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Duration and Term Structure of Trade Agreements

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Duration and Term Structure of Trade Agreements*

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Abstract

Why are some trade agreements concluded for a limited period of time while others have the form of evergreen contracts supplemented with an advance termination notice clause? We use a dynamic incomplete contracting model to demonstrate that the time structure of the trade agreement is related to the nature of the underlying trade-related investments (or other types of irreversible resource adjustments). If these investments are lumpy and specialized to trade in a particular homogeneous good, the agreements with the fixed term of duration are more likely. The fixed-term agreement provides incentives for the initial investment but leaves the parties the flexibility to revisit the need for future investment by resorting to renegotiation. If the agreement covers trade in goods or services requiring incremental investments with spillovers of the investment benefits across industries, there is a lower risk of overinvestment. Therefore, the parties are more likely to choose an evergreen agreement (with an advance termination notice or an escape clause). We show that these predictions are consistent with the econometric evidence on the trade agreements to which the U.S. is a party.

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1 Introduction

The vast majority of the World Trade Organization's members are signatory to one or more regional trade agreements (RTAs) which, in the WTO parlance, refers to all bilateral, regional or plurilateral trade agreements of a preferential nature. The proliferation of regionalism has continued unabated since the early 1990s. More than 420 bilateral and plurilateral free trade agreements and customs union agreements have been notified to the GATT and the WTO up to December 2009, of which over 300 were notified after the creation of the WTO in 1995. The latest figures from the WTO's Committee on Regional Trade Agreements (CRTA) suggest that it maintains a database of some 276 RTAs notified and in force as of May 2010.[1]

Trade agreements are rarely permanently binding upon the signatory parties. Most bilateral and plurilateral trade agreements and treaties expressly allow a state to withdraw as long as it follows certain procedures of notification. These are usually described in a final clause that contains provisions for the agreement's duration or termination, or for the withdrawal of a party. According to these final clauses, agreements can be divided into two broad categories. Some trade agreements are concluded for an indefinite time and allow contracting parties to withdraw from the agreement or to denounce the agreement by giving an advance notice to the other contracting party (parties). Others stipulate trade on fixed terms for a predefined period of time. The final clauses of the agreements of the second type may contain a non-binding statement about the possibility of renewal based on the mutual consent of the parties. Following the recent contract-theoretic literature, we refer to the former type of trade agreements as *evergreen* agreements with advanced withdrawal (or termination) notice, and the latter type as *fixed-term* agreements.

For example, multilateral and plurilateral agreements that are parts of the WTO compact are evergreen contracts with advance termination notice varying from 12 months (the Agreement on Trade in Civil Aircraft) to 60 days (the International Dairy Agreement and the International Bovine Meat Agreement). Other examples of evergreen trade agreements include the 1992 EC-US Agreement on Trade in Large Civil Aircraft (12-month advance notice),[2] the 2004 Euro-Mediterranean Free Trade Area negotiated among the European Union, Israel, Morocco, Tunisia, Jordan and Egypt (6-month advance notice); the 2001 agreement between Armenia and Kazakhstan (6-month advance notice); and the 1997 Agreement on Arab Free Trade Area (12-month advance notice). The examples of fixed-term bilateral trade agreements include the 2001 agreement between Turkey and Jamaica (5-year duration); the 1996 Canada-U.S. Softwood Lumber Agreements (5-year duration); a series of rather short-term agreements concluded in the 1960s-90s between India and Tanzania (with the duration ranging from 1 to 2 years) and India and Bangladesh (with the duration from

[1] The data on Regional Trade Agreements is repoted on the WTO's website http://rtais.wto.org/ui/publicsummarytable.aspx (accessed May 16th, 2010).

[2] The 1992 EC-US Agreement on Large Civil Aircraft also allows an alternative termination mechanism in exceptional circumstances which was used by the US in October 2004. The Agreement states that in exceptional circumstances a party may terminate the agreement within 15 days following consultations concerning a matter leading to termination.

2 to 3 years); and a series of the Lomé Convention trade-and-aid agreements between the EU and a number of developing African, Caribbean, and Pacific countries, which were concluded for fixed terms ranging from 5 to 10 years.

A review of final clauses in a large number of bilateral and plurilateral trade agreements suggests that fixed-term agreements are more common between parties whose bilateral trade is mostly in homogeneous goods (e.g., commodities). This is the reason why most of the fixed-term agreements either include a commodity-exporting developing country as at least one of the parties (e.g., Lomé Convention, India-Bangladesh, and Turkey-Jamaica agreements) or concern sectoral trade between developed countries in a homogeneous commodity (e.g., lumber, oil, or gas). On the other hand, evergreen bilateral trade agreements (with advance notice) are characteristic of countries that trade primarily in manufacturing goods and services. It is therefore not surprising that bilateral trade agreements between developed countries usually have unlimited duration. We have studied all the bilateral and plurilateral trade agreements to which the U.S. is a party and which are currently in effect (see Appendix B4), and have found that it is indeed true that agreements are more likely to be of fixed duration as opposed to being evergreen if they cover trade in commodities and if they are concluded with less developed countries (see Figure 1).

Out of the 98 agreements that we have been able to classify, 56 covered trade in commodities, out of which 23 were fixed term agreements (and 33 evergreen). Amont the other 42 agreements, the vast majority (35) were evergreen and only 7 were fixed-term. In Table 1, we compare the characteristics of the fixed-term and of the evergreen agreements and find that fixed-term agreeements are significantly more likely to cover trade in commodities. In Appendix B, we carry out a simple econometric exercise and show that a fixed-term agreement is more likely to cover the trade in commodities even if we control for the partners' level of development and democracy (see Appendix B).

Table 1. Characteristics of fixed-term and evergreen trade agreements based on the comprehensive sample of the US trade agreements. Standard errors are in parentheses. Source: US Trade Compliance Center (as of July 2007, see Appendix B for details). All the differences are statistically significant at 1% level.

	Fixed-term	Evergreen
Total number	30	68
Per cent covering trade in commodities	0.77 (0.08)	0.49 (0.06)
Log (GDP per capita of trade partners at the time of signing)	7.4 (0.2)	9.0 (0.2)
GDP per capita of partners as a share of the US GDP per capita (at the time of signing)	0.17 (0.05)	0.53 (0.06)

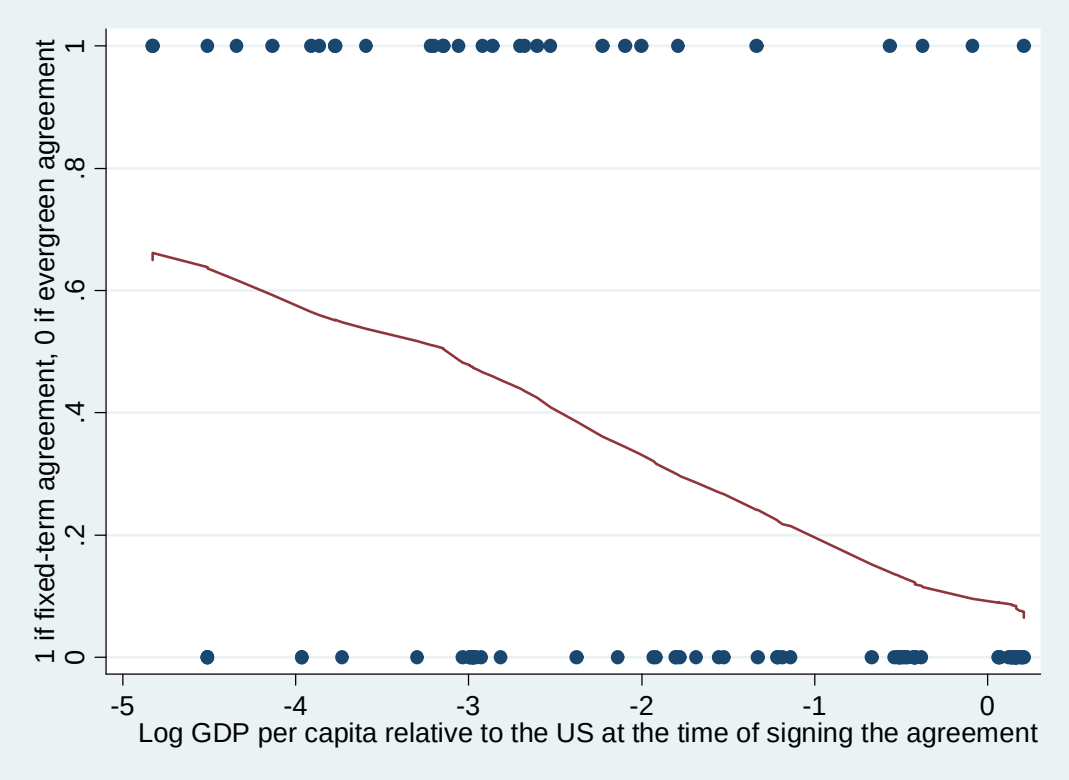

Figure 1: Non-parametric relationship between the level of development (log GDP per capita to US GDP per capita at the time of signing the agreement) of the party to a trade agreement with the US and the probability the contract is a fixed-term (rather than evergreen) agreement. Source: 98 US trade agreements.

How can we explain these patterns? International economics literature focuses on two main reasons why countries might want to sign a trade agreement (Bagwell and Staiger, 2002): (1) trade agreements allow countries to internalize terms-of-trade externalities created by unilateral trade policies (i.e., to overcome the prisoner's dilemma that arises in trade policies between countries with market power in international trade); and (2) trade agreements serve as commitment devices against domestic political economy pressures for protection (e.g., Grossman and Helpman, 1995 and Maggi and Rodriguez-Clare, 1998). In this paper, we discuss an alternative theory. We assume that countries' main motive for signing enforceable trade agreements is for protection of investments associated with irreversible and costly export-specialization policies (e.g., development of trade-related infrastructure) that make the government conducting such polices vulnerable to a hold-up by its trade partner.

Yarbrough and Yarbrough (1992) provide many examples of costly and irreversible trade-related investments and trade policies. Many governments undertake trade-related investments as part of export-promotion and industrial targeting policies. Although the wisdom of industrial targeting

and export promotion policies have been questioned in the economics literature, it is undeniable that governments throughout the world often resort to these policies (see Hausmann and Rodrik, 2006). For example, export-oriented economic activities often require specific inputs for which markets do not exist and which have characteristics of public goods (e.g., regulations, standards, certification, accreditation, provision of certain elements of infrastructure). Many of these public goods differentially benefit particular economic activities. Therefore, it is unavoidable that governments engage in industrial targeting policies in the sense of providing public assets with a high degree of specificity to selected economic activities and to trade partners.

Three assumptions are critical for our argument. First, the trade-related investment (or the policy decision) undertaken by the exporting country government is not only irreversible, but also, to a certain extent, specific to the export destination; the full value of the investment cannot be realized if access to that export market is inhibited. Taken to the extreme, this assumption implies that the investment is useful only for exporting to a particular trade-partner country. More broadly, this assumption means that if the designated export market were shut off, an alternative destination for the export product would be less profitable for the exporters.

Our second assumption is that time is not only a dimension along which the countries' investment, trade and negotiating decisions unfold, but also is a critical variable entering a contract, either as the duration of contractual obligations, or as the advance-notice time for certain unilateral actions. Third, although member countries cannot deviate from the terms of the existing trade agreement, they can renegotiate it at any time.

While the benefits of lasting trade agreements are compelling, they also involve certain costs. As desired trade policies may change dramatically over a short period of time because of economic and political shocks, renegotiating the market access commitments fixed in an agreement may be quite costly. The presence of these costs and benefits makes the analysis of trade agreements similar to the incomplete contract theory (Grossman and Hart, 1986, Hart, 1995) and in particular to the theory of incomplete contracts on time (Guriev and Kvasov, 2005). The parties choosing the duration of the contract, have to resolve the incentive-flexibility tradeoff. If the duration of the trade agreement is too short, there will be no incentives to invest. If the agreement's duration is too long, it will reduce the parties' flexibility to react to external shocks. Although the outdated agreement may be renegotiated, the renegotiated agreement may also be too long and, thus, provide excessively strong investment incentives. The risk of over-investment or of over-specialization is as tangible as that of under-investment. Moreover, this risk is costly for both trade partners, not only for the investing party. Indeed, in a bilateral trade relationship, for the exporting country to specialize in a particular export sector, it must have guaranteed access to the export market for a sufficiently long period to protect itself from the risk of hold-up. The greater the exporting country's trade-specific investment, the larger is the compensation the importing country has to provide to the exporting country for the upfront investment costs, by expanding the duration of its market-access obligations. This is why many countries are reluctant to sign long-term trade agreements

even if there are substantial mutual benefits. A good example is the perennial debate among the EU governments on signing an agreement with Russia on the long-term supply of natural gas. The terms of the agreement proposed by Russia include a large-scale investment in a gas pipeline, which Russia will undertake in exchange for guaranteed long term contracts committing the EU to purchasing Russia's gas. The EU governments are reluctant to sign the agreement on Russia's terms because of the uncertainty about the future of the energy markets.

The optimal time structure of the trade agreement should take into account the trade-off between providing efficient incentives for investment today and making sure that there will be no overinvestment tomorrow. Fixed-term contracts and evergreen contracts help resolve this tradeoff in very different ways. As shown in Guriev and Kvasov (2005), in either case, it is possible to ensure efficient investments, but there is an important distinction: the fixed-term contract is inherently vulnerable to renegotiation while the evergreen contract with advance termination notice can be made renegotiation-proof. Below, we use an example to show that such renegotiation-proofness is useful in some circumstances but not in others.

Consider the bilateral trade setting where one party can make trade-related investments. As investment is not contractible, there is a risk of hold-up; therefore, in order to protect the investment incentives, the parties must sign a binding trade agreement that guarantees market access for the investing trade partner. This agreement can be concluded either for a fixed number of years θ, or for an indefinite duration with the advance termination-notice period α (or with an escape clause). Under the fixed-term agreement, the longer the agreement's duration θ, the greater incentives to invest; thus one can find the optimal length of the agreement θ, that would provide efficient incentives to invest. Now suppose that a new trade-related investment opportunity arises next year. With probability p this new investment project is socially optimal (i.e., it improves the joint welfare of the countries) and should be undertaken, and with probability q it is socially suboptimal and should not be carried out. With probability $1-p-q$ there will be no new trade-related investment opportunity.

The incentives to undertake this new project are very different under the fixed-term agreement and under the evergreen agreement with an advance notice clause. If the trade agreement has a fixed term of duration θ, next year the parties only have $\theta-1$ years remaining under the trade agreement, which represents insufficient incentives for undertaking the investment project which requires at least θ years. If the investment project is jointly optimal, the parties have to renegotiate and replace the agreement with a new one for θ years. Under the evergreen agreement, the opposite is true. Next year, the agreement will provide the very same incentives to invest as this year. This means that if the investment is optimal, there is no need to renegotiate. However, if it is suboptimal, parties have to scrap the agreement because otherwise the foreign country will over-specialize (i.e., will undertake a jointly-suboptimal investment). Therefore, the choice of the agreement will depend on the cost of renegotiation and on whether the risk of overinvestment is greater than that of underinvestment (q is greater than p). If the risk of overinvestment is large (i.e., q is high), a fixed-term agreement will

do better. If, on the other hand, the main danger is the future underinvestment (i.e., not having a sufficiently long-term market-access agreement in place when the probability of value-increasing invesment opportunity, p, is high) and renegotiation is costly, the parties will choose the evergreen type of agreement.

Even though renegotiation costs may be substantial, in reality they are certainly lower than the potential losses due to overinvestment or underinvestment caused by the inefficient duration of the existing trade agreement. Therefore, the inefficient agreement will always be renegotiated in equilibrium. If the trade agreement provides incentives for a 'value-destroying' investment, it will be replaced by another trade agreement, which removes such an incentive, once the investment opportunity arrives. If the trade agreement does not provide adequate incentives for undertaking an investment when it is jointly optimal, a new trade agreement of sufficient duration will take its place. On the other hand, as the renegotiation costs are not trivial,[3] the choice of the agreement should minimize the likelihood of such renegotiation.

The example above outlines the properties of the optimal agreement. If the risk of overspecialization is relatively large, we should see the fixed-term trade agreement that provides incentives for investment today but discourages investment tomorrow. This is applicable to trade in commodities where supporting investments are typically one-off and lumpy. If such an investment turns out inefficient, the welfare cost may be very high for both parties. For example, if a long-term agreement on the import of crude oil provides incentives for upgrading pipelines and oil terminals (i.e., trade-partner-specific and good-specific investments), then the optimally-designed agreement makes sure that the oil-exporting party undertakes only those upgrades that are jointly efficient for the parties.

In the case of trade in less commoditized products, the situation is different. Production and transportation capacity related to trade in goods or services characterized by vertical or horizontal product differentiation is typically less lumpy as it allows small scale incremental investments aimed at improving a particular aspect (or module) of the traded product variety. Even more importantly, investments related to trade in goods characterized by greater product differentiation are typically "leaky" because of the spillovers of the investment benefits across related varieties of the differentiated product. These characteristics of investments in less commoditized (and more differentiated) goods lower the risk of over-investing in them. Indeed, an investment that enhances gains from trade in one product variety today will likely produce spillover benefits that may enhance gains from trade in another variety tomorrow. For example, human capital investments (or labor-market adjustment policies) in a country specializing in outsourced software design can be shared by a large number of software product varieties.

The distinction we draw between the investments in the homogeneous commodity industry and the differentiated product industry is similar to the notion of the product space with the varying

[3] One has to take into account full economic costs of renegotiation, not only the direct legal costs. The full economic costs are related to the fact that trade negotiations take time; and each day of delays involves foregone gains from trade and unrealized investment opportunities.

degree of relatedness among products, which was introduced in Hausmann and Klinger (2007) and Hidalgo et al. (2007). These papers define the relatedness or distance between the goods through the degree of substitutability between the specific assets (e.g., human or physical capital, infrastructure, regulatory framework, and property rights regimes) required to produce the goods. Due to the varying degree of relatedness among goods and services, some parts of the 'product space' are dense while others are sparse. This implies that countries that are specialized in a dense part of the product space have an easier time at changing their export mix than countries that are specialized in more disconnected products located in a sparse part. Hausmann and Klinger (2007) observe that the densest part of the product space tends to be dominated by manufactured products while homogeneous goods and commodities (e.g., oil, mineral ores, timber and cotton, and un-processed agricultural goods) are located in the sparse areas of the product space. They also provide evidence that in general, rich (poor) countries tend to be specialized in dense (sparse) parts of the product space.

As increasingly common in the recent trade literature, we assume that trade agreements are externally enforced (albeit incomplete) contracts. In principle, our argument could be made in a setting with self-enforced agreements. We choose the former setup for the sake of simplicity. As we study agreements that span several periods and may include escape clauses, solving for equilibria in repeated games would be particularly cumbersome.

The rest of the paper is structured as follows. Section 2 provides a review of the related literature on trade and contract theory. Section 3 describes the setup of the model. In Section 4, we solve for incentives under the fixed-term and the evergreen trade agreements. Section 5 concludes.

2 Related literature

The theoretical literature on the relationship between preferential trade agreements and mulilateral trade liberalization is very broad and goes back to the 1950s. The notable examples include Viner (1950), Riezman (1979), Kennan and Riezman (1990), Krugman (1991), Bond and Syropoulos (1996), Bagwell and Staiger (1997a,b), Syropoulos (1999), and Bond et al. (2004). Several strands of that theoretical literature are closely related to our paper. First, there is research on the dynamic effects of trade policy via irreversible investment. Krugman (1987) models the irreversible effects of trade policies in the context of dynamic economies of scale. In that paper, a temporary protectionist policy reduces gains from trade but provides incentives for investment in the sector with dynamic economies of scale. Our paper is also close to the argument discussed informally in Yarbrough and Yarbrough (1992) and to the analysis conducted by MacLaren (1997) who suggested that, without durable trade agreements, irreversible trade-related investments and intersectoral resource adjustments (e.g., labor and capital reallocations in and out of the export sector) are vulnerable to a hold-up by the trading partner. Another closely related paper is Bond (2006) which considers the trade-off between the governments' need to protect irreversible trade-specific investment and the

desire to maintain a degree of policy flexibility in the environment with uncertain terms of trade.[4] One implication of the MacLaren's and Bond's papers is that the costlier the trade partner-specific investment, the longer the duration of the trade agreement specifying the parties' market access committments. However, these papers do not provide any insights as to why some trade agreements are concluded for a fixed term while others are indefinite (with advance termination notice or a temporary escape clause).

To the extent the irreversibility of trade-related investments or sluggishness in trade policy-induced resource adjustment plays a part in our analysis, explaining the duration and term structure of trade agreements bears similarity to the question of why trade liberalization tends to be implemented gradually, rather than being introduced at once at the conclusion of the initial agreement. Staiger (1995), Devereux (1997), and Furusawa and Lai (1999), have shown that the presence of rent-earning factors in the import sector, learning-by-doing in the export sector, and the adjustment costs of moving resources in and out of the import-competing sector, can help to explain the gradual pace of trade liberalization. More recently, Bond and Park (2002) and Chisik (2003) have analyzed mechanisms leading to gradualism in trade liberalization which are based on, respectively, the consumption-smoothing incentives of a small country and the irreversibility of investments in the export sector. The main difference between this literature and our paper is that we depart from the assumption of self-enforced tariff commitments and explicitly model the factors affecting the countries' choices regarding the duration and term structure of trade agreements.

Another related theme in the international economics literature is the effect of uncertainty on the structure of international trade agreements. The earlier papers by Bagwell and Staiger (1990, 2003, 2005), Riezman (1991), and Rosendorff and Milner (2001) consider trade agreements negotiated and enforced in the presence of uncertainty about either the trade volume or terms of trade. All of these papers point out that self-enforcing trade agreements will unravel unless, to decrease their incentives to defect, countries implement more protectionist policies during periods of trade volume surges. Therefore, these papers interpret periods of high tariffs legitimized by the safeguards and escape clauses of the GATT/WTO legal system, not as instances of non-cooperative behavior but rather as an attempt by countries to maintain the self-enforcing nature of international cooperation in the environment with volatile trade volume.[5] In another related paper, Chisik (2009) considers the effect of uncertainty in a model with irreversible quality choices and shows that under

[4] MacLaren (1997) models these investments as trade-partner-specific and irreversible specialization of human capital while Bond (2006) studies the case where parties invest in infrastructure to reduce trade costs. While these two setups are somewhat different, the main ideas carry on from one framework to the other one. For simplicity's sake, we follow Bond's approach.

[5] Klimenko et al. (2008) consider the role of escape clauses in the environment with the terms-of-trade uncertainty where countries have to rely on exogenous enforcement of trade agreements because continuous renegotiation completely undermines the countries' ability to sustain self-enforced cooperation. In their setting, the ability of the escape clause to enhance the value of the trade agreement depends on the extent to which the information about the realizations of the stochastic terms-of-trade variable is verifiable by the dispute settlement body, which adjudicates disputes over alleged violations of trade agreements.

preferential trade agreements–unlike WTO–high uncertainty results in inefficiently low quality.

Although our model of trade agreements does not include the possibility of escape clauses, their role would be very similar to the role of another common clause incorporated in trade agreements: the advance notice for unilateral termination, that plays the central role in our setting. The obligation to give the advance notice limits opportunities for hold-up and therefore protects the incentives to invest. Even if there is a shock that makes termination mutually beneficial, the advance notice of α periods provides the party that undertook a trade-related investment, with a guaranteed compensation of at least α-periods-worth of trade gains. A similar compensating mechanism is included in the typical escape clause. If a country prompted by a terms-of-trade shock imposes a protectionist measure by invoking the escape clause for the duration of β periods, and this temporary surge of protection affects the returns on investments undertaken by other members of the trade agreement, the country that invoked the escape clause has to provide its trade partners a compensation worth β periods of the trade gains promised to them under the terms of the agreement.[6] Therefore, the advance termination-notice clause and the temporary escape clause perform similar functions: they protect the investment incentives.

A relatively recent but fast-growing thread in the international economics literature emphasizes contractual incompleteness of international trade agreements which are enforced exogenously. Battigalli and Maggi (2003) examine the role of international agreements on product standards and show how the incompleteness of the trade agreements provides a role for a central dispute settlement mechanism. Horn, Maggi and Staiger (2005) consider trade agreements with an endogenous level of contractual incompleteness determined by the contracting costs. Horn (2006) analyzes the role of the National Treatment principle of the WTO in overcoming contractual incompleteness of the international trade agreements. Maggi and Staiger (2008) assume that a dispute settlement institution (DSI) is able to choose the degree of contractual incompleteness of the trade agreement, and characterize the DSI design that would be optimal for governments under various contracting conditions. Yet another strand of literature (e.g., Antras and Helpman, 2004) applies incomplete contract theory to the problem of hold-up and vertical integration in the contractual environment involving firms transacting across the international border, rather than governments contracting on trade policies.

Our paper both builds on, and contributes to, the theoretical literature on contracts. Starting with Grossman and Hart (1986), the formal theory of holdup has emphasized the role of long-term contracts in protecting incentives for partner-specific investment. Our model is most closely related to Harris and Holmstrom (1987) and Guriev and Kvasov (2005). Harris and Holmstrom (1987) consider contract dynamics with positive renegotiation costs. Their rationale for long-term

[6] Moreover, as discussed in detail in Bagwell and Staiger (2005), the international legal system typically requires that after the expiration of the escape clause which lasted for β periods, the earliest time the escape clause can be invoked again, is β periods after the end of previous escape clause. Therefore, the investing party is guaranteed the present value of the gains from trade for the period of $[t, t+2\beta]$ where t is the time when the escape clause is invoked the first time.

contracts is risk-sharing (between a risk-neutral employer and risk-averse employee) rather than investment incentives. Harris and Holmstrom (1987) analyze the trade-off between the costs and the benefits of renegotiation (due to the inefficiency of the obsolete contract) and solve for the optimal contract length. Guriev and Kvasov (2005) study incomplete contracts in continuous time where intertemporal linkages are driven by both contracting and investment. They find the optimal contract duration and the length of the advance notice that resolve the abovementioned incentive-flexibility tradeoff for fixed-term contracts and evergreen contracts. In their basic model (which assumes that there are only two states of nature and that renegotiation is costless), these two contract types are equivalent: either can implement the first best.

The contribution of the present paper to the contract theory literature is to emphasize the difference between the two types of contracts in a more realistic setting of trade agreements. We show that, while the contract duration is chosen to provide incentives for investment at the inception of the contract, the availability of the alternative contract types allows for another degree of freedom. Having two distinct contract types helps to differentiate incentives for investment at the inception of the contract and at the contract's more mature stages. The fixed-term contract provides weaker incentives for the future investments than for the present investment. The evergreen contract protects the present and the future investments equally well. Therefore, investment incentives depend not only on the duration of the contract but also on the type of the contract. This, in turn, implies that the choice of the contract type depends on the characteristics of both the present investment and the future investments as well as on the renegotiation costs.

3 Setup

We consider a discrete time model of trade between two countries, home and foreign. In every period, countries can trade, and the foreign country can make an investment reducing its cost of exporting to the home country in the future periods. We begin our analysis by assuming that the foreign country exports a single homogenous good (i.e., a commodity). The foreign country's investment is "lumpy," which is captured by the assumption that in every period the investment is either 0 or 1. This assumption is intended to capture the difference between trade-facilitating investments for the homogeneous good industry and the differentiated (i.e., non-commoditized) good industry. The examples of such lumpy investments intended to facilitate trade in homogeneous goods include the construction of large scale transportation or storage facilities for commodities (e.g., lumber-shipping ports, oil terminals, gas pipelines, electricity grids). By contrast, the main characteristic of investments in the differentiated product industry is their "leaky" nature. While trade-facilitating investment projects may be initiated for each variety of the differentiated good, the accumulated stock of these investments is generic to the entire industry because of the spillovers of investment benefits across product varieties. Moreover, investments for individual product varieties incrementally increase the capacity of the entire differentiated good industry. To make investment

in the differentiated- and homogeneous-good industries comparable, we assume that there is a continuum of differentiated good varieties of measure 1 and the investment for each variety can be either 0 or 1. Because of its leaky nature, the investment reducing the cost of trade for variety i also reduces the trade cost for variety j.[7] Since the probability of an investment for each variety of the differentiated good as well as for the homogeneous good is the same, the expected volume of trade-related investments in the differentiated good industry is between 0 and 1, i.e., exactly as in the homogeneous good industry. But since investments in the differentiated good industry are undertaken independently for each variety, they do not have the all-or-nothing property of the lumpy investment in the homogeneous industry.

In what follows we describe our model in a few steps. First, we consider a two-country trade framework and characterize the outcome of the single-period trade game by solving for the optimal tariffs and for the Nash equilibrium. We then introduce the trade-related investments and describe their effect on the trade cost. This allows us to provide the micro-foundations of countries' payoffs by presenting them as functions of trade-policy and investment variables. Secondly, we describe the nature of uncertainty and the evolution of states of nature over time. Thirdly, we describe the timing of decisions within a period of the model. And finally, we describe the first best. Using the solution to the Bellman equation for the joint returns on investment, we derive the countries' payoffs for the alternative types of trade agreements and characterize the parameter values for which trade-facilitating investment is jointly optimal, either if the countries trade in the differentiated product or if they trade the homogenous product and the state of nature is "good."

3.1 Trade and trade-related investments

The stage game is derived from the basic two-country, two-good framework previously considered by Johnson (1953/54), Mayer (1981) and Dixit (1987). We provide only a terse review of the main elements of this framework. There are countries, home (no $*$) and foreign ($*$). These countries exchange two goods x and y. The home country exports good y in exchange for imports of good x from the foreign country. In this subsection, we assume that both x and y are homogenous goods. In the subsection 3.4, we will consider an alternative setup where x represents a differentiated product with a continuum of possible varieties.[8]

[7] The difference between the two types of goods can be seen in the following example. In the case of commodities, such as lumber, oil, or gas, the necessary investments usually have a very high degree of specificity and have no effect on the production cost of any other good (e.g., a gas pipeline requires a lumpy indivisible investment; also, it cannot be used for transporting oil). By contrast, in software design or consulting services, investments undertaken to facilitate trade in individual varieties are small and independent, but these investments can be reused for an entire spectrum of differentiated product varieties.

[8] To be more specific, we assume that each country is populated by identical agents whose preferences over consumption of the goods can be represented by a quasilinear utility function. This allows us to restrict our analysis to the aggregate utility functions. Letting goods be denoted by subscripts, the home and foreign country utility functions take the form: $\Phi(Q_x, Q_y) = \phi(Q_x) + \phi(Q_y)$ and $\Phi^*(Q_x^*, Q_y^*) = \phi^*(Q_x^*) + \phi^*(Q_y^*)$ where the sub-utility functions $\phi(\cdot)$ and $\phi^*(\cdot)$ are strictly concave in quantities of the consumed goods. For the case of the differentiated

Both countries are large enough to affect the terms of trade through an import tariff, which is the only policy instrument available to the countries' governments. Although good y can be shipped costlessly, importing good x from the foreign to the home country is costly. The per-unit cost of shipping good x from the foreign to the home country $v = v(K^*)$ is a decreasing function of capital stock of trade-related infrastructure K^*. When there is an opportunity, the foreign country can increase the stock of the infrastructure K^* by making an investment. K^* is specific to the relationship between the home and the foreign countries and cannot be used to reduce trade costs with other potential trade partners. For simplicity we assume that the per-period investment is a binary variable: $I = \{0, 1\}$. The cost of investment is c. The investment opportunities arrive at a Poisson rate σ.

We follow the earlier literature on political economy of trade policy (e.g., Baldwin 1987, Bagwell and Staiger, 2005) and assume that each government seeks to maximize a *weighted sum* of the producer surplus, the consumer surplus and the tariff revenue. While the foreign government weighs equally all components of the social welfare, the home government puts a relatively greater weight on the *import-competing producer surplus*. Specifically, let $\gamma > 1$ denote the random parameter representing the weight placed by the home government on its import-competing producer surplus. Then the single-period welfare functions of countries given tariff choices τ and τ^* and the transportation cost $v(K^*)$ are denoted by $U(\tau, \tau^*, \gamma, K^*)$, $U^*(\tau, \tau^*, K^*)$. We make a number of conventional assumptions on $U(\tau, \tau^*, \gamma, K^*)$ and $U^*(\tau, \tau^*, K^*)$ to ensure the existence of static best response functions that generate Nash equilibria in tariffs.[9] High tariffs τ or τ^* lead to the autarky outcome, in which welfare levels of both countries are taken to be zero. For lower levels of τ and τ^*, trade volume is positive, and the welfare of each country is strictly positive, differentiable and strictly quasi-concave in the country's tariff level.

Let $\widehat{\tau}(\tau^*, \gamma, K^*)$ and $\widehat{\tau}^*(\tau, K^*)$ be the values of τ and τ^* that maximize the respective welfare functions of the two countries, i.e., the country's best response tariffs. Given that γ is the weight of the import-competing producer surplus in the home country welfare, it is natural to assume that $\widehat{\tau}_\gamma > 0$. The Nash equilibrium tariffs are denoted by $\widehat{\tau}^N(\gamma, K^*) > 0$, and $\widehat{\tau}^{*N}(K^*) > 0$. We assume that all realizations of γ are consistent with strictly positive trade volumes under Nash equilibrium tariffs. The Nash equilibrium welfare levels are $U^N(\gamma)$ and $U^{*N}(\gamma)$.

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good x available in a continuum of varities of measure 1, Q_x and Q_x^* are the additively-separable utility indexes representing consumption of the differentiated product varieties: $Q_x = \Psi(\int_0^1 \psi(x(j))dj)$ and $Q_x^* = \Psi(\int_0^1 \psi(x^*(j))dj)$. Each variety is supplied by perfectly-competitive constant-returns-to-scale home and foreign suppliers.

[9] Following Dixit (1987) we assume that balanced-trade and Marshall-Lerner conditions are satisfied. This ensures that one country's unilaterally-optimal tariff creates a negative terms-of-trade externality for the other country. Although the phrase "terms-of-trade externality" is rarely used in the parlance of real-world trade-policy negotiators, as Bagwell and Staiger (2002) demonstrate in their recent monograph, the concepts "terms-of-trade gain" and "market-access restriction" describe the single economic experience that occurs when the importing country government raises its import tariff and restricts foreign access to its market.

The joint welfare of the two countries is given by $\widetilde{U}(\tau, \tau^*, \gamma, K^*) \equiv U + U^*$ (hereinafter we will use tilde for the joint variables). We assume that $\widetilde{U}$ is strictly concave in τ for all realizations of $\gamma > 1$, so that the jointly optimal home tariff is strictly positive and non-prohibitive: $\tau^E(\gamma) > 0$ (the superscript "E" stands for "efficient"). Moreover, $\frac{\partial \widehat{\tau}^N(\gamma)}{\partial \gamma} > \frac{\partial \tau^E(\gamma)}{\partial \gamma} > 0$ for all $\gamma > 1$ consistent with strictly positive trade volumes under Nash equilibrium tariffs. We also assume that $\widetilde{U}_{\tau^*} < 0$ which implies that $\tau^{*E}(\gamma) = 0$.

Given our interpretation of γ, it is natural to assume that its reduction implies a lower jointly-optimal tariff ($\tau^E_\gamma > 0$) and a greater volume of import in the home country, which increases the marginal effect of the foreign infrastructure investment on the home country welfare: $\frac{\partial U(\tau, \tau^*, \gamma, K^*)}{\partial \gamma \partial K^*} < 0$. The foreign country can invest either $\Delta K^* = 0$ or $\Delta K^* = 1$ per period; the cost of investment is $c\Delta K^*$.

The parties discount the future at the common discount rate ρ. (We assume that the capital stock does not depreciate; non-trivial depreciation rate would simply be added to ρ.)

The countries' marginal per period payoffs from the investment are $u(\tau, \tau^*, \gamma) = \frac{\partial U(\tau, \tau^*, \gamma, K^*)}{\partial K^*}$ and $u^*(\tau, \tau^*) = \frac{\partial U^*(\tau, \tau^*, K^*)}{\partial K^*}$. The joint per period payoff is given by $\widetilde{u}(\tau, \tau^*, \gamma) \equiv u(\tau, \tau^*, \gamma) + u^*(\tau, \tau^*)$. We introduce a linearization $U^*(\tau, \tau^*, K^*) = U^*(\tau, \tau^*, K_0^*) + \frac{\partial U^*(\tau, \tau^*, K_0^*)}{\partial K^*}(K^* - K_0^*) + o(K^* - K_0^*)$ and assume that maximum per period investment $\Delta K^* = 1$ is small compared to K^*. This assumption allows us to neglect the higher-order terms of the Taylor expansion in the neighborhood of K_0^*. Therefore the effect of investment on future payoffs will be linear.[10] Moreover, we assume that under Nash equilibrium tariffs the foreign country has no incentives to invest: $u^*\left(\widehat{\tau}^N, \widehat{\tau}^{*N}\right) < c$.

3.2 Uncertainty

The home country's domestic political economy parameter γ changes over time. For simplicity, we assume that this parameter has only two realizations: γ can be high $\gamma = \gamma^P$ (i.e., consistent with the protectionist stance of the home government) or low $\gamma = \gamma^L < \gamma^P$ (i.e., consistent with the liberal trade-policy stance of the home government). In the latter case, liberal trade policy is globally optimal (i.e., maximizes joint welfare of the two countries), while if $\gamma = \gamma^P$, the global optimum involves higher trade barriers. Obviously, trade volume and gains from trade under the liberal trade policy of the home government are greater than they under the protectionist trade policy.

[10] In principle, one can argue for either a convex or for concave relationship between the foreign country's investment and welfare. On one hand, the investment cost functions are usually convex. On the other hand, the effect of the infrastructure investment on the welfare is likely to be concave – the more the parties have invested, the greater amount is traded, hence the higher return to the investment. As it is hard to determine the nature of the ultimate effect of K^*, we use a linear function as the first approximation. A non-linear relationship would imply similar results but require more cumbersome derivations.

Linearization also simplifies the role of depreciation. If the linearity assumption holds, depreciation does not affect incentives to invest.

We distinguish between three states of nature: "Good," "Medium," and "Bad" (G, M, and B, respectively). In both G and M states, $\gamma = \gamma^L$, while in state B, $\gamma = \gamma^P$. The difference between the G and M states is that there is no direct transition between states G and B. Essentially, if the state is G, everyone knows that protectionist preferences are unlikely, while if the present state is M, the state B is likely to arrive next period.

Formally speaking, we consider a Markov process where the transitions between the three states occur at given rates. The transitions from state M to states G and B take place at the rates μ_G, μ_B, respectively. For simplicity, we assume that transitions to M, out of both G and B, states occur at the same rate λ. Each row in the transition matrix below represents the probability distribution of the state in the next period s_{t+1} given the current state s_t :

	$s_{t+1} = G$ $(\gamma_{t+1} = \gamma^L)$	$s_{t+1} = M$ $(\gamma_{t+1} = \gamma^L)$	$s_{t+1} = B$ $(\gamma_{t+1} = \gamma^P)$
$s_t = G$ $(\gamma_t = \gamma^L)$	$1-\lambda$	λ	0
$s_t = M$ $(\gamma_t = \gamma^L)$	μ_G	$1-\mu_G-\mu_B$	μ_B
$s_t = B$ $(\gamma_t = \gamma^P)$	0	λ	$1-\lambda$

We use $p_{t,s}$ to denote the probability of being in state $s = G, M, B$ at time t. Given the initial distribution $(p_{0,G}, p_{0,M}, p_{0,B})$, these probabilities are given by:

$$\begin{aligned}
p_{t,G} &= \overline{p}_G + (p_{0,G} - \overline{p}_G)(1-\lambda)^t + \frac{\mu_G}{\mu_G+\mu_B}(p_{0,M} - \overline{p}_M)\left[(1-\lambda)^t - (1-\lambda-\mu_G-\mu_B)^t\right], \\
p_{t,M} &= \overline{p}_M + (p_{0,M} - \overline{p}_M)(1-\lambda-\mu_G-\mu_B)^t, \\
p_{t,B} &= \overline{p}_B + (p_{0,B} - \overline{p}_B)(1-\lambda)^t + \frac{\mu_B}{\mu_G+\mu_B}(p_{0,M} - \overline{p}_M)\left[(1-\lambda)^t - (1-\lambda-\mu_G-\mu_B)^t\right],
\end{aligned}$$

where $\overline{p}_s$ denotes the steady state distribution:

$$(\overline{p}_G, \overline{p}_M, \overline{p}_B) = \left(\frac{\mu_G}{\lambda+\mu_G+\mu_B}, \frac{\lambda}{\lambda+\mu_G+\mu_B}, \frac{\mu_B}{\lambda+\mu_G+\mu_B}\right). \tag{1}$$

The steady state probabilities $\overline{p}_s$ can be derived in either of two ways. First, these probabilities are the limit distribution for $t \to \infty$: $\overline{p}_s = \lim_{t\to\infty} p_{t,s}$. Alternatively, $\overline{p}_s$ is the eigenvector of the transition matrix: if the present state is $p_{t,s} = \overline{p}_s$, then it will be the same next period $p_{t+1,s} = \overline{p}_s$.

Note that we introduce *three* states even though there are only *two* realizations of the home country political economy parameter γ. This makes the structure of uncertainty sufficiently rich to separate trade policy and investment decisions. While liberal trade is optimal in states G and M, investment should only take place in state G. In state G, it is optimal both to set low tariffs

and to invest (as the high level of γ is relatively unlikely to occur in the future). In state B, it is optimal to set higher tariffs and and have a lower volume of trade so that investment does not pay off. In the intermediate state M, parties trade at the same level as in the state G (as the level of γ is low) but do not invest (as the protectionist preferences $\gamma = \gamma^P$ are likely to arrive in the future).

We shall also introduce another source of uncertainty: the availability of the investment opportunity. Investment at time t is only possible if there is an investment opportunity. We assume that investment opportunity is available with probability σ; there is no investment opportunity with probability $1 - \sigma$. The arrivals of investment opportunities are independent across time periods.

3.3 Timing

The timing is as follows.

– Period t begins. State transition is realized. Parties observe the state $s = G, M, B$ and the political economy parameter $\gamma = \gamma^P, \gamma^L$. Investment opportunity arrives (with probability σ) or does not arrive (with probability $1 - \sigma$).

– Parties choose whether to trade according to an agreement signed in previous periods or to renegotiate. The renegotiation may replace the existing agreement with a new long-term or spot trade agreement, or the Nash equilibrium tariffs. Renegotiation incurs cost κ.

– If there is an investment opportunity, the foreign country decides whether to invest.

– Trade occurs. Period t ends.

3.4 Global returns to investment

We begin our analysis with the first best for the homogenous good case, and then extend it to the setup where x is a differentiated product.

Homogenous good.

The first best level of trade depends on the current state of nature. The jointly optimal tariffs are $\tau^E(\gamma), \tau^{*E}(\gamma)$. The level of trade is higher in states G and M (when $\gamma = \gamma^L$).

Let us now solve for the optimal investment decision (contingent upon the arrival of an investment opportunity). Investment raises welfare in all states, but the immediate effect of investment is lower in state B (when γ is high) than in states M and G (and it is the same in M and G states). We denote the joint per-period return to investment in these states by $\widetilde{u}^L \equiv \widetilde{u}\left(\tau^E(\gamma^L), \tau^{*E}(\gamma^L), \gamma^L\right)$ and $\widetilde{u}^P \equiv \widetilde{u}\left(\tau^E(\gamma^P), \tau^{*E}(\gamma^P), \gamma^P\right)$, respectively. As assumed above, the joint return to investment is higher under the liberal trade policy: $\widetilde{u}^L > \widetilde{u}^P$.

The decision to invest should take into account the expected global returns to investment which include the returns in the current state as well as the future transitions to other states of nature.

Let $\widetilde{W}_s$ be the expected social returns to investment where $s = G, M, B$ is the initial state. Once the investment opportunity arrives in state s, investment is optimal whenever $\widetilde{W}_s > c$. By definition,

$$\begin{aligned}
\widetilde{W}_G &= \frac{1}{1+\rho}\left[\widetilde{u}^L + (1-\lambda)\widetilde{W}_G + \lambda\widetilde{W}_M\right] \\
\widetilde{W}_M &= \frac{1}{1+\rho}\left[\widetilde{u}^L + (1-\mu_G-\mu_B)\widetilde{W}_M + \mu_G\widetilde{W}_G + \mu_B\widetilde{W}_B\right] \\
\widetilde{W}_B &= \frac{1}{1+\rho}\left[\widetilde{u}^P + (1-\lambda)\widetilde{W}_B + \lambda\widetilde{W}_M\right]
\end{aligned}$$

where $\rho > 0$ is the discount rate.

This system has the following unique solution:

$$\begin{aligned}
\widetilde{W}_M &= \frac{\widetilde{u}^L(\rho+\lambda+\mu_G) + \widetilde{u}^P\mu_B}{\rho(\rho+\lambda+\mu_G+\mu_B)} \\
\widetilde{W}_G &= \frac{\widetilde{u}^L\left[(\rho+\lambda+\mu_G)(\rho+\lambda)+\rho^2\right] + \widetilde{u}^P\mu_B\lambda}{\rho(\rho+\lambda+\mu_G+\mu_B)(\rho+\lambda)} \\
\widetilde{W}_B &= \frac{\widetilde{u}^L(\rho+\lambda+\mu_G)\lambda + \widetilde{u}^P\left[\mu_B(\rho+\lambda)+(\rho+\lambda+\mu_G)\rho\right]}{\rho(\rho+\lambda+\mu_G+\mu_B)(\rho+\lambda)}
\end{aligned}$$

One can easily check that $\widetilde{u}^L > \widetilde{u}^P$ implies $\widetilde{W}_B < \widetilde{W}_M < \widetilde{W}_G$. In state G, the expected returns to investment are high, as the parties expect relatively long period under low tariffs; in the states B and M, longer periods of protectionism are more likely.

Differentiated goods.

Now consider the case of the differentiated product which is available in a continuum of varieties of measure 1. We assume that investment are additive across the varieties. The crucial assumption is that the per unit cost of trade depends on the aggregate stock of capital $K^* = \int_0^1 K^{*i} di$. This assumption implies that investment is specific to the trading party but not to the variety; investments in reducing the trade in variety i also reduce the cost of trade in variety j. In reality, the substitution between the investments in different product varieties is certainly imperfect, we consider the extreme case of perfect substitution for the sake of tractability.

We also assume that the shocks are independent and identically distributed across the varieties. Again, while in reality there is a non-trivial correlation between political interests associated with different variety producers, we introduce this extreme assumption to simplify the analysis. For our qualitative results we only need that the correlation is not perfect (and thus lower than in the homogenous good case where it is one by definition).

As there is a continuum of product varieties and the shocks are independent, exactly $\overline{p}_s$ per cent of the varieties are in the state $s = G, M, B$. Whenever there is an investment opportunity for variety i, the investment incurs a cost c and results in the expected joint returns of $\overline{W} = \sum_{s=G,M,B} \overline{p}_s \widetilde{W}_s$.[11]

[11] This formula assumes that infrastructure is used randomly across sectors in different states. If the capital is allocated in a non-random way, the condition (2) below would be even less demanding.

We do not assume that the parties can only set one tariff for all varieties. The government sets the tariffs for each variety independently. So at each moment, there is a share $\overline{p}_B$ of varieties with high tariffs and $1 - \overline{p}_B$ varieties with low tariffs.

Assumptions.

Throughout the paper we assume that investment is optimal if the good is differentiated, or if the good is homogenous and the state is G. If the good is homogenous, but the state is M or B, there should be no investment.

Assumption A1. The parameters are such that:

$$\widetilde{W}_M < c < \overline{W}. \tag{2}$$

This assumption implies $\widetilde{W}_B < c < \widetilde{W}_G$ since $\widetilde{W}_B < \widetilde{W}_M$ and $\widetilde{W}_G > \overline{W}$.

The assumption allows us to focus on the most interesting case. Otherwise, either $\overline{W} < c$, and there is no need for investment in the differentiated good case (and the parties are better off not signing any trade agreement), or $\widetilde{W}_M > c$, and state M is not different from state G as in both states it is optimal to set low tariffs and invest.

We also make several assumptions on contractibility and renegotiation.

Contractibility. We assume that investment is not contractible. The state of nature is observable but not verifiable. The only contractible variables are the tariffs and the fact of trade at a given time.

Renegotiation. During each period, parties can renegotiate the previously concluded agreements. All the bargaining power belongs to the home country. The constant per-period cost of renegotiation, κ, is sufficiently small compared to the gains from amending the agreement, which implies that renegotiation will always happen in equilibrium. However, because the renegotiation costs are not trivial, the parties choose the contract that minimizes these costs.

3.5 First best

The above analysis and assumptions allow for describing the first best. In the case of the homogenous good, the free trade is optimal in states G and M while the investment is only socially optimal in state G. The uncertainty is sufficiently rich to decouple trade and investment decisions: in state M the current preferences are pro-trade, so it is optimal to reduce tariffs, but the protectionist preferences are likely to emerge in the future. Hence, investment does not pay off.

In the differentiated good case, where the investments are perfectly leaky and the share of varieties in state G is large enough to ensure that $\overline{W} > c$, investments are jointly optimal.

4 Trade agreements and investment

Suppose an investment opportunity arises. We first derive the incentives to invest under different contract types starting with the case of a homogenous good. Then we solve for the differentiated good case. After that, we compare the renegotiation costs for each case for different types of contracts.

4.1 Null contract

We shall first consider the case of a null contract: countries do not conclude a long-term agreement. The terms of trade are negotiated on the spot. Since the home country is assumed to have full bargaining power, the foreign country's payoff is equivalent to its payoff under the Nash equilibrium. As per our assumption, the return to investment under the Nash equilibrium tariffs is insufficient to cover the investment cost and the foreign country does not invest: $u^*\left(\widehat{\tau}^N, \widehat{\tau}^{*N}\right) < c$. As we show below, as long as renegotiation costs are low relative to the returns to investment, the null contract is outperformed by other agreements.

4.2 Fixed term agreement

The parties sign an agreement to trade for θ periods with the tariffs τ, τ^*. (If θ is not an integer, trade in the last period occurs with a probability $\theta - int(\theta)$). Under this agreement, the foreign country's payoff does not depend on γ; therefore the foreign country's returns to investment only depend on the contracted tariffs τ, τ^* (which are set at the low level $\tau = \tau^E(\gamma^L), \tau^* = \tau^{*E}(\gamma^L)$) and not on the actual state $s = G, M, B$.

Let $v^* = u^*\left(\tau^E(\gamma^L), \tau^{*E}(\gamma^L), \gamma^L\right)$ be the one-period return to investment under the agreement and V_θ^* the expected discounted returns to investment received by the foreign country given the agreement with tariffs τ, τ^* and the duration θ :

$$V_\theta^* = \frac{1}{1+\rho}\left[v^* + V_{\theta-1}^*\right] = v^* \frac{1-(1+\rho)^{-\theta}}{\rho} + (1+\rho)^{-\theta} V_0^*.$$

As argued above, the foreign country's payoff under the null contract is $V_0^* = u^*\left(\widehat{\tau}^N, \widehat{\tau}^{*N}\right) < c$ (regardless of the state $s = G, M, B$). Hence the foreign country's payoff under the agreement with tariffs τ, τ^* and the duration θ is

$$V_\theta^* = v^* \frac{1-(1+\rho)^{-\theta}}{\rho}. \tag{3}$$

The minimum duration $\overline{\theta}$, that provides the incentive to invest, should solve $V_{\overline{\theta}}^* = c$.

Proposition 1 *The minimum duration of the fixed-term agreement which provides a sufficient incentive for investment is*

$$\overline{\theta} = \frac{\ln\left(\frac{v^*}{v^* - c\rho}\right)}{\ln(1+\rho)}.$$

Already after one period into the lifetime of the fixed-term agreement with the duration $\overline{\theta}$ (and tariffs τ, τ^*), this agreement no longer provides sufficient incentives to invest: $V^*_{\overline{\theta}-1} < V^*_{\overline{\theta}} = c$.

Under this trade agreement, the foreign country is happy with its terms and wants to continue with the same tariffs even if state is B, and trade on the same terms is jointly inefficient. Therefore, once state is B is reached, the home country will immediately ask for renegotiation and will compensate the foreign country for scrapping the agreement.

4.3 Evergreen agreement

Now consider an agreement that provides an ongoing protection for investment with a requirement that the unilateral withdrawal from the treaty has to be preceded by a notification of the other party, α periods in advance of the withdrawal.[12] Thus, the agreement stipulates that the parties trade under the tariffs $\tau^E(\gamma^L), \tau^{*E}(\gamma^L)$ indefinitely; the home country has the right to terminate the agreement at time t by sending the foreign country a written notice at time $t - \alpha$.

As long as the state is G, there is no need to renegotiate; renegotiation would be a zero-sum game. Therefore, until the state is B, the parties continue to trade under the terms of the agreement. Once state B arrives, the agreement is renegotiated. If the state is M and there is no new investment opportunity, there is also no need to renegotiate. But if an investment opportunity arrives in state M, the parties do need to renegotiate; otherwise the foreign country would invest, which would be jointly inefficient. Therefore, the home country offers to terminate the trade agreement and pays the compensation equivalent to the foreign country's payoff from another α-periods' worth of trade gains under the terms of the agreement relative to it's Nash equilibrium payoffs (therefore the foreign country obtains V^*_α as defined by (3)).

Now consider the foreign country's investment decision under the evergreen agreement. Suppose that the investment opportunity arrives. The foreign country's returns to investment are as follow. First, there is a payoff v^* for each period until state B (with $\gamma = \gamma^P$) arrives. Second, there is a payment equivalent to the payoff from α periods of trade gains under the terms of the agreement — after this state has arrived. Third, there are the payments equivalent to the outside option (i.e., the Nash outcome) after the good state returns. The latter effect is trivial as the home country has all the bargaining power and would capture the entire surplus from returning to high trade volume.

Therefore the foreign country's returns to investment $V^*_{\alpha,s}$, $s = G, M, B$ are as follows:

$$\begin{aligned}
V^*_{\alpha,G} &= \frac{1}{1+\rho}\left[v^* + (1-\lambda)V^*_{\alpha,G} + \lambda V^*_{\alpha,M}\right] \\
V^*_{\alpha,M} &= \frac{1}{1+\rho}\left[v^* + (1-\sigma)(1-\mu_B-\mu_G)V^*_{\alpha,M} + (1-\sigma)\mu_G V^*_{\alpha,G} + (\sigma + (1-\sigma)\mu_B)\, V^*_\alpha\right] \\
V^*_{\alpha,B} &= V^*_\alpha
\end{aligned}$$

where V^*_α is the return to investment under a fixed-term contract of length α, and v^* is the foreign

[12] An alternative setting is the evergreen contract with a unilateral escape clause (as in Bagwell and Staiger, 2005). The analysis would be similar but more cumbersome. Therefore we focus on the advance termination notice.

country's one-period return to investment given that trade takes place under the contracted tariffs τ, τ^*. In state B, it is jointly efficient to terminate the contract. In order for the foreign country to agree to the immediate termination, the home country has to compensate the foreign country with a one-time payment V^*_α for the foregone α-periods' worth of returns of investment under the trade agreement relative to the returns under the Nash tariffs. In state G, the foreign country will receive one-period's worth of returns v^* and the expected returns for the next period ($V^*_{\alpha,G}$ with probability $1-\lambda$ and $V^*_{\alpha,M}$ with probability λ). In the intermediate state, M, the parties have to take into the account the need to renegotiate the contract in case there is an investment opportunity. If there is no investment opportunity (probability $1-\sigma$), the parties continue to trade under the present contract until state B arrives. If this happens (unconditional probability $(1-\sigma)\mu_B$), parties terminate the contract and the home country pays the foreign country a lump-sum payment V^*_α. If the investment opportunity arrives, the contract provides the foreign country with incentives to invest. On the other hand, if the investment opportunity does arrive in state M, seizing this opportunity is jointly inefficient. Hence, it is optimal to pay V^*_α to the foreign country and terminate the contract immediately.

The solution to the system above is as follows:

$$V^*_{\alpha,G} = \frac{v^*}{\rho}\frac{\rho+\lambda+\sigma+(\mu_B+\mu_G)(1-\sigma)+\left[1-(1+\rho)^{-\alpha}\right]\frac{\lambda}{\rho}\left(\sigma+\mu_G(1-\sigma)\right)}{\rho+\lambda+\sigma+(\mu_B+\mu_G)(1-\sigma)+\frac{\lambda}{\rho}\left(\sigma+\mu_G(1-\sigma)\right)}$$

where we used the expression for V^*_α from (3).

To find the minimum termination notice time $\overline{\alpha}$, that provides sufficient investment incentives, we need to solve $V^*_{\overline{\alpha},G} = c$.

Proposition 2 *The minimum advance termination notice time $\overline{\alpha}$ of the evergreen agreement to provide incentives for investment is*[13]

$$\overline{\alpha} = \frac{\ln\left(\frac{v^*}{v^*-c\rho}\left[1+\rho\frac{\rho+\lambda+\sigma+(\mu_B+\mu_G)(1-\sigma)}{\lambda(\sigma+\mu_G(1-\sigma))}\right]^{-1}\right)}{\ln(1+\rho)} = \overline{\theta} - \frac{\ln\left(1+\rho\frac{\rho+\lambda+\sigma+(\mu_B+\mu_G)(1-\sigma)}{\lambda(\sigma+\mu_G(1-\sigma))}\right)}{\ln(1+\rho)}.$$

4.4 The optimal agreement

Let us now calculate the expected renegotiation costs under each agreement. Suppose that the parties sign the fixed-term agreement (in state G given an investment opportunity). Once it is signed, it provides sufficient incentives to invest in the first period of the agreement's duration. In the subsequent periods, four contingencies can arise. First, if another investment opportunity arrives, the parties need to sign a new fixed-term agreement. Second, state M can arrive; no renegotiation is needed since the remaining duration of the existing fixed-term agreement is insufficient to provide

[13] See Guriev and Kvasov (2005) for a detailed intuition for why the optimal advance notice $\overline{\alpha}$ is shorter than the optimal duration of the fixed-term contract $\overline{\theta}$.

incentives for investment. Hence, the foreign country will not invest. Third, state B may eventually arrive. Then the parties renegotiate. Fourth, the state may remain good but no investment opportunity arrives; there is no need for renegotiation.

Now, let us consider the evergreen agreement. Here the situation is different. If an investment opportunity does arrive in state G, there is no need for renegotiation. But if an investment opportunity arrives in state M, then the parties renegotiate to rule out the investment; they replace the evergreen contract with a null contract. The same happens if state B arrives.

We can now compare the expected renegotiation costs under the fixed-term agreement and under the evergreen agreement.

Proposition 3 *In the case of homogenous good, the parties will choose the fixed-term agreement whenever the risk of investment in the intermediate state is sufficiently high (i.e., λ and σ are sufficiently high, and/or μ_G is sufficiently low).*

The Proof is relegated to Appendix A.

Proposition 3 is quite intuitive. As discussed above, the benefit of the fixed-term agreement is to prevent the suboptimal over-investment. Therefore, the fixed-term agreement is preferred when the intermediate state is more likely (λ is high relative to $\mu_{G,B}$) and investment opportunity is more likely to arrive (high σ). By contrast, the evergreen agreement works well if state G is more likely; in this case, the evergreen agreement continues to provide incentives for (optimal) investment. Therefore the evergreen agreement is chosen whenever state G is more likely (high μ_G). We were unable to obtain unambiguous comparative statics with regard to μ_B as the arrival of state B results in renegotiation under both types of contracts.

To understand the economics of the Proposition, consider the case of trade in commodities that requires a lumpy infrastructure investment. To provide incentives for this investment, parties sign a long-term agreement; but what should the agreement's structure be? This depends on the political and economic environment. Suppose that the parties expect that the current pro-trade stance in the home country is likely to change in the future. Then it is wiser to sign a fixed-term agreement which provides strong incentives today but weaker incentives in the future; hence the agreement will discourage the suboptimal overinvestment tomorrow. If, on the other hand, the current pro-trade political equilibrium is likely to stay, then the evergreen contract is better. Indeed, it will provide equally strong incentives today and tomorrow, hence no need to renegotiate tomorrow.

In the analysis above, the optimal long-term trade agreements include tariffs that are constant over time. This is an implication of the simple structure of uncertainty and non-trivial renegotiation costs. In principle, investment incentives can also be protected by contracts with variable tariffs, for example, high tariffs in some periods and low tariffs in other periods. The tariff levels can be chosen so that the agreement would also provide efficient incentives in the first period; also, like the optimal fixed-term contract above, such a contract would prevent overinvestment – one period into the life of the agreement, the parties do not have incentives to invest. However, the contracts

with variable tariffs involve excessive renegotiation: if the economy is in state G in the next period, the parties will have to renegotiate. In the fixed-term contract with constant tariffs (which are endogenously chosen to maximize joint welfare), such renegotiation is not needed.

4.5 Trade in differentiated goods

In the case of trade in differentiated goods, the analysis is straightforward. At each period, there are investment opportunities for $\sigma > 0$ varieties. The fixed-term agreement should therefore be constantly renegotiated. Expected renegotiation costs are κ per period.

Under the evergreen agreement, if the investment is not too costly, the parties are better off not renegotiating at all and just allowing all investment opportunities to be exploited. (2) in assumption A1 above implies that the parties are better off to allow investments whenever an investment opportunity arrives. Therefore in the case of differentiated goods, the parties prefer the evergreen agreement.

Proposition 4 *If assumption A1 holds, then in the case of differentiated goods, the parties always choose the evergreen agreement with a termination notice* $\overline{\alpha}$.

What happens if the assumption A1 does not hold and $\overline{W} < c$? In this case, it is never optimal to invest in the case of differentiated goods. The parties will therefore have no need to sign a long-term trade agreement – because of the hold-up problem, in equilibrium there will be no investment (which is optimal).

In our model, the termination notice is never used. This is explained by the fact that we consider a continuum of differentiated good varieties, of which exactly $\overline{p}_B = \frac{\mu_B}{\lambda+\mu_G+\mu_B}$ are in state B; the probability of many more varieties being in the protectionist state is trivial. In reality, if there is a discrete set of goods and there is a positive (albeit small) probability that all (or very many) of them are in state B; then the home country may sometimes use the advance notice to terminate the agreement.

4.6 Robustness

The model above makes a number of simplifying assumptions. The main results are robust to the choice of uncertainty and investment technology. E.g., if the state space were richer and investments were continuous rather than binary, the results would still hold. The fixed-term agreement would still be chosen to provide incentives for a lumpy one-off investment once it is signed but not later. In the subsequent periods, the incentives would be weakened and the foreign country would underinvest. Vice versa, the evergreen agreement would provide the same incentives to invest both at the moment of its inception and in the subsequent periods, thus encouraging small and frequent investments. These results may also be generalized to the case where optimal level of investment is not constant in time – as discussed in Guriev and Kvasov (2005), these may be incentivized via an evergreen agreement with an advanced notice period that changes over time.

We do not consider other properties of differentiated goods such as elasticities of substitution, market power, entry, etc. – the only feature that matters for the model above is the fact that in the differentiated-good case, investments are small and frequent rather than one-off and lumpy. Our model assumes full inter-variety spillovers of investment in the differentiated good case. This is certainly an extreme assumption. Yet, our qualitative argument holds to the extent that these spillovers are not trivial. Similarly, while we assume a perfect independence between political economy shocks for individual varieties, our argument only requires that the correlation between these shocks is not perfect. What we essentially need is to make sure that in the case of differentiated goods the risk of overinvestment is lower than in the case of homogenous goods. In such a modified set up, the law of large numbers would not apply, and the analysis would be more involved. In particular, even in the case of differentiated goods, there will be some states of nature where the parties will prefer the fixed-term contract to the evergreen one. Yet, even in this case, an evergreen agreement will be more likely to be chosen in the case of differentiated rather than homogenous good if the renegotiation cost is non-trivial.

5 Concluding remarks

In this paper we argue that the duration and the time structure of trade agreements are driven by the characteristics of traded goods covered by the agreement and the nature of trade-related investments. Even when trade agreements do not explicitly include provisions on such investments, they certainly affect the parties' incentives for undertaking them. Therefore, whenever the parties choose the structure of the trade agreement, they have to address the trade-off between providing the incentives for making efficient investments, and the flexibility of being able to terminate or modify the agreement in order to prevent the inefficient investments. If the agreement is set to expire too soon, it does not protect irreversible investment in trade-related infrastructure. If the agreement is meant to last too long, it reduces the flexibility of the trading parties to use the trade policies for adjusting the terms of trade if there is a change in preferences or other economic parameters. Although the parties can always renegotiate the trade agreement that might have become inefficient due to a realization of the uncertainty, such a renegotiation is costly and, therefore, it is in the interest of both parties to choose a trade agreement that would minimize the expected renegotiation costs. We show that the contracting parties are able to resolve the incentive-flexibility trade-off while at the same time minimizing the renegotiation costs through the use of two instruments: the duration of the trade agreement (short-term vs. long-term) and its time structure (fixed-term agreement vs. evergreen agreement with an advance termination notice).

If the parties trade in a homogeneous good, they are more likely to need an agreement that protects incentives for lumpy irreversible investments. Therefore, the parties will choose a fixed-term trade agreement. Once there is an opportunity for a new investment project, they conclude a new fixed-term agreement of a sufficient duration. By contrast, if trade is in differentiated

good varieties, the investments necessary to facilitate such trade are likely to be in the form of multiple small-scale projects initiated independently for each variety, but increasing trade gains for the industry as a whole. In this case, there is a need for the provision of ongoing trade-related investment incentives for the entire industry. Therefore parties will opt for an evergreen contract with a termination notice.

This prediction seems to be in line with available anecdotal and empirical evidence. In Appendix B, we consider the sample of on-going trade agreements to which the U.S. is a party. Most of these agreements can be classified as either evergreen or fixed-term. The econometric analysis of this sample suggests that trade agreements that cover trade in homogenous goods are normally fixed-term, while the agreements that concern trade in differentiated goods and services are mostly evergreen. Our predictions are consistent with the data even when we control for the level of development and political institutions.

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Appendix A: Proofs

Proof of Proposition 3.

Denote R_s^{FT} the expected renegotiation costs under the fixed-term given the state is s, and r_s the expected renegotiation costs if there is no contract. Then

$$\begin{aligned}
R_G^{FT} &= \frac{1}{1+\rho}\left[\sigma(1-\lambda)(\kappa+R_G^{FT})+(1-\sigma)(1-\lambda)R_G^{FT}+\lambda R_M^{FT}\right] \\
R_M^{FT} &= \frac{1}{1+\rho}\left[(1-\mu_G-\mu_B)R_M^{FT}+\mu_G R_G^{FT}+\mu_B R_B^{FT}\right] \\
R_B^{FT} &= \frac{1}{1+\rho}\left[\kappa+(1-\lambda)r_B+\lambda r_M\right] \\
r_G &= \frac{1}{1+\rho}\left[\sigma(1-\lambda)(\kappa+\min\{R_G^{FT},R_G^{EG}\})+(1-\sigma)(1-\lambda)r_G+\lambda r_M\right] \\
r_M &= \frac{1}{1+\rho}\left[(1-\mu_G-\mu_B)r_M+\mu_G r_G+\mu_B r_B\right] \\
r_B &= \frac{1}{1+\rho}\left[(1-\lambda)r_B+\lambda r_M\right]
\end{aligned}$$

Now consider the evergreen contract. Here the situation is different. If an investment opportunity does arrive in the state G, there is no need for renegotiation. But an investment opportunity arrives in state M, then the parties need to renegotiate to rule out the investment. Also, renegotiation happens once the state B has arrived.

$$\begin{aligned}
R_G^{EG} &= \frac{1}{1+\rho}\left[(1-\lambda)R_G^{EG}+\lambda R_M^{EG}\right] \\
R_M^{EG} &= \frac{\sigma}{1+\rho}\left[\kappa+(1-\mu_G-\mu_B)r_M+\mu_G r_G+\mu_B r_B\right]+ \\
&\quad +\frac{1-\sigma}{1+\rho}\left[(1-\mu_G-\mu_B)R_M^{EG}+\mu_G R_G^{EG}+\mu_B R_B^{EG}\right] \\
R_B^{EG} &= \frac{1}{1+\rho}\left[\kappa+(1-\lambda)r_B+\lambda r_M\right]
\end{aligned}$$

Let us solve for $\delta_s = R_s^{EG} - r_s$ and $\Delta_s = R_s^{FT} - R_s^{EG}$. In the end of the day we are interested in the parameter constellation that imply $\Delta_G < 0$. Let also us introduce $\overline{\delta} = (1-\mu_G-\mu_B)\delta_M + \mu_G\delta_G + \mu_B\delta_B$.

We can see right away that $\Delta_B = 0$ and $\delta_B = \frac{\kappa}{1+\rho}$. Now let's write the equations for the remaining δ_s and Δ_s

$$
\begin{aligned}
\Delta_G &= \frac{1}{1+\rho}\left[\sigma\left(1-\lambda\right)\kappa+\left(1-\lambda\right)\Delta_G+\lambda\Delta_M\right] \\
\Delta_M &= \frac{1}{1+\rho}\left[\left(1-\mu_G-\mu_B\right)\Delta_M+\mu_G\Delta_G-\sigma\kappa+\sigma\overline{\delta}\right] \\
\delta_G &= \frac{1}{1+\rho}\left[\left(1-\lambda\right)\left(1-\sigma\right)\delta_G+\lambda\delta_M-\sigma\left(1-\lambda\right)\kappa-\sigma\left(1-\lambda\right)\min\{\Delta_G,0\}\right] \\
\delta_M &= \frac{1}{1+\rho}\left[\overline{\delta}(1-\sigma)+\sigma\kappa\right]
\end{aligned}
$$

The first two equations imply

$$
\Delta_G = \sigma\frac{\kappa((1-\lambda)(\rho+\mu_G+\mu_B)-\lambda)+\lambda\overline{\delta}}{\rho(\rho+\lambda+\mu_G+\mu_B)+\lambda\mu_B} \tag{4}
$$

$$
\begin{aligned}
\left[\rho+\sigma+\lambda(1-\sigma)\right]\delta_G &= \lambda\frac{1}{1+\rho}\left[\overline{\delta}(1-\sigma)+\sigma\kappa\right]-\sigma\left(1-\lambda\right)\kappa-\sigma\left(1-\lambda\right)\min\{\Delta_G,0\} \\
\delta_G &= \frac{\overline{\delta}-\left(1-\mu_G-\mu_B\right)\frac{1}{1+\rho}\left[\overline{\delta}(1-\sigma)+\sigma\kappa\right]-\mu_B\frac{\kappa}{1+\rho}}{\mu_G} = \\
&= \frac{\left[\rho+\sigma+(\mu_G+\mu_B)(1-\sigma)\right]\overline{\delta}-\sigma\kappa\left(1-\mu_G-\mu_B\right)-\mu_B\kappa}{\left(1+\rho\right)\mu_G}
\end{aligned}
$$

Therefore

$$
\begin{aligned}
&\left[\rho+\sigma+\lambda(1-\sigma)\right]\left[\left[\rho+\sigma+(\mu_G+\mu_B)(1-\sigma)\right]\overline{\delta}-\sigma\kappa\left(1-\mu_G-\mu_B\right)-\mu_B\kappa\right] \\
= \;& \lambda\mu_G\overline{\delta}(1-\sigma)+\lambda\mu_G\sigma\kappa-\sigma\left(1-\lambda\right)\kappa\left(1+\rho\right)\mu_G-\sigma\left(1-\lambda\right)\left(1+\rho\right)\mu_G\min\{\Delta_G,0\}
\end{aligned}
$$

When is the fixed-term contract preferred? Consider the case $\Delta_G<0$. Then

$$
\begin{aligned}
&\left[\rho+\sigma+\lambda(1-\sigma)\right]\left[\left[\rho+\sigma+(\mu_G+\mu_B)(1-\sigma)\right]\overline{\delta}-\sigma\kappa\left(1-\mu_G-\mu_B\right)-\mu_B\kappa\right] \\
= \;& \lambda\mu_G\overline{\delta}(1-\sigma)+\lambda\mu_G\sigma\kappa-\sigma\left(1-\lambda\right)\kappa\left(1+\rho\right)\mu_G-\sigma\left(1-\lambda\right)\left(1+\rho\right)\mu_G\Delta_G
\end{aligned}
$$

$$
\begin{aligned}
&\overline{\delta}\left(\left[\rho+\sigma+\lambda(1-\sigma)\right]\left[\rho+\sigma+(\mu_G+\mu_B)(1-\sigma)\right]-\lambda\mu_G(1-\sigma)\right) \\
= \;& \kappa\left(\lambda\mu_G\sigma-\sigma\left(1-\lambda\right)\left(1+\rho\right)\mu_G+\left[\rho+\sigma+\lambda(1-\sigma)\right]\left[\sigma\left(1-\mu_G-\mu_B\right)+\mu_B\right]\right) \\
& -\sigma\left(1-\lambda\right)\left(1+\rho\right)\mu_G\Delta_G
\end{aligned}
$$

We need to substitute $\overline{\delta}$ from (4), find Δ_G and check that $\Delta_G<0$. This holds if and only if

$$
\begin{aligned}
0 \;>\; & \lambda\mu_G\sigma\left[\lambda-\left(1-\lambda\right)\left(1+\rho\right)\right]+\lambda\left[\rho+\sigma+\lambda(1-\sigma)\right]\left[\sigma\left(1-\mu_G-\mu_B\right)+\mu_B\right]+ \\
& \sigma\left[\left(1-\lambda\right)\left(\rho+\sigma+\mu_G+\mu_B\right)-\lambda\right]\left[\left[\rho+\sigma+\lambda(1-\sigma)\right]\left[\rho+\sigma+(\mu_G+\mu_B)(1-\sigma)\right]-\lambda\mu_G(1-\sigma)\right]
\end{aligned}
$$

It is easy to show that (i) this is never the case if $\lambda\to 0$ and/or $\sigma\to 0$ (ii) this is the case if $\lambda\to 1$, $\sigma\to 1$.

Q.E.D.

Appendix B: Empirical analysis of fixed-term vs. evergreen agreements.

In order to make the factors affecting the duration and terms structure of trade agreements more concrete, we now provide a simple empirical evidence for our theoretical model. We would like to stress that given the limitations of the data and the limited nature of the statistical tests presented below, the following analysis perhaps should be seen more as an empirical illustration rather than a rigorous test of the theory outlined in this paper.

In keeping with the results of our model, we hypothesize that those trade agreements, which cover trade in more commoditized goods, are less likely to be evergreen. We test this hypothesis using a data set of 178 bilateral and plurilateral trade agreements to which the US is currently a party. The texts of all of these agreements are available at the website of the US Trade Compliance Center (TCC).[1] The benefit of using the TCC's data is that (i) they provide a comprehensive list of all agreements currently effective in the US, and (ii) all TCC agreements are comparable as they share at least one common party, the United States.[2]

Since we are interested only in those trade agreements that have direct bearing on the terms of trade, we have excluded from the TCC's data set all the agreements that are not explicitly related to trade in goods or services (e.g., agreements on investment measures). We have also omitted the agreements which we have not been able to classify as either fixed-term or evergreen. As a result, we ended up with the sample consisting of 98 agreements, of which 30 are fixed-term and 68 are evergreen.

Among the 98 agreements in the data set, we have identified 42 agreements, which cover goods or services trade which cannot be classified as trade in commodities. We classified the remaining 56 trade agreements, which are either comprehensive or dedicated to specific commodities, as commodity-related.

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[1] See tcc.export.gov

[2] Another potential source of data for our empirical analysis is the WTO data set of regional trade agreements (RTAs) notified by the countries to the GATT/WTO either under GATT Article XXIV or GATS Article V or the Enabling Clause of the Tokyo Round Agreement which permits preferential arrangements among developing countries in goods trade. However, many sector-specific bilateral agreements between the WTO member countries are not notified to the WTO because they are considered to be side-agreements to the RTAs which are supposed to cover "substantially all" trade. The problem is that the RTAs and their side-agreements often have entirely different final clause provisions regarding treaty duration and termination. For example, while the CUFTA is an evergreen agreement, the Canada-U.S. Softwood Lumber Agreement is a fixed term agreement concluded for 5 years. Also, the WTO data set does include asymmetric market opening agreements in which one country (or a group of countries) lowers barriers for products from certain other countries (e.g., the Lome convention agreements between the EU and former colonies). The absence of such sector-specific side-agreements and asymmetric agreements in the WTO data set makes it unsuitable for our empirical investigation.

The details of this classification are provided in Table 4 below, where the variable *Trade in Commodities* is 0 if the trade agreement is not related to commodities and 1 otherwise.

We employed a number of explanatory variables which may potentially influence the duration and term structure of trade agreements. Since, according to our theory, the optimal type of the agreement depends on the parameters representing the volatility of the political economy environment, we chose to control for the type of political institutions, which may influence the stability. We used variable DEMOC from Polity IV data set to construct variable *Level of democracy* which captures the stability of political institutions. In addition, we employed two variables, *Log GDP per capita of trade partners* and *Log GDP per capita of trade partners relative to US* to control for the level of economic development of the US trade agreement partners. In constructing these variables we used the World Development Indicators to calculate the GDP per capita for the US agreements' partner countries. For the plurilateral agreements, we calculated the weighted average GDP per capita for the agreements' member countries (other than the U.S.) weighted by their population shares.

The dependent variable we seek to explain in our analyses is *Fixed Term*, which is 1 if the final clause of the agreement specifies that it is concluded for a finite period of time and not supposed to be renewed unless parties renegotiate the renewal. It is 0 if the agreement is supposed to remain valid indefinitely unless a party decides to withdraw and gives an advance notice about this to the other parties. Of the 98 agreements in our data set, 30 were of fixed duration (coded 1). The main characteristics of fixed-term and evergreen agreements are compared in Table 1 in the Introduction. Tables B1 and B2 in the end of this Appendix present the summary statistics and the pairwise correlations for all the variables. The data suggests that fixed-term agreements are more likely to cover trade in commodities and to be concluded with less developed and less democratic countries; the differences are significant.

These effects hold in the multivariate regressions as well. As the Table B3 below shows, fixed-term agreements, to which the U.S. is a party, are indeed more likely to be associated with trade in commodities even when we control for the level of economic development in the U.S. trade-partner countries. This result holds when the level of development is represented by the per capita GDP of trade partners as well as their per capita GDP relative to that of the U.S. level. We also find that the degree of democracy turns out to be insignificant once we control for the level of development.

Next, in order to perform a robustness check, we excluded all the agreements, which, in our reading, were concluded mainly to protect access of the US exporters to the foreign markets, and the intellectual property rights agreements (which are also more likely to benefit the U.S. exporters of goods and services). We ended up with the reduced sample of 54 agreements. In this sample, the fixed term agreements are also more likely to be associated with trade in commodities. While 75% of the evergreen agreements are related to trade in commodities, the share of agreements covering commodities among the

fixed-term agreements is 95%. In fact, there is only 1 fixed-term agreement in the reduced sample which is dedicated to trade which cannot be categorized as commodity trade.

We run the same regressions for the reduced sample (Table B3) and find similar results. Only in the last specification, the coefficient of the *Trade in Commodities* dummy is not significant which may be explained by the small sample size.

In order to perform yet another robustness check, we excluded all the agreements between the U.S. and other developed countries (i.e., the OECD countries). While some of these agreements may contain provisions relevant for trade in commodities, the actual share of this kind of trade is relatively small in overall trade between the U.S. and other developed countries if compared with its share in trade between the U.S. and non-OECD countries. After omitting these agreements, the sample is reduced to 54 agreements, 27 of which are fixed term agreements and 27 are evergreen agreements. Among the 27 fixed term agreements, 22 cover trade in commodities (81%); out of the 27 evergreen agreements, only 16 agreements cover trade in commodities (59%). The difference is statistically significant. The results of the probit regressions for this sample are presented in the last three columns of Table B3. The coefficient of the commodity trade dummy remains large and significant.

Overall, consistent with our theoretical argument, we find that both pair-wise and controlling for the level of economic development and democracy, the fixed-term agreements are more likely to be associated with trade in commodities, rather than in non-commoditized goods and services. The effect is economically significant: the share of fixed term agreements among commodities vs. non-commoditized goods differs by 20-30 percentage points.

Again, we warn that although the presented empirical evidence provides support for our theory, our analysis of the current trade agreements between the U.S. and other countries is meant to serve as an illustration of our theory rather than as an indepth empirical study of the trade agreements' duration. Such a study would require a more detailed data base including the trade agreements to which the U.S. is not a party.

Table B1. Summary statistics.

Variable	Observations	Mean	Std.dev.	Min	Max
Fixed term dummy	98	0.31	0.46	0.00	1.00
Dummy: covers trade in commodities	98	0.57	0.50	0.00	1.00
Log (GDP per capita of trade partners relative to US) ♣	98	-1.77	1.57	-4.83	0.21
Log (GDP per capita of trade partners in 2000 US dollars)♣	98	8.51	1.59	5.21	10.5
Level of democracy♣	98	6.77	3.61	0.00	10.0

Table B2. Pairwise correlations (all correlations are significant at 1% level)

Fixed term dummy	1.00				
Covers trade in commodities	0.26	1.00			
Log (GDP per capita of trade partners relative to US) ♣	-0.43	-0.26	1.00		
Log (GDP per capita of trade partners in 2000 US dollars)♣	-0.48	-0.26	0.99	1.00	
Level of democracy♣	-0.33	-0.27	0.75	0.75	1.00

Table B3. Probit regressions for the fixed-term dummy (marginal effects reported).

Dependent variable	Dummy for fixed term agreements								
Sample	Full sample			Reduced sample			Non-OECD partners		
Covers trade in commodities	0.17	0.17	0.17	0.36	0.29	0.26	0.27	0.27	0.28
	(0.09)*	(0.09)*	(0.09)*	(0.13)***	(0.17)*	(0.19)	(0.14)*	(0.14)*	(0.14)**
Log (GDP per capita of trade partners relative to US) ♣	-0.12	-0.13			-0.10		-0.08	-0.08	
	(0.03)***	(0.05)***			(0.07)		(0.06)	(0.07)	
Log (GDP per capita of trade partners in 2000 US dollars)♣			-0.16			-0.18			-0.13
			(0.05)***			(0.07)***			(0.07)*
Level of democracy♣		0.00	0.01		-0.01	-0.01		0	0.01
		(0.02)	(0.02)		(0.03)	(0.03)		(0.02)	(0.02)
Observations	98	98	98	54	54	54	54	54	54
Pseudo R-squared	0.19	0.19	0.22	0.06	0.14	0.19	0.06	0.06	0.09

Robust standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%
♣ population-weighted-averaged across trade partners at the time of signing

Table B4. Classification of US trade agreements.

Agreement	Year signed	Fixed term	Trade in commodities	GDP pc relative to US
APEC Telecommunications MRA	1998	0	0	11.8%
Bulgaria Agreement On Trade Relations	1991	1	1	5.7%
Canada Magazines Agreement	1999	0	0	65.9%
European Union Agreement On Trade In Large Civil Aircraft	1992	0	0	62.9%
India Motion Pictures Agreement	1992	0	0	1.1%
Indonesia Conditions For Market Access For Films And Videos	1992	0	0	2.4%
Israel Free Trade Agreement	1985	0	1	51.2%
Japan Agreement Clarifying The Framework Agreement	1994	0	1	117.8%
Japan Computer Products And Services Agreement	1992	0	0	121.8%
Japan Distilled Spirits Agreement	1997	0	1	115.2%
Japan Enhanced Initiative on Deregulation and Competition Policy	1997	0	0	115.2%
Japan Foreign Lawyers Agreement	1987	0	0	107.4%
Japan Framework Agreement	1993	0	1	120.1%
Japan Grademarked Lumber Agreement	1997	0	1	115.2%
Japan Major Projects Arrangement	1991	1	0	123.2%
Japan Ports And Harbor Practices Agreement	1997	0	0	115.2%
Japan Public Sector Procurement Of Telecommunications Products And Services Agreement	1994	0	0	117.8%
Japan Public Works Agreement (1994)	1994	0	0	117.8%
Japan Report On Medical Equipment And Pharmaceuticals Market-Oriented, Sector-Selective (MOSS) Discussions	1986	0	0	106.5%
Japan Satellite Procurement Agreement	1990	0	0	117.8%
Kazakhstan Trade Relations Agreement	1993	1	1	4.3%
Korea Understanding On Telecommunications--2/17/92	1992	0	0	26.5%
North American Free Trade Agreement	1994	0	1	29.7%
Romania Agreement On Trade Relations	1992	1	1	5.4%
Russia Memorandum of Understanding On Aircraft Market Access	1996	0	0	5.1%
Russia Trade Relations Agreement And Annexes Concerning Settlement Of Lend-Lease Accounts And Status Of Commercial Office In Moscow	1992	1	1	7.4%
Semiconductors Joint Statement	1999	1	0	68.7%
Ukraine Trade Relations Agreement	1992	1	1	4.0%
Agreement on Mutual Acceptance of Oenological Practices	2001	0	0	32.1%
Albania Trade Relations Agreement	1992	1	1	2.3%
Australia Free Trade Agreement	2004	0	1	62.2%
Australia Understanding on Automotive Leather Subsidies	2000	0	1	60.3%
Bahrain Free Trade Agreement	2004	0	1	1.1%
Belarus Memorandum of Understanding on Textiles	2004	1	1	4.7%
Belarus Memorandum of Understanding on Textiles	2002	1	1	4.1%
Belarus Memorandum of Understanding on Textiles	2003	1	1	4.3%
Belgium Friendship, Establishment and Navigation Treaty	1963	1	1	56.9%
European Union Mutual Recognition Agreement on Marine Equipment	2003	0	0	60.6%
Cambodia Trade Relations & Intellectual Property Rights Agreement	1996	1	0	0.8%
Canada Agreement On Beer Market Access In Quebec And British Columbia	1994	0	0	65.9%
Canada Agreement Regarding Tires	1993	0	0	65.3%
Canada Memorandum Of Understanding On Provincial Beer Marketing Practices	1992	0	0	65.4%
Canada Termination Of Bell Canada/Northern Telecom Preferred Supplier Relationship Agreement	1994	0	0	65.9%
Central American/Dominican Republic Free Trade Agreement	2004	0	1	5.4%
Chile Free Trade Agreement	2003	0	1	14.7%
Chile Memorandum Of Understanding On Aquatic Health Systems	2001	0	1	14.5%
Denmark Friendship, Commerce, and Navigation Treaty	1961	1	1	91.7%
European Union Distilled Spirits And Spirit Drinks Agreement	1994	0	1	58.3%
European Union Mutual Recognition Agreement	1997	0	1	60.2%
European Union Pasta Agreement	1987	0	0	59.6%
European Union Understanding on Bananas	2001	0	1	61.4%
Hungary Intellectual Property Rights Agreement	1993	1	1	12.3%

Jamaica Intellectual Property Rights Agreement	1994	1	0	10.8%
Japan--Tokyo Declaration On Global Partnership With The US	1992	0	1	121.8%
Japan Cellular Telephone And Third Party Radio Agreement (1989)	1989	0	0	113.1%
Japan Economic Partnership	2001	0	1	106.5%
Japan International Value-Added Network Services Agreement	1990	0	0	117.8%
Japan International Value-Added Network Services Agreement (#2 Of 2)	1991	0	0	123.2%
Japan Mutual Understanding On Patents	1995	0	1	118.0%
Japan Supercomputer Procurement Agreement	1990	0	0	117.8%
Japan Wood Products Agreement	1990	0	1	117.8%
Jordan Free Trade Agreement	2000	0	1	5.0%
Korea Intellectual Property Rights & Insurance Understandings	1986	0	0	18.6%
Korea Market Access For Wine And Wine Products Agreement	1989	0	0	21.8%
Korea Motion Pictures Importation And Distribution Agreement	1988	0	0	21.2%
Korea Revised Cigarette Agreement	1995	0	0	30.6%
Latvia Trade Relations And IPR Agreement	1994	1	1	8.0%
Madagascar Navigation and Commerce Treaty	1960	1	1	2.8%
Mexico Fresh Tomatoes Antidumping Investigation Suspension Agreement	2002	0	1	16.9%
Mexico Measures Affecting Telecommunications Services	2004	0	0	16.6%
Mexico Tires Certification Agreement	1996	0	1	16.5%
Morocco Free Trade Agreement	2004	0	1	3.7%
Nicaragua Intellectual Property Rights Agreement	1998	1	0	2.3%
North American Free Trade Side Agreement On Environmental Cooperation	1993	0	1	29.7%
Oman Amity, Economic Relations And Consular Rights Treaty	1960	1	1	6.7%
Pakistan Friendship and Commerce Treaty	1961	1	1	1.3%
People's Republic Of China Trade Relations Agreement	1979	1	1	0.8%
Russia Agreement On Firearms And Ammunition	1996	0	0	5.1%
Russia Ammonium Nitrate Antidumping Investigation Suspension Agreement	2000	0	1	5.1%
Russia Bilateral Textile Agreement	1997	0	1	5.0%
Russia Cut-to-Length Carbon Steel Plate Antidumping Investigation Suspension Agreement	2003	0	1	6.0%
Russia Hot-Rolled Flat-Rolled Carbon-Quality Steel Products Antidumping Investigation Suspension Agreement	1999	0	1	4.8%
Russia Uranium Antidumping Investigation Suspension Agreement	1993	0	1	5.2%
Russia Visa Arrangement Concerning Textiles And Textile Products	1996	0	1	5.1%
Singapore Free Trade Agreement	2004	0	1	68.2%
Sri Lanka Intellectual Property Rights Agreement	1991	1	0	2.1%
Thailand Cigarettes Agreement	1990	0	0	5.1%
Togo Amity and Economic Relations Treaty	1967	1	1	1.6%
Trinidad And Tobago Intellectual Property Rights Agreement	1994	1	0	16.7%
Turkey Foreign Film Revenues WTO Settlement	1997	0	0	9.3%
Ukraine Bilateral Textile Agreement	2001	1	1	2.0%
Ukraine Cut-to-Length Carbon Steel Plate Antidumping Investigation Suspension Agreement	1997	0	1	1.9%
Ukraine Visa Arrangement Concerning Textiles And Textile Articles	1997	0	1	1.9%
Vietnam Bilateral Trade Agreement	2000	1	1	1.1%
Vietnam Establishment Of Copyright Relations Agreement	1997	0	0	1.1%
Macedonia (Former Yugoslav Republic Of) Commercial Relations Treaty	1991	1	1	6.9%
Slovenia Commercial Relations Treaty	1991	1	1	26.3%
Croatia Commercial Relations Treaty	1991	1	1	13.5%