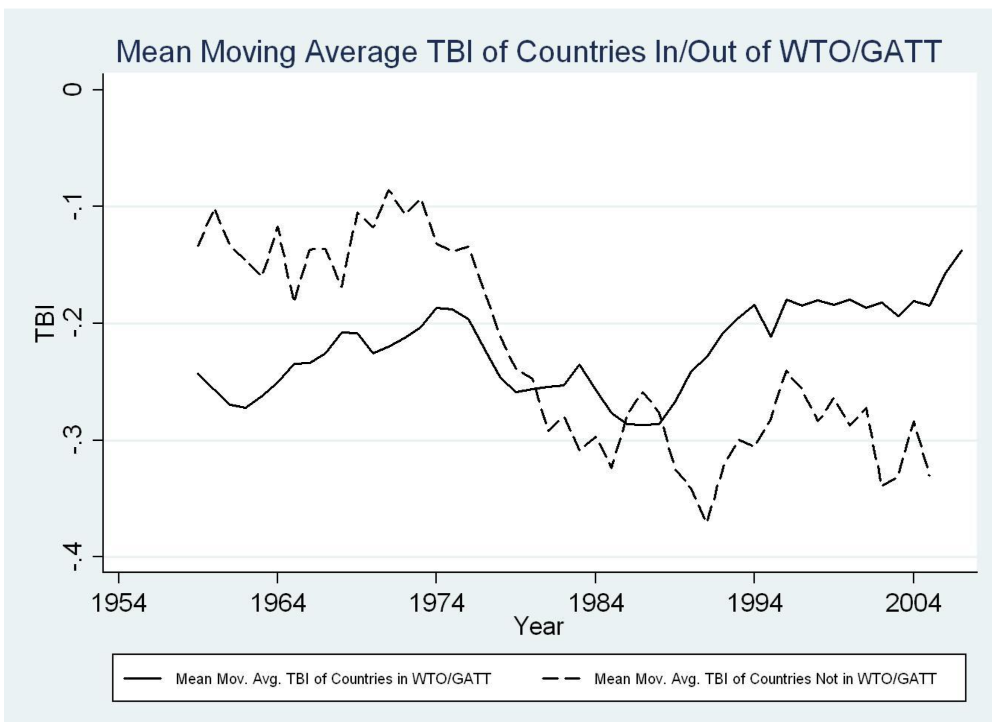
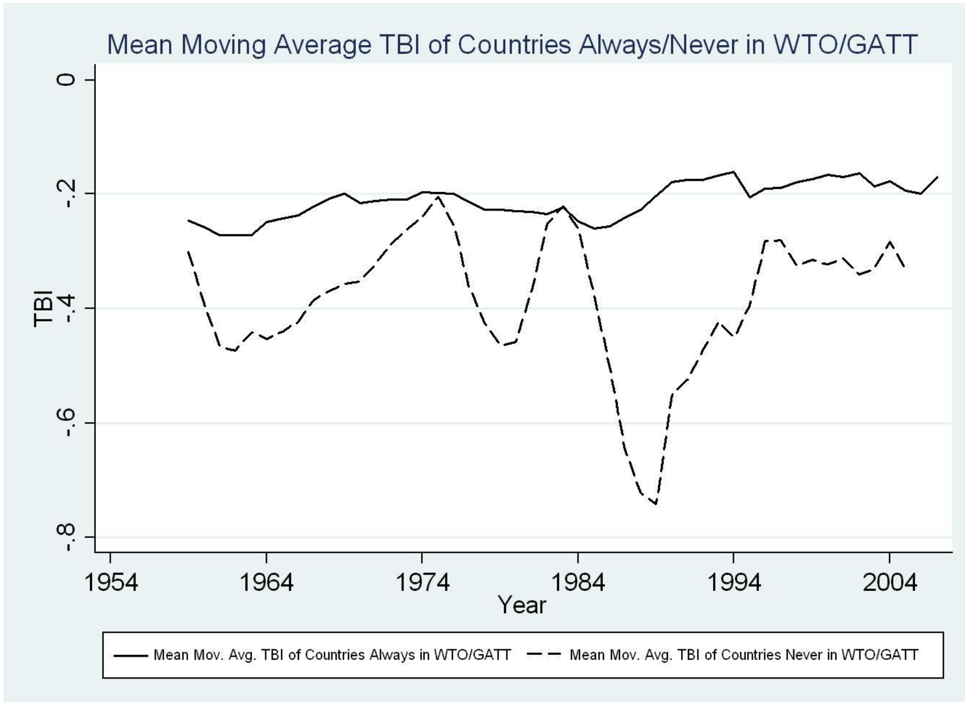


Figure 5.3: Comparison of TBI Between Countries Always or Never Part of the Agreements



In Figure 5.3, there appears to be a difference in policy choice between the countries that are always part of the WTO and GATT, and countries that are never part of the agreements. Countries that are part of the WTO or GATT for their entire time series in most years have a more pro-trade bias than countries that are never part of the agreements. This could be a direct effect of the agreements, or the result of a selection issue, in which countries with highly trade restrictive policies choosing not to become a part of the WTO or GATT.

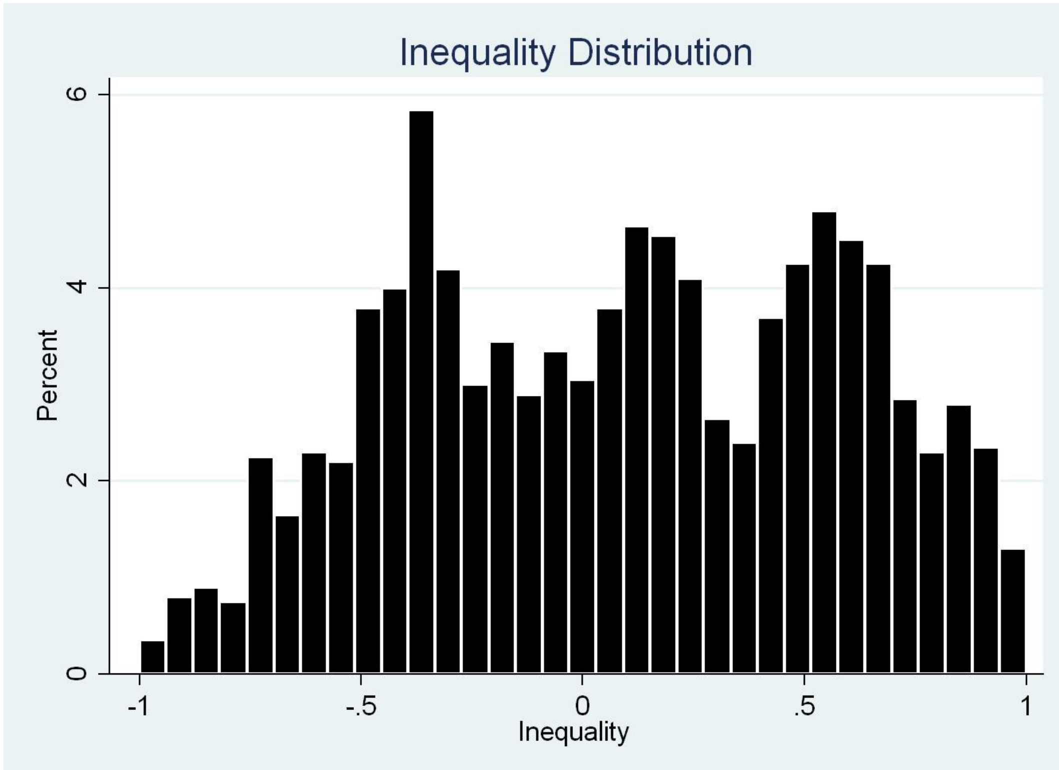
Figure 5.2 illustrates that both groups of countries experience a sharp movement in the direction of pro-trade bias around the time that WTO negotiations regarding agriculture were coming into effect (early 1990s). Whether or not this pattern is the result of changes stemming from these negotiations is not clear[31], and this pattern suggests that non-WTO countries also loosened trade restrictive policies at this time. It is possible that the group of non-WTO countries at that time were decreasing their anti-trade policies in an attempt to avoid trade diversion with trade partners who were now being asked to scale back their own trade restrictive policies.

The data on inequality show that exportable good values are on average slightly larger than the value of importable goods. Positive inequality on average is consistent with our expectations in that, following Levy's (1999) thought experiment that was outlined in L&P (2007), we expect that exporting goods will be the larger sector more often than not. The minimum value of negative one represents a case where the total production value for exporting goods, as indicated in the database, is zero (these are not missing values).

Figure 5.4 shows the distribution of the inequality measure. This variable shows a distribution that is closer to a normal distribution than that of the TBI, and it is slightly skewed to the positive side. Large negative values appear to be less common than large positive values.

[31] Copeland (1990) argues that negotiations may simply result in the use of alternate trade barriers in place of barriers that are reduced in negotiations, in sectors that where trade barriers had not previously been used. Ghazalian and Cardwell (2010), explaining a lack of significance on trade flows of the Uruguay Round of WTO negotiations, argue that negotiations had a range of effects, including a reduction in export subsidies in some cases.

Figure 5.4: Distribution of Inequality



The statistics for the binary variables that are interacted with inequality are close to what we expect, as import-competing goods are smaller more often, and there are more cases of developing countries than developed countries in the dataset. Note that the means for the binary variables that identify which sector is smaller do not sum to one (and the standard deviations are not quite equal, though it does not show in the table due to rounding) because Egypt exhibits perfect income equality among sectors in 1963. This data point triggers neither of the smaller sector identifiers, and thus, not every data point in the dataset triggers a value of one for one of these two binary variables[32].

[32] This does not cause a problem empirically, as we lose the inequality information from that one data point when its interactions in the model are zero.

We noted earlier that the WRI is a measure representing the uniform combined import tariff rate and export subsidy rate that would have to be applied to all goods to cause the same amount of welfare loss as the current policy set (Lloyd *et al.*, 2009). The mean value for the WRI is just under 56 percent, meaning that the average welfare reducing effects of existing policies is the equivalent of a blanket 56 percent combined import tariff and export subsidy rate on all goods in all years. A number this high clearly indicates an industry which has been heavily supported, with significant overall welfare losses as a result. Not only does this number seem high, but the standard deviation is at nearly the same level. Given that the WRI is bounded at zero, this suggests a large tail in the distribution, extending well beyond an equivalent 100 percent tariff rate.

The average market shares for both the import-competing and exporting sectors appear low. This suggests that, in general, shares of the world trading markets among our data are quite spread out among a number of countries. The maximum values of both variables do suggest that there are certain cases where a country has large, or near total, market power in the goods that fall into one of their trade sectors, though this is not common. The minimum values of zero signify cases where the database reported either no import value for import-competing goods or no export value for exporting goods. While this is certainly counterintuitive, these cases likely result from situations where the few goods that fall into one of the sectors are not significantly traded. Thus the actual trade values as shares of consumption or production in certain cases are either not measured or rounded to zero in the database. Thus, there is an implicit assumption that these trade shares are not large enough to report a positive value, and thus we can be confident that the actual value would not largely differ from zero.

The rate of membership in the WTO or GATT is extremely high, at over 80 percent. This shows that most countries in the dataset are currently members (there are no dropouts in the data), and many have been for nearly their entire time series. This indicates that it may be more interesting to interpret the coefficient on this variable in terms of the effect of not being a part of the agreement, as opposed to the effect of signing onto the agreement. For example, a country such as Russia, which has not signed onto the agreement (WTO, n.d.b), is not constrained in their policy choice by WTO regulations (though they could face restrictions imposed by other bilateral and multilateral agreements). Alternatively, the regional PTAs exhibit very low means, which is to be expected, given that not every country belongs to one of these agreements.

Our measure for urbanization produces a wide range of values. The mean of around 51 percent urban may suggest a somewhat lower average development level, but given that more countries in the dataset are considered developing, this is to be expected. The range of values covers nearly the entire spectrum of zero to one hundred percent, meaning that we have wide variation of development level in our sample of countries.

The means of the Herfindahl indices both fall just short of 0.5. This suggests that the typical case in both sectors is where the sectors are not highly concentrated. Both indices, however, have maximum values of one, which is the result of a country having only one good covered by the database in a given year that carries the trade status which registers a value of one. The minimum values of zero signify cases where no goods covered by the database have the trade status which registers a value of zero[33].

The next chapter presents our results, and provides a discussion of how the results compare to the theoretical predictions of L&P (2007).

[33] Cases such as this do not affect our inequality measure, as the database does include aggregate production values for the products that are not covered, allowing us to calculate inequality based on overall production values in every case.

Chapter 6: Results and Discussion

This chapter presents the results of our empirical estimation of the model presented in chapter four. We begin by reporting the results of diagnostic tests. Next, we report the results of our base empirical model, as defined in equation (4.1). We then report the results of our dynamic empirical specification, defined in equation (4.3). Finally, we report both versions of the model, with Herfindahl indices for both sectors included, to check for robustness. The conclusion of the chapter presents a general discussion of the results and the implications suggested by the results.

6.1. Diagnostic Tests

Our first diagnostic test is taken to ensure that we are correct in using a country fixed effects specification, as opposed to a random effects specification. We utilize a test that assesses whether a random effects specification presents a bias in the coefficients over a fixed effects specification. This test is known as the Hausman specification test, which was proposed in Hausman (1978). Hausman (1978) argues that his test is appropriate for assessing the dilemma of random versus fixed effects specification, citing an issue pointed out by Maddala (1971) and Mundlak (1976). The issue is whether the mean individual effect across panels is independent of the other explanatory variables, an assumption that is vital to the consistency of the random effects estimator (Hausman, 1978). Hausman (1978) argues that if this assumption is not violated, then there should be no statistically significant difference between the coefficients of the fixed effects and random effects specifications. Hausman (1978) also argues that if no difference is found, the random effects estimator, which is the asymptotically efficient estimator, should be used. If there is a difference, Hausman (1978) states that the random effects estimator may not be correct, while the fixed effects estimator remains unbiased if the mean individual effect across panels is not independent of the other explanatory variables. This suggests that if we reject the null hypothesis that the difference between the two estimators is zero, then the fixed effects specification is appropriate. Table 6.1 reports the results of a Hausman test on our base empirical model.

Table 6.1: Hausman Specification Test for Fixed Versus Random Effects

	Value	**P-value**
χ^2**(15)**	28.820	0.017

The value of 0.017 suggests that we should reject the null hypothesis of there being no difference between the two estimation methods, and use a fixed effects specification for our empirical model.

Our next step is to diagnose whether groupwise heteroskedasticity or serial correlation is present in our model. To test for groupwise heteroskedasticity, we test the null hypothesis of constant variance across panels, using a modified Wald statistic, as specified by Greene (2000, pp.598). We test for serial correlation in the idiosyncratic error term using a procedure defined by Wooldridge (2002, pp.283). Wooldridge (2002, pp.283) argues that the correlation between the error term of a first differenced version of the estimation equation, and the error term of the first differenced equation, lagged one time period, will be –0.5 if the error terms are not serially correlated. The

Wooldridge (2002, pp.283) test regresses the error term of the non-differenced estimating equation on its lags, and tests whether the coefficient obtained for the lags is statistically equal to -0.5. If this is rejected, we can assume that serial correlation is present. Table 6.2 presents the results of these tests.

Table 6.2: Results of Modified Wald Test and Wooldridge Test

Modified Wald Test	Value	P-value
χ^2**(63)**	52982.020	0.000
Wooldridge Test	**Value**	**P-value**
F(1,61)	1.656	0.203

These results suggest that we need to control for heteroskedasticity, though we do not find evidence that serial correlation is present. Our approach to control for this issue is to use standard errors which are a generalized version of the heteroskedasticity robust standard errors proposed in White (1980). This standard error correction, as presented in Froot (1989) and Williams (2000) is shown to be correct when the assumption of independence among clusters (panels, in our case) cannot be made. Thus, we report results for which the clustered heteroskedasticity robust standard error correction defined by Froot (1989) and Williams (2000) has been made.

6.2. Results

Next, we present the results of our four specifications of our model, in Table 6.3, below. The specifications reported are:

I) the base model, as represented in equation (4.1);

II) the base model, with a lagged dependent variable included, as in equation (4.3);

III) the base model, with Herfindahl indices for both sectors included; and

IV) the dynamic model in equation (4.3), with Herfindahl indices for both sectors included.

Table 6.3: Results for country-fixed effects estimation of models I through IV

Variables	(I) Base Model Coefficient (Std. Error)	(II) Dynamic Model Coefficient (Std. Error)	(III) Base with Herfindahls Coefficient (Std. Error)	(IV) Dynamic with Herfindahls Coefficient (Std. Error)
Inequality, Import-Competing Sector Smaller, Developed	0.653***	0.237**	0.639***	0.243**
	(0.200)	(0.107)	(0.206)	(0.110)
Inequality, Exporting Sector Smaller, Developed	-0.020	-0.000	-0.066	0.006
	(0.115)	(0.070)	(0.162)	(0.088)
Inequality, Import-Competing Sector Smaller, Developing	-0.146	-0.045	-0.164	-0.041
	(0.197)	(0.125)	(0.203)	(0.129)
Inequality, Exporting Sector Smaller, Developing	-0.181	-0.019	-0.181	-0.020
	(0.144)	(0.068)	(0.152)	(0.068)
Welfare Reduction Index	-0.001	-0.000	-0.001	-0.000
	(0.001)	(0.000)	(0.001)	(0.000)
Share of Total World Imports of Import-Competing Goods	0.122	0.093	0.121	0.096
	(0.286)	(0.129)	(0.287)	(0.125)
Share of Total World Exports of Exporting Goods	-0.028	0.020	-0.026	0.019
	(0.208)	(0.102)	(0.216)	(0.104)
WTO/GATT	-0.084	-0.042	-0.084	-0.042
	(0.066)	(0.030)	(0.065)	(0.030)
NAFTA	-0.070	-0.028	-0.066	-0.028
	(0.094)	(0.045)	(0.094)	(0.045)
CAP	-0.085	-0.053	-0.087	-0.052
	(0.059)	(0.032)	(0.060)	(0.032)
MERCOSUR	0.135***	0.051**	0.135***	0.050**
	(0.044)	(0.021)	(0.044)	(0.021)
Andean Community	0.070	0.009	0.060	0.010
	(0.049)	(0.022)	(0.052)	(0.024)
ASEAN	-0.065	-0.054	-0.072	-0.052
	(0.077)	(0.056)	(0.074)	(0.057)
Urbanization	0.001	0.001	0.002	0.001
	(0.004)	(0.002)	(0.004)	(0.002)
Year	0.001	0.001	0.000	0.001
	(0.002)	(0.001)	(0.002)	(0.001)
Lagged TBI	-	0.557***	-	0.557***
		(0.040)		(0.040)
Herfindahl Index for Import-Competing Sector	-	-	0.017	-0.013
			(0.120)	(0.067)
Herfindahl Index for Exporting Sector	-	-	-0.055	0.007
			(0.116)	(0.050)
Constant	-0.197	-0.120	-0.180	-0.115
	(0.168)	(0.087)	(0.213)	(0.109)
Observations	2001	1997	2001	1997
Overall R^2	0.055	0.518	0.060	0.517
Within R^2	0.071	0.330	0.072	0.330
Between R^2	0.037	0.800	0.044	0.795

Note: *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Before we begin the discussion of the results, it is worth noting the reason for the difference in the number of observations among the models. The cause of the difference is a small number of cases where a single year is missing from the middle of a country's time series. In these cases, when the lagged dependent variable is included, no measure of the lagged dependent variable is available for the following year. This results in an additional year being dropped each time that this situation arises. Furthermore, the overall number is short of what was reported in the summary statistics in the previous chapter. This is due to the decision to use a five year moving average lag for our endogenous variables, and only including cases where at least four previous years of observations are available. Thus, the first four years from each country are not included.

Looking first at the results for the base model, we find little support for the hypothesis of a negative coefficient on the inequality variables. We find negative coefficients for both variables representing developing countries, as well as when the exporting sector is smaller in developed countries, though they lack significance. We find a significant and positive coefficient when the import-competing sector is smaller for developed countries. Together, these results suggest that inequality may not be a large factor in the types of policies governments use to support the agricultural sector.

The result suggests that governments of developed countries support the export sector more as it gets larger, as long as it is the larger sector overall. One explanation for this could be that governments of developed countries that have large agricultural sectors, and thus are net exporters of most products, are more focused on increasing their share of world exports than they are on protecting the few import-competing sectors that they have. This would suggest that not only do governments provide more support to net-exported goods of which they are large producers, but that they also have more incentive to support larger net-imported goods that they may be able to export more of than smaller net-imported goods. The results also suggest that developing countries, and developed countries with larger net-importing agricultural sectors, are less influenced by a motive to increase their share of world exports.

A possible explanation for the positive coefficient on inequality is that developed countries with larger net-exporting sectors are more inclined to promote specialization in their agricultural industry. Intuitively, if a country wants to specialize in the production of certain goods, and it wants to be able to export as much as possible after having done so, it should promote production of those goods that it can produce most efficiently relative to the rest of the world. Assuming that the country's most efficient products already earn the most revenue, then the country may provide greater support to its largest products, and thus its largest sector. Our results suggest that developed countries with larger net-exporting sectors are led by this motive more than other countries, though it is not clear why this would be the case.

The estimated coefficient on the WRI variable is insignificant, and the coefficient is only slightly different from zero, when rounded to three decimal places. We did not have a predicted sign on the coefficient for the WRI, and this result seems to support the notion that a goal of reducing societal welfare losses does not affect to which sector a government provides more support. This result does not suggest that governments do not wish to increase the societal welfare level; rather it suggests that there is no consensus among the countries in our data set on which type of policy must be reduced in order to reach that goal.

We also do not find support that market power increases the relative level of support provided to a specific sector. This is a surprising result, as we are confident in our hypothesis on these variables and recent research provides empirical evidence that market power is a determinant of trade support levels (Bagwell and Staiger, 2011; Broda *et al*., 2008). The signs on the coefficients are the reverse of predictions, though are not statistically different from zero. These results suggest that a country does not increase its support to the import-competing sector when it has a greater share of the world's imports of their import-competing goods (or support to the exporting sector when it has a greater share of the world's exports of their exporting goods). Furthermore, while theory suggests that there is a motivation to increase support to a sector when a country holds market power over the world price, there is nothing predicting that countries will actually utilize the advantage they have when this is the case. In this sense, this result may support the notion that countries are not entirely rational about the domestic welfare effects of their policies because they are not taking advantage of potential gains from trade policies.

It is worth noting that there is a difference between our methods and those of Broda *et al.* (2008) and Bagwell and Staiger (2011), both of whom investigate the effects of market power on trade barriers. Broda *et al*. (2008) find evidence that market power is an important determinant of tariff rates for non-WTO countries and non-tariff barriers and statutory tariffs (those placed against countries that are not granted most favoured nation status) for the United States. Broda *et al.* (2008) argue that their results imply that market power is a significant determinant of only those trade policies that are not constrained through the WTO. Similarly, Bagwell and Staiger (2011) find a relationship between tariff cuts that are negotiated for countries to join the WTO, and the import levels of those countries prior to their accession; the result also suggests that market power is a determinant of a type of trade policy (unbound tariff rates) that is not constrained by the WTO. As was noted in chapter five, almost 85 percent of our observations represent countries signed onto GATT or the WTO, and our measure of support includes, though is not limited to, import tariffs (Anderson *et al.*, 2008). Thus, we are estimating the effect of market power on support levels that have at least partially been set cooperatively. This may suggest that, considering Broda *et al.*'s (2008) conclusion that market power only influences trade policies that are not constrained by the WTO, we should not expect to see a significant effect.

The coefficient on the variable indicating membership in the WTO and the GATT is negative and insignificant. As Panagariya (2005) argues, export subsidies are not a major portion of support among WTO countries, so a significantly negative coefficient would not be surprising. However, due to the lack of significance, we cannot conclude that there is any statistical difference between the policy choices of WTO and non-WTO countries. This suggests that non-WTO countries are just as likely to prefer import-protecting policies as WTO countries, even if there is an apparent preference for support type among WTO countries. Overall, the result is consistent with our hypothesis that there is no theoretical reason to believe that being signatory to the GATT or the WTO has a significantly different effect on support to the two sectors.

We find a mix of results for the regional PTAs. The variables for NAFTA, the CAP of the EU, and ASEAN all have negative coefficients, but are insignificant, while the Andean Community has a positive insignificant coefficient. These results suggest that none of these agreements have a clear effect on the use of policies directed towards a certain sector. On the other hand, MERCOSUR has a positive and significant coefficient. Since the only MERCOSUR country in our data is Brazil, this suggests that Brazil reduced its relative support to the import-competing sector after signing onto MERCOSUR.

The coefficient on the level of urbanization is insignificant. This suggests that there is no statistical difference in policy type between more developed and less developed countries, even within the development categories that we use to define the binary development variables that are interacted with inequality. This measure is only included to ensure that we can correctly interpret differences in the coefficients on inequality between developed and developing countries, and while our hypothesis is that the effect is positive, the lack of significance is not surprising. Individual countries may have different preferences, but there does not seem to be any way to generalize policy choice along the lines of development level.

While the time trend has a positive coefficient, as we suspected, it is not significant. This shows that the apparent positive shift in TBI in WTO countries in Figures 5.2 and 5.3 is not large enough to suggest a clear difference in trade policy tendencies across all countries over time.

Model (II) in Table 6.3 gives the results of the dynamic version of our base model, as described by equation (4.3). As we note in chapter four, we predict that the sign on the coefficient for the lagged dependent variable is positive, as we expect that the current TBI is partially determined by the previous level of the TBI. Consistent with this hypothesis, we find a positive coefficient and highly significant result.

This result suggests that policy persistence is not only a determining factor in the choice of which agricultural sector to support, but among the possible factors that we have identified, may be the primary factor determining the level of the TBI. While it is not clear whether this result is due to factors that create resistance to policy change, or whether it is simply a matter of logistical difficulties in implementing a change, it appears clear that there is a level of inertia that restricts the range of policy choices that a country has in a given year.

The remainder of the parameters in model (II) are robust to the inclusion of a lagged dependent variable. There is only one sign change (export market share for exporting goods), and all changes to the coefficients are smaller than 0.1 from the specification without the lagged dependent variable. The two variables that were found to be significant in the base model both remain significant, though they drop from the one percent level to the five percent level. Therefore, estimating a dynamic model does not change our interpretation in any appreciable manner. We continue to have the positive and significant result for inequality in developed countries when the import-competing sector is smaller, while the remainder of the inequality variables are negative and insignificant.

Model (III) includes the Herfindahl indices for each sector in the base empirical model as a robustness check against the inclusion of a control for lobbying power. Once again, we are sceptical about whether they are accurate measures of lobbying power, hence the inclusion as a robustness check.

The coefficients on the Herfindahl indices in model (III) have signs which are the reverse of what is predicted (the prediction is negative for the concentration of the import-competing sector, and positive for the exporting sector), but are insignificant. Furthermore, the remainder of the coefficients in model (III) are very robust to the inclusion of the Herfindahl indices, as compared to model (I). If we were confident in the accuracy of the Herfindahl as measures of lobbying power, we would take this result to suggest that not only is lobbying not an important determinant of trade bias, but that there is no correlation between relative lobbying power of the sectors and the level of inequality. Unfortunately, all that we can be sure of is that our base model is robust to inclusion of Herfindahl indices.

Model (IV) includes the Herfindahl indices in the dynamic model. Similar to model (III), the dynamic model is highly robust to inclusion of the Herfindahl indices. The one curious effect of note is that the Herfindahl indices themselves are not as robust to the inclusion of a lagged dependent variable as most of the other variables are. Coefficients on both of the Herfindahl indices change sign (though the changes are small), and these signs now match our predicted signs. Given the lack of significance, this has no effect on our interpretation.

6.3. Other Tests for Robustness

We also estimate a number of alternative specifications aside from those reported in Table 6.3, and compare these results to our baseline results. The first alternative that we test is the use of inequality measured as a ratio of the production value of exporting goods to the production value of import-competing goods, as opposed to the normalized difference of production values denoted in equation (4.5). We initially measure inequality with a normalized difference given Fossett and South's (1983) note that the normalized difference is preferable to a ratio measure of inequality because the normalized difference is symmetric around zero. Fossett and South (1983) note that if inequality is measured with a ratio, values between zero and one (which in our case result if the exporting sector is smaller) and values above one (which result if the import-competing sector is smaller) are not directly comparable. Thus, we cannot expect there to be high correlation between the two measures since one is symmetric and the other is not, even though both move in the same direction when inequality changes. Regardless, including inequality measured as a ratio provides an interesting comparison, and we report the results of both the static and dynamic models, equations (4.1) and (4.3), estimated with this measure in Table 6.4 (specifications V and VI).

Table 6.4: Results of Static and Dynamic Models with Inequality Measured as a Ratio

	(V) Static with Ratio Inequality	(VI) Dynamic with Ratio Inequality
Variables	**Coefficient (Std. Error)**	**Coefficient (Std. Error)**
Inequality, Import-Competing Sector Smaller, Developed	0.033	0.013
	(0.025)	(0.009)
Inequality, Exporting Sector Smaller, Developed	-0.056	-0.018
	(0.062)	(0.025)
Inequality, Import-Competing Sector Smaller, Developing	-0.000***	-0.000***
	(0.000)	(0.000)
Inequality, Exporting Sector Smaller, Developing	0.023***	-0.006
	(0.007)	(0.005)
Welfare Reduction Index	-0.001	-0.000
	(0.001)	(0.000)
Share of Total World Imports of Import-Competing Goods	0.165	0.093
	(0.306)	(0.128)
Share of Total World Exports of Exporting Goods	-0.062	0.010
	(0.222)	(0.098)
WTO/GATT	-0.084	-0.045
	(0.063)	(0.028)
NAFTA	-0.027	-0.011
	(0.078)	(0.038)
CAP	-0.125*	-0.064*
	(0.069)	(0.035)
MERCOSUR	0.127**	0.048*
	(0.052)	(0.025)
Andean Community	0.047	0.005
	(0.052)	(0.023)
ASEAN	-0.086	-0.057
	(0.086)	(0.056)
Urbanization	0.001	0.001
	(0.004)	(0.002)
Year	0.002	0.001
	(0.002)	(0.001)
1^{st} Lag of TBI	-	0.568***
		(0.040)
Constant	-0.196	-0.114
	(0.190)	(0.098)
Observations	2001	1997
Overall R^2	0.015	0.525
Within R^2	0.053	0.330
Between R^2	0.000	0.827

Note: *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Considering the differences between the two inequality measures, it is not surprising to find differing results. Interestingly, in the static model, we now only find significance on inequality for developing countries, with a negative result when the import-competing sector is smaller in these countries, and a positive result when the exporting sector is smaller. This could be interpreted as providing stronger support for L&P's (2007) theory, however, the collective results certainly remain inconclusive. The other results remain largely unchanged with this alternative measure of inequality, with the only change in significance being that of CAP, which is now significant at the ten percent level.

The dynamic model is more robust to the alternative measure of inequality than the static model. Inequality is now negative and significant for developing countries when the import-competing sector is smaller, but insignificant otherwise. This is more in line with L&P's (2007) theory, as none of the inequality variables have significantly positive coefficients. The only other change is that CAP is negative and significant, similar to when we use the ratio measure of inequality in the static model.

More support is provided for L&P's (2007) theory is provided when the model is estimated with the ratio measure of inequality. Fossett and South's (1983) argument regarding the use of a ratio for measuring intergroup inequality, however, suggests that we should not be as confident in these results. Thus, while the results in Table 6.4 provide an interesting comparison to our baseline results, we continue to base our inference on our original results.

We also investigate three other specifications as robustness checks. In the first, we remove the time trend to assess whether possible correlation between the trend and other variables is affecting our results (specification VII in table 6.5). In the second, we examine the effects of using an alternate proxy for development, gross domestic product (GDP) per capita, in the place of urbanization. We obtain purchasing power parity converted GDP per capita data from the Penn World Tables, edition 7.0 (Heston *et al.*, 2011), which is calculated in constant 2005 dollars (specification VIII in table 6.5). Finally, in the third alternative, we remove the binary variables that signify the development category of a country from our model, and assess inequality broken down by the sign of lagged inequality (specification IX in table 6.5). In each case, the static model is robust to these alternative specifications. The only difference is that when the binary variables for development are removed, inequality is no longer significant. This result is not surprising because we are generalizing its effect to larger groups of countries. There are small changes when these alterations are made to the dynamic model, and these results are reported in Table 6.5.

Table 6.5: Results of Other Robustness Tests on Dynamic Model

	(VII) Dynamic with Year Removed	(VIII) Dynamic with GDP per capita	(IX) Dynamic with No Development Dummies
Variables	**Coefficient (Std. Error)**	**Coefficient (Std. Error)**	**Coefficient (Std. Error)**
Inequality, Import-Competing Sector Smaller, Developed	0.244**	0.259**	-
	(0.109)	(0.110)	
Inequality, Exporting Sector Smaller, Developed	-0.000	-0.016	-
	(0.069)	(0.067)	
Inequality, Import-Competing Sector Smaller, Developing	-0.053	-0.016	-
	(0.127)	(0.119)	
Inequality, Exporting Sector Smaller, Developing	-0.028	-0.002	-
	(0.064)	(0.068)	
Inequality, Import-Competing Sector Smaller, General	-	-	0.030
			(0.097)
Inequality, Exporting Sector Smaller, General	-	-	0.020
			(0.052)
Welfare Reduction Index	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)
Share of Total World Imports of Import-Competing Goods	0.019	0.051	0.082
	(0.129)	(0.113)	(0.130)
Share of Total World Exports of Exporting Goods	0.008	0.037	0.024
	(0.093)	(0.114)	(0.102)
WTO/GATT	-0.037	-0.049	-0.041
	(0.029)	(0.033)	(0.030)
NAFTA	-0.020	-0.012	-0.009
	(0.043)	(0.044)	(0.037)
CAP	-0.041	-0.035	-0.069**
	(0.030)	(0.036)	(0.034)
MERCOSUR	0.048**	0.040**	0.043*
	(0.021)	(0.020)	(0.023)
Andean Community	0.006	0.004	-0.003
	(0.022)	(0.021)	(0.023)
ASEAN	-0.067	-0.057	-0.061
	(0.049)	(0.056)	(0.058)
Urbanization	0.002	-	0.001
	(0.002)		(0.002)
GDP per Capita	-	-0.000	-
		(0.000)	
Year	-	0.002*	0.001
		(0.001)	(0.001)
Lagged TBI	0.556***	0.553***	0.572***
	(0.040)	(0.042)	(0.040)
Constant	-0.165*	-0.079*	-0.132
	(0.084)	(0.040)	(0.092)
Observations	1997	1980	1997
Overall R^2	0.489	0.473	0.537
Within R^2	0.329	0.333	0.327
Between R^2	0.720	0.658	0.857

Note: *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Taking the time trend out has little impact on the results in the dynamic model. The only change in significance is for the constant, which is now negative and significant at the ten percent level. This suggests that the inclusion of the time trend is not markedly affecting our results, especially on inequality.

When we replace urbanization with GDP per capita as a proxy for development level, there are two significance changes[34]. Those changes are on the time trend, which is now positively significant at the ten percent level, and the constant, which once again becomes negative and significant at the ten percent level. Otherwise, our results remain robust to this change.

Both inequality variables remain insignificant and are positive when we do not interact the inequality variables with binary variables for development level. This is expected because we are now generalizing inequality across a more diverse range of countries. The only other differences as a result of this change are that CAP is now negative and significant at the five percent level, and MERCOSUR is now only significant at the ten percent level. The remainder of the results are robust to this change.

6.4. Discussion

Our results provide little support for L&P's (2007) theory that inequality is an important determinant of trade policy, as measured by trade bias. In fact, we find evidence that developed countries with larger net-exporting sectors increase support to a sector as it gets larger, suggesting a preference for inequality. We recognize that our inability to

[34] We also lose a small number of observations from this approach. The Penn World Table (Heston *et al.*, 2011) does not have GDP per capita data for a few years in our dataset. Since there are only a few observations that must be dropped, we do not expect there to be much impact.

accurately measure the effect of lobbying in our model could introduce a bias, though we are not able to identify what coefficients are biased, and in what direction.

Perhaps the most intriguing result from our empirical estimation is the fact that the effect of inequality is appreciably different when the import-competing sector is smaller in a developed country. Our results suggest that developed countries with larger net-exporting sectors actually increase support to exporting goods as they get relatively larger, which suggests a desire to expand exports, instead of protecting the smaller import-competing sector. A related explanation is that developed countries with larger net-exporting sectors attempt to promote specialization by supporting goods that it produces most efficiently. On the other hand, developing countries, and developed countries with larger net-importing sectors, show no significant effect of inequality on support to either the larger or smaller sector.

Our results suggest that governments are not overly concerned with reducing the level of inequality among sectors within their agricultural industry, and that the parameter on inequality, α, in L&P's (2007) government utility function, equation (3.5), is small. The positive coefficient for inequality in predominantly exporting developed countries suggests that for these countries the level of inequality may not even enter negatively in the government utility function (equation 3.5). At the least, L&P's (2007) government utility function is not supported by our results.

Another interesting result is the lack of significance on the estimated parameters of the majority of our control variables. We are not surprised with this result for the

WRI or for the PTAs, as we did not predict to see a significant effect, and were mostly concerned with ensuring that the amount of omitted variable bias on other coefficients is limited. We are surprised by the coefficients on our proxies for market power, though, as we have reason to be confident that they are important factors in determining trade policy. Our method of estimating market shares is imperfect, as we lack trade information from countries outside of our data set. But considering the range of important agricultural countries that are included in the data set, we feel that the measurement error should be small enough that the estimated coefficient is quite accurate. It is possible that our results regarding market power differ from those of previous empirical studies because we are measuring the effect of market power on some policies that are set cooperatively (through trade agreements), and some that are not. This differs from Broda *et al.* (2008) and Bagwell and Staiger (2011), who focus solely on non-cooperatively set policies.

Our dynamic model clearly suggests that a country's historical trade policy is an important factor in the choice of current agricultural trade. While we are not surprised by this result, the lack of significance for most other variables in our model suggests that policy persistence may be the predominant determining factor in the decision to restrict or promote trade. There may be strong resistance to change in agricultural support structures, or it may be that it is logistically difficult to impose large change to the support structure on a year to year basis. We argue that the effect is a mixture of both factors, as it is unrealistic to expect continual change to policy, and it is intuitive that a government might face political pressure if it chooses to make dramatic changes over a short time period. We can clearly state that the set of available agricultural trade policies from which a government must choose in any given year appears restricted to a set of policies that are similar to the previous year's set.

Despite the importance of past policies in determining current policies, we still expect other factors to play roles in determining the direction of bias in agricultural trade policy. However, we find that whether a country shifts its support to exporting or import-competing goods is not significantly determined by factors for which we are able to control. Our results suggest that trade policy changes are somewhat *ad hoc*. This suggests that there is no consistent way of explaining why a cross-section of countries chooses to change their relative support to different sectors. There are most likely country-specific factors, which are controlled for with country fixed effects, but that we cannot identify, that are more effective in providing an explanation of these changes. However, there would appear to be no factor which is important in general across a wide range of countries.

What do these results mean? We are not able to conclusively determine why countries continue to use trade restrictive (anti-trade) policies instead of trade-promoting policies. If the goal of trade negotiation is to get countries to reduce protection for their import-competing agricultural industries and move towards specialization in exportables, then it remains unclear what the best strategy is. If we were to see a negative and significant coefficient result on the inequality variable, then we could argue that governments are hesitant to remove the safety net for smaller agricultural industries. This would mean the focus of negotiations on changing support structures should turn towards larger sectors. Given what we do find, it appears as if the one consistent obstacle in changing the policy set is finding ways to urge governments to make changes more quickly. If the reason for policy inertia is domestic opposition to change, then the focus of negotiations may have to turn to either providing incentives for governments to make changes regardless of opposition, or to attempting to reduce the opposition of industries that have important political economy strength[35].

Beyond policy inertia, it appears as though the answer to the question of how to change the agricultural policy set may have more to do with understanding the country-specific rationale for the choice of a policy set. Some countries, though our results suggest not many, may have government utility functions that are similar to the L&P's (2007), and inequality in the agricultural sector is an important consideration. Alternatively, some countries may prefer to promote larger sectors as part of a greater desire to increase their market power in the export market. For many countries, the key factors may be the individual country effects, which are invariant along ideological, political, and cultural lines. For example, if a country is a net-importer of a good that it historically produced, one that may have deep traditional or religious ties, it may go out of its way to protect it even if the country has no other incentive to protect a small, import-competing good. Similarly, a country may be ideologically inclined to protect smaller industries, a belief that may be shared by its competing political parties, and

[35] An example of this is supply managed industries in Canada.

thus does not change as the governmental structure changes. There is no way to generalize the effect that these factors have, nor is there a way to identify the individual effect for a specific country, beyond extensive knowledge of the priorities of that specific country's government.

Ultimately, the primary use of knowledge gained from our analysis is the ability to use the generally important determinants of policy choice to identify the types of products that countries have less preference for supporting. If we had found the estimated coefficient on inequality to be negative and significant, for example, we could have suggested that future multilateral trade negotiations focus on reducing support to larger industries, as governments would seem to be exhibiting a desire to protect small industries. However, our results do not provide support for L&P's (2007) theory, and they suggest that the important factors in the choice of trade policies vary across countries. This lack of generality in determinants of policy choice suggests that it may be difficult to reach trade agreements between multiple countries when those countries have such varying preferences regarding the products that they support.

In this chapter, we report and discuss the results of our empirical estimation, and discuss the implications of our results in the context of trade negotiations. The next, and final, chapter summarizes the project and provides a conclusion.

Chapter 7: Summary and Conclusion

7.1. Summary

Rodrik (1995) argues that the continued use of anti-trade policies is an important puzzle in the analysis of trade policy. This thesis attempts to provide insight into that puzzle by empirically analysing the theory of L&P (2007), which proposes that income inequality between factors is a possible driving force behind anti-trade bias in policy. Based on an analysis of the marginal effects of both an import-competing tariff and an export-promoting tariff on government utility, as well as the marginal effect of a concern for inequality on a government's optimal import-competing tariff level, we propose a reduced form empirical estimating equation to assess the validity of L&P's (2007) theory. Our empirical model assesses the theory across a large panel data set, including 63 countries and a time series that in some cases dates back to the 1950s, with an average time series of just under 32 observations.

We control for a number of determinants of trade policy, including market power, welfare effects, PTAs, and development level. We feel that we are not able to accurately control for the lobbying effects proposed in G&H's (1994) theory, and we discuss the potential consequences of their omission during our discussion of results. Estimating the empirical model using panel data, we are able to utilize country fixed effects which controls for a number of potential invariant political, cultural, and institutional factors that differ across countries; factors that would not easily be controlled for otherwise.

We also estimate our model dynamically, including a lagged dependent variable in our otherwise static estimating equation. We note the argument of Nickell (1981) and Roodman (2006) that dynamic panel bias decreases as the time series becomes longer, and note Roodman's (2009) argument that when panel data is estimated with GMM methods, larger numbers of instruments can be produced as the time series gets longer. This can result in decreased control for endogeneity under these methods, which means that the bias may remain (Roodman, 2009). Thus, we estimate our dynamic specifications using the standard fixed effects estimation method, as opposed to utilizing the GMM methods of Arellano and Bond (1991) or Arellano and Bover (1995)/Blundell and Bond (1998).

7.2. Conclusion

Our results do not provide support for L&P's (2007) theory that reducing income inequality among factors (and thus, sectors) drives governments' decisions regarding the choice of which sector to support, at least within agriculture. For developing countries, and developed countries with a larger net-import-competing sector, we find negative coefficients on the variables defining these cases, which suggests increased support for the smaller sector. However these coefficients are statistically insignificant. For developed countries with a larger net-exporting sector, we find a significantly positive coefficient, suggesting that these countries increase support to a sector as it becomes relatively larger; a notion that is contrary to L&P's (2007) theory. A possible explanation for this result is that developed countries with larger net-exporting sectors wish to increase their share of the export market, supporting net-exported goods and larger net-imported goods that export more than smaller net-imported goods. Another possible explanation is that developed countries with larger net-exporting sectors attempt to promote specialization in the agricultural industry by promoting more efficiently produced goods. It appears that only developed countries with larger net-exporting sectors display a preference for supporting the larger sector; other countries show a small preference to protect the smaller sector, but the preference in these cases is not statistically significant and therefore does not provide strong support for L&P's (2007) theory.

The empirical results provide policy insight beyond the testing of L&P (2007). First, it appears very unlikely to see significant changes in policy from one year to the next. This could be a result of logistical difficulties in effecting change in a short time period, or a result of domestic opposition to altering the support structure that is in place. Even if a government sees a reason to change relative support levels, it appears that there is often very little done with immediacy, and even making changes over an extended period of time may be difficult given domestic opposition. Besides the policy inertia that appears to exist, the lack of statistical significance among the estimated parameters for our control variables suggests that we cannot accurately identify all of the reasons that trade policies change. Factors that have theoretical and empirical support from other studies, such as the effect of increased market power on the ability to impose increased domestic support through the ability to alter world price, seem to be less of a factor when assessed across many countries and years.

Our results suggest that we cannot make generalizations across countries about trade policy choice. General implications for broader international trade issues, such as multilateral and bilateral negotiations are not clear. It seems that most countries have differing reasons for the support structures that are in place. Thus, countries that are negotiating for reduced barriers with trading partners will require extensive knowledge of individual countries' preferences. This suggests that bilateral negotiations are an enticing approach to reaching trade agreements. This way, countries can target reductions in trade restrictions on certain types of goods that other countries have less preference for supporting, without requiring wide ranging agreements when every country has different preferences. If a country wishes to have greater market access for a good that it produces, it may have a better chance of gaining that access by negotiating bilaterally with another country that is perceived to be more likely than others to offer that access. Suppose, for example, there are two countries, A and B, that are exploring negotiations towards a bilateral trade agreement. If Country B sets its policy based on a motive to reduce inequality, for example, it may be more likely to reduce support to goods that it produces a lot of. If the good that Country A desires greater market access for is one of those goods, then Country B may make a good partner to enter into negotiations with, particularly if Country B conversely desires greater access in a good that Country A has a low preference for supporting. This notion is less applicable to multilateral agreements, where the goods that countries prefer supporting, and the goods that countries want to gain greater market access for, vary.

Our results suggest that L&P's (2007) theory regarding income inequality between factors is not observable in panel data on trade policy in agriculture. We also have a strong indication that once trade policies are in place, they are slow to change. Beyond this, policy choice factors seem to vary widely across countries. We understand that issues regarding measurement of control variables, especially for a panel the size of ours, limit the ability to make inferences from our model. Regardless of these issues, it would appear that the issue of how countries choose whether to restrict or promote trade with their policies has not been solved to this point, and alternative theories may be required to provide a clearer picture of how the process works.

7.3. Future Research

There are a number of possible directions for future research. First, since we are sceptical about our ability to measure the lobbying capabilities of sectors, there is an opportunity for future research to assess the importance of this factor under L&P's (2007) theoretical framework. Unfortunately, a measure such as lobbying contributions, or accurate information on the level of political organization within sectors was not available for this research. In time, this information may become available for a wider range of countries and years, providing future researchers the capability to better identify a factor that is well documented as an important factor in previous empirical literature (for example, Goldberg and Maggi (1999), Gawande and Bandyopadhyay (2000), Gawande and Hoekman (2006), Gawande (1997), and Mitra *et al.* (2006)).

Another possible direction may be to break the data set into groups of countries, which might allow for the inclusion of other factors in the model, or even better measurement of the factors that we have considered. We are only able to include those theoretically important factors that we can measure accurately across the broad range of countries and years that we have TBI data for, possibly limiting our capabilities. Furthermore, a closer look at a specific geographical or political group of countries may allow for the consideration of factors that are specific to that group, factors that could become apparent with a more intimate knowledge of the group of countries being assessed. This approach could also apply to breaking the data into groups of years, as there may be factors that are only important in certain time periods.

Finally, future research may extend the assessment of L&P's (2007) theory to industries other than agriculture. It is possible that the factors that determine the choice of agricultural trade policy are different from those for other economic sectors, and empirically assessing L&P's (2007) theoretical model for those other sectors, or even economy-wide, would provide for an interesting comparison to our results.

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Appendix A: Products on Which the TBI is Based

In the Distortions to Agricultural Incentives database produced by the World Bank (Anderson and Valenzuela, 2008), each country's TBI is calculated for each year based on calculations of a nominal rate assistance for each agricultural product. These rates are then weighted by production value and summed within each sector (exporting or import-competing) to compile the overall sectoral rates of assistance, which are then entered into equation (4.4) (Anderson *et al.*, 2008). Anderson *et al.* (2008) note that they aim to include seventy percent of agricultural production from the products that are covered within the database, the rate of assistance being directly measured for these products. Anderson *et al.* (2008) mention that for the remaining thirty percent of production, the rate of assistance is "guesstimated" and included with the other goods in the sectoral rates of assistance. The products covered within the database vary widely among countries; the various products and aggregate groupings of products that are included at least once are listed in table A.1. The products that make up the remaining thirty percent of production are not known, as the neither the database (Anderson and Valenzeula, 2008) nor Anderson *et al.* (2008) provide indication as to what they are.

Table A.1: Products Directly Covered in the Database

Apple	Coconut	Mandarin	Pig Meat	Spinach
Banana	Coffee	Milk	Plantain	Strawberry
Barley	Cotton	Millet	Potato	Sugar
Bean	Cucumber	Oat	Poultry	Sunflower
Beef	Egg	Oilseed	Pulse	Sweet Potatoes
Cabbage	Fruit & Vegetable	Olive	Pyrethrum	Tea
Camel	Fruits	Onion	Rapeseed	Teff
Cashew	Garlic	Orange	Rice	Tobacco
Cassava	Grape	Other Crops	Rubber	Tomato
Chat	Groundnut	Other Grains	Rye	Vanilla
Chickpea	Gum Arabic	Other Roots & Tubers	Sesame	Vegetables
Chillies	Hazelnut	Palm Oil	Sheep Meat	Wheat
Clove	Hides & Skins	Pear	Sisal	Wine
Coarse Grains	Jute	Peas	Sorghum	Wool
Cocoa	Maize	Pepper	Soybean	Yam

Source: Compiled by author from Anderson and Valenzuela (2008).