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The Economics of Investor Protection: ISDS versus National Treatment[1]

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Abstract

This paper scrutinizes the effects of investor-state dispute settlements (ISDS) and national treatment provisions in a two-period model where foreign investment is subject to domestic regulation and a holdup problem. It shows that ISDS can mitigate the holdup problem and increases aggregate welfare, but comes with additional regulatory distortions for the first period. A national treatment provision avoids these regulatory distortions, but implies entry distortions because it makes the holdup problem also apply to domestic firms. If the domestic regulatory framework applies to many domestic firms, a national treatment provision welfare-dominates ISDS.

Keywords: Investor-State Dispute Settlement; National Treatment Provision; Foreign Direct Investment; TTIP; TPP; Regulation.

JEL Classification: F21, F23, F53, F55.

1 Introduction

Almost all investment implies exposure to political risk: Once upfront cost is sunk the sovereign may change the legal environment, say through regulatory standards, such that the ex ante incentive for the investment is put into question ex post. This type of risk would not raise a problem if the investor's and the government's interests were perfectly aligned. In this case, any change would be due to a change in the regulatory environment and not due to any opportunistic behavior. However, this is not the case for a foreign investor as a government's interest in private foreign investment will hardly coincide with profits earned by this investor. Moreover, in many cases enforceable contracts between the investor and the government cannot be written. At the same time, investment is often relationship-specific such that it has little (if any) value outside the host country. Due to anticipation by foreign investors, regulatory risk may thus lead to beneficial investments not being carried out at all, or not carried out to the socially optimal amount, an issue that is well know as the holdup problem.

This problem is particularly severe in the context of foreign direct investment (FDI) and has been discussed extensively in the literature on FDI and multinational firm behavior.[1] Arguably, other things equal, a government's interest is more aligned with domestic investors than with foreign investors. Moreover, a country's legal provisions to deal with ex post erosion of investment incentives through government policies are often deemed more satisfactory for domestic investment than for FDI. In particular, foreign investors may feel uneasy with the specter of having to pursue their interests against host country governments, based on host countries' legal systems. For this reason, international investment agreements often include investor protection provisions such as investor-state dispute settlement (ISDS) mechanisms.[2] These mechanisms are intended to indemnify for-

[1]For the role of the holdup problem for FDI see Chapter 5 in Navaretti and Venables (2006). Antràs (2003), Antràs and Helpman (2004) and Antràs and Chor (2013) develop a framework where a holdup problem arises between input and final goods suppliers that is managed by a proper allocation of ownership rights.

[2]In a large-sample survey of international investment agreements, the OECD (2012) has found ISDS provisions to be present in as many as 93%, or some 3.000 agreements. The issue has gained a high level of

eign investors if host country government policies are causing "unjustified" harm through an ex post erosion of investment incentives. Existing ISDS mechanisms follow procedures separate from the host country's legal system, mostly relying on ad hoc panels, that feature potential compensation of private foreign investors through monetary payments by host country governments.

One might generally expect ISDS provisions to generate more investor-friendly policies of host country governments. However, such expectations are potentially wrongheaded for the simple reason that governments will anticipate the likelihood of future indemnity payments when forming present policies. ISDS mechanisms are governed by the aim to limit private investors' exposure to increases in costs, or reductions in revenues, that are caused by excessive government regulation, thereby mitigating the negative effect of this exposure on the amount of investment undertaken. But this need not generate more investor-friendly regulation, because it triggers an intertemporal trade off. A lenient present standard may attract FDI, but it also increases the odds that the government will want to increase its regulatory stringency in the future, in order to adjust to a change in economic conditions. If a more stringent regulatory standard entails ISDS-imposed compensation payments, because if it is deemed unjustified by the ISDS panel, then a lower present regulatory standard increases the expected cost of adjusting the standard in the future. Moreover, if leniency causes high FDI inflows in the present, then any compensation awarded by an ISDS panel will be all the more costly to the host government as it applies to a larger number of firms. Conversely, imposing a more stringent regulatory standard may be costly in reducing the present inflow of FDI, but this cost may be justified as a quasi-premium for insuring against the odds of desired future adjustments becoming more costly through ISDS-payments.

It is this trade-off that we scrutinize in the first part of this paper. For this purpose,

public attention through large scale cases, such as the EUR 1.4 billion claim brought against the German government by a Swedish energy investor, and through controversy about whether the Transatlantic Trade and Investment Partnership (TTIP) presently negotiated between the US and the EU and the Trans-Pacific Partnership (TPP) Agreement presently negotiated between several Pacific rim countries, including the US, Canada, Australia and Japan, ought to contain a separate chapter on investor protection through an ISDS provision.

we develop a two period model that captures these intertemporal trade-offs implied by ISDS mechanisms and that allows us to analyze whether ISDS does indeed mitigate the holdup problem vis à vis foreign investors. In our model, a government decides about the stringency of a regulatory standard based on the domestic welfare effects of regulation. Increasing regulatory stringency has a positive effect on domestic welfare. At the same time, it increases operating cost and therefore reduces foreign investors' profits. On this account, the government's and the private investor's interests are opposed to each other. However, the government is interested in FDI as such, and we model this through a direct positive effect of the investor's *operating* profit on domestic welfare. In this sense, the interests of the government and the private investor are partly aligned. We show that in this environment ISDS makes the government overregulate in the first period and reduce overregulation in the second. We also show that aggregate welfare increases with ISDS despite the first period overregulation.

We then compare ISDS with national treatment provisions.[3] National treatment means that the government is not allowed to discriminate between domestic and foreign firms, and we demonstrate that it will avoid any first period regulatory distortion. While this provision looks like an easy solution to the holdup problem, it introduces other distortions. The government now deals with a mix of domestic and foreign firms, so the share of domestic firms matters. Since it has only one instrument, viz. a single regulatory standard, for both groups of firms, the presence of a holdup problem vis à vis foreign firms is bound to affect treatment of domestic firms as well. Anticipating this effect, the government wants to keep the share of domestic firms large, leading to a suboptimally low level of entry by foreign investors. We demonstrate that a national treatment provision welfare-dominates ISDS, if this distortion decreases with an increase in the share of domestic firms and the regulatory framework is not firm-specific. Thus, we show that the role a

[3]The recent TPP Agreement includes both a national treatment provision and an ISDS provision. However, Article 9.4 of the TPP draft (2015) restricts national treatment to " ... the establishment, acquisition, expansion, management, conduct, operation, and sale or other disposition of investments in its territory". Therefore, national treatment does not imply equal regulatory treatment until it will violate minimum standards of fair treatment.

national treatment provision can play for fixing the holdup problem depends also on the regulatory design.

To our knowledge, this is the first paper to analyze the effects of ISDS and national treatment provisions in a unified theoretical framework. Most of the literature on ISDS is empirical and offers little guidance on the trade-offs implied by different investor protection mechanisms. An exemption is Aisbett *et al* (2010a) who discuss the role of compensations if regulation makes a foreign investment worthless and a court will decide in favor of compensations the higher the *ex ante* probability of harm caused by the investment is. In our model, regulation reduces, but does not necessarily eliminate investor profit, and the ISDS panel does not receive any signal and/or will ignore it due to its design.[4] The empirical literature regards investor protection provisions as a means of attracting FDI, in particular for developing countries where institutional investor protection might be underdeveloped,[5] and thus it shares some features with the literature on tax competition.[6] Our focus here is not on competition for FDI, but on the welfare implications of different forms of investor protection. The reason is twofold: First, we want to keep the model as simple as possible to start with, and thus we do not consider strategic interactions among countries or among firms. Ruling out strategic interactions both among countries and among firms serves to keep the model simple enough to deliver sharp welfare predictions. Second, investor protection provisions, particularly ISDS, are hotly debated in countries negotiating trade deals like the Transatlantic Trade and Investment Partnership (TTIP) between the EU and the US, or the Trans-Pacific Partnership (TPP) between the US and 11 other pacific countries. Since the agreements reached will hold for all countries involved, investor protection can no longer be used strategically for attracting FDI. Indeed,

[4]Their framework bears close resemblance to the literature on land takings, as pioneered by Blume *et al* (1984). Aisbett *et al* (2010b) discuss optimal compensations in a model in which a regulator can only close down a foreign operation and a court deciding on compensations receives a stochastic signal, but ISDS tribunals do have little in common with independent courts. See in particular footnote 8 for the appointment procedure suggested for TPP.

[5]See for example Neumayer et al (2016). These authors suggest that the increase in ISDS provisions is due to a "contagion" effect. We do not study the potential dynamics of international investment agreements but focus on the effects of different provisions in a bilateral agreement.

[6]See, for example, Haufler and Wooton (1999, 2010).

avoiding inefficient non-cooperative equilibria is a key rationale for these agreements in the first place.

Our paper is also related to the literature on inter-governmental dispute settlement under the auspices of the WTO and its effects on firm behavior.[7] The difference is that we focus on dispute settlement between private investors and the government in the specific context of regulatory standards pertaining to investment projects. We are concerned with the incentive problems deriving from asymmetric information and incomplete contracts between foreign investors and the host country government in cases where investors are "locked in" after entry, and we explore the efficiency properties of ISDS and national treatment mechanisms that are commonly proposed as potential solutions to these problems.

There is also a literature on the formation and the impact of international investment agreements. One strand of this literature has explored which type of countries are more likely to sign bilateral investment treaties (BITs). For example, Bergstrand and Egger (2013) consider the co-existence of BITs and PTAs (preferential trade agreements) and show that the likelihood of both a BIT and a PTA is higher between two countries the larger and more similar their GDP is, but that an increase in relative factor endowments decreases the likelihood of a BIT, while it makes a PTA more likely. The other strand of the literature has investigated whether BITs increase FDI. For example, Egger and Merlo (2012) show for German multinationals that BITs increase both the number of multinational firms and the number of plants per firm. However, measuring regulatory stringency by the presence of ISDS provisions, Berger *et al* (2011) show that more stringent BITs do not necessarily lead to more FDI. Interestingly, our model shows that ISDS will not change the entry incentive, so we would also not expect more FDI from an ISDS provision.

We wish to highlight right from the start that our modeling framework stacks the deck

[7]For models on the effect of firm behavior to WTO rules, see for example Anderson (1992), Bagwell and Staiger (1990) and Maggi and Staiger (2009, 2011) There is also a literature why trade agreements are flexible, see Beshkar and Bond (2010), Horn, Maggi an Staiger (2010).

in favor of ISDS because our model cannot address a number of problems associated with ISDS. First, we ignore all procedural and legal costs associated with ISDS, which can be substantial. Second, we take the ownership structure of firms as given (distinguishing only domestic and foreign firms) and do not allow for strategic ownership changes in response to ISDS, although we discuss some aspects of this issue at the end of Section 3. Third, we do not take into account that an ISDS panel may rule on its own, may not follow best practice procedures when appointing its members, and may face little or no control by law-makers in the signatory countries.[8] This setup may violate the Rule of Law in several countries, creating an economic "Guantanamo Bay", and the costs of by-passing legal procedures will not be easy to assess, but could be substantial.

The remainder of this paper is organized as follows. Section 2 sets up the basic model and develops the outcome without any provision. Section 3 extends this model to the case of ISDS and develops the regulatory regime in the presence of ISDS. Section 4 discusses a national treatment provision and compares it to an ISDS provision. Section 5 concludes.

2 The basic model

The model developed below is partial equilibrium in nature. We look at two countries, domestic and foreign, where foreign investors consider establishing an affiliate in the home country. We focus on the domestic country, but the model can be regarded as a model of reciprocal FDI such that similar effects materialize in the foreign country dealing with domestic investors. Expected profits are influenced by a regulatory standard set by the

[8] Article 9.21 of the TPP draft (2015), for example, specifies for the appointment of the ISDS tribunal that "[u]nless the disputing parties agree otherwise, the tribunal shall comprise three arbitrators, one arbitrator appointed by each of the disputing parties and the third, who shall be the presiding arbitrator, appointed by agreement of the disputing parties." In the context of TTIP, the use of ad hoc panels has been questioned on legal grounds. To allay legal concerns, the European Commission has therefore proposed to establish an international investment court featuring an appellate mechanism with tenured judges, in order to ease the legal concerns about dispute settlement through ad hoc panels; see http://trade.ec.europa.eu/doclib/docs/2015/may/tradoc_153408.PDF for an account of the EU's negotiation position on ISDS and Titi (2016). It is doubtful whether the US will be able to agree to this proposal, given that the design of TPP arbitration is substantially different.

domestic government. For the basic model and the subsequent section, we confine the analysis to foreign investors. The purpose of the model is to highlight the economic problem an ISDS provision is meant to address, and in line with common practice we assume that any ISDS provision is designed for foreign investors only. We will be more explicit on the role of domestic firms versus foreign investors when dealing with a national treatment provision as the principal alternative to ISDS.

In our model, decision making takes place in two consecutive periods that differ in two important ways. First, foreign investors may enter only in stage one and will be "locked" in during period two. Thus, once entry has taken place, the investment project is completely specific to the host country and has no other use. Second, the sensitivity of domestic welfare with respect to the regulatory standard may differ across periods and is revealed to the government at the beginning of each period. Upon learning about this sensitivity at the beginning of period one, the government irrevocably sets the regulatory standard for period one. Observing this standard, and forming rational expectations about regulation in the second period, potential investors decide about entry. At the time of entry, the period two sensitivity of welfare with respect to regulation is a stochastic variable with a distribution function known to both the government and foreign investors. Importantly, the realization of this variable cannot be verified by a third party.[9] Therefore, the government cannot commit to a contingent level of period two regulation, and investor entry at the beginning of period two is thus subject to a holdup problem. In other words, no third party can verify whether a regulatory tightening in period two is an appropriate response to a changed regulatory environment or simply a result of the host government exploiting the holdup problem.

There is a mass one of potential foreign investors who share the same operating technology, but differ in terms of the fixed entry cost ϕ that they need to incur for this investment. We assume that ϕ is distributed according to a cumulative distribution function $F(\phi)$ and

[9]This is inline with the US model BIT (bilateral investment treaty), which allows for post establishment tightening of investment-related regulations under certain exceptions but assumes that a host country's "invocation and application of the exception will be difficult or perhaps impossible for an investor to challenge in arbitration"; see Poulsen et al. (2015, p. 144).

density $f(\phi) := F'(\phi)$ on the domain $[\underline{\phi}, \infty]$. In case of a greenfield investment, ϕ is the respective cost of this investment. In case of an acquisition, ϕ is the acquisition cost which is the difference between the acquisition price and potential acquisition gains from combining the investor's and the target's potentially complementary assets.

Investment has a two-period time horizon, $t = 1, 2$, whereby the periodic profit depends on the stringency of a regulatory standard, denoted by $s_t \in [0, \bar{s}]$, which is assumed to affect the operating cost. Period t maximum operating profit of a representative foreign investor is $\pi_t = \pi(s_t)$, where $-\infty < \pi'(s_t) < 0$ and $\pi''(s_t) \leq 0$. Furthermore, there exists a regulation level $\bar{s}$ such that $\pi(\bar{s}) = 0$ and $\pi(s) > 0$ for all $s < \bar{s}$. Note that the function $\pi(\cdot)$ is invariant across periods and investors. Investors care about expected profits, and entry decisions are based on the observed regulatory standard of period one, on an entry subsidy, denoted by Σ, and on rational expectations about the regulatory standard of period two. In turn, the government sets the period one standard as well as the entry subsidy in a subgame perfect fashion, and under rational expectations about subsequent entry of foreign investors.

A number of comments on our modeling strategy are in order. First, we allow the domestic country to attract foreign firms also with a subsidy, which is in line with common practice of developed countries and allows us to exactly identify the holdup problem, as we will show below.[10] Second, we do not consider domestic consumer surplus, assuming that it is not affected by attracting FDI, for example because the firms under consideration produce for a third market. Third, we do not consider strategic interactions among firms. The strategic trade policy literature has shown that the incentives in an environment of strategic interactions among firms depend crucially on assumptions on market structures, whether firms compete with strategic substitutes or strategic complements and whether they serve their own country and the countries of their competitors or a third country

[10]Under the Agreement on Subsidies and Countervailing Measures of the WTO, our entry subsidy would qualify as an actionable subsidy. Actionable subsidies are not prohibited, but can be challenged if they cause adverse effects. We allow the use of subsidies as we do not see the direct adverse effects for other countries, and the equivalent of a subsidy could be easily provided in form of any other assistance. Nevertheless, we have also performed the analysis without allowing a subsidy, and the details are available upon request.

(see, for example, Markusen and Venables, 1988). None of this is considered here since we want to squarely focus on the welfare channels primarily relevant for investor protection.

Consequently, our basic model considers two elements of domestic welfare. The first is the direct benefit from the regulatory standard. We use $\theta_t > 0$ to denote the period t sensitivity of welfare with respect to the type of regulation considered and $\theta_t v(s_t)$ to measure the domestic benefit that derives from an active firm complying with the period t regulatory standard s_t. Plausibly, we assume $v'(s_t) > 0$ and $v''(s_t) < 0$, i.e., a decreasing marginal benefit of regulatory tightening. The host government realizes θ_1 before setting its regulatory standard s_1 and before investors decide upon entry.[11] At the time of entry, θ_2 is a stochastic variable, distributed according to a cumulative distribution function $G(\theta)$ on the domain $[\underline{\Theta}, \overline{\Theta}]$. We assume that $\theta_1 < \overline{\Theta}$ so that there is a strictly positive probability for the second period featuring a higher sensitivity of social welfare with respect to the regulatory standard.

The second element of welfare is some positive spillover from the investor to the domestic economy, say through vertical linkages with local suppliers or higher wages paid to domestic workers. In addition, there will be an increase in domestic tax revenues.[12] We abstain from any detailed modeling of these effects, but simply assume that they can be represented by a periodic stream $\alpha\pi(s_t)$, with $\alpha > 0$. We assume, plausibly, that $0 < \alpha < 1$.[13]

In case of entry, the foreign investor is locked in for both periods. Therefore, upon learning about the realization of θ_2, the domestic government will maximize $\alpha\pi(s_2) +$

[11] It is thus irrelevant whether only the government or both, the government and the investor observe θ_1. For the investor, what counts is the regulatory standard s_1 that she must comply with and the entry subsidy Σ offered to her as well as the fact that, for reasons mentioned above, the government cannot commit to any regulatory policy for period two.

[12] There are multiple reasons for such spillovers; see Blomström and Koko (1998), Görg (2007) and OECD (2008).

[13] As we shall see in Section 3 below, an ISDS mechanism introduces an additional welfare channel which is the compensation payment from the domestic government to the foreign investor.

$\theta_2 v(s_2)$, leading to a regulation level $s_2^*(\theta_2)$ defined by the first-order condition[14]

$$\alpha\pi'(s_2^*(\theta_2)) + \theta_2 v'(s_2^*(\theta_2)) = 0. \tag{1}$$

Knowing the distribution function of θ_2, all potential investors correctly anticipate – in expected value terms – the government's regulatory policy. Using a caret to denote expected values, expected second period profits are given by $\hat{\pi}_2 = \int_{\underline{\Theta}}^{\overline{\Theta}} \pi[s_2^*(\theta)]\mathrm{d}G(\theta)$. Similarly, using R_2 to denote the welfare gains from period two regulation, we have $\hat{R}_2 = \int_{\underline{\Theta}}^{\overline{\Theta}} \theta v[s_2^*(\theta)]\mathrm{d}G(\theta)$.

In the first stage, the domestic government sets both the standard s_1 and the entry subsidy Σ. An investor with entry cost ϕ will enter if $\pi(s_1) + \hat{\pi}_2 + \Sigma - \phi \geq 0$. The domestic government will therefore maximize $F(\phi)\Big[\alpha(\pi(s_1) + \hat{\pi}_2) + \theta_1 v(s_1) + \hat{R}_2 - \Sigma\Big]$ with respect to s_1 and Σ, subject to the participation constraint $\Sigma = \phi - (\pi(s_1) + \hat{\pi_2})$. It is obvious that this maximization problem is equivalent to maximizing

$$W(s_1, \phi) = F(\phi)\Big[(1+\alpha)(\pi(s_1) + \hat{\pi}_2) + \theta_1 v(s_1) + \hat{R}_2 - \phi\Big] \tag{2}$$

with respect to s_1 and ϕ. Expression (2) nicely demonstrates the holdup problem. Due to the participation constraint, the government apparently maximizes aggregate welfare, i.e., sum of all profits plus spillovers and regulation benefits, minus entry cost. But a first best outcome is infeasible because the domestic government cannot commit to an optimal level of second-period regulation vis à vis foreign investors, which we argue is the key rationale underlying investor protection in bilateral investment treaties.[15] As welfare is separable across periods, however, the first period regulation level will be first best. Maximization

[14]Throughout the paper, we assume that $a\pi'(s_t)+\theta_t v''(s_t) < 0$ for all θ_t and s_t, and for all $a \in [\alpha, 1+\alpha]$, whence the first-order condition will also be sufficient. Furthermore, $0 < s_2^*(\underline{\Theta}) < s_2^*(\overline{\Theta}) < \bar{s}$, which guarantees an interior solution.

[15]If it could, we would see the Coase Theorem in action and the levels of both regulation and entry would be first best, irrespective of how aggregate welfare is distributed between the domestic country and foreign investors.

yields the first-order conditions

$$\begin{aligned} (1+\alpha)\pi'(s_1^*) + \theta_1 v'(s_1^*) &= 0, \qquad (3) \\ f(\phi^*)\Big[(1+\alpha)(\pi(s_1^*)+\hat{\pi}_2) + \theta_1 v(s_1^*) + \hat{R}_2 - \phi^*\Big] - F(\phi^*) &= 0, \end{aligned}$$

where we use starred symbols to indicate optimal values.[16] The above first-order conditions imply the following

Lemma 1. *Absent any ISDS or national treatment provision, the regulatory standard s_1^* will be first best, but the entry level ϕ^* will be suboptimally low.*

Proof. Note that aggregate welfare is additive over the two periods. The first line in (3) immediately shows that s_1 is first best and that s_1 is independent on ϕ. Writing $H(\omega^*, \phi^*)$ for the left hand side in the second line of (3), we note that ω^* is less than the first best level of expected aggregate welfare contributed by a representative investor, due to the holdup problem. Since $\partial H/\partial\omega > 0$ and $\partial H/\partial\phi < 0$ from the second order condition, it follows that moving to the first best would imply an entry level that is higher than ϕ^*; entry is suboptimally low. □

It is worth emphasizing that the holdup problem causes a suboptimally low level of entry despite the entry subsidy at the government's disposal. Note carefully that $s_2^* > s_1^*$ even if $\theta_2 = \theta_1$. In the second period, the participation constraint is not binding anymore, and hence nothing stops the domestic government from tightening regulatory standards. Note also that, even if the government could commit to follow the first best regulation in the second period similar to (3), a higher regulatory standard is possible if $\theta_2 > \theta_1$. A domestic firm would exactly face this risk, but since its profits would be taken into

[16]The second-order condition requires that $W(s_1, \phi)$ be concave in s_1 and ϕ. Note that the second-order derivative with respect to s_1 is negative by the assumptions about $\pi(\cdot)$ and $v(\cdot)$ introduced above, while the cross-derivative is zero. Therefore, concavity requires that $f'(\phi^*)(\Omega^* - \phi^*) - 2f(\phi^*) < 0$, where Ω^* indicates the optimal value of profits plus spillovers plus regulation benefits. We assume that this condition is fulfilled. Morevover, we assume that $\phi^* \in [\underline{\Theta}, \overline{\Theta}]$, guaranteeing an interior solution. If $\phi^* < \underline{\Theta}$, the holdup problem would not affect entry; if $\phi^* > \overline{\Theta}$, entry would never occur. For similar reasons, we assume that $s_1^* \in [0, \bar{s}]$.

account, an increase in regulatory standards would necessarily be due to an increase in θ_2. A foreign firm, however, knows that its activities count only as far as the spillover effect is concerned, and it knows that no reliable mechanism exists that can credibly verify whether an increase in regulatory standards is is justified by an increase in θ_2.[17] The next section will investigate whether and how ISDS can possibly mitigate the holdup problem.

3 Introducing ISDS

The basic idea of an ISDS provision as modeled in this paper is to guard investors against the risk of "unjustified" regulatory tightening by host country governments, and the principle of the ISDS mechanism is monetary compensation for profit losses.[18] Of course, any ISDS panel will not be in the position to decide whether an increase in regulatory tightness is really due to a change in the domestic environment. Otherwise, it would be easy to use this panel for escaping from the holdup problem in the first place. We therefore assume that the panel will be called in only if regulation is tightened and can be expected to listen to evidence brought forward by the government and the investor. Since there cannot be any clear rules for the panel, its decision will be a stochastic result as well.[19] This suggests that the outcome of the ruling will be completely stochastic and will depend mainly on the role that the investment agreement assigns to the ISDS provision. If the

[17] Maskin and Tirole (1999) have shown that a unilateral holdup problem can be solved if both parties can credibly make an agreement with a third party (an arbitrator) that does not have to rely on the third party knowing and being able to verify the true θ_2. However, recent ISDS provisions do not include a third party. See Stähler (2016) for the design of an optimal ISDS provision that includes a third party.

[18] Article 9.28 of the TPP draft (2015) specifies that "the tribunal may award (...) only: (a) monetary damages and any applicable interest; and (b) restitution of property, in which case the award shall provide that the respondent may pay monetary damages and any applicable interest in lieu of restitution." Penalties are not allowed.

[19] In particular, Article 9.7 of the TPP draft (2015) specifies that "[n]o Party shall expropriate or nationalize a covered investment either directly or indirectly through measures equivalent to expropriation or nationalization ...", so any regulation leading to a profit decrease could qualify as a measure equivalent to an expropriation. The TTP draft does not define "police policy carve-outs" (PPCAs) in the sense of Aisbett *et al* (2010a) except for the tobacco industry in Article 29.5 (see also footnote 24). It has chapters on environmental cooperation and labor standards, but they do not define PPCAs.

purpose of ISDS is arbitration, then the probability of a ruling in favor of the investor will be small, as a sovereign country will have little difficulty in rejecting the claims underlying the panel ruling. In contrast, if the investment agreement provides for a binding ISDS verdict, then this probability will be large because the government may face severe sanctions if it does not comply with the ruling. In either case, from an investor's perspective, the compensation payment is a stochastic variable, both because the regulatory environment in period two is stochastic and because the ISDS ruling is stochastic. Importantly, the expected ISDS payment of period two is influenced by regulation in period one. The more stringent period one regulation, the lower the likelihood that an optimal response to the regulatory environment of period two will in fact cause a profit loss for the investor.

More specifically, if the government increases regulatory tightness in period two, setting $s_2 > s_1$, the ISDS panel rules with some positive probability that foreign investors are entitled to complete compensation for lost profits. The expected compensation payment for period two is equal to

$$T(s_1, s_2, q) = \begin{cases} q\left[\pi(s_1) - \pi(s_2)\right] & \text{if } s_2 > s_1, \\ 0 & \text{otherwise.} \end{cases} \tag{4}$$

In the first line of (4), q denotes the probability of an ISDS panel ruling in favor of a foreign investor, conditional on $s_2 < s_1$, in which case the compensation payment is enforceable at zero cost. Thus, q is a parameter that captures the toughness of foreign investor protection. Obviously, no ISDS compensation can occur in period one. We will also use q for our comparative static exercises in order to demonstrate the effect of ISDS: a marginal increase in q starting from $q = 0$ gives us the effects of introducing ISDS, a marginal increase in q when $q > 0$ gives us the effects of tightening ISDS.[20]

The sequencing of decision making is as before. At the beginning of period one, the host

[20]Expression (4) is equivalent to a partial compensation rule in which each plaintiff will receive a fraction q of its profit losses. Note the asymmetry of ISDS, as the investor will not be charged with probability q if profits increase. See also footnote 22. Furthermore, given the appointment procedure as suggested for TPP (see footnote 8), q can also be regarded as the probability that the arbitrator appointed by the plaintiff will successfully make the presiding arbitrator rule in favor of the plaintiff.

government sets the regulatory standard s_1 and offers an entry subsidy Σ, and foreign investors subsequently decide about entry. In period two, after observing θ_2, the government sets s_2. If $s_2 > s_1$, the ISDS panel decides on whether incumbent investors are entitled to compensation according to (4). Consequently, the key novelty arising from ISDS is that the government's regulatory decision at the beginning of period two will depend on the regulatory standard set in period one. Subgame perfection requires that the government anticipates this dependency when determining the regulatory standard in period one. To analyze this dependency, it proves convenient to use $W_2(s_1, s_2) := \theta_2 v(s_2) + \alpha\pi(s_2) - T(s_1, s_2, q)$ to denote second period domestic welfare.

Given the standard s_1, the period two problem for the host government will be to maximize $W_2(s_1, s_2)$ with respect to s_2. A key aspect of the ISDS mechanism now is that $W_2(s_1, s_2)$ is not differentiable at $s_2 = s_1$,

$$W_2 = \begin{cases} \alpha\pi(s_2) + \theta_2 v(s_2) & \text{if} \quad s_2 \leq s_1, \\ \alpha\pi(s_2) + \theta_2 v(s_2) - q\left[\pi(s_1) - \pi(s_2)\right] & \text{if} \quad s_2 > s_1. \end{cases} \tag{5}$$

This leads to

Lemma 2. *Given an ISDS provision aimed at compensation for regulatory tightening, the government behavior in period two is conditional on s_1 and given by*

$$s_2^*(\theta_2) = \begin{cases} \mu\left(\frac{\alpha}{\theta_2}\right) < s_1 & \text{if} \quad \theta_2 \in [\underline{\Theta}, \underline{\theta}_2(s_1)], \\ s_1 & \text{if} \quad \theta_2 \in [\underline{\theta}_2(s_1), \overline{\theta}_2(s_1, q)], \\ \mu\left(\frac{\alpha+q}{\theta_2}\right) > s_1 & \text{if} \quad \theta_2 \in [\overline{\theta}_2(s_1, q), \overline{\Theta}]. \end{cases} \tag{6}$$

where $\underline{\theta}_2(s_1) := \alpha / h(s_1)$, $\overline{\theta}_2(s_1, q) := (\alpha + q) / h(s_1)$ and $\mu(\cdot) := h^{-1}(\cdot)$ with $h(s_2) := -v'(s_2) / \pi'(s_2) > 0$.

Proof. See Appendix A.1 □

Figure 1 depicts downward-sloping schedules $\theta_2 v'(s_2)$ for alternative values of θ_2 as well as upward-sloping schedules for $-\alpha\pi'(s_2)$ and $-\alpha\pi'(s_2) - q\pi'(s_1)$ for a certain level

of s_1. Given this level of s_1, the solid line traces the intersection points, in line with the first order condition for maximizing $W_2(s_1, s_2)$ with respect to s_2, as θ_2 increases continuously from very low to very high values, compared to θ_1 (which determines s_1).[21] Intuitively, if the sensitivity θ_2 lies below a certain threshold level $\underline{\theta}_2(s_1)$, such as θ_{2l}, then the government has no incentive to tighten regulation in period two, but will choose a lower regulatory standard than in period one. In contrast, if this sensitivity increases above a certain threshold $\overline{\theta}_2(s_1, q)$, such as θ_{2h}, then the incentive for tightening regulation is sufficiently strong for the government to risk an adverse ISDS ruling. It therefore sets $s_2^* = \mu\left((\alpha + q)/\theta_{2h}\right) > s_1$. For an intermediate range of θ_2, for example if $\theta_2 = \theta_{2m} > \theta_1$, this risk is too large and the government sets $s_2^* = s_1$. Thus, the two threshold levels $\underline{\theta}_2(s_1)$ and $\overline{\theta}_2(s_1, q)$ mark an ISDS-induced "range of inaction" where the government learns about a new environment favoring tighter regulation, but abstains from increasing the regulatory standard. The benefits from doing so are more than outweighed by the risk of facing an ISDS ruling forcing the government to compensate foreign investors for erosion of profits.

Figure 1 also depicts the second period domestic welfare loss deriving from this ISDS mechanism for cases where $\theta_2 > \underline{\theta}_2(s_1)$. Note that this loss (gray-shaded area) arises also for $\theta_2 \in [\underline{\theta}_2(s_1), \overline{\theta}_2(s_1, q)]$, in which case the government avoids compensation payment by sticking to s_1. Moreover, for $\theta_2 > \overline{\theta}_2(s_1, q)$, the loss exceeds the compensation payment. In Figure 1, this deadweight loss is marked by the triangle ABC. This result can be generalized:

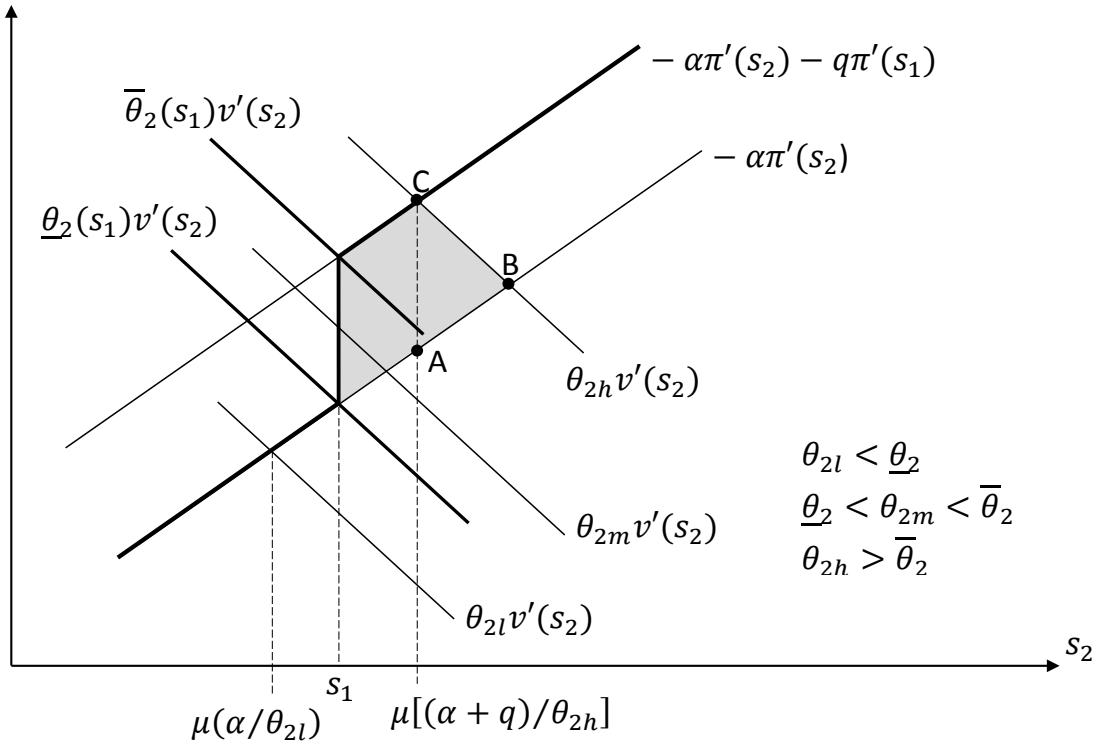
Lemma 3. *For given s_1, introducing and tightening the ISDS mechanism reduces expected domestic welfare.*

Proof. See Appendix A.2 □

Lemma 3 substantiates the insights from Figure 1. Note carefully, however, that this result holds only for a given s_1, so it does not yet incorporate the above mentioned

[21] For the sake of a clear exposition, Figure 1 depicts linearized schedules for $v'(s)$ and $\pi'(s)$.

Figure 1: Domestic welfare loss in the second period



intertemporal relationship between regulation in the two periods. To pave the ground for a better understanding of the optimal policy in this setting, Lemma 4 addresses the effects that the first period regulatory standard s_1 has (i) on the regulation to be expected in period two, (ii) on the expected benefits thereof, and (iii) on the expected compensation payment due to ISDS ruling. We find:

Lemma 4. *Given an ISDS provision, the expected second period regulatory standard as well as the expected regulation gains increase with the first period standard s_1, while the expected ISDS compensation payment decreases with s_1.*

Proof. See Appendix A.3 □

The intuition for Lemma 4 is as follows. From Figure 1 we know that an increase in s_1 increases the lower as well as the upper bound of the interval $[\underline{\theta}_2(s_1), \overline{\theta}_2(s_1, q)]$. But since

the optimal second period standard is the same at both ends of this interval (and equal to s_1), this has no first-order effect on the expected value of s_2^*. What remains is the direct effect of a rise in s_1 on s_2^* for θ_2-values within this interval, which have a probability mass equal to $G[\overline{\theta}_2(s_1, q)] - G[\underline{\theta}_2(s_1)]$. Moreover, within this interval any increase in s_1 feeds into an equal increase in s_2^*. Given this effect on s_2^*, any increase in s_1 feeds into an added regulatory gain in line with $v'(s_1)$, and in line with the (unconditional) expected sensitivity of welfare with respect to regulation over the aforementioned interval. Finally, a rise in the first period regulatory standard reduces the magnitude of compensation payments by $q\pi'(s_1)$, provided that the government chooses a second period regulatory standard above s_1, which occurs with probability $1 - G[\overline{\theta}_2(s_1, q)]$.

While it is obvious now that ISDS will reduce *domestic* welfare in the second period for a given s_1, it is not clear yet what it will do to *aggregate* welfare. As before, the domestic government sets both the standard s_1 and the entry subsidy Σ in the first period, and entry will now occur if a potential investor with entry cost ϕ finds $\pi(s_1) + \hat{\pi}_2 + \Sigma + \hat{T}_2 - \phi \geq 0$. Thus, the domestic government will maximize $F(\phi)\Big[\alpha(\pi(s_1)+\hat{\pi}_2)+\theta_1 v(s_1)+\hat{R}_2-\hat{T}_2-\Sigma\Big]$ with respect to s_1 and Σ, subject to the participation constraint $\Sigma = \phi-(\pi(s_1)+\hat{\pi}_2+\hat{T}_2)$. Again, this maximization problem is equivalent to maximizing aggregate welfare

$$F(\phi)\Big[(1+\alpha)(\pi(s_1) + \hat{\pi}_2(s_1)) + \theta_1 v(s_1) + \hat{R}_2(s_1) - \phi\Big] \tag{7}$$

with respect to s_1 and ϕ. Note, however, that $\hat{\pi}_2$ and $\hat{R}_2$ now also depend on s_1. The government now takes into account an intertemporal dependency in regulation: Its choice of s_1 in period one will determine its policy options in the second period. Comparing the optimal policy with the optimal policy absent any ISDS provision, we find:

Proposition 1. *The introduction of an ISDS provision leads to overregulation in the first period, reduces overregulation in the second period, and increases aggregate welfare, but does not change the entry incentive.*

Proof. See Appendix A.4. □

Thus, a main conclusion of our analysis is that an ISDS mechanism aiming at indemnity payment may reduce the holdup problem, but this comes with the cost of overregulation in the first period.[22] The intuition is quite straightforward. Overregulation in the first period buys the government more discretion in the second period. Interestingly, the entry distortion remains unaffected, whence the welfare effect is driven by the two regulation levels s_1 and $\hat{s}_2$. We know that the domestic government chooses a first best regulation level for the first period, but overregulates in the second period without any investor protection. Hence, the ISDS-induced changes in regulation levels have an asymmetric effect on aggregate welfare: increasing s_1 has no first order effect on welfare, while reducing $\hat{s}_2$ has a first order effect which is positive. The reason for an unchanged entry level is that the profit effect of any increase in period one regulation s_1 is exactly offset – in expected value terms – by a corresponding profit effect of lower period two regulation plus the transfer payment received from the government. Note, however, that no ISDS provision can lead to the global first best because it leads unavoidably to overregulation in the first period. Thus, any ISDS provision can at best ameliorate the holdup problem, but not solve it.

A major concern that is expressed for any ISDS provision is that it it restricts access to an ISDS provision to foreign firms, thus discriminating against domestic firms. However, domestic firms will not face the holdup problem in the first place, because the domestic government will take their profits into account, in addition to the spillover, when deciding on regulation. In the context of this model, the different treatment of foreign firms via ISDS is therefore not without justification. While it is true that domestic firms are equally exposed to the risk of an increase in the regulatory standard due to a large enough realization of θ_2, this would not constitute overregulation but simply reflect a change in circumstances. Given this asymmetry between domestic and foreign firms, granting access to ISDS compensation to domestic firms would seem like a strange way to implement

[22]This result is due to the asymmetry of ISDS and would disappear if the investor could also be charged with probability q in case of a profit increase. In particular, a symmetric setup with $q = 1$ would insure the investor against any change in regulation.

non-discrimination. In the next section, we therefore investigate national treatment in regulatory standards in the presence of domestic as well as foreign firms, treating this as a basic alternative to a standard ISDS mechanism open only to foreign firms.

A problem arises, however, if firms can simply change their ownership status once they become unhappy with the specific regulation they are facing. This is an option that our model does not accommodate. For example, a domestic firm could move headquarters and become a foreign firm with access to an ISDS provision. Changing ownership essentially undoes the perfect alignment of interest, offering it a stochastic transfer from the government. Note that this would not constitute a welfare neutral distribution, since the government would take this into account when regulating the domestic firm, although there is no holdup problem that could conceivable justify this.[23] Alternatively, a foreign firm originating from a country that has no investment agreement with the host country or one without ISDS provision could get access via a subsidiary in a country that has such an agreement.[24] These considerations prompt us to analyze whether a national treatment provision can do a better job than ISDS in the context of our model. It goes without saying that it will definitely be immune against strategic ownership changes whereas ISDS is not.

4 National treatment

A national treatment provision guarantees that all investors are subject to the same regulatory treatment irrespective of their nationality. To lend this idea precise meaning,

[23]It does not help that a government dealing with a domestic firm will achieve the first best because the firm will change its ownership if the first best second period regulation is tighter due to $\theta_2 > \theta_1$ as it is interested in its profit only and not in aggregate welfare. By changing ownership it can increase its profit due to an expected compensation after access to ISDS.

[24]A famous case in point is Philip Morris, a US tobacco company, that has used its Hong Kong and Swiss subsidiaries to sue both the Australian and the Uruguayan government for its policy on cigarette packaging. Australia has an investment agreement with an ISDS provision with Hong Kong, and Uruguay with Switzerland, but both would not have anticipated this implication when signing it. In December 2015, the panel came out with a ruling in favor of the Australian government. It is interesting to note that the plaintiff has argued that the regulation on cigarette packaging at issue is equivalent to expropriation in exactly the sense envisaged by Article 9.7 of the TPP agreement; see footnote 18.

we assume that domestic and foreign firms are the same in all respects, except for their nationality. In particular, they have the same profit function, they create the same spillover α for the domestic economy, and they generate the same concern giving rise to regulation, as captured by $v(s)$. However, nationality plays out in the government's objective function where domestic firms' profits receive a full "weight" equal to $1+\alpha$, while foreign firms' profits matter only through their spillover α. The government would therefore want to treat domestic and foreign investors differently, but is constrained to a single regulatory standard s applied to both types of firms. Intuitively the severity of this constraint depends on the share of foreign firms in the total number of regulated firms.

It would certainly be naïve to expect from a national treatment restriction that the government sets common regulatory standards as if all firms were domestic. Instead, when setting common standards, the government will recognize that national treatment effectively exposes domestic firms to the type of overregulation prompted by the holdup problem existing vis à vis foreign firms, even though such a holdup problem does not in fact exist vis à vis domestic firms since domestic profits receive full weight in the government's objective function.

In order to keep the analysis clean from strategic interactions among firms, we assume a fixed mass of domestic firms that are already active in the domestic country. As before, let the mass of *potential* foreign entrants be normalized to one. Not all of them will enter, but the government will know the entry realization of period one when deciding on regulation in period two. Accordingly, let $\sigma^*, 0 < \sigma^* < 1$, denote the share of potential foreign investors that decide to enter at the beginning of period one. Furthermore, let $\sigma > 0$ denote the mass of domestic firms relative to the mass of *potential* foreign entrants. Note that it can well be that $\sigma > 1$, which is the case if the number of domestic firms is larger than the number of potential foreign investors.

Let us first consider second period regulation. Deprived of a discriminatory instrument, the domestic government will maximize period two domestic welfare

$$\tilde{W}_2 = \sigma(1+\alpha)\pi(s_2) + \sigma^*\alpha\pi(s_2) + (\sigma+\sigma^*)\theta_2 v(s_2)$$

with respect to s_2 in the second period, after foreign entry has occurred in period one. Domestic welfare is now the sum of domestic profits, a weighted average of domestic and foreign spillovers, and the benefits of regulating all firms. Therefore, a national treatment provision makes domestic firms indirectly exposed to the holdup problem as well, and the strength of this effect depends on the ratio of σ^* to σ. Maximization leads to the first-order condition

$$(\sigma(1+\alpha)+\sigma^*\alpha)\pi'(s_2^{**}(\theta_2,\sigma,\sigma^*))+(\sigma+\sigma^*)\theta_2 v'(s_2^{**}(\theta_2,\sigma,\sigma^*))=0. \tag{8}$$

Second period regulation now also depends on the share of domestic firms σ and on the entry realization σ^*, in addition to the realization of θ_2. In particular, an increase in σ^* makes s_2^{**} increase, that is,

$$\frac{\partial s_2^{**}(\theta_2,\sigma,\sigma^*)}{\partial \sigma^*}=-\frac{\alpha\pi'(s_2^{**}(\theta_2,\sigma,\sigma^*))+\theta_2 v'(s_2^{**}(\theta_2,\sigma,\sigma^*))}{(\sigma(1+\alpha)+\sigma^*\alpha)\pi''(s_2^{**}(\theta_2,\sigma,\sigma^*))+(\sigma+\sigma^*)\theta_2 v''(s_2^{**}(\theta_2,\sigma,\sigma^*))}>0, \tag{9}$$

where the numerator is positive due to the first-order condition (8), and the denominator is negative due to the second order condition. The intuition is that an increase in the mass of foreign firms having entered in period one increases the weight on the direct welfare effect of period two regulation, one for one, whereas the weight on the negative profit effect of regulation increases less than proportionally, since $\alpha<1$. It thus aggravates the period two holdup problem, leading to a higher period two regulation. Conversely, a larger share of domestic firms decreases regulation levels, as

$$\frac{\partial s_2^{**}(\theta_2,\sigma,\sigma^*)}{\partial \sigma}=-\frac{(1+\alpha)\pi'(s_2^{**}(\theta_2,\sigma,\sigma^*))+\theta_2 v'(s_2^{**}(\theta_2,\sigma,\sigma^*))}{(\sigma(1+\alpha)+\sigma^*\alpha)\pi''(s_2^{**}(\theta_2,\sigma,\sigma^*))+(\sigma+\sigma^*)\theta_2 v''(s_2^{**}(\theta_2,\sigma,\sigma^*))}<0, \tag{10}$$

where the numerator is negative due to the first-order condition (8), so the influence of the holdup problem is reduced. The intuition for this is as before, but it now works in the opposite direction because domestic firms' profits receive a weight $1+\alpha>1$. [25]

[25]The first order condition (8) may be written as $(1+A)\alpha\pi'(\cdot)+\theta_2 v'(\cdot)=0$, where $A:=\sigma/((\sigma+\sigma^*)\alpha)>0$, which implies that the numerator of (9) is equal to $-A\alpha\pi'(\cdot)>0$. By the same

Note carefully that we cannot sign $\partial^2 s_2^{**}(\theta_2, \sigma, \sigma^*)/\partial\sigma\partial\sigma^*$ without specifying the functional forms. Thus, it is not clear whether a marginal increase in the share of domestic firms will reduce or increase regulatory standards due to an increase in foreign entry, since the effects depend on third derivatives of the objective function. In order to shed some more light on these effects, suppose that $\pi_t(s_t) = \gamma - s_t$ and $v_t = \theta_t \ln(s_t)$ (see for details Appendix A.5). If the share of domestic firms is large (small) such that

$$\sigma > (<) \frac{\alpha}{1+\alpha}\sigma^* \tag{11}$$

$\partial^2 s_2^{**}(\theta_2, \sigma, \sigma^*)/\partial\sigma\partial\sigma^*$ is negative (positive). The intuition is straightforward: If the share of domestic firms is large, a further increase in foreign entry will not make regulatory standards increase strongly, as domestic firms are dominant and their large share reduces the marginal effect of the holdup problem such that the standard will not increase by much.

As before, both the government and foreign investors will correctly anticipate the regulatory behavior in the second period, but this must also include the expectation on market entry. Rational expectations warrant that the expectation of σ^* is equal to $F(\phi)$. Furthermore, second period regulation depends only on the number of entrants and not on their individual fixed cost realizations. Consequently, expected profits and expected regulation gains are given by

$$\begin{aligned}
\tilde{\pi}_2(\sigma, \phi) &= \int_{\underline{\Theta}}^{\overline{\Theta}} \pi(s_2^{**}(\theta, \sigma, F(\phi)))\mathrm{d}G(\theta), \\
\tilde{R}_2(\sigma, \phi) &= \int_{\underline{\Theta}}^{\overline{\Theta}} \theta v(s_2^{**}(\theta, \sigma, F(\phi)))\mathrm{d}G(\theta).
\end{aligned}$$

Note that $\tilde{\pi}_2$ is the expected second period profit not only of a foreign investor, but also of a domestic firm. Thus, national treatment makes domestic firms "hostages" to the holdup problem.

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logic, (8) may be written as $(1-B)(1+\alpha)\pi'(\cdot) + \theta_2 v'(\cdot) = 0$, where $B := \sigma^*/((\sigma+\sigma^*)(1+\alpha)) < 0$, which implies that the numerator of (10) is equal to $-B(1+\alpha)\pi'(\cdot) > 0$.

What about first period regulation? In the case of national treatment, the domestic government has no incentive to overregulate in order to have more discretion in the second period. Moreover, national treatment does also not allow to specify different regulations for domestic firms and foreign investors in the first period. Interestingly, however, this is the equilibrium outcome even if the government were allowed to discriminate in the first period. To see this, consider the foreign investor. This investor will enter if $\pi(s_1) + \tilde{\pi}_2(\phi) + \Sigma - \phi \geq 0$, and the maximization problem of the domestic government now is to maximize

$$\begin{aligned} & \sigma\Big[(1+\alpha)(\pi(s_1)+\tilde{\pi}_2(\sigma,\phi)) + \theta_1 v(s_1) + \tilde{R}_2(\sigma,\phi)\Big] \\ + \quad & F(\phi)\Big[\alpha(\pi(s_1)+\tilde{\pi}_2(\sigma,\phi)) + \theta_1 v(s_1) + \tilde{R}_2(\sigma,\phi) - \Sigma\Big] \end{aligned}$$

with respect to s_1 and Σ subject to the participation constraint $\Sigma = \phi - (\pi(s_1) + \tilde{\pi}_2(\sigma,\phi))$. Again, we can rewrite this maximization problem in equivalent form, such that the domestic government maximizes

$$\tilde{\Omega} = \Big[\sigma + F(\phi)\Big]\Big[(1+\alpha)(\pi(s_1)+\theta_1 v(s_1)) + \tilde{\Omega}_2(\sigma,\phi)\Big] - F(\phi)\phi \tag{12}$$

with respect to s_1 and ϕ, where we have used $\tilde{\Omega}_2(\sigma,\phi) = (1+\alpha)\tilde{\pi}_2(\sigma,\phi) + \tilde{R}_2(\sigma,\phi)$ to denote the maximized second period welfare per firm. The government now takes into account that foreign entry will lead to overregulation. The first-order conditions now read

$$\begin{aligned} (1+\alpha)\pi'(s_1^{**}) + \theta_1 v'(s_1^{**}) &= 0, \quad (13) \\ \Big[\sigma + F(\phi^{**})\Big]\frac{\partial\tilde{\Omega}_2(\sigma,\phi^{**})}{\partial\phi} & \\ + f(\phi^{**})\Big[(1+\alpha)(\pi(s_1^{**})+\tilde{\pi}_2(\phi^{**})) + \theta_1 v(s_1^{**}) + \tilde{R}_2(\phi^{**}) - \phi^{**}\Big] - F(\phi^{**}) &= 0, \end{aligned}$$

where s_1^{**} and ϕ^{**} denote the optimal regulation level and the optimal entry level, respectively.

We observe from (13) that the first period regulation will be first best, if the government is not allowed to discriminate between domestic and foreign investors. But the same result

would emerge, if the government were allowed to do so in the first, but not in the second period. In fact, we see from (12) that the government has no incentive to treat domestic and foreign firms differently in the first period. As for domestic firms, it takes their profits directly into account; as for foreign firms, it does so by the participation constraint. Furthermore, a direct implication of this observation is that $\partial^2\tilde{\Omega}/\partial s_1\partial\phi = 0$.

However, national treatment does imply an entry distortion in the first period, and this distortion is twofold. First of all, second period aggregate welfare is suboptimally small as in the case of ISDS. This effect can be seen in the last line of (13): $(1+\alpha)(\pi(s_1^{**}) + \tilde{\pi}_2(\sigma,\phi^{**})) + \theta_1 v(s_1^{**}) + \tilde{R}_2(\sigma,\phi^{**}) - \phi^{**}$ is less than its globally optimal level, but it is not clear whether it is larger or smaller than its counterpart under ISDS. The second effect is an additional distortion imposed by the national treatment provision that has no ISDS counterpart: The government correctly anticipates that foreign entry will compromise the second period regulation standard that affects domestic firms as well (see the expression in the second line of (13)).

How does national treatment compare with ISDS in terms of aggregate welfare? To answer this question, we must compare the aggregate welfare generated by each firm under ISDS to the one generated by a national treatment provision. While this seems hard to do without further specifying the model, we can make progress on this question by considering the conditions under which the distortions imposed by the national treatment provision will become smaller with an increase in the share of domestic firms. Thus, we now ask whether a sufficiently large share of domestic firms can make a national treatment provision welfare-dominant.

Under ISDS, aggregate welfare generated by each domestic firm is maximal, but lower for foreign entrants. Under a national treatment provision, aggregate welfare generated by each firm, domestic and foreign, is smaller than its maximum. Therefore, a national treatment provision will be welfare-dominant for some share of domestic firms if its distortions become smaller with an increase in σ. We know that a national treatment provision does not imply any distortion for s_1. Domestic and foreign firms become overregulated in the second period, but expression (10) shows that this distortion becomes the smaller,

the larger the share of domestic firms. If there is no domestic firm, a national treatment provision does not have any bite. But note that $F(\phi) < 1$, while σ is not constrained. If the share of domestic firms is very large, $s_2^{**}(\theta_2)$ will be close to first best.

A potential ambiguity arises for the entry decision. In general it is not clear how a larger share of domestic firms will affect the entry distortion as we observe two opposing effects: On the hand, an increase in σ makes domestic firms relatively more important for a given second period regulation, and the domestic government will therefore want to reduce foreign entry; on the other hand, an increase in σ reduces s_2 and and makes domestic firms less vulnerable to foreign entry as the strength of the holdup problem is reduced. Finally, we do not know whether an increase in σ will increase or reduce $\partial s_2/\partial\phi > 0$. Thus, while ISDS implies a distortion of the first period regulation (for any value of q), the national treatment provision does not, but will distort the entry decision. However, we find that the result is unambiguous for a sufficiently large share of domestic firms:

Proposition 2. *If $\sigma > F(\phi^{**})$ and $\partial^2 s_2^{**}(\theta_2, \sigma, \sigma^*)/\partial\sigma\partial\sigma^* < 0$, aggregate welfare increases with σ. If σ is sufficiently large, a national treatment provision welfare-dominates ISDS.*

Proof. See Appendix A.6. □

Note that the conditions developed here are all sufficient. Hence, it may well be that a national treatment provision will do better even if one of these conditions is violated. Proposition 2 shows that a national treatment provision will definitely work better if the number of domestic firms is large enough and the marginal effect of foreign entry is not emphasized by an increase in the share of domestic firms. In this case, a sufficiently large share of domestic firms makes both the entry distortion in the first period and the holdup distortion in the second period sufficiently small. In particular, Proposition 2 shows that an increase in the share of domestic firms is beneficial, if $\sigma > F(\phi^{**})$ to begin with. Note also that $\sigma > F(\phi^{**})$ fulfills condition (11). Thus, for the specification leading to condition (11), a sufficiently large share of domestic firms will make a national treatment provision welfare-dominant. Appendix A.6 shows that national treatment will converge

to the first best levels with an increase in the share of domestic firms, including the first best entry level.

5 Concluding remarks

Using a simple two period model where foreign investors are subject to domestic regulation and a holdup problem, we have shown that both ISDS and national treatment provisions have the potential to mitigate the holdup problem present with foreign direct investment. Both, however, also imply additional distortions. With ISDS, the government will overregulate in the first period to buy more discretion in the second period. With national treatment, the government has less incentives to promote foreign entry. If the entry distortion is not too large with a national provision, it will work better than ISDS.

As the entry distortion becomes smaller with the number of domestic firms, the holdup problem can be dealt with better by a national treatment provision, if the share of domestic firms is not too small. In this case, an immediate policy implication is that a regulatory framework should be as general as possible, meaning that it should cover industries or even all economic activities in the same way. National treatment provisions have no bite if regulations are firm-specific, but can deal with the holdup problem only if the number of domestic activities subject to the same regulation is not too small. Therefore, it seems that a neglected issue in negotiations on investor protection is that countries could also agree on more general regulatory frameworks. For example, if a country realized the need for environmental regulation, it seems that introducing a pollution tax on all activities will protect foreign investors better than introducing technological standards that can be industry- or even firm-specific. Furthermore, if governments succeed in adjusting the regulatory framework in this sense, they also avoid all the additional problems that an ISDS mechanism may create that our model could not accommodate. This could even be the best strategy, if the regulatory framework for whatever reason cannot be sufficiently general so that the share of domestic firms is large enough for all necessary regulations, as long as the benefits from keeping the holdup problem at bay are large in many other

areas of regulation.

Appendix

A.1 Proof of Lemma 2

To start with, take the first line in (5), assuming that the optimal value of s_2, denoted by s_2^*, is below s_1. The first-order condition for this solution is $s_2^* = \mu\,(\alpha/\,\theta_2)$, where $\mu(\cdot) := h^{-1}(\cdot)$ with $h(s_2) := -\,v'(s_2)/\,\pi'(s_2) > 0$. However, s_2^* is a solution to the above maximization problem, if – and only if – it is true that $s_1 \geq \mu\,(\alpha/\theta_2)$. This may be rewritten as $\theta_2 \leq \underline{\theta}_2(s_1)$, where $\underline{\theta}_2(s_1) := \alpha/\,h(s_1)$. Obviously, $\underline{\theta}_2(s_1)$ is increasing in s_1: $\partial\underline{\theta}_2/\partial s_1 = -\,(\alpha\pi''(s_2) + \theta_2 v''(s_2))/\,v'(s_1) > 0$. Moreover, we have $\partial s_2^*/\partial\theta_2|_{\theta_2<\underline{\theta}_2(s_1)} = -v'(s_2)/(\alpha\pi''(s_2) + \theta_2 v''(s_2)) > 0$, and the envelope theorem tells us that $\mathrm{d}W_2 = \theta_2\mathrm{d}\theta_2$.

Next, take the second line in (5), assuming that $s_2^* > s_1$. The first-order condition now reads as $\alpha\pi'(s_2) + \theta_2 v'(s_2) = -q\pi'(s_2)$. Clearly, solving this condition for s_2 yields a value smaller than $\mu\,(\alpha/\,\theta_2)$. We may write this solution as $s_2^* = \mu\,[(\alpha+q)/\,\theta_2]$. However, this is a solution to (5) only if $s_2^* > s_1$. As above, whether this is the case depends on the value of θ_2. Inserting s_1 into the first-order condition and solving for θ_2 gives us the threshold value $\overline{\theta}_2(s_1, q)$ that needs to be surpassed for $\mu\,[(\alpha+q)/\,\theta_2]$ to be a solution to the government's maximization problem. This threshold may be written as $\overline{\theta}_2(s_1, q) := (\alpha+q)/\,h(s_1)$.

Obviously, $\overline{\theta}_2(s_1, q)$ is increasing in s_1, as is $\underline{\theta}_2(s_1)$. Most importantly, we observe that

$$\frac{\partial\overline{\theta}_2}{\partial s_1} = -\frac{(\alpha\pi''(s_2) + \theta_2 v''(s_2)) + q\pi''(s_1)}{v'(s_1)} > \frac{\partial\underline{\theta}_2}{\partial s_1},$$

that is, an increase in s_1 widens the gap between the two threshold values of θ_2. Moreover, $\overline{\theta}_2(s_1, q)$ is also increasing in q. Turning to the impact of variations in θ_2 on second period regulation, for $\theta_2 > \overline{\theta}_2(s_1, q)$ we have $\partial s_2^*/\partial\theta_2|_{\theta_2>\overline{\theta}_2(s_1,q)} = -v'(s_2)\,/[(\alpha\pi''(s_2) + \theta_2 v''(s_2)) + q\pi''(s_2)] > 0$. Moreover, $\partial s_2^*/\partial\theta_2|_{\theta_2>\overline{\theta}_2(s_1,q)} < \partial s_2^*/\partial\theta_2|_{\theta_2<\underline{\theta}_2(s_1)}$. Intuitively, the period two standard reacts less strongly to an increase in the regulation sensitivity if the ISDS is binding than if it is not. And again, from the envelope theorem we have $\mathrm{d}W_2 = \theta_2\mathrm{d}\theta_2$.

What happens for values of $\theta_2 \in [\underline{\theta}_2(s_1), \overline{\theta}_2(s_1, q)]$, such as θ_{2m} in Figure 1? Clearly, the government will not set the standard equal to $\mu\,[(\alpha+1)/\theta_2]$, for this would be optimal only if the ISDS panel rules in favor of a compensation payment $T(s_1, s_2, q)$. But this will not be the case, since for $\theta_2 \in [\underline{\theta}_2(s_1), \overline{\theta}_2(s_1, q)]$ we have $\mu\,[(\alpha+1)/\theta_2] < s_1$, as shown above. Hence for this interval of the regulation sensitivity the optimal regulatory standard will be s_1.

A.2 Proof of Lemma 3

It proves convenient to define the following expected value operators: $\underline{E}_\theta[h(\theta)] := \int_{\underline{\Theta}}^{\underline{\theta}_2(s_1)} h(\theta)\mathrm{d}G(\theta)$, $E_\theta[h(\theta)] := \int_{\underline{\theta}_2(s_1)}^{\overline{\theta}_2(s_1,q)} h(\theta)\mathrm{d}G(\theta)$, and $\overline{E}_\theta[h(\theta)] := \int_{\overline{\theta}_2(s_1,q)}^{\overline{\Theta}} h(\theta)\mathrm{d}G(\theta)$. We have

$$\begin{aligned}
\hat{s}_2 &= \underline{E}_\theta[s_2^*(\theta)] + E_\theta[s_1] + \overline{E}_\theta[s_2^*(\theta)], \\
\hat{R}_2 &= \underline{E}_\theta\left[\theta v[s_2^*(\theta)]\right] + E_\theta[\theta v(s_1)] + \overline{E}_\theta\left[\theta v[s_2^*(\theta)]\right], \\
\hat{\pi}_2 &= \underline{E}_\theta\left[\pi[s_2^*(\theta)]\right] + E_\theta[\pi(s_1)] + \overline{E}_\theta\left[\pi[s_2^*(\theta)]\right], \\
\hat{T} &= q\overline{E}_\theta\left[\pi(s_1) - \pi[s_2^*(\theta)]\right].
\end{aligned}$$

Expected welfare is equal to $\hat{W}_2 = \alpha\hat{\pi}_2 + \hat{R}_2 - \hat{T}$. Differentiation and using the envelope theorem and Leibnitz' rule, yields

$$\begin{aligned}
\frac{\mathrm{d}\hat{W}_2(\cdot)}{\mathrm{d}q} &= \alpha\frac{\mathrm{d}\hat{\pi}_2(\cdot)}{\mathrm{d}q} + \frac{\mathrm{d}\hat{R}_2(\cdot)}{\mathrm{d}q} - \frac{\mathrm{d}\hat{T}_2(\cdot)}{\mathrm{d}q} \\
&= \int_{\underline{\theta}_2(s_1)}^{\overline{\Theta}} \left[\alpha\pi'(\cdot) + \theta_2 v'(\cdot) - q\pi'(\cdot)\right] \frac{\partial s_2(\cdot)}{\partial q}\mathrm{d}G(\theta_2) - \overline{E}_\theta\left[\pi(s_1) - \pi[s_2^*(\theta)]\right] \\
&= -\overline{E}_\theta\left[\pi(s_1) - \pi[s_2^*(\theta)]\right] < 0
\end{aligned}$$

as $\alpha\pi'(\cdot) + \theta_2 v'(\cdot) - q\pi'(\cdot) = 0$ due to (6).

A.3 Proof of Lemma 4

Taking derivatives w.r.t. s_1 and applying Leibnitz' rule yields

$$\frac{\partial\hat{s}_2}{\partial s_1} = E_\theta[1] = G[\overline{\theta}_2(s_1,q)] - G[\underline{\theta}_2(s_1)] \geq 0, \tag{A.1}$$

$$\frac{\partial\hat{R}_2}{\partial s_1} = v'(s_1)E_\theta[\theta] \geq 0, \tag{A.2}$$

$$\frac{\partial\hat{\pi}_2}{\partial s_1} = \pi'(s_1)E_\theta[1] \leq 0 \tag{A.3}$$

$$\frac{\partial\hat{T}_2}{\partial s_1} = q\pi'(s_1)\overline{E}_\theta[1] = q\pi'(s_1)\left[1 - G[\overline{\theta}_2(s_1,q)]\right] \leq 0. \tag{A.4}$$

Note that in these derivatives $s_2^*[\underline{\theta}_2(s_1)] = s_1 = s_2^*[\overline{\theta}_2(s_1,q)]$.

A.4 Proof of Proposition 1

The first-order conditions emerge as[26]

$$\begin{aligned} \theta_1 v'(s_1^*) + (1+\alpha)\pi'(s_1^*) + (1+\alpha)E_\theta[1]\pi'(s_1^*) + E_\theta[\theta]v'(s_1^*) &= 0, \\ f(\phi^*)\Big[(1+\alpha)(\pi(s_1^*)+\hat{\pi}_2) + \theta_1 v(s_1^*) + \hat{R}_2 - \phi^*\Big] - F(\phi^*) &= 0. \end{aligned} \tag{A.5}$$

In the first line, the third and the fourth terms capture the interdependency. Specifically, the third term on the left gives the marginal effect of an increase in the first period standard on expected second period profits. As is evident from Figure 1, this effect works through the limits of the "inaction range" of θ_2, within which any increase in s_2 directly feeds into an increase also of s_2 and an associated reduction in profits according to $\pi'(s_1^*)$. And the unconditional probability mass for this is given by $E_\theta[1]$; see the proof of Lemma 3 in Appendix A.2. A similar argument holds for the effect on the regulation benefit in line with $v'(s_1^*)$ and the expected value of θ_2 within the "inaction interval" given by $E_\theta[\theta]$.

As for aggregate welfare, let

$$\Omega = F(\phi)\left(R_1 + \hat{R}_2 + (1+\alpha)(\pi_1 + \hat{\pi}_2) - \phi\right)$$

denote the maximized aggregate welfare where

$$\begin{aligned} \hat{R}_2 &= \underline{E}_\theta[\theta v(s_2^*(\theta_2))] + E_\theta[\theta v(s_2^*(\theta_2))] + \overline{E}_\theta[\theta v(s_2^*(\theta_2))], \\ \hat{\pi}_2 &= \underline{E}_\theta[\pi(s_2^*(\theta_2))] + E_\theta[\pi(s_2^*(\theta_2))] + \overline{E}_\theta[\pi(s_2^*(\theta_2))], \end{aligned}$$

and $s_2^*(\theta_2)$ is determined by the first-order condition (A.5). For convenience, we define $\Lambda = \Omega/F(\phi)$. Due to the envelope theorem,

$$\frac{\mathrm{d}\Omega}{\mathrm{d}q} = \int_{\underline{\theta}_2(s_1)}^{\overline{\theta}_2(s_1,q)} \frac{\partial \Omega}{\partial s_2^*(\theta_2)} \frac{\mathrm{d}s_2^*(\theta_2)}{\mathrm{d}q} \mathrm{d}G(\theta) + \frac{\partial \Omega}{\partial q}.$$

Consider $\partial\Omega/\partial q$ first. The only direct effect of q on Ω is on $\overline{\theta}_2(s_1,q) = (\alpha+q)/h(s_1)$ such

[26] Again, we assume interior solutions such that $\phi^* \in [\underline{\Theta}, \overline{\Theta}]$ and $s_1^* \in [0, \bar{s}]$.

that $\partial\overline{\theta}_2(s_1,q)/\partial q = 1/h(s_1)$. Consequently,

$$\begin{aligned}\frac{\partial\Lambda}{\partial q} &= \frac{\partial E_\theta[\theta v(s_2^*(\theta_2))]}{\partial q} + \frac{\partial\overline{E}_\theta[\theta v(s_2^*(\theta_2))]}{\partial q} \\ &+ \left(\frac{\partial E_\theta[\pi(s_2^*(\theta_2))]}{\partial q} + \frac{\partial\overline{E}_\theta[\pi(s_2^*(\theta_2))]}{\partial q}\right)(1+\alpha) \\ &= \frac{\overline{\theta}_2(s_1,q)v(s_2(\overline{\theta}_2(s_1,q)))}{h(s_1)} - \frac{\overline{\theta}_2(s_1,q)v(s_2(\overline{\theta}_2(s_1,q)))}{h(s_1)} \\ &+ (1+\alpha)\left(\frac{\pi(s_2(\overline{\theta}_2(s_1,q)))}{h(s_1)} - \frac{\pi(s_2(\overline{\theta}_2(s_1,q)))}{h(s_1)}\right) = 0,\end{aligned} \tag{A.6}$$

and

$$\frac{\mathrm{d}\Lambda}{\mathrm{d}q} = \int_{\underline{\Theta}}^{\overline{\Theta}} \frac{\partial\Lambda}{\partial s_2^*(\theta_2)}\frac{\mathrm{d}s_2^*(\theta_2)}{\mathrm{d}q}\mathrm{d}G(\theta) = \int_{\overline{\theta}_2(s_1,q)}^{\overline{\Theta}} \frac{\partial\Lambda}{\partial s_2^*(\theta_2)}\frac{\mathrm{d}s_2^*(\theta_2)}{\mathrm{d}q}\mathrm{d}G(\theta)$$

because $\mathrm{d}s_2^*(\theta_2)/\mathrm{d}q = 0$ for all $\theta_2 \in [\underline{\Theta}, \overline{\theta}_2(s_1,q)]$. For all $\theta_2 \in [\overline{\theta}_2(s_1,q), \overline{\Theta}]$, $s_2^*(\theta_2)$ is determined by the first-order condition $(q+\alpha)\pi'(s_2^*(\theta_2)) + \theta_2 v'(s_2(\theta_2)) = 0$ and total differentiation yields

$$\frac{\mathrm{d}s_2^*(\theta_2)}{\mathrm{d}q} = -\frac{\pi'(s_2^*(\theta_2))}{(q+\alpha)\pi''(s_2^*(\theta_2)) + \theta_2 v''(s_2^*(\theta_2))} < 0. \tag{A.7}$$

Thus, ISDS reduces the second period regulation. Furthermore, we find that for all $\theta_2 \in [\overline{\theta}_2(s_1,q), \overline{\Theta}]$ that

$$\frac{\partial\Lambda}{\partial s_2^*(\theta_2)} = (1+\alpha)\pi'(s_2^*(\theta_2)) + \theta_2 v'(s_2(\theta_2)) = (1-q)\pi'(s_2^*(\theta_2)) < 0$$

due to the first-order condition w.r.t. s_2 and thus

$$\frac{\mathrm{d}\Omega}{\mathrm{d}q} = F(\phi)\frac{\mathrm{d}\Lambda}{\mathrm{d}q} = F(\phi)(1-q)\int_{\overline{\theta}_2(s_1,q)}^{\overline{\Theta}} \pi'(s_2^*(\theta_2))\frac{\mathrm{d}s_2^*(\theta_2)}{\mathrm{d}q}\mathrm{d}G(\theta) > 0. \tag{A.8}$$

Since we find that $\frac{\partial^2\Omega}{\partial s_1\partial\phi} = 0$, the first-order condition w.r.t. s_1 does not depend on the entry cost ϕ, so we can write it as an implicit function

$$\psi_1(s_1,q) = \theta v'(s_1) + (1+\alpha)\pi'(s_1) + E_\theta[\theta]v'(s_1) + (1+\alpha)E_\theta[1]\pi'(s_1) = 0$$

where

$$E_\theta[\theta] = \int_{\underline{\theta}_2(s_1)}^{\overline{\theta}_2(s_1,q)} \theta \mathrm{d}G(\theta); E_\theta[\theta] = \int_{\underline{\theta}_2(s_1)}^{\overline{\theta}_2(s_1,q)} \mathrm{d}G(\theta) = G(\overline{\theta}_2(s_1,q)) - G(\underline{\theta}_2(s_1)).$$

The sufficient condition imposes concavity such that $\partial\psi_1(\cdot)/\partial s_1 < 0$. Since $\overline{\theta}_2(s_1,q) = (\alpha+q)/h(s_1)$, we find that

$$\frac{\partial E_\theta[\theta]}{\partial q} = \frac{\overline{\theta}_2(s_1,q)g(\overline{\theta}_2(s_1,q))}{h(s_1)}, \frac{\partial E_\theta[1]}{\partial q} = \frac{g(\overline{\theta}_2(s_1,q))}{h(s_1)}$$

such that

$$\frac{\partial \psi_1}{\partial q} = \frac{g(\overline{\theta}_2(s_1,q))}{h(s_1)} \left(\overline{\theta}_2(s_1,q)v'(s_1) + (1+\alpha)\pi'(s_1)\right) > 0. \tag{A.9}$$

Expression (A.9) is positive because $\psi_1(s_1,q) = 0$ can be rewritten as

$$\theta v'(s_1) + (1+\alpha)\pi'(s_1) + E_\theta[1]\left(\frac{E_\theta[\theta]}{E_\theta[1]}v'(s_1) + (1+\alpha)\pi'(s_1)\right) = 0,$$

where $E_\theta[\theta]/E_\theta[1] < \overline{\theta}_2(s_1,q)$. Consequently, s_1 is set such that it maximizes a weighted average of θ_1 and $E_\theta[\theta]/E_\theta[1]$. Since $\overline{\theta}_2(s_1,q) > E_\theta[\theta]/E_\theta[1]$ and $\overline{\theta}_2(s_1,q) > \theta_1$ – because $\overline{\theta}_2(s_1,q)$ is the realization at which the ISDS risk is accepted by the domestic government – it follows that

$$\overline{\theta}_2(s_1,q)v'(s_1) + (1+\alpha)\pi'(s_1) > 0$$

which proves that expression (A.9) is positive and that s_1 increases with q because $ds_1/dq = -(\partial\psi_1/\partial q)/(\partial\psi_1/\partial s_1) > 0$. We use $\frac{\partial^2\Omega}{\partial s_1 \partial\phi} = 0$ and the definition of Λ to write the first-order condition w.r.t. ϕ as

$$\psi_2(\phi,q) = f(\phi)\Lambda(\cdot) - F(\phi) = 0.$$

The second order condition warrants $\partial\psi_2(\cdot)/\partial\phi < 0$, and we know that $\partial\Lambda/\partial q = 0$ due to (A.6), implying $\partial\psi_2(\cdot)/\partial q = 0$, and consequently $d\phi/dq = 0$.

A.5 Cross derivative of $s_2^{**}(\theta_2, \sigma, \sigma^*)$

For $v_t = \theta_t \ln(s_t)$, straightforward calculations show that the optimal second period regulation and its derivatives are given by[27]

$$\begin{aligned} s_2^{**}(\cdot) &= \frac{\theta_2^2(\sigma+\sigma^*)}{(1+\alpha)\sigma+\alpha\sigma^*}, & \frac{\partial s_2^{**}(\cdot)}{\partial\sigma} &= -\frac{\theta_2^2\sigma^*}{((1+\alpha)\sigma+\alpha\sigma^*)^2} < 0, \\ \frac{\partial s_2^{**}(\cdot)}{\partial\sigma^*} &= \frac{\theta_2^2\sigma}{((1+\alpha)\sigma+\alpha\sigma^*)^2} > 0, & \frac{\partial^2 s_2^{**}(\cdot)}{\partial\sigma\partial\sigma^*} &= \frac{\theta_2^2(\alpha\sigma^*-(1+\alpha)\sigma)}{((1+\alpha)\sigma+\alpha\sigma^*)^3}, \end{aligned} \tag{A.10}$$

and thus $\partial^2 s_2^{**}(\cdot)/\partial\sigma\partial\sigma^* > (<)0$ if $\alpha\sigma^* > (<)(1+\alpha)\sigma$.

A.6 Proof of Proposition 2

The proof proceeds in two steps. First, we prove that the entry level increases with σ if $\sigma > F(\phi^{**})$ to begin with and $\partial^2 s_2^{**}(\cdot)/\partial\phi\partial\sigma < 0$. Second, we prove that ϕ^{**} approaches its first best cut-off level when $\sigma \to \infty$. Let us write the first-order condition for entry as

$$\begin{aligned} \Psi(\cdot) &= \Big[\sigma + F(\phi^{**})\Big]\frac{\partial\tilde{\Omega}_2(\sigma,\phi^{**})}{\partial\phi} \\ &+ f(\phi^{**})\Big[(\Omega(s_1^{**}) + \tilde{\Omega}_2(\sigma,\phi^{**}) - \phi^{**}\Big] - F(\phi^{**}) = 0 \end{aligned}$$

where $\Omega(s_1^{**}) = (1+\alpha)\pi(s_1^{**}) + \theta_1 v(s_1^{**})$. Due to the assumed concavity of the objective function, that is, $\partial\Psi(\cdot)/\partial\phi < 0$, and due to $\partial\Psi(\cdot)/\partial_1 = \partial^2\Omega/\partial s_1\partial\phi = 0$, the change of ϕ^{**} with σ is determined by

$$\frac{\partial\Psi(\cdot)}{\partial\sigma} = \frac{\partial\tilde{\Omega}_2(\sigma,\phi^{**})}{\partial\phi} + \Big[\sigma + F(\phi^{**})\Big]\frac{\partial^2\tilde{\Omega}_2(\sigma,\phi^{**})}{\partial\phi\partial\sigma} + f(\phi^{**})\frac{\partial\tilde{\Omega}_2(\sigma,\phi^{**})}{\partial\sigma}$$

[27] Of course, parameter restrictions apply. $\underline{\Theta} \geq ((1+\alpha)\sigma+\alpha\sigma^*)/(\sigma+\sigma^*)$ guarantees that regulation benefits will be positive, and γ must be sufficiently large.

only. We now compute these partial derivatives, taking into account that $\partial s_2^{**}(\cdot)/\partial\phi = f(\cdot)\partial s_2^{**}(\cdot)/\partial\sigma^*$ and $\partial^2 s_2^{**}(\cdot)/\partial\phi\partial\sigma = f(\cdot)\partial^2 s_2^{**}(\cdot)/\partial\sigma^*\partial\sigma$:

$$\begin{aligned}
\frac{\partial\tilde{\Omega}_2(\cdot)}{\partial\phi} &= f(\cdot)\int_{\underline{\Theta}}^{\overline{\Theta}}\Big[(1+\alpha)\pi'(\cdot)+\theta v'(\cdot)\Big]\frac{\partial s_2^{**}(\cdot)}{\partial\phi}\mathrm{d}G(\theta),\\
\frac{\partial\tilde{\Omega}_2(\cdot)}{\partial\sigma} &= \int_{\underline{\Theta}}^{\overline{\Theta}}\Big[(1+\alpha)\pi'(\cdot)+\theta v'(\cdot)\Big]\frac{\partial s_2^{**}(\cdot)}{\partial\sigma}\mathrm{d}G(\theta),\\
\frac{\partial^2\tilde{\Omega}_2(\cdot)}{\partial\phi\partial\sigma} &= f(\cdot)\int_{\underline{\Theta}}^{\overline{\Theta}}\Big[(1+\alpha)\pi''(\cdot)+\theta v''(\cdot)\Big]\frac{\partial^2 s_2^{**}(\cdot)}{\partial\phi\partial\sigma}\mathrm{d}G(\theta).
\end{aligned}$$

Thus,

$$\begin{aligned}
\frac{\partial\Psi(\cdot)}{\partial\sigma} &= f(\cdot)\left(\int_{\underline{\Theta}}^{\overline{\Theta}}\overbrace{\Big[(1+\alpha)\pi'(\cdot)+\theta v'(\cdot)\Big]}^{+}\Big[\frac{\partial s_2^{**}(\cdot)}{\partial\phi}+\frac{\partial s_2^{**}(\cdot)}{\partial\sigma}\Big]\mathrm{d}G(\theta)\right. \qquad \text{(A.11)}\\
&+ \left.\int_{\underline{\Theta}}^{\overline{\Theta}}\underbrace{\Big[(1+\alpha)\pi''(\cdot)+\theta v''(\cdot)\Big]}_{-}\frac{\partial^2 s_2^{**}(\cdot)}{\partial\phi\partial\sigma}\mathrm{d}G(\theta)\right)
\end{aligned}$$

If $\partial^2 s_2^{**}(\cdot)/\partial\sigma\partial\sigma^* < 0$, the second term of (A.11) is clearly positive. Now consider

$$\frac{\partial s_2^{**}(\cdot)}{\partial\phi}+\frac{\partial s_2^{**}(\cdot)}{\partial\sigma} = \frac{\left(1+\frac{\alpha}{2}\right)\pi'(\cdot)+\theta_2 v'(\cdot)}{2((\sigma(1+\alpha)+\sigma^*)\pi''(\cdot))+(\sigma+\sigma^*)\theta_2 v''(\cdot))}.$$

This term is positive if

$$\left(1+\frac{\alpha}{2}\right)\pi'(\cdot)+\theta_2 v'(\cdot) > 0 = \frac{\sigma(1+\alpha)+F(\cdot)}{\sigma+F(\cdot)}\pi'(\cdot)+\theta_2 v'(\cdot) \Leftrightarrow \sigma > F(\phi^{**}),$$

where we have used the first-order condition again. Thus, ϕ^{**} will unambiguously increase with σ (i) if $\sigma > F(\phi^{**})$ and (ii) if $\partial^2 s_2^{**}(\cdot)/\partial\sigma\partial\sigma^* < 0$. Note that these are sufficient conditions only.

So far, we have shown that the entry distortion becomes smaller with an increase in σ if these conditions are fulfilled. However, this is not yet proof for welfare-dominance as we also have to show that the optimal cut-off level converges to the globally optimal one with an increase in σ. If this is the case, a $\hat{\sigma}$ exists such that the national treatment provision welfare-dominates ISDS for all $\sigma \geq \hat{\sigma}$, because ISDS will always impose a distortion for s_1.

If $\sigma \to \infty$, it is obvious that s_2^{**} will approach its globally optimal regulation level. As

for entry, the globally optimal entry level will be realized if $f(\phi^{**})\Big[(\Omega(s_1^{**}) + \tilde{\Omega}_2(\sigma, \phi^{**}) - \phi^{**}\Big] - F(\phi^{**}) = 0$ or equivalently if $\Big[\sigma + F(\phi^{**})\Big]\frac{\partial\tilde{\Omega}_2(\sigma,\phi^{**})}{\partial\phi}$ converges to zero when $\sigma \to \infty$. We find this to be true, as

$$\lim_{\sigma\to\infty}\Big[\sigma + F(\phi^{**})\Big]\frac{\partial\tilde{\Omega}_2(\cdot)}{\partial\phi} = \lim_{\sigma\to\infty}\frac{\sigma + F(\phi^{**})}{\frac{1}{\frac{\partial\tilde{\Omega}_2(\cdot)}{\partial\phi}}} = \lim_{\sigma\to\infty}\frac{\left(\frac{\partial\tilde{\Omega}_2(\cdot)}{\partial\phi}\right)^2}{\frac{\partial^2\tilde{\Omega}_2(\cdot)}{\partial\phi\partial\sigma}} = 0,$$

where we have rewritten the limit in a first step such that we can use L'Hopital's Rule because both the limit of the numerator and the limit of denominator are infinite as

$$\lim_{\sigma\to\infty}\frac{\partial\tilde{\Omega}_2(\cdot)}{\partial\phi} = 0 \text{ because } \lim_{\sigma\to\infty}(1+\alpha)\pi'(\cdot) + \theta_2 v'(\cdot) = 0.$$

We find that the limit is zero and the entry level approaches its globally optimal level because

$$\lim_{\sigma\to\infty}\frac{\partial^2\tilde{\Omega}_2(\cdot)}{\partial\phi\partial\sigma} = \lim_{\sigma\to\infty} f(\cdot)\int_{\underline{\Theta}}^{\overline{\Theta}}\Big[(1+\alpha)\pi''(\cdot) + \theta_2 v''(\cdot)\Big]\frac{\partial^2 s_2^{**}(\cdot)}{\partial\phi\partial\sigma}\mathrm{d}G(\theta_2) \neq 0.$$

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