ABSTRACT

Title: THE EFFECTS OF LOSS AVERSION ON TRADE POLICY: THEORY AND EVIDENCE

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We study the implications of loss aversion for trade policy determination and show how it allows us to explain a number of important and puzzling features of trade policy. An important question concerning trade policy is why a disproportionate share of protection goes to declining industries. We show that if individuals' preferences exhibit loss aversion, higher protection will be given to sectors in which profitability is declining. In addition, by making lobby formation endogenous, we show that an industry will be more likely to become organized and lobby for protection if it has a loss. We also show that if the coefficient of loss aversion is large enough, there will be an anti-trade bias in trade policy. The anti-trade bias refers to the fact that trade policy tends to favor import-competing sectors and thus restricts rather than expands trade, and is considered an important puzzle in the literature. Our lobby formation predictions also reinforce the anti-trade bias result.

We use a nonlinear regression procedure to estimate the parameters of the model and test its predictions. We find support for the model and the estimates of the loss aversion parameters are very close to those obtained by Kahneman and Tversky

(1992) using experimental data. Protection is found to be more responsive to losses than to gains, and the estimates of the coefficient of loss aversion are about 2. The results are also consistent with diminishing sensitivity to income changes for both gains and losses, a prediction that distinguishes loss aversion from risk aversion. In order to test some predictions on the lobbying side, we estimate an equation on political organization and find evidence of loss aversion in lobby formation. Finally, but importantly, we find that the data favors our model over the current leading political economy model of trade protection, due to Grossman and Helpman (1994).

THE EFFECTS OF LOSS AVERSION ON TRADE POLICY: THEORY AND EVIDENCE

By

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Dedication

To my parents, Lupe and Carlos, and my brothers, José Carlos and Gabriel.

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Chapter 1: Introduction and Literature Review

1.1 Introduction

Although economists are usually opposed to protectionism, governments continue to use trade policy to protect domestic industries on a widespread basis. In recent years, a growing literature on the political economy of trade policy has analyzed various motives for protection, but despite some significant developments a number of important questions remain. For instance, why is such a disproportionate share of protection given to declining industries? The most protected sectors in the US and many other countries, such as agriculture, textiles, clothing, footwear and steel, are all declining sectors. Similarly, why is trade policy typically biased in favor of import-competing sectors and thus restricts rather than expands trade? The anti-trade bias in trade policy is considered an important puzzle in the literature because most existing models do not generate such prediction. The Grossman and Helpman (1994) (henceforth GH) model has become the leading political economy model of trade protection because, by explicitly modeling government-industry interactions, it derives from first principles a set of directly testable predictions about the determinants of protection.[1] However, it does not explain why protection is usually given to industries in which profits and employment are declining, and under some neutral assumptions it predicts a *pro*-trade bias in trade policy.

[1] Goldberg and Maggi (1999) and Gawande and Bandyopadhyay (2000) were the first to test its predictions.

In this dissertation we incorporate individual loss aversion in a political economy model to derive and estimate the effects of loss aversion on trade policy determination, and show how it allow us to explain a number of important and puzzling features of trade policy. According to the pressure-group approach, interest groups that spend more on lobbying should, other things equal, receive the most government support. Given that we would expect bigger and expanding industries to be in a better position to finance lobbying expenditures or provide larger contributions, it is paradoxical that a surprising amount of support goes to declining sectors.[2] This fact provides a motivation for using loss aversion as a natural framework that can generate such pronounced asymmetry. The concept of loss aversion is due to Kahneman and Tversky (1979), who provide experimental evidence that individuals place a larger welfare weight on the loss of a given amount of income than on a gain of the same amount. Empirical estimates of loss aversion are typically close to 2, meaning that the disutility of giving something up is twice as large as the utility of acquiring it.[3] In a model of endogenous protection in which individual preferences exhibit loss aversion, we show that higher protection will be given to sectors in which profitability is declining.

Loss aversion has gained increased recognition in economics as an important explanation for several patterns of human behavior and many phenomena that remain paradoxes in traditional choice theory, such as the endowment effect (Thaler [1980])

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[2] In Section 1.2.1 we review the literature related to this question.

[3] See, for instance, Kahneman, Knetsch and Thaler (1990), and Kahneman and Tversky (1992).

and the equity premium puzzle (Benartzi and Thaler [1995]).[4] Loss aversion differs from risk aversion in that, first, it implies a kink in the utility function and thus generates a pronounced asymmetry even for arbitrarily small gains and loses. Second, there is diminishing sensitivity: the marginal value of both gains *and* losses decreases with their size, and our empirical results also support this prediction. Risk aversion does not generate diminishing sensitivity over losses. Third, under loss aversion there is reference dependence, and in our model this implies that for two sectors that are symmetric in all respects except that one has a loss and the other a gain of similar magnitude, the sector that has a loss receives higher protection. A traditional concave utility function cannot generate this result, since the level of income is similar in both sectors and hence both would get the same protection.[5]

As Rodrik (1995) points out, although a common answer to the question of why free trade is so rarely practiced relies on the government's use of trade policy to redistribute income toward specific groups, an equally important puzzle remains: Why is this redistribution biased in favor of import competing sectors and therefore restricts trade? The anti-trade bias puzzle is particularly relevant for small economies, given that they cannot use tariffs to improve their terms of trade. Some political economy models of endogenous protection get rid of the puzzle by introducing some

[4] Further references and details are provided in the literature review (Section 1.2.3).

[5] The same is true if the government has a concern for inequality. Another example of how loss aversion generates different predictions for protection is that if we consider a situation in which all sectors experience equal losses, the inequality concern motive does not lead to any transfers for them, while the loss aversion motive predicts protection for all.

artificial assumptions.[6] Moreover, the leading political economy model of GH (1994) not only cannot explain the anti-trade bias but, in fact, under some symmetry assumptions predicts a pro-trade bias (Levy [1999]).

We show that if individual preferences exhibit loss aversion and the coefficient of loss aversion is large enough, there will be an anti-trade bias in trade policy. The intuition is as follows. Starting with two (non-numeraire) sectors that are completely symmetric, consider a shock that leads the country to trade both goods, such as a shock to the endowments that increases output in one sector and decreases output in the other sector by the same amount. The first good becomes the export good and the other the import good. Since output is higher in the export than in the import-competing sector and protection is proportional to output, this (the "size effect") leads to the tariff being lower than the export subsidy. This is the only effect present in the GH model, and thus in that model we get a pro-trade bias. Under loss aversion, in contrast, the same shock also leads to a loss for the import-competing sector that looms larger than the gain of the export sector and, if the coefficient of loss aversion is sufficiently high, this effect (which we call the "loss aversion effect") dominates the size effect and the tariff will be higher than the export subsidy. We show that the anti-trade bias also arises between two large countries even if cooperation removes the terms-of-trade motive for the use of trade protection.[7]

[6] For instance, the tariff-formation function approach, first used by Findlay and Wellisz (1982), assumes that interest groups lobby for tariffs but not export subsidies. Similarly, the political-support function approach a la Hillman (1982) assumes that the policymaker wants support from import-competing interest groups but not from exporting ones.

[7] We also show that alternative shocks that lead the country to trade both of the non-numeraire goods will generate an anti-trade bias if the coefficient of loss aversion is large enough. In addition, we

We then endogenize lobby formation and show that, for a high enough coefficient of loss aversion, 1) an industry will be more likely to become organized and lobby for protection if it has a loss, and 2) import competing sectors will be more likely to form a lobby than export sectors, reinforcing the anti-trade bias result. The intuition for the first result is that the increase in income brought about by protection has a larger impact on utility for a sector that experiences a loss, due to loss aversion, and the additional protection associated with becoming organized is higher for the loser sector as well. This result leads to the second, since if importers lose and exporters gain as the country starts trading with the rest of the world (in the absence of intervention), the net benefit of forming a lobby will be larger for importers. The result is important more generally for the political economy literature, since it can apply to the question of why declining industries receive a disproportionate share of government support not only in the form of trade protection but also through other policy instruments, such as production subsidies, tax breaks, etc. Loss aversion provides an explanation for this by implying that losers will have a larger incentive to become politically organized.

We then study the empirical importance of loss aversion for trade policy. We use a nonlinear regression procedure to directly estimate the parameters of the model and test its predictions. The results for the US support the model and the loss aversion parameter estimates are very close to those obtained by Kahneman and Tversky (1992) with experimental data. We find that losses have a larger impact on protection than gains, and we estimate the coefficient of loss aversion to be about 2. In addition,

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provide the condition that must hold for an anti-trade bias when we do not impose any symmetry assumptions.

we can reject the null hypothesis of no loss aversion against the alternative that the coefficient of loss aversion is greater than one. The results are also consistent with diminishing sensitivity to income changes for both gains *and* losses. We also reject the null hypothesis that the exponent of the income changes is equal to one. This empirical result also provides a contribution to the literature on behavioral economics, since diminishing sensitivity in gains *and* losses is an important distinction between loss and risk aversion. To our knowledge, this is the first study that provides econometric estimates from non-experimental data of *all* the parameters of the value function proposed by Kahneman and Tversky (1992).[8]

We incorporate loss aversion in the framework of GH (1994), and given that our predictions for protection differ from those of GH, we compare the empirical performance of both models and find that the standard information criteria favor our model over the GH model. These results contrast with those of Gawande and Bandyopadhyay (2000) and Goldberg and Maggi (1999), who find that introducing additional variables in the estimation of the GH model does not significantly improve its explanatory power. Our approach differs from theirs, however, in that we have a well-specified alternative hypothesis. In addition, their estimates of the weight that the government attaches to political contributions relative to social welfare are puzzlingly low and, as Gawande and Krishna (2003) say, "(...) enough to cast doubt on the value of viewing trade policy determination through this political economy

[8] We know of two papers that estimate the loss aversion coefficient using non-experimental data. Putler (1992) estimated separate demand elasticities for increases and decreases in the retail price of shell eggs relative to a reference price and obtains a ratio of 2.4. Hardie, Johnson and Fader (1993) estimate coefficients of loss aversion for quality in the case of orange juice that are also about 2; however, they assume that the value functions are linear and thus do not test for diminishing sensitivity and do not estimate the corresponding parameter.

lens." (p.20). Our estimates imply a significantly larger weight on contributions, consistent with the common-agency approach's assumption that protection is "sold". In fact, our estimates imply that most protection is sold and the government attaches a very low weight to social welfare.

Finally, given that the influence of special interest groups via political contributions is a crucial determinant of protection in the model, we estimate a Probit equation on political organization using a two-stage conditional maximum likelihood estimator and find evidence of loss aversion in lobby formation: an industry is more likely to become organized if it has a loss.

The next section in this chapter discusses the literature related to protection of declining industries and the anti-trade bias in trade policy, and describes the concept of loss aversion, its implications and the evidence that supports it. In Chapter 2 we study the implications of loss aversion for trade policy. First, we present the model and solve for the equilibrium trade policies. We then show that if individual preferences exhibit loss aversion, higher protection will be given to sectors in which profits are declining. We also show that if the coefficient of loss aversion is sufficiently large, then trade policy will have an anti-trade bias. Finally, we endogenize lobby formation and study the implications that this has for trade policy, protection and the anti-trade bias. In Chapter 3 we estimate the parameters of the model and provide empirical evidence of the relevance of loss aversion for trade policy determination and lobby formation. In Chapter 4 we conclude.

1.2 Literature

1.2.1 Declining Industries and Protection: The Loser's Paradox

Several authors have reported that a disproportionate share of protection is given to declining industries. Typical examples in the US and many other developed countries include textiles, agriculture, footwear and steel. In the US, Hufbauer, Berliner and Elliot (1986) and Hufbauer and Rosen (1986) study 31 cases of special protection for troubled industries. Ray (1991) presents econometric evidence that protection is associated with slow-growth and declining industries. Marvel and Ray (1983) provide evidence that the pattern of protection that resulted from the Kennedy Round was structured to minimize the cost of disruption for domestic industries facing significant import threats. They find that an industry's growth rate is negatively related to its level of protection, and also that NTBs were used systematically to offset losses for domestic firms that would have occurred as a result of tariff reductions.

Moreover, national laws and principles in international trade agreements allow for the use of some forms of protection favoring domestic over foreign firms, such as antidumping, countervailing duties and safeguards, provided that injury conditions or threats of injury to an established industry due to imports exist. Baldwin and Steagall (1994) and Baldwin (1985) find a significant positive correlation between affirmative "serious injury" findings by the US International Trade Commission (ITC) and declining profits and employment. Interestingly, the former also find that the ITC tends to make an affirmative decision "regardless of the source of the injury" (i.e., whether it is caused by imports or other factors).

Baldwin and Robert-Nicoud (2002) refer to the fact that "losers" win a disproportionate share of government's support as *the losers' paradox*.[9] According to the pressure-group approach, interest groups that spend more on lobbying should, other things equal, receive the most government support. Given that we would expect bigger and expanding industries to be in a better position to finance lobbying expenditures, the fact that a surprising amount of support goes to declining sectors is puzzling. One explanation for this is the conservative social welfare function due to Corden (1974), by which politicians place a larger weight on reductions than on increases in income. But, since a specific form of the policymaker's objective function is imposed and not derived from microfoundations, the answer is basically assumed.[10] In addition, due to its political economy component, our model can account for the fact that not all declining industries get similar protection: organized industries often receive more protection than unorganized ones.[11]

Hillman (1982) and Cassing and Hillman (1986) use a political support function to study why declining industries that receive protection continue to decline.

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[9] They provide a review of the literature that addresses this paradox.

[10] In contrast, we will focus on the effects of loss aversion on the behavior of individuals (which in turn translates to firms and lobbying groups), and use a model in which the policymaker's objective function can be derived from microfoundations.

[11] The political economy literature on trade protection has emphasized the importance of political influences in determining trade policy. See GH (1994), Goldberg and Maggi (1999), and Gawande and Bandyopadhyay (2000), for instance.

However, these approaches do not explain why declining industries receive protection in the first place.[12]

Grossman and Helpman (1996) rely on free riding by new entrants in growing industries to show that early entrants in those industries will have little incentive to lobby, whereas declining industries are not likely to face new entry, since they presumably offer below normal rates of return on new investment. In a related paper, Baldwin and Robert-Nicoud (2002) use a lobbying model that allows for free entry and sunk costs to show that in expanding industries, entry tends to erode the rents obtained from lobbying, while in declining industries, sunk costs rule out entry provided that the rents are not too high. The asymmetry in appropriability leads to asymmetric lobbying and so to losers getting most of the protection.[13]

Independent work by Freund and Ozden (2004), written after our first version of the theoretical part of this thesis, studies the effects of loss aversion on trade protection, with a focus on the effects of negative shocks on protection. They also study the dynamics of protectionist policies and show that protection following a negative price shock will be persistent, which we do not explicitly address here.[14]

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[12] Van Long and Vousden (1991) show that Hillman's main result holds also in a general equilibrium framework. Brainard and Verdier (1997) suggest that liquidity constraints on lobbying activities may be more binding in growing industries than in declining ones.

[13] However, one would expect that in declining industries the probability of exiting the industry is higher, which would reduce the expected benefit from lobbying. In addition, our model differs from these approaches in that it can explain not only why *organized* declining industries get more protection, but also why governments may have an incentive to provide higher protection to losers than winners even if the industries are unorganized, that is, *even if the government is a pure social welfare maximizer*.

[14] Our first version was written in July 2003. We presented a version of the theoretical and empirical results at the Inter-University Graduate Student Conference at Yale University in May 2004, and at the North American Summer Meeting of the Econometric Society in June 2004.

Their modeling of loss aversion is different from ours in that they do not incorporate the effects of positive changes on utility, which leads to different predictions than the ones we obtain. Other differences are, first, that they do not formally address the anti-trade bias puzzle.[15] Second, they take lobby formation as exogenous and thus do not study the effects of loss aversion on lobby formation. Finally, they do not test the predictions of their model.

1.2.2 The Anti-Trade Bias

In this section we will cite some of the explanations that have been provided by the literature concerning the anti-trade bias in trade policy. As Rodrik (1995) mentions, one possible answer is that tariffs were initially imposed for revenue reasons and that the anti-trade bias persists due to some bias toward the status quo. In that line, Fernandez and Rodrik (1991) explain persistence by showing that there is a bias toward the status quo, and therefore against efficiency enhancing reforms such as trade liberalization, if some of the winners and losers from the reform cannot be identified ex ante. As a result, liberalization may be rejected under majority voting even though it would have received adequate political support ex post had it been adopted. Another explanation that relates the anti-trade bias to a status quo bias is due to the conservative welfare function postulated by Corden (1974), described earlier.

[15] They obtain the prediction that a deviation from free trade will result under loss aversion even if the government maximizes social welfare only, but do not explicitly address the question of why protection is typically biased in favor of import-competing sectors rather than export sectors, and thus there is an anti-trade bias. (They state that their model does not directly address the anti-trade bias and only mention some potential reasons of why it might arise).

However, these arguments do not explain the initial structure of protection, but rather take it as given. In addition, except for the case of less developed countries, we can question the importance of the revenue motive for the use of trade policy in most of the other countries at present, as well as for the use of quantity restrictions that do not produce revenue.

Olson (1983) states that negative shocks will lead to more lobby formation due to the fact that they reduce the benefit for potential entrants, and therefore reduce the free-rider problem associated with lobby formation. If negative shocks affect primarily import-competing sectors, this could lead to an anti-trade bias. Nevertheless, those shocks would also increase the probability of exiting the industry, reducing the expected benefit of lobby formation.[16]

Combining analytical and numerical techniques, Eaton and Grossman (1985) show that trade policy will often have an anti-trade bias in a small economy that faces uncertain terms of trade if some factors are immobile ex post and insurance markets are incomplete. They assume that when capital is allocated between production activities the terms of trade are unknown. A tariff redistributes income toward the group with a higher marginal utility in either of the two states of nature considered, acting as a partial substitute for insurance. However, Dixit has shown in various papers that not explicitly modeling the causes for markets to be incomplete can lead to erroneous policy proposals.[17]

[16] Moreover, it is not clear why negative shocks would affect mostly import-competing sectors.

[17] See, for instance, Dixit (1989). We should point out that, in contrast to theirs, our argument does not rely on uncertainty or incomplete markets.

Finally, Limão and Panagariya (2004) use a general equilibrium model to show that an anti-trade bias can arise provided that the elasticity of substitution in production is larger than one. Also in a general equilibrium framework, Limão and Panagariya (2003) show that if the government's objective reflects a concern for inequality, or diminishing political support from factor owners, then trade policy exhibits an anti-trade bias. The reason is that, starting from a symmetric equilibrium, the same shock that leads the economy to trade leaves the owners of the import factor worse off relative to the owners of the export factor, and a tariff reverses some of this equity loss. Our approach differs in that we explicitly model the political process and that we rely on loss aversion in individual preferences instead of an inequality concern on the part of the government to explain the anti-trade bias.

1.2.3 Loss Aversion

In traditional expected utility theory, the domain of the utility function is final assets, rather than gains or losses. Kahneman and Tversky (1979) provide evidence that value or utility is determined by changes in wealth, and thus they emphasize the importance of changes as opposed to final asset positions that include current wealth.[18]

[18] Markowitz (1952) was the first to propose that utility be defined on gains and losses rather than on final asset positions. Nonetheless, as the authors point out, the emphasis on changes does not imply that the value of a particular change is independent of the initial position. Value should be treated as a function in two arguments: the asset position and the magnitude of the change from the reference point (although the representation as a function of one argument can be a satisfactory approximation when changes are small or even moderate).

Another important characteristic of preferences of which Kahneman and Tversky (1979) find evidence is that the disutility that one experiences in losing a sum of money is greater than the pleasure associated with gaining the same amount. This phenomenon is called *loss aversion* and it leads to a utility function that is steeper for losses than for gains. The concept was first defined in the framework of prospect theory and then extended to choice under certainty (Tversky and Kahneman [1991]). Several experiments have suggested a coefficient of loss aversion of about 2 under both risky and riskless choices.[19]

An implication of loss aversion is what has been called the *status quo bias*: individuals have a strong tendency to remain at the status quo, because the disadvantages of leaving it receive more weight than the advantages.[20]

Finally, Kahneman and Tversky (1979) find evidence of what they call *diminishing sensitivity*: the marginal value of both gains and losses decreases with their size. Note that this does not hold under a concave utility, which implies *increasing* sensitivity to losses.

Based on the findings described above, Kahneman and Tversky (1992) propose a value function defined over gains and losses relative to some reference point -such as the status quo- with a slope that changes abruptly at the reference point, consistent with loss aversion. Specifically, they propose a function of the following form:

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[19] See Kahneman, Knetsch and Thaler (1990), Tversky and Kahneman (1990) and Tversky and Kahneman (1991).

[20] See Knetsch (1989), who conducts an experiment that illustrates the status-quo bias. See also Samuelson and Zeckhauser (1988), who demonstrated this effect using different experiments.

$$v(x) = \begin{cases} x^{\alpha} & if \;\; x \geq 0 \\ -\lambda(-x)^{\beta} & if \;\; x < 0 \end{cases}$$

where λ is the coefficient of loss aversion and x is measured as the difference in wealth with respect to the last time wealth was measured. Using experimental evidence, they estimate α and β to be 0.88 (consistent with diminishing sensitivity) and λ to be 2.25.[21]

We should point out that, besides reference dependence and diminishing sensitivity over both gains and losses, loss aversion also differs from a standard concave utility function in that the slope of the value function changes abruptly at the reference level, so that we have a pronounced asymmetry even for arbitrarily small gains and losses. As Tversky and Kahneman (1992) say "The observed asymmetry between gains and losses is far too extreme to be explained by income effects or by decreasing risk aversion." (p. 298). In fact, an important aspect of loss aversion is that it can resolve the criticism on expected utility put forward by Rabin (2000) and Rabin and Thaler (2001), who show that for *any* concave utility function, even very little risk aversion over modest stakes implies an absurd degree of risk aversion over larger stakes.[22]

[21] The estimation was based on an experiment involving 25 graduate students from Berkeley and Stanford, in which subjects indicated preferences between different sure outcomes and a risky prospect. Certainty equivalents were thus derived from observed choices, and the authors used a nonlinear regression procedure to estimate the parameters separately for each subject and then obtained their median values.

Several existing studies have used loss aversion to explain different puzzles. These include Dunn (1996), who using survey evidence from seven labor markets, presents empirically determined indifference functions for income and leisure which exhibit loss aversion, and this in turn can explain the theoretically unexpected stability observed in labor markets when there is an overtime premium. Some theoretical papers that incorporate loss aversion into worker's preferences include Bhaskar (1990) and Mc Donald and Sibly (2001). Shea (1995) finds that consumption responds more strongly to predictable income declines than to predictable income increases. That asymmetry is consistent with models in which preferences exhibit loss aversion (see Bowman, Minehart and Rabin [1999]). Benartzi and Thaler (1995) use loss aversion to explain the equity premium puzzle. In recent years, loss aversion has also been frequently applied in behavioral finance. For example, Barberis et al. (2001) introduce loss aversion into investor preferences and show that their model reproduces some puzzling features of aggregate asset pricing data, such as the high mean, volatility and predictability of stock returns. Similarly, Barberis and Huang (2001) use loss aversion to explain the time series and cross-sectional behavior of individual stocks. The marketing literature has also reported evidence of loss aversion in consumer judgment and choice. For instance, Puttler (1992) and Hardie, Johnson and Fader (1993) find evidence of loss aversion in the demand for eggs and orange juice, respectively. Another example is Van Ittersum et al. (2004), who show that the importance of product attributes in consumer judgment and choice is larger if the attribute levels represent a loss relative to the consumer's reference point.

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[22] For example, Rabin (2000) shows that a person who turns down a 50-50 bet of losing $100 and gaining $110 would also turn down a 50-50 bet of losing $1000 and gaining *any* amount of money.

Chapter 2: Implications of Loss Aversion for Trade Policy

2.1 The Model

We consider a small competitive economy that takes world prices as given (in section 2.3.2 we consider the case of large economies). Individuals have identical preferences but may differ in their factor endowments. They maximize their utility, which is given by

$$u = \begin{cases} x_0 + \sum_{i=1}^{n} u_i(x_i) - \lambda\left[-\left(\tilde{E} - \Phi(\tilde{E})\right)/\Phi(\tilde{E})\right]^{\beta} & if\ \tilde{E} < \Phi(\tilde{E}) \\ x_0 + \sum_{i=1}^{n} u_i(x_i) + \left[\left(\tilde{E} - \Phi(\tilde{E})\right)/\Phi(\tilde{E})\right]^{\alpha} & if\ \tilde{E} \geq \Phi(\tilde{E}) \end{cases} \tag{1}$$

where x_0 is consumption of the numeraire good; x_i denotes consumption of good *i*, *i* = 1, 2, ... , *n*; $\tilde{E}$ is income derived from the sale of factor endowments; $\Phi(\tilde{E})$ denotes the expected value of $\tilde{E}$, which is determined in the previous period; and $\lambda > 1$ is the coefficient of loss aversion.[23] The sub-utility functions $u_i(\cdot)$ are differentiable, increasing and strictly concave.

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[23] We should point out that the coefficient of loss aversion was introduced in prospect theory and thus the parameter λ in our model does not strictly correspond to the coefficient of loss aversion defined under uncertainty. However, Tversky and Kahneman (1991), who extend loss aversion to the case of choice under certainty, mention that λ (which captures the asymmetry of the welfare effects between consumption below and above the reference point in their modeling) can be interpreted as the coefficient of loss aversion.

Individuals in our model derive utility (or value) not only from consumption levels but also from deviations in their income from their expected income. An employee who already expected to earn a certain salary might consider receiving a lower salary than the one he expected as a loss, even if the salary he actually receives is higher than it was in the previous period. We appeal to the psychological motives that lie behind the evidence on the "endowment effect", in which individuals become attached to a good once they own it and thus giving it up represents a loss for them; and this loss has a larger welfare effect than the gain associated with receiving it.[24] Köszegi and Rabin (2005), who define the reference point as recent expectations about outcomes, argue that such evidence can also be interpreted in terms of expectations, since in those cases people would expect to keep the status quo. In the typical experiment *all* individuals are "given" a mug to inspect, but only the owners are told it belongs to them and can keep it.[25] Therefore, it can be argued that the difference between owners and non-owners "(...) is not current or lagged physical possession, but rather expectation of future possession." (p.16).[26] Presumably the same is true regarding income: once an individual has incorporated a certain

[24] See Thaler (1980), Kahneman, Knetsch and Thaler (1990) and Tversky and Kahneman (1991). The reference point is typically assumed to be the pre-choice status quo, or past consumption, although Kahneman and Tversky do not provide a theory of determination of the reference point.

[25] In the experiments, some subjects are given a mug and are told they own it, while others are only asked to inspect the mug from their neighbors.

[26] Köszegi and Rabin (2005) cite some evidence that indicates that expectations are more important in determining people's perceptions of gains and losses than the status quo or past consumption. For instance, Loewenstein (1988) finds that the amount that people have to be paid to delay receiving a good they have anticipated getting today is larger than what they are willing to pay to speed up receiving a good they had expected to get in the future. This also indicates that unanticipated losses loom larger than unanticipated gains. In addition, they mention some studies that report evidence on emotions and neural responses to both the outcome of a lottery and its unattained outcome.

expectation concerning his level of income, a lower realization of income would be regarded as a loss. As Köszegi and Rabin (2005) state: “An employee who had been confidently expecting a 10% raise might assess a raise of only 5% as a loss.” (p.2)[27]

Thus, the first term in (1), given by $x_0 + \sum u_i(x_i)$, reflects utility over consumption. The second term captures the idea that individuals care about changes in their income with respect to the level of income they had expected to have, with losses looming larger than gains.[28]

We will introduce and focus on the effects of unanticipated shocks only, and therefore the expectation of income formed in the previous period equals income in the previous period, that is, $\Phi(\widetilde{E}) = \widetilde{E}^{(-1)}$.

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[27] Köszegi and Rabin (2005) point out that modeling the reference point as expectations makes possible to avoid some dismissals of the theory of Kahneman and Tversky that occur when applied as traditionally interpreted, such as in Plott and Zeiler (2003) and List (2003). Thus, they state that findings by List (2003) that the endowment effect can be overcome by traders with significant market experience, for instance, could be interpreted as more experienced traders expecting a high probability of parting with items they have just acquired.

[28] It is common to add to the utility function a loss aversion term that captures the effects of changes in consumption or income with respect to the reference point. For instance, Bowman et al. (1999) define utility as a sum of a function that captures utility over a reference level of consumption, and a gain-loss utility function that depends on the changes in consumption with respect to the reference point (this gain-loss function satisfies loss aversion and diminishing sensitivity). Köszegi and Rabin (2005) define utility also as the sum of a consumption utility function (that depends on the level of consumption) and a gain-loss utility function. (We should point out that although they describe utility as defined over consumption, in their analysis they consider two dimensions of choice: consumption goods and dollar wealth, and thus unexpected changes in wealth also affect utility and exhibit loss aversion. The same is true in Heidhues and Köszegi (2005), who draw on the framework of Köszegi and Rabin (2005) and also incorporate loss aversion in money). Barberis et al. (2001) and Barberis and Huang (2001) model utility as the sum of a term capturing utility over consumption and another term capturing the effect of changes in wealth. They point out that even if the second term were not present, individuals would still care about changes in income because of what those changes mean for consumption, and by adding the second term they take the view that changes in income generate utility *over and above* the indirect utility that comes through consumption. (They suggest that an investor’s income may be associated with ego, self-esteem, or a feeling of mastery). Our modeling relies on the evidence of loss aversion under certainty and incorporates Köszegi and Rabin (2005)’s argument that deviations from what people *expected* to have affect utility directly, as we mentioned above.

An individual with income E will consume $x_i = d_i(p_i) = [u'_i(p_i)]^{-1}$ of good i, and $x_0 = E - \sum_i p_i d_i(p_i)$ of the numeraire good. The indirect utility function is:

$$v(\mathbf{p}, E) = \begin{cases} E - \lambda\left[-\left(\widetilde{E} - \widetilde{E}^{(-1)}\right)/\,\widetilde{E}^{(-1)}\right]^{\beta} + s(\mathbf{p}) & \text{if } \widetilde{E} < \widetilde{E}^{(-1)} \\ E + \left[\left(\widetilde{E} - \widetilde{E}^{(-1)}\right)/\,\widetilde{E}^{(-1)}\right]^{\alpha} + s(\mathbf{p}) & \text{if } \widetilde{E} \geq \widetilde{E}^{(-1)} \end{cases} \tag{2}$$

where **p** is the vector of domestic prices, and the consumer surplus derived from the non-numeraire goods is given by $s(\mathbf{p}) = \sum_i u_i\left(d_i(p_i)\right) - \sum_i p_i d_i(p_i)$.

Good 0 is manufactured from labor alone with constant returns to scale and an input-output coefficient equal to 1. It is assumed that the supply of labor is large enough to ensure that some of this good is always produced. Then, the wage rate equals 1 in equilibrium. Each of the non-numeraire goods is produced using labor and a sector-specific factor, with constant returns to scale. The supply of the specific factors is fixed. Since the wage is fixed, the rents derived from the specific factors are a function of the domestic price only. We denote these rewards by $\Pi_i(p_i)$. By Hotelling's lemma, output is given by $y_i = \Pi'_i(p_i)$.

The government can implement trade taxes and subsidies. The net per capita revenue from all taxes and subsidies is:

$$r(\mathbf{p}) = \sum_i (p_i - p_i^*)\left[d_i(p_i) - \frac{1}{N} y_i(p_i)\right] \tag{3}$$

where p_i^* is the world price of good *i* and *N* measures the total population. We assume that the government redistributes revenue uniformly to all individuals and thus $r(\mathbf{p})$ equals the net transfer to each individual.

An individual derives income from wages and government transfers, and potentially from the ownership of some specific factor. We assume that they own at most one specific factor. The owners of the specific factor used in industry *i* may decide to organize themselves into lobby groups. For now we will assume that in some exogenous set of sectors *L*, the specific factors have been able to organize for political activity (later on we endogenize lobby formation). Each lobby offers the government a contribution schedule, $C_i(\mathbf{p})$, which maps every policy that the government might choose into a campaign contribution level. We denote the joint welfare of the members of lobby *i* by $V_i = W_i - C_i$, where W_i is their gross-of-contributions joint welfare, given by:[29]

$$W_i = \begin{cases} l_i + \Pi_i(p_i) - \lambda\left[-\left(\widetilde{E}_i - \widetilde{E}_i^{(-1)}\right)/\,\widetilde{E}_i^{(-1)}\right]^{\beta} + \theta_i N[r(\mathbf{p}) + s(\mathbf{p})] & if\ \widetilde{E}_i < \widetilde{E}_i^{(-1)} \\ l_i + \Pi_i(p_i) + \left[\left(\widetilde{E}_i - \widetilde{E}_i^{(-1)}\right)/\,\widetilde{E}_i^{(-1)}\right]^{\alpha} + \theta_i N[r(\mathbf{p}) + s(\mathbf{p})] & if\ \widetilde{E}_i \geq \widetilde{E}_i^{(-1)} \end{cases} \tag{4}$$

where l_i is the labor supply (also labor income) of the owners of the specific input used in industry *i*, and θ_i is the fraction of the population that owns some of this

[29] We will assume that there is a single owner of each specific factor. If we had more than owner and each one owns a fraction δ_j of the specific factor *i* (where *j* could vary across owners), then it can be shown that the only difference is that the loss and gain terms (the third term in equation (4) and the protection equation that we derive, shown in (8)) would be multiplied by the number of individuals who own the specific factor *i*. None of our results (propositions 1 to 5) would be affected by this.

factor. We will assume, for simplicity, that ownership in any given sector is highly concentrated, so that $\theta_i \to 0$ and each industry lobbies only for its own product. This allows us to abstract from the effects of lobby competition and focus on the interaction between the government and each of the lobbies. This assumption and the fact that what we include in the loss aversion term is the income derived from the sale of factor endowments allow us to abstract from some effects that are not crucial in terms of the results, while gaining significantly in tractability. In addition, we believe that the psychological motives behind loss aversion over changes in income with respect to expected income might be particularly strong for work income (return to labor and the specific factors), than for transfers exogenously received from the government.[30] Therefore, we have that, for lobby *i*,

$\lim_{\theta_i \to 0} E_i \equiv \lim_{\theta_i \to 0}\left[l_i + \Pi_i(p_i) + \theta_i N r(\mathbf{p})\right] = l_i + \Pi_i(p_i) \equiv \widetilde{E}_i$ and:[31]

$$W_i = \begin{cases} l_i + \Pi_i(p_i) - \lambda\left[\left(\Pi_i(p_i^{(-1)}) - \Pi_i(p_i)\right)/E_i^{(-1)}\right]^{\beta} & if\ \Pi_i(p_i) < \Pi_i(p_i^{(-1)}) \\ l_i + \Pi_i(p_i) + \left[\left(\Pi_i(p_i) - \Pi_i(p_i^{(-1)})\right)/E_i^{(-1)}\right]^{\alpha} & if\ \Pi_i(p_i) \geq \Pi_i(p_i^{(-1)}) \end{cases} \quad (5)$$

30 An implication of this is that if the government uses a lump sum transfer to fully compensate a sector for which income from factor endowments is lower than it was expected, that would not eliminate the motive for using a tariff. We should also point out that including the tariff revenue in the loss aversion term would only reinforce the anti-trade bias result that we discuss later on, since an import tariff leads to a transfer of income to the individuals while an export subsidy implies that the government must levy resources from them and therefore tends to generate losses. Also, excluding this from the loss aversion term allows us to identify the industries with losses and gains in the empirical implementation of the model.

31 We take the factor endowments of each individual as constant across periods. Therefore, $\Pi_i(p_i) < \Pi_i(p_i^{(-1)})$ if and only if $E_i < E_i^{(-1)}$ and $\Pi_i(p_i) \geq \Pi_i(p_i^{(-1)})$ if and only if $E_i \geq E_i^{(-1)}$.

where $\Pi_i(p_i^{(-1)})$ denotes last period's profits for the lobby.

The government maximizes a weighted sum of contributions and social welfare:

$$G = \sum_{i \in L} C_i(\mathbf{p}) + aW(\mathbf{p}), \qquad a \geq 0 \tag{6}$$

where social welfare is obtained by adding indirect utilities over all individuals:

$$\begin{aligned} W(\mathbf{p}) = l + \sum_{i=1}^{n} \Pi_i(p_i) - \sum_{\Pi_i < \Pi_i^{(-1)}} \lambda \left[\left(\Pi_i(p_i^{(-1)}) - \Pi_i(p_i) \right) / E_i^{(-1)} \right]^{\beta} \\ + \sum_{\Pi_i \geq \Pi_i^{(-1)}} \left[\left(\Pi_i(p_i) - \Pi_i(p_i^{(-1)}) \right) / E_i^{(-1)} \right]^{\alpha} + N[r(\mathbf{p}) + s(\mathbf{p})] \end{aligned} \tag{7}$$

The game is a two-stage noncooperative game in which the lobbies simultaneously choose their political contribution schedules in the first stage and the government sets the policy and collects the contributions associated with it in the second, as in GH (1994). They define the equilibrium drawing on the work of Bernheim and Whinston (1986).[32]

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[32] In particular, they state that $\left(\{C_i^0\}_{i \in L}, \mathbf{p}^0 \right)$ is a subgame-perfect Nash equilibrium if and only if: **a)** C_i^0 is feasible for all $i \in L$; **b)** $\mathbf{p}^0$ maximizes $\sum_{i \in L} C_i^0(\mathbf{p}) + aW(\mathbf{p})$ on *P*; **c)** $\mathbf{p}^0$ maximizes $W_j(\mathbf{p}) - C_j^0(\mathbf{p}) + \sum_{i \in L} C_i^0(\mathbf{p}) + aW(\mathbf{p})$ on *P* for every $j \in L$; and **d)** for every $j \in L$ there exists a $\mathbf{p}^j \in P$ that maximizes $\sum_{i \in L} C_i^0(\mathbf{p}) + aW(\mathbf{p})$ on *P* such that $C_j^0(\mathbf{p}_j) = 0$.

In the Appendix we derive the equilibrium policies for both organized and unorganized sectors, and obtain a general equation for the equilibrium policies:

$$\frac{\tilde{t}_i}{1+\tilde{t}_i} = \begin{cases} \frac{1}{a}\left\{ I_i + (I_i + a)\beta\lambda \frac{\left(\left|\Delta\Pi_i\right|\right)^{\beta-1}}{\left(E_i^{(-1)}\right)^{\beta}} \right\} \frac{\tilde{z}_i}{\tilde{e}_i} & \text{if } \Delta\Pi_i < 0 \\ \frac{1}{a}\left\{ I_i + (I_i + a)\alpha \frac{\left(\Delta\Pi_i\right)^{\alpha-1}}{\left(E_i^{(-1)}\right)^{\alpha}} \right\} \frac{\tilde{z}_i}{\tilde{e}_i} & \text{if } \Delta\Pi_i > 0 \end{cases} \quad (8)$$

where $\tilde{t}_i = (\tilde{p}_i - p_i^*)/p_i^*$ is the equilibrium *ad valorem* trade tax or subsidy; $I_i = 1$ if $i \in L$ and zero otherwise; $\Delta\Pi_i = \Pi_i(\tilde{p}_i) - \Pi_i\left(\tilde{p}_i^{(-1)}\right)$; $\tilde{z}_i = y_i(\tilde{p}_i)/m_i(\tilde{p}_i)$ is the equilibrium ratio of domestic output to imports (negative for exports); and $\tilde{e}_i = -m_i'(\tilde{p}_i)\,\tilde{p}_i / m_i(\tilde{p}_i)$ is the elasticity of import demand (defined to be positive) or export supply (defined to be negative). For any variable x, we use $\tilde{x}$ to denote its equilibrium value.

Notice that there is protection even for the unorganized sectors, which is due to the direct effect on utility generated by changes in income with respect to its reference level.[33] Therefore, the model predicts protection even if the government is a pure social welfare maximizer, that is, if $a \to \infty$. In addition, we can distinguish the effect that loss aversion has on protection from a status-quo bias effect. For a sector that experiences a loss, loss aversion works in the direction of increasing protection in order to attenuate the negative effect the loss has on utility, and hence in that case we

[33] Thus, we should also point out that if exporters gain when the country opens to trade, the fact that a gain increases utility leads to protection for the exporters even if they are unorganized.

could say that it moves the agents back toward their status-quo utility level. However, if we consider a sector that has a gain, loss aversion also leads to an increase in protection, because gains have a positive effect on utility and, therefore, in that case it tends to move the agents *further away* from the status quo.[34] Finally, note that under diminishing sensitivity to income changes for both gains and losses (that is, α and β lower than one), larger changes are associated with lower protection (see equation (8)). As we mentioned before, this contrasts with the case of a concave utility.

2.2 Protection to Declining Industries

In this section we discuss how loss aversion leads to a bias by which protection tends to favor industries in which profitability is declining. First, recalling that the GH model yields the following solution for the equilibrium policies:

$$\frac{\tilde{t}_i}{1+\tilde{t}_i} = \frac{1}{a} I_i \frac{\tilde{z}_i}{\tilde{e}_i} \qquad (9)$$

we can see that in that model past profits, and more precisely whether the sector is better off or worse off with respect to the previous period, play no role in determining the levels of protection. Our model implies that, given symmetry between two sectors in everything (including size) except in that one experiences a loss and the other a

[34] Nonetheless, for two sectors that are symmetric in all respects except that one has a loss and the other a gain of equal magnitude, loss aversion leads to higher protection for the sector that experiences a loss. Below we say more about this.

gain of equal magnitude, the sector that experiences a loss receives higher protection (a higher import tariff or export subsidy). This result is stated in proposition 1 (see the Appendix for the proof). The reason is that under loss aversion losses loom larger than gains. In particular, according to the estimates of Kahneman and Tversky (1992) for α, β and λ, the second term inside the brackets in (8) is approximately twice as large for the sector that is worse off than for the sector that is better off.[35]

Proposition 1. (Protection to declining industries): *Consider two sectors, i and j, which are symmetric in all respects except that one has a loss and the other a gain of similar magnitude, that is: i)* $\Delta\Pi_i < 0$ *; ii)* $\Delta\Pi_j > 0$ *; and iii)* $|\Delta\Pi_i| = \Delta\Pi_j$.[36] *Under loss aversion, the "loser" sector gets higher protection.*

Hence, while the GH model does not explain why protection is usually given to sectors in which profits are declining, our model implies that, under loss aversion, higher protection will be given to those sectors in which profitability is declining, other things equal. This will also have implications for the prediction of an anti-trade bias, as we discuss in the next section. Note that this result would not hold under a

[35] Recall that they estimate λ to be about 2.

[36] For example, assume a pre-trade situation in which $y_i > y_j$ (demands equal respective outputs and everything else is symmetric between both sectors), and their prices are equal to the world prices, which in turn equal one by the choice of units. Introduce a shock to the endowments of the specific factors that reduces output in sector *i* by $(y_i - y_j)/2$ and increases output in sector *j* by the same amount. Therefore, after the shock, $y'_i = y'_j$, and the sectors are symmetric in all respects except that one has a loss and the other a gain of equal magnitude. (The country now imports good *i* and exports good *j*, which results in an import tariff being imposed on good *i* and an export subsidy on good *j*).

standard concave utility function (or a government with an inequality concern), since in that case symmetry in size would lead to similar protection for both sectors, regardless of the fact that one sector has a loss and the other a gain. Another example of how loss aversion leads to different predictions for protection is that if we consider a situation in which all sectors experience equal losses, the inequality concern motive does not lead to any transfers for them, while the loss aversion motive predicts protection for all.

In addition, in contrast to Baldwin and Robert-Nicoud (2002) and GH (1996), our model not only provides an explanation as to why organized declining industries get more protection, but also as to why governments may have an incentive to respond more vigorously to protect losers than promote winners even if the industries are unorganized, that is, *even if the government is a pure social welfare maximizer*. On the other hand, in contrast to the results that would arise with a utilitarian government or the conservative social welfare function due to Corden (1974), our model can account for the fact that organized industries typically receive more protection than unorganized ones, due to its political economy component.

2.3 The Anti-trade Bias Puzzle

2.3.1 A small economy

We begin by considering the case of a small economy. First, we explain how the GH model predicts a pro-trade bias. Consider the GH model with two non-numeraire goods, good 1 and good 2. Start with complete symmetry between sectors in consumption and production, and assume that under autarky their domestic prices are equal to their respective world prices, which in turn equal unity by the choice of units. Thus, initially there is no trade. Suppose that the endowments of the specific factors change such that the output of good 1 increases by 1 percent and that of good 2 contracts by 1 percent. Good 1 then becomes an export good and good 2 and import good, with trade balancing between them under no intervention. Now recall that the GH model predicts the equilibrium policies given by (9) and therefore an export subsidy on good 1 and a tariff on good 2 (provided that both sectors are organized). Moreover, given the symmetry assumption, the import tariff is lower than the export subsidy due to the fact that the export sector is larger and the level of protection is proportional to output. This implies that exports increase by more than imports decrease and therefore there is a *pro*-trade bias, since the volume of trade is larger than under free trade. This was the result pointed out by Levy (1999). We should point out that the anti or pro-trade bias refers to the outcome of trade policy (the volume of trade relative to the free-trade equilibrium) and not to the direction of change of trade policy after any given shock.[37] Given its neutrality assumptions, this is the most natural starting point to study the anti-trade bias puzzle. Previous authors, such as Limão and Panagariya (2004, 2003) also consider a symmetric scenario as the starting point. This allows us to neutralize the effects one could obtain by introducing any arbitrary asymmetries that may provide other motives for an anti-trade bias. In

[37] We should also mention that it is possible to obtain an anti-trade bias in the Grossman and Helpman model if we introduce some arbitrary asymmetries in the elasticities, for instance, or if there is only one non-numeraire good and it is imported. However, in the last case the result arises only because the export sector (which produces the numeraire good) is not allowed to lobby.

addition, it allows us to show how an anti-trade bias can arise under loss aversion *in the same context* in which the GH model has been shown to predict a pro-trade bias. Later we look at cases in which the initial situation is not symmetric.

Let us now turn to our model. Consider again two non-numeraire goods and similar symmetry assumptions. Introduce the same shock that increases output of good 1 by 1 percent and contracts output of good 2 by 1 percent. Given that the loss (in the absence of intervention) for the import sector is of equal magnitude than the gain for the export sector, without further assumptions the model can predict a pro or anti-trade bias. The reason is that while on the one hand the lower output in the import sector calls for a lower level of protection (the "size effect"), the loss experienced by that sector looms larger than the similar gain of the export sector, due to loss aversion, and the direction of the bias will depend on which of these two effects dominates. The following proposition provides the condition under which the model predicts an anti-trade bias (see the Appendix for the proof).

Proposition 2. (Anti-trade bias condition): *Consider a small country with two sectors that are initially symmetric in consumption and production, and the autarkic prices equal the world prices, which in turn equal one by the choice of units. This implies that initially there is no trade (in the absence of intervention). Introduce a shock that increases output in sector 1 and reduces output in sector 2 by the same amount. There will be an anti-trade bias if and only if the following condition holds:*

$$\lambda > \left[\frac{1}{\beta \frac{(\Delta\Pi_2)^{\beta-1}}{(E^{(-1)})^{\beta}}} \left\{ \frac{y_1 - y_2}{(1+a)y_2} + \alpha \frac{(\Delta\Pi_1)^{\alpha-1}}{(E^{(-1)})^{\alpha}} \frac{y_1}{y_2} \right\} \right]_{t_1=t_2=0} \tag{10}$$

If we set $\alpha = \beta$[38] and let $\Delta\Pi \equiv \Delta\Pi_1 = |\Delta\Pi_2|$ in (10), we obtain:

$$\lambda > \left[\frac{\Delta\Pi / (\Delta\Pi / E^{(-1)})^{\beta}}{\beta(1+a)} \frac{y_1 - y_2}{y_2} + \frac{y_1}{y_2} \right]_{t_1 = t_2 = 0} \tag{11}$$

That is, for a sufficiently large coefficient of loss aversion, the model generates an anti-trade bias. We should stress that $\lambda > 1$ is a necessary condition for (11) to hold, so that we need loss aversion to be present *and* the coefficient of loss aversion to be large enough.[39] In the previous section, we explained that the predictions for protection under loss aversion differ from those obtained under a concave utility or a government with an inequality concern. We can add here that under the scenario considered in proposition 2, an inequality concern would lead to a tariff for sector 2 and an export *tax* for sector 1. The export tax arises because in that case positive

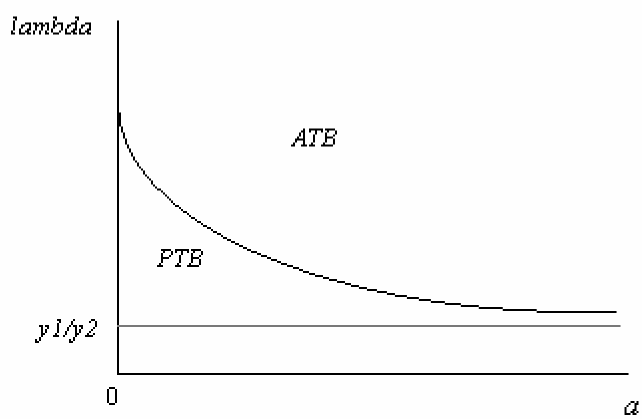
[38] Kahneman and Tversky (1992) estimate α and β to be 0.88. We also find empirical support for the assumption that $\alpha = \beta$ in Chapter 3.

[39] If we do not set $\alpha = \beta$ one could have the condition holding for β sufficiently larger than α even if $\lambda = 1$. However, having β greater than α would be an alternative way of modeling loss aversion, since it implies a larger effect on utility of losses versus gains. We prefer to model loss aversion by means of the coefficient λ , and let α and β capture diminishing sensitivity, as do Kahneman and Tversky (1992). The main point is that, in any case, we need a discontinuity in the slope to obtain an anti-trade bias.

changes do not generate utility; instead, they lead to an increase inequality. Moreover, a concave utility would not generate an anti-trade bias under the same conditions that loss aversion does. For instance, if we consider the scenario mentioned in proposition 1, where both sectors have the same size after the shock but the import sector loses due to the shock while the export sector gains, loss aversion would lead to an anti-trade bias whereas a concave utility would not; it would predict equal protection for both sectors.

Note that (11) is more likely to hold if: a) the output of good 1 is not too large compared to the output of good 2 (because if it were the export sector would have more to gain from protection); and b) the weight that the government places on social welfare, *a*, is not too small (so that the asymmetry between the importers' loss and the exporters' gain receives more weight in the government's objective). Figure 1 shows the values of λ (*lambda*) and *a* for which the model predicts an anti-trade bias.

Figure 1: Anti-Trade Bias



More generally, without imposing any symmetry assumptions, any shock that increases the endowment of the specific factor used in the export sector and decreases that of the factor used in the import sector will generate an anti-trade bias if and only if:

$$\lambda > \left[\frac{1}{\beta \frac{\left(\left|\Delta\Pi_2\right|\right)^{\beta-1}}{\left(E_2^{(-1)}\right)^{\beta}} \frac{y_2}{-p_2 m_2'}} \left\{ \frac{\frac{y_2}{p_2 m_2'} - \frac{y_1}{p_1 m_1'}}{(1+a)} + \alpha \frac{\left(\Delta\Pi_1\right)^{\alpha-1}}{\left(E_1^{(-1)}\right)^{\alpha}} \frac{y_1}{-p_1 m_1'} \right\} \right]_{t_1=t_1=0} \qquad (11')$$

Any technological shock that increases productivity in sector 1 and reduces productivity in sector 2 will have the same implications. Finally, consider again a situation in which the domestic prices of goods 1 and 2 under autarky are equal to their respective world prices. A shock that increases the world price of good 1 and decreases the world price of good 2 will cause good 1 to be exported and good 2 to be imported, generating an anti-trade bias if and only if (11') holds.

The results of this section can be generalized in the following proposition.

Proposition 3. A*ny shock that induces the country to trade both of the non-numeraire goods causing a loss for the import sector (in the absence of protection) leads to* $t_2 > t_1$ *(i.e., trade policy has an anti-trade bias) if and only if the coefficient of loss aversion is sufficiently large, such that equation (11') holds.*

Before relaxing the small-country assumption, we discuss further the asymmetric initial configurations (i.e., without imposing any symmetry assumptions). Consider first a pre-trade situation in which output in sector 1 is larger than output in sector 2 (both prices equal one by the choice of units) and there is a shock that leads the country to export good 1 and import good 2 causing a loss for the import sector.[40] As a result, after the shock we still have $y_1 > y_2$. Then, the size effect calls for a lower level of protection in sector 2 than in sector 1, but the loss aversion effect goes in the opposite direction, calling for higher protection in the import sector. Hence, if the coefficient of loss aversion is high enough for condition (11') to hold, there will be an anti-trade bias.

Now suppose that, initially, output is larger in sector 2 and introduce the same type of shock. If the ordering of outputs is reversed so that $y_2 < y_1$ after the shock, we have a situation similar to the one previously discussed in terms of the direction of the effects, i.e. the size effect and the loss aversion effect work in opposite directions, and there will be an anti-trade bias if and only if equation (11') holds. On the other hand, if the output ranking is preserved, so that $y_2 > y_1$ after the shock, then both the size effect and the loss aversion effect work in the same direction, making the anti-trade bias condition more likely to hold. In particular, if $\left(\Delta\Pi_2 / E_2^{(-1)}\right)^\beta / \Delta\Pi_2 = \left(\Delta\Pi_1 / E_1^{(-1)}\right)^\beta / \Delta\Pi_1$, and $p_2 m_2' = p_1 m_1'$ after the shock, the

[40] From our previous discussion of the various shocks that have these effects one can see that nearly all the possible shocks that lead the country to trade both of the non-numeraire goods will cause a loss for the import-competing sector.

right hand side of (11') will be less than 1.[41] In that case (11') will always hold (since it is sufficient that $\lambda \geq 1$) and we get an anti-trade bias for sure.[42]

2.3.2 Two large countries

We now turn to the case of large economies. Consider a world with two countries, home and foreign, that are identical in all respects. Initially there is no motive for trade or for a tariff or subsidy. Next, consider a shock that causes the following: $y_1 = y_2^* > y_2 = y_1^*$,[43] where stars denote foreign country variables. Since the optimum tariff argument can easily generate an anti-trade bias by providing an incentive for trade protection in order to improve the terms of trade, we look at the cooperative case to ensure that our results are not driven by the terms of trade motive. Let $p_i = \tau_i p_i^w$, where $\tau_i < 1$ denotes an import subsidy or export tax and $\tau_i > 1$ denotes an import tariff or export subsidy, and p_i^w denotes the world price of good *i*.

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[41] We use $\alpha = \beta$.

[42] We can also consider a situation in which the country is initially trading with the rest of the world and introduce a shock that goes in the opposite direction, that is, one that reduces output in sector 1 and increases output in sector 2. Now it is the export sector the one that loses, and loss aversion calls for higher protection in that sector (the size effect doing the opposite). Although in this case it is possible to obtain a pro-trade bias, it is also possible to still have an anti-trade bias if protection ends up being higher in sector 2 than in sector 1, either because the size effect dominates or if we started out with a situation in which $t_2 > t_1$ (recall that this is what the model predicts that would arise when the country opens to trade, provided that the loss aversion coefficient is large enough). In addition, if the shock is sufficiently large we could have that the country reverts to autarky, in which case it is not clear that the government would want to protect sector 1 with an export subsidy instead of an import tariff, or even that the export sector turns into an import-competing sector and so the optimal policy becomes an import tariff. Consequently, we can have negative shocks to the export sector and still get an anti-trade bias.

[43] For example, consider a transfer of δ units of the specific factor of sector 2 from home to foreign and δ units of the factor specific to sector 1 from foreign to home.

We focus on the net effect of the policies in each sector, $\tau_1 - \tau_1^*$ or $\tau_2 - \tau_2^*$. The cooperative equilibrium gives:[44]

$$\tau_2 - \tau_2^* = \frac{1}{a}\left\{1 + (1+a)\beta\lambda \frac{\left(\left|\Delta\Pi_2\right|\right)^{\beta-1}}{\left(E_2^{(-1)}\right)^{\beta}}\right\}\frac{y_2}{-p_2^w m_2'}$$

$$-\frac{1}{a}\left\{1 + (1+a)\alpha \frac{\left(\Delta\Pi_2^*\right)^{\alpha-1}}{\left(E_2^{*(-1)}\right)^{\alpha}}\right\}\frac{y_2^*}{-p_2^w m_2'} \qquad (12)$$

Therefore, $\tau_2 - \tau_2^*$ is positive (that is, there is net trade protection)[45] if and only if:

$$\lambda > \frac{1}{\beta \dfrac{\left(\left|\Delta\Pi_2\right|\right)^{\beta-1}}{\left(E_2^{(-1)}\right)^{\beta}}}\left\{\frac{y_2^* - y_2}{(1+a)y_2} + \alpha \frac{\left(\Delta\Pi_2^*\right)^{\alpha-1}}{\left(E_2^{*(-1)}\right)^{\alpha}}\frac{y_2^*}{y_2}\right\} \qquad (13)$$

which is exactly condition (10) replacing y_2^* for y_1. Hence, we have that if the coefficient of loss aversion is sufficiently large, there will be an anti-trade bias in trade policy in a model with two large economies. This differs from the GH model, in

[44] Given symmetry, we only present the results for good 2. The cooperative equilibrium consists of sets of contribution functions and trade policy vectors for the home and foreign countries such that the settlement is efficient from the point of view of both governments, and that no lobby can gain by restructuring its contribution schedule. It is derived by maximizing the joint welfare of each lobby and a hypothetical mediator when the contribution schedules of all other lobbies are taken as given (See GH [1995] for more details).

[45] The domestic tariff on good 2 would exceed the export subsidy in the foreign country on good 2. We could also have an export tax that exceeds an import subsidy, since τ_2 and τ_2^* are set so as to effect a transfer between the countries. But in any case, the net effect of intervention is to restrict trade.

which the cooperative equilibrium results in net trade promotion, as Levy (1999) has shown.[46]

2.4 Endogenous Lobby Formation

So far we have considered the set of organized industries as exogenous. Some authors have shown that, when studying the policies that arise in the presence of organized interest groups, endogenizing lobby formation may lead to important and surprising changes in the results. For instance, Mitra (1999) provides a theory of lobby formation in the framework of the GH model and shows that the equilibrium trade subsidy for an organized group becomes not always positively related to the government's affinity for political contributions.[47] These findings highlight the importance of accounting for the effects of lobby formation on the equilibrium policies. In this section we allow for endogenous formation of lobbies and show that loss aversion has important implications for political organization, and this in turn

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[46] The intuition is analogous to the one for the case of a small economy, discussed in the previous section.

[47] He also shows that, if everyone in the population owns a specific factor, free trade may arise in equilibrium either when the government is highly responsive to political contributions or when it is highly welfare oriented. In addition, Drazen, Limão and Stratmann (2004) use a model of bargaining between interest groups and the government to show that caps on the contributions that lobbies can make will actually lead to an increase in the number of lobbies that form, as long as the cap is not too low. The larger number of lobbies, in turn, may imply an increase in the total amount of contributions made and a decrease in social welfare, and they find empirical support for their prediction using data for the US. This result contrasts with the literature on campaign finance reform that argues that contribution limits can reduce the amount of money in politics and increase social welfare, but assumes that the number of lobbies is fixed.

will have an effect on trade policy, protection to declining industries and the anti-trade bias, in addition to some broader implications for political economy.[48]

The model now has the following two stages: In the first stage, the owners of each specific factor decide whether to contribute to the financing of the fixed costs of forming a lobby. The second stage reproduces the previous model where lobbies provide the government with their contribution schedules and then the government sets trade policy to maximize a weighted sum of political contributions and social welfare.

Let n now denote the actual number of lobbies formed. In the second stage of the game we take the number of lobbies as given and solve for the equilibrium policies, obtaining the result given by equation (8). It then remains to solve for the number of lobbies that form in the first stage.

Let Ω_o and Ω_u respectively be the equilibrium gross welfare of an organized group and of an unorganized group.[49] Also, let C be the equilibrium contribution by a lobby and let the fixed cost of lobby formation for the ith group of specific factors be denoted by F_i. Then, this group will form a lobby if and only if $\Omega_o - \Omega_u - C > F_i$.

Let the groups be indexed in ascending order of their fixed costs, such that

$$F_{\min} \leq F_1 < F_2 \cdots < F_n < F_{n+1} \cdots < F_\eta \leq F_{\max}$$

[48] We follow Mitra's (1999) approach in this section.

[49] These do not depend on n, since the equilibrium policies are independent of n by the assumption of concentration of ownership of the specific factors.

Take the case of a continuous number of lobbies, with the total mass of non-numeraire goods normalized to unity, so that $n \in [0, 1]$. Then $F'(n) > 0$. Let NB represent the net benefit from forming a lobby (net of contributions), with

$$NB = \Omega_o - \Omega_u - C \tag{14}$$

Let $\Delta\Pi_o = \left|\Pi_o - \Pi_u^{(-1)}\right| / E^{(-1)}$ and $\Delta\Pi_u = \left|\Pi_u - \Pi_u^{(-1)}\right| / E^{(-1)}$. The gross benefit is then:

$$GB = \Omega_o - \Omega_u = \begin{cases} \Pi_o + (\Delta\Pi_o)^\alpha - \left\{\Pi_u - \lambda(\Delta\Pi_u)^\beta\right\} & \text{if } \Pi_u < \Pi_u^{(-1)} \\ \Pi_o + (\Delta\Pi_o)^\alpha - \left\{\Pi_u + (\Delta\Pi_u)^\alpha\right\} & \text{if } \Pi_u \geq \Pi_u^{(-1)} \end{cases} \tag{15}$$

For simplicity of exposition, we are assuming that an unorganized group may either gain or lose with respect to the previous period, whereas an organized group always gains.[50]

With truthful contributions, the equilibrium contribution by an organized group is given by $C_o = \Omega_o - b_o$, where $b_o = \Omega_o - C_o$ is the net-of-contributions welfare (determined in equilibrium). As in Mitra (1999), we can show that in equilibrium a lobby contributes just enough to compensate for the reduction in social

[50] We do not explicitly include here the case where the sector has a loss if it is organized, but doing so would not qualitatively change the results, since the only difference is that in that case becoming organized reduces the loss instead of leading to a gain relative to the previous period. The important difference for our results is between sectors that lose and sectors that gain if they remain unorganized. In the appendix we do consider that case explicitly and provide the condition for the results of this section to hold under that scenario as well.

welfare brought about by its formation (see the Appendix for the proof). Letting W_o and W_u denote welfare (the sum of producer surplus, consumer surplus and tariff revenue) generated by an organized sector and by an unorganized sector respectively, we can write that condition as follows:

$$C = -a(W_o - W_u) \tag{16}$$

We also have:

$$W_u = \begin{cases} \Pi_u - \lambda\left(\Delta\Pi_u\right)^{\beta} + Ns(p^u) + (p^u - p^w)m(p^u) & \text{if } \Pi_u < \Pi_u^{(-1)} \\ \Pi_u + \left(\Delta\Pi_u\right)^{\alpha} + Ns(p^u) + (p^u - p^w)m(p^u) & \text{if } \Pi_u \geq \Pi_u^{(-1)} \end{cases} \tag{17}$$

where $s(p^u) = u\left(d(p^u)\right) - p^u d(p^u)$; and

$$W_o = \Pi_o + \left(\Delta\Pi_o\right)^{\alpha} + Ns(p^o) + (p^o - p^w)m(p^o) \tag{18}$$

where we are assuming that $\Pi_o \geq \Pi_u^{(-1)}$, as mentioned above. From equations (14) and (16) to (18) we can obtain:

$$NB = \begin{cases} (1+a)\left\{(\Pi_o - \Pi_u) + (\Delta\Pi_o)^\alpha + \lambda(\Delta\Pi_u)^\beta\right\} - aN\left[s(p^u) - s(p^o)\right] \\ + a\left[(p^o - p^w)m(p^o) - (p^u - p^w)m(p^u)\right] \qquad if\ \Pi_u < \Pi_u^{(-1)} \\ \\ (1+a)\left\{(\Pi_o - \Pi_u) + (\Delta\Pi_o)^\alpha - (\Delta\Pi_u)^\alpha\right\} - aN\left[s(p^u) - s(p^o)\right] \\ + a\left[(p^o - p^w)m(p^o) - (p^u - p^w)m(p^u)\right] \qquad if\ \Pi_u \geq \Pi_u^{(-1)} \end{cases} \tag{19}$$

Since $NB'(n) = 0$ and $F'(n) > 0$, there is a unique equilibrium with n^* organized groups, where $NB = F(n^*)$.

In the Appendix we show that for two sectors that are symmetric in all respects except that one has a loss and the other a gain of equal magnitude, the loser sector will have a higher benefit of forming a lobby, provided that the coefficient of loss aversion is large enough.[51] The intuition is that the increase in income brought about by protection has a larger impact on utility for a sector that has a loss, and the additional protection associated with becoming organized is higher for the loser sector as well. The benefit of avoiding a loss also has a larger positive effect on social welfare and that tends to reduce the contribution that the lobby has to give to the government. Therefore, for a sufficiently high coefficient of loss aversion, these benefits of avoiding a loss, together with the higher tariff revenue (and thus lower contribution) associated with the higher increase in protection, will dominate the effect of a larger decrease in consumer surplus (which tends to increase the

[51] The fact that unorganized industries also get protection under loss aversion is taken into account. Therefore, we show that, after accounting for this, the net benefit of forming a lobby is higher for a sector that has a loss.

contribution that the industry must give to the government). This result is stated in the following proposition (the exact condition is given in the appendix).

Proposition 4. (Lobby formation and protection to declining industries): *Consider two sectors that are symmetric in all respects except that one has a loss and the other a gain of similar magnitude. If the coefficient of loss aversion is sufficiently high, the net benefit of forming a lobby will be larger for the sector that loses.*

This helps to explain why declining industries usually get more protection (reinforcing the result obtained in Section 2.2), and can explain more generally why "losers" obtain most of the government support not only in the case of trade policy but also for other policy instruments such as production subsidies, tax relief, etc.

Consider the shocks that were mentioned in the previous section, such as a shock that increases the endowment of the specific factor used in one sector and decreases that of the factor used in the other sector; a technological shock that increases productivity in one sector and reduces productivity in the other; or a shock that increases the world price of one good and decreases the world price of the other. These shocks will cause the country to trade and lead to a loss for the import sector and a gain for the export sector in the absence of protection. Then, proposition 4 implies that, for a sufficiently high loss aversion coefficient, the net benefit of forming a lobby will be higher for the importers than for the exporters. Consequently, for a fixed cost that is lower than the net benefit for the importers but higher than that of the exporters, importers will lobby for protection while exporters will not. These results make more likely that trade policy will exhibit an anti-trade bias, the exact outcome depending on the fixed costs and net benefits of each sector. In particular, consider initially a symmetric equilibrium with a total mass of non-numeraire sectors normalized to one, and introduce a shock that increases the endowment of the specific factors used in sectors $n \in [0, 1/2)$ and decreases that of the factors used in sectors $n \in (1/2, 1]$. Then, the first half of sectors become export sectors and the remaining ones import sectors. Given symmetry in the fixed costs of organization, we have that if the coefficient of loss aversion is sufficiently high, more import lobbies will form than export lobbies. Proposition 5 summarizes this result.

Proposition 5. (Lobby formation and anti-trade bias): *Consider a symmetric equilibrium with a total mass of non-numeraire goods normalized to one, and introduce a shock that increases the endowment of the specific factors used in the sectors* $n \in [0, 1/2)$ *and decreases that of the factors used in the sectors* $n \in (1/2, 1]$. *Assuming also symmetry in the fixed cost of forming a lobby, more import-competing lobbies will form than export ones provided that the coefficient of loss aversion is sufficiently high.*

Chapter 3: Loss Aversion and Trade Policy-- Empirical Evidence

In this Chapter we provide empirical evidence of the effects of loss aversion on trade policy. We focus initially on the protection equation and in section 3.4 we present evidence on loss aversion and lobby formation.

3.1 Econometric Specification and Predictions

We apply a nonlinear regression procedure to directly estimate the structural parameters of the model and their standard errors. We describe the methodology in more detail in subsection 3.3.1. Under loss aversion, the model's predictions for protection are given by equation (8), on the basis of which we specify the following equation to be estimated:

$$\frac{\tilde{t}_i}{1+\tilde{t}_i}\frac{\tilde{e}_i}{\tilde{z}_i} = \frac{1}{\gamma_0} I_i + \frac{1}{\gamma_0}\gamma_1\gamma_2\left(I_i \times D_i \times \frac{\left(\left|\Delta\Pi_i\right|\right)^{\gamma_1 - 1}}{\left(E_i^{(-1)}\right)^{\gamma_1}} \right) + \gamma_1\gamma_2\left(D_i \times \frac{\left(\left|\Delta\Pi_i\right|\right)^{\gamma_1 - 1}}{\left(E_i^{(-1)}\right)^{\gamma_1}} \right)$$
$$+ \frac{1}{\gamma_0}\gamma_1\left(I_i \times (1 - D_i) \times \frac{\left(\Delta\Pi_i\right)^{\gamma_1 - 1}}{\left(E_i^{(-1)}\right)^{\gamma_1}} \right) + \gamma_1\left((1 - D_i) \times \frac{\left(\Delta\Pi_i\right)^{\gamma_1 - 1}}{\left(E_i^{(-1)}\right)^{\gamma_1}} \right) + \varepsilon_i \qquad \text{(E1)}$$

We decided to take $\tilde{z}_i / \tilde{e}_i$ into the left-hand side for various reasons. First, the elasticities are likely to be measured with error. Second, both variables are potentially endogenous.[52] Finally, leaving $\tilde{z}_i / \tilde{e}_i$ on the right-hand side would mean to have it interacted with all the right-hand-side terms and that might confound the effect that losses and gains have on protection, which is our main focus, as well as introduce potential collinearity problems. In equation (E1), D_i is a dummy variable that is equal to one if the sector experiences a loss (i.e., if $\Delta\Pi_i < 0$) and zero otherwise. The use of that dummy allows us to estimate different coefficients for losses and gains, as predicted by the theory. We denote the parameters to be estimated by γ_j, where $j = 0, 1, 2$, and the regression error term by ε_i. The error term is included to capture potential measurement error in the variables and other factors (not accounted for in the model) that may influence the determination of trade policy. Since Kahneman and Tversky estimated both α and β to be 0.88, we set $\alpha = \beta$ when we specify equation (E1).[53] From equations (8) and (E1), we obtain the following predictions:

i) $\gamma_0 = a \geq 0$;

ii) $\gamma_1 = \beta \in (0, 1)$; and

iii) $\gamma_2 = \lambda > 1$.

[52] They may vary with the price as protection changes. Having those variables on the left-hand side eliminates the need to either instrument or specify separate equations for them. The alternative approach of leaving both variables on the right hand side and specifying additional equations for them has the caveat that, as Goldberg and Maggi (1999) point out, it is difficult to come up with a sensible reduced specification for the elasticities.

[53] Later we relax this assumption.

The first prediction simply follows from the fact that the weight that the government places on social welfare should be non-negative. The second follows from the fact that, according to the theory developed by Kahneman and Tversky (1979), there is diminishing sensitivity and hence β should be between zero and one. The last prediction is implied by the definition of loss aversion, according to which losses have a larger impact on value or utility than gains, and therefore the coefficient of loss aversion should be greater than one.

3.2 Data

The data we use consists of 241 four digit SIC U.S. industries in 1983.[54] Protection is measured by the NTB coverage ratio. Even though the theory calls for the use of *ad valorem* tariffs, an argument in favor of the use of NTBs is that U.S. tariffs in 1983 were determined by multilateral (GATT) tariff negotiations, while the model assumes that the country can set its tariffs unilaterally. We should point out that the use of coverage ratios has the potential problem that it may understate or overstate protection; however, they are considered the best available measure of NTBs.[55] The import elasticities come from Shiells et al. (1986), and were purged of the errors-in-variables problem by Gawande and Bandyopadhyay (2000) (henceforth

[54] Part of the data was kindly provided by Kishore Gawande, and the rest was obtained from the Annual Survey of Manufactures.

[55] Trefler (1993) found a high correlation (0.78) between ad valorem tariffs and their coverage ratios, providing some evidence in favor of the use of coverage ratios. A more detailed discussion on the use of NTB coverage ratios can be found in Goldberg and Maggi (1999). Gawande and Bandyopadhyay (2000) and Goldberg and Maggi (1999), among others, also use NTB coverage ratios as the measure for protection.

GB).[56] Z is measured as the gross output to import ratio. The politically organized industries were determined by GB (2000) by regressing the ratio of PAC spending to value added on bilateral import penetration (for five major partners) interacted with twenty two-digit SIC dummies. Those industries for which the predicted value of the dependent variable was positive were considered organized in the trade arena. The union of the sets of organized industries obtained for the five partners was then taken.[57] The terms that measure losses and gains were obtained using data from the Annual Survey of Manufactures (henceforth ASM). The numerator of $\left(|\Delta\Pi_i|\right)^{\beta-1} / \left(E_i^{(-1)}\right)^{\beta}$ was measured as the absolute value of the change in value added (VA) between 1982 and 1983 (raised to the power of $\beta - 1$). We use the change in VA as a measure of the change in the industry's reward to the specific factors. The term in brackets in the denominator was defined as VA in 1982.[58] We examined the sensitivity of the results to modifying the measures for the loss and gain variables (including using a longer period to calculate them) as we discuss in the next section. Finally, the value of D_i was determined according to whether the change in VA between 1982 and 1983 for industry *i* was negative or positive. (When we use a longer period to measure the losses and gains this dummy variable is redefined accordingly).

[56] A description of the procedure can be found in GB (2000).

[57] The purpose of this is to identify import-related lobbying. Since aggregate imports were used in *z*, bilateral import penetration ratios are used here.

[58] The model strictly calls for payments to the industry's specific factors plus labor income in the denominator, but since we do not have a measure of labor income that the members of an industry may have from working elsewhere, we use VA as the best available proxy for E.

3.3 Estimation

3.3.1 Methodology

The right-hand side expression of the protection equation (E1) is nonlinear in both variables and parameters. In addition, the right-hand side variables may be correlated with the error term due to potential endogeneity of the political organization variable and the magnitude of the loss/gain of each industry (since these variables may change in response to changes in prices generated by protection), and to measurement error associated with *I* due to possible misclassification. Consequently, we estimate (E1) using nonlinear two-stage least squares (NL2SLS).[59]

The instruments that we use include mainly industry characteristics, such as the capital-labor ratio interacted with industry-group dummies; the fraction of workers classified as unskilled, scientists and engineers, and managerial; output per firm (scale); the four-firm concentration ratio; the Herfindahl index of firm concentration; the share of output sold as intermediate goods; and a Herfindahl measure of intermediate-goods-output buyer concentration. These variables are included to instrument for the political organization variable, as has been done by other authors under the argument that they are correlated with that variable but not with the regression error. They can also be instruments for the loss/gain variables, since higher concentration or capital and skilled-labor intensity may be associated with larger profits, which appear in the denominator as the level of VA. But due to the presence of the loss/gain variables we also include the change in the wage

[59] According to that procedure the instruments can include not only the levels of the exogenous variables, but also their quadratic terms and cross-products. GMM results are also reported later.

between 1983 and 1982 (in percentage terms),[60] and the dummy variable that equals one if the industry's change in VA is negative and zero if it is positive.[61,62] The validity of the instruments was evaluated using an overidentifying restrictions test (described below). Also, we reestimate the model excluding some instruments that could be suspected to be at least "somewhat endogenous", as we report later.

3.3.2 Results

The results of the NL2SLS estimation are presented in Table 1. All three parameters -- β, λ and a-- are statistically significant at the 1% level (individually and jointly). Moreover, the predictions i) to iii) (described in section 3.1) are satisfied even though no restrictions were imposed in the estimation. The estimated value of β is 0.81, which is positive and lower than one (consistent with diminishing sensitivity), and close to the value of 0.88 obtained by Kahneman and Tversky (1992). Furthermore, we cannot reject the null hypothesis that $\beta = 0.88$ (the probability was 0.25). We also should point out that we can reject the null hypothesis that $\beta = 1$ (in

[60] This variable was obtained as the ratio of payments to employees divided by the number of employees, using data from the ASM. We should point out that, although one might worry that wages could respond to changes in good prices, some authors have found that for the U.S. most of the adjustment takes place through employment, and that the impact on the return to labor is quite small. See Revenga (1992) and Grossman (1986).

[61] The dummy is included to address an issue arising from the nonlinearity, since the protection equation is decreasing in the absolute value of the change in VA (i.e., it increases when the change in VA lies in the interval $(-\infty, 0)$ and it decreases when it lies in $(0, \infty)$) and the limit for the loss and gain terms is being defined at zero.

[62] Since including all the possible cross products would imply having too many instruments we include the linear terms, the squared terms, and the interaction of the linear terms with the dummy, scale, the Herfindahl index and the share of output sold as intermediate goods (this choice was based on the statistical significance of these variables in the first stage regressions). We estimated the model including interactions with other variables and the results were not significantly affected.

this regression and the regressions presented in all the following tables), at the 1% level. The parameter λ is estimated to be 1.95, which is greater than one, providing evidence in favor of loss aversion (losses have a larger effect on protection than gains). We also tested for loss aversion ($\lambda > 1$) against the null hypothesis that $\lambda = 1$. We can reject the null hypothesis of no loss aversion, in the regression presented in Table 1 and the following tables, at least at the 10% level. Moreover, the estimated value of λ is close to 2, consistent with the results of the previous literature. Also, we cannot reject the null hypothesis that $\lambda = 2.25$, as estimated by Kahneman and Tversky (1992) (the probability was 0.67).

Finally, the estimated value of *a* is positive, as expected, and lower than the value obtained by GB (2000). GB's estimate of *a* implies that the share of the total weight given to social welfare gross of contributions is over 0.999. The estimate of Goldberg and Maggi (1999) implies a weight of 0.986.[63] These estimates of *a* are considered very large and at odds with the view that trade policy is determined largely by political influences (Gawande and Krishna [2003]). On the other hand, our estimates of *a* imply a significantly larger weight on contributions than on social welfare, suggesting that protection is indeed "sold", but implying a very low weight on social welfare. Our estimates vary between 0.02 (Table 1) and 0.06 (Table 3)

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[63] Those weights refer to social welfare gross of contributions. Both estimates imply nearly equal weight on aggregate welfare *net* of contributions than on contributions. If a_1 is the weight on aggregate contributions and a_2 is the weight on aggregate welfare net of contributions, then $a = a_2/(a_1 - a_2)$ (see GH [1994] or GB (2000)). GB's and Goldberg and Maggi's estimates imply that the share of weight attached to contributions ($a_1/(a_1 + a_2)$) is 0.500 and 0.504, respectively.

depending on the estimation procedure. They imply a share of weight attached to contributions between 0.94 and 0.98.[64]

Table 1: NL2SLS Estimates

Parameter	Value	Std. Error
β	0.808***	0.063
λ	1.948***	0.714
a	0.022***	0.007
R^2	0.154	
Adj. R^2	0.147	
Log-likelihood	-1909.286	
Observations	241	

*** Significant at 1%.

In addition, we tested the hypotheses that the composite coefficients of the variables $I_i \times D_i \times \left[\Pi_i\left(\tilde{p}_i^{(-1)}\right) - \Pi_i\left(\tilde{p}_i\right)\right]^{\gamma_1 - 1} / \left(E_i^{(-1)}\right)^{\gamma_1}$,

$D_i \times \left[\Pi_i\left(\tilde{p}_i^{(-1)}\right) - \Pi_i\left(\tilde{p}_i\right)\right]^{\gamma_1 - 1} / \left(E_i^{(-1)}\right)^{\gamma_1}$ and

$I_i \times (1 - D_i) \times \left[\Pi_i\left(\tilde{p}_i\right) - \Pi_i\left(\tilde{p}_i^{(-1)}\right)\right]^{\gamma_1 - 1} / \left(E_i^{(-1)}\right)^{\gamma_1}$ are significant:

1) $H_0 : \frac{1}{\gamma_0}\gamma_1\gamma_2 = \frac{1}{a} \times \beta \times \lambda = 0$;

[64] We should also mention that, since some NTBs do not generate revenue and are therefore more costly in terms of social welfare, the value of *a* that one would get from the estimation when the policy is an NTB could be very different than when the policy is a tariff, and hence cannot be interpreted identically. Thus, our main focus has been to compare our value of *a* with the ones obtained by previous authors that also used NTBs. However, it is worth noting that Mitra (2002) performs estimations of the GH (1994) model for Turkey using both tariffs and NTBs, and the estimates of *a* do not differ much between each other.

2) $H_0^{'} : \gamma_1\gamma_2 = \beta \times \lambda = 0$; and

3) $H_0^{''} : \frac{1}{\gamma_0}\gamma_1 = \frac{1}{a} \times \beta = 0$.

The hypotheses involve nonlinear restrictions and therefore we used a Wald test. All three hypotheses can be rejected. The probabilities were 0.001 and 0.013 for 1) and 2), respectively. The fact that 1) is rejected implies that 3) is also rejected. [65]

We should point out that, although the dependent variable is censored below zero and we did not impose restrictions to prevent the predicted values from being negative, we found that the model's predicted values are never negative.

We also estimated the model without setting $\alpha = \beta$. The estimated value of β was 0.82 and α was 0.69. Although the value of α was lower than the one of β, the former was estimated with less precision (the standard error was 0.296, compared to only 0.065 for β).[66] Moreover, we cannot reject the null hypothesis that $\alpha = \beta$, providing support for our assumption that both parameters are equal when we estimated equation (E1). The evidence of diminishing sensitivity for both gains *and* losses provides an important distinction from the case of a concave utility. A concave utility predicts increasing sensitivity to losses, and in that case we would expect to find $\beta > 1$. Again, we can reject the null hypothesis that $\beta = 1$ at the 1% level.

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[65] We also carried out a White test for heteroskedasticity. The probability was 0.26, indicating that we cannot reject the null hypothesis of homoskedasticity.

[66] The values of the other parameters do not vary much (the value of λ was 2.29 and *a* was estimated to be 0.03). These results are reported in the Appendix.

3.3.3 Robustness

We examined the sensitivity of the results to changing the measure of the loss and gain variables. Instead of using VA, we used VA excluding payments to non-production workers (in both the numerator and denominator of $\left[\Pi_i\left(\widetilde{p}_i^{(-1)}\right)-\Pi_i\left(\widetilde{p}_i\right)\right]^{\beta-1}/\left(E_i^{(-1)}\right)^{\beta}$). An argument for the use of this measure is that non-production workers may be considered more mobile.[67] The results still hold. All three parameters were statistically significant at the 1% level. The parameter β was equal to 0.84, λ was 1.37 (which is lower than the previous value but still greater than one, consistent with loss aversion), and a was 0.02. Moreover, because policies might take longer to respond to changes in industry variables, we also performed the estimation using a longer period of time to define the losses and gains. Instead of using the change in VA between 1982 and 1983 we used the change between 1979 and 1983.[68] All parameters are significant at the 1% level, and we cannot reject the hypothesis that the loss aversion parameters are equal to the values estimated by Kahneman and Tversky (that is, $\beta = 0.88$ and $\lambda = 2.25$). The value of λ was 2.23, which is again in the neighborhood of two, as in the results of the previous section.[69] However, the R^2

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[67] The argument for the use of VA without excluding payments to non-production workers, however, is that the owners of capital in an industry may also own the skilled labor.

[68] To determine the change in VA between 1979 and 1983 we calculated a rate of growth using the percentage changes between 1979-80, 1980-81 and 1982-1983, since due to a change in reporting instructions the data of 1983 and 1982 are not directly comparable to those of previous years. Since $\left(\Delta\Pi\right)^{\beta-1}/\left(E^{(-1)}\right)^{\beta} = \left(\Delta\Pi / E^{(-1)}\right)^{\beta-1}/E^{(-1)}$ and the percentage change in VA for the period gives us a measure of term inside brackets in the numerator, we then divide the numerator (raised to the power of $\beta-1$) by the initial income, measured as VA in 1979. Instruments that involve changes were redefined accordingly.

[69] The estimate of a is also unchanged with respect to the 1982-1983 estimation.

is lower than the one obtained in the original estimation (0.13 versus 0.15), which indicates that the data favors the shorter period to measure the losses and gains.

In addition, we evaluated the sensitivity of the results to alternative treatments of the political organization variable. Given that we obtained predictions on the lobbying side by endogenizing lobby formation and in Section 3.4 we estimate a political organization equation, in that section we also discuss the results that we obtain by replacing the data on *I* with an ex post classification based on that regression.[70]

We performed a test of overidentifying restrictions to assess the validity of the instruments and we cannot reject the joint null hypothesis that the excluded instruments are uncorrelated with the error and correctly excluded from the estimated equation, providing support for the assumption that the set of instruments is valid.[71] As we mentioned above, however, some of the instruments can be suspected to be endogenous, in particular the capital-labor ratios and the fraction of workers in each category.[72] We reestimated equation (E1) excluding those variables from the set of

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[70] Before using those results, we also experimented with the alternative of estimating a probit regression of *I* on the instruments and replacing the fitted values from that regression into the right-hand side of equation (E1) before doing the nonlinear estimation. The estimated values of β, λ and a were 0.84, 2.07 and 0.02, respectively, which are very close to those from the previous estimation. Second, we also preformed an estimation treating *I* as econometrically exogenous. The estimated β was 0.75, λ was 2.28 and a was 0.03 (all were statistically significant at least at the 5% level). Again, the results do not vary significantly.

[71] The statistic was 102.55 and the corresponding Chi-squared value was 104.13. The statistic was calculated as the number of observations times the uncentered R^2 from a regression of the NL2SLS residuals on the instruments. The number of degrees of freedom for the Chi-squared equals the number of overidentifying restrictions. See Wooldridge (2001), p.122-124.

[72] Factor shares could be endogenous because they may respond to price changes induced by protection.

instruments. The estimated values of β, λ and a were 0.84, 1.72 and 0.02, respectively, which do not differ much from the ones previously obtained. Also, all three coefficients were significant at the 1% level.

Furthermore, although one could expect the right-hand side variables in equation (E1) to be potentially endogenous, we performed a Hausman test to evaluate such possible endogeneity.[73] We cannot reject the null hypothesis that the right-hand side variables are exogenous. The results of estimating the model treating the right-hand side variables as exogenous (by nonlinear least squares) are reported in Table 2. They are qualitatively and quantitatively similar to those obtained using instrumental variables. In particular, the coefficient of loss aversion is estimated to be 2.39, which is again greater than one, as predicted by loss aversion, and close to 2, consistent with the findings of the previous literature.

Table 2: NLLS Estimates

Parameter	Value	Std. Error
β	0.774***	0.056
λ	2.386***	0.918
a	0.032***	0.011
R^2	0.160	
Adj. R^2	0.153	
Log-likelihood	-1908.380	
Observations	241	

*** Significant at 1%.

[73] The test was carried out by including the residuals obtained from regressing each of the potentially endogenous variables on the instruments into the equation to be estimated by NLLS and then testing for the joint significance of those residuals.

Nonetheless, an argument for the use instrumental variables is that when we applied the same Hausman test to an estimation that is linear in the parameters we did reject the null hypothesis of exogeneity. The linear estimation (linear in the parameters although not in the regressors) was performed using two-stage least squares with the same set of instruments described earlier. The equation that we estimate is:

$$\frac{\tilde{t}_i}{1+\tilde{t}_i}\frac{\tilde{e}_i}{\tilde{z}_i} = \phi_0 I_i + \phi_1\left(I_i \times D_i \times \frac{\left(\left|\Delta\Pi_i\right|\right)^{0.12}}{\left(E_i^{(-1)}\right)^{0.88}}\right) + \phi_2\left((1-I_i)\times D_i \times \frac{\left(\left|\Delta\Pi_i\right|\right)^{0.12}}{\left(E_i^{(-1)}\right)^{0.88}}\right)$$
$$+\phi_3\left(I_i \times (1-D_i)\times \frac{\left(\Delta\Pi_i\right)^{0.12}}{\left(E_i^{(-1)}\right)^{0.88}}\right) + \phi_4\left((1-I_i)\times(1-D_i)\times \frac{\left(\Delta\Pi_i\right)^{0.12}}{\left(E_i^{(-1)}\right)^{0.88}}\right) + \varepsilon_i \quad \text{(E2)}$$

The loss and gain terms were defined assuming $\beta = 0.88$, based on Kahneman and Tversky (1992) and their coefficients were found to be positive, as expected, and statistically significant at either the 1% or 5% level.[74] This specification included again four terms related to the losses/gains (one for the loss interacted with *I*, one for the loss interacted with (1- *I*) and two corresponding terms for the gains).[75]

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[74] We also experimented with the value of β that we obtained in the nonlinear estimation, 0.81, and the results were qualitatively and quantitatively similar. According to the theory, β should be between zero and one. Hence, to study the sensitivity of the results to the value of that parameter, we did the linear estimation replacing β with values starting with 0.1 and adding 0.1 each time until 0.9 was reached (a value of 0.95 was also used). The value of β that was associated with the highest R^2 was 0.8 (the R^2 decreases monotonically as we either increase or decrease β from 0.8). Again, this value is close to the one estimated by Kahneman and Tversky (1992).

[75] The results are reported in the Appendix. This is equivalent to having the losses and gains interacted with *I* and then not interacted (instead of interacted with 1- *I*), in the sense that they are both structural estimations, and only the interpretation of the coefficient changes. The reason why we did not follow the other possibility is that in that case multicollinearity problems are more likely to arise (the correlation between the term interacted with *I* and the one not interacted was 0.97 for losses and 0.88

With the linear estimation we do not immediately obtain the estimate of the coefficient of loss aversion (λ), but it is still possible to obtain it as the ratio of the loss and gain coefficients (according to the model, the ratio is equal to λ for both the organized and the unorganized industries, i.e., the terms interacted with I and 1- I). We found that ratio to be equal to 2.85 for unorganized industries and 2.10 for organized industries, providing evidence in favor of loss aversion. Moreover, we cannot reject the null hypothesis that those two ratios are equal, as predicted by the model (the probability was 0.68). A Wald test to determine whether the coefficients on losses and gains are different was also carried out, and we rejected the null hypothesis that they are equal for both organized and unorganized industries, with probabilities 0.017 and 0.037, respectively. This result is necessary for loss aversion to hold.

As a final robustness test, we report in Table 3 the results obtained when we estimated equation (E1) by GMM. All three coefficients are again significant at the 1% level and do not differ much from those previously reported. β, λ and a were estimated to be 0.60, 2.05 and 0.06, respectively, being consistent with the theoretical predictions.

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for gains, while the correlation between the term interacted with I and that interacted with 1- I was only -0.06 for losses and -0.14 for gains).

Table 3: GMM Estimates

Parameter	Value	Std. Error
β	0.602***	0.078
λ	2.049***	0.725
a	0.058***	0.013
R^2	0.135	
J-statistic	0.227	
Observations	241	

*** Significant at 1%.

3.3.4 Quantification

In this subsection we use the results from the NL2SLS estimation to quantify the effects of changes in VA on protection, comparing the effects of losses and gains as well as the cases of organized and unorganized industries.

Figure 2 plots the fitted values of the protection variable (given by NTB/(1+NTB)) against the change in VA (in billions of dollars), and includes a second order polynomial trend line. We can see that higher protection will be given to industries with smaller changes (for both losses and gains), due to diminishing sensitivity. [76]

To compare the effects of losses and gains on protection, we calculated the fitted values of protection that industries with losses would receive according to the estimated values of the parameters, and also the values of protection that those same

[76] We should point out that since there is a direct effect on utility generated by changes in income with respect to its reference level, if a sector experiences a gain, loss aversion leads to an increase in protection. (Nonetheless, for two sectors that are symmetric in everything except that one had a loss and the other a gain of equal magnitude, loss aversion leads to higher protection for the sector that experienced a loss).

industries would receive had their losses been gains instead. [77] It can be seen in Figure 3 that losses are associated with higher protection than gains (everything else equal), and that the absolute value of the difference decreases with the value of the change in VA.

Figure 2: All Industries

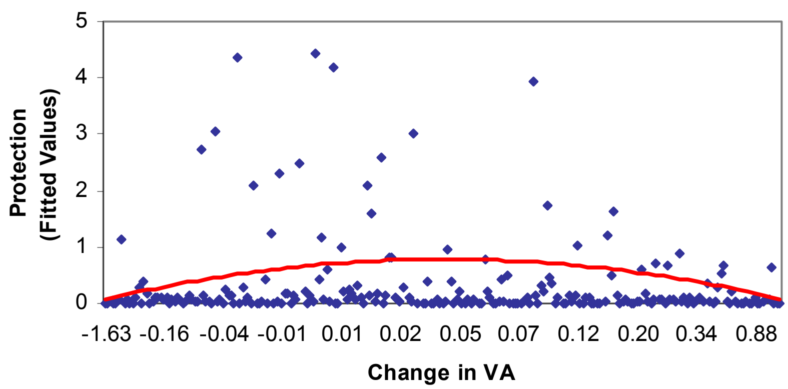
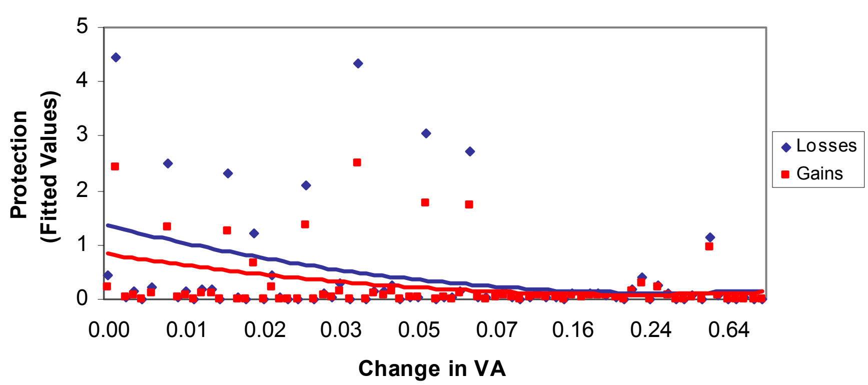


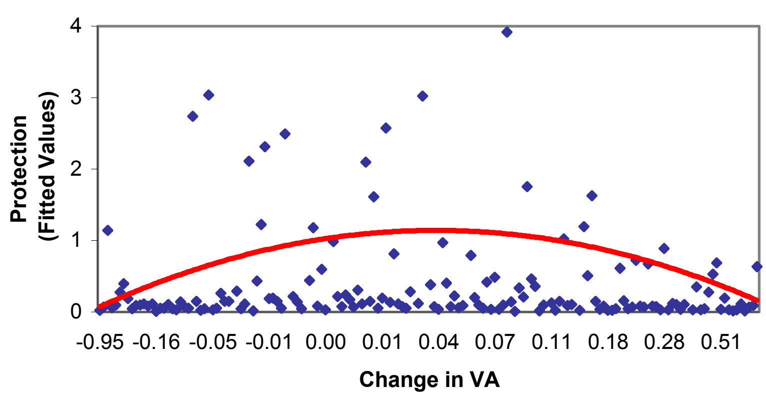
Figure 3: Losses versus Gains



[77] That is, multiplying the changes in VA by minus one and computing the protection values using the parameters corresponding to gains, keeping everything else equal

Whereas Figure 2 includes all industries, Figure 4 plots the fitted values of protection only for the organized industries, and Figure 5 plots the values of protection that would correspond to those same industries if they were unorganized.[78] We include these additional figures because under loss aversion we have both a political economy motive and a social welfare motive for protection, and we want to quantify how important the latter is relative to the former. We can see that the unorganized industries get much lower protection,[79] indicating that the political economy motive for protection is much more significant than the social welfare motive that arises from loss aversion.

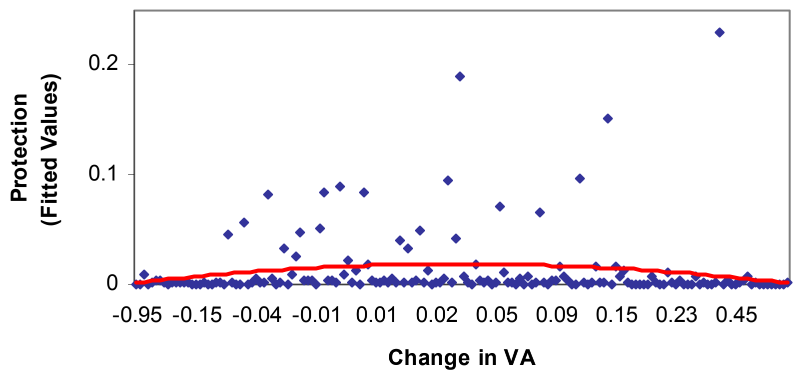
Figure 4: Organized Industries



[78] That is, changing only the value of the political organization variable from one to zero.

[79] Note that the scale of the vertical axis is different in both figures.

Figure 5: Unorganized Industries



Row (1) of Table 4 shows the predicted value of protection calculated at the mean value of VA in 1982 and z/e and assuming that the change in VA is 1%, for gains and losses in organized and unorganized industries. Row (2) shows the predicted value of protection assuming a 10% change in VA.[80] We can see that the increase in protection (shown in row (3)) when we compare the cases of a 1% change and 10% change in VA is roughly twice as much if the change is negative than if it is positive (for both organized and unorganized industries). The table also shows that, everything else equal, an organized industry gets much higher protection than an unorganized one, as we mentioned before, and that losses are associated with higher protection than gains (everything else equal).

[80] We should point out that a 10 percent change is the median change in VA for the whole sample, and it is very close to the median changes for both organized and unorganized industries, which are 11 percent and 9 percent, respectively. Also, a 10% change is associated with lower protection than a 1% change due to diminishing sensitivity.

Table 4: NTB/(1+NTB)

	Organized		Unorganized	
	Loss	***Gain***	***Loss***	***Gain***
(1) 1% change in VA	0.9683	0.6549	0.0139	0.0071
(2) 10% change in VA	0.7382	0.5368	0.0089	0.0046
(3) Increase: (1) – (2)	0.2301	0.1181	0.0050	0.0025

3.3.5 Model Selection

Table 5 presents information criteria corresponding to our model and the original GH model (i.e., dropping the four regressors measuring the losses and gains from the right-hand side of (E1)).[81] Lower values are preferred and thus both the Akaike (AIC) and the Schwarz information criterion (SIC) provide evidence in favor of our model.

Since in the theoretical model we made the assumption of concentration of ownership of the specific factors, two additional model comparisons may be worthwhile. The first compares the original GH model without imposing that assumption (which we will call the unrestricted GH model)[82] to the GH model

[81] The prediction for protection in the GH model (with z/e in the left-hand side) is given by $\left(\tilde{t}_i/(1+\tilde{t}_i)\right)/(\tilde{z}_i/\tilde{e}_i) = (1/a)I_i$. The coefficient of the political organization variable in the estimation of the GH model was positive (as expected) and significant at the 1% level.

[82] In that case the protection equation is: $\left(\tilde{t}_i/(1+\tilde{t}_i)\right)/(\tilde{z}_i/\tilde{e}_i) = \left(1/(a+\alpha_L)\right)I_i - \left(\alpha_L/(a+\alpha_L)\right)$, where α_L denotes the proportion of the population that is organized.

including the assumption (the information appearing in Table 5 corresponds to the last case). The second compares our loss aversion model to the unrestricted GH model, which is a comparison of nonnested models.

Table 5: Information Criteria (NL2SLS Estimation)

Criterion	Loss Aversion	GH 1994
Akaike[1]	15.870	16.077
Schwarz[2]	15.913	16.091
Log Likelihood	-1909.286	-1936.237

1. AIC = -2L/n + 2k/n
2. SIC = -2L/n + k logn/n

We estimated the unrestricted GH model by 2SLS, and obtained a value of 16.026 for the AIC and 16.055 for the SIC.[83] These values are lower than those of the GH model that includes the assumption of concentration (which appear in Table 5). Hence, both information criteria favor the unrestricted GH model over the restricted one.

Since the unrestricted GH model was estimated by a linear regression procedure (linear in the parameters), we compare it to the linear estimation of the model with loss aversion, which was discussed in the previous subsection. The models are nonnested, and therefore we use the *J* test proposed by Davidson and

[83] With z/e in the left-hand side the unrestricted model is equal to the restricted one plus a constant term, and both models can be nested.

MacKinnon (1993). We find that the data also favors our model over the unrestricted GH model.[84]

3.4 Evidence on Loss Aversion and Lobby Formation

In this section we estimate a lobby formation equation based on the predictions obtained in section 2.4, and test for the presence of loss aversion in lobby formation. Equation (19) shows the net benefit of forming a lobby. We do not perform structural estimation because we do not have information that allows us to measure the effects that an industry that becomes organized generates on producer surplus, consumer surplus and tariff revenue. The equation that we estimate is given by:

$$I_i = \delta_0 + \delta_1 \left(d_i \times \frac{(\Delta\Pi_i)^{\beta-1}}{\left(E_i^{(-1)}\right)^{\beta}} \right) + \delta_2 \left((1-d_i) \times \frac{(\Delta\Pi_i)^{\beta-1}}{\left(E_i^{(-1)}\right)^{\beta}} \right) + \delta_3 e_i + \delta_4 \frac{m_i}{y_i} + \mathbf{X}_i \varphi + \mu_i \tag{E3}$$

In equation (E3), the dependent variable is the political organization dummy (see section 3.2). A prediction of the model is that, for a sufficiently high coefficient of loss aversion, a sector that experiences a loss will be more likely to form a lobby than one that experiences a gain, because the direct effect on utility as well as the extra

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[84] When we include the fitted values from the unrestricted GH model in the estimation of our model we find that they are not statistically significant (the probability was 0.37), and thus we reject the GH model. On the other hand, when we include the fitted values from the loss aversion model in the GH model estimation we find that they are significant (the probability was 0.00), and therefore we cannot reject the loss aversion model.

protection associated with becoming organized are higher for the sector with a loss. Since in a one year period there may not be sufficient activity in terms of lobby formation, we measure the losses and gains over the period 1979-1983. Thus, d_i is a dummy variable that equals one if the change in VA between 1979 and 1983 was negative and zero if it was positive.[85] Given that the amount of deadweight loss also affects the net benefit of forming a lobby, we include in (E3) the elasticity of import demand (e_i), and the import-output ratio (m_i / y_i).[86] The vector $\mathbf{X}_i$ contains measures of concentration traditionally used in the political economy literature and that could also proxy to some extent for the fixed cost of forming a lobby, as well as factor shares. The error term is μ_i. More precisely, $\mathbf{X}_i$ includes the four-firm concentration ratio (Conc4), the Herfindahl index of concentration (LHerf), the capital-labor ratio interacted by industry group dummies (KL_Cap, KL_Res and KL_Mfg), and the fraction of workers classified as unskilled (P_Uns), scientists and engineers (P_Sci), and managerial (P_Man).[87]

Since the dependent variable is binary and some of the right-hand side variables are potentially endogenous (the loss/gain, the elasticity and the import-

[85] We determine the change in VA between 1979 and 1983 in the way described in subsection 3.3.3.

[86] We would expect this variable to negatively affect the probability of forming a lobby since higher imports imply a larger social cost from an increase in protection and a lower output means that the industry has less to gain from higher protection.

[87] We should point out that since the GH (1994) model treats lobby formation as exogenous, the fact that we test predictions obtained by endogenizing lobby formation differs from Goldberg and Maggi (1999), who estimate a separate equation for *I* but only including variables of the kind that we have on the $\mathbf{X}_i$ vector, and from Gawande and Bandyopadhyay (2000), who estimate an equation for contributions but not for lobby formation. They allow for the political organization variable to be potentially endogenous in the estimation of the protection equation but they do not test any predictions on political organization obtained from endogenizing lobby formation.

output ratio), we estimate a probit model using the two-stage conditional maximum likelihood (2SCML) estimator proposed by Rivers and Vuong (1988).[88] We use the same instruments as before.[89] The results appear on Table 6, which includes two estimations: one in which we replace β by 0.88 (the value estimated by Kahneman and Tversky [1992]), and the other setting $\beta = 0.81$ (the value that we obtained in the nonlinear estimation of the protection equation). Both regressions give similar results. We found that we cannot reject the null hypotheses of exogeneity of the right-hand side variables.[90] The main predictions that we want to test are that losses and gains are statistically significant and that losses have a larger impact on lobby formation than gains, that is $\delta_1 > \delta_2$. As predicted, we find that both losses and gains are significant at the 5% level, and that losses have a larger coefficient than gains, consistent with loss aversion. The ratio of those coefficients was 1.94 when $\beta = 0.88$, suggesting a coefficient of loss aversion that is again in the neighborhood of 2. Moreover, we can not reject the null hypotheses that the ratio is equal to 2.25, as estimated by Kahneman and Tversky (1992) (the probability was 0.77).
When $\beta = 0.81$, the ratio was 1.76, which is lower but still not statistically different from 2.25 (the probability was 0.56). Thus, we find evidence of loss aversion in lobby

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[88] According to that procedure, in the first stage we regress the potentially endogenous variables on the instruments (by least squares) and then we estimate the probit model including the residuals from the first stage as additional regressors. A convenient feature of the procedure is that we can test for exogeneity by evaluating the statistical significance of those residuals.

[89] Changes between 1983 and 1982 were replaced by changes between 1983 and 1979. We should point out that all the first-stage R-squares were greater than 0.40.

[90] The residuals added to the probit regressions were not statistically significant (neither individually nor jointly).

formation. An industry is more likely to become organized if it experiences a loss, everything else equal. This provides additional empirical support for our theoretical result that loss aversion allows us to explain why declining industries get most of the protection.[91]

As we mentioned in section 3.3.3, we did a final sensitivity analysis by reestimating the protection equation (E1) using a political organization variable obtained from the estimation of equation (E3). We classified an industry as organized if its predicted probability of being organized from the probit estimation was at least 0.6.[92] The estimated values of β, λ and a were 0.84, 2.15 and 0.02, respectively, which are very close to the results from section 3.3 (the results are shown in Table 10 in the Appendix).

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[91] As for the other variables, the import-output ratio has the expected sign and it is significant at the 10% level. The elasticity has a positive coefficient (contrary to what we would expect) but is not significant. Regarding the variables included in $\mathbf{X}_i$, the literature does not yield unambiguous sign predictions, as Goldberg and Maggi (1999) point out. According to our results the proportions of scientists and engineers and managers, as well as the capital-labor ratios (except for one group of industries) are statistically significant.

[92] This gives us 149 organized industries (see the Appendix for the list). We should point out that using $\beta = 0.88$ (the value obtained by Kahneman and Tversky [1992]) or $\beta = 0.81$ (the value that we obtained when we estimated the protection equation) gives exactly the same results in terms of which industries are classified as organized.

Table 6: Probit (2SCML) Estimates

	$\beta = 0.88$		$\beta = 0.81$	
Variable	**Coef.**	**S. Error**	**Coef.**	**S. Error**
Constant	-0.741	1.825	-0.747	1.831
Loss[1]	0.219**	0.088	0.167**	0.068
Gain[2]	0.113**	0.058	0.095**	0.047
e	0.631	0.572	0.615	0.573
m/y	-2.023*	1.156	-1.926*	1.146
Conc4	-0.756	1.312	-0.737	1.311
P_Uns	-2.040	3.065	-2.036	3.085
P_Sci	11.837***	3.659	11.736***	3.651
P_Man	-6.118*	3.443	-6.006*	3.437
KL_Cap	0.014	0.023	0.015	0.023
KL_Res	0.514***	0.105	0.512***	0.105
KL_Mfg	0.110**	0.051	0.111**	0.052
LHerf	-0.074	0.246	-0.072	0.246
Log Likelihood	-109.67		-109.61	
I_R [3]	0.259		0.259	
$\bar{I}_R$ [3]	0.202		0.203	
McFadden R^2	0.274		0.274	
Observations	241		241	

*** Significant at 1%, ** Significant at 5%, * Significant at 10%.

1. Loss = $d_i \times (\Delta\Pi_i)^{\beta-1} / \left(E_i^{(-1)}\right)^{\beta}$; 2. Gain = $(1-d_i) \times (\Delta\Pi_i)^{\beta-1} / \left(E_i^{(-1)}\right)^{\beta}$; 3. Measures of predictive performance defined in Betancourt and Clague (1981). These are measures of information that reflect not only whether the predictions are right or wrong but also their degree of certainty. For instance, in the dichotomous case, more credit (discredit) is given to a correct (incorrect) prediction that is close to 1 or 0 than to one that is close to 0.5. $\bar{I}_R$ also corrects for the degrees of freedom.

Chapter 4: Conclusion

We study the effects of loss aversion on trade policy determination and use it to explain some important and puzzling features of trade policy. An important question concerning trade policy is why such a disproportionate amount of protection is given to declining industries. We show that if individual preferences exhibit loss aversion, sectors in which profitability is declining will receive higher protection. Moreover, by endogenizing lobby formation, we show that an industry will be more likely to become organized and lobby for protection if it has a loss.

In addition, as Rodrik (1995) points out, it constitutes an important puzzle the fact that trade policy is typically biased in favor of import competing sectors, and is therefore trade restricting rather than trade promoting. The current leading political economy model of trade protection, due to Grossman and Helpman (1994), cannot explain the anti-trade bias in trade policy and, in fact, under some symmetry assumptions predicts a pro-trade bias. We show that if the coefficient of loss aversion is sufficiently large, there will be an anti-trade bias under neutral assumptions. The cases in which symmetry is not imposed are also analyzed, leading to qualitatively similar conclusions. The results hold for a variety of shocks that lead the country to trade with the rest of the world. They also hold for two large countries even after the terms-of-trade motive for protection is removed. By allowing lobby formation to be endogenous, we then show that for a sufficiently high coefficient of loss aversion, import-competing sectors will be more likely to form a lobby than export sectors, which reinforces the anti-trade bias result.

We use a nonlinear regression procedure to directly estimate the parameters of the model and test its predictions. We find empirical support for the model and we obtain estimates of the parameters that are very similar to those estimated by Kahneman and Tversky (1992) using experimental data. Losses are found to have a larger impact on protection than gains, and we obtain estimates of the coefficient of loss aversion that are about 2. The results are also consistent with diminishing sensitivity to income changes for both gains and losses. By testing for diminishing sensitivity and estimating the corresponding parameter, this dissertation also contributes to the literature on behavioral economics, since diminishing sensitivity for both gains *and* losses constitutes an important distinction from the case of risk aversion. To our knowledge, no previous paper has provided econometric estimates from non-experimental data of *all* the parameters of the value function proposed by Kahneman and Tversky (1992). We also find that the data favors our model over the GH model. These results contrast with those of Gawande and Bandyopadhyay (2000) and Goldberg and Maggi (1999), who find that the introduction of additional variables in the estimation of the GH model does not significantly improve its explanatory power. Our approach differs from theirs, however, in that we have a well-specified alternative hypothesis.

In addition, we estimate a Probit equation on political organization using a two-stage conditional maximum likelihood estimator and we find evidence of loss aversion in lobby formation, consistent with our theoretical prediction. This result highlights the importance of loss aversion more broadly for political economy issues, since under the pressure-group approach, special interest groups that spend more on lobbying should get larger support from the government (other things equal), and because one would expect the bigger and expanding industries to be in a better position to finance lobbying expenditures, the fact that declining industries appear to be much more successful at playing the political system for government support seems paradoxical. Loss aversion provides an explanation for this by implying that losers will have a larger incentive to become politically organized, and our empirical results support this prediction. This finding may apply not only to trade policy but to other policy instruments such as production subsidies, minimum price supports. It could also have implications for the long-run growth of an economy, since higher protection for declining sectors may weaken the movement of resources toward more profitable and dynamic sectors, particularly if governments are very responsive to political pressures by domestic lobbies.

Appendix A: Technical Appendix to Chapter 2

A.1 Equilibrium Policies

First, we derive the equilibrium policies for the organized sectors. Given that there is no interaction between lobbies, the condition that, for every lobby *i*, the equilibrium price vector maximizes the joint welfare of that lobby (net of contributions) and the government (condition (c) on footnote 23), implies that:

$$p_i^0 \equiv \arg\max \{W_i(p_i) - C_i^0(p_i)\} + \{C_i^0(p_i) + aW(\mathbf{p})\} = W_i(p_i) + aW(\mathbf{p}) \qquad \text{(A1)}$$

The first-order condition is:

$$\frac{\partial W_i}{\partial p_i} + a\frac{\partial W}{\partial p_i} = 0 \qquad \text{for all } i \in L \qquad \text{(A2)}$$

Using (5), (7) and (A2) we can obtain the equilibrium policies for $i \in L$:

$$\frac{\tilde{t}_i}{1+\tilde{t}_i} = \begin{cases} \dfrac{1}{a}\left\{1 + (1+a)\beta\lambda \dfrac{\left[\Pi_i\left(\tilde{p}_i^{(-1)}\right) - \Pi_i\left(\tilde{p}_i\right)\right]^{\beta-1}}{\left(E_i^{(-1)}\right)^{\beta}}\right\}\dfrac{\tilde{z}_i}{\tilde{e}_i} & \text{if } \Pi_i\left(\tilde{p}_i\right) < \Pi_i\left(\tilde{p}_i^{(-1)}\right) \\ \dfrac{1}{a}\left\{1 + (1+a)\alpha \dfrac{\left[\Pi_i\left(\tilde{p}_i\right) - \Pi_i\left(\tilde{p}_i^{(-1)}\right)\right]^{\alpha-1}}{\left(E_i^{(-1)}\right)^{\alpha}}\right\}\dfrac{\tilde{z}_i}{\tilde{e}_i} & \text{if } \Pi_i\left(\tilde{p}_i\right) > \Pi_i\left(\tilde{p}_i^{(-1)}\right) \end{cases} \qquad \text{(A3)}$$

where $\tilde{t}_i = (\tilde{p}_i - p_i^*)/p_i^*$ is the equilibrium *ad valorem* trade tax or subsidy for $i \in L$, $\tilde{z}_i = y_i(\tilde{p}_i)/m_i(\tilde{p}_i)$ is the equilibrium ratio of domestic output to imports (negative for exports) and $\tilde{e}_i = -m_i'(\tilde{p}_i)\, \tilde{p}_i / m_i(\tilde{p}_i)$ is the elasticity of import demand (defined to be positive) or export supply (defined to be negative).

In the case of the unorganized sectors, the first-order condition (A2) becomes:

$$a\frac{\partial W}{\partial p_i} = 0 \qquad \text{for all } i \notin L \tag{A4}$$

Using (7) and (A4) we can obtain, for $i \notin L$:

$$\frac{\tilde{t}_i}{1+\tilde{t}_i} = \begin{cases} \beta\lambda \dfrac{\left[\Pi_i\left(\tilde{p}_i^{(-1)}\right) - \Pi_i\left(\tilde{p}_i\right)\right]^{\beta-1}}{\left(E_i^{(-1)}\right)^{\beta}} \dfrac{\tilde{z}_i}{\tilde{e}_i} & \text{if } \Pi_i(\tilde{p}_i) < \Pi_i\left(\tilde{p}_i^{(-1)}\right) \\ \alpha \dfrac{\left[\Pi_i\left(\tilde{p}_i\right) - \Pi_i\left(\tilde{p}_i^{(-1)}\right)\right]^{\alpha-1}}{\left(E_i^{(-1)}\right)^{\alpha}} \dfrac{\tilde{z}_i}{\tilde{e}_i} & \text{if } \Pi_i(\tilde{p}_i) > \Pi_i\left(\tilde{p}_i^{(-1)}\right) \end{cases} \tag{A5}$$

Using (A3) and (A5) we can write a general equation for the equilibrium policies, which is given by equation (8) in the text.

A.2 Anti-Trade Bias (Small Economy)

Proof of Proposition 1

Consider two sectors, *i* and *j*, such that $z_i = z_j = z, e_i = e_j = e, I_i = I_j = I$ and $E_i^{(-1)} = E_j^{(-1)} = E^{(-1)}$. Let $\Delta\Pi_i < 0$, $\Delta\Pi_j > 0$ and $|\Delta\Pi_i| = \Delta\Pi_j = \Delta\Pi$. From equation (8) we have:[93]

$$\frac{\tilde{t}_i}{1+\tilde{t}_i} = \frac{1}{a}\left\{I + (I+a)\beta\lambda\frac{[\Delta\Pi]^{\beta-1}}{\left(E^{(-1)}\right)^{\beta}}\right\}\frac{\tilde{z}}{\tilde{e}}, \text{ and } \frac{\tilde{t}_j}{1+\tilde{t}_j} = \frac{1}{a}\left\{I + (I+a)\beta\frac{[\Delta\Pi]^{\beta-1}}{\left(E^{(-1)}\right)^{\beta}}\right\}\frac{\tilde{z}}{\tilde{e}} \tag{A6}$$

Since $\lambda > 1$, (A6) implies that $\tilde{t}_i > \tilde{t}_j$.

Proof of Proposition 2

Using equation (A3) we have that protection in sector 2 will exceed protection in sector 1 if and only if:

$$\left\{1 + (1+a)\beta\lambda\frac{\left(|\Delta\Pi_2|\right)^{\beta-1}}{\left(E_2^{(-1)}\right)^{\beta}}\right\}\frac{y_2(p_2)}{-p_2 m_2'(p_2)} > \left\{1 + (1+a)\alpha\frac{\left(\Delta\Pi_1\right)^{\alpha-1}}{\left(E_1^{(-1)}\right)^{\alpha}}\right\}\frac{y_1(p_1)}{-p_1 m_1'(p_1)}$$

which, after invoking symmetry and simplifying, becomes equation (10) in text.[94]

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[93] We also use $\alpha = \beta$.

A.3 Loss Aversion and Lobby Formation

Equilibrium Contribution

Recall that with truthful contributions, the equilibrium contribution by an organized group when there are *n* organized groups is given by $C_o = \Omega_o - b_o$, where $b_o = \Omega_o - C_o$ is the net-of-contributions welfare (determined in equilibrium). To calculate the equilibrium contribution by an organized group, we ask what will happen if a small number of sectors, of measure Δn, decide to defect. Then the policymaker obtains:

$$G^D = (n - \Delta n)\left[\Omega_o - b_o\right] + aW(n - \Delta n) \tag{A7}$$

where the first term represents contributions and the second represents social welfare weighted by *a*.

The equilibrium policymaker's welfare is:

$$G = n\left[\Omega_o - b_o\right] + aW(n) \tag{A8}$$

(A7) and (A8) must be equal for Δn small enough. Equating them and taking the limit as $\Delta n \to 0$ we obtain:

[94] We also use $E^{(-1)} = E_1^{(-1)} = E_2^{(-1)}$, given symmetry.

$$b_o = \Omega_o + aW' \tag{A9}$$

Replacing (A9) into the expression for the contribution, we have:

$$C = -aW'(n) \tag{A10}$$

This means that, in equilibrium, a lobby contributes just enough to compensate for the reduction in social welfare brought about by its formation.

Proof of Proposition 4

From equation (19) in the text, we can compare the net benefit of forming a lobby for an industry that has a loss (NB^L) and an industry that has a gain (NB^G):

$$\begin{aligned} NB^L - NB^G &= (1+a)\Big\{(\Pi_o^L - \Pi_u^L) - (\Pi_o^G - \Pi_u^G) + \Big[\big(\Delta\Pi_o^L\big)^\alpha + \lambda\big(\Delta\Pi_u^L\big)^\beta\Big] - \Big[\big(\Delta\Pi_o^G\big)^\alpha - \big(\Delta\Pi_u^G\big)^\alpha\Big]\Big\} \\ &+ a\Big[\big((p^{oL} - p^w)m(p^{oL}) - (p^{uL} - p^w)m(p^{uL})\big) - \big((p^{oG} - p^w)m(p^{oG}) - (p^{uG} - p^w)m(p^{uG})\big)\Big] \\ &- aN\Big[\big(s(p^{uL}) - s(p^{oL})\big) - \big(s(p^{uG}) - s(p^{oG})\big)\Big] \end{aligned} \tag{A11}$$

The first line in the previous equation is positive. The term in brackets in that line corresponds to $GB^L - GB^G$, which is positive because the additional protection associated with becoming organized is larger for the sector that has a loss and also the increase in income brought about by protection has a larger impact on utility for a sector that has a loss, due to loss aversion.[95] It is multiplied by (1+ *a*) because the benefit of avoiding a loss also has a positive effect on social welfare and that tends to reduce the contribution that the lobby has to give to the government. The term in the second line in (A11) is positive provided that tariff revenue increases with the tariff, which also translates in a lower contribution. Finally, the term in the third line is negative because the decrease in consumer surplus when the sector that has a loss becomes organized is higher than for the other sector.[96] This tends to increase the contribution that the industry must give to the government. Therefore, for a sufficiently high coefficient of loss aversion, the benefit of avoiding a loss (both for the industry and in terms of social welfare, since the latter affects the contribution), together with the tariff revenue effect, will dominate the last effect of a decrease in consumer surplus and we will have that $NB^L > NB^G$. From (A11) we obtain the condition for proposition 4 to hold:

$$\lambda > \frac{1}{\left(\Delta\Pi_u^L\right)^\beta} \Big\{ (\Pi_o^G - \Pi_u^G) - (\Pi_o^L - \Pi_u^L) + \left(\Delta\Pi_o^G\right)^\alpha - \left(\Delta\Pi_o^L\right)^\alpha - \left(\Delta\Pi_u^G\right)^\alpha$$
$$+ \frac{a}{1+a} N\left(\left[s(p^{uL}) - s(p^{oL})\right] - \left[s(p^{uG}) - s(p^{oG})\right]\right)$$
$$- \frac{a}{1+a}\left[(p^{oL} - p^{wL})m(p^{oL}) - (p^{uL} - p^{wL})m(p^{uL}) + (p^{oG} - p^{wG})m(p^{oG}) - (p^{uG} - p^{wG})m(p^{uG})\right]\Big\}$$

In (A11) we assumed that the industry always gains with respect to the previous

[95] This is also reinforced by the fact that profits are increasing and convex in the price, since the initial price (i.e. the price if the sector remains unorganized) is higher for the loser sector.

[96] This is because the increase in protection is higher and consumer surplus is decreasing and concave in price.

period when it is organized. If the industry that has a loss also loses when organized, the term $\left(\Delta\Pi_o^L\right)^\alpha$ in (A7) is replaced with $-\lambda\left(\Delta\Pi_o^L\right)^\beta$, and the condition for proposition 4 becomes:

$$\lambda > \frac{1}{\left(\Delta\Pi_u^L\right)^\beta - \left(\Delta\Pi_o^L\right)^\beta} \Big\{ (\Pi_o^G - \Pi_u^G) - (\Pi_o^L - \Pi_u^L) + \left(\Delta\Pi_o^G\right)^\alpha - \left(\Delta\Pi_u^G\right)^\alpha$$
$$+ \frac{a}{1+a} N\left(\left[s(p^{uL}) - s(p^{oL})\right] - \left[s(p^{uG}) - s(p^{oG})\right]\right)$$
$$- \frac{a}{1+a}\left((p^{oL} - p^{wL})m(p^{oL}) - (p^{uL} - p^{wL})m(p^{uL}) + (p^{oG} - p^{wG})m(p^{oG}) - (p^{uG} - p^{wG})m(p^{uG})\right)\Big\}$$

Appendix B: Tables from Chapter 3

Table 7: Political Organization Variable (I)

SIC4	DESCRIPTION	I	
		PAC regression	Probit regression
2032	Canned specialties	0	0
2033	Canned fruites and vegetables	0	0
2034	Dehydrated fruits, vegetables and soups	0	0
2035	Pickles, sauces and salad dressings	0	0
2037	Frozen fruits and vegetables	0	0
2041	Flour and other grain mill products	0	0
2043	Cereal breakfast foods	0	0
2044	Rice milling	0	0
2046	Wet corn milling	0	0
2047	Dog, cat, and other pet food	0	0
2048	Prepared feeds, n.e.c.	0	0
2074	Cottonseed oil mills	0	0
2076	Vegetable oil meals n.e.c.	0	0
2077	Animal and marine fats and oils	0	0
2082	Malt beverages	0	0
2084	Wines, brandy, and brandy spirits	0	0
2085	Distilled liquor, except brandy	0	0
2086	Bottled and canned soft drinks	0	0
2087	Flavoring extracts and syrups, n.e.c.	0	0
2091	Canned and cured seafoods	0	0
2095	Roasted coffee	0	0
2097	Manufactured Ice	0	0
2098	Macaroni and spaghetti	0	0
2099	Food preparations, n.e.c.	0	0
2211	Weaving mills, cotton	1	1
2221	Weaving mills, manmade fiber and silk	1	1
2231	Weaving and finishing mills, wool	1	1
2252	Hosiery, n.e.c.	1	1
2257	Circular knit fabric mills	1	1
2258	Warp knit fabric mills	1	1
2271	Woven carpets and rugs	1	1
2272	Tuftted carpets and rugs	1	1
2279	Carpets and rugs, n.e.c.	1	1

2291	Felt goods, except woven felts and hats	1	1
2292	Lace goods	1	1
2294	Processed textile waste	1	1
2295	Coated fabrics, not rubberized	1	1
2296	Tire cord and fabric	1	1
2297	Nonwoven fabrics	1	1
2298	Cordage and twine	1	1
2299	Textile goods, n.e.c.	1	1
2311	Men's and boys' suits and coats	1	0
2331	Women's and misses' blouses	1	1
2337	Women's and misses' suits and coats	1	1
2341	Women's and children's underwear	1	0
2342	Brassieres and allied garments	1	0
2369	Children's outerwear, n.e.c.	1	1
2381	Fabric dree and work gloves	1	1
2384	Robes and dressing gowns	1	1
2385	Waterproof outer garments	1	1
2386	Leather and sheep line clothing	1	1
2387	Apparel belts	1	0
2389	Apparel and accessories, n.e.c.	1	1
2391	Curtains and draperies	1	0
2392	House furnishings, n.e.c.	1	0
2393	Textile bags	1	1
2397	Schiffli machine embroideries	1	1
2399	Fabricated textile products, n.e.c.	1	1
2411	Logging camps and logging contractors	1	1
2421	Sawmills and planing mills, general	1	1
2426	Hardwood dimension and flooring	1	1
2429	Special product sawmills, n.e.c.	1	1
2431	Millwork	1	1
2435	Hardwood veneer and plywood	1	1
2436	Softwood veneer and plywood	1	1
2439	Structural wood members, n.e.c.	1	1
2449	Wood containers, n.e.c.	1	1
2491	Wood preserving	1	1
2492	Particleboard	1	1
2499	Wood products, n.e.c.	1	1
2515	Mattresses and bedsprings	1	1
2517	Wood TV and radio cabinets	1	1
2621	Paper mills, except building paper	1	1
2631	Paperborad mills	1	1
2641	Paper coating and glazing	1	1
2642	Envelopes	1	1
2643	Bags, except textile bags	1	1
2646	Pressed and molded pulp goods	1	1
2647	Sanitary paper products	1	1
2649	Converted paper products	1	1
2651	Folding paperboard boxes	1	1
2654	Sanitary food containers	1	1

2661	Building paper and board mills	1	1
2721	Periodicals	0	0
2731	Book publishing	0	1
2752	Commercial printing, lithographic	0	1
2754	Commercial printing, gravure	0	1
2782	Blankbooks and looseleaf binders	0	0
2821	Plastic materials and resins	1	1
2822	Synthetic rubber	1	1
2823	Cellulosic manmade fibers	1	1
2824	Organic fibers, noncellulosic	1	1
2831	Biological products	1	0
2833	Medicinals and botanicals	1	0
2834	Pharmaceutical preparations	1	0
2841	Soap and other detergents	1	0
2842	Polishes and sanitation goods	1	0
2843	Surface active agents	1	0
2844	Toilet preparations	1	0
2873	Nitrogenous fertilizers	1	1
2874	Phosphatic fertilizers	1	1
2879	Agricultural chemicals, n.e.c.	1	1
2911	Petroleum refining	0	1
3011	Tires and inner tubes	1	0
3021	Rubber and plastic footwear	1	0
3079	Miscellaneous plastic products	1	1
3111	Leather tanning and finishing	0	0
3131	Boot and shoe cut stock and findings	0	1
3142	House slippers	0	1
3143	Men's footwear, except athletic	0	0
3144	Women's footwear, except athletic	0	0
3149	Footwear, except rubber, n.e.c.	0	1
3171	Women's handbags and purses	0	1
3172	Personal leather goods, n.e.c.	0	0
3199	Leather goods, n.e.c.	0	1
3211	Flat glass	1	1
3221	Glass containers	1	1
3229	Pressed and blown glass, n.e.c.	1	1
3231	Products of purchased glass	1	1
3241	Cement, hydraulic	1	1
3251	Brick and structural clay tile	1	1
3253	Ceramic wall and floor tile	1	0
3255	Clay refractories	1	1
3259	Structural clay products, n.e.c.	1	1
3261	Vitreous plumbing fixtures	1	1
3262	Vitreous china food utensils	1	1
3263	Fine earthware food utensils	1	1
3264	Porcelain electrical supplies	1	1
3269	Pottery products, n.e.c.	1	1
3271	Concrete block and brick	1	1
3272	Concrete products, n.e.c.	1	1

3273	Ready-mixed concrete	1	1
3274	Lime	1	1
3275	Gypsum products	1	1
3281	Cut stone and stone products	1	1
3291	Abrasive products	1	1
3292	Asbestos products	1	1
3296	Mineral wool	1	1
3297	Nonclay refractories	1	1
3299	Nonmetalic mineral products, n.e.c.	1	1
3312	Blast furnaces and stell mills	1	1
3313	Electrometallurgical products	1	1
3321	Gray iron foundries	1	1
3322	Malleable iron foundries	1	1
3331	Primary copper	1	1
3333	Primary zinc	1	1
3334	Primary aluminum	1	1
3351	Copper rolling and drawing	1	1
3353	Aluminium sheet, plate and foil	1	1
3354	Aluminium extruded products	1	1
3356	Nonferrous rolling and drawing, n.e.c.	1	1
3357	Nonferrous wire drawing and insulating	1	1
3421	Cutlery	0	0
3423	Hand and edge tools, n.e.c.	0	0
3425	Hand saws and saw blades	0	0
3429	Hardware, n.e.c.	0	0
3441	Fabricated structural metal	0	0
3443	Fabricated plate work (Boiler shops)	0	0
3462	Iron and steel forgings	0	1
3465	Automotive stampings	0	0
3466	Crowns and closures	0	1
3493	Steel springs, except wire	0	1
3494	Valves and pipe fittings	0	0
3496	Miscellaneous fabricated wire products	0	0
3497	Metal foil and leaf	0	0
3499	Fabricated metal products, n.e.c.	0	0
3511	Turbines and turbine generator sets	1	1
3519	Internal combustion engines, n.e.c.	1	1
3541	Machine tools, metal cutting types	1	0
3542	Machine tools, metal forming types	1	1
3544	Special dies, tools, jigs, and fixtures	1	1
3545	Machine tool accessories	1	0
3546	Power driven handtools	1	0
3547	Rolling mill machinery	1	0
3549	Metalworking machinery, n.e.c.	1	0
3551	Food products machinery	1	1
3552	Textile machinery	1	1
3553	Woodworking machinery	1	0
3554	Paper industries machinery	1	0
3555	Printing trades machinery	1	0

3559	Special industry machinery, n.e.c.	1	0
3561	Pumps and pumping equipment	1	0
3562	Ball and roller bearings	1	1
3563	Air and gas compressors	1	0
3564	Blowers and fans	1	0
3565	Industrial patterns	1	1
3566	Speed changers, drives, and gears	1	1
3567	Industrial furnices and ovens	1	1
3568	Power transmission equipment, n.e.c.	1	1
3569	General industry machinery, n.e.c.	1	0
3574	Calculating and accounting machines	1	1
3576	Scales and balances, except laboratory	1	1
3579	Office machines, n.e.c., and typewriters	1	1
3581	Automatic merchandising machines	1	0
3585	Refrigeration and heating equipment	1	1
3586	Measuring and dispensing pumps	1	0
3612	Transformers	1	1
3613	Switchgear and switchboard apparatus	1	1
3621	Motors and generators	1	1
3623	Welding apparatus, electric	1	1
3624	Carbon and graphite products	1	1
3631	Household cooking equipment	1	0
3632	Household refrigerators and freezers	1	0
3635	Households vacuums cleaners	1	0
3636	Sewing machines	1	0
3639	Household appliances, n.e.c.	1	0
3641	Electric lamps	1	1
3643	Current-carrying wiring devices	1	1
3644	Non-current-carrying wiring devices	1	1
3648	Lighting equipment, n.e.c.	1	1
3651	Radio and TV receiving sets	1	1
3652	Phonograph records and prerecorded tape	1	1
3691	Storage batteries	1	1
3692	Primary batteries, dry and wet	1	1
3693	X-ray, electromedical, and electrotherapeutic	1	1
3694	Engine elctrical equipment	1	1
3699	Electrical equipment and supplies, n.e.c.	1	1
3711	Motor vehicles and car bodies	0	0
3714	Motor vehicle parts and accessories	0	1
3721	Aircraft	0	1
3724	Aircraft engines and engine parts	0	1
3728	Aircraft equipment, n.e.c.	0	1
3743	Railroad equipment	0	1
3751	Motorcycles, bicycles, and parts	0	0
3824	Fluid meters and counting devices	0	1
3825	Instruments to measure electricity	0	0
3829	Measuring and controlling devices, n.e.c.	0	0
3832	Optical instruments and lenses	0	1

3851	Ophtalmic goods	0	0
3861	Photographic equipment and supplies	0	1
3911	Jewerly, precious metals	0	0
3914	Silverware and plated ware	0	0
3915	Jewelers' materials and lapidary work	0	0
3931	Musical instruments	0	0
3942	Dolls	0	0
3944	Games, toys, and chidren's vehicles	0	0
3949	Sporting and athletic good, n.e.c.	0	0
3991	Brooms and brushes	0	0
3993	Signs and advertising displays	0	1
3996	Hard surface floor coverings	0	0
3999	Manufacturing industries, n.e.c.	0	0
	Number of Industries with I = 1	**164**	**149**
	Number of Observations	**241**	**241**

Table 8: NL2SLS Estimation (without setting $\alpha = \beta$)

Parameter	Value	Std. Error
β	0.818***	0.065
α	0.687**	0.296
λ	2.285*	1.234
a	0.025**	0.053
R^2	0.150	
Adj. R^2	0.139	
Observations	241	

*** Significant at 1%, ** Significant at 5%, * Significant at 10%.

Table 9: 2SLS Estimation

Variable	Coefficient	Std. Error
*Loss**(1-*I*)	234.144***	51.674
*Gain**(1-*I*)	82.204**	35.604
*Loss*I*	88.803***	13.393
*Gain*I*	42.302**	20.972
I	3.142	73.640
R^2	0.149	
Adj. R^2	0.134	
Prob(F-stat)	0.000	
Observations	241	

*** Significant at 1%, ** Significant at 5%.

$Loss = D_i \times \left[\Pi_i^{(-1)} - \Pi_i\right]^{\beta-1} \Big/ \left(E_i^{(-1)}\right)^{\beta}$, $Gain = (1-D_i) \times \left[\Pi_i - \Pi_i^{(-1)}\right]^{\beta-1} \Big/ \left(E_i^{(-1)}\right)^{\beta}$

Table 10: NL2SLS Estimation (I from Probit)

Parameter	Value	Std. Error
β	0.838***	0.059
λ	2.149***	0.777
a	0.021***	0.007
R^2	0.182	
Adj. R^2	0.175	
Observations	241	

*** Significant at 1%.

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