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Essays on the Political Economy of Trade Liberalisation

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Abstract

This doctoral thesis contributes to a growing strand of literature on the nature and causes of trade liberalisation from a political economy perspective. In three core chapters, I identify distinct and novel features of trade liberalisation.

In Chapter 2, I demonstrate that unilateral and cooperative trade policy depend crucially on the degree of natural trade costs, or transport costs, in a model where terms-of-trade and profit-shifting motives for trade policy are important. When trade costs decline, a conflict of interest between unilateral and cooperative trade policy intensifies: unilateral policy aims to optimally exploit a country's monopoly power over its terms of trade, whereas cooperative policy aims to minimise losses in transit. In a framework where cooperative trade policy must be sustained by a reputational mechanism, I demonstrate that import tariffs can be lowered in response to decreases in natural trade costs, provided the long-run cooperative objectives of minimising losses in transit are more important than the short-run temptation of distorting the terms of trade and shifting profits towards the domestic market. These temptations become larger when trade costs decline since when the degree of natural distortions of consumer prices, and the degree of natural profit-shifting are lower, import tariffs are more effective at doing the job. I also demonstrate that a free trade agreement can be supported for a larger range of discount factors when trade costs decline.

In Chapter 3, I analyse the sustainability of unilateral and bilateral trade liberalisation by introducing a time-inconsistency problem in addition to standard terms-of-trade manipulations. I find that the government's bargaining power vis-à-vis a politically organised lobby is a key parameter in the determination of the sustainability of trade liberalisation. Unilateral trade liberalisation, which is when the government unilaterally sets the dynamically efficient trade policy, can be sus-

tained for every discount factor if the government has no bargaining power. This is because when the government has no bargaining power, it is only just compensated for the short-run distortion associated with trade policy, and not for the long-run distortions which come about from overinvestment in protected sectors. As the government's bargaining power increases, the level of patience required to sustain unilateral trade liberalisation also increases, and when the bargaining power exceeds a critical threshold, the government is able to extract so much rent that it is better off continuing its implicit contract with the lobby. Bilateral trade liberalisation imposes further sanctions on the part of a deviating country when its trading partner punishes it. This ensures that bilateral trade liberalisation can be sustained for all levels of the government's bargaining power provided the world is sufficiently patient. However, for low bargaining powers unilateral trade liberalisation can be supported for a larger range of discount factors whereas when the bargaining power exceeds a critical level, a trade agreement is needed to sustain trade liberalisation.

In the last of the core chapters, Chapter 4, the question I address is one of the nature rather than the causes of trade liberalisation as in the two chapters that preceded it. I carry out an empirical examination of the political-economy model in Maggi and Rodriguez-Clare (2007). The model makes clear predictions regarding the tariff cuts in a trade agreement which can be perfectly enforced internationally. There are two distortions of non-cooperative trade policy: terms-of-trade manipulations, and a dynamic inconsistency. Thus, when two countries come together to sign a trade agreement these are the distortions they solve. The model predicts that tariff cuts should be explained by a terms-of-trade component, which I capture by the value of net imports, and inter-industry capital mobility, which I measure using three different variables: persistence of profits, capital-labour ratios and four-firm concentration ratios. I find that the first two variables capturing capital mobility perform very well at explaining the speed of liberalisation of US import protection on Mexican products. The results on the terms-of-trade component are less convincing although on most econometric specifications I obtain the correct sign.

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Chapter 1

Introduction

Since World War II, the world has experienced substantial liberalisation of political barriers to trade. Several rounds of multilateral trade liberalisation under the auspices of GATT/WTO has ensured gradual reductions in import tariffs from over 40 per cent in 1945 to less than 4 per cent today in the developed world. In addition, the signing of a countless number of bilateral and regional trade agreements has intensified economic integration in most parts of the world. It is a challenging task for economists and political scientists alike to understand the nature and causes of this development, and in the academic world a growing number of researchers are trying to find answers to this issue.

The present doctoral thesis will contribute to our understanding of three broader questions: (i) What drives countries to impose political barriers to trade such as import tariffs unilaterally? (ii) What drives the desire of governments to cooperate over trade policy? (iii) Once countries have embarked upon a phase of tariff reductions, what can be said about the nature of the path from unilateral trade policy to internationally efficient trade policy?

Although the GATT/WTO has been a successful institution in the post-war era, and has achieved immense results in the trade policy arena, there are concerns that multilateral trade negotiations have come to a standstill in the recent Doha round[1]. During the ongoing financial crisis which emerged in 2007/2008, many countries around the world have resorted to protectionism in various forms, and there is genuine concern that the past success of reducing trade barriers will be compromised. In order to understand the recent slowdown of trade liberalisation, it is important to study the past success.

The thesis is organised in three core chapters which make separate contributions within the general theme of political economy of trade liberalisation. Each chapter examines models where governments have particular motives to grant trade protection. Common to them all is the assumption that a country as a whole can improve its terms of trade through trade policy. This motive to grant import protection figures prominently in the trade literature. If a country acts in this manner, however, it is unlikely to go unpunished by international trading partners, and the result is a so-called terms-of-trade driven prisoner's dilemma. Countries can thus improve their welfare by deciding to cooperate over trade policy by signing a trade agreement. The idea that terms-of-trade manipulations give rise to a problem which a trade agreement might solve dates back to Mill (1844) and Torrens (1844), while the first formal treatment was given in Johnson (1953). Terms-of-trade distortions form the motive for signing trade agreements in Grossman and Helpman (1995) and Bagwell and Staiger (1999, 2002). Although the empirical relevance for terms-of-trade manipulations in the setting of trade policy have been met with considerable scepticism (see for example Ethier (2004, 2007)), recent empirical studies have documented strong and significant evidence Focusing on 15 countries that were never GATT members, and that hence set their tariffs in a unilateral fashion prior to joining the WTO, Broda limao and Weinstein.(2008) estimate the degree of market power that each of these countries was able to exert on the foreign export (world) prices that it faced (as captured by

[1]The Doha round started in November 2001. As of 2011, talks have stalled over a divide between on the one hand, developed nations such as the EU, the US and Japan, and on the other, developing nations represented mainly by Brazil, China, India and South Africa.

the foreign export supply elasticities faced by these countries). Their estimates, show that most countries, even apparently small countries, have significant ability to alter their terms of trade on many imported products with their tariff choices. Another question is whether tariff cuts negotiated at the level of the GATT/WTO reflect the removal of that portion of the noncooperative tariff that embodies the terms-of-trade motive. Broda, Limao and Weistein (2008) also address this question by checking whether measures of the power to affect world prices help predict the levels of noncooperative trade policies but do not help predict the levels of bound tariffs resulting from GATT/WTO negotiations. Focusing on the United States, they find that US non-tariff barriers and so-called statutory tariff rates, which have not been subjected to direct negotiations within the GATT/WTO, are significantly and positively related to the degree of market power that the United States exerts on the world prices of its import products, whereas the US MFN tariffs,which have been the subject of GATT/WTO negotiations, exhibit no such relationship. Similar papers which attempt to disentangle the degree of terms-of-trade manipulations include Bagwell and Staiger (2006) and Ludema and Mayda (2010).

In Chapter 2 of this thesis, I construct a model of international oligopoly where two countries are unilaterally driven into a terms-of-trade and profit-shifting prisoner's dilemma in the setting of trade policy. In addition to political import tariffs, world trade is subject to natural trade costs (or transport costs) which are outside the government's control. I identify interesting relationships between natural trade costs and trade policy. Unilaterally, the incentive to distort the terms of trade in a country's favour, and the incentive to shift profits towards the domestic market increases when trade costs decline. This is because when natural trade costs are lower, the degree of natural distortion of consumer prices, and the degree of natural profit-shifting towards the domestic market is higher, making import tariffs more effective at doing the job. Cooperative trade policy, however, has a different objective. Acting cooperatively the two countries prefer to set import tariffs lower when trade costs decline. This is because when trade costs are lower, a smaller amount of the traded quantities are lost in transit, facilitating lower cooperative tariffs. Hence, when trade costs decline, a conflict of interest between unilaterally optimal trade policy and cooperative trade policy intensifies. I go on to examine the sustainability of cooperative trade policy when any cooperative trade policy must be sustained through a reputational mechanism. In an infinitely repeated game, I find that lower import tariffs can be lowered in response to falling trade costs provided the governments' long-run objectives of minimising losses in transit are sufficiently important relative to each government's short-run temptation to distort the terms of trade in its favour, and shifting profits towards the domestic market. I also show that lower import tariffs in response to falling trade costs can be sustained for the largest range of discount factors. Moreover, I show that a free trade agreement can be supported for a larger range of discount factors when trade costs fall, provided the firms interact strategically. The intuition behind this is that although the temptation to deviate from a free trade agreement increases when trade costs decline, the international externalities that are felt by both countries when punishment occurs outweigh the short run gains.

It can be said that Chapter 2 very much goes into the heart of the first and second questions outlined in the beginning of this introduction, namely examining governments' incentives to either cooperate or conduct independent trade policies. The same can be said about Chapter 3 which is build around a two-country model of perfect competition. In that chapter, I introduce a time inconsistency in the setting of trade policy: the optimal trade policy for some future period may not be optimal once the future actually arrives. Time-inconsistency problems were first introduced into economics by Kydland and Prescott (1977) and Fischer (1980). They apply the idea to various economic circumstances such as central bank policy and taxation. In my framework, the idea is applied to a trade policy framework, and the idea is that owners of physical capital make investments that are irreversible in any given period, which is what I refer to as the short run, but after one period, that is in the long, capital can be reallocated to equalise returns across industries. This brings about a conflict of interest between the optimal trade policy in the short run, where capital is sunk, and in the long run where capital is perfectly mobile. It is assumed that tariffs are determined in a political-economy framework where owners of capital in the import-competing sector organise as a political lobby to obtain trade protection. I model the negotiation between the government and the lobby as a Nash bargaining situation with bargaining powers of the two parties exogenously given. The bargaining power of the government is a key parameter, together with the government's discount factor, for the sustainability of trade liberalisation. The tariff obtained maximises the joint welfare of the government and the lobby taking the current capital allocation as given. In the next period, however, this encourages entry into the protected sector, and the government may not be compensated for this long-run misallocation of capital if its bargaining power is low. International terms-of-trade distortions exist alongside this time-inconsistency problem, and together they represent two powerful motives to sign a trade agreement. I assume that any deviation from the politically optimal tariff (the tariff that obtains by political interaction with the lobby) must be sustained by a reputational mechanism. I distinguish between unilateral trade liberalisation, in which the government unilaterally obtains a means of committing to the socially optimal tariff (the tariff which optimally exploits a country's monopoly power over its terms of trade), and bilateral trade liberalisation in which the two countries come together to maximise joint welfare. In an infinitely repeated game, I show that unilateral trade liberalisation can be sustained for all discount factors if the government has no bargaining power. In that case, the government is only compensated for the immediate distortions of trade policy through campaign contributions from the lobby, but not for the long-run misallocation of capital. As the bargaining power of the government increases, however, the degree of patience required to sustain unilateral trade liberalisation increases, and when the government's bargaining power exceeds a critical level no discount factor can support trade liberalisation. A trade agreement involves the maximisation of joint welfare of the two countries, such that in addition to solving the outlined commitment problem, terms-of-trade manipulations are internalised. This imposes additional sanctions on the part of the governments. In fact, it can be proven that trade liberalisation can be supported for any bargaining power provided the two governments are sufficiently patient. For low bargaining powers, unilateral trade liberalisation can be supported for a larger range of discount factors, whereas when the bargaining power becomes sufficiently large, a trade agreement is needed to sustain trade liberalisation. I do not attempt to model the factors underlying the determination of the relative bargaining position of the government and a lobby. What I have in mind, however, is that the bargaining power of a government is expected to be lower in an open political system based on several coalitions. The decentralisation of the political power gives a government a lower bargaining position, as opposed to an autocratic system where the government might be able to extract more rents from the political negotiation. Interpreted in this way, the model predicts more trade liberalisation in more open and democratic political system, a prediction which is in line with casual observation.

In Chapter 4, I examine a political-economy model very similar to the one in Chapter 3, but the question I am addressing is related to the third question outlined above. I assume that two countries have decided to sign a trade agreement which is perfectly enforceable internationally. I then go on to examine whether something can be said about the nature of the path of tariff reductions. The chapter is empirical, and it puts the political-economy model in Maggi and Rodriguez-Clare's (2007) to the data. The aim is to keep the empirical estimating equations tied as close as possible to the theoretical model. There are two motives to grant trade protection in the theoretical model: (i) to internalise an international terms-of-trade distortion, and (ii) to solve a domestic commitment problem similar, and in this sense it is no different from the model outlined in Chapter 3. Hence, when the two countries come together to sign a trade agreement, there will be two components of trade liberalisation, one that internalises terms-of-trade distortions, and one that ensures commitment on the part of the government. In a dynamic extension, it is predicted that the terms-of-trade component translates into an immediate trade liberalisation, whereas the political component is gradual, and this gradual liberalisation depends on the degree of inter-industry capital mobility. The intuition is that as the economy adjusts to a new equilibrium with free trade, industries that employ more fixed capital will experience greater losses in the adjustment phase. I put this prediction to the data by finding empirical variables to capture the terms-of-trade manipulations and inter-industry capital mobility. I then examine if these variables can explain some of the variation of the US tariff cuts on Mexican imports after signing the North American Free Trade Agreement in 1994. I follow Bagwell and Staiger (2006) and use net imports to capture the terms-of-trade component, and I experiment with three different variables to measure the degree of inter-industry capital mobility: persistence of profits, capital-labour ratios and four-firm concentration ratios. I find that the first two measure of capital mobility perform very well in terms of explaining tariffs cuts: more mobile industries experience bigger annual tariffs cuts than industries that employ more fixed capital. The third measure is ineffective at explaining trade liberalisation. The variable capturing the terms-of-trade component has the right sign, that is, the degree of terms-of-trade manipulations may explain part of the tariff cuts. However, on most specifications of the empirical estimating relation the results are insignificant. I conclude there is some evidence that inter-industry capital mobility can explain the gradual component of trade liberalisation, whereas the evidence on terms-of-trade manipulations is substantially weaker.

In Chapter 5, I draw together the main results and insights from this thesis, and offer a discussion of possible extensions, before outlining avenues for future research.

Chapter 2

The Self-enforceability of Trade Agreements in the Presence of Trade Costs

2.1 Introduction

The history of trade liberalisation in the post-war era is intimately related with the expansion of the GATT/WTO, and to the signing of a countless number of bilateral and regional trade agreements. Since World War II, average ad valorem import tariffs have been reduced from over 40 percent to less than 4 percent. There are clearly strong forces pushing countries to sign trade agreements, and it is important for economists and political scientists alike to understand the nature and causes of the desire to engage in cooperative trade policy. Why do countries sign trade agreements, and what determines the extent of trade liberalisation? Did it occur because governments became aware of the harmfulness of non-cooperative trade policies, or was it caused by external events which made cooperation more favourable?

Alongside the substantial reduction in politically-induced tariff protection, the

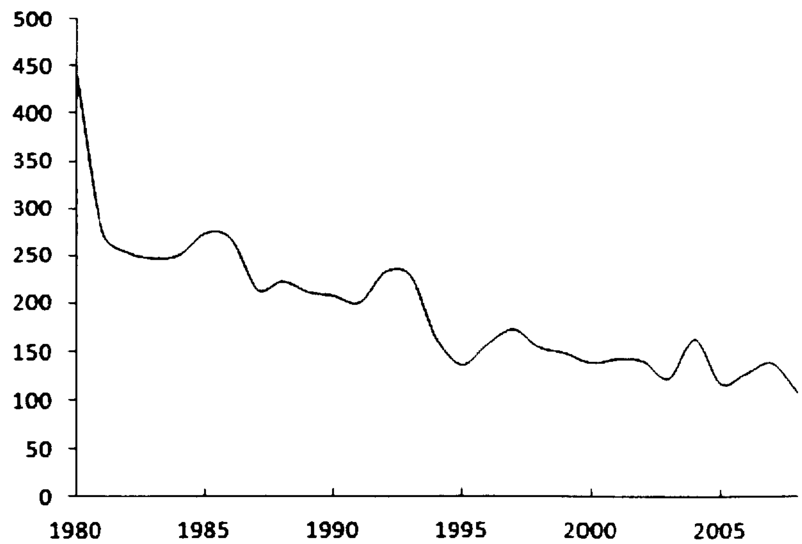

Figure 2.1: The evolution of trade costs over time.

post war era has witnessed a gradual decline in the overall level of trade costs. Figure 2.1 is taken from McGowan and Milner (2011), and it shows the trend in trade costs over the past three decades. Trade costs are measured using Novy's (2010) gravity approach, and it effectively gives a measure of the ratio of external trade barriers to internal barriers. In the figure trade costs, for a sample of developed countries, have been averaged to give an idea of the overall trade costs in the developed world. The data begins in 1980 and records average trade costs of a little less than 450 percent of internal trade costs. In 2006, average trade costs have dropped to around 135 percent. In the present chapter, I study the nature of the relationship between trade costs and the apparent extensive trade liberalisation which has occurred up until now.

I make a clear distinction between trade costs that are politically induced which in the present model consist of import tariffs, and those trade costs which are natural in the sense that governments are unable to influence them through policy. In the trade literature, it is most common to refer to such trade barriers as transport costs, but I stress *natural* trade costs because I want these to comprise all kinds of barriers to trade which are outside the influence of government. These could include: transport technology, storage, inventory and preparation technology, communications networks, language barriers and so on.

I construct a modified version of Yi's (1996) extension of the Brander (1981) model of oligopoly with two countries called Home and Foreign, and with one firm in each. Each firm produces one good, and these goods are substitutable according to a substitution index which varies between zero and one. If the index is zero each firm is a monopolist and there is no strategic interaction amongst them. If the index is one, the two firms produce homogeneous goods. Unilaterally, each country maximises individual welfare with respect to an import tariff, and the model offers two motives to grant such import protection: (i) a terms-of-trade motive, and (ii) a profit-shifting motive. The first motive arises due to the influence of import tariffs on the net-of-tariff price of an imported good. This motive is standard in the trade-policy literature, and it was first identified by Johnson (1953) for perfectly competitive economies[1]. The key is that a country as a whole can use its monopoly power over its terms of trade to improve welfare. The second motive arises due to rent-shifting made possible by the oligopolistic distortion. By reducing market access for the foreign exporter, import tariffs can shift profits towards the domestic producer. This motive is absent under perfect competition where prices equal to marginal costs.

The incentives to impose import tariffs through improved terms of trade and higher domestic profits are not invariant to changes in natural trade costs. In fact, when natural trade costs are lower, the unilateral gain from imposing import tariffs is higher. This is because when Home's consumer prices and domestic profits are distorted to a lesser extent by natural trade costs, a politically induced import tariff is more effective at distorting terms of trade in Home's favour, and shifting

[1]The idea is further developed in Grossman and Helpman (1995). and Bagwell and Staiger (1999. 2001) for perfectly competitive economies.

profits towards the Home producer in the domestic market.

Unilateral trade policy produces international externalities, however, since a country's trading partner will see a worsening of its terms of trade and profits shifted away from their firm. These international distortions are greater the lower the level of natural distortions through trade costs. The countries engaged in a tariff war will find themselves caught in a terms-of-trade and a profit-shifting prisoner's dilemma and they may be willing to cooperate in order to reach a more efficient equilibrium.

I first consider an equilibrium in which Home and Foreign are able to sign a binding trade agreement which is perfectly enforceable. In this situation, Home and Foreign simply maximise joint welfare with respect to import tariffs to reach the optimal level of joint welfare, thus neutralising the externalities of unilateral trade policy. However, since the presence of natural trade costs represents losses in transit, globally efficient trade policy involves setting lower tariffs when trade costs fall. More specifically, due to the oligopolistic distortion firms produce sub-optimal quantities and in the absence of trade costs, it is optimal to subsidise them. When trade costs are positive, however, the governments balance subsidising the oligopolistic firms against minimising losses in transit. Hence, when acting to maximise global welfare, the two countries will set lower tariffs in response to exogenous decreases in natural trade costs. There is, therefore, a conflict of interest between unilateral and global trade policy: unilaterally, it is optimal to raise tariffs when trade costs fall, whereas bilaterally it is optimal to lower the tariffs. The joint welfare gain from cooperation is thus larger when trade costs are lower.

I then move on to discuss trade agreements in a framework where the two countries are unable to write binding contracts. While the literature on trade agreements offers several approaches to modelling imperfect contract enforcement, one particular approach which is based on repeated games stands out. According to these models, trade policy cooperation is limited by countries' weighting the one-shot incentives to deviate from an agreed-upon tariff against the discounted benefits from future cooperation. This view of trade policy cooperation is a fair reflection of reality since the world is currently not equipped with an international law enforcement agency capable of sanctioning nations that do not honour international agreements. The GATT/WTO has served as an international institution offering a negotiation forum, which allows countries to reach a higher welfare through mutual tariff concessions. Outside enforcement is ensured through a number of rules, permitting countries to punish cheating nations[2].

I model trade policy cooperation as a repeated prisoner's dilemma. The two countries can choose to sign any agreement specifying that tariffs be lowered from their non-cooperative levels. Once such an agreement is signed, however, any of the two countries has a one-shot incentive to deviate from an agreed-upon tariff by distorting the terms of trade in their favour, and shifting profits towards their respective domestic firms when the other country cooperates. It is assumed that if a country does not honour an agreed-upon tariff, the other country will punish it by reverting to the non-cooperative Nash tariffs forever as of the following period. Self-enforceability thus implies that the present discounted value of honouring a trade agreement must be greater than or equal to the one-shot payoff from deviating and the present discounted value of infinite Nash reversion. The requirement of self-enforceability may, therefore, constrain the trade agreement to a second-best one from a joint welfare-maximising perspective in order to keep each country's incentive to stay in the agreement.

I consider two types of agreements which are subject to a self-enforcement constraint. The first type is based on what I define as the optimal self-enforceable tariff, and the second is a free trade agreement (FTA).

[2]For example. Article 22.3 of the Understanding on Rules and Procedures Governing the Settlement of Disputes. and a limited punishment rule by the GATT Article XXVIII.

The first type is the tariff which obtains when the two countries maximise their joint welfare with respect to import tariffs subject to the self-enforcement constraints. If the world is very patient the self-enforcement constraint is not binding, and the two countries are simply able to implement the internationally efficient tariffs. On the other hand, if short-run considerations are so important that the self-enforcement constraint binds, the agreement must involve tariffs that lie somewhere in between the efficient tariffs and the politically optimal Nash tariffs in order to persuade each country to adhere to the agreement. I then go on to examine how exogenous changes in natural trade costs affect the optimal self-enforceable tariffs. It turns out that if countries are very impatient such that short-run considerations are important, tariffs need to be raised in response to falling trade costs. This is because when trade costs fall the one-shot payoff from deviating from an agreed-upon tariff increases, since there is a greater benefit from distorting terms of trade in a country's favour, and shifting profits towards the domestic firm. On other words, in order to keep an impatient country's incentive to stay in the agreement, tariffs need to be raised in response to falling trade costs in order to reduce the short-run payoff from unilateral deviation. If the world is sufficiently patient, however, the long run payoff from cooperation is relatively more important, and for that reason the joint objective of minimising losses in transit becomes more important. While this may not imply that the internationally efficient tariffs are self-enforceable, countries care sufficiently about the future to sustain lower tariffs in response to falling trade costs. Hence, the relationship between tariffs and trade costs depends crucially on how patient the world is. I demonstrate that tariffs fall in response to falling trade costs for the largest range of discount factors, allowing the two countries to increase their welfare.

The second type of agreement, a FTA, is useful for several reasons. First, the post-war era has witnessed the emergence of a large number of FTAs, and it is therefore interesting to see how trade costs affect the sustainability of such an agreement. Second, because a FTA involves removing import tariffs as a trade policy instrument it may be that such an agreement is the most self-enforcing if there are fixed costs associated with reinstating customs and border controls. Although I do not model such fixed costs explicitly, they could easily be added to the model. I define a critical discount factor above which a FTA is self-enforceable. This discount factor is given as the ratio of the one-shot gain from deviating from a FTA to the long-run loss from infinite Nash reversion. I demonstrate that the one-shot gain from deviating is greater when trade costs fall. This is because, relative to free trade, the one-shot benefit from distorting the terms of trade and shifting profits towards the domestic firm is higher when the natural distortion due to trade costs is lower. The long run loss from infinite Nash reversion is also higher when trade costs fall, since the punishment in terms of lost profit in the export market and worsened terms of trade is higher when trade costs are lower. Provided that firms interact strategically, I demonstrate that although the one-shot benefit from deviating from a FTA is higher when trade costs are lower, the greater international externalities that would result from deviation ensures that a FTA is more sustainable when trade costs fall. Put differently, a FTA can be supported for a larger range of discount factors when trade costs are lower. This relationship is steeper when the degree of strategic interaction is higher. I also show that there is a discontinuity in the relationship between trade costs and trade policy cooperation. In fact, there is a trade cost threshold that must be crossed before a FTA can be supported at all. This is because when trade costs are above this threshold there are too many losses in transit such that free trade is far too deep a trade liberalisation from a joint welfare-maximising perspective. If firms do not interact strategically, there is no relationship between the critical discount factor and trade costs. This is because, when each firm is a monopolist in its own market, the change (with respect to trade costs) in the unilateral gain from deviation is exactly proportional to the change in the long run loss. Hence, there is no such relationship.

I would argue that this model is able to account for several aspects of the post-war era trade liberalisation. First, provided the world has been sufficiently patient, this theory can explain the gradual (rather than immediate) fall in import tariffs. Due to the gradual decline in natural trade frictions, the world has experienced fewer losses in transit, making lower tariffs more self-enforceable. This has allowed successive rounds of trade liberalisation through the GATT/WTO. Second, the theory may be able to explain why the developed world has experienced much deeper reductions in politically induced trade protection, since transport costs are generally much higher between poorer countries. Finally, since the theory suggests that global free trade is more self-enforceable when trade costs are lower, it can help explain the emergence of the large number of FTAs since World War II.

Moreover, I believe the model is relevant for the design of international trading institutions such as the WTO and the European Union. A relevant question is the deepness of political integration and the extent to which institutions such as the EU and the WTO should be given supra-national powers over trade policy. According to the theory, FTAs can be supported for a larger range of discount factors when trade costs are lower. This implies that when trade costs fall the European Union could actually return powers over trade policy to member states, knowing that trade liberalisation stands a higher chance of sustaining itself in the absence of a law enforcement agency.

At the same time, the model can be relevant in times of economic recessions, since the degree to which governments value the future often depends on the state of the macro economy. In times of recession, governments may care more about short-run considerations, and for that reason international law enforcement agencies may need to be deepened to deal with falling natural trade costs and the consequent increased incentives to deviate.

The literature on trade policy reveals many channels through which trade costs affect the welfare of import tariffs. In models where there is free entry and exit a standard motive for imposing import tariffs is the so-called home-market effect. Two prominent examples are Venables (1985) and Venables (1987). The first of these models considers an oligopoly model with free entry and homogeneous products while the second uses Dixit-Stiglitz style monopolistic competition. In both models, a positive import tariff imposed by one country has the effect of attracting entry of firms in that country and exit in the other. This increases the amount of goods available not subjected to costly trade costs, thus increasing welfare for the country that imposes the tariff. Countries will consequently find themselves caught in a tariff war to attract firms.

Using a model of multinational enterprises, Ludema (2002) constructs a similar model where firms face a trade-off between being close to foreign markets (to avoid trade costs) and to concentrate production at home (to exploit economies of scale). When trade costs are reduced the incentive to unilaterally impose import tariffs decreases since a smaller proportion of the traded quantities is lost in transit and the desire to exploit economies of scale is increased. The desire to cooperate is therefore also greater. Notice that the present model finds that the incentive to impose import tariffs increases when trade costs fall which is the opposite of Ludema's (2002) finding. It is therefore reassuring that the finding that a FTA agreement is more self-enforceable when trade costs are lower is the same in this model as in Ludema's (2002). But in my model the result has a different driver, namely that the externalities that unilateral trade policy impose internationally when trade costs are lower, makes a FTA more self-enforceable.

Ludema's (2002) model produces the counterfactual implication that there is a positive relationship between FDI and import protection. It is well known, however, that countries with larger FDI flows have lower levels protection. Hence, the present model demonstrates that the relationship between the self-enforceability of FTAs and trade costs carries over to an environment with different motives for trade policy.

More recently, Zissimos (2010) models the formation of FTAs as a coordination problem. He shows how distance can be used to solve such coordination problems between countries. His main finding is that countries that are located closer to each other geographically (distance could here be interpreted as transport costs) impose greater externalities (in the form of terms-of-trade and profit-shifting distortions) upon each other, thus increasing the desire to coordinate their trade policy choices by forming a FTA. As in the present model, however, Zissimos (2010) does not invoke a requirement that trade agreements must be self-enforceable. Other papers which consider similar issues in models of perfect competition include Bond and Syropoulos (1996), Bond (2001), and Bond, Syropoulos and Winters (2001).

On the empirical side, very few papers have analysed the relationship between trade costs and cooperative trade policy, but casual observation should convince us that there is indeed a relationship. In fact, of the many variables which might explain the emergence of trade agreements proximity stands out. In the first systematic attempt to model the predictors of FTA membership, Baier and Bergstrand (2004) find that proximity is a good predictor of membership of FTAs. They find this result using a probit model for a sample of 54 countries (or 1431 country pairs).

Since I have restricted this model to a two-country framework, I am not contributing to the debate on regionalism as the absence of a third country omits the possibility of trade diversion. This could potentially affect both the long-run benefits from cooperation and short-run incentives to deviate for the case of preferential trade agreements. If it is assumed that trade agreements are signed between natural trading partners, however, this trade diversion effect may not pose a large problem. In any case, the present framework may be more applicable to the case of multilateral trade agreements as negotiated under the GATT/WTO. In the concluding section of this chapter, I discuss how my results might extend to frameworks with more than two countries.

The present model also contributes to the literature on gradual trade liberalisation. In Furusawa and Lai (1999), the requirement that trade agreements be self-enforceable induces gradual trade liberalisation. They construct a two-country two-sector trade model in which there is an adjustment cost to be incurred for a worker to move from one sector to the other. If the two countries choose to embark on a path of trade liberalisation they will liberalise as much as possible while keeping each country's incentive to stay in the agreement. In every period, deeper trade liberalisation is made possible and the importable sector shrinks. In a similar model, Maggi and Rodriguez-Clare (2007), which will form the basis for empirical estimation in Chapter 4, show that trade liberalisation can be gradual due to imperfect mobility of capital. This allows faster trade liberalisation when capital is more mobile. That paper, however, does not require trade agreements to be self-enforceable. In the present model, gradualism emerges from the effects of trade costs: a gradual but unanticipated exogenous decline in trade costs facilitates lower import tariffs, provided the two countries are sufficiently patient.

This chapter is organised as follows. In Section 2.2 I present the model of oligopoly which will be employed in this chapter. Section 2.3 discusses the unilateral trade policy equilibrium, before Section 2.4 moves on to discuss how cooperative trade policy can be used to solve this inefficiency. In Section 2.5 and Section 2.6, I discuss how the requirement of self-enforceability can change the outcomes of cooperative trade policy, and Section 2.7 concludes while discussing some useful extensions.

2.2 The model

In this section I present a version of Yi's (1996) extension of the Brander (1981) model of trade with oligopoly. I consider a world with two countries called Home and Foreign and an infinite number of discrete time periods. Each country has one firm, each producing one good. I assume there is no entry/exit such that firms make abnormal profits in equilibrium. Preferences are identical across countries and can be represented by the following quasilinear-quadratic utility function in each period:

$$U(\mathbf{q_i}, M_i) = aQ_i - \frac{\gamma}{2}Q_i^2 - \frac{1-\gamma}{2}\sum_{j=h,f} q_{ij}^2 + M_i, \quad i = h, f, \tag{2.1}$$

where q_{ij} is country i's consumption of country j's products, $\mathbf{q_i} \equiv (q_{ih}, q_{if})$ is country i's consumption vector, $Q_i \equiv q_{ih} + q_{if}$ and M_i is country i's consumption of the numeraire good. The numeraire is freely traded across countries to settle the balance of trade, and I assume that each country's endowment of this good is sufficient to guarantee a positive consumption in equilibrium. The parameter $\gamma \in [0; 1]$ represents a substitution index: when $\gamma = 0$ goods are independent and each firm is a monopolist in its own market. As γ increases goods become closer substitutes. Assuming $\gamma < 1$ consumers have a taste for variety. Notice that γ can be thought of as a measure of the degree of strategic interaction between firms, such that a higher γ implies a more direct competition among firms.

The two countries may not be symmetric in every aspect but for convenience I shall present all economic expressions for Home as the analogous expressions for Foreign are not hard to express once the reader has been presented with the expressions for Home. By maximising utility in (2.1) it is possible to derive Home's demand for the Home firm's good and the Foreign firm's good, respectively, as:

$$p_{hh} = a - q_{hh} - \gamma q_{hf} \quad \text{and} \quad p_{hf} = a - q_{hf} - \gamma q_{hh}. \tag{2.2}$$

The analogous demand functions for Foreign's demand for the Home good and the Foreign good can be found by exchanging h and f in (2.2). Trade is subject to natural trade costs of the iceberg form. In order for one unit of exports to arrive in Home, $1+\alpha_h$ units must be produced. Similarly, in order for one unit of exports to arrive in Foreign, $1+\alpha_f$ units must be produced. I assume there are no internal natural trade costs. In order to keep the analysis simple, I assume throughout most of the paper that trade costs are symmetric such that $\alpha_h = \alpha_f = \alpha$. This assumption is arguably realistic as long as the analysis refers to trade between two developed nations, while if trade took place between a developing country and one which is developed the assumption may not be valid. This is because with a transport technology which is less evolved the concept of distance may be different. It is not unrealistic to assume that, say 2000 miles between two developing countries is different than 2000 miles between two developed countries. In Section 2.6, I deal with how asymmetry affects the *relative* incentives of the two countries to cooperate.

In addition to natural trade costs the governments of each country are able to impose political trade costs in the form of a specific import tariff. I assume that tariffs are country-specific such that Home sets a tariff equal to τ_h on imports from Foreign's firm, and Foreign sets a tariff equal to τ_f. I also assume there are no internal political trade barriers.

Both firms produce at the same marginal cost of c in their respective domestic markets, $c = c_{hh} = c_{ff}$, but due to trade costs (both political and natural) the effective marginal cost of exporting becomes $c_{fh} = c + \alpha_f + \tau_f$ for the Home firm and $c_{hf} = c + \alpha_h + \tau_h$ for the Foreign firm. Markets are segmented and firms compete in a Cournot fashion by choosing quantities in each country. In the Home market, the Home firm solves the problem, $\max_{q_{hh}} \pi_{hh} = (p_{hh} - c)\, q_{hh}$, and the Foreign firm solves, $\max_{q_{hf}} \pi_{hf} = (p_{hf} - c_{hf})\, q_{hf}$, yielding the following first-order conditions:

$$p_{hh} - c - q_{hh} = 0 \quad \text{and} \quad p_{hf} - c - \alpha_h - \tau_h - q_{hf} = 0 \,. \tag{2.3}$$

Using (2.2) these conditions can be rewritten as:

$$a - c - 2q_{hh} - \gamma q_{hf} = 0 \quad \text{and} \quad a - c - \tau_h - \alpha_h - 2q_{hf} - \gamma q_{hh} = 0. \tag{2.4}$$

Summing the first-order conditions in (2.4) gives the following per-period quantities in Cournot equilibrium:

$$q_{hh} = \frac{\Gamma(0,\gamma) + \gamma(\tau_h + \alpha_h)}{\Gamma(0,\gamma)\,\Gamma(2,\gamma)} \text{ and } q_{hf} = \frac{\Gamma(0,\gamma) - 2(\tau_h + \alpha_h)}{\Gamma(0,\gamma)\,\Gamma(2,\gamma)}, \tag{2.5}$$

where $\Gamma(\cdot)$ is defined as $\Gamma(k,\gamma) \equiv 2 - \gamma + k\gamma$, and I have normalised such that $a - c = 1$. By summing the quantities produced by each firm, I obtain an expression for the total quantity demanded by Home:

$$Q_h = \frac{2 - (\tau_h + \alpha_h)}{\Gamma(2,\gamma)}$$

By solving the profit maximising problems for the Home and Foreign firms, respectively, in the Foreign market it is possible obtain the analogous expressions for Cournot quantities in the Foreign market, q_{ff}, q_{fh} and Q_f.

The equilibrium quantities have the following properties:

$$\begin{aligned}
\frac{dq_{hh}}{d\tau_h} &= \frac{dq_{hh}}{d\alpha_h} = \frac{\gamma}{\Gamma(0,\gamma)\Gamma(2,\gamma)} > 0 \text{ and } \frac{dq_{hf}}{d\tau_h} = \frac{dq_{hf}}{d\alpha_h} = -\frac{2}{\Gamma(0,\gamma)\Gamma(2,\gamma)} < 0. \\
\frac{dQ_h}{d\tau_h} &= \frac{dQ_h}{d\alpha_h} = -\frac{1}{\Gamma(2,\gamma)} < 0
\end{aligned}$$

If Home raises its tariff on imports of goods from Foreign, the consumption of foreign imports and the total consumption fall, but the consumption of Home's domestic good increases. Exogenous increases in natural trade costs, α_h, have the same effect on quantities. In fact, what matters for the equilibrium quantities are *total* trade costs whether political or natural. A similar argument applies to quantities in Foreign.

Using the first-order condition in (2.3) I obtain the equilibrium per-period profits of the Home and Foreign firms, respectively, in the Home market:

$$\begin{aligned}
\pi_{hh}(\tau_h, \alpha_h) &= (p_{hh} - c) q_{hh} = q_{hh}^2; \\
\pi_{hf}(\tau_h, \alpha_h) &= (p_{hf} - c - \tau_h - \alpha_h) q_{hf} = q_{hf}^2 .
\end{aligned}$$

Hence, I have,

$$\begin{aligned}
\frac{d\pi_{hh}}{\tau_{hh}} &= \frac{d\pi_{hh}}{\alpha_h} = \frac{2\gamma q_{hh}}{\Gamma(0,\gamma)\Gamma(2,\gamma)} > 0; \\
\frac{d\pi_{hf}}{\tau_h} &= \frac{d\pi_{hf}}{\alpha_h} = -\frac{4 q_{hf}}{\Gamma(0,\gamma)\Gamma(2,\gamma)} < 0.
\end{aligned} \tag{2.6}$$

If Home raises its tariff (or there is an exogenous rise in natural trade costs) on imports from Foreign, the Home firm's profits from domestic sales rise, but the export profits of the Foreign firm in Home fall. It is possible to obtain the analogous profits of the Home firm and of the Foreign firm, respectively π_{ff} and π_{fh}, in the Foreign market, and apply the same arguments to profits there.

There are two sources of gains from trade in the model: an increased variety of goods and decreased market power of the domestic industry. When the substitution index γ is lower, consumers value variety whereas the pro-competitive effect is higher when γ is higher.

I define total consumer welfare in Home, C_h, to be the consumers surplus enjoyed from consuming every variety (provided $\gamma < 1$), and the tariff revenue which is redistributed back to individuals in a lump-sum fashion. I can express this total consumer welfare in each period as:

$$\begin{aligned} C_h(\tau_h, \alpha_h) &= CS_h(\tau_h, \alpha_h) + TR_h(\tau_h, \alpha_h) \\ &= \frac{1}{2}(a - p_{hh}) q_{hh} + \frac{1}{2}(a - p_{hf}) q_{hf} + \tau_h q_{hf}. \end{aligned} \tag{2.7}$$

The total profits of Home's firm consist of the profits it makes from serving its domestic market as well as its profits from supplying the market in Foreign. I can express these per-period aggregate profits as:

$$\begin{aligned} \Pi_h(\tau_h, \tau_f, \alpha_h, \alpha_f) &= \pi_{hh}(\tau_h, \alpha_h) + \pi_{fh}(\tau_f, \alpha_f) \\ &= (p_{hh} - c) q_{hh} + (p_{fh} - c - \tau_f - \alpha_f) q_{fh}. \end{aligned} \tag{2.8}$$

The per-period welfare of each country can be expressed by adding up consumer welfare in (2.7) and profits in (2.8):

$$W_h(\tau_h, \tau_f, \alpha_h, \alpha_f) = CS_h(\tau_h, \alpha_h) + TR_h(\tau_h, \alpha_h) + \Pi_h(\tau_h, \tau_f, \alpha_h, \alpha_f). \tag{2.9}$$

Exchanging h and f in equations (2.7)-(2.9) gives the corresponding per-period expressions for consumer surplus, tariff revenue and aggregate profits for Foreign.

2.3 Unilateral trade policy

When acting non-cooperatively, it is assumed that the governments of each country set tariffs so as to maximise their individual welfare. The governments move first by setting optimal tariffs and the two firms then set Cournot quantities subject to the tariffs chosen by the governments in each market. As discussed in Baldwin and Venables (1995) and Mrazova (2011), it is possible to decompose the welfare effects of import tariffs into a terms-of-trade effect (ToT), a volume-of-trade effect (VoT), and a profit-shifting (PS) effect. Differentiating (2.9) with respect to τ_h yields[3],

$$\frac{dW_h}{d\tau_h} = \underbrace{-q_{hf}\frac{dp^*_{hf}}{d\tau_h}}_{ToT\geq 0} + \underbrace{\tau_h\frac{dq_{hf}}{d\tau_h}}_{VoT\leq 0} + \underbrace{(p_{hh}-c)\frac{dq_{hh}}{d\tau_h}}_{PS\geq 0}, \tag{2.10}$$

where p^*_{hf} is the net-of-tariff price of Foreign's good sold in Home, or $p^*_{hf} = p_{hf} - \tau_h$. The ToT effect is the variation in the net-of-tariff price which Foreign's firm receive for their exports to Home. In this model, the ToT effect is positive such that an increase in Home's import tariff improves Home's terms of trade. The tariff reduces Home's volume of trade ($VoT \leq 0$) due to a higher consumer price of imports, but it shifts profits from foreign exporters to domestic producers by reducing market access ($PS \geq 0$). This last effect is due to the oligopolistic distortion where the import tariff moves the domestic firm towards the Stackelberg leader output level. This effect would be absent under perfect competition where prices equal marginal costs. Moreover, if there were no strategic interaction between firms ($\gamma = 0$), then it will be the case that $\frac{dq_{hh}}{d\tau_h} = 0$, such that there would be no profit-shifting incentive for imposing import tariffs. In this case, the only motive to unilaterally impose tariffs is to switch the terms of trade in its favour. However, when oligopoly matters there are two motives: to improve the terms of trade and to shift profits towards domestic firms. Substituting the Cournot quantities (2.5) and the inverse

[3]See Appendix 2.8.1 for the derivation.

demand function (2.2) in (2.10), I can solve for the optimal non-cooperative tariffs for Home, and analogously for Foreign, as[4]:

$$\tau_h^N = \frac{1-\alpha_h}{3} \text{ and } \tau_f^N = \frac{1-\alpha_f}{3}, \tag{2.11}$$

where the superscript N on the optimal tariff in (2.11) stands for Nash, and is there to illustrate the prisoner's dilemma nature of non-cooperative trade policy. Notice that Home's (Foreign's) optimal tariff is independent of the trade costs incurred by exporting to Foreign (Home). Notice further from Appendix 2.8.1 that the governments do not set Nash tariffs strategically such that the Nash tariff in Home (Foreign) is independent of the Nash tariff in Foreign (Home). This feature of the model is due to the fact that the two countries' markets are segmented. Because of the assumed linear demand function it is possible that tariffs become prohibitive. To rule this out I impose the condition,

$$\alpha_h < 1 - \frac{3}{4}\gamma \left(\alpha_f < 1 - \frac{3}{4}\gamma\right), \tag{2.12}$$

on Home (Foreign) trade costs throughout the rest of this chapter. In Appendix 2.8.3, I prove the following proposition:

Proposition 2.1: *If* $\alpha_h < 1 - \frac{3}{4}\gamma \left(\alpha_f < 1 - \frac{3}{4}\gamma\right)$ *there exists a unique non-prohibitive Nash tariff for Home (Foreign).*

It is useful to see how changes in Home trade costs change the incentive to

[4]See Appendix 2.8.2 for the derivation.

impose import tariffs. Taking the derivative with respect to α_h in (2.10) yields[5]:

$$\frac{d^2W_h}{d\tau_h d\alpha_h} = -\frac{1}{\Gamma(0,\gamma)\,\Gamma(2,\gamma)} < 0. \tag{2.13}$$

This implies that as α_h falls, the gain from imposing tariffs increases. This is because when natural trade costs are lower, the natural distortion of profits and consumer prices is lower, making import tariffs more effective at switching terms of trade in Home's favour, and shifting profits towards the domestic firm in the domestic market. Hence, the negative correlation between the Nash tariffs and trade costs, that is $\frac{d\tau_h^N}{d\alpha_h} = -\frac{1}{3} < 0$ (and $\frac{d\tau_f^N}{d\alpha_f} = -\frac{1}{3} < 0$).

Unilateral trade policy is inefficient, however, as one country's welfare gain comes at the expense of the other. By taking the derivative of Home's welfare with respect to Foreign's import tariff it is similarly possible to decompose the welfare effect into a terms-of-trade (ToT), a volume-of-trade (VoT) and a profit-shifting (PS) component[6]:

$$\frac{dW_h}{d\tau_f} = \underbrace{q_{fh}\frac{dp^*_{fh}}{d\tau_f}}_{ToT\leq 0} \underbrace{- (\tau_f + \alpha_f)\frac{dq_{fh}}{d\tau_f}}_{VoT\geq 0} + \underbrace{(p_{fh} - c)\frac{dq_{fh}}{d\tau_f}}_{PS\leq 0}, \tag{2.14}$$

where p^*_{fh} is the net-of-tariff price of Home's good sold in Foreign. Substituting Foreign's Nash tariff in (2.11) into (2.14) yields[7]:

$$\left.\frac{dW_h}{d\tau_f}\right|_{\tau_f^N} = \frac{4\left[\gamma - 4(1-\alpha_f)\right]}{3\left[\Gamma(0,\gamma)\,\Gamma(2,\gamma)\right]^2} < 0 \tag{2.15}$$

Hence, by acting non-cooperatively, international trade policy produces a terms-of-trade externality and a profit-shifting externality. It is also clear from (2.15)

[5]See Appendix 2.8.2 for the derivation.
[6]See Appendix 2.8.1 for the derivation.
[7]See Appendix 2.8.2 for the derivation.

that these externalities become more severe when trade costs are lower:

$$\left.\frac{d^2 W_h}{d\tau_f d\alpha_f}\right|_{\tau_f^N} = \frac{16}{3\left[\Gamma(0,\gamma)\Gamma(2,\gamma)\right]^2} > 0.$$

It is similarly possible to see how the substitution index affects international externalities by taking the derivative of (2.15) with respect to γ:

$$\left.\frac{d^2 W_h}{d\tau_f d\gamma}\right|_{\tau_f^N} = \frac{16\left(1-\gamma^2\right) + 64\gamma\left(1-\alpha_f\right) - 4\gamma^2}{3\left(\Gamma(0,\gamma)\Gamma(2,\gamma)\right)^3} > 0.$$

An increase in the degree of strategic interaction among firms, thus, increases international externalities. A trade agreement may be used to overcome this prisoner's dilemma by inducing cooperation.

2.4 Trade liberalisation with commitment

In this section, I derive the most efficient tariffs which would obtain if the two countries were able to commit themselves to all future tariffs stipulated by a trade agreement. This implies that Home and Foreign are not allowed to deviate from an agreed-upon tariff. This case would arise, for example, if there was a supranational government, or some international law enforcement agency which was able to ensure that agreements are honoured. Given this environment, the governments of Home and Foreign set two cooperative tariffs, τ_h^C and τ_f^C, to maximise the present discounted value of their joint welfare:

$$\max_{\tau_h,\tau_f}\frac{1}{1-\delta}J\left(\tau_h,\tau_f,\alpha_h,\alpha_f\right) = \frac{1}{1-\delta}\left(W_h\left(\tau_h,\tau_f,\alpha_h,\alpha_f\right) + W_f\left(\tau_h,\tau_f,\alpha_h,\alpha_f\right)\right), \tag{2.16}$$

where $\delta < 1$ is the discount factor assumed symmetric across countries. As with unilateral policy the governments move first by setting efficient tariffs and firms then choose quantities subject to those tariffs. Taking the derivative of (2.16) with respect to τ_h yields the following first order condition[8]:

$$\frac{dJ}{d\tau_h} = (p_{hh} - c)\frac{dq_{hh}}{d\tau_h} + (p_{hf} - c)\frac{dq_{hf}}{d\tau_h} - \alpha_h \frac{dq_{hf}}{d\tau_h}. \tag{2.17}$$

Exchanging h and f in (2.17) gives the analogous first order condition for Foreign's cooperative tariff. Substituting the inverse demand functions (2.2) and the Cournot quantities (2.5) into (2.17), I can solve for the internationally efficient tariff for Home, and analogously for Foreign, as[9]:

$$\tau_h^E = \tau_f^E = \frac{-\Gamma(0,\gamma)\,\Gamma(0,\gamma) + \frac{1}{2}\alpha_h(4+\gamma^2) + \frac{1}{2}\alpha_f(4+\gamma^2)}{(4-3\gamma^2)}. \tag{2.18}$$

Thus, if Home and Foreign were able to commit to any tariff they would choose τ_h^E and τ_f^E, respectively, in every period forever. In the absence of any trade costs $\alpha_h = \alpha_f = 0$, the efficient cooperative tariffs are negative. This is because in the presence of oligopolistic markets, firms produce suboptimal quantities and it is therefore efficient to subsidise them. As trade costs increase (both Home and Foreign, respectively, α_h and α_f), however, an increasing amount of the traded quantities are lost in transit. Hence, from a joint welfare-maximising perspective it becomes optimal to subsidise the traded quantities less, and as trade costs exceed a critical threshold it will be more efficient to impose a positive tariff to reduce the quantity lost in transit. If trade costs are symmetric, this critical threshold can be solved from (2.18) as,

$$\alpha \geq \overline{\alpha} \equiv 1 - \frac{4\gamma}{4+\gamma^2}. \tag{2.19}$$

[8]See Appendix 2.8.4 for the derivation

[9]See Appendix 2.8.4 for the derivation.

In Appendix 2.8.4, I show that as trade costs symmetrically approach their upper bounds in (2.12), the efficient tariffs in (2.18) converge to the Nash tariffs in (2.11), and in the limit they are equal:

$$\tau^E_{h\,\alpha\to 1-\frac{3}{4}\gamma} = \tau^N_h \text{ and } \tau^E_{f\,\alpha\to 1-\frac{3}{4}\gamma} = \tau^N_f \tag{2.20}$$

Notice the conflict of interest between non-cooperative and cooperative trade policy. When acting unilaterally countries wish to set higher tariffs when trade costs fall, but from a bilateral perspective tariffs should be lowered when trade costs fall. In order to get a feel for the differences of unilateral and cooperative trade policy objectives, I draw the Nash and efficient tariffs as functions of trade costs in Figure 2.2. I have set $\gamma = 0.5$ such that trade is eliminated when $\alpha = 1 - \frac{3}{4}\frac{1}{2} = \frac{5}{8}$ (see Eq. (2.12)). The reason for setting γ equal to this value is purely for illustrative purposes, and it could be set at any other value yielding similar results.

2.5 Trade liberalisation without commitment

In this section, I focus on cooperative tariffs which must be sustained through a reputational mechanism. This implies that Home and Foreign do not necessarily achieve the highest possible level of long-run welfare in any agreement as in the previous section. This is because in every period, as will be clear below, each country is weighting the short-run gain from deviating from an agreed-upon tariff against the long-run benefit from adhering to it. Thus, because of the requirement of self-enforceability, one could say that from a long-run perspective, the two countries may be constraining themselves to a second-best agreement.

I consider two types of agreements which are subject to a self-enforcement constraint. First, I solve for the optimal bilateral tariff which can be sustained

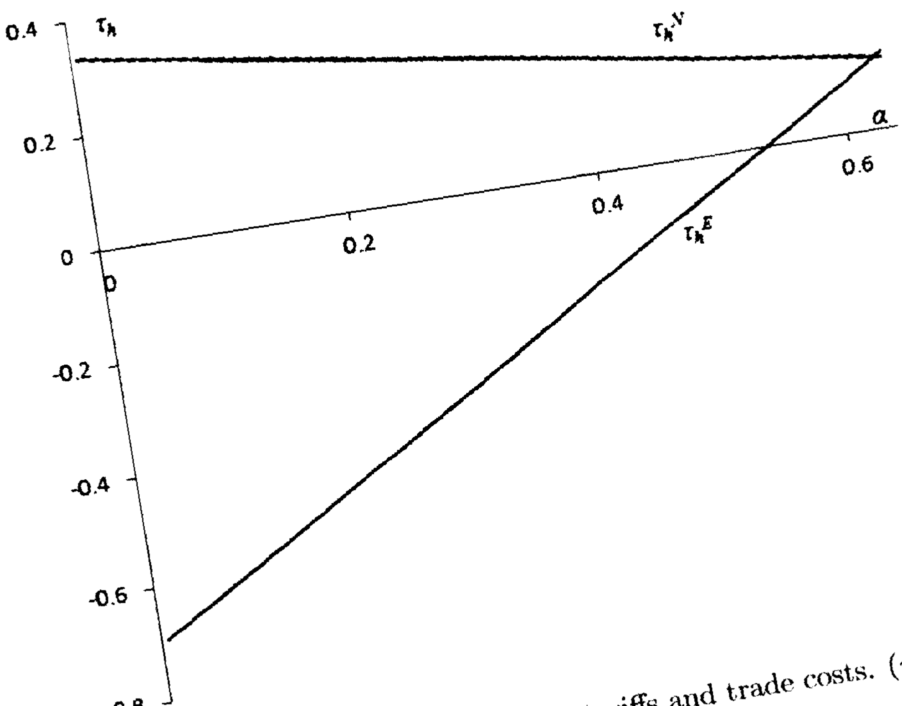

Figure 2.2: The relationship between tariffs and trade costs. ($\gamma = 0.5$).

through a reputational mechanism. This optimal tariff depends crucially on the degree of patience of the two countries. Patient countries are able to agree upon tariffs which are closer to the efficient tariffs of the previous section, whereas impatient countries cannot sustain significant departures from the Nash tariffs. Second, I will analyse the self-enforceability of global free trade. This particular case is useful since many countries have signed FTAs in the post-war era. Since a FTA involves removing import tariffs as a trade policy instrument, it could be argued that such an agreement is the most self-enforceable if there is a fixed cost associated with reinstating customs and border controls. I am not modelling this fixed cost explicitly but it could easily be added to the analysis. In both cases, I will examine how trade costs affect the incentives to engage in cooperative trade policy.

As with the case of unilateral trade policy, the setting of cooperative trade policy can be considered as a two-stage game: in the first stage governments jointly set tariffs, and in the second the two firms choose Cournot output levels in, respectively, the Home and Foreign market. The two countries play this two-stage game in every period an infinite number of times. A strategy is an infinite sequence of functions mapping the history of play into current actions. Let the cooperative tariffs be given as the pair $\left(\tau_h^C, \tau_f^C\right)$, such that the present discounted value of adhering to the agreement is:

$$\frac{1}{1-\delta} W_h^C \left(\tau_h^C, \tau_f^C, \alpha_h, \alpha_f\right). \tag{2.21}$$

I assume that if a country does not honour the trade agreement in any given period, the other country will punish it by reverting to the politically optimal Nash tariff forever as of the following period. The deviating country will, however, enjoy a short-run benefit from deviation by distorting the terms-of-trade in its favour and shifting profits towards the domestic firm. It is possible to find this one-shot deviation payoff from the point of view of Home by substituting Home's non-cooperative Nash tariff from (2.11) into the expression for welfare:

$$W_h^D\left(\tau_h^N, \tau_f^C, \alpha_h, \alpha_f\right),$$

where the superscript D stands for deviation. Since the other country will punish the cheating nation by reverting to the Nash tariff forever as of the following period, the deviation payoff reduces to the following after one period:

$$W_h^P\left(\tau_h^N, \tau_f^N, \alpha_h, \alpha_f\right),$$

where the superscript P stands for punishment. The present discounted value of the deviation welfare in Home can thus be expressed as:

$$W_h^D\left(\tau_h^N, \tau_f^C, \alpha_h, \alpha_f\right) + \frac{\delta}{1-\delta} W_h^P\left(\tau_h^N, \tau_f^N, \alpha_h, \alpha_f\right). \tag{2.22}$$

In order for a trade agreement to be self-enforceable, the welfare from honouring the trade agreement must be greater than or equal to the welfare from deviation. The discounted value of the welfare from cooperation can be obtained from (2.21), and together with (2.22) I can express the following self-enforcement constraint for Home:

$$\frac{1}{1-\delta} W_h^C\left(\tau_h^C, \tau_f^C, \alpha_h, \alpha_f\right) \geq W_h^D\left(\tau_h^N, \tau_f^C, \alpha_h, \alpha_f\right) + \frac{\delta}{1-\delta} W_h^P\left(\tau_h^N, \tau_f^N, \alpha_h, \alpha_f\right). \tag{2.23}$$

2.5.1 Optimal self-enforceable tariffs: explaining gradualism in trade liberalisation

The efficient tariffs obtained in Section 2.4 may not be supported in an agreement which is subject to a self-enforcement constraint for all discount factors. It may be that higher tariffs can be agreed-upon, however, which can be sustained by repeated interaction. In this subsection, I define an optimal self-enforceable tariff and examine the relationship between this tariff and natural trade costs. For the purposes of this subsection I assume that trade costs are symmetric such that $\alpha_h = \alpha_f = \alpha$. Before proceeding, however, it will be useful to calculate the level of patience required to sustain the internationally efficient tariffs in (2.18). This can be done by solving (2.23) for a critical discount factor, δ_e, above which an agreement stipulating that Home and Foreign adhere to the efficient tariffs, τ_h^E and τ_f^E, respectively, is self-enforceable:

$$\delta_e = \frac{W_h^D\left(\tau_h^N, \tau_f^E, \alpha\right) - W_h^C\left(\tau_h^E, \tau_f^E, \alpha\right)}{W_h^D\left(\tau_h^N, \tau_f^E, \alpha\right) - W_h^P\left(\tau_h^N, \tau_f^N, \alpha\right)}. \tag{2.24}$$

Notice that the numerator of (2.24), $W_h^D - W_h^C$, is the short-run benefit to Home from deviating from the internationally efficient tariff when Foreign cooperates. This is given as the short run benefit from switching the terms of trade in Home's favour, and shifting profits towards the domestic firm in the Home market relative to the efficient tariffs. The denominator of (2.24), $W_h^D - W_h^P$, is the long-run loss in welfare when Foreign, which was caught by surprise in the previous period, retaliates by reverting to the Nash tariff. The critical discount factor is thus given as the ratio of the short-run gain from deviation to the long-run loss. In Appendix 2.8.5, I demonstrate that this critical discount factor is given as,

$$\delta_e = \frac{3\left(4-\gamma^2\right)}{2\left(8-3\gamma^2\right)}. \tag{2.25}$$

Hence, for any discount factor greater than δ_e the internationally efficient tariffs can be sustained. Notice that this discount factor is independent of α. When trade costs fall, the temptation to cheat on the agreement increases but so does the long-run benefit of adhering to it, leaving the critical discount factor, δ_e, unchanged. Notice further that δ_e is weakly increasing in γ[10]. When γ is larger, the temptation to unilaterally deviate from an agreement by distorting terms of trade and shifting profits towards the domestic firm is larger raising the level of patience required to sustain the efficient tariffs.

If the two countries discount the future at a level lower than δ_e, however, is it then possible to find a tariff which improves welfare whilst keeping each country's incentive to stay in the agreement? Let the optimal self-enforceable tariffs for Home and Foreign be given as the pair $\left(\tau_h^S, \tau_f^S\right)$. To fix ideas, I rewrite the self-enforcement constraint (2.23) for Home in the following convenient way:

$$W_h^D\left(\tau_h^N, \tau_f^S, \alpha\right) - W_h^C\left(\tau_h^S, \tau_f^S, \alpha\right) \leq \delta\left(W_h^D\left(\tau_h^N, \tau_f^S, \alpha\right) - W_h^P\left(\tau_h^N, \tau_f^N, \alpha\right)\right), \tag{2.26}$$

and symmetrically I can write the self-enforcement constraint for Foreign by exchanging h and f as:

$$W_f^D\left(\tau_f^N, \tau_h^S, \alpha\right) - W_f^C\left(\tau_f^S, \tau_h^S, \alpha\right) \leq \delta\left(W_f^D\left(\tau_f^N, \tau_h^S, \alpha\right) - W_f^P\left(\tau_f^N, \tau_h^N, \alpha\right)\right). \tag{2.27}$$

Home and Foreign would jointly like to achieve the highest level of long-run welfare by maximising joint welfare (2.16). The requirement of self-enforceability, however, constrains the two countries by (2.26) and (2.27). The optimal self-enforceable

[10]The derivative $\frac{d\delta_e}{d\gamma} = \frac{12\gamma}{(8-3\gamma^2)^2} \geq 0$ for $\gamma \in [0;1]$.

tariff solves the following:

$$\max_{\tau_h,\tau_f} \frac{1}{1-\delta} J(\tau_h,\tau_f,\alpha) = \frac{1}{1-\delta}\left(W_h(\tau_h,\tau_f,\alpha)+W_f(\tau_h,\tau_f,\alpha)\right)$$
$$s.t.\ (2.26) \text{ and } (2.27). \tag{2.28}$$

If the discount factor $\delta \geq \delta_e$, the constraints in (2.26) and (2.27) are not binding, and Home and Foreign will set import tariffs at their efficient levels given in (2.18). Otherwise they will set import tariffs at their minimum self-enforceable levels. In Appendix 2.8.5, I show that the minimum self-enforceable tariffs which solve (2.28) when (2.26) and (2.27) are binding, are given as:

$$\tau_h^M = \tau_f^M = \frac{\alpha\left(40\delta+3\gamma^2-12\right)-40\delta-3\gamma^2+12+24\delta\gamma}{3\left(12-3\gamma^2-8\delta\right)}. \tag{2.29}$$

Thus, the optimal self-enforceable tariffs for Home and Foreign, respectively, are:

$$\tau_h^S = \max\left(\tau_h^M,\tau_h^E\right) \text{ and } \tau_f^S = \max\left(\tau_f^M,\tau_f^E\right)$$

In order to get a feel for these tariffs, imagine two extreme worlds. The first world is characterised by extreme myopia, such that Home and Foreign care only about welfare in the current period ($\delta = 0$). Setting $\delta = 0$ in (2.29) it is clear that in this case, the self-enforceable tariffs are equal to the Nash tariffs. If the world cares only about current-period welfare, no departures from the Nash tariffs are possible. In the second world the two countries are characterised by farsightedness with a discount factor in the range, $\delta \in [\delta_e; 1[$. In this case, the two countries are patient enough to implement the efficient tariffs in (2.18). Thus, in an extremely myopic world, no agreement is possible since only the Nash tariffs are sustainable, but in a very farsighted world, the efficient tariffs can be implemented. But how about discount factors that lie in between these cases? Assume now that the world discounts the future at the rate $\delta \in]0;\delta_e[$. This is where the minimum cooperative tariffs (2.29) become important. These tariffs can be thought of as a weighted average of the Nash tariffs and the efficient tariffs. A property of the minimum tariffs which I prove in Appendix 2.8.5 is that, when trade costs increase towards the upper bound given in (2.12), they converge towards the Nash tariffs:

$$\tau^M_{h\ \alpha\to 1-\frac{3}{4}\gamma} = \tau^N_h \text{ and } \tau^M_{f\ \alpha\to 1-\frac{3}{4}\gamma} = \tau^N_f. \tag{2.30}$$

This is due to the property that there is no conflict between unilateral and cooperative trade policy in the limit where import tariffs are prohibitive. Formally, I can find out the relationship between trade costs and trade policy by taking the derivative of (2.29) with respect to α. This yields:

$$\frac{d\tau^M_h}{d\alpha} = \frac{(40\delta + 3\gamma^2 - 12)}{3\,(12 - 3\gamma^2 - 8\delta)}.$$

Since the denominator of this derivative is positive, I can evaluate the sign by solving for δ in the numerator. Hence, there is a positive relationship between τ^M_h (and symmetrically for τ^M_f) and α if and only if,

$$\delta > \frac{12 - 3\gamma^2}{40}. \tag{2.31}$$

For convenience, I am going to define medium to high discount factors as any discount factor greater than the threshold given in (2.31). Any discount factor lower than or equal this threshold is defined as a low discount factor. With a slight abuse of terminology, I am going to say that the world is patient if the two countries have a medium to high discount factor, and impatient if they have low discount factors. Hence, if the countries are patient, and if they implement the tariffs, τ^S_h and τ^S_f, respectively, they will set lower tariffs when trade costs fall. If, on the other hand, countries are impatient, they may still find cooperative tariffs which can make them both better off. These cooperative tariffs, however, will need to be raised in response to falling trade costs. The reason for these relationships is as follows. As can be seen from (2.26) the greater is the discount factor, the greater the valuation the two countries will place on their welfare in the long run. This implies that for a patient world, the cooperative tariff must be closer to the efficient tariffs in (2.18), which are increasing in trade costs. In this patient world, therefore, the objective of Home and Foreign is mainly to use import tariffs jointly to minimise the transit losses associated with trade costs. In an impatient world, on the other hand, the cooperative tariffs must be closer to the Nash tariffs, which are decreasing in trade costs. In this case, if tariffs depart significantly from their Nash levels, the temptation to distort terms of trade and to shift profits towards the domestic firms is too large. Hence, in a patient world, trade liberalisation is deeper when natural trade costs fall. Provided WTO member countries have been sufficiently patient, this may help explaining gradualism in the trade liberalisation rounds under the GATT/WTO. Falling trade costs, as evidenced in Figure 2.1, may have facilitated deeper self-enforceable trade liberalisation over time. Impatient countries may also achieve trade liberalisation according to this theory, but stronger international law enforcement agencies are required to sustain welfare-enhancing trade liberalisation in response to falling trade costs. It should be added, however, that an implicit assumption is that falling trade costs are unanticipated, such that governments are not able to plan the optimal trade policy on a horizon in which falling trade costs are anticipated. Such an analysis, while fruitful, is beyond the scope of this thesis.

In Figure 2.3 I depict the optimal self-enforceable tariff in Home as a function of trade costs for various discount factors in the range, $\delta \in]0; \delta_e[$. The two bold lines are the efficient and Nash tariffs, respectively, reproduced from Figure 2.2. The

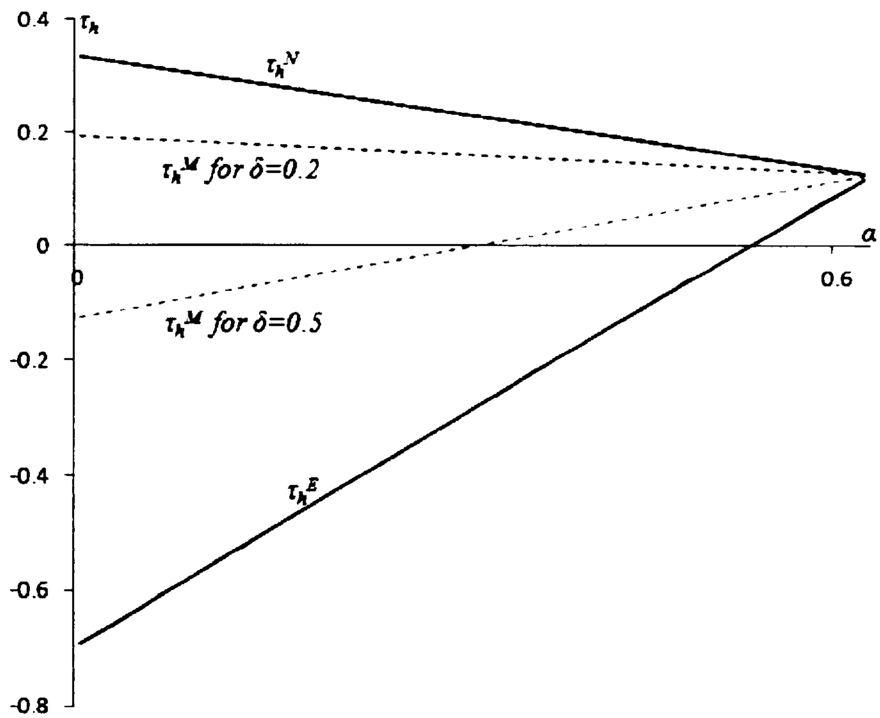

Figure 2.3: Optimal self-enforcable tariffs. ($\gamma = 0.5$).

two dashed lines represent optimal self-enforceable tariffs for discount factors of 0.2 and 0.5, respectively. When the discount factor is 0.2, short-run considerations are more important. In fact, in order to keep each country's incentive to stay in the agreement, tariffs need to be raised in response to falling trade costs. In other words, because the future is not important enough, tariffs must be raised in order to make sure each country does not fall for the temptation to distort the terms of trade in their favour, or shift profits towards their respective domestic industries when trade costs fall. On the other hand, when the world discounts the future at the rate 0.5, gradual trade liberalisation is made possible by falling natural trade costs.

2.6 The self-enforceability of a free trade agreement

In this subsection I will consider the sustainability of global free trade. This case is useful for at least two reasons: (i) many countries have signed FTAs in the post-war era, and (ii) a FTA involves giving up import tariffs as a policy instrument as opposed to the efficient tariffs which involve using import tariffs to reach the maximum level of joint welfare. If customs and border controls involve significant fixed costs, it may be that a FTA is more self-enforceable than any other agreement by removing import tariffs as a policy option. Global free trade, however, does not solve the problem of suboptimal quantities which is present under oligopolistic competition. Recall from Section 2.4 that the efficient tariffs in (2.18) may be positive for sufficiently high trade costs since the two countries jointly try to minimise traded quantities lost in transit. Hence, it will be the case that from a joint welfare-maximising perspective, free trade is far too deep a trade liberalisation if trade costs exceed that threshold (see Eq. (2.19)). In this case, therefore, the two countries would not choose to sign a FTA.

Hence, the cooperative policy options available to Home and Foreign are, respectively, the tariffs $\tau_h^{FT} = \tau_f^{FT} = 0$ provided $\tau_h^E \leq 0$ and $\tau_f^E \leq 0$. It will be convenient to express the self-enforcement constraint (2.23) in terms of a critical discount factor, δ_c, above which the FTA is self-enforceable:

$$\begin{aligned}
\delta_c\left(\alpha_h,\alpha_f\right) &= \frac{W_h^D\left(\tau_h^N,\tau_f^{FT},\alpha_h,\alpha_f\right)-W_h^C\left(\tau_h^{FT},\tau_f^{FT},\alpha_h,\alpha_f\right)}{W_h^D\left(\tau_h^N,\tau_f^{FT},\alpha_h,\alpha_f\right)-W_h^P\left(\tau_h^N,\tau_f^N,\alpha_h,\alpha_f\right)} \qquad (2.32)\\
&= \frac{CS_h\left(\tau_h^N,\alpha_h\right)-CS_h\left(\tau_h^{FT},\alpha_h\right)+TR_h\left(\tau_h^N,\alpha_h\right)}{\pi_{fh}\left(\tau_f^{FT},\alpha_f\right)-\pi_{fh}\left(\tau_f^N,\alpha_f\right)}\\
&\quad+\frac{\pi_{hh}\left(\tau_h^N,\alpha_h\right)-\pi_{hh}\left(\tau_h^{FT},\alpha_h\right)}{\pi_{fh}\left(\tau_f^{FT},\alpha_f\right)-\pi_{fh}\left(\tau_f^N,\alpha_f\right)}.
\end{aligned}$$

As with (2.24) the numerator of (2.32), $W_h^D - W_h^C$, is the short-run benefit from deviating from the FTA when the other country cooperates. This is given as the short run benefit from switching the terms of trade in Home's favour, and shifting profits towards the domestic firm in the Home market relative to free trade. This gain depends only on trade costs incurred by exporting to Home, α_h, and it is independent of α_f. The denominator of (2.32), $W_h^D - W_h^P$, is the long-run loss in welfare when the other country, which was caught by surprise in the previous period, retaliates by reverting to the Nash tariff. This loss depends on natural trade costs incurred by exporting to Foreign, α_f, but is independent of α_h. The critical discount factor is thus given as the ratio of the short-run gain from deviation to the long-run loss.

The next step in the analysis is to examine how trade costs affect the critical discount factor (2.32) for zero cooperative tariffs, and I will first consider asymmetric changes in trade costs. Suppose there is an exogenous change in trade costs incurred by exporting to Home, α_h, possibly due to changes in technology. The short-run gain from deviating from free trade, $W_h^D - W_h^C$, consists of a consumer and a producer gain. The total benefit to consumers from import protection relative to free trade, $CS_h\left(\tau_h^N, \alpha_h\right) - CS_h\left(\tau_h^C, \alpha_h\right) + TR_h\left(\tau_h^N, \alpha_h\right)$, depends on how Home's natural trade costs affect the terms of trade gain and the volume of trade loss relative to free trade. Similarly, the producer gain, $\pi_{hh}\left(\tau_h^N, \alpha_h\right) - \pi_{hh}\left(\tau_h^C, \alpha_h\right)$, depends on how Home's natural trade costs affect the degree to which the Nash tariff is able to shift profits towards the domestic firm relative to free trade. This producer gain is positive provided that firms interact strategically ($\gamma > 0$). In Appendix 2.8.6, I show that there is a negative correlation between Home trade costs, α_h, and the short-run benefit from deviation, $W_h^D - W_h^C$. This implies that when α_h is low, the gain from unilaterally deviating from free trade is higher implying that, *ceteris paribus*, a FTA becomes less self-enforceable when Home trade costs are lower. This is because when natural trade costs are lower, the natural distortion of profits and consumer prices is lower, making import tariffs more effective at switching terms of trade in Home's favour, and shifting profits towards the domestic firm in the Home market relative to free trade. This feature of the model is different from Ludema's (2002) model of trade with multinational firms in which the short run gain from deviation is *increasing* in trade costs. The reason for this is that more multinationals increases the variety of goods not subjected to trade costs, such that the gain to consumers is lower when trade costs are lower.

Suppose, now, there is an exogenous change in the natural trade costs incurred by exporting to Foreign, α_f. This affects the long-run loss in Home welfare when Foreign retaliates, $W_h^{SR} - W_h^P$. This loss consists of the difference between the Home firm's export profits under free trade trade and under protectionism, $\pi_{fh}\left(\tau_f^C, \alpha_f\right) - \pi_{fh}\left(\tau_f^N, \alpha_f\right)$. In Appendix 2.8.6, I show that there is a negative correlation between Foreign trade costs and the long-run loss from deviation. The intuition for this result is the following: if trade costs incurred by exporting to Foreign are lower, profits are to a lesser extent naturally diverted away from the Home firm in Foreign's market, thus ensuring the Home firm's profits in Foreign's market are larger. This, however, makes retaliatory responses by Foreign larger. Thus, when Foreign's natural trade costs decline, a free trade agreement becomes more self-enforceable by lowering the critical discount factor, δ_c. I summarise my findings in the following proposition:

Proposition 2.2: *If trade costs incurred by exporting to Home decrease, a FTA becomes less self-enforceable since it raises the critical discount factor,* $\frac{d\delta_c}{d\alpha_h} < 0$. *If trade costs incurred by exporting to Foreign decrease, however, a FTA becomes more self-enforceable,* $\frac{d\delta_c}{d\alpha_f} > 0$.

The proof of this proposition can be found in Appendix 2.8.6. One problem with having asymmetric trade costs is that in order for a trade agreement to be self-enforceable, it must be incentive-compatible for both countries. In the present model it will be the case that the country with the lower trade costs will be the one which finds it harder to sustain free trade. This is because the one-time incentive for the country with the lower trade costs is higher since there is a lower degree of natural profit-shifting and consumer price manipulation. Moreover, the punishment it experiences in the long run is proportionally lower since higher trade costs naturally reduces its firm's market share in the other country. Hence, it is only necessary to focus on the self-enforcement constraint of the country with the lower trade costs, since this constraint defines the boundary of the sustainability of global free trade.

It would be realistic to assume, however, that in the real world, there is not so much asymmetry in terms of trade costs, in particular between developed nations. In the following, therefore, an assumption of symmetry is imposed, that is, $\alpha_h = \alpha_f = \alpha$, and equi-proportional changes in trade costs are examined. Notice that both the numerator and the denominator of (2.32) are decreasing in α. Hence, when α decreases the short run gain from deviating from free trade will increase as will the long run punishment. Hence, there are two forces in play: (a) when there is fall in α, the short-run gain from deviating from free trade increases, making the FTA *less* self-enforceable, and (b) when there is a fall in α, the long-run loss from deviating will decrease making the free trade agreement *more* self-enforceable. Thus, I have to examine how the gain (numerator) and the loss (denominator) vary proportionally with trade costs.

To find the net effect I write up an expression for the critical discount factor[11]:

$$\begin{aligned}\delta_c(\alpha) &= \frac{CS_h\left(\tau_h^N,\alpha\right)-CS_h\left(\tau_h^{FT},\alpha\right)+TR_h\left(\tau_h^N,\alpha\right)+\pi_{hh}\left(\tau_h^N,\alpha\right)-\pi_{hh}\left(\tau_h^C,\alpha\right)}{\pi_{fh}\left(\tau_f^{FT},\alpha\right)-\pi_{fh}\left(\tau_f^N,\alpha\right)}\\ &= \frac{3(1-\alpha)(4-\gamma^2)}{8(5(1-\alpha)-3\gamma)}. \qquad (2.33)\end{aligned}$$

Taking the derivative with respect to α yields:

$$\frac{d\delta_c}{d\alpha}=\frac{30\gamma(4-\gamma^2)}{8(5(1-\alpha)-3\gamma)^2}\geq 0. \qquad (2.34)$$

On the basis of (2.34), I can propose the following:

Proposition 2.3: *Provided $\gamma>0$ a FTA becomes more self-enforceable when trade costs between two countries decline, $\frac{d\delta_c(\alpha)}{d\alpha}>0$. If $\gamma=0$ there is no relationship between the self-enforceability of a FTA and trade costs.*

A proof of this proposition can be found in Appendix 2.8.6. Provided there is strategic interaction among firms it will be the case that when trade costs decline, tariffs are more effective at distorting the terms of trade in Home's favour and at shifting profits towards the domestic firm. The long-run consequences of unilateral deviation are more severe when trade costs are lower, however, making the long-run benefit from trade cooperation higher.

If there is no strategic interaction between firms ($\gamma=0$), neither political trade costs nor natural trade costs are able to shift profits towards the domestic firm (see (2.6)), and it is possible to rewrite the critical discount factor (2.33) as:

$$\delta_c(\alpha)=\frac{CS_h\left(\tau_h^N,\alpha\right)-CS_h\left(\tau_h^C,\alpha\right)+TR_h\left(\tau_h^N,\alpha\right)}{\pi_{fh}\left(\tau_f^C,\alpha\right)-\pi_{fh}\left(\tau_f^N,\alpha\right)}=\frac{3}{10}. \qquad (2.35)$$

[11] See Appendix 2.8.6 for the steps behind this.

When $\gamma = 0$, the effect of α on the gain to consumers from deviating is exactly proportional to the loss in export profits. This is because when goods are independent of each other, the change in welfare from natural trade costs affects only traded goods. Thus, the change in the gain to consumers from deviating is proportional to the change in the loss inflicted upon the Foreign firm's export profits, and by symmetry this loss is equal to the Home firm's loss in the Foreign market. The critical discount factor is therefore independent of α and equal to a constant, in this model $\frac{3}{10}$.

When γ increases the degree of strategic interaction between firms increases, and profit-shifting becomes a more important motive in the setting of trade policy. Therefore, a trade agreement becomes less self-enforceable for every value of α. This can be seen by taking the derivative of (2.33) with respect to γ:

$$\frac{d\delta_c}{d\gamma} = \frac{3(1-\alpha)(12+3\gamma^2-10\gamma(1-\alpha))}{8(5(1-\alpha)-3\gamma)^2} > 0$$

It can also be seen from (2.34) that the relationship between δ_c and α becomes steeper when γ is higher. Taking the derivative of (2.34) with respect to γ yields,

$$\frac{d^2\delta_c(\alpha)}{d\alpha d\gamma} = \frac{3(20(1-\alpha)-15\gamma^2(1-\alpha)+12\gamma+3\gamma^2)}{8(5(1-\alpha)-3\gamma)^3} > 0.$$

In order to get a feel for the relationship between δ_c and α I draw them as a function of each other in Figure 2.4 for different values of γ. From the diagram it is clear that for $\gamma = 0$ the relationship is a flat line whereas when γ increases the relationship between δ_c and α becomes steeper. When the degree of strategic interaction between firms is higher, the profit-shifting motive for trade policy becomes greater, raising the critical discount factor for every value of α. However, a higher γ will raise the critical discount factor less for lower trade costs. This is because the problem of profit-shifting is larger when trade costs are lower increasing the incentive to cooperate. One interpretation of this could be that, in this model, FTAs have a greater regional bias when the degree of strategic interaction among firms is higher.

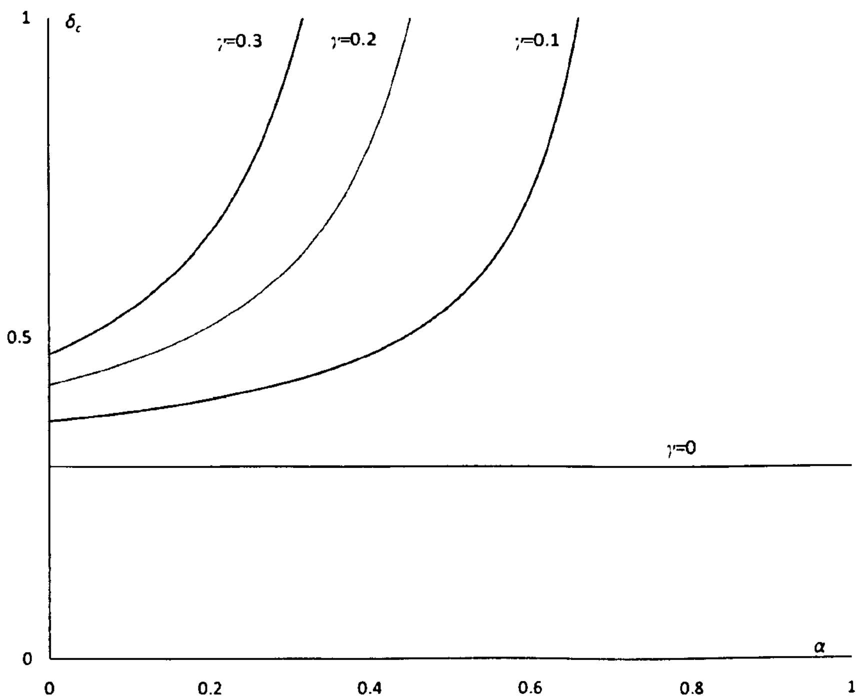

Figure 2.4: The critical discount factors as functions of trade cost.

It is possible that trade costs exceed a threshold, $\widehat{\alpha}$, above which a FTA is not self-enforceable at all. This threshold can be obtained from (2.33):

$$\delta_c(\alpha) = \frac{3(1-\alpha)(4-\gamma^2)}{8(5(1-\alpha)-3\gamma)} \geq 1.$$

Solving for α yields:

$$\alpha \geq \widehat{\alpha} \equiv 1 - \frac{24\gamma}{28+3\gamma^2}.$$

When α is greater than this threshold, global free trade is too deep a trade liberalisation. From a joint welfare-maximising perspective, too many units of production are lost in transit, and it would therefore be better to impose a positive import tariff closer to the Nash tariffs.

2.7 Concluding remarks

In this chapter I have analysed the nature of the relationship between trade costs and trade policy under oligopoly. I first showed the difference of objectives of unilateral and cooperative trade policy. First, unilateral trade policy maximises each country's domestic welfare with respect to an import tariff. The import tariff distorts the terms of trade and shifts profits towards each country's respective domestic firms. This import tariff is more effective at accomplishing these aims when the degree of natural distortion through trade costs is lower. Hence, each country would like to set higher tariffs when trade costs are lower. Second, when the two countries set import tariffs cooperatively these externalities are neutralised, and the resulting internationally efficient tariffs are lower when trade costs fall since their objective is to minimise losses in transit. Hence, the objectives of cooperative and non-cooperative trade policy diverge when trade costs fall: acting unilaterally, the two countries would like to raise tariffs in response to falling trade costs, whereas the reverse is the case cooperatively. I then added a requirement that trade agreements be sustained under a reputational mechanism. I assumed that if either of the two countries defected from an agreement in any given period, the other would punish it by reverting to the politically optimal Nash tariff forever as of the following period. I analysed two types of such agreements. First, I considered the optimal self-enforceable tariff and demonstrated that provided the two countries care enough about the future, lower import tariffs can be supported when trade costs fall. If the world was too impatient, however, tariffs needed to be raised in response to falling trade costs to keep each country's incentive to remain in the agreement. This is because impatient countries would find it harder to resist the increased short-runs gains from deviation when trade costs fall. Second, I considered a FTA, and looked at how changes in trade costs affected the sustainability of such an agreement. When trade costs fall, the one-shot benefit from deviating from a FTA increased, but so did the long run benefit from cooperation. This is because the international externalities which unilateral deviation imposes, lowers the incentives to deviate.

The model could be extended in several interesting ways. First, I have ignored potential and interesting asymmetries between countries. Imagine, for example, that each country hosts more than one firm, and that the number of firms is larger in one country than the other. In this case the country with fewer firms will suffer less when the other country retaliates by reducing market access. It may then be that the small country will be less likely to honour a FTA than the larger country. Second, the model could be extended to include several countries, who sign up for mutually beneficial tariff reductions. In this case, consider one home country and $n-1$ other countries. I could allow trade costs between Home and each of the $n-1$ countries to differ. Imagine that all of the countries come together in a GATT/WTO framework to sign a FTA. Provided that trade costs between Home and each of the $n-1$ members are not so high that a FTA is not optimal from a joint welfare-maximising perspective, such a scenario would yield the same results as in the present two country framework. If one country is so remote (in terms of trade costs) that free trade is not optimal, however, higher tariffs would need to be negotiated with this country in order to ensure sustainability. Third, consider a three-country version of this model, where two of the three countries decide to sign a trade agreement without the third one. Such an agreement would not necessarily be welfare improving if substantial trade is diverted away from the third country. This would have consequences for both the short-run incentives to deviate and the long run benefits from cooperation. It would be interesting to see how the results of the present model would extend to such a setting.

2.8 Appendix to Chapter 2

2.8.1 Derivation of Eq. (2.10) and Eq. (2.14)

Substituting (2.7) and (2.8) into (2.9) yields:

$$\begin{aligned} W_h &= \frac{1}{2}(a - p_{hh})\, q_{hh} + \frac{1}{2}(a - p_{hf})\, q_{hf} + \tau_h q_{hf} \\ &\quad + (p_{hh} - c)\, q_{hh} + (p_{fh} - c - \tau_f - \alpha_f)\, q_{fh}. \end{aligned} \tag{2.36}$$

Taking the derivative wrt. τ_h I obtain:

$$\begin{aligned} \frac{dW_h}{d\tau_h} &= -\frac{1}{2}\frac{dp_{hh}}{d\tau_h} q_{hh} + \frac{1}{2}(a - p_{hh})\frac{dq_{hh}}{d\tau_h} - \frac{1}{2}\frac{dp_{hf}}{d\tau_h} q_{hf} \\ &\quad + \frac{1}{2}(a - p_{hf})\frac{dq_{hf}}{d\tau_h} + q_{hf} + \tau_h \frac{dq_{hf}}{d\tau_h} + \frac{dp_{hh}}{d\tau_h} q_{hh} \\ &\quad + (p_{hh} - c)\frac{dq_{hh}}{d\tau_h}. \end{aligned} \tag{2.37}$$

Notice that markets are segmented such that production decisions in Foreign are independent of those in Home, or $\frac{dp_{fh}}{d\tau_h} = 0$, $\frac{dq_{fh}}{d\tau_h} = 0$ and $\frac{d\tau_f}{d\tau_h} = 0$. I next substitute the demand functions in (2.2) into (2.37) which, after some algebraic manipulations, reduces (2.37) to:

$$\frac{dW_h}{d\tau_h} = -q_{hf}\frac{dp_{hf}}{d\tau_h} + q_{hf} + \tau_h \frac{dq_{hf}}{d\tau_h} + (p_{hh} - c)\frac{dq_{hh}}{d\tau_h}.$$

Defining the net-of-tariff price of the Foreign good sold in the Home market as $p^*_{hf} = p_{hf} - \tau_h$, I obtain the expression in (2.10). By writing up demand functions, Cournot quantities, and the expression for total welfare in Foreign's market, I could carry out the exact same steps for Foreign and derive the analogous decomposition of the welfare effects in that country. **q.e.d.**

To find the effect of the Foreign tariff on Home welfare I take the derivative of

(2.36) wrt. τ_f. This yields:

$$\frac{dW_h}{d\tau_f} = \frac{dp_{fh}}{d\tau_f} q_{fh} - q_{fh} + (p_{fh} - c - \tau_f - \alpha_f) \frac{dq_{fh}}{d\tau_f}. \tag{2.38}$$

Defining the net-of-tariff price of the Home good sold in the Foreign market as $p^*_{fh} = p_{fh} - \tau_f$ I obtain the expression in the (2.14). **q.e.d.**

2.8.2 Derivation of Eq. (2.11), Eq. (2.13) and Eq. (2.15)

Substituting the inverse demand functions in (2.2) and the Cournot quantities in (2.5) into (2.10), yields the following expression:

$$\begin{aligned} \frac{dW_h}{d\tau_h} &= \frac{(\Gamma(0,\gamma))^2 - \Gamma(0,\gamma)\Gamma(2,\gamma)(\tau_h + \alpha_h)}{(\Gamma(0,\gamma)\Gamma(2,\gamma))^2} \\ &\quad - \tau_h \frac{2}{\Gamma(0,\gamma)\Gamma(2,\gamma)} + \frac{\gamma}{\Gamma(0,\gamma)\Gamma(2,\gamma)} \\ &\quad - \left[\gamma \frac{\Gamma(0,\gamma) - 2(\tau_h + \alpha_h)}{\Gamma(0,\gamma)\Gamma(2,\gamma)}\right] \frac{\gamma}{\Gamma(0,\gamma)\Gamma(2,\gamma)}. \end{aligned} \tag{2.39}$$

Setting this expression equal to zero and rearranging I obtain:

$$-3\Gamma(0,\gamma)\Gamma(2,\gamma)\tau_h - \Gamma(0,\gamma)\Gamma(2,\gamma)\alpha_h + \Gamma(0,\gamma)\Gamma(2,\gamma) = 0.$$

Solving for τ_h yields the expression in (2.11). By writing up demand functions, Cournot quantities, and the expression for total welfare in Foreign's market, I could carry out the exact same steps for Foreign and obtain the optimal tariff for that country as well. Taking the derivative of (2.39) wrt. α_h, I obtain the expression in (2.13). **q.e.d.**

By writing up expressions for the inverse demand functions and Cournot quantities in the Foreign market, an expression for (2.38) can be found as:

$$\frac{dW_h}{d\tau_f} = -\frac{\Gamma(0,\gamma) - 2(\tau_f + \alpha_f)}{\Gamma(0,\gamma)\Gamma(2,\gamma)} \frac{4}{\Gamma(0,\gamma)\Gamma(2,\gamma)}. \tag{2.40}$$

Substituting the Foreign Nash tariff from (2.11) into (2.40) yields the expression in (2.15). **q.e.d.**

2.8.3 Proof of Proposition 2.1

I need to show that the imported quantity in Home is positive when Home implements the Nash tariff in (2.11). In other words, it is sufficient to show that (from (2.5)):

$$q_{hf}\left(\tau_h^N\right) = \frac{\Gamma(0,\gamma) - 2\left(\tau_h^N + \alpha_h\right)}{\Gamma(0,\gamma)\Gamma(2,\gamma)} > 0.$$

Substituting the Nash tariff from (2.11) yields:

$$\frac{\Gamma(0,\gamma) - 2\left(\frac{1-\alpha_h}{3} + \alpha_h\right)}{\Gamma(0,\gamma)\Gamma(2,\gamma)} > 0.$$

Solving for α_h gives the expression in the proposition. By expressing the imported Cournot quantity in the Foreign market I could find the equivalent condition for the Foreign market. **q.e.d.**

2.8.4 Derivation of Eq. (2.17), Eq. (2.18) and Eq. (2.20)

The joint welfare of Home and Foreign is given as:

$$\frac{1}{1-\delta} J(\tau_h, \tau_f, \alpha_h, \alpha_f) = \frac{1}{1-\delta}\left(W_h(\tau_h, \tau_f, \alpha_h, \alpha_f) + W_f(\tau_h, \tau_f, \alpha_h, \alpha_f)\right). \tag{2.41}$$

The expression for welfare in Home is obtained by substituting (2.7) and (2.8) into the expression for Home welfare (2.9). The equivalent expression for Foreign welfare is easily obtained by exchanging h and f in (2.9). Substituting the expressions for Home and Foreign welfare into (2.41) yields:

$$\begin{aligned} J(\tau_h, \tau_f, \alpha_h, \alpha_f) &= CS_h(\tau_h, \alpha_h) + TR_h(\tau_h, \alpha_h) + \Pi_h(\tau_h, \tau_f, \alpha_h, \alpha_f) \\ &\quad + CS_f(\tau_f, \alpha_f) + TR_h(\tau_f, \alpha_f) + \Pi_f(\tau_h, \tau_f, \alpha_h, \alpha_f) \\ &= \frac{1}{2}(a - p_{hh}) q_{hh} + \frac{1}{2}(a - p_{hf}) q_{hf} + \tau_h q_{hf} \\ &\quad + (p_{hh} - c) q_{hh} + (p_{fh} - c - \tau_f - \alpha_f) q_{fh} \\ &\quad + \frac{1}{2}(a - p_{ff}) q_{ff} + \frac{1}{2}(a - p_{fh}) q_{fh} + \tau_f q_{fh} \\ &\quad + (p_{ff} - c) q_{ff} + (p_{hf} - c - \tau_h - \alpha_h) q_{hf}. \end{aligned} \tag{2.42}$$

Differentiating (2.42) with respect to τ_h yields

$$\begin{aligned} \frac{dJ}{d\tau_h} &= -\frac{1}{2}\frac{dp_{hh}}{d\tau_h} q_{hh} + \frac{1}{2}(a - p_{hh}) \frac{dq_{hh}}{d\tau_h} - \frac{1}{2}\frac{dp_{hf}}{d\tau_h} q_{hf} \\ &\quad + \frac{1}{2}(a - p_{hf}) \frac{dq_{hf}}{d\tau_h} + q_{hf} + \tau_h \frac{dq_{hf}}{d\tau_h} + \frac{dp_{hh}}{d\tau_h} q_{hh} \\ &\quad + (p_{hh} - c) \frac{dq_{hh}}{d\tau_h} + q_{hf} \frac{dp_{hf}}{d\tau_h} - (\tau_h + \alpha_h) \frac{dq_{hf}}{d\tau_h} \\ &\quad + (p_{hf} - c) \frac{dq_{hf}}{d\tau_h}. \end{aligned} \tag{2.43}$$

Substituting the inverse demand functions (2.2) and the equivalent demand functions for Foreign into (2.43), and performing several algebraic steps reduces (2.43) to:

$$\frac{dJ}{d\tau_h} = (p_{hh} - c) \frac{dq_{hh}}{d\tau_h} + (p_{hf} - c) \frac{dq_{hf}}{d\tau_h} - \alpha_h \frac{dq_{hf}}{d\tau_h}, \tag{2.44}$$

which is the expression in (2.17). Substituting the inverse demand functions (2.2) and the Cournot quantities (2.5) and the equivalent functions for Foreign into (2.44) yields:

$$\frac{J(\tau_h, \tau_f, \alpha_h, \alpha_f)}{d\tau_h} = \frac{-2\Gamma(0, \gamma)\Gamma(0, \gamma) + (\alpha_h + \alpha_f)(4 + \gamma^2) - \tau_h(8 - 6\gamma^2)}{(\Gamma(0, \gamma)\Gamma(2, \gamma))^2}.$$

Solving for τ_h yields:

$$\tau_h^E = \frac{-\Gamma(0,\gamma)\Gamma(0,\gamma) + \frac{1}{2}\alpha_h(4+\gamma^2) + \frac{1}{2}\alpha_f(4+\gamma^2)}{(4-3\gamma^2)}. \tag{2.45}$$

I could carry out the same steps to find τ_f^E, in which case I would find, by symmetry, that it is the same as τ_h^E.

For symmetric trade costs $\alpha_h = \alpha_f = \alpha$ it is easy to show that, in the limit, the efficient tariffs and the Nash tariffs are equal. Setting (2.45) equal to (2.11) I obtain:

$$\frac{-\Gamma(0,\gamma)\Gamma(0,\gamma) + \alpha(4+\gamma^2)}{(4-3\gamma^2)} = \frac{1-\alpha}{3}.$$

Solving for α yields $\alpha = 1 - \frac{3}{4}\gamma$, which is the upper bound proposed in (2.19). **q.e.d.**

2.8.5 Derivation of Eq. (2.25), Eq. (2.29) and Eq. (2.30)

In order to derive the level of patience required for an agreement based on the efficient tariffs in (2.18) to be sustained for Home (and symmetrically for Foreign), I need to evaluate Home's welfare in the three cases where: (i) both countries cooperate, (ii) both play Nash, and (iii) Home deviates by playing Nash while Foreign cooperates. I can find the expressions for Home welfare by substituting the inverse demand functions (2.2) and the Cournot quantities (2.5) into (2.9), and then evaluate them at the various tariff levels. Thus, after substantial algebraic manipulations, I obtain:

$$
\begin{aligned}
W_h^C\left(\tau_h^E, \tau_f^E, \alpha\right) &= \frac{7+4\alpha^2-8\alpha-6\gamma(1-\alpha)}{2\left(4-3\gamma^2\right)}; \\
W_h^P\left(\tau_h^N, \tau_f^N, \alpha\right) &= \frac{188-21\gamma^2+\left(18\gamma^3-120\gamma\right)(1-\alpha)}{18(2-\gamma)^2(2+\gamma)^2} \\
&\quad +\frac{\left(80-12\gamma^2\right)\alpha^2+\left(24\gamma^2-160\right)\alpha}{18(2-\gamma)^2(2+\gamma)^2}; \\
W_h^D\left(\tau_h^N, \tau_f^E, \alpha\right) &= \frac{\left(288\gamma^3-54\gamma^2-672\gamma\right)(1-\alpha)-72\alpha\gamma^4}{6\left(4-3\gamma^2\right)^2\left(4-\gamma^2\right)} \\
&\quad +\frac{36\alpha^2\gamma^4+63\gamma^4-192\gamma^2\left(1+\alpha^2\right)}{6\left(4-3\gamma^2\right)^2\left(4-\gamma^2\right)} \\
&\quad +\frac{384\gamma^2\alpha+448\alpha^2+592-896\alpha}{6\left(4-3\gamma^2\right)^2\left(4-\gamma^2\right)}.
\end{aligned}
$$

Substituting these expressions into (2.24) yields (2.25). **q.e.d.**

The minimum self-enforceable tariffs $\left(\tau_h^M, \tau_f^M\right)$ can be found by solving (2.28). Recall that the minimum self-enforceable tariffs will be chosen when the self-enforcement constraints bind. I first define the following expressions:

$$
\begin{aligned}
\Phi_1\left(\tau_h, \tau_f, \tau_h^N, \tau_f^N\right) &= W_h^D\left(\tau_h^N, \tau_f, \alpha\right)-W_h^C\left(\tau_h, \tau_f, \alpha\right) \\
&\quad -\delta\left(W_h^D\left(\tau_h^N, \tau_f, \alpha\right)-W_h^P\left(\tau_h^N, \tau_f^N, \alpha\right)\right); \\
\Phi_2\left(\tau_h, \tau_f, \tau_h^N, \tau_f^N\right) &= W_f^D\left(\tau_f^N, \tau_h, \alpha\right)-W_f^C\left(\tau_f, \tau_h, \alpha\right) \\
&\quad -\delta\left(W_f^D\left(\tau_f^N, \tau_h, \alpha\right)-W_f^P\left(\tau_f^N, \tau_h^N, \alpha\right)\right).
\end{aligned}
$$

Next, I solve (2.28) using the Lagrange method:

$$
\begin{aligned}
\Psi\left(\tau_h, \tau_f, \lambda_1, \lambda_2\right) &= \max_{\tau_h, \tau_f} \frac{1}{1-\delta}\left(W_h\left(\tau_h, \tau_f, \alpha\right)+W_f\left(\tau_h, \tau_f, \alpha\right)\right) \\
&\quad +\lambda_1\left[\Phi_1\left(\tau_h, \tau_f, \tau_h^N, \tau_f^N\right)\right] \\
&\quad +\lambda_2\left[\Phi_2\left(\tau_h, \tau_f, \tau_h^N, \tau_f^N\right)\right],
\end{aligned}
$$

where λ_1 and λ_2, respectively, are the Lagrange multipliers of Home's and Foreign's self-enforcement constraints. Differentiating wrt. τ_h, τ_f, λ_1 and λ_2 yields:

$$\begin{aligned}\frac{d\Psi}{d\tau_h} = \; & \frac{-4-\lambda_1\gamma^2\alpha\delta+8\lambda_2\delta-4\lambda_1+4\lambda_1\alpha\delta+\lambda_1\gamma^2\delta}{(1+\delta)(2-\gamma)^2(2+\gamma)^2} \\ & -\frac{\lambda_1\gamma^2\alpha+4\lambda_2\delta\gamma+4\lambda_2\delta^2\gamma+8\lambda_2\delta\alpha+8\lambda_2\delta^2\alpha}{(1+\delta)(2-\gamma)^2(2+\gamma)^2} \\ & +\frac{4\lambda_1\alpha-4\lambda_1\delta+\lambda_1\gamma^2+8\lambda_2\delta^2-4\tau_h+4\gamma+4\alpha}{(1+\delta)(2-\gamma)^2(2+\gamma)^2} \\ & -\frac{\gamma^2-\gamma^2\alpha+3\lambda_1\gamma^2\tau_h\delta-12\lambda_1\tau_h\delta+3\lambda_1\gamma^2\tau_h}{(1+\delta)(2-\gamma)^2(2+\gamma)^2} \\ & +\frac{3\gamma^2\tau_h+12\lambda_1\tau_h-8\lambda_2\delta^2\tau_h}{(1+\delta)(2-\gamma)^2(2+\gamma)^2};\end{aligned}$$

$$\begin{aligned}\frac{d\Psi}{d\tau_f} = \; & \frac{-4-4\lambda_2\delta-\lambda_2\gamma^2\alpha\delta-4\lambda_2-8\lambda_1\alpha\delta+4\lambda_2\delta\alpha}{(1+\delta)(2-\gamma)^2(2+\gamma)^2} \\ & -\frac{4\lambda_1\delta\gamma+4\lambda_1\delta^2\gamma+8\lambda_1\delta^2\alpha-\lambda_2\gamma^2\delta+\lambda_2\gamma^2\alpha}{(1+\delta)(2-\gamma)^2(2+\gamma)^2} \\ & +\frac{8\lambda_1\delta+8\lambda_1\delta^2+4\lambda_2\alpha+\lambda_2\gamma^2-4\tau_f+4\gamma}{(1+\delta)(2-\gamma)^2(2+\gamma)^2} \\ & +\frac{4\alpha-\delta^2+\delta^2\alpha+3\gamma^2\tau_f-8\lambda_1\delta\tau_f-8\lambda_1\delta^2\tau_f}{(1+\delta)(2-\gamma)^2(2+\gamma)^2} \\ & +\frac{12\lambda_2\delta\tau_f-3\lambda_2\gamma^2\tau_f+12\lambda_2\tau_f-3\lambda_2\gamma^2\tau_f\delta}{(1+\delta)(2-\gamma)^2(2+\gamma)^2};\end{aligned}$$

$$\begin{aligned}\frac{d\Psi}{d\lambda_1} = \; & \frac{-40\delta+12+80\alpha\delta+24\gamma\delta+12\alpha^2-3\gamma^2\alpha^2}{18(2-\gamma)^2(2+\gamma)^2} \\ & -\frac{40\delta\alpha^2+24\delta\gamma\alpha+72\tau_h+24\alpha+3\gamma^2-6\gamma^2\alpha}{18(2-\gamma)^2(2+\gamma)^2} \\ & -\frac{27\gamma^2\tau_h^2-72\tau_h\alpha-108\tau_h-144\delta\tau_f+72\delta\tau_f^2}{18(2-\gamma)^2(2+\gamma)^2} \\ & +\frac{18\gamma^2\tau_h-18\gamma^2\alpha\tau_h-72\delta\gamma\tau_f-144\delta\alpha\tau_f}{18(2-\gamma)^2(2+\gamma)^2};\end{aligned}$$

$$
\begin{aligned}
\frac{d\Psi}{d\lambda_2} = & \frac{-40\delta+12+80\alpha\delta+24\gamma\delta+12\alpha^2-3\gamma^2\alpha^2}{18(2-\gamma)^2(2+\gamma)^2} \\
& -\frac{40\delta\alpha^2+24\delta\gamma\alpha+72\tau_f+24\alpha+3\gamma^2-6\gamma^2\alpha}{18(2-\gamma)^2(2+\gamma)^2} \\
& -\frac{27\gamma^2\tau_f^2-72\tau_f\alpha-108\tau_f-144\delta\tau_f+72\delta\tau_h^2}{18(2-\gamma)^2(2+\gamma)^2} \\
& +\frac{18\gamma^2\tau_f-18\gamma^2\alpha\tau_f-72\delta\gamma\tau_h-144\delta\alpha\tau_h}{18(2-\gamma)^2(2+\gamma)^2};
\end{aligned}
$$

Solving these four equations in the four unknowns τ_h, τ_f, λ_1 and λ_2 yields:

$$
\begin{aligned}
\lambda_1 &= \lambda_2 = \frac{16\delta+3\gamma^2-6\gamma^2\delta-12}{\delta(1+\delta)(12-8\delta-3\gamma^2)}; \\
\tau_h &= \tau_f = \frac{\alpha(40\delta+3\gamma^2-12)-40\delta-3\gamma^2+12+24\delta\gamma}{3(12-3\gamma^2-8\delta)}.
\end{aligned}
\tag{2.46}
$$

It is easy to show that the minimum enforceable tariffs are equal to the Nash tariffs in the limit. Setting (2.46) equal to (2.11) yields:

$$
\frac{\alpha(40\delta+3\gamma^2-12)-40\delta-3\gamma^2+12+24\delta\gamma}{3(12-3\gamma^2-8\delta)} = \frac{1-\alpha}{3}.
$$

Solving for α yields $\alpha = 1-\frac{3}{4}\gamma$, which is the upper bound proposed in (2.12). **q.e.d.**

2.8.6 Effects of trade costs on δ_c

I will begin by showing that the effect of α_h on the short-run gain by deviating from free trade, $W_h^D\left(\tau_h^N,\tau_f^C,\alpha_h,\alpha_f\right) - W_h^C\left(\tau_h^C,\tau_f^C,\alpha_h,\alpha_f\right)$, is negative. Substituting (2.7) and (2.8) into (2.9) yields an expression for Home welfare. Evaluating this when Home plays Nash by imposing the Nash tariff in (2.11), and when Foreign cooperates by choosing free trade, I have an expression for $W_h^D\left(\tau_h^N,\tau_f^C,\alpha_h,\alpha_f\right)$. Evaluating Home welfare when both set tariffs to zero gives an expression for $W_h^C\left(\tau_h^C,\tau_f^C,\alpha_h,\alpha_f\right)$. Using the inverse demand functions (2.2) and the Cournot quantities (2.5), it is possible to obtain, after substantial algebraic steps, the following:

$$W_h^D\left(\tau_h^N,\tau_f^C,\alpha_h,\alpha_f\right)-W_h^C\left(\tau_h^C,\tau_f^C,\alpha_h,\alpha_f\right)=\frac{\left(1-\alpha_h\right)^2}{6\left(2-\gamma\right)\left(2+\gamma\right)}. \tag{2.47}$$

Differentiating wrt. α_h yields:

$$\frac{d\left(W_h^D-W_h^C\right)}{d\alpha_h}=-\frac{2\left(1-\alpha_h\right)\alpha_h}{6\left(2-\gamma\right)\left(2+\gamma\right)}<0.$$

Since this derivative is negative I can deduce that $\frac{d\delta_c}{d\alpha_h}<0$, which was claimed in Proposition 2.2. Next I show that the effect of α_f on the long-run loss from not adhering to the FTA is also negative. Following a similar procedure I obtain:

$$W_h^D\left(\tau_h^N,\tau_f^C,\alpha_h,\alpha_f\right)-W_h^P\left(\tau_h^N,\tau_f^N,\alpha_h,\alpha_f\right)=\frac{4\left(1-\alpha_f\right)\left(5\left(1-\alpha_f\right)-3\gamma\right)}{9\left(2-\gamma\right)^2\left(2+\gamma\right)^2}. \tag{2.48}$$

Differentiating wrt. α_f yields:

$$\frac{d\left(W_h^D-W_h^P\right)}{d\alpha_f}=-\frac{4\left(10\left(1-\alpha_f\right)-3\gamma\right)}{9\left(2-\gamma\right)^2\left(2+\gamma\right)^2}<0.$$

Similarly, since this derivative is negative I can deduce that $\frac{d\delta_c}{d\alpha_f}>0$, which was also claimed in Proposition 2.2.

Setting $\alpha_h=\alpha_f=\alpha$ and dividing (2.47) by (2.48) yields an expression for the critical discount factor for symmetric trade costs:

$$\delta_c\left(\alpha\right)=\frac{3\left(1-\alpha\right)\left(4-\gamma^2\right)}{8\left(5\left(1-\alpha\right)-3\gamma\right)}.$$

which is the expression in (2.33). Taking the derivative wrt. α yields:

$$\frac{d\delta_c}{d\alpha}=\frac{30\gamma\left(4-\gamma^2\right)}{8\left(5\left(1-\alpha\right)-3\gamma\right)^2}\geq 0.$$

It is clear that when $\gamma = 0$ this derivative is zero, and when $\gamma > 0$ it is strictly positive. This is what Proposition 2.3 claims. **q.e.d.**

Chapter 3

Political Pressure, Bargaining Power and the Self-enforceability of Trade Liberalisation

3.1 Introduction

The post-war era has witnessed substantial liberalisation of political barriers to trade, either through multilateral trade negotiations under the auspices of the GATT/WTO or through the signing of a countless number of bilateral and regional trade agreements. Central to the debate on trade policy lies the desire to understand the nature and causes of this development.

A promising yet under-researched strand of literature focuses on problems of time inconsistency in the domestic political arena as a distinct reason for countries to join trade agreements. According to these models, international trade agreements provide governments with valuable commitment vis-à-vis domestic economic agents to ensure that governments adhere to trade policies that are in their long-term interest. Fundamentally, time inconsistency involves the notion that the best plan for some future period is not optimal once the future period actually arrives.

In the present framework, I assume that physical capital is fixed in the short run, that is in any given period, but allowed to be freely reallocated after one period has passed. This assumption brings about a conflict of interest between the government's short-run interests, or the incentives to impose trade policy when the private sector has sunk capital, and its long-run interests where capital is allocated according to a condition that equalises returns across sectors.

Another prominent motive for signing a trade agreement, which has been analysed extensively in the literature, is the desire on the part of governments to escape a so-called terms-of-trade driven prisoner's dilemma. The idea behind this motive is the notion that a country as a whole has market power on international markets, and is thus able to use trade policy to distort its terms of trade at the expense of trading partners. Acting in this manner, however, is likely to be reciprocated and the end result is that countries get caught in a prisoner's dilemma leaving everyone worse off.

In this chapter, I construct a model with two countries called Home and Foreign with an infinity of time periods. The model combines time-inconsistency and terms-of-trade distortions to produce two powerful motives for a government to liberalise trade. More specifically, this framework allows me to analyse the sustainability of unilateral trade liberalisation, where the time inconsistency problem is solved domestically, and bilateral trade liberalisation where the two countries can also escape a terms-of-trade driven prisoner's dilemma by inducing international cooperation.

Trade policy is determined in a framework where domestic lobbies, representing owners of capital in the economy's import-competing sector, offer political campaign contributions, or bribes, to the government in exchange for protection, as in Grossman and Helpman (1994, 1995). In each country and in every period, the government and the lobby come together to bargain efficiently over import tariffs and contributions. The government's welfare consists of a weighted average of overall social welfare, or the utility of the representative agent, and political bribes, where the weight on the latter is a parameter which determines the extent of *politics*. The optimal political tariff maximises the joint welfare of the government and the lobby.

A key parameter of the model is the bargaining power of the government vis-à-vis the lobby. If the government has all the bargaining power, it will extract all the rents from protection. On the other hand, if the lobby has all the bargaining power, the government is paid exactly the amount which makes it indifferent between inducing the politically optimal tariff or the socially optimal tariff, the latter being the tariff that optimally exploits a country's monopoly power over its terms of trade.

The government faces a problem of dynamic inconsistency: the optimal trade policy is not time-consistent. In any given period when capital is sunk, the government has an incentive to set the tariff that maximises its current welfare by accepting a bribe from the lobby and setting the import tariff at the politically optimal level. This high level of the tariff will encourage capital reallocation from the numeraire sector towards the import-competing sector, and the bribes that the government receives from the lobby may not compensate it for this long-run misallocation of capital if its bargaining power is low. From a unilateral perspective, the government may have an incentive to announce that it will not accept bribes, and set the tariff at its socially optimal level in the following period. Once that period arrives and capital is sunk, however, the government will be tempted to renege on its announcement and set the tariff at the politically optimal level, accepting bribes.

The behaviour of owners of capital is not invariant to expectations of future trade policy, however, and if the government capitulates to protectionist pressures in the current period, it is unlikely the private sector will believe the government's promise of a lower tariff in the next period. Hence, capital owners rationally allocate capital to the import-competing sector in expectation that the government will not be able to resist protectionist pressures. The economy thus ends up in an undesirable long-run political equilibrium where an excessive amount of resources is allocated to the import-competing sector.

I first analyse a scenario in which the government gets an opportunity to commit to any announced trade policy it wishes for which ever reason. Provided the government's bargaining power is not too large, the Home government would unilaterally announce that it would no longer accept bribes, and thus set the import tariff at the socially optimal level. Since it is able to commit, capital owners will believe this and allocate capital in expectation of that. In this situation the dynamic inconsistency problem is solved by giving the government a first-mover advantage in the setting of trade policy. Unilateral trade liberalisation, however, does not solve the international terms-of-trade driven prisoner's dilemma, and a trade agreement is thus needed to ensure international cooperation. If the two countries sign a trade agreement, it will allow the government of each country to: (i) credibly commit vis-à-vis their respective private sectors, and (ii) internalise the international terms-of-trade distortion. The joint welfare-maximising tariff involves free trade.

I then go on to analyse a situation where any departures from the politically optimal tariffs must be sustained by a reputational mechanism[1]. This implies that in order for the private sector in a country, or the government of the other country, to believe that the government is committed to dynamically efficient policies, the

[1] In the introduction to Chapter 2, I argued that this view of trade policy cooperation is a fair reflection of reality since the world is currently not equipped with an international law enforcement agency capable of sanctioning nations that do not honour international agreements. Enforcement under the WTO is ensured through a number of rules such as Article 22.3 of the Understanding on Rules and Procedures Governing the Settlement of Disputes, and a limited punishment rule by the GATT Article XXVIII.

government must have demonstrated commitment in the past. Thus, assuming the government decides to unilaterally liberalise trade by setting the import tariff at the socially optimal level, it must over time convince the private sector that it can sustain it. If at any point the government deviates, it will enjoy short-run benefits in the form of a bribes, but in the following period and in every period that follows forever after, the private sector will no longer find the government credible and allocate capital in expectation that the government cannot resist capitulating to political pressures. If the government decides to sign a trade agreement with the other country, on the other hand, the short-run benefits from deviation are two-fold: (i) it can enjoy a bribe from the lobby, and (ii) it can distort its terms of trade in its favour when the other country cooperates. In the following period, however, the private sector will no longer find the government credible and it will never trust the government again. In addition to this, the government of the other country will punish it by reverting to the politically optimal tariff forever as of the following period.

The sustainability of unilateral and bilateral trade liberalisation depends on two key parameters: the government's bargaining power vis-à-vis the lobby, and the government's discount factor. I define a critical discount factor above which trade liberalisation is self-enforceable. I first analyse the sustainability of unilateral trade liberalisation. If the government has no bargaining power, contributions are just enough to make the government indifferent between imposing the politically optimal tariff and the socially optimal one in any given period. In this case the government is not compensated for the long-run misallocation of capital. Because of this, unilateral trade liberalisation can be supported for every discount factor. As the government's bargaining position increases, however, the degree to which it is compensated for the long-run misallocation of capital increases. When the bargaining power exceeds a critical threshold, the government is more than compensated for this misallocation, and no discount factor can support unilateral trade liberalisation. The critical discount factor is increasing in the bargaining power, which implies that the degree of patience required to sustain trade liberalisation is increasing in the amount of rents the government can extract from the political negotiation with the lobby.

I then analyse the sustainability of a trade agreement. In this case, the short-run benefits from deviation are larger than in the case of unilateral deviation, since such benefits now also include distorting the terms of trade in a country's favour when the other country was lured into cooperating. In the following period, however, the deviating country forever loses the private sector's trust, and the other country will punish it by reverting to the politically optimal tariff forever after. Hence, both the short-run temptation to deviate is higher, but also the long-run loss. I prove that because of the increased threat of punishment, a trade agreement can be supported for every level of the government's bargaining power provided the government is sufficiently patient. However, the degree of patience required to sustain a trade agreement is higher the greater the government's bargaining power, just as in the as in the case of unilateral trade liberalisation. I also find that when the government has no bargaining power, the critical discount factor to sustain a trade agreement is strictly positive, unlike unilateral trade liberalisation. This is because in the case of unilateral trade liberalisation there is no short-run benefit from deviation when the government's bargaining power is zero, but with at trade agreement, the deviating country benefits from a terms of trade distortion when the other country cooperates.

Unilateral trade liberalisation can then be compared to that of bilateral trade liberalisation. I demonstrate that for low levels of the government's bargaining power unilateral trade liberalisation can be sustained for a larger range of bargaining powers. When the government's bargaining power is sufficiently high, however, a trade agreement is needed to sustain trade liberalisation.

I do not attempt to model the factors underlying the relative bargaining power of the government, but as argued in Maggi and Rodriguez-Clare (1998), it could be the case that such a bargaining position is weaker in countries with more open parliamentarian systems. For example, it could reasonably be expected that in a political system which is based on several different coalitions, lobbies are in a greater position to extract rent. This is because lobbies may have greater opportunities to offer different contribution schedules to several agents within a political system where the decision-making process is more decentralised. On the other hand, in an autocratic system in which power is highly concentrated, it could be argued that the government has the upper hand in the negotiation process.

Interpreted in this way, both unilateral and bilateral trade liberalisation are more likely to be sustained in more decentralised political systems where the government's bargaining power is lower. This could explain why trade liberalisation has been more biased towards developed and democratic nations: trade liberalisation is simply harder to sustain in autocratic systems. In addition to this, I believe this theory is able to contribute to our understanding of non-reciprocal trade liberalisation, usually between a developed nation and several developing countries, which has been a common occurrence in the last few decades[2]. The theory may be able to explain why mostly democratic nations can sustain such arrangements, and why their less democratic trading partners do not reciprocate.

Time inconsistency is a common economic phenomenon, and widely applied in a variety of areas of economics such as behavioural economics, macroeconomics and monetary economics. In their seminal papers, Kydland and Prescott (1977) and Fischer (1980) deal with a variety of such issues, for example within central bank policy and taxation. Staiger and Tabellini (1987) and Tornell (1991) are

[2] For example. the 2000 African Growth and Opportunity Act (AGOA) between the US and several African sub-Saharan countries.

amongst the first to introduce time inconsistency issues into the setting of trade policy. In Staiger and Tabellini (1987) the government is driven to increase tariffs by a desire to redistribute income from individuals with a low marginal utility of income to individuals with a high marginal utility. This trade policy, however, must reach the private sector by surprise since if the policy is anticipated the free movement of labour will equalise returns such that the redistributive impact of the tariff is substantially smaller.

Tornell (1991) considers the time inconsistency of protectionist programmes designed to be temporary. He argues that if authorities capitulate to protectionist pressures in the present they are unlikely to resist them in the future. The inability to pre-commit to the unconditional elimination of protection in the future, in turn, generates a trade-off for a firm receiving protection. If it does not invest sufficiently in cost reductions, it gains from a renewal of protection while saving the opportunity cost of capital. However, it loses the benefits from cost reductions and the resulting increase in competitiveness. If the gains from not investing in cost reductions outweigh the gains from cost reductions, clearly a firm will not invest sufficiently and the temporary protectionist programme becomes time inconsistent.

The paper which is perhaps closest related to the present framework is Maggi and Rodriguez-Clare (1998). They construct a model of a small open economy, with the same elements of time inconsistency as the present framework. They find that when the government's bargaining power exceeds a critical threshold, the government of the small country will obtain a lower utility by committing to free trade. Maggi and Rodriguez-Clare (1998), however, do not consider an environment where trade liberalisation must be sustained by a reputational mechanism, and because they restrict themselves to a framework with one small country which takes the world prices as given, they are not able to analyse the sustainability of reciprocal trade liberalisation. To the best of my knowledge, this paper is the first to consider an infinitely repeated game structure with politically organised lobbies in the trade literature.

Conconi and Perroni (2009) analyse the sustainability of international policy coordination in a framework where there are dynamic inconsistencies. They find that internationally efficient policies are more likely to be sustained whenever domestic policy commitment is not feasible. Moreover, international cooperation is more likely to be sustained whenever international externalities from domestic policies are greater.

In a model which is very similar to the present, Maggi and Rodriguez-Clare (2007) consider an environment where countries can sign perfectly binding agreements. Two countries, which are initially stuck in a time-consistent but suboptimal political equilibrium, get an opportunity to sign a perfectly enforceable free trade agreement. They find that the speed by which capital can exit the import-competing sector, determines the speed of trade liberalisation. That model is presented in much more detail in Chapter 4 of this thesis, which also puts its main predictions to the data.

Terms-of-trade manipulations as a motive to grant import-protection and as a motive to sign trade agreements figure prominently in the trade literature, and it was first identified by Johnson (1953). The idea is further developed in Grossman and Helpman (1995) and Bagwell and Staiger (1999, 2002). In fact, in those papers, terms-of-trade manipulations form the sole basis for signing trade agreements.

The chapter is organised as follows. Section 3.2 presents the basic ingredients of the model, before characterising the nature of the time inconsistency problem in Section 3.3. In Section 3.4, I consider an environment where unilateral or bilateral trade liberalisation, respectively, are perfectly enforceable, and in Section 3.5, I add a requirement of self-enforceability to either type of trade liberalisation. Section 3.6 compares the sustainability of unilateral and bilateral trade liberalisation, and finally, Section 3.7 concludes with some remarks.

3.2 The model

I assume a world with an infinite number of discrete time periods. There are two large countries which I call Home (H) and Foreign (F) each producing three goods: two manufacturing goods (M_1 and M_2) and one numeraire good (N). Preferences for the three goods are identical across the two countries and they can be represented by the following quasi-linear utility function in each period[3]:

$$U = x_N + \sum_{i=1}^{2} u(x_i),$$

where x_N denotes consumption of the numeraire good, and x_i denotes consumption of the manufacturing goods. One of the advantages of a quasi-linear utility function is that it eliminates income effects as well as cross-price effects on demand[4]. This is essentially breaking up a general equilibrium model into partial equilibria and, by implication, consumers' welfare can then be measured in terms of surplus derived from the manufacturing sectors. In order to make the model tractable, I specify $u(\cdot) = vx_i - \frac{x_i^2}{2}$ (where v is a positive parameter) such that the demand for the manufacturing goods can be represented by the simple linear function $d(p_i) = v - p_i$ in each period. The per-period surplus from consuming

[3] I obmit time subscripts whenever it does not cause any confusion.

[4] In order to see this, set up the Lagrangian for the consumer's optimisation problem: $\mathcal{L} = x_N + \sum_{i=1}^{2} u(x_i) + \lambda\left[I - x_N - \sum_{i=1}^{2} p_i x_i\right]$. The first order condition for x_N implies $\frac{\partial \mathcal{L}}{\partial x_N} = 1 - \lambda = 0 \Longrightarrow \lambda = 1$. Since the marginal utility of income is 1, I can derive the demand functions for the manufacturing goods as $p_i = u'(x_i)$.

each of the manufacturing goods is:

$$s(p_i) = u(d(p_i)) - p_i d(p_i). \tag{3.1}$$

The model has two types of capital called type 1 and type 2. One unit of type 1 capital produces one unit of M_1 whereas one unit of type 2 capital produces one unit of M_2. It is assumed that H and F are endowed with one unit of each type of capital. The technology to produce the numeraire good differs in the two countries. In H the numeraire is produced on a one-to-one basis using type 1 capital whereas in F the numeraire is produced one-to-one with type 2 capital. $H(F)$ will employ its endowment of type 2 (type 1) capital in the M_2-sector (M_1-sector), and split its endowment of type 1 (type 2) capital between the M_1-sector and the numeraire (the M_2-sector and the numeraire) depending on demand. The implication of this technological structure is that H is a natural importer of M_1 and F is a natural importer of M_2. The amount of capital allocated to a given sector is fixed in any given period but is allowed to be freely re-allocated after one period according to an equal-returns condition to be specified below. I denote by $k_{1H}(k_{2F})$ the amount of capital allocated to the M_1-sector (M_2-sector) in $H(F)$ in any given period. Note that mobility of capital is relevant only between the two countries' respective importing sectors and their respective numeraire sectors.

The governments in H and F may choose to implement a trade policy in their respective importing sectors. It is assumed that such a trade policy comes in the form of a specific import tariff τ_{1H} in H and τ_{2F} in F. I assume that the two governments decide not to implement any trade policies in the numeraire sector, or in their respective exporting sectors. Hence, $\tau_{2H} = \tau_{1F} = \tau_{NH} = \tau_{NF} = 0$.

If tariffs are not prohibitive the domestic price of M_1 in H is $p_{1H} = p_{1F} + \tau_{1H}$ and the domestic price of M_2 in F is $p_{2F} = p_{2H} + \tau_{2F}$. I assume that international markets clear such that $d(p_{1H}) + d(p_{1F}) = 1 + k_{1H}$ and $d(p_{2H}) + d(p_{2F}) = 1 + k_{2F}$.

Using these conditions I can derive convenient expressions for the prices in H and F. Thus, the home and foreign prices, respectively, of M_1 expressed as a function of the tariff and capital allocation are:

$$\begin{aligned} p_{1H}(\tau_{1H}, k_{1H}) &= v - \frac{1}{2}(1 + k_{1H} - \tau_{1H}); \\ p_{1F}(\tau_{1H}, k_{1H}) &= v - \frac{1}{2}(1 + k_{1H} + \tau_{1H}), \end{aligned} \tag{3.2}$$

and similarly, the home and foreign prices, respectively, of M_2 are:

$$\begin{aligned} p_{2H}(\tau_{2F}, k_{2F}) &= v - \frac{1}{2}(1 + k_{2F} + \tau_{2F}); \\ p_{2F}(\tau_{2F}, k_{2F}) &= v - \frac{1}{2}(1 + k_{2F} - \tau_{2F}). \end{aligned} \tag{3.3}$$

The total welfare (that is, the utility of the representative agent) is given by consumer surplus, tariff revenue and factor income. Hence, I can express total welfare of H and F in each period, respectively, as:

$$\begin{aligned} W_H &= p_{1H}k_{1H} + 1 - k_{1H} + \tau_{1H}m_{1H} + s_{1H} + p_{2H} + s_{2H}; \\ W_F &= p_{2F}k_{2F} + 1 - k_{2F} + \tau_{2F}m_{2F} + s_{2F} + p_{1F} + s_{1F}, \end{aligned}$$

where $m_{1H} = d(p_{1H}) - k_1 (m_{2F} = d(p_{2F}) - k_2)$ denotes imports of $M_1(M_2)$ in $H(F)$, and s_{ij} is consumer surplus of good $i = 1, 2$ in country $j = H, F$. Notice the additive separability between the two manufacturing sectors, M_1 and M_2. In particular, notice that the welfare in H can be decomposed into two terms: the first one, $p_{1H}k_{1H} + 1 - k_{1H} + \tau_{1H}m_{1H} + s_{1H}$, depends only on the home variables, τ_{1H} and k_{1H}, and the second, $p_{2H} + s_{2H}$, depends only on the foreign variables, τ_{2F} and k_{2F}. This argument applies analogously to country F. I can therefore express the welfare of the two countries in terms of the home variables:

$$\begin{aligned}
W_H(\tau_{1H}, k_{1H}) &= p_{1H}(\tau_{1H}, k_{1H})\, k_{1H} + 1 - k_{1H} + \tau_{1H} m_{1H}(\tau_{1H}, k_{1H}) \\
&\quad + s_{1H}(\tau_{1H}, k_{1H}) + [\cdot]; \\
W_F(\tau_{1H}, k_{1H}) &= p_{1F} + s_{1F} + [\cdot], \qquad (3.4)
\end{aligned}$$

where the terms in $[\cdot]$ depend on the foreign variables, τ_{2F} and k_{2F}.

Since all variables are symmetric, it suffices to focus on one country, as the analysis of the other country will be its mirror imagine. For that reason, I simply refer to the home country, and drop country subscripts whenever it does not cause confusion. Hence, the relevant welfare function, expressed as a function of tariffs and capital allocations, is:

$$\begin{aligned}
W(\tau_1, k_1, \tau_2, k_2) &= p_1(\tau_1, k_1)\, k_1 + 1 - k_1 + \tau_1 m_1(\tau_1, k_1) \qquad (3.5) \\
&\quad + s_1(\tau_1, k_1) + p_2(\tau_2, k_2) + s_2(\tau_2, k_2).
\end{aligned}$$

Using the expressions in respectively, (3.2) and (3.3), for the prices of country H's imported good, M_1, and its exported good, M_2, and the expression for consumer surplus (3.1), I can derive the following convenient expression for welfare in country H:

$$\begin{aligned}
W(\tau_1, k_1, \tau_2, k_2) &= \left(v - \frac{1}{2}(1 + k_1 - \tau_1)\right) k_1 + 1 - k_1 + \tau_1 \left(\frac{1}{2}(1 - k_1 - \tau_1)\right) \\
&\quad + \frac{1}{2}\left(\frac{1}{2}(1 + k_1 - \tau_1)\right)^2 + \left(v - \frac{1}{2}(1 + k_2 + \tau_2)\right) \\
&\quad + \frac{1}{2}\left(\frac{1}{2}(1 + k_2 + \tau_2)\right)^2. \qquad (3.6)
\end{aligned}$$

The political side of this framework is modelled in a similar way as Grossman and Helpman (1994,1995). I assume that capital owners in the manufacturing sector are able to solve the free-rider problem and organise as a political lobby to curry favour with the government; it does so by offering political bribes in exchange for protection which it collects from all of its members in proportion to the amount of capital they have invested. I denote by C the total amount of contributions, and by $c = \frac{C}{k_1}$ the amount of contributions per unit of capital of the importing sector. I also assume that owners of capital in the exporting sector and in the numeraire sector do not organise as a lobby. The political structure across the two countries is symmetric, allowing me to focus on the home country. In every period, the lobby seeks to maximise total returns to capital in the importing sector net of contributions,

$$U^L = p_1(\tau_1, k_1)\, k_1 - ck_1.\text{[5]} \tag{3.7}$$

Following Grossman and Helpman (1994,1995), the government's per-period objective function is a weighted average of social welfare in (3.6) and political contributions,

$$U^G = W(\tau_1) + aC. \tag{3.8}$$

The parameter a captures the importance of contributions relative to social welfare such that when a is higher, politics is more important.

Before characterising the political equilibrium it will be useful to consider the equilibrium under free trade. In this equilibrium, arbitrage ensures that returns across the numeraire and the M_1-sector are equalised for zero tariffs. This implies that the returns per unit of capital in the M_1-sector must be equal to one. Hence, I can solve for the allocation of capital from the following condition, $p_1(0, k_1) = 1$.

[5] I assume that capital owners can allocate capital to at most one sector in the economy. If α is the fraction of population that owns some capital in the M_1-sector, the lobby's objective is $(p_1 - c)\, k_1 + \alpha\,[\tau_1 m_1 + s_1 + s_2]$. If I further assume that ownership of capital in that sector is very concentrated, α is negligible.

Using (3.2), this can be solved as:

$$k_1^{ft} = 2v - 3. \tag{3.9}$$

For a positive allocation of capital to both the numeraire and the M_1-sector, k_1^{ft} must be greater than zero and less than one. To ensure this I impose, throughout the rest of this chapter, the following condition on the demand parameter v:

$$\frac{3}{2} < v < 2. \tag{3.10}$$

3.3 The political equilibrium

A property of the present model is the notion that without commitment capital owners have a first mover-advantage. The setting of unilateral trade policy can thus be seen as a two-stage game. In the first stage, owners of capital make their investment decisions, and in the second, the government and the lobby bargain efficiently over tariffs and contributions. The bargaining process is modelled as a standard Nash bargaining game in which the government's bargaining power is given by the parameter $\beta \in [0; 1]$, such that the lobby's bargaining power is $(1 - \beta)$.

The equilibrium of the game can be found by backward induction, so I will first determine the equilibrium tariff and the level of contributions in the second stage of the game, given the fixed allocation of capital determined in the first stage. This can also be seen as the short-run equilibrium.

The private sector uses the bribe as an instrument to affect the government's tariff choice. Its payoff increases if either the tariff increases, $\frac{dU^L}{d\tau_1} > 0$, or if the bribe it has to pay decreases, $\frac{dU^L}{dC} < 0$ The government's utility, on the other hand, is increasing in contributions or when the tariff, τ_1, approaches its socially optimal level. The threat point is the status quo where the lobby contributes nothing and the government implements the socially optimal tariff. In such a case, there is no bribe ($C = 0$), the government sets $\tau_1 = \tau_1^{so}$, where *so* stands for socially optimal, and both the government and the lobby obtain their reservation payoffs. To obtain efficiency in the bargaining process fix the private sector's payoff at the value $\overline{U}^L$. Then using (3.7), rewrite (3.8) as $U^G(\tau_1, \overline{U}^L) = W(\tau_1) + a[p_1(\tau_1, k_1)k_1 - \overline{U}^L]$. Efficiency is obtained when the tariff maximises this expression, or equivalently, when it satisfies:

$$\max_{\tau_1} J(\tau_1, k_1) = U^G + aU^L = W(\tau_1, k_1) + ap_1(\tau_1, k_1)k_1. \tag{3.11}$$

Hence, the optimal tariff maximises the joint welfare of the government and the lobby. Notice that due to the additive separability, the government and the lobby cannot influence the foreign variables, τ_2 and k_2. Solving (3.11) yields a solution for the politically optimal (*po*) tariff:

$$\tau_1^{po}(k_1) = \frac{(1 - k_1 + 2ak_1)}{3}. \tag{3.12}$$

This tariff consists of two components. The first, $\frac{1-k_1}{3}$, captures the incentive to distort the terms of trade. When the supply difference between the numeraire and the M_1-sector is larger, the volume of trade is larger, and hence the incentive to distort the terms of trade is higher. The second component, $\frac{2ak_1}{3}$, represents the influence exerted by politics. When the size of the sector is larger, and when the weight the government attaches to contributions is larger, this effect is higher. If the government did not value political contributions it would choose a tariff to maximise social welfare (*so*):

$$\tau_1^{so}(k_1) \equiv \lim_{a \to 0} \tau_1^{po}(k_1) = \frac{(1 - k_1)}{3}. \tag{3.13}$$

The contribution paid to the government is an average of the welfare loss from protection and the lobby's willingness to pay for protection weighted by the relative bargaining powers of the two players. The contribution per unit of capital for inducing the tariff, τ_1, can be expressed as a function of the import tariff and capital allocation:

$$
\begin{aligned}
c(\tau_1, k_1) &= \frac{C(\tau_1, k_1)}{k_1} = (1-\beta)\, a \frac{\left[W(\tau_1^{so}, k_1) - W(\tau_1, k_1)\right]}{k_1} \\
&\quad + \beta \left[p_1(\tau_1, k_1) - p_1(\tau_1^{so}, k_1)\right] \\
&= (1-\beta)\left(\frac{3}{8ak_1}\right)(\tau_1 - \tau_1^{so})^2 + \beta \frac{1}{2}(\tau_1 - \tau_1^{so}). \qquad (3.14)
\end{aligned}
$$

Notice that if the government has no bargaining power, that is if $\beta = 0$, contributions are just enough to compensate the government for the welfare distortion associated with protection. On the other hand, if $\beta = 1$ the government extracts all the rents derived by capitalists from protection. Plugging the tariffs (3.12) and (3.13) into (3.14) yields a convenient expression for contributions paid to the government for inducing τ_1^{po}:

$$
c(k_1) = \frac{C(k_1)}{k_1} = \left(\frac{1+\beta}{6}\right) a k_1. \qquad (3.15)
$$

It is now possible to move back to the first stage of the game and solve for the optimal capital allocation. The conditions characterising the long-run political equilibrium are:

$$
\begin{aligned}
\tau_1 &= \tau_1^{po}(k_1); \qquad (3.16) \\
p_1(\tau_1, k_1) - c(\tau_1, k_1) &= 1. \qquad (3.17)
\end{aligned}
$$

The first condition stipulates that the chosen tariff is the one that maximises the joint welfare of the government and the lobby, and the second requires that the return to capital in the import-competing sector net of contributions is equal to the return to capital in the numeraire. The second condition draws on the notion that capital owners are unable to coordinate their investment decisions, and choose allocations strategically. This equal-returns condition implicitly defines a curve in (τ_1, k_1)-space which I label $\tau_1^{er}(k_1)$. Solving the system (3.16)-(3.17) yields specific solutions for the long-run allocation of capital and for the long-run tariff[6]:

$$\begin{aligned} \widehat{\tau}_1 &= \frac{4 - a(1-\beta) + 2(2a-1)(3v-4)}{3[4 - a(1-\beta)]}; & (3.18) \\ \widehat{k}_1 &= \frac{2(3v-4)}{4 - a(1-\beta)}. & (3.19) \end{aligned}$$

I can similarly solve for the tariff/capital allocation pair that would obtain in the absence of lobbying, (τ_1^W, k_1^W), which yields:

$$\begin{aligned} \tau_1^W &\equiv \lim_{a\to 0} \widehat{\tau}_1 = \frac{2-v}{2}; & (3.20) \\ k_1^W &\equiv \lim_{a\to 0} \widehat{k}_1 = \frac{(3v-4)}{2}. & (3.21) \end{aligned}$$

In order for the tariffs to be non-prohibitive I impose, throughout the rest of the chapter, the following condition on a:

$$a < \frac{6(2-v)}{6v-7}. \tag{3.22}$$

In Appendix 3.8.1 I prove the following:

Proposition 3.1: *If $a < \frac{6(2-v)}{6v-7}$ there exists a unique long-run equilibrium for all values of β. In this equilibrium H and F impose a positive but non-prohibitive tariff equal to $\widehat{\tau}_1$.*

[6] See Appendix 3.8.1 for the steps behind this derivation.

In Figure 3.1, I illustrate the equilibrium without commitment for the special case where the lobby has all the bargaining power $\beta = 0$. I depict the tariffs in (3.12) and (3.13) as functions of the capital allocation together with the equal-returns curve $\tau_1^{er}(k_1)$[7]. The long-run equilibrium is given as the intersection between the $\tau_1^{po}(k_1)$-curve and the equal-returns curve. Notice the difference between the equilibrium with lobbying and that which maximises social welfare. In particular, notice that the M_1-sector is larger when there is lobbying $\widehat{k}_1 > k_1^W$. This difference represents an over-investment problem which the government is not compensated for when $\beta = 0$. In this case the lobby offers a contribution which is just enough to make the government indifferent between setting the tariff at $\tau_1^{po}(k_1)$ relative to $\tau_1^W(k_1)$. But this only compensates the government for the short-run distortion associated with import protection (a consumption distortion), and not for the long-run misallocation of capital.

It will also be useful for illustrative purposes to draw the equilibrium for the case where the government has all the bargaining power, and this is done in Figure 3.2. In this case, the equal-returns curve becomes vertical for any tariff $\tau_1 \geq \tau_1^W$. Since the government extracts all rents from the political game, capital owners do not increase profits when tariffs increase. For that reason, the import-competing sector is not subject to an over-investment problem. Hence, it will be the case that $\widehat{k}_1 = k_1^W$.

Unilateral trade policy is inefficient: not only does the government face a commitment problem vis-à-vis its domestic importing sector, the terms-of-trade distortion imposes externalities on the other country. The two countries will find themselves in a terms-of-trade driven prisoner's dilemma, and they may be better off obtaining a commitment device to ensure a higher level of welfare from a long-run perspective.

[7]The lobby would not pay the government to set a tariff below what it would set on its own so for any $\tau_1 \leq \tau_1^W$ the equal-returns curve simply becomes $p_1(\tau_1, k_1) = 1$. I do not draw this part of $\tau_1^{er}(k_1)$ in the figure.

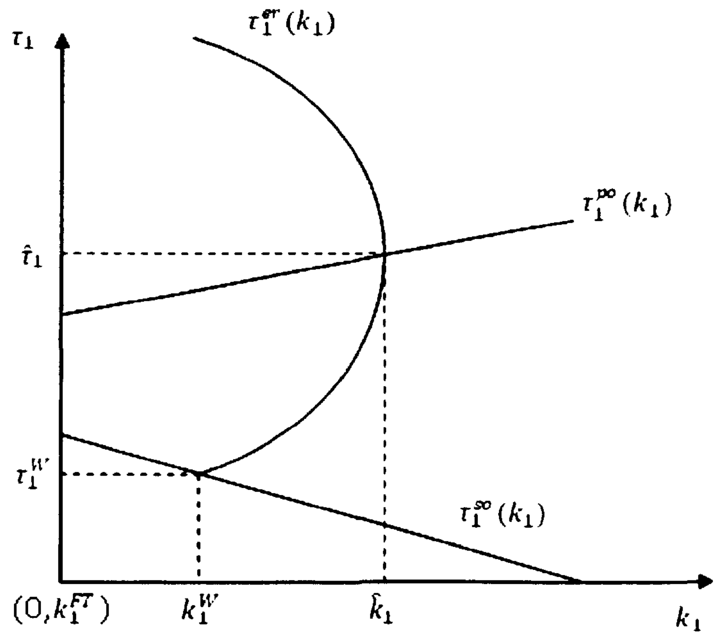

Figure 3.1: The long-run equilibrium without commitment for $\beta = 0$.

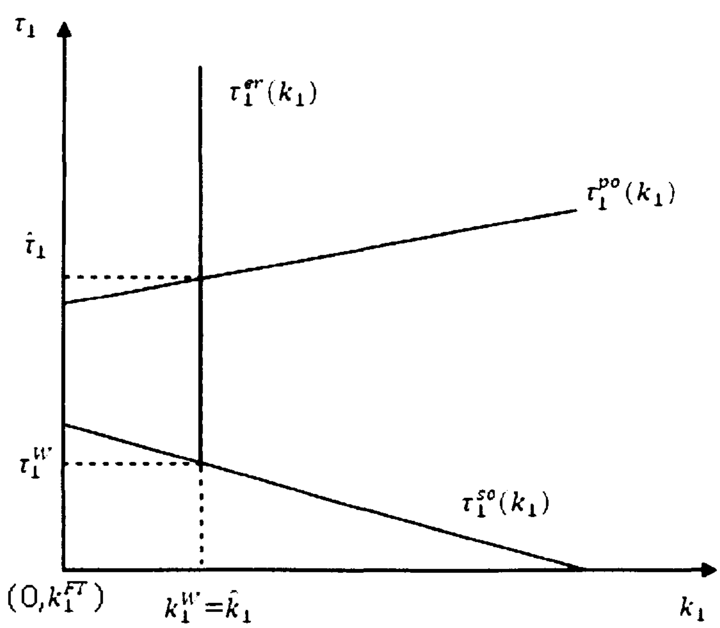

Figure 3.2: Long-run equilibrium without commitment for $\beta = 1$.

3.4 Trade liberalisation with commitment

In this section, I assume that the two countries are able to obtain some form of commitment device which is able to free them from this implicit contractual relationship with the lobby. This commitment device could take many forms. For example, the two countries could sign a trade agreement which could credibly distance each government from the pressure exerted by the lobbies in their respective countries. Alternatively, each government could unilaterally delegate the responsibility for the setting of trade policy to an institution which is insulated from political pressures. Either way, a commitment technology reverses the order of moves of the game, and gives the government a first mover advantage. Formally, this implies that the optimal tariffs are first selected by the governments in a first stage followed by capital owners in a second stage choosing how much capital to allocate to the import-competing sector subject to the tariffs chosen by the government in the first stage. In the next two subsections, I will consider both types of commitment device.

3.4.1 Unilateral commitment

Suppose the government of country H has solved its commitment problem in its domestic importing sector by for example delegating the setting of trade policy to an independent institution which is not subjected to political pressures. The setting of trade policy thus takes into account the 'long-run' movement of capital between the importing sector and the numeraire. In this case, the government maximises social welfare, and forgoes contributions from the lobby. The government's objective function thus becomes $U^G = W$. Since the government has devised a mechanism which enables it to commit to all future policy actions, the private sector will base its capital allocation decisions on the trade policy announced by the government. This capital allocation can be derived from the requirement that returns are equalised across the importing- and the numeraire sector, $p_1(\tau_1, k_1) = 1$. Hence, the government maximises its objective function with respect to τ_1, subject to the equal-returns constraint:

$$\begin{aligned} \max_{\tau_1, k_1} U^G(\tau_1, k_1) &= W_H(\tau_1, k_1) \\ \text{s.t. } p_1(\tau_1, k_1) &= 1 \end{aligned} \tag{3.23}$$

In Appendix 3.8.2, I demonstrate that the solution to this optimisation problem yields the following two convenient expressions for the capital allocation and the tariff which obtains when the government is able to unilaterally commit:

$$\tau_1^U = \tau_1^W = \frac{2-v}{2}; \tag{3.24}$$

$$k_1^U = k_1^W = \frac{(3v-4)}{2}. \tag{3.25}$$

The tariff/capital allocation pair (τ_1^U, k_1^U) is the same as (τ_1^W, k_1^W) from (3.20)-(3.21). Notice, however, that the pair (τ_1^W, k_1^W) was derived by finding the optimal tariff for any capital allocation and then substituting the equal-returns condition to find the actual capital allocation. The pair (τ_1^U, k_1^U), on the other hand, was found by endogenising the capital allocation in the optimisation problem. The fact that I obtain the same result implies that there is no conflict between the government's short-run and long-run objectives, and hence, the government does not suffer from a commitment problem with respect to the trade policies it wishes to select on its own. In other words, the equal-returns constraint in the optimisation problem (3.23) is not binding, and the welfare function $W(\tau_1^{so}(k_1), k_1)$ has a peak at $k_1 = k_1^W$.

3.4.2 Bilateral commitment

Suppose that at some point in time, country H and F get an opportunity to sign a trade agreement. Such an agreement serves two purposes: (i) it ensures that both governments can commit vis-à-vis their respective import-competing sectors, and (ii) since it maximises joint welfare it solves the terms-of-trade driven prisoner's dilemma. The lobby is not willing to pay the government for signing a trade agreement so contributions drop out of the government's objective function in both countries. Hence, the objective functions become $U_H^G = W_H$ and $U_F^G = W_F$. Since it is assumed that the trade agreement is binding, it allows the government to set tariffs before the capital allocations are selected. A trade agreement maximises the following:

$$\begin{aligned} \max_{\tau_1,k_1,\tau_2,k_2} U_H^G + U_F^G &= W_H(\tau_1,k_1,\tau_2,k_2) + W_F(\tau_1,k_1,\tau_2,k_2) \qquad (3.26) \\ \text{s.t. } p_1(\tau_1,k_1) &= 1 \text{ and } p_2(\tau_2,k_2) = 1. \end{aligned}$$

Since the two countries are symmetric, the equilibrium tariff and capital allocation in the two countries will be the same. Hence, in Appendix 3.8.3, I demonstrate that the tariff and the capital allocation in country H, which solve (3.26), are:

$$\tau_1^T = 0; \qquad (3.27)$$

$$k_1^T = k^{ft} = 2v - 3. \qquad (3.28)$$

When the governments can commit and when they solve for their joint welfare, they would sign a free trade agreement.

3.5 Trade liberalisation without commitment

In this section, I consider a scenario in which any import tariff that differs from the political optimal one in (3.12) has to be sustained through a reputational mechanism. This implies that the present discounted value of adhering to a pre-announced trade policy has to be greater than or equal to the present discounted value from deviation. I assume that in period t the government finds itself in the long run equilibrium where the tariff equals $\widehat{\tau}_1$ and where the capital allocation is $\widehat{k}_1$, respectively, as given in (3.18) and (3.19). For which ever reason, the government decides to alter its long-run trade policies in order to reach a higher level of welfare. I model this as a conventional infinitely repeated game with trigger strategies. Let τ_1^A be the tariff which the government announces that it will implement in the future. When setting this tariff the private sector is not willing to pay any bribes. I assume that the private sector believes this announcement and it will consequently choose the capital allocation, k_1^A, which solves $p_1\left(\tau_1^A, k_1^A\right) = 1$, or in words, capital will be allocated across sectors such as to equalise returns. The present discounted value of honouring this tariff for country H as of period $t+1$ and forever thereafter is given as:

$$\frac{1}{1-\delta}U^A\left(\tau_1^A\left(k_1^A\right), k_1^A, \phi\right) = \frac{1}{1-\delta}W\left(\tau_1^A\left(k_1^A\right), k_1^A, \phi\right). \tag{3.29}$$

where $\phi = (\tau_2, k_2)$ represents the foreign tariff and capital allocation which, for now, are unspecified. The function U^A represents the government's per-period utility form adhering to an announced policy. The private sector will form expectations about the credibility of government action based on past decisions. In other words, if the government announces that it will commit to a particular trade policy, the private sector will believe it provided the government has demonstrated that it can sustain this tariff in the past. If the government deviates from this tariff in say period s, the private sector will no longer find the government credible, and it will base its investment decisions on that as of period $s+1$. In period s, however, the private sector is caught by surprise. I assume that if the government deviates it does so by re-engaging with the politically organised lobby, accepting a bribe and setting the tariff at $\tau_1^{po}\left(k_1^A\right)$ as given in (3.12).The government achieves short-run benefits from such deviation in the form of a bribe from the import-competing sector, and possibly also a short-run terms-of-trade improvement if it had signed a trade agreement with the other country. It is assumed that the government's decision to deviate catches the private sector by surprise such that the capital allocation is stuck at k_1^A in period s. The government's one-shot benefit from deviation (provided there is no change in country F's trade policies) in any given period is:

$$U^D\left(\tau_1^{po}\left(k_1^A\right), k_1^A, \phi\right) = W\left(\tau_1^{po}\left(k_1^A\right), k_1^A, \phi\right) + aC\left(\tau_1^{po}\left(k_1^A\right), k_1^A, \phi\right),$$

where the superscript D stands for deviation. In the following period (that is, the period after defection) where capital is perfectly mobile, the economy will return to the long-run political equilibrium:

$$U^P\left(\widehat{\tau}_1, \widehat{k}_1, \phi\right) = W\left(\widehat{\tau}_1, \widehat{k}_1, \phi\right) + aC\left(\widehat{\tau}_1, \widehat{k}_1, \phi\right),$$

where the superscript P stands for punishment. The present discounted value of welfare from deviation is thus given as:

$$U^D\left(\tau_1^{po}\left(k_1^A\right), k_1^A, \phi\right) + \frac{\delta}{1-\delta}\left[U^P\left(\widehat{\tau}_1, \widehat{k}_1, \phi\right)\right]. \tag{3.30}$$

Hence, I can express a self-enforcement constraint using (3.29) and (3.30) as:

$$\frac{1}{1-\delta}U^A\left(\tau_1^A\left(k_1^A\right),k_1^A,\phi\right) \geq U^D\left(\tau_1^{po}\left(k_1^A\right),k_1^A,\phi\right) + \frac{\delta}{1-\delta}\left[U^P\left(\widehat{\tau}_1,\widehat{k}_1,\phi\right)\right].$$

It will prove convenient to write this constraint in terms of a critical discount factor above which trade liberalisation is self-enforceable. Hence, trade liberalisation is self-enforceable if and only if:

$$\delta \geq \delta_C \equiv \frac{U^D\left(\tau_1^{po}\left(k_1^A\right),k_1^A,\phi\right) - U^A\left(\tau_1^A\left(k_1^A\right),k_1^A,\phi\right)}{U^D\left(\tau_1^{po}\left(k_1^A\right),k_1^A,\phi\right) - U^P\left(\widehat{\tau}_1,\widehat{k}_1,\phi\right)}. \tag{3.31}$$

Notice the numerator of this equation is the short-run gain from deviating from the announced trade policy and accepting a bribe from the import-competing sector when the private sector was caught by surprise. The denominator is the long-run loss from deviation, or more specifically, the difference in welfare of deviating from the announced trade policy in the short-run where the private sector was caught by surprise and in the long-run where deviation is anticipated. Hence, the critical discount factor is given as the ratio of the short-run gain from deviation to the long run loss.

3.5.1 The sustainability of unilateral trade liberalisation

Suppose the government decides to delegate the responsibility for setting trade policy to an institution designed to distance itself from the political lobby, but suppose also that there is no constitutional arrangement which precludes the government from taking back responsibility for trade policy in any given period. For that reason, in order to convince the private sector that the government will adhere to the arrangement, it must demonstrate commitment over time. I assume that there is no change in country F's trade policies such that the foreign tariff and capital allocation are $\widehat{\phi} = \left(\widehat{\tau}_2, \widehat{k}_2\right)$. Hence, the tariff and capital allocation in, respectively country H and F, that emerge under such arrangement are $\left(\tau_1^{so}\left(k_1^W\right), k_1^W\right)$ and $\widehat{\phi}$ which implies that the per-period utility the government obtains by honouring the unilateral liberalisation is $U^A\left(\tau_1^{so}\left(k_1^W\right), k_1^W, \widehat{\phi}\right) = W\left(\tau_1^{so}\left(k_1^W\right), k_1^W, \widehat{\phi}\right)$. If the government chooses to deviate in, say period s, it will re-engage with the lobby and set the tariff at $\tau_1^{po}\left(k_1^W\right)$. Recall that when the government deviates the capital allocation is stuck at k_1^W since the private sector is caught by surprise. Thus, the utility the government achieves in this first period of deviation is $U^D\left(\tau_1^{po}\left(k_1^W\right), k_1^W, \widehat{\phi}\right) = W\left(\tau_1^{po}\left(k_1^W\right), k_1^W, \widehat{\phi}\right) + aC\left(\tau_1^{po}\left(k_1^W\right), k_1^W\right)$. One period after defection, however, the private sector will no longer believe the government's ability to keep the tariff at its socially optimal level, and rationally expect that the government will re-engage with politics; the economy will thus end up in the long-run political equilibrium where the government yields utility equal to $U^P\left(\widehat{\tau}_1, \widehat{k}_1, \widehat{\phi}\right) = W\left(\widehat{\tau}_1, \widehat{k}_1\right) + aC\left(\widehat{\tau}_1, \widehat{k}_1\right)$. Given all this information, I can define a critical discount factor above which unilateral trade liberalisation is self-enforceable. Hence, using (3.31) unilateral trade liberalisation is self-enforceable if and only if:

$$\delta \geq \delta_U \equiv \frac{U^D\left(\tau_1^{po}\left(k_1^W\right), k_1^W, \widehat{\phi}\right) - U^A\left(\tau_1^{so}\left(k_1^W\right), k_1^W, \widehat{\phi}\right)}{U^D\left(\tau_1^{po}\left(k_1^W\right), k_1^W, \widehat{\phi}\right) - U^P\left(\widehat{\tau}_1, \widehat{k}_1, \widehat{\phi}\right)}. \tag{3.32}$$

The next step is to examine how the government's bargaining power affects the critical discount factor in (3.32). In order to gain intuition for the results that follow consider the numerator of (3.32). Notice that it consists of two terms: (i) the difference in government welfare under the two tariff regimes, $W\left(\tau_1^{po}\left(k_1^W\right), k_1^W\right) - W\left(\tau_1^{so}\left(k_1^W\right), k_1^W\right)$, and (ii) the contributions paid to the government to deviate from the socially optimal tariff, $aC\left(\tau_1^{po}\left(k_1^W\right), k_1^W\right)$. Using the politically optimal tariff in (3.12), the socially optimal tariff in (3.13), and the expression for contributions in (3.15), I can write up useful expressions for these two terms:

$$\begin{aligned} W\left(\tau_1^{po}\left(k_1^W\right), k_1^W\right) - W\left(\tau_1^{so}\left(k_1^W\right), k_1^W\right) &= -\frac{1}{6}a^2\left(k_1^W\right)^2; \\ aC\left(\tau_1^{po}\left(k_1^W\right), k_1^W\right) &= \left(\frac{1+\beta}{6}\right)a^2\left(k_1^W\right)^2. \end{aligned}$$

The first expression is in absolute terms the government's reservation utility: the minimum amount needed to induce the government to pick the politically optimal tariff, and the second is the actual contribution. Subtracting the two terms from each other yields:

$$\begin{aligned} U^D\left(\tau_1^{po}\left(k_1^W\right), k_1^W, \widehat{\phi}\right) - U^A\left(\tau_1^{so}\left(k_1^W\right), k_1^W, \widehat{\phi}\right) &= \left(\frac{\beta}{6}\right)a^2\left(k^W\right)^2 \qquad (3.33) \\ &= \frac{1}{24}\beta a^2\left(3v-4\right)^2, \end{aligned}$$

where the second line uses $k^W = \frac{(3v-4)}{2}$, from (3.21). The numerator of (3.32) can thus be seen as the excess of contributions over the government's reservation utility. If the lobby has all the bargaining power, $\beta = 0$, contributions are just enough to make the government indifferent between the two tariff regimes in the short run such that there is no short-run gain from deviation. As β increases, however, the temptation to accept bribes increases, since the government is able to extract larger rents from the political bargaining process. Also, the higher the weight attached to political contributions, a, the higher the incentive to deviate. Hence, when $\beta = 0$, unilateral deviation can be supported for every discount factor in the range $\delta \in]0;1[$ since in this case the government has no incentive to unilaterally deviate.

Unilateral trade liberalisation can be supported for some range of discount factors as long as δ_U is strictly less than one. From (3.32) it is clear that this is the case whenever:

$$U^A\left(\tau_1^{so}\left(k_1^W\right), k_1^W, \widehat{\phi}\right) > U^P\left(\widehat{\tau}_1, \widehat{k}_1, \widehat{\phi}\right). \tag{3.34}$$

Hence, unilateral trade liberalisation can be sustained for some range of discount factors provided the government's utility from adhering to the announced trade policy is strictly greater than its utility in the long-run political equilibrium. It will be convenient to rewrite (3.34) in the following way[8]:

$$W\left(\tau_1^{so}\left(k_1^W\right), k_1^W\right) > W\left(\tau_1^{so}\left(\widehat{k}_1\right), \widehat{k}_1\right) + \left(\frac{\beta}{6}\right) a^2 \left(\widehat{k}_1\right)^2$$

There are two cases to consider:

Case 1: $\beta = 0$. When the government has no bargaining power, it is only compensated for the short-run distortion from protection and not for the long-run misallocation of capital. Since the function $W\left(\tau_1^{so}\left(k_1\right), k_1\right)$ has a peak at k_1^W it follows that $W\left(\tau_1^{so}\left(k_1^W\right), k_1^W\right) > W\left(\tau_1^{so}\left(\widehat{k}_1\right), \widehat{k}_1\right)$ such that $U^A\left(\tau_1^{so}\left(k_1^W\right), k_1^W, \widehat{\phi}\right) > U^P\left(\widehat{\tau}_1, \widehat{k}_1, \widehat{\phi}\right)$.

Case 2: $\beta = 1$. In this case, the equilibrium level of capital is the same in the political equilibrium as it is when the government adheres to the announced trade policy, $k_1^W = \widehat{k}_1$ for $\beta = 1$. The only difference is that in the long-run political equilibrium the government receives contributions, implying that the government must be better off in the political equilibrium. Hence, the inequality in (3.34) is

[8] To see this note that $\widehat{\tau}_1 = \tau_1^{po}\left(\widehat{k}_1\right)$. Hence, $U^P\left(\widehat{\tau}_1, \widehat{k}_1, \widehat{\phi}\right) = W\left(\tau_1^{po}\left(\widehat{k}_1\right), \widehat{k}_1\right) + aC\left(\tau_1^{po}\left(\widehat{k}_1\right), \widehat{k}_1\right)$. Contributions are paid to induce the government to implement τ_1^{po}. Multiplying the expression for contributions in (3.15) by the capital allocation $\widehat{k}_1$ yields an expression for total contributions times a, $aC\left(\tau_1^{po}\left(\widehat{k}_1\right), \widehat{k}_1\right) = \left(\frac{1+\beta}{6}\right) a^2 \left(\widehat{k}_1\right)^2$. Notice that the government's reservation utility for implementing τ_1^{po} is given by $W\left(\tau_1^{so}\left(\widehat{k}_1\right), \widehat{k}_1\right) - W\left(\tau_1^{po}\left(\widehat{k}_1\right), \widehat{k}_1\right)$. Using (3.12) and (3.13) this can be written as $\left(\frac{1}{6}\right) a^2 \left(\widehat{k}_1\right)^2$. Adding and subtracting $W\left(\tau_1^{so}\left(\widehat{k}_1\right), \widehat{k}_1\right)$ from $U^P\left(\widehat{\tau}_1, \widehat{k}_1, \widehat{\phi}\right)$ thus yields $W\left(\tau_1^{so}\left(\widehat{k}_1\right), \widehat{k}_1\right) + \left(\frac{\beta}{6}\right) a^2 \left(\widehat{k}_1\right)^2$.

not satisfied, and it is the case that $U^A\left(\tau_1^{so}\left(k_1^W\right), k_1^W, \widehat{\phi}\right) < U^P\left(\widehat{\tau}_1, \widehat{k}_1, \widehat{\phi}\right)$.

Since $U^A\left(\tau_1^{so}\left(k_1^W\right), k_1^W, \widehat{\phi}\right)$ does not depend on β, I can analyse the intermediate case of $0 < \beta < 1$ by considering the derivative of $U^P\left(\widehat{\tau}_1, \widehat{k}_1, \widehat{\phi}\right)$ with respect to β. The latter is monotonically increasing in β for two reasons: first, because $U^P\left(\widehat{\tau}_1, \widehat{k}_1, \widehat{\phi}\right)$ is directly increasing in β and, second, because the capital allocation $\widehat{k}_1$ is decreasing in β. This argument is proven formally in Appendix 3.8.4, along with the proof of the following proposition:

Proposition 3.2: *there exists a level of the government's bargaining power β, $\overline{\beta}$, such that $U^A\left(\tau_1^{so}\left(k_1^W\right), k_1^W, \widehat{\phi}\right) > U^P\left(\widehat{\tau}_1, \widehat{k}_1, \widehat{\phi}\right)$ if and only if $\beta < \overline{\beta} = 5 - 2\sqrt{6} \approx 0.101$.*

This implies that whenever $\beta \geq \overline{\beta}$ unilateral trade liberalisation cannot be supported for any discount factors. If, on the other hand, the government's bargaining power lies in the range $\beta \in]0; \overline{\beta}[$, there is a range of discount factors which can support trade liberalisation. Since the government extracts larger rents when β increases, it will be the case that the level of patience required to sustain trade liberalisation is strictly increasing in β when $\beta \in]0; \overline{\beta}[$. This result can be formally stated in the following proposition:

Proposition 3.3: *The critical discount factor above which unilateral trade liberalisation can be sustained by repeated interaction is strictly increasing in the governments' bargaining power, β, in the range given as $\beta \in]0; \overline{\beta}[$, provided politics matter, $a > 0$. Hence $\frac{\partial \delta_U}{\partial \beta} > 0$ for $a > 0$ and $\beta \in]0; \overline{\beta}[$.*

The proof of this proposition is given in Appendix 3.8.5. In Figure 3.3, I have depicted the critical discount factor, δ_U, as a function of β. It is clear that when the government has no bargaining power, unilateral trade liberalisation can be supported for every discount factor, but as β increases, the level of patience required to sustain the announced departure from the time-consistent political tariffs increases. When the government's bargaining power exceeds the critical level $\overline{\beta}$, the government is better off in the political equilibrium where it can enjoy bribes from capital-owners in the importing sector. In this case, bribes more than compensate the government for the long-run misallocation of capital.

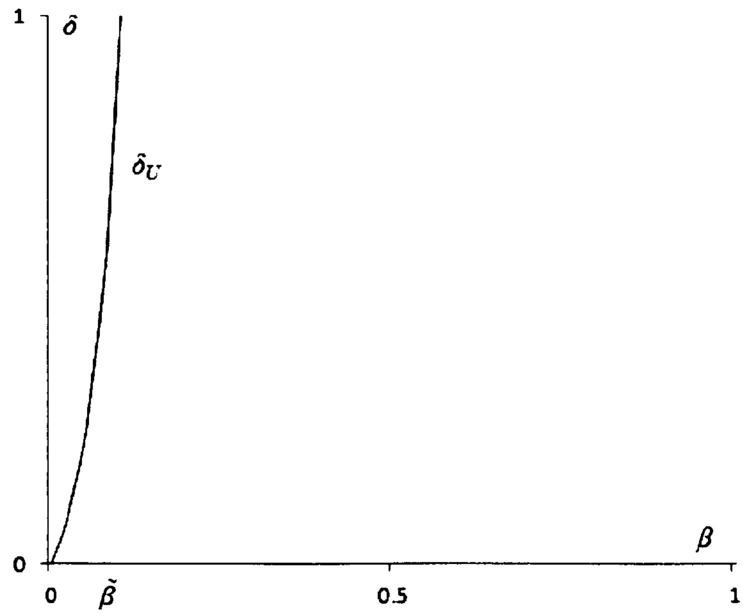

Figure 3.3: The discount factor, δ_U, as a function of β. ($a = 0.5$ and $v = 1.6$).

3.5.2 The sustainability of a trade agreement

Suppose the governments in the two countries are able to sign a trade agreement to maximise their joint welfare. Suppose also, however, that due to the absence of a world supranational power to enforce such an agreement, both countries can deviate from the agreement in any period. The governments announce as of period t that in period $t + 1$, they will sign a free trade agreement, and that they will no longer accept bribes. If the private sectors in the two counties believe that the governments will in fact go ahead with this, they will allocate capital in expectation of those tariffs. In this case, the tariff-capital allocation pair that emerges under such arrangement is (τ_1^T, k_1^{ft}) in country H and (τ_2^T, k_2^{ft}) in country F yielding per-period utility of $U^A\left(\tau_1^T, k_1^{ft}, \tau_2^T, k_2^{ft}\right) = W\left(\tau_1^T, k_1^{ft}, \tau_2^T, k_2^{ft}\right)$. If the government in H chooses to deviate in, say period s, it will re-engage with the lobby and set the tariff at $\tau_1^{po}\left(k_1^{ft}\right)$. It is assumed that the government is able to catch both the private sector in its own country and the government in the other country by surprise, such that the domestic capital allocation is stuck at k_1^{ft} and that the trade policy in the foreign country is based on an expectation of cooperation. Deviation will thus yield per-period utility of $U^D\left(\tau_1^{po}\left(k_1^{ft}\right), k_1^{ft}, \tau_2^T, k_2^{ft}\right) = W\left(\tau_1^{po}\left(k_1^{ft}\right), k_1^{ft}, \tau_2^T, k_2^{ft}\right) + aC\left(\tau_1^{po}\left(k_1^{ft}\right), k_1^{ft}\right)$. One period after defection, however, the private sector in country H will no longer believe its government's ability to honour the trade agreement, and rationally expect that it will set tariffs at their politically optimal levels. Moreover, since country H defected on the agreement, country F will punish it by reverting to the politically optimal tariff one period after the defection. The private sectors in both countries will rationally expect that the governments will re-engage in politics, and the economy thus returns to the long-run political equilibrium where the tariff and capital allocation are $(\widehat{\tau}_1, \widehat{k}_1)$ in country H and $(\widehat{\tau}_2, \widehat{k}_2)$ in country F. The government's per-period utility in this long-run equilibrium is $U^P\left(\widehat{\tau}_1, \widehat{k}_1, \widehat{\tau}_2, \widehat{k}_2\right) = W\left(\widehat{\tau}_1, \widehat{k}_1, \widehat{\tau}_2, \widehat{k}_2\right) + aC\left(\widehat{\tau}_1, \widehat{k}_1\right)$. Using this information, I can define a critical discount factor above which a trade agreement is self-enforceable. Thus, using (3.31) a trade agreement is self-enforceable if and only if:

$$\delta \geq \delta_T \equiv \frac{U^D\left(\tau_1^{po}\left(k_1^{ft}\right), k_1^{ft}, \tau_2^T, k_2^{ft}\right) - U^A\left(\tau_1^T, k_1^{ft}, \tau_2^T, k_2^{ft}\right)}{U^D\left(\tau_1^{po}\left(k_1^{ft}\right), k_1^{ft}, \tau_2^T, k_2^{ft}\right) - U^P\left(\widehat{\tau}_1, \widehat{k}_1, \widehat{\tau}_2, \widehat{k}_2\right)}. \tag{3.35}$$

Unlike unilateral trade liberalisation, when the two countries sign a trade agreement with each other they are also solving the international terms-of-trade externality. This implies that there is an additional welfare gain in the trade agreement equilibrium: in addition to the governments' in the two countries being able to commit vis-à-vis their respective import-competing sectors, they are also able to solve the international prisoner's dilemma. What this also implies is that when any country deviates the punishment is higher, since not only has the government lost its credibility to conduct welfare-improving trade policies vis-à-vis domestic capital owners, the other country punishes it by distorting the terms-of-trade to its disadvantage. This has implications for both the short-run temptation to deviate from the trade agreement, $U^D\left(\tau_1^{po}\left(k_1^{ft}\right), k_1^{ft}, \tau_2^T, k_2^{ft}\right) - U^A\left(\tau_1^T, k_1^T, \tau_2^T, k_2^{ft}\right)$, and for the long-run loss, $U^D\left(\tau_1^{po}\left(k_1^{ft}\right), k_1^{ft}, \tau_2^T, k_2^{ft}\right) - U^P\left(\widehat{\tau}_1, \widehat{k}_1, \widehat{\tau}_2, \widehat{k}_2\right)$. In fact, both the short-run temptation to deviate and the long-run loss are greater. It turns out, however, that due to the added incentive to stay in the agreement that comes about by the threat of punishment on the part of the other country, a trade agreement can be supported for any level of the government's bargaining power β, provided the government is sufficiently patient. This result can be formalised in the following proposition which is proved in Appendix 3.8.6:

Proposition 3.4: *$\delta_T < 1$ for all values of β.*

While this is true, a higher bargaining power of the two governments increases the level of patience required to sustain a trade agreement provided politics matter, $a > 0$. The intuition behind this finding is the following. When β is higher, the government is able to reap a larger share of the revenue from deviation in the form of bribes, when the other country cooperates and when the private sector is caught by surprise, $\frac{\partial U^D}{\partial \beta} > 0$. The government's per-period utility in the long-run

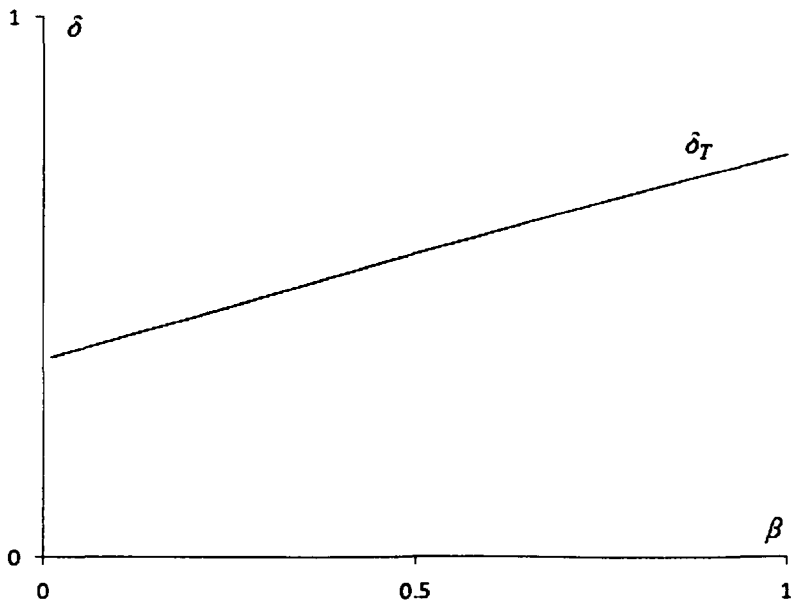

Figure 3.4: The discount, δ_T, as a function of β. ($a = 0.5$ and $v = 1.6$).

political equilibrium is also higher when β is higher for two reasons. First, bribes are larger, and the capital allocation is closer to the socially optimal level $\widehat{k}_2 \rightarrow k_1^W$ for $\beta \rightarrow 1$. This implies $\frac{\partial U^P}{\partial \beta} > 0$. The government's per-period utility in the case where it sticks to the agreement is unchanged $\frac{\partial U^A}{\partial \beta} = 0$. In Appendix 3.8.7 I prove the following:

Proposition 3.5: *The critical discount factor above which a trade agreement can be sustained by repeated interaction is strictly increasing in the governments' bargaining power, β, provided politics matter, $a > 0$. Hence $\frac{\partial \delta_T}{\partial \beta} > 0$ for $a > 0$.*

The relationship between the critical discount factor and β is depicted in Figure 3.4.

3.6 Unilateral versus global trade liberalisation: a comparison

The relative sustainability of unilateral trade liberalisation can now be compared and contrasted with the signing of a global free trade agreement. In Section 3.5.1, I established that unilateral trade liberalisation can be supported for every discount factor when $\beta = 0$. When β increases, however, the government reaps an increasingly larger share of the revenue from import protection, raising the level of patience required to sustain unilateral trade liberalisation. As β exceeds a critical threshold, $\overline{\beta}$, the government's benefit, in the form of contributions from the lobby, is so high that commitment to foreclose contributions from the lobby would leave it worse off. Signing a trade agreement with the other country, however, changes both the short-run benefits from deviation as well as the long-run loss. The fact that deviation will be punished by the other country imposes greater sanctions on the governments for high levels of β.

There are two cases to consider:

Case 1: $\beta = 0$. When the government has no bargaining power, it is the case that $\delta_U = 0$ whereas $\delta_T > 0$. The latter is strictly positive since even if the government's bargaining power is zero, there is still a benefit from distorting the terms of trade in a country's favour when the other cooperates.

Case 2: $\beta \geq \overline{\beta}$. In this case, unilateral trade liberalisation cannot be supported for any discount factor in the range $0 < \delta < 1$. Proposition 3.4, however, established that $\delta_T < 1$ for all values of β.

I depict the relationship between δ_U and δ_T, respectively, and β in Figure 3.5 for specific parameter values of a and v. It is clear from the figure that unilateral trade liberalisation can be supported for a larger range of discount factors for low bargaining powers, whereas when β gets sufficiently large, a trade agreement is

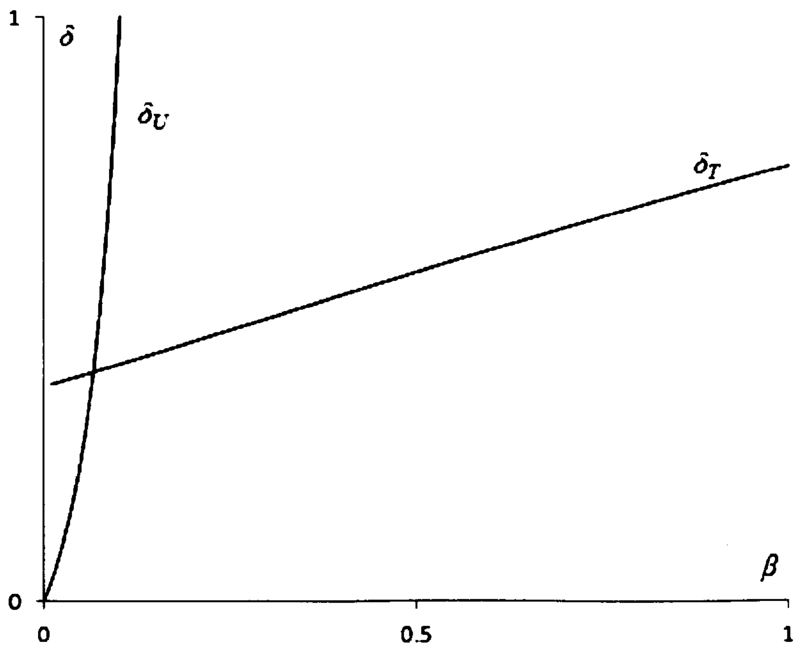

Figure 3.5: The discount factors, δ_U and δ_T, as functions of β. ($a = 0.5$ and $v = 1.6$).

needed to liberalise trade.

3.7 Concluding Remarks

The present chapter contributes to our understanding of the broader area of the political economy of trade liberalisation by analysing the sustainability of unilateral and bilateral commitment strategies, when governments are unable to commit to dynamically efficient trade policies.

In the present framework the demand for trade liberalisation is driven by the desire to commit vis-à-vis domestic interest groups as well as solving an international terms-of-trade driven prisoner's dilemma. Unilateral trade liberalisation solves the problem of time inconsistency in the domestic political arena, whereas a trade agreement solves both types of problems.

Central to the argument is the government's bargaining power vis-à-vis the lobby. The self-enforceability of both unilateral and bilateral trade liberalisation is increasing in the ability of the government to extract rents from the Nash bargaining process. I would expect that the bargaining power of a government is weaker in an open democratic system, where the power of government is less centralised. This gives lobbies greater opportunities to offer bribes to several constellations within the government. My results thus indicate that countries with open and democratic political systems are more likely to be able to sign trade agreements with each or unilaterally liberalise trade.

The present model could be extended in several interesting ways. First, an assumption of symmetry between the two countries has been imposed. This has allowed to keep the analyses simple yet informative. The simplification, however, is not in line with the current economic landscape in which we live, and it would be interesting to see to what extent asymmetries would change the baseline results. It would be interesting to study the sustainability of an agreement between a country where the government's bargaining power is low, and one in which the bargaining power is high. There could be a country with a very decentralised political system ($\beta = 0$) which could be considered as a more democratic country (giving the interpretation in the introduction of this chapter), and one where the government has all the power ($\beta = 1$), possibly a very autocratic country. The autocracy has a much greater short-run incentive to deviate from the agreement since its government can extract all the rents from the bargaining process with the lobby. The government of the democracy, on the other hand, only achieves more favourable terms of trade in one period when the other country was induced to cooperate. The punishments the two countries incur are also different. The autocracy will experience a harder punishment since the long-run political equilibrium in the democracy will be characterised by overinvestment in the protected sector, which reduces the profits of capital owners producing the exporting good in the autocracy. By the reverse reasoning it can be deduced that the democracy will experience a smaller punishment. Since the democracy would experience a smaller short-run gain, and a smaller punishment, and the autocracy will experience a larger short-run gain and a larger punishment, it is less clear how that affects the sustainability of an agreement. It is certain, however that the democracy will be able to sustain unilateral liberalisation. The theory can thus explain the emergence of non-reciprocal trade agreements between democratic developed nations and less democratic nations.

Second, I have ignored analysing potential trade diverting effects of a regional trade agreement. Imagine, for example, introducing a third country to the model. In that case, there might be further welfare effects of the distortions resulting from the short-run effects of tariffs imposed on the country outside the agreement, and the long-run effects of capital allocations. If it is assumed that trade agreements are signed between natural trading partners, the problem of trade diversion may not be very large. Moreover, it may also be argued that a lot of cooperation over trade policy takes place in multilateral negotiations under the WTO.

3.8 Appendix to Chapter 3

3.8.1 Proof of Proposition 3.1

Using the expression for the price of country H's imported good in (3.2), and the expression for contributions in (3.14), I can write the equal-returns condition (3.17) as:

$$v - \frac{1}{2}(1 + k_1 - \tau_1) - (1 - \beta)\left(\frac{3}{8ak_1}\right)(\tau_1 - \tau_1^{so})^2 - \beta\frac{1}{2}(\tau_1 - \tau_1^{so}) = 1.$$

Setting $\tau_1 = \tau_1^{po}(k_1)$ from (3.12) and solving for k_1 yields, after substantial algebraic manipulations, an expression for the unique capital allocation in the long-run political equilibrium:

$$k_1 = \widehat{k}_1 \equiv \frac{2(3v-4)}{4-a(1-\beta)}. \tag{3.36}$$

Substituting $\widehat{k}_1$ back into (3.12) yields the unique expression for the tariff in the long-run political equilibrium:

$$\tau_1 = \widehat{\tau}_1 \equiv \frac{4-a(1-\beta)+2(2a-1)(3v-4)}{3[4-a(1-\beta)]}.$$

Notice that the condition (3.22) implies that $a < \frac{3}{2}$, and hence the denominator of (3.36) is positive. The numerator is also positive given that I have assumed that $v > \frac{3}{2}$ in (3.10). Hence, in equilibrium a positive amount of capital is allocated to the M_1-sector. It is similarly possible to show that $\widehat{k}_1 < 1$ using the conditions imposed on a and v. **q.e.d.**

3.8.2 Derivation of Eq. (3.24) and Eq. (3.25)

I solve the optimisation problem in (3.23) using the method of Lagrange. Using (3.6) and the expression for the price of country H's imported good in (3.2), I can rewrite (3.23) in the following way:

$$\begin{aligned}
\Psi^U(\tau_1, k_1, \lambda) &= \max_{\tau_1, k_1} W(\tau_1, k_1) + \lambda[p_1(\tau_1, k_1) - 1] \\
&= \max_{\tau_1, k_1}\left(v - \frac{1}{2}(1+k_1-\tau_1)\right)k_1 + 1 - k_1 + \tau_1\left(\frac{1}{2}(1-k_1-\tau_1)\right) \\
&\quad + \frac{1}{2}\left(\frac{1}{2}(1+k_1-\tau_1)\right)^2 + \left(v - \frac{1}{2}(1+k_2+\tau_2)\right) \\
&\quad + \frac{1}{2}\left(\frac{1}{2}(1+k_2+\tau_2)\right)^2 + \lambda\left[\left(v - \frac{1}{2}(1+k_1-\tau_1)\right) - 1\right],
\end{aligned}$$

where λ is the Lagrange multiplier for this optimisation problem. Differentiating $\Psi^U(\tau_1, k_1, \lambda)$ for τ_1, k_1 and λ yield the following three equations:

$$\begin{aligned}
\frac{\partial \Psi^U(\tau_1, k_1, \lambda)}{\partial \tau_1} &= \frac{2\lambda + 1 - k_1 - 3\tau_1}{4}; \\
\frac{\partial \Psi^U(\tau_1, k_1, \lambda)}{\partial k_1} &= \frac{4v - 3k_1 - 5 - \tau_1 - 2\lambda}{4}; \\
\frac{\partial \Psi^U(\tau_1, k_1, \lambda)}{\partial \lambda} &= \frac{2v - 3 - k_1 - \tau_1}{2}.
\end{aligned}$$

Solving these equations in the three unknowns yields one unique solution:

$$\tau_1^U = \frac{2-v}{2};\ k_1^U = \frac{3v-4}{2};\ \lambda = 0.$$

q.e.d.

3.8.3 Derivation of Eq. (3.27) and Eq. (3.28)

I solve the optimisation problem in (3.26) using the method of Lagrange. Eq. (3.4) gives an expression for the part of country F's welfare which does not depend on the home variables, τ_1 and k_1. Using the expression for the price of M_1 in country F from (3.2), and the expression for the consumer surplus (3.1), the welfare in country F can be written as:

$$W_F(\tau_1, k_1) = \left(v - \frac{1}{2}(1 + k_1 + \tau_1)\right) + \frac{1}{2}\left(\frac{1}{2}(1 + k_1 + \tau_1)\right)^2 + [\cdot], \tag{3.37}$$

where the term $[\cdot]$ does not depend on τ_1 and k_1. Hence, using (3.6) and (3.37), and the equal-returns constraint, $p_1(\tau_1, k_1) = 1$, I can write up the following optimisation problem in τ_1 and k_1:

$$\begin{aligned}\Psi^A(\tau_1,k_1,\lambda) &= \max_{\tau_1,k_1} W_H(\tau_1,k_1)+W_F(\tau_1,k_1)+\lambda\left[p_1(\tau_1,k_1)-1\right]+[\cdot] \\ &= \max_{\tau_1,k_1}\left(v-\frac{1}{2}(1+k_1-\tau_1)\right)k_1+1-k_1+\tau_1\left(\frac{1}{2}(1-k_1-\tau_1)\right) \\ &\quad +\frac{1}{2}\left(\frac{1}{2}(1+k_1-\tau_1)\right)^2+\left(v-\frac{1}{2}(1+k_1+\tau_1)\right) \\ &\quad +\frac{1}{2}\left(\frac{1}{2}(1+k_1+\tau_1)\right)^2+\lambda\left[\left(v-\frac{1}{2}(1+k_1-\tau_1)\right)-1\right]+[\cdot],\end{aligned}$$

where λ is the Lagrange multiplier for this optimisation problem. Differentiating $\Psi^A(\tau_1,k_1,\lambda)$ wrt. τ_1, k_1 and λ gives the following three equations:

$$\begin{aligned}\frac{\partial\Psi^A(\tau_1,k_1,\lambda)}{\partial\tau_1} &= \frac{\lambda-\tau_1}{2}; \\ \frac{\partial\Psi^A(\tau_1,k_1,\lambda)}{\partial k_1} &= \frac{2v-3-\lambda-k_1}{2}; \\ \frac{\partial\Psi^A(\tau_1,k_1,\lambda)}{\partial\lambda} &= \frac{2v-3-k_1+\tau_1}{2}.\end{aligned}$$

Solving these equations in the three unknowns yields one unique solution:

$$\tau_1^A=0;\ k_1^A=2v-3;\ \lambda=0.$$

It is also possible to carry out this optimisation problem for the foreign variables, τ_2 and k_2, yielding the same results due to symmetry. **q.e.d.**

3.8.4 Proof of Proposition 3.2

I begin by deriving expressions for $U^A\left(\tau_1^{so}\left(k_1^W\right),k_1^W,\widehat{\phi}\right)$ and $U^P\left(\widehat{\tau}_1,\widehat{k}_1,\widehat{\phi}\right)$. Substituting the socially optimal tariff (3.13) into (3.6) and rearranging yields:

$$U^A\left(\tau_1^{so}\left(k_1^W\right),k_1^W,\widehat{\phi}\right)=\frac{7}{6}+\frac{1}{3}\left(k_1^W\right)^2+[\cdot], \tag{3.38}$$

where the term in $[\cdot]$ depends only on the foreign variables which are fixed at $\widehat{\phi} = \left(\widehat{\tau}_2, \widehat{k}_2\right)$ Similarly, substituting the politically optimal tariff in (3.12) into (3.6), and adding the contributions from (3.15) at the capital allocation, $\widehat{k}_1$, yields after substantial rearranging:

$$U^P\left(\widehat{\tau}_1, \widehat{k}_1, \widehat{\phi}\right) = \left(\frac{3v-4}{3}\right)\left(\widehat{k}_1\right) - \left(\frac{2-\beta a^2}{6}\right)\left(\widehat{k}_1\right)^2 + \frac{7}{6} + [\cdot]. \tag{3.39}$$

Although the foreign variables are not independent of β they cancel out when taking the difference between $U^A\left(\tau_1^{so}\left(k_1^W\right), k_1^W, \widehat{\phi}\right)$ and $U^P\left(\widehat{\tau}_1, \widehat{k}_1, \widehat{\phi}\right)$. Using the expression for $\widehat{k}_1$ in (3.19), and for k_1^W in (3.21), I can write up an explicit expression for the difference:

$$\begin{aligned} U^A - U^P &= \frac{1}{3}\left(\frac{(3v-4)}{2}\right)^2 - \left(\frac{2(3v-4)^2}{3(4-a(1-\beta))}\right) \\ &+ \left(\frac{2-\beta a^2}{6}\right)\left(\frac{2(3v-4)}{4-a(1-\beta)}\right)^2. \end{aligned} \tag{3.40}$$

Setting this expression equal to zero and solving the resulting second degree polynomial for β yields two solutions:

$$\beta = 5 \pm 2\sqrt{6}.$$

It is clear that only one of these solutions lie within the permitted range for β, and that solution is the critical value given in the proposition, $\overline{\beta} = 5 - 2\sqrt{6}$.

Next by setting $\beta = 0$ in (3.40), I obtain:

$$U^A\left(\tau_1^{so}\left(k_1^W\right), k_1^W, \widehat{\phi}\right) - U^P\left(\widehat{\tau}_1, \widehat{k}_1, \widehat{\phi}\right)\Big|_{\beta=0} = \frac{a^2(3v-4)^2}{12(4-a)^2} > 0.$$

The sign of this expression can be established using the condition in (3.10). Setting

$\beta = 1$ in (3.40) yields:

$$U^A\left(\tau_1^{so}\left(k_1^W\right), k_1^W, \widehat{\phi}\right) - U^P\left(\widehat{\tau}_1, \widehat{k}_1, \widehat{\phi}\right)\Big|_{\beta=1} = -\frac{a^2(3v-4)^2}{24} < 0,$$

where again the condition in (3.10) can be used to assess the sign. Hence, whenever $\beta < \overline{\beta}$, $U^A\left(\tau_1^{so}\left(k_1^W\right), k_1^W, \widehat{\phi}\right) > U^P\left(\widehat{\tau}_1, \widehat{k}_1, \widehat{\phi}\right)$. **q.e.d.**

3.8.5 Proof of Proposition 3.3

The derivative of (3.32) can be expressed as:

$$\frac{\partial \delta_U}{\partial \beta} = \frac{\frac{\partial\left(U^D - U^A\right)}{\partial \beta}\left(U^D - U^P\right) - \frac{\partial\left(U^D - U^P\right)}{\partial \beta}\left(U^D - U^A\right)}{\left(U^D - U^P\right)^2}.$$

Noting that $\frac{\partial\left(U^A\right)}{\partial \beta} = 0$ this can be rewritten as:

$$\frac{\partial \delta_U}{\partial \beta} = \frac{\frac{\partial\left(U^D\right)}{\partial \beta}\left(U^A - U^P\right) + \frac{\partial\left(U^P\right)}{\partial \beta}\left(U^D - U^A\right)}{\left(U^D - U^P\right)^2} > 0.$$

In Appendix 3.8.4 I proved that $U^A - U^P > 0$ if and only if $\beta < \overline{\beta}$. As can be seen from (3.33), the sign of $U^D - U^A$, is clearly positive. Thus, what is left to show is that $\frac{\partial\left(U^D\right)}{\partial \beta} > 0$ and $\frac{\partial\left(U^P\right)}{\partial \beta} > 0$. To evaluate the sign of $\frac{\partial\left(U^D\right)}{\partial \beta}$ note first that since the capital allocations in k_1^W is independent of β as well as the tariff, $\tau_1^{po}\left(k_1^W\right)$, social welfare is independent of β. It thus suffices to consider the effect of β on the level of contributions. From (3.15) I have:

$$aC\left(k_1^W\right) = \left(\frac{1+\beta}{6}\right) a^2 \left(k_1^W\right)^2.$$

Taking the derivative and substituting for k_1^W from (3.21) yield:

$$\frac{\partial\left(U^D\right)}{\partial \beta} = \frac{a^2(3v-4)^2}{24} > 0.$$

Finally, to find an expression for $\frac{\partial(U^P)}{\partial\beta}$, I can use the fact that the tariff in the long-run political equilibrium can be expressed as $\widehat{\tau}_1 = \tau_1^{po}\left(\widehat{k}_1\right)$. Hence, substituting (3.12) into (3.6), and adding contributions from (3.15) evaluated at $\widehat{k}_1$ yields[9]:

$$U^P\left(\widehat{\tau}_1, \widehat{k}_1\right) = \left(\frac{3v-4}{3}\right)\widehat{k}_1 - \left(\frac{2-a^2\beta}{6}\right)\left(\widehat{k}_1\right)^2 + \frac{7}{6}. \tag{3.41}$$

Using (3.19), I can write up the following derivatives:

$$\frac{\partial \widehat{k}_1}{\partial\beta} = -\frac{2(3v-4)a}{(4-a(1-\beta))^2}; \tag{3.42}$$

$$\frac{\partial\left(\widehat{k}_1\right)^2}{\partial\beta} = -\frac{8(3v-4)^2 a}{(4-a(1-\beta))^3}. \tag{3.43}$$

Taking the derivative of (3.41) wrt. $\widehat{k}_1$ and $\left(\widehat{k}_1\right)^2$ and plugging in (3.42) and (3.43) yield:

$$\begin{aligned}
\frac{\partial U^P}{\partial\beta} &= -\left(\frac{3v-4}{3}\right)\left(\frac{2(3v-4)a}{(4-a(1-\beta))^2}\right) + \left(\frac{2-a^2\beta}{6}\right)\left(\frac{8(3v-4)^2 a}{(4-a(1-\beta))^3}\right) \\
&= \left(\frac{(3v-4)^2 a}{3(4-a(1-\beta))^3}\right)\left[4\left(2-a^2\beta\right) - 2(4-a(1-\beta))\right] \\
&= \left(\frac{(3v-4)^2 a^2}{3(4-a(1-\beta))^3}\right)\left[2(1-\beta) - 4a\beta\right].
\end{aligned}$$

Hence, $\frac{\partial U^P}{\partial\beta} > 0$ if and only if $\beta < \frac{1}{1+2a}$. Since a cannot exceed $\frac{3}{2}$ (see (3.22) and (3.10)), it is clear that $\frac{\partial U^P}{\partial\beta} > 0$ for the relevant range of $\beta \in]0;\overline{\beta}[$. With this information it can be confirmed that $\frac{\partial\delta_U}{\partial\beta} > 0$ for $\beta \in]0;\overline{\beta}[$. **q.e.d.**

3.8.6 Proof of Proposition 3.4

First note that $\delta_T < 1$ implies $U^A\left(\tau_1^T, k_1^{ft}, \tau_2^T, k_2^{ft}\right) > U^P\left(\widehat{\tau}_1, \widehat{k}_1, \widehat{\tau}_2, \widehat{k}_2\right)$ for all values of $\beta \in [0;1]$. I will begin by showing that $U^P\left(\widehat{\tau}_1, \widehat{k}_1, \widehat{\tau}_2, \widehat{k}_2\right)$ is monoton-

[9] Since there is no change in foreign variables, k_2 and τ_2, I can ignore these.

ically increasing in β. The tariffs in the long-run political equilibrium can be expressed as $\widehat{\tau}_1 = \tau_1^{po}\left(\widehat{k}_1\right)$ and $\widehat{\tau}_2 = \tau_2^{po}\left(\widehat{k}_2\right)$[10]. Hence, substituting (3.12) into (3.6), and adding contributions from (3.15) evaluated at $\widehat{k}_1$ yields:

$$\begin{aligned} U^P\left(\widehat{\tau}_1, \widehat{k}_1, \widehat{\tau}_2, \widehat{k}_2\right) &= v - \frac{13}{18} + \left(\frac{3v-4}{3}\right)\widehat{k}_1 - \left(\frac{1+a}{9}\right)\widehat{k}_2 \\ &\quad - \left(\frac{6-3a^2\beta}{18}\right)\left(\widehat{k}_1\right)^2 + \left(\frac{1+a^2+2a}{18}\right)\left(\widehat{k}_2\right)^2. \end{aligned} \tag{3.44}$$

Due to the assumed symmetry of the model, it is the case that $\widehat{k}_1 = \widehat{k}_2$. Using (3.19), I can write up the following derivatives:

$$\frac{\partial \widehat{k}_1}{\partial \beta} = \frac{\partial \widehat{k}_2}{\partial \beta} = -\frac{2(3v-4)a}{(4-a(1-\beta))^2}; \tag{3.45}$$

$$\frac{\partial\left(\widehat{k}_1\right)^2}{\partial \beta} = \frac{\partial\left(\widehat{k}_2\right)^2}{\partial \beta} = -\frac{8(3v-4)^2 a}{(4-a(1-\beta))^3}. \tag{3.46}$$

Taking the derivative of (3.44) wrt. $\widehat{k}_1$, $\left(\widehat{k}_1\right)^2$, $\widehat{k}_2$ and $\left(\widehat{k}_2\right)^2$, and plugging in (3.45) and (3.46) yields:

$$\begin{aligned} \frac{\partial U^P}{\partial \beta} &= -\frac{2}{9}\frac{(9v-a-13)(3v-4)a}{(4-a(1-\beta))^2} + \frac{4}{9}\frac{(5-2a-a^2-3a^2\beta)(3v-4)^2 a}{(4-a(1-\beta))^3} \\ &\quad + \frac{6}{9}\frac{(3v-4)^2 a^2}{(4-a(1-\beta))^2} \\ &= \frac{2(3v-4)a}{9(4-a(1-\beta))^3}\left[\begin{array}{c} (a+1)(4-a(1-\beta)) \\ +(8a-2-5a^2-3a^2\beta+3a(1-\beta))(3v-4) \end{array}\right]. \end{aligned} \tag{3.47}$$

Using (3.10) the sign of $2(3v-4)a$ can be established to be non-negative. Moreover, it is clear the denominator is positive. Hence, the sign of (3.47) can be

[10] Due to the assumption of symmetry, the foreign tariff will mirror that of the home tariff. Hence, it will be set according to $\tau_2^{po}(k_2) = \frac{(1-k_2+2ak_2)}{3}$.

evaluated from the term in $[\cdot]$. First, it is clear that the first term is strictly positive, whereas the sign of the second term can be both positive or negative depending on the parameter a. The first term is monotonically increasing in β, and the second is monotonically decreasing. Hence, I will make the positive term as small as possible by setting $\beta = 0$, such that the first term becomes $(a+1)(4-a)$. In addition, I will make the potentially negative terms as low as possible by setting $\beta = 1$ such that the second term becomes $(8a - 2 - 5a^2 - 3a^2)(3v - 4)$. Hence, if $\frac{\partial U^P}{\partial \beta} > 0$ it must be the case that:

$$(a+1)(4-a) + \left(8a - 2 - 5a^2 - 3a^2\right)(3v - 4) > 0. \tag{3.48}$$

Notice that the term $(3v - 4)$ is monotonically increasing in v. The condition on the political parameter a in (3.22) implies that $v < \frac{12+7a}{6(a+1)}$. Substituting this into (3.48) it is easy to show that $\frac{\partial U^P}{\partial \beta} > 0$ for $a > 0$.

I proceed by finding an expression for $U^A\left(\tau_1^T, k_1^{ft}, \tau_2^T, k_2^{ft}\right)$. Since there are no contributions from the lobby in the case where the government commits to a free trade agreement, the utility of the government can be evaluated by setting tariffs to zero and plugging in the free trade allocation of capital (4.3) for the two symmetric countries:

$$U^A\left(\tau_1^T, k_1^{ft}, \tau_2^T, k_2^{ft}\right) = v^2 - 2v + 3.$$

This expression is obviously independent of the government's bargaining power, since the government has 'freed' itself from politics. Since $U^P\left(\widehat{\tau}_1, \widehat{k}_1, \widehat{\tau}_2, \widehat{k}_2\right)$ is monotonically increasing in β I can set $\beta = 1$ to obtain the highest value of the utility in the long-run political equilibrium. Substituting the capital allocation from (3.19) into (3.44) and noting symmetry, $\widehat{k}_1 = \widehat{k}_2$, I can express the following:

$$\begin{aligned} U^P\left(\widehat{\tau}_1, \widehat{k}_1, \widehat{\tau}_2, \widehat{k}_2\right)\Big|_{\beta=1} &= -\frac{3}{2}v + \frac{2}{3}a + \frac{8}{9}a^2 - \frac{5}{6}av + \frac{7}{8}v^2 \\ &\quad + \frac{1}{4}av^2 + \frac{1}{2}a^2v^2 - \frac{4}{3}a^2v + \frac{5}{2}. \end{aligned}$$

In order to prove the proposition I thus have to evaluate the following:

$$\begin{aligned} U^A\left(\tau_1^T, k_1^{ft}, \tau_2^T, k_2^{ft}\right) - U^P\left(\widehat{\tau}_1, \widehat{k}_1, \widehat{\tau}_2, \widehat{k}_2\right)\Big|_{\beta=1} &> 0 \\ &\Leftrightarrow \\ -\frac{1}{2}v - \frac{2}{3}a + \frac{1}{2} - \frac{8}{9}a^2 + \frac{5}{6}av + \frac{1}{8}v^2 - \frac{1}{4}av^2 - \frac{1}{2}a^2v^2 + \frac{4}{3}a^2v &> 0. \quad (3.49) \end{aligned}$$

Differentiating this expression wrt. to a and solving yields a unique maximum:

$$a = \frac{4}{3}\left(\frac{2-v}{3v-4}\right).$$

Using the condition on the demand parameter (3.10) it is clear this maximum lies in the interior of the permitted range for a, $\frac{4}{3}\left(\frac{2-v}{3v-4}\right) < \frac{6(2-v)}{6v-7}$. Hence, the smallest values of (3.49) lie on the exterior of the permitted range for a. Substituting $a = 0$ into (3.49) yields:

$$-\frac{1}{2}v + \frac{1}{2} + \frac{1}{8}v^2 > 0.$$

It is direct to verify the sign of this expression using the condition on the demand parameter in (3.10). Substituting the upper bound for a into (3.49) yields:

$$\frac{1}{8}\left(\frac{860v - 719v^2 + 264v^3 - 36v^4 - 380}{(6v-7)^2}\right) > 0.$$

The sign of this expression can also be readily verified using (3.10). **q.e.d.**

3.8.7 Proof of Proposition 3.5

The derivative of (3.35) can be expressed as:

$$\frac{\partial \delta_T}{\partial \beta} = \frac{\frac{\partial (U^D - U^A)}{\partial \beta}\left(U^D - U^P\right) - \frac{\partial (U^D - U^P)}{\partial \beta}\left(U^D - U^A\right)}{\left(U^D - U^P\right)^2}.$$

Noting that $\frac{\partial (U^A)}{\partial \beta} = 0$ this can be rewritten as:

$$\frac{\partial \delta_T}{\partial \beta} = \frac{\frac{\partial (U^D)}{\partial \beta}\left(U^A - U^P\right) + \frac{\partial (U^P)}{\partial \beta}\left(U^D - U^A\right)}{\left(U^D - U^P\right)^2} > 0.$$

In Appendix 3.8.6 I showed that $U^A - U^P > 0$ for every value of a and $\frac{\partial (U^P)}{\partial \beta} > 0$ for $a > 0$. It is also possible to show that $U^D - U^A > 0$. This is because there are at least two gains from deviating from a zero tariff when the other country cooperates. First, setting the tariff at the socially optimal level, τ_1^{so}, distorts the terms of trade in country H's favour, and second, if $\beta > 0$ the government can reap part of the surplus from protection. This can be proved formally by finding explicit expression for U^D and U^A. Substituting the expressions for $\tau_1^{po}\left(k_1^{ft}\right)$, k_1^{ft}, τ_2^T and k_2^{ft} into U^D, and the expressions for τ_1^T, k_1^{ft}, τ_2^T and k_2^{ft} into U^A yields:

$$U^D - U^A = \frac{2}{3} - \frac{2}{3}v + \frac{3}{2}a^2\beta + \frac{2}{3}a^2v^2\beta - 2va^2\beta + \frac{1}{6}v^2. \tag{3.50}$$

It is easy to show that (3.50) is monotonically increasing in β. Hence, the value is lowest when $\beta = 0$. Substituting $\beta = 0$ into (3.50) yields:

$$\frac{2}{3} - \frac{2}{3}v + \frac{1}{6}v^2.$$

It is direct to verify that this is positive using (3.10).

To evaluate the sign of $\frac{\partial (U^D)}{\partial \beta}$ note first that since the capital allocations in, respectively, country H and F, k_1^{ft} and k_2^{ft}, are independent of β[11] as well as the tariffs, $\tau_1^{po}\left(k_1^{ft}\right)$ and τ_2^T, social welfare is independent of β. It thus suffices to consider the effect of β on the level of contributions. From (3.15) I have:

$$aC\left(k_1^{ft}\right) = \left(\frac{1+\beta}{6}\right) a^2 \left(k_1^{ft}\right)^2.$$

Taking the derivative and substituting for k_1^{ft} from (4.3) yield:

$$\frac{\partial\left(U^D\right)}{\partial\beta} = \frac{a^2\left(2v-3\right)^2}{6} > 0.$$

With this information it can be confirmed that $\frac{\partial\delta_T}{\partial\beta} > 0$. **q.e.d.**

[11] By symmetry. $k_2^{ft} = k_1^{ft} = 2v - 3$.

Chapter 4

Inter-industry Capital Mobility and the Political Economy of Trade Liberalisation

4.1 Introduction

The liberalisation of political barriers to trade has been substantial in the post-war era. Average ad valorem tariffs have come down significantly under the auspices of the GATT/WTO, and economic integration has been further deepened by the signing of a countless number of bilateral and regional trade agreements. The present chapter differs from the previous two in that it focuses on the nature of trade liberalisation rather than the causes. It thus assumes that for whichever reason, two countries have made the decision to sign a trade agreement with each other to improve their welfare. Hence, in this chapter, I will analyse issues relating to the path of trade liberation in a trade agreement.

The novel contribution which I make in this chapter lies entirely in the empirical part, and the theoretically framework which I will be using follows the political-economy model in Maggi and Rodriguez-Clare (2007). In that model, very clear and testable predictions are generated, and these can be taken to the data. The aim is to do just that and keep the empirical analyses as closely tied with the theory as possible. The theoretical model offers two motives to grant protection to a domestic importing industry. One is a government's desire to distort terms of trade in its favour by influencing world prices through trade policy, and the other is a domestic commitment problem which comes about through a game which the government plays with owners of capital which are organised in a lobby. In this sense, the model is identical to the one presented in the previous chapter.

Two countries that do not cooperate and distort each other's terms of trade will end up in an undesirable terms-of-trade driven prisoner's dilemma, and if the two governments cooperate they will be able to increase their joint welfare. A trade agreement can serve this purpose by maximising the joint national welfare of the two countries. It is assumed that owners of physical capital in the private sector make investments which are sunk in the short run, that is, in a given period. However, unlike the model in Chapter 3, where capital was perfectly mobile after just one period, there may be frictions in the degree to which capital can move out of one sector and into another. The ease of entry and exit is referred to as inter-industry capital mobility, but it may be assumed that in the long run, that is allowing a sufficient amount of periods to pass capital will eventually be allocated to equalise returns. This creates a dynamic inconsistency in that the trade policy which is optimal in the long-run where capital is, at least eventually, allocated to equalise returns may not coincide with what is optimal once capital is sunk. The government thus suffers from a time-inconsistency problem, and it will have an incentive to obtain a commitment device. It is assumed that a trade agreement is perfectly enforceable internationally, and is able to ensure commitment on the part of the government, and free itself from the protectionist pressures in the domestic political arena. Thus, this model does not consider issues of imperfect enforcement of trade policy which formed the basis of the previous two chapters. The trade agreement has two components: (i) one that solves the international terms-of-trade distortion, and (ii) one that ensures commitment on the part of the government to optimal long-run trade policies.

A dynamic version of the model, which is strictly speaking the one I am testing, predicts that when two countries sign a trade agreement with each other, an immediate tariff cut materialises, which solves the terms-of-trade distortion. This is followed by gradual trade liberalisation, the speed of which is determined by inter-industry mobility of capital. The intuition behind this result is that if factors of production are sunk, capital owners will experience economic losses when confronted with greater competition from a foreign trading partner. However, if factors of production can be reallocated to alternative uses in the economy, capital owners will not suffer losses and carry on employing their endowments of capital elsewhere.

The case study which I have chosen is the free trade agreement signed between the US and Mexico in 1994 through the North American Free Trade Agreement (NAFTA). The theoretical model considers a move from a tariff set in a framework in which two countries do not negotiate with each other over trade policy to a cooperative zero tariff. When choosing an empirical case-study it has therefore been important to find two countries that are suited for this theory. The United States and Mexico experienced little cooperation over trade policy prior to signing a free trade agreement in 1994 and comparing the appropriate period including and after this year provides an excellent empirical case-study. I choose the US as the home country, and consider tariff cuts on imports from Mexico since the signing of NAFTA in 1994. The reason for this is that the data for the US is more complete for all of the empirical variables.

I do not include Canada, which also joined NAFTA in 1994, since the US and Canada can trace their history of trade cooperation back to the Automotive Products Agreement in 1965 as well as through the GATT/WTO framework which is thought to be more favourable to developed countries. For this reason, I do not find US cuts on Canadian products empirically relevant.

I use three variables to empirically capture inter-industry capital mobility. The first is persistence of profits as modelled in Mueller (1990). The idea is that greater persistence in profits is driven by imperfect mobility of capital. Hence, the variable essentially infers inter-industry capital mobility from observed economic behaviour. For that reason, the variable also captures the opportunity cost, which cannot be measure directly, of remaining in a particular industry. The second variable is capital-labour ratios. If it is assumed that capital represents sunk costs, and labour variable costs, it can be inferred that an industry is less mobile the larger is its capital requirements. This variable thus captures the explicit sunk costs of being active in an industry. The measure does not come without problems, since it can be argued that many skilled workers are not very mobile across industries, whereas many types of capital and machinery is. The third variable is the four-firm concentration ratio. It is argued that the larger is the share of total production of the four largest firms the greater is the sunk cost outlay of production. This may seem true at first, but it could also be argued that there is no guarantee that larger firms necessarily employ capital which is less mobile.

Empirically, I follow Bagwell and Staiger (2006) by using the value of net imports to measure the terms-of-trade component of trade liberalisation. The idea behind using this variable is that when net imports are larger, the degree to which countries can distort the terms of trade in their favour is larger.

I find that persistence of profits and capital-labour ratios are statistically significant in terms of explaining the speed of liberalisation of US tariffs on Mexican imports. I employ several econometric models to cross-examine the consistency of my findings, such as panel data methods and a tobit regression. The third measure of inter-industry capital mobility, the four-firm concentration ratio is unable to account for the speed of trade liberalisation.

Net imports are not very successful in terms of accounting for the terms-of-trade component of trade liberalisation, although most specifications have the effect correctly signed and in some cases I obtain a significant effect. I do not necessarily take these results to refute the model's predictions regarding the terms-of-trade component, as the net imports may not be the first best variable to capture terms-of-trade distortions. A measure of the elasticity of export supply would probably be more successful at accounting for the degree to which countries can manipulate their terms of trade as argued in Broda, Limao and Weinstein (2008), and it is only due to data constraints that I do not employ this variable.

Time inconsistency problems are common in economics, and they trace their roots back to Kydland and Prescott (1977) and Fischer (1980). Staiger and Tabellini (1987) and Tornell (1991) are amongst the first to address issues of time inconsistency into the setting of trade policy. Empirically, there is relatively little evidence that time inconsistency problems matter in the setting of trade policy, although Staiger and Tabellini (1999) and Bagwell and Staiger (2006) find some evidence.

In his insightful exposition, Hiscox (2002a) shows how the degree of factor mobility determines political coalitions over trade policy in the 19th and 20th century. For the UK, France, Australia, Sweden, New Zealand and Canada, periods of high factor mobility are associated with protectionist pressures from the political parties representing the scarce factors of production whereas in periods of low factor mobility political coalitions over trade policy follow industry-specific interests and there is larger disagreement over trade policy within political parties.

This is to be expected as when factors of production are more mobile the economy can to a larger extent be approximated by a Hechscher-Ohlin framework in which the scarce factor stands to lose from trade liberalisation (Stolper-Samuelsen effects). In periods of low factor mobility the Ricardo-Viner model (which models sector-specific factors) is more appropriate as a description of the economy, and coalitions should then be expected to follow industry lines. The periods which Hiscox (2002a) identifies as having low factor mobility are the early 19th century and the last half of the 20th century. Transport and communication costs were high in the early 19th century which inhibited factor mobility. Towards the end of the 19th century and early 20th century lower transport and communication costs facilitated mobility of factors. But towards the 1950s industries began to employ labour and capital which were more sector specific.

Hiscox (2002b) tests whether industries with higher factor mobility have lower protection in a non-cooperative (i.e. without a trade agreement) framework. As a measure of factor mobility he uses financing choices. If the financing of a firm is mainly by borrowing the sector is considered more mobile, but if a large part of the financing is by equity Hiscox (2002b) infers that there would be a larger interest premium for borrowing because the investment is more sector specific. Based on this measure he finds the opposite of what the model in Maggi and Rodriguez-Clare (2007) would predict: that firms with higher factor mobility receive higher protection. He concludes that this could be evidence for a home market effect: perhaps having higher factor mobility imposes a larger threat of exiting a country to produce somewhere else, and the government would then grant protection to keep the firm in the home market. The novelty of the present framework, however, is the testing of a domestic commitment motive based on factor mobility in a co-operative framework, i.e. in a framework in which trade policy is set cooperatively in an agreement. To the best of my knowledge, this prediction has not been taken to the data as of yet.

Terms-of-trade distortions figure prominently in theoretical economic models, Johnson (1953) being the first to identify the issue. The idea is further developed in Grossman and Helpman (1995) and Bagwell and Staiger (1999, 2001). Not until recently, however, has the empirical literature caught up with the theoretical advances. Recent papers by Broda, Limao and Weinstein (2008), Bagwell and Staiger (2006) and Ludema and Mayda (2010) provide strong evidence for terms-of-trade manipulations in trade policy. This stands in contrast to the findings in the present chapter, which does not provide conclusive evidence for terms-of-trade manipulations.

The chapter is organised as follows. In Section 4.2 I present the basic ingredients of the model. In Section 4.3, I present details of the non-cooperative equilibrium, before Section 4.4 describes equilibria with a trade agreement. In Section 4.5, I provide an intuitive discussion of a continuous-time extension of the model. In Section 4.6 I explain my empirical strategy for estimating the model, and Section 4.7 follows up with an account of the empirical variables measuring inter-industry capital mobility. Section 4.8 describes the data, and Section 4.9 provides the results. I conclude with some remarks in Section 4.10.

4.2 The model

The basic model in Maggi and Rodriguez-Clare (2007) is set in two periods. Strictly speaking, it is not this simple two-period model which I am testing empirically, but a full dynamic version. However, as the continuous time extension is more involved mathematically, I find it appropriate to present the two-period model analytically and the dynamic one intuitively. I refer the reader to the original paper for an elaborate analytical exposition of the dynamic model. The basic ingredients of this model are similar to the model in the previous chapter, but since

I am considering very different issues in the present chapter, I have changed most of the notation to make it more appropriate for the issues discussed here.

In the basic two-period model, there are two large countries Home (H) and Foreign (F) which are able to influence world prices through trade policies. They each produce three goods: one freely traded numeraire good and two manufacturing goods (M_1 and M_2). There are two types of capital, M_1 is produced one-for-one with type 1 capital and M_2 is produced one-for-one with type 2 capital in each country. The technology to produce the numeraire good differs in the two countries: H uses type 1 capital one-for-one to produce this good and F uses type 2 capital one-for-one. It is assumed that each country is endowed with one unit of each type of capital. Because of this, $H(F)$ is not able to allocate any of its one-unit endowment of type 2 capital (type 1 capital) to other uses than to the production of $M_2(M_1)$ and its production possibilities frontier is then fixed at 1 for this good. However, since $H(F)$ can allocate its one-unit endowment of type 1 capital (type 2 capital) in both the numeraire sector and the M_1-sector (M_2-sector) the production choice in (N, M_1)-space ((N, M_2)-space) will be determined by demand conditions. This ensures that H is a natural importer of M_1 and F is a natural importer of M_2. Preferences are given as the following quasi-linear utility function[1]:

$$U = c_N + \sum_{i=1}^{2} u(c_i),$$

where c_i denotes consumption of manufacturing good i. It is assumed that the utility of each manufacturing good is $u(c_i) = vc_i - \frac{c_i^2}{2}$ which is the same across countries. Hence, demand of the manufacturing goods, which is derived from marginal utility, is $d(p_i) = v - p_i$, and from this consumer surplus can be derived

[1] I argued in Chapter 3. that one of the advantages of a quasi-linear utility function is that it eliminates income effects as well as cross-price effects on demand. This is essentially breaking up a general equilibrium model into partial equilibria and, by implication, consumer welfare can then be measured in terms of surplus derived from the manufacturing sectors. This also allows for an easy extension to multiple import-competing sectors as they can be included additively and separably.

simply as $s(p_i) = u(d(p_i)) - p_i d(p_i)$. H imposes a specific tariff equal to τ on imports of M_1 and F imposes a tariff equal to τ^* on imports of M_2 in F. The domestic prices of the two goods are then, respectively, $p_1 = p_1{}^* + \tau$ and $p_2{}^* = p_2 + \tau^*$. H and F invest an amount $k(k^*)$ in the manufacturing sector M_1 (M_2) and the remaining one unit endowment of type 1 capital (type 2 capital) is invested in the two countries' respective numeraire sectors. Because of the assumption of large countries the supply and demand conditions in one country will have an impact on world prices. Prices in H and F of goods M_1 and M_2 are thus determined by international market-clearing conditions given by $d(p_1) + d(p_1{}^*) = k+1$ and $d(p_2) + d(p_2{}^*) = k^*+1$. Isolating prices in these conditions provides neat expressions for prices in H and F, respectively, of goods M_1 and M_2, respectively:

$$
\begin{aligned}
p_1(\tau, k) &= v - \frac{1}{2}(k + 1 - \tau); \qquad (4.1)\\
p_2(\tau^*, k^*) &= v - \frac{1}{2}(k^* + 1 + \tau^*);\\
p_1{}^*(\tau, k) &= v - \frac{1}{2}(k + 1 + \tau); \qquad (4.2)\\
p_2{}^*(\tau^*, k^*) &= v - \frac{1}{2}(k^* + 1 - \tau^*).
\end{aligned}
$$

Notice that since H is a natural importer of M_1 the price of this good is increasing in the tariff it imposes, whereas the price of its exporting good, M_2, is decreasing in the tariff which the foreign country imposes on this good. It is also possible to write imports as a function of the tariff and capital allocation by noting that imports are given by excess demand over domestic production, $m_1 = d(p_1) - k$ for H and $m_2{}^* = d^*(p_2{}^*) - k^*$ for F, which is $m(\tau, k) = \frac{1}{2}(1 - k - \tau)$ and $m^*(\tau^*, k^*) = \frac{1}{2}(1 - k^* - \tau^*)$, respectively. The welfare in the two countries (or the utility of the representative agent) is given by capital income, tariff revenue and consumer surplus which for H and F, respectively, can be written as:

$$\begin{aligned} w(\tau, k, \tau^*, k^*) &= [(1-k)] + [p_1(\tau, k)k + \tau m_1(\tau, k) \\ &\quad + s_1(\tau, k)] + [(p_2(\tau^*, k^*) + s_2(\tau^*, k^*)]; \end{aligned}$$

$$\begin{aligned} w^*(\tau, k, \tau^*, k^*) &= [(1-k^*)] + [p_2{}^*(\tau^*, k^*)k^* + \tau^* m_2{}^*(\tau^*, k^*) \\ &\quad + s_2{}^*(\tau^*, k^*)] + [p_1{}^*(\tau, k) + s_1{}^*(\tau, k)], \end{aligned}$$

where s_i and $s_i{}^*$ denote their respective consumer surplus from consuming manufacturing good i. In order to make the analysis simpler, notice from the expression for home welfare that the terms in the first two brackets depend only on the home tariff, τ, and the home capital allocation, k, whereas the term in the last bracket depends only on the foreign tariff, τ^*, and the foreign capital allocation, k^*. This additive separability also applies to the expression for foreign welfare. Since it is assumed that preferences and the production structure are symmetric, this separability implies that it is possible to focus on the importing sector in H, that is sector M_1, knowing that the analysis for the other sector will be its mirror image. It is therefore possible to drop subscripts and focus on the equilibrium in the importing sector M in the home country. I shall adopt this notation in the rest of this chapter.

The welfare of H and F can now be written as functions of the home tariff and capital allocation:

$$W(\tau, k) = (1-k) + p(\tau, k)k + \tau m(\tau, k) + s(\tau, k) + [.];$$

$$W^*(\tau, k) = p^*(\tau, k) + s^*(\tau, k) + [.],$$

where the terms in brackets do not depend on τ and k.

The political side of the model follows closely that of Grossman and Helpman (1994). Capital owners in the import-competing sector are organised as a lobby and effectively buy protection in exchange of political contributions to the incumbent government. It is assumed that the political structure is symmetric across the two countries. Total contributions from the lobby to the government are denoted C and contributions per-unit of capital are denoted c, such that $C = ck$. The utility of the home government depends on welfare of the home country and contributions from the lobby. The government attaches weight of a to welfare so the total utility of the government becomes $U^G = aW(\tau, k) + C$. The utility of the lobby depends negatively on contributions so $U^L = p(\tau, k)k - C$. The tariffs and contributions which obtain will depend on whether the home country engages in independent trade policies or choose to set trade policy in a cooperative manner with the foreign government.

Before characterising the non-cooperative equilibrium, it will be useful to consider the equilibrium under free trade. In this equilibrium arbitrage ensures that returns across the numeraire and the M-sector are equalised for zero tariffs. This implies that the returns per unit of capital in the M-sector must be equal to one. Hence, I can solve for the allocation of capital from the following condition, $p_1(0, k_1) = 1$. Using (4.1) evaluated at $\tau = 0$, this can be solved as:

$$k^{ft} = 2v - 3. \tag{4.3}$$

For a positive allocation of capital to both the numeraire and the M-sector, k^{ft} must be greater than zero and less than one. To ensure this I impose, throughout the rest of this chapter, the following condition on the demand parameter v:

$$\frac{3}{2} < v < 2. \tag{4.4}$$

In the next subsection I shall outline the case of non-cooperative trade policies, and then proceed to trade policies set in a perfectly enforceable agreement.

4.3 The non-cooperative equilibrium

4.3.1 The short run

If the two countries choose not to cooperate over trade policy they end up in an undesirable non-cooperative equilibrium which will be discussed in detail in this section. The tariff which is chosen maximises the joint surplus of the government and the lobby taking the capital allocation as given. In the long run, however, the capital allocation is endogenously given by expectations of future protection. This gives rise to a commitment problem which comes about because the government and the lobby make decisions about tariffs and capital allocations simultaneously. If the government had a first-mover advantage the commitment problem would not arise. The situation can be seen as a simultaneous-move game set in two stages. In the first stage, investors allocate their capital given the expectations of future protection, and in the second stage the government and the lobby bargain efficiently over an import tariff and a level of contributions. The solution can be found by backward induction, so I begin the analysis by solving for the tariff in the second stage of the game, which defines the short-run equilibrium. The tariff maximises the joint welfare of the government and the lobby:

$$J^{SR} = aW(\tau, k) + p(\tau, k)k. \tag{4.5}$$

Solving yields:

$$\tau = \tau^J(k) \equiv \left(\frac{1}{3}\right)\left(1 - k + \frac{2k}{a}\right). \tag{4.6}$$

(4.6) can be split into two terms, $\frac{1-k}{3}$ and $\frac{2k}{3a}$. The first is a terms-of-trade motive for imposing a tariff. As it is assumed that the two countries are large, the home country is able to pass-through some of the cost of protection by manipulating world prices. The larger the supply difference of the manufacturing good[2], $1-k$, the higher the incentive to do so as the volume of imports is larger in that case. The other term is weighted by the inverse of a, implying that it captures the political influence of the lobby. This political motive for imposing the tariff is larger when the sector is larger (larger k) and when the inverse of a is larger. The national welfare-maximising tariff is obtained when the government places no weight on the welfare of the lobby. Hence:

$$\tau^W(k) = \lim_{a\to\infty} \tau^J(k) \equiv \left(\frac{1-k}{3}\right) \tag{4.7}$$

4.3.2 The long run

It is now possible to move one step back in the backward induction analysis to find the allocation of capital and the tariff in the long-run equilibrium. Unlike the model in Chapter 3, it is assumed that the lobby has all the bargaining power in the model so the contributions necessary to induce the government to choose a particular trade policy should just compensate the government for the distortion caused by the policy. Since in the absence of lobbying the government would set the tariff at $\tau^W(k)$ in (4.7), the total contribution should equal the welfare loss which the government incurs from deviating from the national welfare-maximising tariff and setting the tariff at $\tau^J(k)$ from (4.6) instead. Thus, the contribution per-unit of capital is given by:

[2]Recall the foreign supply is fixed at 1.

$$\frac{C(\tau,k)}{k} = c(\tau,k) = \frac{a[W\left(\tau^W(k),k\right) - W(\tau,k))}{k} = \left(\frac{3a}{8k}\right)(\tau - \tau^w(k))^2. \quad (4.8)$$

It is not necessary to define this function where τ is less than τ^W because the lobby is not willing to pay the government for a tariff lower than what would be chosen in the absence of lobbying. It is now possible to determine the long-run equilibrium. In the long run, two conditions must be satisfied: (i) the tariff is set at $\tau^J(k)$ from (4.6), and (ii) the return to the manufacturing sector net of contributions must equal the return to capital in the numeraire sector which is 1. Thus,

$$\tau = \tau^J(k), \quad (4.9)$$

$$p(\tau,k) - c(\tau,k) = 1. \quad (4.10)$$

(4.10) is an implicit function in (τ, k)-space and it can conveniently be denoted as $k^{er}(\tau)$. The long-run equilibrium is given as the intersection between $\tau^J(k)$ and $k^{er}(\tau)$. Let the capital allocation and tariff at this intersection be denoted $(\widehat{k}, \widehat{\tau})$. It will also be useful to consider the point of intersection of $k^{er}(\tau)$ and $\tau^W(k)$ and I will denote this by (k^W, τ^W). This is the tariff which obtains if the home government could free itself from the pressure exerted by the lobby (a first-mover advantage or a commitment strategy) unilaterally[3]. The equilibrium is illustrated in Figure 4.1. In order to ensure that the long-run equilibrium exists and that it is unique, I impose the following condition on the parameter a:

$$a > \frac{6v - 7}{6(2 - v)}. \quad (4.11)$$

[3]Unilateral trade liberalisation was analysed in Chapter 3, in a framework where dynamically efficient trade policy had to be sustained by a reputational mechanism.

In Appendix 4.11.1, I prove the following proposition:

Proposition 4.1: *If* $a > \frac{6v-7}{6(2-v)}$ *there exists a unique long-run equilibrium, where each country imposes a positive but non-prohibitive tariff equal to* $\widehat{\tau}$*.*

The shape of the $k^{er}(\tau)$-curve is such that it is increasing in k below $\widehat{\tau}$ and decreasing in k above it: since entry into the M-sector reduces the return to capital, there will be a unique optimal allocation of capital at the intersection with the $\tau^J(k)$-curve. The free trade allocation of capital is chosen such that it coincides with the origin of the diagram. If the government was able to set a tariff only to maximise national welfare it would choose (k^W, τ^W) but the pressure of the lobby forces the equilibrium to the point $(\widehat{k}, \widehat{\tau})$. The tariff-capital pair $(\widehat{k}, \widehat{\tau})$ lies above (k^W, τ^W), which lies above $(k^{ft}, 0)$. The difference between $(\widehat{k}, \widehat{\tau})$ and (k^W, τ^W) can be thought of as the part of the tariff which is politically motivated, and the difference between (k^W, τ^W) and $(k^{ft}, 0)$ is the part of the tariff motivated by the government's desire to switch the terms of trade in its favour.

4.4 Equilibria with a free trade agreement

From the preceding analysis it is clear that when the government and the lobby maximise their joint surplus with respect to τ the government fails to take into account the endogeneity of k. The result is an overinvestment problem which derives from the government's lack of ability to credibly commit *not* to engage in this implicit contractual relation with the lobby. The government is fully compensated for the short-run trade distortion associated with protection, but because of the long-run capital allocation distortion the government has an incentive to obtain a commitment strategy. If a free trade agreement is able to impose a

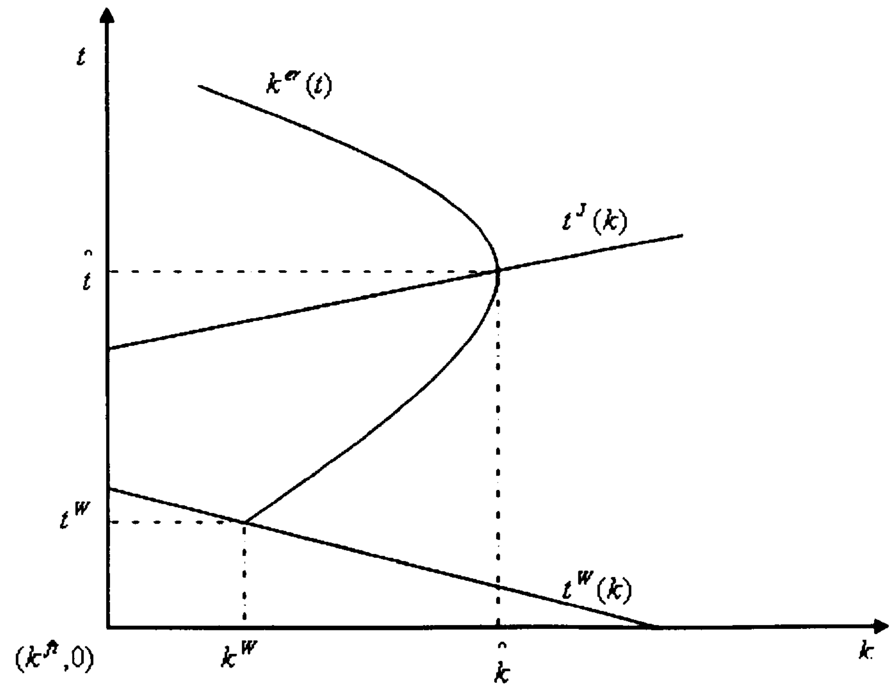

Figure 4.1: The non-cooperative equilibrium.

binding contractual commitment which can free the government from the political pressure exerted by the lobby, the government has an incentive to take this opportunity. I assume that a free trade agreement is indeed perfectly enforceable, and that the government is then able to use a free trade agreement to internalise the externalities of independent and non-cooperative trade policies.

Maggi and Rodriguez-Clare (2007) consider agreements that specify exact tariffs and agreements that specify tariff ceilings. The difference between the two cases lies in the fact that if agreements specify exact tariffs there will be no ex-post lobbying as the tariff is fixed at the level set by the agreement. If agreements specify ceilings, on the other hand, there is a case for ex-post contributions. They argue that tariff ceilings are weakly preferred to exact tariffs as ex-post lobbying contributions mitigate the overinvestment problem by lowering the return to the import-competing sector. In the present exposition of the model, I shall focus on tariff ceilings such that if $\overline{\tau}$ is the tariff ceiling set by the agreement, the chosen tariff in the home country will have to be $\tau \leq \overline{\tau}$, and symmetrically for the foreign country.

The trade agreement is analysed in a two-period framework, and in period 1 the government gets an opportunity to sign a free trade agreement. It is assumed that the agreement is unanticipated, so the behaviour of the lobby and the government in the post-agreement stage is similar to the non-cooperative equilibrium. After the agreement is signed the lobby will reallocate capital in expectation of future protection, but the difference is that protection is now constrained by the agreement. The ability to reallocate capital may not be perfect, however, and a key parameter of the model is the degree to which capital can move from the manufacturing sector to the numeraire sector. In the continuous-time version of Maggi and Rodriguez-Clare (2007) they also consider agreements that are anticipated which implies that some capital reallocation can occur before the signing of the agreement. I abstract from this possibility in the present chapter. The fact that the agreement is unanticipated is an assumption which ensures simple yet informative results in the two-period model. In order to consider anticipated agreements it would be necessary to construct a full dynamic version of the model. I refer the interested reader to Maggi and Rodriguez-Clare (2007) for an analystical exposition of this extension, but I will comment on how the results of that model differ from the two-period model below.

If capital can be perfectly reallocated in period 2, the lobby does not derive any rents from protection. However, if capital is entirely fixed, capital owners have an incentive to lobby for some protection in the agreement. The trade agreement maximises the welfare of the lobbies and the two governments. I assume that owners of capital in the foreign country do not influence the formation of the the tariff in country H and vice-versa (recall that the production of the manufacturing good in the foreign country is fixed at 1 as is also the case in H's exporting sector by symmetry). The trade agreement will maximise the following objective with respect to a tariff ceiling $\overline{\tau}$:

$$\Psi = U^G + U^L + U^{G^*} + U^{L^*} \tag{4.12}$$

This can be viewed as a game with the following timing:

(i) the agreement is selected,

(ii) if feasible capital is reallocated in expectation of future protection (constrained by the agreement), and

(iii) the government and the lobby in the home country choose a tariff in the import-competing sector subject to the constraints set by the agreement (and symmetrically in the foreign import-competing sector).

I will solve for the equilibrium tariff by backward induction and, thus, begin the analysis in the final stage of the game and work back to the first stage. Thus, I will first find the equilibrium tariff and contributions expressed, respectively, as functions of the tariff ceiling and capital allocation, $\tau(\overline{\tau}, k)$ and $c(\overline{\tau}, k)$. Then I can move one step back in the backward induction analysis to the second stage in order to find the optimal capital allocation as a function of the tariff ceiling, $k^{er}(\overline{\tau})$. Finally, I end up in the first stage of the game where the objective of the agreement, (4.12), can be expressed as a function of the tariff ceiling, which can then be solved for.

Stage (iii)

Prior to the agreement the home country finds itself in the long-run equilibrium with capital given by $\widehat{k}$ and tariff equal to $\widehat{\tau}$, and symmetrically for the foreign country. It is assumed that after the agreement is signed in period 1, capital owners are able to exit the import-competing sector in period 2 with probability z. If $z = 1$ all capital is able to exit but if $z = 0$ all capital is stuck. Regardless of the value of z, capital is fixed in period 1 and as such capital mobility refers to long-run mobility. The more realistic case $0 < z < 1$ refers to imperfect mobility of capital. If capital is fixed the amount of capital in period 2 is unchanged at $\widehat{k}$, but if capital is imperfectly mobile, the period 2 capital allocation is stuck at $k_z = (1 - z)\widehat{k}$. The objective of the free trade agreement (4.12) can be written as:

$$\Psi(\tau, k) = aW(\tau, k) + aW^*(\tau, k) + kp(\tau, k) + \widehat{k} - k. \tag{4.13}$$

The first two terms on the right-hand-side capture the welfare of the governments of H and F, the third is the welfare of the lobby, and the last captures the rents of those capital owners in the import-competing sector that move to the numeraire sector. Compared with (4.5), only two terms are added: foreign welfare, $aW^*(\tau, k)$, takes account of the terms-of-trade externality, and $\widehat{k} - k$ takes account of the welfare of those capital owners that are able to switch to the numeraire sector. This last term is added because a trade agreement gives the government a first-mover advantage. The government gets an opportunity to choose a tariff (jointly with the lobby and the foreign government) which maximises joint welfare, and because the agreement is set *before* capital is reallocated the commitment problem is internalised.

If the tariff ceiling is greater than $\tau^J(k)$ in (4.6), then it is not binding and thus redundant. Because if the constraint of the agreement is greater than the tariff set non-cooperatively, this amounts to no constraint at all, and the outcome of the post-agreement lobbying will be to choose the tariff $\tau^J(k)$, as in the non-cooperative equilibrium. However, if $\overline{\tau} < \tau^J(k)$ the bargaining that takes place between the governments and the lobby will be subject to a binding constraint.

Thus, the chosen tariff will be $\tau(\overline{\tau}, k) = \min(\overline{\tau}, \tau^J(k))$. I restrict the analysis to the case where $\overline{\tau} \leq \tau^J(k)$. If the tariff ceiling is less than $\tau^W(k)$ there will be no contributions, as capital owners will not pay the government for imposing a tariff lower than what would be chosen in the absence of lobbying. However, if $\overline{\tau} \geq \tau^W(k)$ contributions will be similar to (4.8), the only difference being that tariffs are constrained by the ceiling set by the agreement:

$$c(\overline{\tau}, k) = \left(\frac{3a}{8k}\right)(\overline{\tau} - \tau^w(k))^2.$$

Stage (ii)

It is now possible to move one step back to the second stage of the game to solve for the optimal capital allocation in period 2. If capital is not fixed, and a sufficient amount of capital is mobile, the allocation is determined by the equal-returns condition (4.14), which is now given as:

$$p(\overline{\tau}, k) - c(\overline{\tau}, k) = 1. \tag{4.14}$$

Let $k^{er}(\overline{\tau})$ denote the solution to this implicit function. Notice that $k^{er}(\overline{\tau})$ is a curve with slope equal to 1 for $\overline{\tau} < \tau^W(k)$ as no political contributions are paid in that case (in this region it is defined by $p(\overline{\tau}, k) = 1$). If a sufficient amount of capital is stuck, however, the solution to the problem may not lie on $k^{er}(\overline{\tau})$, as will be clear below.

Stage (i)

I continue the backward induction analysis and go one step back to the first stage of the game. To do so, I rewrite (4.13) more conveniently by adding and subtracting total contributions $ck = C$, noting that net contributions to capital equal 1:

$$\Psi(\tau, k^{er}(\overline{\tau})) = aW(\tau, k^{er}(\overline{\tau})) + aW^{*}(\tau, k^{er}(\overline{\tau})) + C(\overline{\tau}, k^{er}(\overline{\tau})) + \widehat{k} \tag{4.15}$$

If $\overline{\tau} \geq \tau^{W}(k)$ contributions are positive and since the lobby pays contributions that just compensate the government for the distortion associated with protection, I can substitute

$$aW(\tau, k^{er}(\overline{\tau})) + C(\tau, k^{er}(\overline{\tau})) = aW(\tau^{W}(k^{er}(\overline{\tau}), k^{er}(\overline{\tau})),$$

into (4.15). If $\overline{\tau} < \tau^{W}(k)$ contributions will be zero and the objective of the trade agreement will just be the one given in (4.15) with total contributions set equal to zero. Summarising:

$$\Psi(\overline{\tau}, k^{er}(\overline{\tau})) = \left\{ \begin{array}{cc} aW(\tau^{W}(k^{er}(\overline{\tau}), k^{er}(\overline{\tau})) + aW^{*}(\tau, k^{er}(\overline{\tau})) + \widehat{k} & \text{for } \overline{\tau} \geq \tau^{W} \\ aW(\tau, k^{er}(\overline{\tau})) + aW^{*}(\tau, k^{er}(\overline{\tau})) + \widehat{k} & \text{for } \overline{\tau} < \tau^{W} \end{array} \right\} \tag{4.16}$$

In Appendix 4.11.2, I show that (4.16) is decreasing in τ, which will be important for the analysis below. It is possible to decompose the optimal agreement into its terms-of-trade and political components. If, say the home government, for some reason was able to obtain a first-mover advantage and was able to commit vis-à-vis the home lobby it would not need a trade agreement to solve the political distortions in the domestic arena. In this case the only motive for signing a trade agreement would be to rid the distortions due to the two countries' optimally exploiting their monopoly power over terms of trade. The unilateral tariff that would be chosen in this case would maximise the following:

$$J^{DC}(\overline{\tau}, k) = aW(\tau, k) + kp(\tau, k) + \widehat{k} - k. \tag{4.17}$$

The only difference between (4.13) and (4.17) is that the home government does not negotiate with the foreign government and terms-of-trade externalities are neglected. Following the same three-stage procedure that took me from (4.12) to (4.16), I can rewrite (4.17) as:

$$\Psi(\overline{\tau}, k^{er}(\overline{\tau})) = \left\{ \begin{array}{ll} aW(\tau^W(k^{er}(\overline{\tau}), k^{er}(\overline{\tau})) + \widehat{k} & \text{for } \overline{\tau} \geq \tau^W \\ aW(\tau, k^{er}(\overline{\tau})) + \widehat{k} & \text{for } \overline{\tau} < \tau^W \end{array} \right\} \tag{4.18}$$

The next thing to do is to determine how these optimal agreements depend on the degree of mobility of capital. I begin by analysing the two polar cases of perfectly mobile capital ($z = 1$) and fixed capital ($z = 0$), and finish up with the more realistic case of imperfectly mobile capital.

4.4.1 Perfectly mobile capital

When capital is perfectly mobile any excess rents obtained from protection will be eroded by the optimal reallocation of capital. Because of this capital owners are not willing to pay the government for any protection in period 2. With this in mind, I can proceed by maximising (4.16) taking into account that k is determined by the equal-returns condition. The tariff ceiling set by the agreement then becomes:

$$\overline{\tau}^A = 0,$$

that is, free trade regardless of the value of a. It is possible to decompose this tariff cut into its terms-of-trade and political components. If the home country was somehow able to commit vis-à-vis the lobby it would choose the tariff τ^W which maximises national welfare without negotiating with the foreign government. Hence, it would maximise (4.18), and the tariff becomes:

$$\tau^W = 1 - \frac{v}{2}.$$

The case of perfect mobility of capital is illustrated in Figure 4.2. The equal-returns curve, $k^{er}(\overline{\tau})$, coincides with $k^{er}(\tau)$ in Figure 4.1 anywhere above the $\tau^W(k)$-curve, and below it, it is a straight line with slope equal to one. The trade agreement involves a zero tariff and capital is given by its free trade allocation, k^{ft}. The political part of the agreement is simply the difference between the tariff-capital pair $(\widehat{\tau}, \widehat{k})$ in the non-cooperative equilibrium, and the tariff-capital pair which maximises national welfare (τ^W, k^W). However, if the maximisation problem also involves foreign welfare, the equilibrium is given as capital-tariff pair $(k^{ft}, 0)$. This pair rids all externalities of protection, both domestically and internationally.

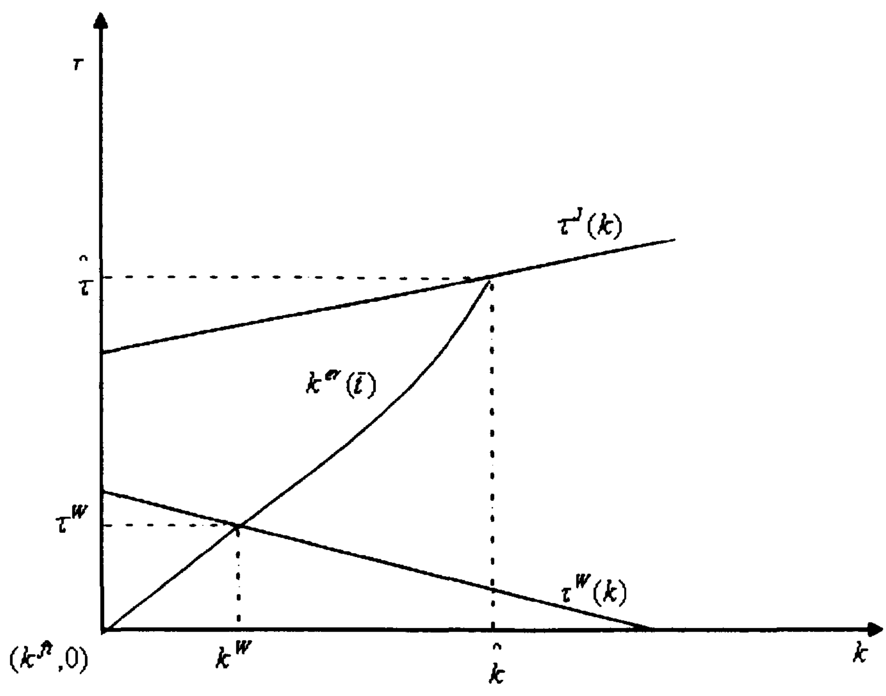

Figure 4.2: The trade agreement when capital is perfectly mobile.

4.4.2 Fixed capital

The case of fixed capital is particularly simple as no capital can exit the import-competing sector, and the amount of capital is then given as the level set in the non-cooperative equilibrium $\widehat{k}$. Thus, it suffices to maximise (4.13) taking $\widehat{k}$ as given. This yields:

$$\tau^{\Psi}(k) = \arg\max_{\overline{\tau}} \Psi(\overline{\tau}, k) = \frac{k}{a}. \tag{4.19}$$

In the case of fixed capital I can also decompose the tariff cut into its terms-of-trade and political components. If it is assumed that the home country gets a commitment strategy that enables it to internalise the political externality, then it will be able to set a tariff that maximises national welfare. In this case it just maximises (4.17). Since k is fixed at $\widehat{k}$ the remaining terms are the same as in (4.5). The tariff will then be $\widehat{\tau} = \tau^J(\widehat{k})$, just as if there was no agreement at all. Thus, if capital is fixed, a domestic commitment mechanism will not achieve any tariff reductions, and the only motive for entering a trade agreement is to rid the distortions due to the two countries' exploiting their monopoly power over terms of trade in the non-cooperative equilibrium.

4.4.3 Imperfectly mobile capital

The case of imperfectly mobile capital connects the dots between the extreme case of perfectly mobile capital and that of fixed capital. The proportion of capital which is able to exit is $z \in [0;1]$. As in the case of perfect capital mobility I maximise the objective of the agreement in (4.16) with respect to $\overline{\tau}$, noting that only a proportion of $k_z = (1-z)\widehat{k}$ is able to leave the importing sector. If enough capital is able to exit the import-competing sector to equalise returns between that sector and the numeraire sector, the capital allocation will be $k^{er}(\overline{\tau})$ derived from (4.14), but if this is not the case the capital allocation will be fixed at k_z.

Thus, I can define the equilibrium capital allocation as $\tilde{k}^{er}(\overline{\tau}) \equiv \max\{k^{er}(\overline{\tau}), k_z\}$. It is now possible to connect the two extreme cases of perfect capital mobility and fixed capital. Let $\overline{\tau}^{er}(k)$ denote the inverse of $k^{er}(\overline{\tau})$. The fact that (4.16) is decreasing in $\overline{\tau}$, which is proved in Appendix 4.11.2, is important for the tariff which obtains since this implies that the tariff will be the smaller of $\overline{\tau}^{er}(k)$ and $\tau^{\Psi}(k)$ where the latter is defined by (4.19). Therefore, I can summarise the tariff for the case of imperfect capital mobility as:

$$\overline{\tau}^{A} = \min(\overline{\tau}^{er}(k), \tau^{\Psi}(k)) \text{ for } k \geq k^{ft} \text{ and } \overline{\tau}^{A} = 0 \text{ for } k < k^{ft}.$$

Thus, if z is small and not enough capital can exit the import-competing sector to equalise returns, the tariff will be given by:

$$\tau^{\Psi}(k) = \frac{k_z}{a} = \frac{(1-z)\widehat{k}}{a}. \tag{4.20}$$

(4.20) is clearly decreasing in z. However, if a sufficient amount of capital can exit to equalise returns the tariff-capital pair will lie somewhere on the equal-returns curve, $\overline{\tau}^{er}(k)$. Using the expression for the price of the importing good in country H (4.1) and the contribution function (4.8) in (4.14) this is given by:

$$\overline{\tau}^{er}(k) = \left\{ \begin{array}{c} v - \frac{1}{2}(1 + k - \overline{\tau}) - \left(\frac{3a}{8k}\right)(\overline{\tau} - \tau^{w}(k))^2 - 1 \text{ for } \overline{\tau} > \tau^{W}; \\ \\ v - \frac{1}{2}(1 + k - \overline{\tau}) - 1 \text{ for } \overline{\tau} \leq \tau^{W}. \end{array} \right\} \tag{4.21}$$

Setting $k = k_z = (1 - z)\widehat{k}$ it can be verified that $\overline{\tau}^{er}(k)$ is also decreasing in z.

In Figure 4.3, I depict the tariff-capital line $\tau^{\Psi}(k)$ given by (4.20) as well as the $\tau^{er}(k)$-curve in (4.21). As z increases from 0 (fixed) to 1 (perfectly mobile), the tariff-capital pair travels from point A on the $\tau^{\Psi}(k)$-curve to the point of intersection between the $\tau^{\Psi}(k)$-curve and the $\tau^{er}(k)$-curve labelled point B, and then down the $\tau^{er}(k)$-curve until the free trade point is reached. Consider the capital allocation k_z'. In this case the tariff lies on the $\tau^{\Psi}(k)$-curve as the allocation k_z' is not sufficient to equalise returns across the two sectors. This is not the case for the point k_z'' which lies on the equal-returns curve. Hence, the model makes the following prediction:

Proposition 4.2: *trade liberalisation is deeper when capital is more mobile as summarised by the parameter z.*

In the case of imperfectly mobile capital it is also possible to decompose the effects of the terms-of-trade and the political components of trade liberalisation. Recall that when capital is perfectly mobile the optimal tariff-capital pair when the home government is able to commit unilaterally is (τ^W, k^W), but if capital is fixed it is the same as the non-cooperative pair $(\widehat{\tau}, \widehat{k})$. When capital is imperfectly mobile the unilateral tariff with domestic commitment just travels from $(\widehat{\tau}, \widehat{k})$ to (τ^W, k^W) along the equal-returns curve with the parameter z_i. Thus, along the segment of the $\tau^{\Psi}(k)$-curve which lies below the $\tau^{er}(k)$-curve, the difference between these curves is the terms-of-trade component of trade liberalisation, whereas the political component takes the tariff from $\widehat{\tau}$ to the appropriate point on the $\tau^{er}(k)$-curve. On this last point it is important to bear in mind that for small z (i.e. when $\tau^{\Psi}(k)$ lies below $\tau^{er}(k)$) the terms-of-trade component of the trade agreement is also decreasing in z as the gap between $\tau^{\Psi}(k)$ and $\tau^{er}(k)$ becomes smaller as z increases from 0. So when z is small the degree of capital mobility may also have an effect on the terms-of-trade component.

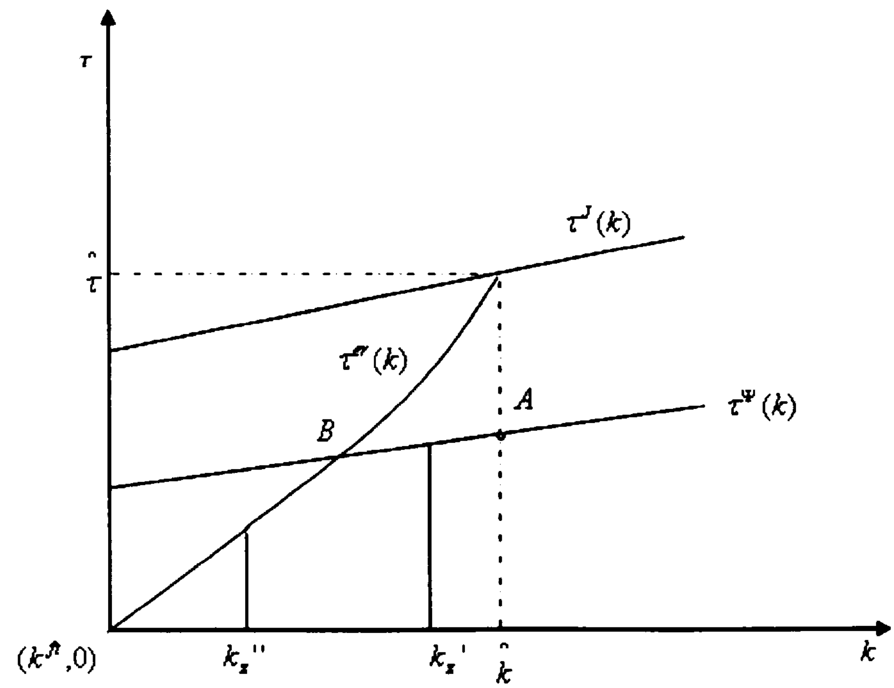

Figure 4.3: The trade agreement when capital is imperfectly mobile.

4.5 Extension to dynamic setting

The basic two-period model in Maggi and Rodriguez-Clare (2007) is a reduced-form of a full dynamic model. The full dynamic model is essentially the model which I am testing in the empirical part of this chapter. For full details of this extension I refer to the original paper, but I shall here describe it without the use of math. The major difference between the two versions is that the dynamic version makes a prediction regarding the *speed* rather than *extent* of trade liberalisation. Consider Figure 4.3. If at some point in time, the home government signs a trade agreement with the foreign government there will be an instantaneous drop in the tariff from the non-cooperative level $\hat{\tau}$ to point A which lies on the $\tau^{\Psi}(k)$-curve. This instantaneous drop is due to the terms-of-trade component of trade liberalisation. After this there will be two phases of gradual trade liberalisation.

In the first phase the tariff travels along from point A on the $\tau^{\Psi}(k)$-curve until it reaches point B. Then the tariff will travel along the equal-returns curve until the free trade allocation is reached. The free trade allocation is reached because in the very long run, capital is perfectly mobile. However, it may take a long time until enough capital can exit to reach the free trade allocation. This dynamic model thus makes a clear prediction:

The speed of trade liberalisation increases with the degree of capital mobility as summarised by the parameter z.

It is exactly this prediction of the model which I am going to take to the data. If capital is very mobile trade liberalisation will be fast whereas if capital is relatively immobile trade liberalisation will be slower. The fact that the free trade allocation is eventually reached assumes that capital can be perfectly reallocated in very long run. This may be appropriate for a free trade area such as the European Union or the NAFTA.

One advantage of the full dynamic model is that anticipated agreements can be considered. From a real-world perspective it would be expected that agreements are anticipated so this may be considered the more realistic case. Maggi and Rodriguez-Clare (2007) show that the results carry over to a framework in which the private sector can anticipate agreements - the only difference being that some capital reallocation will necessarily occur prior to the agreement since the return to the protected sectors will be lower. In Section 4.8 I briefly comment on my results when allowing mobility effects to take place prior to the year of signing the agreement.

The prediction which I am going to test is whether the speed of trade liberalisation depends on the degree of inter-industry capital mobility. In the real world, tariffs are not observed in continuous time but at yearly intervals so one could argue that I am testing a discrete multi-period version of the model.

4.6 Empirical strategy

In this section, I will outline my empirical strategy for estimating the model. I will aim to keep the empirical estimations as closely tied with the theory as possible. The model makes a clear prediction regarding the speed of trade liberalisation when countries enter trade agreements. Industries with highly mobile factors of production are expected to experience faster trade liberalisation than industries that rely on more fixed investments. The distortions in the non-cooperative equilibrium are two-fold: (i) the governments' lack of commitment vis-à-vis domestic lobbies and (ii) the prisoner's dilemma scenario brought about by lack of international cooperation. Hence, trade liberalisation reflects the governments solving these problems by signing a trade agreement. Since it may take time for investors to adjust that capital investment between sectors, trade liberalisation thus has two components: (i) one determined by the degree of mobility across sectors of capital, and (ii) one which reflects the international terms-of-trade distortion prior to signing an agreement. More specifically, the model predicts an instantaneous drop in tariffs which reflects the tariff cut that internalises the terms-of-trade distortion, and a gradual phase of trade liberalisation, the speed of which is determined by inter-industry capital mobility. Let $\widehat{\tau}_i$ be the tariff imposed in the noncooperative equilibrium for industry i and τ_i^A the post-agreement tariff, such that an empirical estimating relation could take the following form:

$$\widehat{\tau}_i - \tau_i^A = \beta_0 + \beta_1 z_i + \beta_2 ToT_i, \tag{4.22}$$

where z_i is some measure of inter-industry capital mobility of industry i, ToT_i is some variable which captures the terms-of-trade component of the trade liberalisation, and the βs are estimating coefficients. The full dynamic specification of the model suggests a time path for the tariff rates, and it will therefore be appropriate to specify a dynamic version of the estimating equation (4.22): an equation which considers how yearly tariff cuts depend on inter-industry capital mobility and terms-of-trade manipulations. The yearly tariff cuts can be interpreted as the slope of a time path from the pre-agreement non-cooperatively set tariff to the final tariff which, in this model, is free trade. Thus, I introduce (yearly) time subscripts, t, and express the following estimating equation:

$$\tau_{it+1} - \tau_{it} = \beta_0 + \beta_1 z_i + \beta_2 ToT_{it}, \tag{4.23}$$

It is a challenging task to obtain reliable measures of both capital mobility and terms-of-trade distortions, but the present model, however, offers some clues. According to (4.6), the degree of terms-of-trade distortions in the non-cooperative equilibrium is equal to the difference between foreign and domestic supply of the import-competing good. This variable, in turn, is related to the size of imports: hence, the larger the imports, the greater the incentive to distort terms of trade. The variable which I am going to employ to capture the terms-of-trade component is, thus, the value of net-imports (Net_imp_{it}). I feel this is justified since this variable is also used in Bagwell and Staiger (2006) to measure the same thing. I do realise, however, that the use of this variable is most probably not the optimal measure of the true terms-of-trade distortion. The best variable is, in my view, export supply elasticities of a trading partner, as this would provide the correct measure of the extent to which trade policy can influence foreign prices. The reason for the neglect of the use of this superior measure is purely due to data limitations for the countries in the sample (see below).

Recall that the model predicts an immediate tariff reduction due to solving the terms-of-trade distortion. In a discrete multi-period version of the model for estimation, I thus assume that this reduction due to the terms-of-trade component, if it exists, takes place in the year of signing the agreement. Let the agreement be signed in year s, and let D_s be a dummy variable which takes the value 1 in year s and zero otherwise. I can thus re-write the estimating equation in the following way:

$$\begin{aligned} \tau_{it+1} - \tau_{it} &= \beta_0 + \beta_1 z_i + \beta_2 (Net\_imp_{it} * D_s) \\ &\quad + \beta_3 (Net\_imp_{it} * (1 - D_s)) + D_t, \end{aligned} \tag{4.24}$$

where D_t is a time dummy for year t. If the theory is correct, trade liberalisation should be faster when industries are more mobile, $\beta_1 > 0$, the cut in the year of the signing the agreement should be explained by net imports in that year $\beta_2 > 0$, and net imports should have no explanatory power in subsequent years, $\beta_3 = 0$. I also allow for the possibility that the component of the trade liberalisation which is due to terms-of-trade distortions is gradual, and I will thus estimate the following,

$$\tau_{it+1} - \tau_{it} = \beta_0 + \beta_1 z_{it} + \beta_2 (Net\_imp_{it}) + D_t, \tag{4.25}$$

in addition to (4.24).

I shall restrict attention to a particular trade agreement, namely NAFTA signed by the US, Canada and Mexico. It could also be extended to a WTO framework by considering MFN tariff cuts, but since the dynamic model in Maggi and Rodriguez-Clare (2007) predicts a time path for tariffs from the non-cooperatively set tariffs to free trade a case study of one agreement, such as the NAFTA, would be more interesting. WTO tariff cuts are perhaps determined in a more prolonged negotiation framework which is not what the model has in mind. I further restrict attention to the manufacturing sector as more data is available for this industry. What I also find particularly appealing about the NAFTA as a case-study is that each country in this free trade area is the other's most important trading partner, which implies that trade flows are larger. For this reason, the countries may not be price-takers and terms-of-trade considerations may be important, although this is far from guaranteed.

Recall that the model is able to explain gradual reductions after countries have signed a trade agreement, where trade policies prior to the agreement were entirely non-cooperative. One concern is, thus, that the high degree of cooperation over trade policy between the US and Canada prior to NAFTA would render tariff cuts between these countries after 1994 inappropriate to explain the theory. US-Canadian trade cooperation traces its roots all the way back to the Automotive Products Agreement between the two countries which was signed in 1965. The US-Canadian free trade agreement was signed in 1987, and in addition the two countries have also experienced substantial MFN tariff cuts under the auspices of the GATT/WTO[4]. I shall therefore restrict attention to the US and Mexico, as these countries experienced little trade policy cooperation prior to the signing of NAFTA in 1994. I have chosen to focus on the US as the home country as this is the country with the most complete data for the variables which I intend to use. Thus, the tariff cuts which I will be looking at are those imposed by the US on products imported from Mexico. The next section will discuss issues related to measuring inter-industry capital mobility.

[4]In an earlier version of this chapter I had included results of US tariff cuts on Canadian imports, with results that were not consistent with the theory. These results are availble upon request. I do not take this as evidence to refute the theory for at least two reasons: (i) I was not able to obtain tariff data as far back as 1987, when the trade agreement was signed between the two countries, since product codes of tariffs were not consistent with data on inter-industry capital mobility, and (ii) US-Canadian trade policy cooperation materialised over many decades, and as such there were no clear pre- and post agreement phases.

4.7 Measures of inter-industry capital mobility

The most challenging part of this research is to find an empirical measure for inter-industry capital mobility. One issue is the level of aggregation. I would expect that the degree of capital mobility increases with the degree of disaggregation. The closer the products are related to one another the easier it is for a firm to switch production between them. The measures of capital mobility which I am going to employ come at the 4-digit SIC level in the US manufacturing industries.

There are many candidates for measuring capital mobility and the challenge is to find the one which comes closest to what the theoretical model has in mind. In the model, trade liberalisation should depend on the ease with which firms can exit in response to increased competitive pressures from trading partners in an agreement. A potential candidate is thus one which reflects the explicit costs of adjustment such as capital-labour ratios. One could assume, as in Grossman and Helpman (1994,1995) that capital represents the fixed factor and labour the mobile factor. If an industry employs a large amount of capital per worker it would then be assumed that the capital this industry employs is more immobile. However, there is a great degree of heterogeneity of capital and labour and one cannot be sure that capital is, in fact, less mobile than labour. With an advanced production technology there is more reliance on skilled workers, which are thought to be more sector specific, used in the production process. Moreover, a large part of capital can be either rented or sold on, and where this is the case capital could be thought of as less sector specific. Marcus (1967) regresses firm exit rates on the capital-output ratio, and although it has the expected sign it is statistically insignificant in most of his econometric specifications. One reason for this could be that the capital-labour ratio measures only explicit costs of exit and neglects the opportunity cost, which I will say more about below.

The four-firm concentration ratio measures the market share of the four largest firms in the industry. It is expected that if this ratio is larger, there are greater benefits from economies of scale, and one could reasonably conjecture that this has to do with a larger amount of sunk costs in production. Hence, an increase in the four-firm concentration ratio corresponds to less inter-industry mobility. However, this is far from guaranteed since even if large firms in an industry use a large amount of sunk cost, it does not follow that these sunk costs necessarily represent investments in capital which is relatively immobile.

A very good potential variable for measuring inter-industry capital mobility would be one which is able to infer the degree of mobility from observed economic behaviour. Economic agents in the economy respond to incentives in their environment and maximise profit. The profit an agent earns is the difference between the revenue of a particular asset minus total opportunity costs. It is the theory that these economic profits converge to zero in the long run, but the speed of convergence may differ substantially across sectors. It would be inappropriate to exclusively consider the movements of factors of production (labour and capital) across sectors because the mere fact that some sectors will see a higher labour turnover or switches of capital uses does not properly reflect the incentives that agents face, in particular the opportunity costs of alternative uses of capital or labour. For example, a worker may move from one sector to another even if it is very costly, simply because this worker's marginal contribution is much greater in a different sector. Moreover, if capital markets are close to perfect then even if the sunk costs are high, agents will still be able to borrow for investment purposes. In response to trade liberalisation I would expect that the return to capital decreases in the import-competing sectors. This means that the opportunity cost of this capital rises which facilitates exit. Therefore, capital owners will not exit the import-competing sectors only because they have made large sunk investments, they will also do so when the opportunity cost of remaining in the sector becomes too high. Thus, a variable which I am particularly interested in is the degree of persistence of profits and the speed of adjustments to the long-run competitive level of profits.

Hiscox (2002a) uses profit differentials as his preferred measure of inter-industry capital mobility. Profit differentials not only reflect the accounting costs of moving (such as capital-labour ratios) but also the opportunity cost. It is the opportunity cost which matters when economic agents make decisions. My preferred variable exploits this fact by constructing a variable which determines the speed of adjustment to long-run profits as modelled in Mueller (1990), and I shall review this in the next subsection. Mueller (1990) suggests that this variable may be related to other industry characteristics such as the number of firms in an industry and the degree of industry concentration. He notes, however, that the degree of external competition (i.e. the threat of entry from outside firms) may be equally important to the determination of profit persistence.

In this research I will use persistence of profits as a measure of inter-industry capital mobility along with capital-labour ratios and four-firm concentration ratios. In the next section I will show how to derive a measure of persistence of profits using Mueller's (1990) approach.

4.7.1 Measuring the persistence of profits

If capital markets are perfect and an industry will eventually be profitable then a high fixed costs of production should not necessarily imply that an industry employs less mobile capital as it only reflects the accounting cost of switching rather than the opportunity cost which is what determines economic decision making. Profits are usually defined as either economic or accounting profits. Accounting profits are simply the difference between total revenue and total explicit costs, whereas economic profits refer to the difference between total revenue and total implicit and explicit costs, where implicit costs are the yield a particular economic activity would earn in its best alternative use. It is the theory that these economic profits converge to zero in the long run in a competitive environment, and if this occurs slowly for a particular industry, then it may be concluded that this industry uses less mobile factors of production which delays the convergence of profits. If factors of production are industry-specific they are difficult to convert into alternative uses, which in turn will lower the opportunity cost. It may be possible to infer capital mobility from observed economic behaviour. By observing the convergence of profits over a period of time I am able to obtain a measure of the degree of mobility of various industries. The approach does not come without problems, however, as supernormal profits may persist even in the long run for reasons other than the degree of mobility. This will be the case if the riskiness across various industries differs: if economic agents are risk averse, they will demand a premium for investing in sectors that carry a higher risk. This could translate into a lower price-to-earnings ratio on share markets. Another problem is related to the investment motives of economic investors. If some economic agents invest for other than profit-maximising motives and if this proportion of non-profit maximisers differs substantially across industries the model will be biased. In this thesis I shall abstract from such issues, however.

The model which I use is the one employed in Mueller (1990) and I will present it here. Profits can be thought of as having a permanent component (π_{ip}) for industry i, which reflects the rents of those factors which stay constant over time, and a transitory component x_{it} which reflects short-run conditions:

$$\pi_{it} = \pi_{ip} + x_{it}. \tag{4.26}$$

The permanent component can be split into a competitive return (c), and a permanent industry-specific rent (r_i):

$$\pi_{ip} = c + r_i. \tag{4.27}$$

The competitive rent is the same across industries and Mueller (1990) argues that one can think of it as the yield on save assets such as government bonds whereas the industry specific return reflects the level of supernormal profits earned by a particular industry, and this is determined by the ease with which firms can enter or exit the industry in the very long run. However, in this model it is assumed that this long-run industry-specific profit takes so long to converge that for the purposes of estimation it can be thought of as a permanent industry-specific return. The importance here is that I am able to capture the speed by which industries are able to bid down short-term transitory rents. It should be noted that this may also imply that the measure I obtain also takes account of the speed of within-industry adjustment as well as between-industry adjustment.

It is possible that the time span t to erode short-term rents is so fast that they would be eliminated within a year. Since time is measured in years this would imply that $\text{corr}(x_{it}, x_{it-1}) = 0$. If it takes more time than a year to erode short-term rents then it is more reasonable to assume $\text{corr}(x_{it}, x_{it-1}) \neq 0$. In this case it can be assumed that x_{it} follows a first-order autoregressive process given by:

$$x_{it} = \lambda_i x_{it-1} + \epsilon_{it}. \tag{4.28}$$

It is assumed that the ϵ_{it} are independently and identically distributed random variables with zero mean and constant variance. For stationarity of the short-term rents it is required $|\lambda_i| < 1$. In order to get an estimating equation, I lag the expression in (4.26) one period and plug in (4.27) and (4.28). This yields:

$$\pi_{it} - \lambda_i \pi_{it-1} = (1 - \lambda_i)(c + r_i) + \epsilon_{it},$$

which can be written in autoregressive form as:

$$\pi_{it} = \alpha_i + \lambda_i \pi_{it-1} + \epsilon_{it}, \quad i = 1, 2, ..., N, \quad t = 1, 2, ..., T \tag{4.29}$$

where $\alpha_i = (1 - \lambda_i)(c + r_i) \equiv (1 - \lambda_i)\pi_{ip}$. Mueller (1990) estimates this autoregressive model for the period 1967-82 for all US manufacturing industries. The speed of adjustment to long run profits is simply given as $1 - \lambda_i$, and this is the measure which I intend to use as a measure of capital mobility. If $1 - \lambda_i$ is high the speed of adjustment to long run profits is fast and from this I would infer that this sector employs relatively mobile capital. If it is low, however, it can be deduced that the industry employs less mobile capital. One particular attractive feature about this variable is that it lies between zero and one for industries whose profits are not exploding. This allows for a very convenient interpretation of the results: If $1 - \lambda_i$ is 0, the industry's profits are perfectly persistent or, in other words, it can be inferred that the industry employs fixed capital. This would correspond to the case of fixed capital in the theoretical model. If, on the other hand, $1 - \lambda_i$ is 1 all transitory rents are eroded after one period (in this case one year) and this would correspond to the other benchmark of perfectly mobile capital. When I use the $1 - \lambda_i$s from (4.29) for estimation, I can conveniently interpret the coefficient as the difference between a perfectly mobile industry and an industry which employs fixed capital. Some industries have values of $1 - \lambda_i$ which are less than zero implying exploding profits. I do not exclude them on those grounds since an industry with exploding profits over the period under consideration, would have an even lower opportunity cost, and it would then be expected that the incentive to delay protection would be even higher for such an industry.

The true interpretation of $1-\lambda_i$ is the speed of erosion of short-term transitory rents and as such it does not measure the speed of adjustment of industry-specific rents to a common competitive rate. For that reason it is not certain whether it is within-industry mobility or between industry mobility that is being captured by this measure. This may at first seem as though it does not properly capture the idea of inter-industry capital mobility as modelled by Maggi and Rodriguez-Clare (2007). I do not find that this is a shortcoming of the measure for two reasons. First, in the theoretical model the idea is that capital owners in the import-competing sectors exit and invest in the numeraire sector in response to trade liberalisation, and the numeraire sector can be given a broad interpretation of an opportunity cost of remaining in the import-competing sector. Since in the real world, the opportunity cost of each industry differs and because the opportunity cost may lie within the industry because of the aggregation, this part of the model can be considered too simple[5]. My empirical variable for inter-industry capital mobility thus goes beyond the basic model but I believe this is more realistic for the purposes of empirical examination. Second, what I am trying to infer from the persistence of profits is capital mobility, but one could reasonably argue that the persistence of profits over the short term may actually be what Maggi and Rodriguez-Clare (2007) attempt to infer from capital mobility[6].

The fact that some industries may be able to achieve rents over a short time period for whichever reason may provide them with an incentive to lobby for some protection in a trade agreement as more rents can be achieved from such protection. So while the persistence of profits may not always originate in the degree of inter-industry capital mobility, it provides the same incentives to lobby

[5]I would imagine that extending the model to a setting with mobility between multiple industries is involved. Maggi and Rodriguez-Clare (2007) use this simple structure because it captures the main idea.

[6]I thank Professor Rod Falvey of Bond University in Australia for pointing this out.

for protection as if the persistence of profits did indeed originate in capital mobility. It could reflect the reluctance of some capital owners to move capital to different activities even if they were capable of doing so simply because the opportunity cost of lobbying for protection is very low.

4.8 Data and estimation

I measure tariff cuts as the ad valorem or ad valorem equivalent of specific tariffs aggregated to the 4-digit SIC level, and these are taken from the National Bureau of Economic Research (NBER) for the period 1989 to 2001. The tariffs are weighted by their trade share at the HS8 level so one can see the variable as an index of trade resistance. I multiply the tariffs by 100 to allow for an easier interpretation. I do not use any non-tariff barriers such as anti-dumping duties because I am concerned that there is too much non-cooperation in these duties. I exclude industries for which there are missing values for some of the tariffs at the Harmonised System (HS) 8 level. The data for net imports is also taken from the NBER for the period 1989 to 2001, and it is measured in billions of US$. To re-capitulate, I use the following three measures of inter-industry capital mobility for industry i:

Persistence of profits (PoP_i),
Capital-labour ratios (C/L_i),
Four-firm concentration ratio $(C4_i)$,

Profits are measured as the total value added minus payroll divided by the value of industry sales at the four-digit SIC level. One could argue that I should divide by total depreciable assets instead of sales, but since these are only available in five year intervals, sales are used as a substitute. I have gathered data from the 1992 US Census of Manufacturers and the Annual Surveys of Manufacturers (1993-1996) to estimate (4.29), and then collect the $1 - \lambda_i$-values for each industry to use them in (4.24) and (4.25). Many industries were reclassified in the 1987 Census of Manufacturers so it is very difficult to construct longer time series for a large number of industries. One solution to this is to aggregate those industries that were reclassified or to find more disaggregated data to construct the relevant profit measures at the 4-digit SIC level. However, this may cause measurement problems so instead, I have chosen a particular time period for the estimation of the λ_is across industries, namely the period for which there are no missing values. This period is from 1987 to 1996. The short coming of using this period is that since the λ_is may reasonably change over time, it would be more appropriate for the estimation to use estimates of the λ_is where the chosen time period is the ten-year period prior to the year of the tariff cuts. In that way I could make the mobility measure vary over time and use panel data techniques such as fixed effects. However, in this thesis I will stick with a mobility variable which does not vary over time.

The data for the last two variables are taken from the 1992 Census of manufacturers. Capital-labour ratios are measured as the value (in millions of $US) of depreciable assets divided by the number of production workers. I do not divide by the total number of employees as I am concerned that skilled labour does not reflect a variable cost of production, unlike production workers. The four-firm concentration ratio is the percentage share of total revenue by the largest four firms in an industry, and the last variable is. I divide the four-firm concentration ratio by 100 such that the interpretation of the coefficient in the regression is the increase/decrease in the tariffs when the four-firm concentration ratio increases from zero to 100 per cent. All measures of inter-industry capital mobility are time-invariant, due to data constraints[7].

I restrict attention to US import-competing sectors as the theory is developed to explain tariff cuts in import-competing sectors. I define an import-competing industry to be one which was an importer on net in the three years prior to signing NAFTA (1991-1993). Hence, it is possible that some industries become net exporters at some point in my sample, but since I would like to monitor the same industries throughout, I do not exclude them in later years. I would obviously exclude industries once they reach free trade which for some industries happen faster than others. In Table 4.1-4.3, I provide descriptive statistics for all my variables. From Table 4.1, it can be seen that the weighted average tariff which the US imposed on Mexican products have been declining throughout the whole period (1989-2001), but that the decline is faster after the signing of NAFTA in 1994. I also provide descriptive statistics for net imports throughout the sample period in Table 4.2, and it can be noted that these do not change much over the period. The variables for inter-industry capital mobility are summarised in Table 4.3.

Table 4.1: Weighted US tariffs on Mexican products - summary statistics

Year	Observations	Mean (%)	Std. dev.	Min	Max
1989	130	3.90	6.10	0.00	25.00
1990	130	3.52	6.05	0.00	25.28
1991	130	3.50	6.47	0.00	26.73
1992	130	3.18	6.12	0.00	25.38
1993	130	2.26	4.75	0.00	20.02
1994	130	1.32	3.64	0.00	14.39
1995	130	1.12	2.94	0.00	15.28
1996	130	0.83	2.10	0.00	13.95
1997	130	0.46	1.46	0.00	12.64
1998	130	0.17	1.03	0.00	10.13
1999	130	0.21	1.07	0.00	10.13
2000	130	0.12	0.83	0.00	8.83
2001	130	0.00	0.00	0.00	0.00

[7] Capital-labour ratios and four firm concentration ratios are only provided in five-year intervals.

Table 4.2: Net imports (billions of US$) from Mexico - summary statistics

Year	Observations	Mean (%)	Std. dev.	Min	Max
1989	130	0.899	2.735	0.000	23.655
1990	130	0.924	2.738	0.000	23.655
1991	130	0.881	2.705	0.000	23.655
1992	130	0.894	2.724	0.000	23.655
1993	130	0.895	2.713	0.000	23.655
1994	130	0.888	2.704	0.000	23.655
1995	130	0.870	2.709	0.000	23.655
1996	130	0.907	2.733	0.000	23.655
1997	130	0.909	2.733	0.001	23.655
1998	130	0.882	2.694	0.000	23.655
1999	130	0.881	2.695	0.000	23.655
2000	130	0.882	2.694	0.000	23.655
2001	130	0.892	2.680	0.000	23.655

Table 4.3: Measures of inter-industry capital mobility - summary statistics

Years 1989-2001	Obs.	Mean (%)	Std. dev.	Min	Max
Persistence of profits	128	0.63	0.31	0.02	1.33
Capital-labour ratio (millions of US$)	128	63.80	88.86	2.17	726.10
Four-firm concentration ratio (%)	128	41.43	20.54	9.00	98.00

One concern is the censoring of the tariff data: tariff cuts could be biased as they are constrained by zero. Consider Figure 4.4. I plot a hypothetical tariff path from its non-cooperative level to zero. In this case I have drawn a linear path for the tariff. If the last tariff cut was not constrained by zero it would follow the dashed line to a negative value. Because of the zero constraint the speed of trade liberalisation may be underestimated. To overcome this problem I complement the estimation with a tobit regression.

In order to control for industry effects, I specify two types of panel data estimation procedures. These methods exploit both the cross-sectional variation (industries) and the time-series dimension of the data. The procedure applied in the present analysis comprises the fixed effects vector decomposition (FEVD) esti-

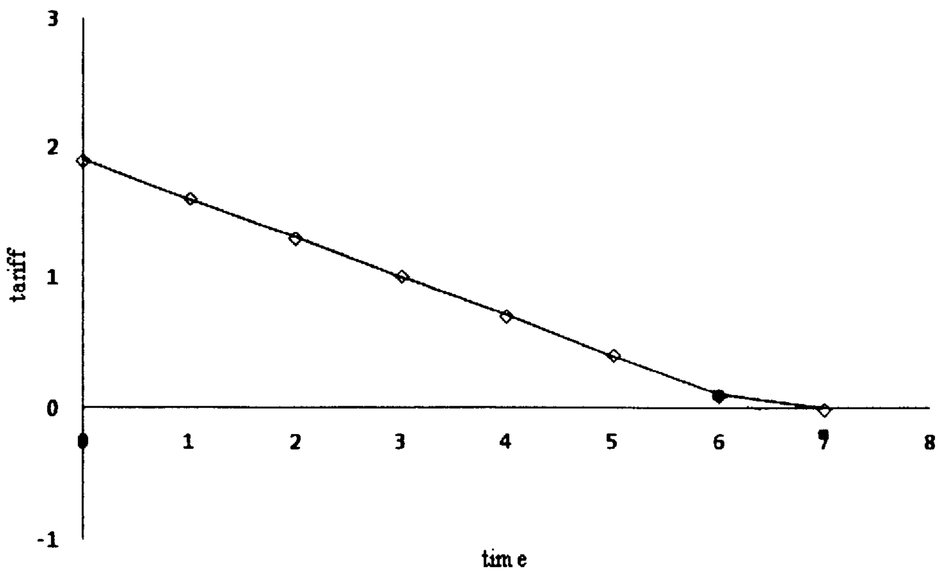

Figure 4.4: Evolution of a hypothetical tariff over time.

mator[8] and the random effects (RE) estimator. The appeal of these estimators is that they control for unobserved industry-specific determinants, while facilitating the estimation of time-invariant variables.

Another issue is the potential reverse causality between tariff cuts and inter-industry capital mobility. The model predicts that the degree of mobility causes tariff cuts, but as noted by Sachs and Warner (1995), trade liberalisation is usually accompanied by market reforms to increase the mobility of factors of production. This would pose a particularly serious problem if the estimation was carried out in a cross-country setting. However, I believe the problem is less severe in a multi-sector setting such as the present, since governments might have applied the same policies to all industries within a country. I shall not pursue this point any further in this analysis. In the section that follows I present my empirical findings. In my original tables, or the tables in the first draft of this paper, I had included regressions where I allowed capital mobility effects on tariffs to take place prior

[8]The FEVD estimator was introduced by Plumper and Troeger (2007).

to the agreement in 1994. I have ommited them here since there is no evidence that there was any effect of mobility and trade liberalisation, thus contradicting the hypothesis that the NAFTA agreement was anticipated. However, is should be noted that there was little variation in tariffs prior to this year in any case such that it would be hard for any variable to explain changes in tariffs prior to NAFTA.

4.9 Results

4.9.1 Persistence of profits as explanatory variable

I first estimate (4.24) and (4.25) using persistence of profits, PoP_i, as a measure of inter-industry capital mobility. The estimating equations are thus:

$$\begin{aligned} \tau_{it+1} - \tau_{it} &= \beta_0 + \beta_1 PoP_i + \beta_2(Net\_imp_{it} * D_{1994}) \\ &\quad + \beta_3(Net\_imp_{it} * (1 - D_{1994})) + D_t + \alpha_i, \end{aligned} \tag{4.30}$$

and

$$\tau_{it+1} - \tau_{it} = \beta_0 + \beta_1 PoP_i + \beta_2(Net\_imp_{it}) + D_t + \alpha_i, \tag{4.31}$$

where the industry-specific effects, α_i, are included for the FEVD and RE estimations. I report the results of estimating (4.30) and (4.31), respectively, in Table 4.4 and Table 4.5. Recall that the measure for persistence of profits takes a value between zero and one, where a higher value corresponds to a more mobile industry. In fact, the coefficient estimate can be interpreted as the difference between an industry that employs fixed capital ($PoP_i = 0$) to one that is perfectly mobile ($PoP_i = 1$).

The first column of Table 4.4 reports the estimates for the pooled OLS regression, which does not control for industry-specific effects. The coefficient on

Table 4.4: Persistence of profits regression

Variable	Pooled OLS	Tobit	FEVD	Random effects
PoP_i	0.683***	0.711***	0.760***	1.025*
	(0.258)	(0.233)	(0.048)	(0.578)
$Net\_imp_{it} * D_t$	0.017	-0.007	0.376***	0.050
	(0.072)	(0.071)	(0.047)	(0.090)
$Net\_imp_{it} * (1 - D_t)$	0.087	0.092	-0.000	-0.170
	(0.080)	(0.070)	(0.238)	(0.112)
Observations	178	178	178	178
R^2	0.12	0.05	0.78	0.06
RMSE	1.20			

Time period for estimation is 1994-2001
* significant at 10%
** significant at 5%
*** significant at 1%
Pseudo R^2 reported for tobit regression
Constant terms as well as year dummies are not reported

PoP_i is equal to 0.683 and is highly significant. This implies that a perfectly mobile industry experienced a year tariff cut which was 0.683 percentage points larger than an industry employing fixed capital. The effect of the terms-of-trade distortion in the year of signing the agreement, measured by net imports interacted by a 1994 year dummy, has the correct sign in the OLS regression, but fails to be statistically significant. The effect is also small since net imports are denominated in billions of $US. Due to a concern that the distribution of tariffs is censored the second column reports the results of running a tobit regression. The coefficient estimate of persistence of profits remains large and highly significant. Notice also that the coefficient is larger than the OLS coefficient, implying that the basic OLS regression might underestimate the effect. The last two columns report the results of the fixed effects regressions where industry-specific effects are controlled for. The effects of persistence of profits on tariff cuts remain large and statistically significant for both regressions, and the effect of the terms-of-trade component of trade liberalisation in the year 1994 for the FEVD estimator is positive and significant. The last finding lends support to the view that the tariff

Table 4.5: Persistence of profits regression - gradual ToT

Variable/Year	Pooled OLS	Tobit	FEVD	Random effects
PoP_i	0.769***	0.698***	0.815***	1.092*
	(0.261)	(0.233)	(0.162)	(0.582)
Net_imp_{it}	0.053	0.042	0.000	-0.010
	(0.054)	(0.049)	(0.033)	(0.086)
Observations	178	178	178	178
R^2	0.11	0.04	0.76	0.10
RMSE	1.19			

Time period for estimation is 1994-2001
* significant at 10%
** significant at 5%
*** significant at 1%
Pseudo R^2 reported for tobit regression
Constant terms as well as year dummies are not reported

reduction that took place in 1994 can be partly explained by solving the terms-of-trade driven prisoner's dilemma internationally. It should be said that none of the other regressions obtained a statistically significant effect.

In Table 4.5, I report results from the estimation of (4.31), where it is assumed that the terms-of-trade component of trade liberalisation is gradual. The coefficient on persistence of profits remains positive and statistically significant in all regressions. However, the coefficient on net imports is statistically insignificant, and has the wrong sign in the random effects regression. This would suggest that the terms-of-trade component, if it exists, is not gradual, and it cannot be used to explain yearly tariff cuts on Mexican imports to the US.

4.9.2 Capital-labour ratios as explanatory variable

I specify the following estimating equations with capital-labour ratios:

$$\begin{aligned} \tau_{it+1} - \tau_{it} &= \beta_0 + \beta_1 C/L_i + \beta_2(Net\_imp_{it} * D_{1994}) \\ &\quad + \beta_3(Net\_imp_{it} * (1 - D_{1994})) + D_t + \alpha_i, \end{aligned} \tag{4.32}$$

and

$$\tau_{it+1} - \tau_{it} = \beta_0 + \beta_1 C/L_i + \beta_2(Net\_imp_{it}) + D_t + \alpha_i. \qquad (4.33)$$

The results of running regressions (4.32) and (4.33), respectively, are presented in Table 4.6 and Table 4.7. The capital-labour ratio is meant to capture the degree of sunk to variable costs, such that an increase in this ratio implies larger fixed costs. This implies that an increase in this variable corresponds to a decrease in capital mobility, and thus, the effect of the capital-labour ratio on the tariff cut should be negative. In the first column of Table 4.6, I report the result of running a pooled OLS regression of (4.32). The coefficient on the capital-labour ratio has the expected sign, and is statistically significant at the 5% level. An increase in the capital-labour ratio of one million US dollars is expected to decrease the tariff cut by 1.594 percentage points. The result is robust to the use of a tobit model, which controls for the censoring of the tariff data, and even find the largest effect out of all of the estimating methods. The FEVD estimator puts the coefficient of the capital-labour ratio to be significant. However, the standard errors of the random effects estimator are so large that it is not significant for that regression. The coefficient of the capital-labour ratio is significant in three out of four specifications. Notice that in the FEVD estimator, the coefficient on net imports in 1994 is positive and significant.

The results are similar when estimating (4.33). All variables have the expected sign, although the estimates of the coefficients on net imports are very small and fail to be significant (see Table 4.7).

Table 4.6: Capital-labour ratio regression

Variable	Pooled OLS	Tobit	FEVD	Random effects
C/L_i	-1.594**	-1.804***	-1.597***	-1.466
	(0.618)	(0.556)	(0.365)	(1.640)
$Net\_imp_{it} * D_t$	0.034	0.012	0.376***	0.062
	(0.075)	(0.070)	(0.048)	(0.091)
$Net\_imp_{it} * (1 - D_t)$	0.126	0.126*	-0.000	-0.168
	(0.081)	(0.071)	(0.048)	(0.114)
Observations	178	178	178	178
R^2	0.11	0.04	0.78	0.04
RMSE	1.20			

Time period for estimation is 1994-2001
* significant at 10%
** significant at 5%
*** significant at 1%
Pseudo R^2 reported for tobit regression
Constant terms as well as year dummies are not reported

Table 4.7: Capital-labour ratio regression - gradual ToT

Variable	Pooled OLS	Tobit	FEVD	Random effects
C/L_i	-1.537**	-1.740***	-1.457***	-1.534
	(0.614)	(0.554)	(0.377)	(1.657)
Net_imp_{it}	0.076	0.068	0.000	0.000
	(0.055)	(0.050)	(0.034)	(0.088)
Observations	178	178	178	178
R^2	0.10	0.05	0.05	0.08
RMSE	1.20			

Time period for estimation is 1994-2001
* significant at 10%
** significant at 5%
*** significant at 1%
Pseudo R^2 reported for tobit regression
Constant terms as well as year dummies are not reported

4.9.3 Four-firm concentration ratios as explanatory variable

As with the previous two explanatory variables I specify the exact estimating equations:

$$\begin{aligned} \tau_{it+1} - \tau_{it} &= \beta_0 + \beta_1 C4_i + \beta_2(Net\_imp_{it} * D_{1994}) \\ &\quad + \beta_3(Net\_imp_{it} * (1 - D_{1994})) + D_t + \alpha_i, \end{aligned} \tag{4.34}$$

and

$$\tau_{it+1} - \tau_{it} = \beta_0 + \beta_1 C4_i + \beta_2(Net\_imp_{it}) + D_t + \alpha_i. \tag{4.35}$$

I report the results of running (4.34) and (4.33), respectively, in Table 4.8 and Table 4.9. The four-firm concentration ratio measures the market share of the four largest firms in the industry. It is expected that if this ratio is larger, there are greater benefits from economies of scale, and one could reasonably conjecture that this has to do with a larger amount of sunk costs in production. Hence, an increase in the four-firm concentration ratio corresponds to less inter-industry mobility. Generally speaking, this variable is far less promising in terms of explaining the theoretical model. Most coefficients have the wrong sign and none of them are statistically significant. However, the coefficient on net imports interacted with the 1994 dummy is statistically significant in column three of Table 4.8 for the FEVD estimator. I conclude that the four-firm concentration is either an imperfect measure of inter-industry capital mobility, or it does a poor job in explaining the theory. This finding may not be surprising, since it is not guaranteed that, even if large firms in an industry use a large amount of sunk cost, that these sunk costs necessarily represent investments in capital which is relatively immobile.

Table 4.8: Four-firm concentration ratio regression

Variable	Pooled OLS	Tobit	FEVD	Random effects
$C4_i$	0.002	0.001	-0.001	0.004
	(0.004)	(0.004)	(0.003)	(0.010)
$Net\_imp_{it} * D_t$	0.018	-0.003	0.376***	0.041
	(0.078)	(0.075)	(0.049)	(0.097)
$Net\_imp_{it} * (1 - D_t)$	0.076	0.077	0.000	-0.191
	(0.085)	(0.076)	(0.050)	(0.118)
Observations	178	178	178	178
R^2	0.07	0.03	0.78	0.02
RMSE	1.23			

Time period for estimation is 1994-2001
* significant at 10%
** significant at 5%
*** significant at 1%
Pseudo R^2 reported for tobit regression
Constant terms as well as year dummies are not reported

Table 4.9: Four-firm concentration ratio regression - gradual ToT

Variable	Pooled OLS	Tobit	FEVD	Random effects
$C4_i$	0.002	0.001	0.003	0.004
	(0.004)	(0.004)	(0.003)	(0.010)
Net_imp_{it}	0.044	0.036	0.000	-0.022
	(0.059)	(0.054)	(0.036)	(0.093)
Observations	178	178	178	178
R^2	0.07	0.03	0.76	0.05
RMSE	1.22			

Time period for estimation is 1994-2001
* significant at 10%
** significant at 5%
*** significant at 1%
Pseudo R^2 reported for tobit regression
Constant terms as well as year dummies are not reported

4.10 Concluding remarks

In this chapter I have taken the political-economy model in Maggi and Rodriguez-Clare (2007) to the data, to examine whether it could stand up to empirical scrutiny. The model makes two simple predictions, namely that (i) trade liberalisation should be faster when factors of production are more mobile, and that (ii) the initial phase of trade liberalisation is characterised by an immediate tariff cut to solve an international terms-of-trade externality. Overall, with regards to two measures of inter-industry capital mobility, namely persistence of profits and capital-labour ratios, the estimates of the coefficients on inter-industry capital mobility showed large and statistically significant effects. Capital-labour ratios are meant to capture the value of sunk costs of production relative to variable costs, and they could therefore be said to measure the explicit cost of capital. The variable does not come without criticism, however, as it neglects to measure the opportunity cost of production, and it could also be said that it is not guaranteed that capital, as a production factor, is necessarily less mobile than labour. Persistence of profits goes one step further by incorporating a measure of the opportunity costs of production in addition to explicit costs: persistent profits are likely to imply that there is a high opportunity cost of production in a particular industry. The last variable which I tried to fit to the data, the four-firm concentration ratio, failed to be able to explain tariff cuts. This may not be surprising since it is not guaranteed that larger firms employ factors of production that are necessarily less mobile across sectors.

The terms-of-trade component of trade liberalisation received little support in the data, although using the FEVD estimator there appeared to be an effect in the year Mexico and the US signed the NAFTA. This is contrary to Bagwell and Staiger (2006) who finds that terms-of-trade motives form an important part of tariff reductions in trade agreements[9]. They use the value of imports and the volume of imports to explain tariff reductions, but unlike me they average the import flows over a certain period, not necessarily a period which is in the same year of signing trade agreements. I have also attempted to do the same by averaging the value of net imports[10], but the results do not change much, and I did not obtain significance on any coefficients. The fact that the US may be a small country with respect to its trading partners is consistent with Magee and Magee (2008) who find that US tariffs have a very small impact on world prices, and conclude that even if it is the largest economy in the world, for trade purposes it may still be a small country which cannot influence world prices through trade policy.

The model has plenty of scope for further empirical examination and theoretical extensions. For example, the model postulates that there is an overinvestment problem in protected sectors in the non-cooperative equilibrium. It would be interesting to examine the extent of this overinvestment in protected industries, and how these industries contract in response to trade liberalisation. Such hypotheses could be applied to the use of alternative forms of protection, such as anti-dumping measures and non-tariff barriers, as these are more commonly observed as means of protection in the developed world in the 21st century.

The empirical examination could also be extended to a WTO framework to conduct a cross-country examination of trade liberalisation and inter-industry capital mobility. It might be argued, however, that a WTO framework is less fit for the purposes of the theoretical model. This is because the model compares a situation where two countries have never cooperated over trade policy to a phase of gradual tariff reductions. Trade liberalisation under the auspices of the GATT/WTO has

[9]They use a sample of countries that joined the WTO in the 1990s.

[10]I use the value of net imports in lieu of the value of imports. When I use imports the results do not change in any significant way. I also think that net imports should perform better at explaining terms-of trade motives. The government may not wish to distort trade if the country it represents produces a large amount of exports.

taken more than half a century of multiple rounds of trade liberalisation, however, so it may be argued that it is hard for one variable, such as for example persistence of profits, to capture the variation in tariffs for such a long time period.

The theoretical model could also be extended to look at a framework with several factors of production, and the conflicting interests of the owners of these factors could be examined, as is done empirically in Hiscox (2002a).

Moreover, it is possible to consider foreign lobbying over domestic tariffs and see how the *relative* mobility of foreign and domestic industries may or may not change the results. Following the discussion in Gray (1973) it would not be hard to imagine how an extension to include foreign lobbying would turn out. I will only consider extreme cases of fixed and perfectly mobile factors of production as the intermediate case of imperfectly mobile factors of production only translate into changing degrees rather than absolute results. The model extension would have to have curvature in the production function to avoid complete specialisation. Consider the case where the home and foreign governments both employ factors of production that are perfectly mobile in a particular sector. If the home country is an importer and the foreign country is an exporter, then the trade agreement would maximise the joint surplus of the two governments and the two lobbies. However, since both lobbies own perfectly mobile factors of production, they will not achieve any rents from protection and the result is free trade. Also, consider the case where both lobbies employ factors of production that are fixed. In this case, the home lobby would lobby for protection whereas the foreign lobby would lobby for free trade. The outcome of a free trade agreement would thus depend on the strengths of the lobbying efforts in the two countries. The case where the home government employs fixed factors of production and the foreign employs perfectly mobile factors of production for the particular industry translates into a slow liberalisation phase, as the home lobby would lobby for protection but the foreign would not, as capital owners would not realise any rents from this. This discussion implies that what matters is *relative* mobility of the home and foreign sectors.

4.11 Appendix to Chapter 4

4.11.1 Proof of Proposition 4.1

Using the expression for the price of country H's imported good in (4.1), and the expression for contributions in (4.8), I can write the equal-returns condition (4.10) as:

$$v - \frac{1}{2}(k + 1 - \tau) - \left(\frac{3a}{8k}\right)(\tau - \tau^{w}(k))^{2} = 1.$$

Setting $\tau = \tau^{J}(k)$ from (4.6) and solving for k yields, after substantial algebraic manipulations, an expression for the unique capital allocation in the long-run political equilibrium:

$$\widehat{k} = 2a\left(\frac{3v - 4}{4a - 1}\right). \tag{4.36}$$

The condition assumed in (4.11) ensures $a > \frac{1}{4}$ such that the denominator of the previous expression is positive. The numerator is also positive since I assume that $v > \frac{3}{2}$ in (4.4). Using (4.11) and (4.4), it can also be verified that $\widehat{k} < 1$. The equilibrium tariff can be solved by plugging (4.36) back into (4.6). This yields:

$$\widehat{\tau} = \tau^{J}\left(\widehat{k}\right) = \frac{1}{3}\left(1 + \frac{(4 - 2a)(3v - 4)}{4a - 1}\right) > 0.$$

The sign of this expression can be verified from (4.11) and (3.10). **q.e.d.**

4.11.2 Proof that (4.16) is decreasing in $\overline{\tau}$

I would like to show that the following expression is decreasing in $\overline{\tau}$:

$$\Psi(\overline{\tau}, k^{er}(\overline{\tau})) = \left\{ \begin{array}{cc} aW(\tau^W(k^{er}(\overline{\tau}), k^{er}(\overline{\tau})) + aW^*(\tau, k^{er}(\overline{\tau})) + \widehat{k} & \text{for } \overline{\tau} \geq \tau^W \\ aW(\tau, k^{er}(\overline{\tau})) + aW^*(\tau, k^{er}(\overline{\tau})) + \widehat{k} & \text{for } \overline{\tau} < \tau^W \end{array} \right\}.$$

If $\overline{\tau} < \tau^W$, there will be no contributions, and $k^{er}(\overline{\tau})$ is a line with slope equal to 1, making the claim easy to verify. The less straight-forward case is to show that $aW(\tau^W(k^{er}(\overline{\tau}), k^{er}(\overline{\tau})) + aW^*(\tau, k^{er}(\overline{\tau})) + \widehat{k}$ is decreasing in $\overline{\tau}$ for $\overline{\tau} \geq \tau^W$. Applying the envelope theorem yields:

$$W_k(\tau^W(k^{er}(\overline{\tau}), k^{er}(\overline{\tau}))\frac{dk^{er}(\overline{\tau})}{d\overline{\tau}} + W_t{}^*(\tau, k^{er}(\overline{\tau})) + W_t{}^*(\tau, k^{er}(\overline{\tau}))\frac{dk^{er}(\overline{\tau})}{d\overline{\tau}}.$$

Since $W_t{}^* < 0$ and $\frac{dk^{er}(\overline{\tau})}{d\overline{\tau}} > 0$ it suffices to show that $W_k(\tau^W(k^{er}(\overline{\tau}), k^{er}(\overline{\tau}))$ and $W_t{}^*(\tau, k^{er}(\overline{\tau}))$ are both negative. The sign of $W_t{}^*(\tau, k^{er}(\overline{\tau}))$ can be established by noting that the only effect of k and W^* is through terms of trade, and an increase in k worsens country F's terms-of-trade. What remains to show is that $W_k(\tau^W(k^{er}(\overline{\tau}), k^{er}(\overline{\tau})) < 0$. This is equivalent to showing that $W_k(\tau^W(k), k) < 0$ for $k > k^W$. Some algebra reveals that:

$$W_k(\tau^W(k), k) = p(\tau^W(k), k) - 1.$$

Given that $p(\tau^W(k^W), k^W) = 1$ the claim follows. **q.e.d.**

Chapter 5

Concluding Remarks

Deeper economic integration is central to our understanding of welfare and growth in the 20th and 21st centuries, and while the literature is in a growing phase, there is much more to be learned about the drivers of political barriers and the desire to abolish them. The present doctoral thesis has contributed to this strand of literature with three core chapters that identified aspects of the nature and causes of trade liberalisation.

In Chapter 2, I constructed a model of oligopoly to study the relationship between natural trade costs and unilateral and cooperative import tariffs. Unilateral trade policy seeks to optimally exploit a country's monopoly power over its terms of trade, in addition to shifting profits towards the domestic market. When trade costs decline, the incentive to manipulate the terms-of-trade and shift profits increases. This is because when trade costs are lower, the degree of natural manipulation of consumer prices and the degree of natural profit shifting is lower, making import tariffs more effective at doing the job. Cooperative trade policy, on the other hand, aims to minimise losses in transit, and hence, when trade costs decline, cooperative tariffs are lowered. This implies that when trade costs decline, a conflict of interest between what is optimal unilaterally and cooperatively intensifies. In a framework where cooperative trade policy must be sustained by a reputational mechanism, I demonstrated that import tariffs depend crucially on the discount factor and natural trade costs. If the countries in a trade agreement are sufficiently patient, they will be able to lower tariffs in response to falling trade costs, whereas if they care too much about short-run gains, import tariffs must be raised in response to falling trade costs to ensure that countries resist the temptation to switch terms of trade in their favour and shift profits towards their respective domestic markets. I further demonstrated that a free trade agreement can be sustained for a larger range of discount factors when trade costs fall.

In the second core chapter, Chapter 3, I introduced a dynamic inconsistency, in addition to standard terms-of-trade manipulations, to study the sustainability of unilateral and bilateral trade liberalisation. Investors incur investments in physical capital which are irreversible in any given period, that is what I call the short run, but allowed to be freely reallocated after one period, which is what I call the long run. This brings about a conflict of interest in terms of the optimal trade policy in the short run where capital is sunk, and in the long run where it is perfectly mobile. The government and a lobby bargain efficiently over an import tariff and a level of contributions, and the bargaining power of the two parties is a crucial parameter in the determination of the sustainability of trade liberalisation. Unilateral trade liberalisation involves committing to the dynamically optimal trade policy, which implies setting the import tariff at the socially optimal level, or the level which optimally exploits a country's terms of trade, and giving up campaign contributions from the lobby. Bilateral trade liberalisation involves signing a trade agreement, which implies that international terms of trade externalities are solved in addition to the time-inconsistency problem. I assumed that any type of trade liberalisation must be sustained by a reputational mechanism. In this framework I found that if the government has all the bargaining power, unilateral trade liberalisation can be supported for every discount factor, but as the government's bargaining power increases, the degree of patience required to sustain unilateral trade liberalisation increases. As the bargaining power exceeds a critical threshold, the government is better off continuing its political relationship with the lobby, and unilateral trade liberalisation cannot be support for any discount factor. Since bilateral trade liberalisation involves punishment from a country's trading partner in case of deviation, this imposes further sanctions on the part of a deviating country. I demonstrated that bilateral trade liberalisation can be supported for every discount factor, provided the government is sufficiently patient. However, for low bargaining powers, unilateral trade liberalisation can be supported for the largest range of discount factors, whereas for high bargaining powers, a trade agreement is needed to ensure commitment.

In Chapter 4, I used the political-economy model of Maggi and Rodriguez-Clare (2007) to empirically study the nature rather than the causes of trade liberalisation as was the case in the previous two chapters. Maggi and Rodriguez-Clare (2007) set up a theoretical model very similar to the one in Chapter 3, but with two important differences. First, I assume the lobby has all the bargaining power, and that a bilateral trade agreement is perfectly enforceable. It is assumed that for whichever reason the two countries have decided to sign a trade agreement. When doing so they solve international terms-of-trade externalities as well as a time-inconsistency problem as described in the previous chapter. The extent of trade liberalisation depends on a terms-of-trade component determined by the degree of terms-of-trade distortions in the non-cooperative equilibrium, and inter-industry capital mobility. The intuition is that the greater the inter-industry capital mobility the smaller the losses incurred by trade liberalisation since capital can more easily be employed elsewhere. I took a dynamic version of the model to the data. I used US tariff cuts on Mexican products and regress these cuts on net imports, which captures terms-of-trade distortions, and inter-industry capital mobility measured by persistence of profits, capital-labour ratios, and four-firm concentration ratios. I found that the empirical results on the relationship between tariff cuts on capital mobility were consistent with the predictions of the theoretical model using the first two measures of capital mobility, whereas the last measure cannot explain the variation in tariff cuts. The term capturing the terms-of-trade component is correctly signed on most specifications but is scarcely statistically significant.

The research questions addressed in all of the core chapters are relevant in terms of explaining the nature and causes of trade liberalisation, and each of them identify distinct and novel features of this issue. It has been a major goal to keep all three papers as closely related to one another as possible, while ensuring each of them posed separate research questions. I shall devote the last paragraphs of this thesis to discussing potential extensions.

Symmetry of the countries analysed in the models has been recurrent throughout the entire thesis. This has been done to keep the analysis simple yet informative. The assumption of symmetry, however, most certainly cannot be assumed for the real world, and many interesting results might obtain if the assumption was relaxed. In the concluding section of Chapter 3, I discussed intuitively how asymmetric bargaining powers between the two countries could result in a more complex prediction regarding the sustainability of trade liberalisation. I argued that a government with a low bargaining power vis-à-vis a lobby would have low benefits of deviating from a trade agreement, but would also face a low punishment on the part of the trading partner following retaliation. The reverse would be the case for a country where the government has a large bargaining power. Hence, the analysis becomes less straight-forward with such an extension. Asymmetry could also be introduced to the model in Chapter 4. Inter-industry capital mobility and lobbying over trade policy were restricted to the import-competing sectors in the two countries. Imagine for example that I introduced mobility of capital for the exporting sectors and allowed their owners to lobby for their desired trade policy during the negotiation of an agreement. In this case, what would matter for the speed of trade liberalisation would not only be inter-industry mobility of capital in the importing sectors, but also that of the exporting sectors. The sign of the relationship between capital mobility of the exporting sector and the speed of trade liberalisation, however, would be the opposite. If capital owners in the foreign exporting sector employed fixed capital, for example, they would lobby for faster trade liberalisation, as opposed to owners of capital in the import-competing sector which would lobby for slower trade liberalisation. What would matter is thus the *relatively* degree of inter-industry capital mobility.

Throughout the entire thesis I have also restricted attention to two country-frameworks. By doing this, I have been ignoring potentially important trade-diverting effects of trade liberalisation. If it is assumed that trade agreements are signed between natural trading partners, the problem of trade diversion may not be very large. Moreover, it may also be argued that a lot of cooperation over trade policy takes place in multilateral negotiations under the WTO.

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