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International Partnerships, Foreign Control and Income Levels: Theory and Evidence*

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Abstract

We analyze the effects of different regimes of control rights over critical resources on the total domestic income of open economies. Considering home control, foreign control, and international partnerships in a theoretical model with incomplete contracts and more productive foreign technologies, we show that (i) partnerships can be jointly optimal, (ii) foreign control is never optimal, (iii) assigning complete residual rights to foreign firms reduces domestic income via a Dutch-Disease mechanism. Empirical evidence using a new dataset on petroleum ownership structures for up to 68 countries between 1867-2008 shows that (i) international partnerships tend to generate higher domestic income than foreign control, and (ii) partnership and foreign control are linked to high or intermediate relative profitability of the domestic resource endowment, whereas home control is associated with low relative profitability.

JEL Codes D23, F20, O13.

Keywords Property rights, Control rights, National Income, Panel data.

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1 Introduction

In a world with costly transactions and incomplete contracts, the allocation of control rights over productive assets influences the size and the distribution of the gains from economic activity, and directly affects the incentives for agents to invest. From this perspective, who has control over the exploitation of critical resources – e.g., essential primary inputs – is a crucial determinant of economic performance, especially in developing countries richly endowed with natural wealth.[1] In this paper, we investigate the causes and consequences of different regimes of control rights over the exploitation of primary resources. Our analysis has four distinctive features. First, we look beyond the conventional division between private and public ownership and instead focus on domestic, foreign, and mixed 'international partnership' forms of control rights regimes. Second, control rights regimes are the outcome of bargaining between exploiting firms and the State, which is the *de jure* owner of the resource stock.[2] Third, we study how different control regimes influence the aggregate income of a resource-rich economy when the primary sector coexists with, and withdraws rival inputs from, non-primary sectors. Fourth, we address this issue at both the theoretical and empirical levels, testing the insights of the model on a new dataset on petroleum control rights structures.

Situations of substantial foreign control over strategic primary resources are quite common in today's globalized world. Considering a representative sample of sixty-four oil-producing economie s in 2005, we observe that domestic control over extraction is the dominant property structure in only nine countries: foreign control and international partnerships prevail in the vast majority of cases – twenty-four and thirty-one countries, respectively.[3] Standard economic reasoning suggests that technological gaps play a fundamental role in the rise of foreign-control regimes or international partnerships. Countries that discover new stocks of natural resources

[1] We distinguish between property and control rights: the former regards basic ownership rights, while the latter includes access, exploitation and investment rights, which can be assigned independently of basic ownership of an asset.

[2] The United Nations General Assembly resolution 1803 (XVII) of 14 December, 1962 (on "Permanent sovereignty over natural resources") grants "The right of peoples and nations to permanent sovereignty over their natural wealth and resources", a concept that is echoed in most countries' constitutions. Given this basic assignment of *ownership* over natural resources to the State, the salient question becomes who has *the right to exploit* these resources, or alternatively: *who has access to and control over the resource.*

[3] See Section 5 below for a detailed description of sources and methods.

often lack the technological know-how necessary to exploit these endowments, and the foreign firms operating abroad in the sector of interest are typically more efficient than yet-to-be-established domestic enterprises. In this scenario – which most likely but not exclusively arises in less developed economies – the resource-rich country may gain from assigning full or partial control rights to foreign firms: the natural endowment is exploited with the most efficient technology and generates additional domestic income as the foreign firm pays concession fees and royalties.

The flip side of enacting foreign control is that the residual profits reaped from resource exploitation are repatriated and potentially re-invested abroad. A recent OECD study shows that, in low-income countries, foreign firms' profit remittances exceeded new foreign direct investment (FDI) inflows in every year between 1999-2005 – a pattern which is especially strong during periods of economic crisis, when parent companies tend to repatriate financial resources to strengthen their balance sheet (Mold et al., 2009). More generally, foreign-based firms have little interest in raising domestic welfare in the host country as this is beyond the scope of their profit-maximization obligation towards shareholders (Vrankel, 1980; Onorato, 1995).

Building on these considerations, we construct a model in which the technological differences between domestic and foreign firms, and the asymmetric objectives pursued by foreign firms and the 'State' (i.e., the authority assigning exploitation rights over domestic resources), are explicit determinants of the surplus generated by primary production under different regimes. We consider a small open economy where a newly discovered natural resource endowment can be exploited to produce a tradeable 'commodity'. Producing the commodity also requires the use of local capital withdrawn from the pre-existing 'traditional sector'. In this setup, *control rights* include (i) the rights of access to the resource endowment, the rights to produce and sell the commodity; (ii) the rights to choose the level of investment; and (iii) the residual rights of control over the local capital. The State considers three possible regimes: Home Control, which assigns all control rights to a domestic enterprise; Foreign Control, which assigns all control rights to a foreign firm endowed with the most productive technology; or creating an international Partnership involving mixed control, where the foreign firm provides the best technology and the State provides local capital. The profits from commodity production are shared according to Nash Bargaining, and the regime of control rights affects equilibrium outcomes for two reasons. First, residual rights over local capital are a source of bargaining power because investment levels are not contractible ex-ante (Grossman and Hart, 1986; Hart and Moore, 1990). Second, the impact of residual rights on investment incentives is asymmetric because the parties aim at different targets: while the foreign firm maximizes its share of ex-post profits, the State maximizes *total* domestic income taking into account the reallocation effects induced by the shifting of local capital from traditional to commodity production.[4]

We analyze two variants of the model by considering alternative ways in which local capital is transferred to domestic firms in the event of bargaining breakdown under Foreign Control. In the first variant, the State confiscates the foreign firm's local capital. In the second variant, the State is credibly committed to compensate (part of) the initial investment cost so that the foreign firm has (partial) residual rights. Both circumstances are empirically plausible: confiscation characterized several processes of nationalization (Guriev et al., 2011); but partial or complete State repurchase, including forms of compensation such as preferential access for the formally expropriated firms, is not a rare event either (Philip, 1994). Remarkably, both versions of the model show that Partnership can be jointly optimal whereas Foreign Control cannot. Another interesting result is that the State should not assign complete residual rights over local capital to the foreign firm because this would generate massive crowding-out in the traditional sector and thereby lower domestic income: the ideal degree of residual rights always lies between the polar cases of 'confiscation' and 'complete repurchase'.

At the empirical level, we consider the petroleum sector. Oil is an essential input and is found in a large number of countries in different regions and at different stages of economic development, making a comparison particularly relevant. Collecting data from a variety of primary and secondary sources, we present a large new dataset on control rights regimes and national incomes for up to 68 oil-producing countries, starting as early as 1867 and extending to 2008 in up to 28 five-year periods. We explore two questions linked to the theoretical model.

[4] The maximization of national income and pursuit of national interest is often mentioned as a reason for greater state involvement in a crucial sector. For example, Kobrin (1984) traces the evolution of petroleum sector control rights from mostly foreign control to increasing participation (right up to nationalization) by host-country governments as "the perception that foreign investors could not be trusted to develop resources in the national interest became widespread" (ibid., p. 146). In her case study, Randall (1987) describes how the "remarkably high rate of repatriation of profits [by foreign oil firms] from Venezuela" (ibid., .21) led to a decades-long series of negotiations over rent distribution that culminated in the 1976 nationalization of the petroleum industry.

First, the relationship between control regimes and domestic income levels, and second, the relationship between control regimes and relative international profitability of the domestic resource endowment. Regarding the first question, fixed-effects panel data estimations show that Partnership leads to higher national income than Foreign Control. Furthermore, both Partnership and Foreign Control lead to higher domestic income than Home Control when we take into account the technology level. The results are strongly significant and robust to controlling for factors such as institutional quality, OPEC membership and time effects. Concerning the second question, the findings from pooled multinomial logit estimations are in line with the theoretical insights: the more profitable oil endowments tend to be under Foreign Control or Partnership, while the least profitable ones are likely to be domestically controlled.

Our analysis is connected to different strands of literature. The role of residual control rights as a source of bargaining power is a key insight of the modern theory of the firm pioneered by Grossman and Hart (1986) and Hart and Moore (1990). In this framework, several studies analyzed private versus public provision of services (Hart et al., 1997), as well as private versus government ownership of public projects (Besley and Ghatak, 2001).[5] We depart from these contributions in many respects – most importantly, we abstract from the issue of public versus private control.[6] Rajan and Zingales (1998) study the problem of selecting and choosing the number of managers to be granted access rights to critical inputs within a firm. Our analysis abstracts from the problem of selecting a specific domestic (foreign) firm from a large set of potential technology providers. We consider a State that chooses between a given domestic and a given foreign technology under the hypothesis that foreign firms are more productive, but will repatriate all residual profits.[7] The analysis is therefore positive in spirit: we assess the consequences of market incompleteness, while normative issues of optimal mechanism design are beyond the scope of this paper.

[5] Hart et al. (1997) show that the private contractor's incentive to reduce costs is too strong because he ignores the adverse effect on other non-contractible characteristics that matter for the government – e.g., service quality. Besley and Ghatak (2001) show that when the parties value the project differently, ownership should lie with the party with highest valuation regardless of who is the key investor and of other aspects of technology.

[6] In our model, a government implementing 'Home Control' is actually indifferent between private and public management: the absence of local market failures implies an efficient allocation of local assets regardless of whether the extractive firm is controlled by the State or by local households.

[7] The same difference arises with respect to the recent literature studying the effects of incomplete contracts in the organization of production within multinational firms (Antràs, 2005).

The parallel literature specialized in resource economics typically also focuses on the consequences of private versus public ownership for the productive efficiency of primary sectors (Al-Obaidan and Scully, 1992; Megginson, 2005; Wolf, 2009; Guriev et al., 2011). We depart from sectoral observations concerning efficiency and instead analyze the consequences of control regimes in the primary sector for the *aggregate* domestic income of resource-rich economies. In several related studies from the political science field, Jones Luong and Weinthal (2001, 2010) have long held that ownership structures are important when looking at the socio-economic impacts of resource abundance, particularly petroleum and natural gas. We draw inspiration from their work in the empirical part of this paper, but depart from their focus on public versus private ownership and fiscal policy outcomes.

The plan of the paper is as follows. Section 2 describes the basic model. Sections 3 and 4 characterize the equilibria under confiscation and under credible repurchase, respectively. Section 5 presents our empirical analysis, and section 6 concludes.

2 The Model

A small open economy, denoted by **E**, produces a tradable final good **Z** – henceforth, *traditional good* – and is endowed with a stock of a natural resource (e.g., oil wells, mineral deposits) that can be exploited to produce a *commodity*, denoted by **X**. Prior to the discovery of the natural endowment, the economy only produces the traditional good and the access rights over the resource are held by the agent *State*. As domestic firms are initially specialized in sector **Z**, the economy has little knowledge of the production process of commodity **X**, which requires a specific technology for processing as well as investment in local capital. In this environment, the State may implement three different *regimes of control rights* – i.e., rules defining the rights to exploit the resource and sell the commodity, the rights to choose investment levels, and the residual rights over local capital – indexed by $i = h, f, p$. The first option is to implement *Home Control* ($i = h$), that is, assigning all control rights to a newly established domestic enterprise, which may be public or private. The second regime is *Foreign Control* ($i = f$), that is, assigning all control rights to a specialized foreign firm upon payment of a license fee. Third, the State may create a *Partnership* ($i = p$) in which the foreign firm provides the technology, exploits the resource and sells the commodity while the State provides local capital: a public manager chooses investment according to the State's objective, which is to maximize total domestic income.

2.1 Markets and Technologies

Both the traditional good and the commodity are sold on competitive world markets at the respective prices q_z and q_x, taken as given at the country level. Producing the commodity entails two types of cost. First, the owner of the processing technology – i.e., the domestic manager under Home Control, the foreign firm under Foreign Control or Partnership – must pay a fixed start-up cost, denoted by s_i, which can be thought of as a technology-specific investment that bears an internal cost to the firm (e.g., in-house R&D effort) but does not imply any additional income for the residents of economy **E**. Second, the firm must rent *local capital*, a rival input exclusively supplied by residents of country **E** (e.g., land) and rewarded at the interest rate r that prevails in the local market.

Local capital is internationally immobile but nationally mobile, being essential to produce the traditional good as well as the commodity. Denoting by x and z the physical output levels of goods **X** and **Z**, we posit

$$\begin{aligned} x_i &\equiv \chi_i(k_i) && \text{with} \quad \chi_i'(\cdot) > 0, \quad \chi_i''(\cdot) < 0, \\ z_i &\equiv \zeta(k_{\max} - k_i) && \text{with} \quad \zeta'(\cdot) > 0, \quad \zeta'(\cdot) \leqslant 0, \end{aligned} \tag{1}$$

where $k_{\max}$ indicates the total endowment of local capital in economy **E**.[8] The commodity technology $\chi_i(\cdot)$ and the level of investment in the commodity sector, k_i, are regime-contingent. However, under Foreign Control and Partnership, the commodity sector uses the same foreign technology, so that $\chi_f(\cdot)$ and $\chi_p(\cdot)$ are identical. The assumption of strictly decreasing returns to local capital in commodity production, $\chi_i''(\cdot) < 0$, is necessary to have strictly positive profits for the foreign firm under regimes $i = (f, p)$. Moreover, Foreign Control and Partnership can be valid alternatives to Home Control only if the foreign technology is ceteris paribus more efficient: in this respect, we assume that domestic and foreign technologies are identical up to a Hicks-neutral productivity parameter implying that the foreign technology yields higher commodity output for a given input level, that is, $\chi_f(k') = \chi_p(k') > \chi_h(k')$ for any $k' > 0$.

[8] Our assumptions in sections 2 and 3 guarantee an interior equilibrium with full utilization of local capital and positive production in both sectors. Possible corner solutions (where one sector rents $k_{\max}$ and the other sector disappears) are discussed in detail in the extended model of section 4.

Besides these general assumptions, we will often exploit two explicit forms for technologies that yield a complete analytical characterization of equilibrium outcomes. For the commodity sector, we will consider

$$\begin{aligned} x_h &\equiv \chi_h(k_h) \equiv \varphi_1 \cdot \psi k_h^{\beta} && \text{with} \quad \varphi_1 > 0, \\ x_i &\equiv \chi_i(k_i) \equiv \varphi_2 \cdot \psi k_i^{\beta} && \text{with} \quad \varphi_2 > \varphi_1 \qquad \text{for} \quad i = (f, p), \end{aligned} \tag{2}$$

where $\beta \in (0,1)$ is the elasticity of output to capital, $\psi > 0$ is a scale parameter representing a country-specific characteristic – e.g., the size of the domestic resource endowment – and φ_i is a productivity parameter: given $\varphi_2 > \varphi_1$, the foreign technology is ceteris paribus more productive than the domestic technology. For the traditional sector, we will assume that $\zeta(\cdot)$ displays constant returns to scale:

$$z_i \equiv \zeta(k_{\max} - k_i) \equiv \rho \cdot (k_{\max} - k_i), \quad \text{with} \quad \rho > 0. \tag{3}$$

Under specification (3), the equilibrium rental rate for local capital is

$$r_i = q_z \cdot \zeta'(k_{\max} - k_i) = q_z \rho \tag{4}$$

as long as the traditional sector produces a positive quantity. We will assume that aggregate capital $k_{\max}$ is sufficiently abundant to ensure an interior equilibrium $0 < k_i < k_{\max}$.

2.2 Cost Sharing, Domestic Income and Firm's Profits

In the commodity sector, production costs are shared as follows. Under Home Control, the domestic firm pays the start-up cost s_h, chooses the investment level k_h paying the associated rents $r_h k_h$, and produces the commodity using the domestic technology, $x_h = \chi_h(k_h)$. All net revenues $q_x x_h - s_h$ become additional income for residents.

Under Foreign Control, the foreign firm pays s_f, chooses investment k_f paying the associated rents $r_f k_f$, and produces the commodity using the foreign technology, $x_f = \chi_f(k_f)$. From the perspective of a benevolent State, the advantage of Foreign Control is that the commodity is produced more efficiently. The drawback is that only a fraction of the foreign firm's revenues become domestic income: the foreign firm pays a license fee to the State in order to obtain the concession but sends all residual gains back to its country of origin, outside **E**. The level of the license fee, ℓ_f, is determined by bargaining between the State and the foreign firm.

Under Partnership, the foreign firm provides the technology $\chi_p(\cdot)$ and bears the cost of in-house R&D, s_p. The State provides local capital k_p and pays the rents $r_p k_p$ using the proceeds from lump-sum taxes imposed on domestic residents. The two parties then bargain over the level of the license fee, ℓ_p, determining the respective shares of profits from commodity sales.

In the above scheme, aggregate domestic income in the various regimes, Y_i, is determined by the expressions reported in Table 1. The difference between Foreign Control and Partnership is as follows. In both regimes, the State exhibits balanced budget and rebates to households the fee paid by the foreign firm via lump-sum transfers. However, under Partnership, the cost of local investment $r_p k_p$ is paid by the State – and, hence, by residents via lump-sum taxes – whereas, under Foreign Control, residents receive ℓ_f from the State plus rents $r_f k_f$ from the foreign firm. Table 1 also reports the profits earned by the foreign firm in the various regimes: if the State chooses Home Control, the foreign firm produces outside economy **E** and earns a reservation profit denoted by Π_0.

2.3 Behavioral Assumptions and Timing of Events

In any regime i, the foreign firm aims at maximizing profits Π_i whereas the State aims at maximizing aggregate domestic income Y_i. Under Home Control, the State does not interact with the foreign firm and the social problem has a fairly simple structure (see section 2.5 below). Considering Foreign Control and Partnership, the detailed timing of events is as follows:

Stage 0 (Regime choice). The State and the foreign firm sign a contract establishing which regime $i = (f, p)$ will be enforced. Investment levels k_i are not contractible at this stage.

Stage 1 (Investment). The foreign firm pays s_i and the party in charge of local investment chooses k_i paying $r_i k_i$. Both s_i and $r_i k_i$ are henceforth sunk and local capital k_i is fixed: the traditional sector uses the residual amount $k_{\max} - k_i$ to produce **Z**.

Stage 2 (Profit-Sharing Problem). The State and the foreign firm decide the level of the fee ℓ_i according to Nash Bargaining, determining the respective shares of the total profits from commodity production $q_x \chi_f(k_f) - s_f - r_f k_f$.

Stage 3 (Commodity Production). If the parties reach an agreement on profit-sharing at stage 2, the commodity is produced with the foreign technology and the agreed transfer ℓ_i is enforced. If bargaining at stage 2 breaks down with no agreement, economy **E** produces the commodity using the domestic technology with the available local capital, $\chi_h(k_i)$, while the foreign firm operates abroad.

A crucial assumption is that investment levels are non-contractible at Stage 0. As both parties anticipate that k_i will affect their bargaining power at Stage 2, the investor will set k_i at Stage 1 in order to maximize its overall payoff. Control rights and residual rights over local capital thus affect the allocation, in line with Grossman and Hart (1986) and Hart and Moore (1990). However, differently from standard cake-sharing problems, the present model contains a crucial asymmetry between the *overall payoffs* of the two parties (Y_i and Π_i) and the *bargaining payoffs* at Stage 2: the State aims at maximizing total domestic income, not just the share of profits from commodity production.

2.4 Bargaining and No-Trade Payoffs at Stage 2

At Stage 2, the State and the foreign firm choose the level of the license fee ℓ_i. We assume that the profits from commodity production are shared according to the *Nash bargaining solution*, i.e., the parties split their renegotiation surplus 50/50 over the disagreement point. The bargaining payoffs at Stage 2 for the State (S_i) and foreign firm (F_i) under regime i are

$$\begin{aligned} S_f &\equiv \ell_f && \text{and} \quad F_f \equiv q_x\chi_f(k_f) - s_f - r_f k_f - \ell_f, \\ S_p &\equiv \ell_p - r_p k_p && \text{and} \quad F_p \equiv q_x\chi_p(k_p) - s_p - \ell_p. \end{aligned} \tag{5}$$

The disagreement point is identified by the *no-trade payoffs* that the parties receive if bargaining breaks down at Stage 2. Because k_i is fixed at Stage 1 and all costs are sunk, the no-trade payoffs at Stage 2 differ from those that would be realized if the State were to choose Home Control at Stage 0. Specifically, the no-trade payoffs are determined by the following circumstances.

If negotiations break down at Stage 2, economy **E** may still exploit k_i to produce the commodity using the domestic technology $\chi_h(\cdot)$. However, the use of k_i after the breakdown is subject to the existence of residual control rights over local capital. Under Partnership, the State already holds the rights to use k_p and may transfer them to a new domestic firm. Under Foreign Control, instead, the rights to use k_f are held by the foreign firm and must be transferred in some way to domestic firms. In this respect, two scenarios may arise. The first possibility is that the State confiscates k_f by exerting its power to enforce the local laws – in which case, the foreign firm has no residual control rights. The second possibility is that the State is credibly committed to repurchase k_f by paying the full (partial) investment cost born by the foreign firm – in which case, the foreign firm has complete (partial) residual rights. We consider both scenarios since they are equally plausible in reality. In the present and in the next section, we analyze the case of confiscation. Credible repurchase is studied in section 4.

Assuming confiscation in the event of bargaining breakdown, the no-trade payoffs for the State (D_i) and for the foreign firm (Δ_i), respectively, equal

$$\begin{aligned} D_f &\equiv q_x \chi_h (k_f) - s_h \quad \text{and} \quad D_p \equiv q_x \chi_h (k_p) - s_h, \\ \Delta_f &\equiv \Pi_0 - s_f - r_f k_f \quad \text{and} \quad \Delta_p \equiv \Pi_0 - s_p. \end{aligned} \tag{6}$$

Expressions (6) show that local capital affects no-trade payoffs in both regimes. Consequently, the party in charge of investment is able to modify its bargaining power at Stage 2 by choosing k_i strategically at Stage 1.

2.5 Home Control

While Foreign Control and Partnership require agreement between the State and the foreign firm, the regime of Home Control can be characterized as a basic planning problem. Because there is no source of inefficiency, domestic residents may enjoy the maximum level of income generated by the domestic technology. Formally, the investment level that maximizes aggregate domestic income is $k_h^\star \equiv \arg\max \{Y_h = q_z \zeta (k_{\max} - k_h) + q_x \chi_h (k_h) - s_h\}$. The solution is characterized by the standard efficiency condition,

$$q_x \cdot \chi_h' (k_h^\star) = q_z \cdot \zeta' (k_{\max} - k_h^\star) = r_h, \tag{7}$$

which depicts a first-best scenario where the marginal product of local capital matches its marginal cost. The State may implement solution (7) in different ways. Provided that domestic commodity producers act as price takers on the capital market, creating a State enterprise (that rebates all rents to residents via lump-sum subsidies) or a private domestic firm (that maximizes profits taking r_h as given) yield equivalent results: the market equilibrium determines equal marginal productivities across sectors and residents earn

$$Y_h^\star \equiv q_z \zeta (k_{\max} - k_h^\star) + q_x \chi_h (k_h^\star) - s_h, \tag{8}$$

which is the first-best level of domestic income under Home Control. Indeed, when defining the Home Control regime, we purposely avoided distinguishing between *private* and *public* domestic enterprises: in the current setting, this characteristic does not matter for the results.[9]

3 Bargaining Equilibria

Under Foreign Control and Partnership, the State and the foreign firm share profits from commodity production according to Nash Bargaining. Solving the model backwards, we characterize the solution to the profit-sharing problem (Stage 2), the investment strategies (Stage 1), and the characteristics of optimality and feasibility of the initial regime choice (Stage 0). To save space, the proofs of all the results and propositions are collected in a separate Appendix.

3.1 Profit Sharing and Investment Strategies

At Stage 2, the State and the foreign firm agree on the level of transfers that maximizes the Nash product

$$\ell_i^N \equiv \arg\max \{(S_i - D_i) \cdot (F_i - \Delta_i)\} \quad \text{for} \quad i = (f, p). \tag{9}$$

We assume that the parameter values are such that the Nash-bargaining solution ℓ_i^N yields positive gains so that the equilibrium outcome is ex-post efficient.[10] In the current problem, the solution ℓ_i^N implies the following levels of domestic income and foreign firm's profits

$$Y_i^N \equiv q_z\zeta (k_{\max} - k_i) + \frac{1}{2} \cdot [q_x\chi_i (k_i) - s_i + r_i k_i] + \frac{1}{2} \cdot (D_i - \Delta_i), \tag{10}$$

$$\Pi_i^N \equiv \frac{1}{2} \cdot [q_x\chi_i (k_i) - s_i - r_i k_i] - \frac{1}{2} \cdot (D_i - \Delta_i), \tag{11}$$

for each regime $i = (f, p)$. At stage 1, both parties fully anticipate the bargaining outcomes (10)-(11). Hence, under Foreign Control, the foreign firm chooses k_f in order to maximize Π_f^N whereas, under Partnership, the State chooses k_p in order to maximize Y_p^N. The solutions to these investment problems are summarized in the following Proposition. Denoting equilibrium

[9] Under Home Control, the State has no incentive to impose a concession fee on domestic private firms: this would introduce an unnecessary hold-up problem that conflicts with the objective of maximizing total domestic income. Under Foreign Control and Partnership, instead, the license fee is imposed because otherwise all the residual profits from commodity production accruing to the foreign firm are repatriated abroad.

[10] The agreement yields strictly positive gains in regime i provided that the aggregate profits from commodity production satisfy $S_i + F_i = q_x\chi_i (k_i) - s_i - r_i k_i > D_i + \Delta_i$ under regime i.

values by superscript '$\star$', and abstracting from specific assumptions concerning technologies, all interior equilibria $k_i^\star \in (0, k_{\max})$ obey the conditions stated below:

Proposition 1 *Under Foreign Control, the foreign firm chooses $k_f^\star$ in order to satisfy*

$$q_x \cdot \chi_f'(k_f^\star) = \underbrace{2 \cdot r_f^\star}_{\text{Double interest}} + \underbrace{q_x \cdot \chi_h'(k_f^\star)}_{\text{Bargaining power}} . \tag{12}$$

Under Partnership, the State chooses $k_p^\star$ in order to satisfy

$$q_x \cdot \chi_p'\left(k_p^\star\right) = \underbrace{2 \cdot q_z \zeta'\left(k_{\max} - k_p^\star\right)}_{\text{Double interest}} - \underbrace{q_x \cdot \chi_h'\left(k_p^\star\right)}_{\text{Bargaining power}} - \underbrace{r_p^\star}_{\text{Residual rights}} , \tag{13}$$

which, given the equilibrium rental rate $r_p^\star = q_z \zeta'\left(k_{\max} - k_p^\star\right)$, implies

$$q_x \cdot \chi_p'(k_p^\star) = r_p^\star - q_x \cdot \chi_h'(k_p^\star). \tag{14}$$

Proposition 1 clarifies how both regimes depart from the first-best allocation of local capital characterized by the efficiency condition $q_x \chi_i'(k_i^\star) = r_i^\star$. The first element of distortion is the non-contractibility of investment combined with profit-sharing: the expectation of splitting net revenues with the other party prompts the investor to rent an amount of capital yielding a marginal benefit equal to two times its marginal cost. This mechanism implies the 'double-interest terms' appearing in (12) and (13). The second element of distortion is the bargaining power generated by confiscation: in case of disagreement at Stage 2, domestic firms can use local capital to produce the commodity. Hence, a marginal increase in k_i raises the commodity output that economy **E** would produce in the event of bargaining breakdown, which translates into a marginal increase in the State' bargaining power measured by $q_x \chi_h'\left(k_i^\star\right)$. This is an additional cost of investment for the foreign firm under Foreign Control – see (12) – and is an additional benefit for the State under Partnership – see (13).

The last term appearing in (13) reflects the fact that, under Partnership, the State already holds the rights to use local capital and therefore 'saves' the cost of acquiring it if bargaining breaks down. The foreign firm, instead, does not have residual rights over local capital under Foreign Control as we are currently assuming confiscation if bargaining breaks down. This asymmetry in residual rights implies that the investment strategy under Partnership is closer to the first-best allocation relative to Foreign Control.[11]

[11] In (12), the tendency of the foreign firm to under-invest is boosted by two self-reinforcing mechanisms. In (13), instead, the 'residual-rights term' sterilizes the 'double-interest term' and the resulting condition (14)

3.2 Income Levels and Profits

The general message of Proposition 1 is that, with respect to the first-best allocation, Foreign Control implies under-investment whereas Partnership yields over-investment in local capital. We now discuss the impact of these investment strategies on domestic income and the foreign firm's profits when the production technologies are given by (2)-(3). The sign of income and profit gaps between alternative regimes is exclusively determined by two parameters: the elasticity of commodity production to local capital, β, and the index of productivity gap,

$$\gamma \equiv \varphi_2 / \varphi_1 > 1,$$

which measures the extent to which the foreign technology is more productive than the domestic technology. Setting $s_f = s_p$ without loss of generality,[12] we can prove the following

Proposition 2 *Under the technologies (2)-(3), the investment rules (12)-(13) determine a critical level of the productivity gap* $\gamma_0 \equiv \frac{e+2}{e-2} \approx 6.7$ *such that:*

$$\begin{aligned} &\textit{if } \gamma < \gamma_0 \textit{ then } Y_p^\star > Y_f^\star \textit{ for any } \beta \in (0,1)\,; \\ &\textit{if } \gamma > \gamma_0 \textit{ then there exists } \beta_0(\gamma) \in (0,1) \textit{ such that } \begin{cases} Y_p^\star > Y_f^\star \textit{ for any } \beta > \beta_0(\gamma)\,, \\ Y_p^\star \leqslant Y_f^\star \textit{ for any } \beta \leqslant \beta_0(\gamma)\,. \end{cases} \end{aligned}$$

Concerning the foreign firm's profits, there exists a critical level $\gamma_1 \equiv \Gamma(e) \approx 2.2$ *such that*

$$\begin{aligned} &\textit{if } \gamma < \gamma_1 \textit{ then } \Pi_f^\star > \Pi_p^\star \textit{ for any } \beta \in (0,1)\,; \\ &\textit{if } \gamma > \gamma_1 \textit{ then there exists } \beta_1(\gamma) \in (0,1) \textit{ such that } \begin{cases} \Pi_f^\star > \Pi_p^\star \textit{ for any } \beta > \beta_1(\gamma)\,, \\ \Pi_f^\star \leqslant \Pi_p^\star \textit{ for any } \beta \leqslant \beta_1(\gamma)\,. \end{cases} \end{aligned}$$

Both $\beta_0(\gamma)$ *and* $\beta_1(\gamma)$ *are increasing in* γ.

Proposition 2 defines the conditions for observing positive or negative gaps in income and profit levels between Foreign Control and Partnership: the threshold values (γ_0, γ_1) and the

implies that, under Partnership, the only deviation from the first-best allocation consists of the 'bargaining-power term'.

[12] Recall that the start-up cost is paid by the foreign firm under both regimes $i = (f, p)$. The assumption $s_f = s_p$ is not restrictive because start-up costs are technology-specific, and the same technology is used under Foreign Control and Partnership. Moreover, the assumption $s_f = s_p$ does not play any role in the determination of the income gap $Y_p^\star - Y_f^\star$, which is unaffected by start-up costs (see the proof of Proposition 2 in Appendix).

associated frontiers $(\beta_0(\gamma), \beta_1(\gamma))$ are invariant to the parameters appearing in the model,[13] and are graphically represented in Figure 1. The first result is that domestic income is higher under Partnership than under Foreign Control in most cases: $Y_p^\star > Y_f^\star$ holds in the portion of the parameter space lying above the $\beta_0(\gamma)$ locus in Figure 1 (a). Foreign Control yields higher domestic income only when the productivity gap is very high *and* the elasticity of capital is very low. For example, if the foreign technology is ten times as productive as the domestic technology ($\gamma = 10$), the capital elasticity must lie below $\beta_0 \approx 0.19$ in order to have $Y_f^\star > Y_p^\star$. The reason for this result is that Partnership implies two contrasting effects on domestic income: investment is higher than under Foreign Control (positive 'accumulation effect') but the rents paid to local capital employed in commodity production are entirely financed by taxes on domestic residents (negative 'rent effect'). The positive impact of the accumulation effect typically dominates, but it is weaker the higher is the productivity gap and the lower is the capital elasticity. Consequently, $Y_p^\star > Y_f^\star$ holds unless γ is very high and β is very low.[14]

The second implication of Proposition 2 is that the foreign firm's profits are higher under Partnership in many cases: as shown in Figure 1 (b), moderately high values of γ combined with moderately low values of β yield $\Pi_p^\star > \Pi_f^\star$. The intuition is twofold. On the one hand, an increase in γ increases the rental cost borne by the foreign firm more than it increases commodity production under Foreign Control relative to Partnership; this implies $\Pi_p^\star > \Pi_f^\star$ for high values of γ. On the other hand, an increase in the capital elasticity reduces the joint surplus more under Partnership than under Foreign Control because the State (foreign firm) overinvests (underinvests) in local capital, and this implies $\Pi_p^\star > \Pi_f^\star$ for low values of β.

3.3 Regime Choice: Optimality and Agreeability

This section characterizes the optimality properties of control regimes in two logical steps. First, building on Proposition 2, we restrict our attention to the choice between Foreign Control or Partnership (subsection 3.3.1). Second, we study the conditions under which Home Control yields higher payoffs to one or both parties (subsection 3.3.2). Importantly, we do not assume

[13] The proof of Proposition 2 does not assume specific values for any of the parameters: the threshold levels $\gamma_0 \approx 6.7$ and $\gamma_1 \approx 2.2$ stem from the quasi-exponential forms that income gaps and profit gaps take under the assumed production functions (3) and (2). See the proof of Proposition 2 in the Appendix.

[14] See the Appendix (below the proof of Proposition 2) for further details on this point.

a specific type of game or bargaining procedure for determining the initial regime choice: we perform a more general analysis showing whether, and under what circumstances, a given regime guarantees the highest payoff to both parties. To this aim, we exploit the following definitions. Considering Foreign Control and Partnership, regime $i = (f, p)$ is *agreeable* for the State if it implies $Y_i^\star > Y_h^\star$, and is *agreeable* for the foreign firm if it implies $\Pi_i^\star > \Pi_0$. Accordingly, regime $i = (f, p)$ is *jointly agreeable* if it implies $Y_i^\star > Y_h^\star$ and $\Pi_i^\star > \Pi_0$. In other words, (joint) agreeability signals whether one (every) party is willing to make an agreement on regime $i = (f, p)$ at Stage 0. Considering all the regimes, we label regime i as *jointly optimal* if it guarantees the highest payoff to each party – that is, if it yields maximal income and profits with respect to all alternative regimes. Accordingly, we will call *spontaneous agreement* an agreement at Stage 0 that implements the jointly optimal regime.

3.3.1 Optimality: Foreign Control versus Partnership

Suppose that both Foreign Control and Partnership are jointly agreeable: the foreign firm and the State strictly prefer regimes f and p to Home Control. Combining the loci $\beta_0(\gamma)$ and $\beta_1(\gamma)$ defined in Proposition 2, we obtain a remarkable result: Partnership can be jointly optimal, whereas Foreign Control can never be jointly optimal because the inequalities $Y_p^\star < Y_f^\star$ and $\Pi_p^\star < \Pi_f^\star$ cannot hold simultaneously. In fact, defining the four parametrization sets

$$A \equiv \left\{(\gamma, \beta) : Y_p^\star > Y_f^\star \text{ and } \Pi_p^\star > \Pi_f^\star\right\}, \qquad B \equiv \left\{(\gamma, \beta) : Y_p^\star < Y_f^\star \text{ and } \Pi_p^\star > \Pi_f^\star\right\},$$
$$C \equiv \left\{(\gamma, \beta) : Y_p^\star > Y_f^\star \text{ and } \Pi_p^\star < \Pi_f^\star\right\}, \qquad G \equiv \left\{(\gamma, \beta) : Y_p^\star < Y_f^\star \text{ and } \Pi_p^\star < \Pi_f^\star\right\},$$

we can prove that (A, B, C) are all non-empty whereas G is empty. This result is graphically shown in Figure 1 (c), and formally established below.

Proposition 3 *Suppose that both Foreign Control and Partnership are jointly agreeable under technologies (2)-(3). Then, Foreign Control cannot be jointly optimal. Partnership, instead, is jointly optimal provided that* $(\gamma, \beta) \in A$.

Proposition 3 establishes that only Partnership can be a spontaneous agreement at Stage 0. Under parametrization A, each party chooses Partnership and has no incentive to deviate because this regime maximizes each party's payoff. Foreign Control cannot be a spontaneous equilibrium because all the parametrizations outside A entail conflict between the parties. The

State (foreign firm) strictly prefers Partnership (Foreign Control) under parametrization C, and viceversa under parametrization B.

Under parametrizations B and C, which regime is going to be implemented depends on the bargaining environment at Stage 0: different procedures may yield different solutions to the conflict. It is possible that, being the *de jure* owner of the resource endowment at Stage 0, the State imposes procedures that lead to the most favorable outcome for domestic residents – e.g., a 'take-it-or-leave-it' offer to the foreign firm[15] – but alternative procedures that favor the foreign firm may nonetheless be plausible. Tackling this issue is not our main objective: in the remainder of the analysis, we keep the bargaining procedure at Stage 0 unspecified, and focus on the more general question of which regimes are agreeable, and which regime is jointly optimal, in a complete ranking that compares Home Control, Foreign Control and Partnership.

3.3.2 Agreeability: Complete Characterization

The results discussed in the previous subsection characterize the initial regime choice when both Foreign Control and Partnership are jointly agreeable. A complete characterization of the outcomes, however, requires considering all the other cases in which Home Control yields higher benefits than one or both regimes for one or both parties. In this respect, a crucial role is played by the value of the *reservation profit* for the foreign firm, Π_0. For each party, the agreeability of each negotiated regime is determined by a specific inequality (see Appendix):

$$\begin{aligned} Y_p^\star > Y_h^\star \quad &\text{iff} \quad \Pi_0 < \Pi_0^{yp}, \qquad & \Pi_p^\star > \Pi_0 \quad &\text{iff} \quad \Pi_0 < \Pi_0^{\pi p}, \\ Y_f^\star > Y_h^\star \quad &\text{iff} \quad \Pi_0 < \Pi_0^{yf}, \qquad & \Pi_f^\star > \Pi_0 \quad &\text{iff} \quad \Pi_0 < \Pi_0^{\pi f}. \end{aligned} \tag{15}$$

The intuition behind the upper bounds that determine agreeability for the State, Π_0^{yp} and Π_0^{yf}, is that a high reservation profit implies a high disagreement payoff for the foreign firm and thereby a lower profit share for domestic residents ex-post: if Π_0 is sufficiently high, the State prefers Home Control to alternative regimes. Instead, the upper bounds determining agreeability for the foreign firm, $\Pi_0^{\pi p}$ and $\Pi_0^{\pi f}$, signal that the firm will prefer Partnership and/or Foreign Control only if the profitability of operating abroad, Π_0, is sufficiently low.

[15] An extreme but clear example is the case in which, at Stage 0, the State proposes only Partnership (only Foreign Control) under parameterization C (parametrization B) and the foreign firm accepts because the proposed regime yields higher profits relative to Π_0.

Importantly, the upper bounds listed in (15) can be partially ranked: the inequalities

$$\Pi_0^{yp} > \Pi_0^{\pi p} \text{ and } \Pi_0^{yp} > \Pi_0^{\pi f} \tag{16}$$

hold for every constellation of parameters (see Appendix). Combining this result with the parametrization sets (A, B, C) defined above, we can determine which regimes are agreeable, and possibly optimal, as the reservation profit ranges from low to high values. For example, suppose that (γ, β) belongs to the parametrization set B. In this case, we necessarily have $\Pi_0^{yf} > \Pi_0^{yp} > \Pi_0^{\pi p} > \Pi_0^{\pi f}$.[16] This implies that both Partnership and Foreign Control are jointly agreeable for low levels of the reservation profit; only Partnership is jointly agreeable for intermediate levels of the reservation profit; and only Home Control can arise for high levels of the reservation profit, and is possibly jointly optimal.[17] Repeating this exercise for all parametrizations, we obtain the results reported in Table 2 – where parametrization C exhibits two subcases, labelled as $C1$ and $C2$ (see the Appendix for detailed proofs).

The most general result delivered by Table 2 is that Home Control is always associated to high levels of the reservation profit.[18] In the opposite case of low reservation profit – see the last row of Table 2 – both Foreign Control and Partnership are jointly agreeable and the outcomes are those already emphasized in section 3.3.1: Partnership is jointly optimal under parametrization A, whereas either regime may arise as a (non-spontaneous) agreement outside parametrization A. Concerning intermediate levels of the reservation profit, we obtain that Partnership is the only agreeable regime in most parametrizations: as the reservation profit increases, the first restriction that is violated is, typically, either $\Pi_0 < \Pi_0^{\pi f}$ or $\Pi_0 < \Pi_0^{yf}$.

These results can be summarized as follows. Since Π_0 measures how convenient it is to operate outside **E** for the foreign firm, the reservation profit in our model can be interpreted as an inverse index of the profitability of the economy's resource endowment relative to the profitabil-

[16] By definition, parametrization B implies $Y_f^\star > Y_p^\star$ and $\Pi_p^\star > \Pi_f^\star$, which implies $\Pi_0^{yf} > \Pi_0^{yp}$ and $\Pi_0^{\pi p} > \Pi_0^{\pi f}$. Combining these inequalities with result (16) we obtain $\Pi_0^{yf} > \Pi_0^{yp} > \Pi_0^{\pi p} > \Pi_0^{\pi f}$. Further details are reported in the Appendix (see the complete proof of the results reported in Table 2).

[17] Specifically, both Partnership and Foreign Control are jointly agreeable if $\Pi_0 < \Pi_0^{\pi f}$; only Partnership is jointly agreeable if $\Pi_0^{\pi f} < \Pi_0 < \Pi_0^{\pi p}$; only Home Control can arise if $\Pi_0 > \Pi_0^{\pi p}$. Moreover, Home Control is jointly optimal if $\Pi_0 > \Pi_0^{yf}$.

[18] When $\Pi_0 > \max\{\Pi_0^{\pi f}, \Pi_0^{\pi p}\}$, neither Partnership nor Foreign Control are jointly agreeable because the foreign firm surely prefers operating outside economy **E**. Moreover, Home Control becomes jointly optimal when $\Pi_0 > \max\{\Pi_0^{yf}, \Pi_0^{yp}\}$.

ity of the resource stocks existing in the rest of the world.[19] In this respect, Table 2 suggests an interesting hypothesis: *high relative profitability of resource extraction in* **E** *(that is, low* Π_0*) is associated with either Partnership or Foreign Control; intermediate relative profitability in* **E** *(that is, intermediate* Π_0*) is mostly associated with Partnership; low relative profitability in* **E** *(that is, high* Π_0*) is associated with Home Control.* In section 5, we will test this prediction empirically by checking which regimes are associated to different degrees of relative profitability in petroleum extraction.

4 Residual Rights and Credible Repurchase

So far, we have assumed that the foreign firm expects the confiscation of local capital if negotiations break down. This expectation affects domestic income under Foreign Control because the lack of residual rights on capital reduces the foreign firm's incentive to invest. We now extend the model to include the concession of (partial) residual rights for the foreign firm. This issue is empirically relevant: partial or complete State repurchase, or the granting of preferential access to 'expropriated' firms, is often observed (Philip, 1994). In reality, resource-rich States compensate the foreign firm's investment for a variety of reasons that typically include political opportunity. In our model, there is a clear incentive for the State to compensate the foreign firm: the concession of residual rights over local capital increases the foreign firm's willingness to invest, creating potential gains in domestic income under Foreign Control.

We assume that, in the initial contract of Foreign Control signed at Stage 0, the State declares to compensate, in the event of bargaining breakdown, a fraction $\lambda \in (0, 1)$ of the investment cost $r_f k_f$ initially borne by the foreign firm. Letting $\lambda \to 0$, we are back to the case of confiscation. Letting $\lambda \to 1$, we have 'complete repurchase': the State repays the investment cost at full price and the foreign firm has complete residual rights. Clearly, the initial declaration of the State is effective only under credible commitment: in the absence of

[19] This interpretation can be easily formalized in our model. In expression (2), we have defined the scale parameter $\psi > 0$ as a country-specific characteristic – e.g., the size of the domestic resource endowment. This implies that, if the foreign firm operates in economy **E**, the residual profits are an increasing function of ψ. Similarly, the reservation profit will be an increasing function $\Pi_0(\psi_0)$, where ψ_0 denotes the resource endowment that the foreign firm might exploit outside economy **E**. The level of the reservation profit is therefore an inverse index of the international relative profitability of the domestic resource endowment in economy **E**.

commitment devices, the State is tempted to confiscate the foreign firm's local capital. We thus have two polar cases. If the State's declaration is not credible, the foreign firm rationally expects confiscation and therefore operates under the hypothesis that the true λ is zero; in this scenario, our previous analysis remains fully valid and the results of section 3 continue to hold. If, instead, the commitment is fully credible – e.g., because the initial contract is subject to international laws that are binding for the State[20] – the foreign firm expects the true λ to coincide with the initially declared value; in this case, we obtain the results summarized below.

4.1 Profit Sharing and Investment with Credible Repurchase

The introduction of credible repurchase only affects the regime of Foreign Control. The bargaining payoffs in (5) are unchanged whereas the no-trade payoffs of both parties under Foreign Control, D_f and Δ_f, are replaced by

$$D_{f\lambda} \equiv q_x \chi_h (k_{f\lambda}) - s_h - \lambda r_{f\lambda} k_{f\lambda} \quad \text{and} \quad \Delta_{f\lambda} \equiv \Pi_0 - s_f - (1-\lambda) r_{f\lambda} k_{f\lambda}, \tag{17}$$

where the subscript '$f\lambda$' denotes the regime of Foreign Control under credible repurchase. At Stage 2, Nash bargaining determines the ex-post levels of income and foreign firm's profits

$$Y^N_{f\lambda} = q_z z_{f\lambda} + r_{f\lambda} k_{f\lambda} + \frac{1}{2} \cdot \left[q_x \chi_h (k_{f\lambda}) - 2\lambda r_{f\lambda} k_{f\lambda} + q_x \chi_f (k_{f\lambda}) - s_h - \Pi_0 \right], \tag{18}$$

$$\Pi^N_{f\lambda} = \frac{1}{2} \cdot \left[q_x \chi_f (k_{f\lambda}) - 2(1-\lambda) r_{f\lambda} k_{f\lambda} - q_x \chi_h (k_{f\lambda}) + \Pi_0 + s_h - 2s_f \right]. \tag{19}$$

At Stage 1, the foreign firm chooses $k^\star_{f\lambda}$ in order to maximize (19). In an interior solution, the investment strategy is characterized by

$$q_x \chi'_f \left(k^\star_{f\lambda}\right) = \underbrace{2r^\star_{f\lambda}}_{\text{Double interest}} + \underbrace{q_x \chi'_h (k^\star_{f\lambda})}_{\text{Bargaining power}} - \underbrace{2\lambda r^\star_{f\lambda}}_{\text{Residual rights}} \quad \text{for} \quad 0 < k^\star_{f\lambda} < k_{\max}. \tag{20}$$

Condition (20) replaces and generalizes our previous result (12). The introduction of credible repurchase creates residual control rights for the foreign firm and therefore boosts investment: $k^\star_{f\lambda}$ increases with λ. However, granting complete residual rights to the foreign firm, $\lambda = 1$, is not desirable from an efficiency viewpoint: although a moderate degree of repurchase contrasts the foreign firm's tendency to under-invest, an excessive degree of repurchase would induce over-investment in commodity production. The following results clarify this point.

[20] For example, modern petroleum contracts typically include explicit provisions for arbitration in case of disputes (Taverne 1994; Onorato 1995).

Under the production technologies (2)-(3), there exists an upper bound for the degree of repurchase, $\lambda_{\max}$, above which the investment problem has a corner solution: the foreign firm reaps all the available capital and the traditional sector disappears (see the Appendix):

$$\exists \quad \lambda_{\max} < 1 \text{ such that } \lambda \geqslant \lambda_{\max} \text{ implies } k^{\star}_{f\lambda} = k_{\max} \text{ and } z_{f\lambda} = 0. \tag{21}$$

Hence, an interior solution to the investment problem requires $0 < \lambda < \lambda_{\max}$. The intuition is that excessive residual rights drive the overall marginal investment cost for the firm to zero and thus push investment toward the maximum feasible level. More generally, increasing the degree of repurchase generates a tradeoff in aggregate income levels. As λ ranges from zero to $\lambda_{\max}$, commodity production $x_{f\lambda}$ increases due to higher investment, but traditional production $z_{f\lambda}$ shrinks due to the *crowding-out* of local capital. In particular, there exists a critical threshold level of the degree of repurchase, $\tilde{\lambda}$, above (below) which the positive income effect of higher commodity production dominates (is dominated by) the negative income effect of crowding-out in the traditional sector:

Proposition 4 *Under technologies (2)-(3), the equilibrium domestic income under Foreign Control with credible repurchase, $Y^{\star}_{f\lambda}$, is a hump-shaped function of λ. The maximum, characterized by $\partial Y^{\star}_{f\lambda}(\lambda)/\partial\lambda = 0$, is associated to the threshold level*

$$\lambda = \tilde{\lambda} \equiv \frac{2 + \beta(\gamma - 1)}{\gamma + 1 + \beta(\gamma - 1)} < 1, \tag{22}$$

which lies within the relevant range $0 < \tilde{\lambda} < \lambda_{\max}$ provided that $k_{\max}$ is sufficiently large. Instead, the equilibrium profit of the foreign firm, $\Pi^{\star}_{f\lambda}$, is an increasing convex function of λ.

Proposition 4 delivers two important results. First, the income-maximizing degree of residual rights lies between the polar cases of 'confiscation' and 'complete repurchase': the State *should not grant complete residual rights to the foreign firm* because a high value of λ reduces aggregate income via the crowding-out effect. Second, residual rights over local capital have opposite consequences in different regimes. Under Partnership, complete residual rights for the State push investment towards the efficient level (cf. Proposition 1). Under Foreign Control, instead, assigning complete rights to the foreign firm implies over-investment in the commodity sector because the foreign firm does not care about the crowding-out effects that this strategy induces in the traditional sector.

Both these results stem from our main behavioral assumption: the State aims at maximizing domestic income, whereas the foreign firm only pursues profit maximization at the sectoral level. We also stress that, if we interpret the scenario of massive crowding-out as a "Dutch-Disease phenomenon" – that is, a reduction in aggregate productivity induced by the creation of a new primary sector – our results unveil a new potential explanation for the low income levels that characterize many resource-rich countries: the concession of excessive residual control rights to foreign firms that exploit critical domestic resources.[21]

4.2 Income, Profits and Regime Choice with Credible Repurchase

In section 3.2 above, we characterized income and profit gaps arising between Foreign Control and Partnership in terms of two parameters, β and γ. With credible repurchase, incomes and profits also depend on λ. In this subsection, we assume $\lambda = \tilde{\lambda}$, that is, the State declares the income-maximizing degree of repurchase under Foreign Control. This hypothesis is furthermore reasonable if we interpret λ as a potential control variable for the State at Stage 0.[22]

The analysis of the case $\lambda = \tilde{\lambda}$ essentially confirms our previous results, the only difference being that credible repurchase restricts the parametrization space in which Partnership is jointly optimal. Still, there is no possibility that Foreign Control is jointly optimal. The analogy with Propositions 2 and 3 is formally established below.

Proposition 5 *Under the investment rules (13) and (20) with $\lambda = \tilde{\lambda}$, the technologies (2)-(3) determine a critical level of the productivity gap $\gamma_2 \equiv \frac{1+\ln 2}{1-\ln 2} \approx 5.5$ such that:*

$$\text{if } \gamma < \gamma_2 \text{ then } Y_p^\star > Y_{f\lambda}^\star \text{ for any } \beta \in (0,1);$$

$$\text{if } \gamma > \gamma_2 \text{ then there exists } \beta_2(\gamma) \in (0,1) \text{ such that } \begin{cases} Y_p^\star > Y_{f\lambda}^\star \text{ for any } \beta > \beta_2(\gamma), \\ Y_p^\star \leqslant Y_{f\lambda}^\star \text{ for any } \beta \leqslant \beta_2(\gamma). \end{cases}$$

[21] The theoretical explanations for the rise of Resource-Curse phenomena are numerous and diverse – see Mehlum et al. (2006), van der Ploeg (2011), van der Ploeg and Venables (2011). To our knowledge, the literature on this topic has so far neglected the possibility that the crowding-out mechanism stems from incomplete contracts and the granting of excessive residual rights to foreign firms.

[22] The exogenous or endogenous nature of λ is not relevant for our analysis as long as we do not specify the bargaining procedure determining the initial regime choice at Stage 0. When solving the model backwards, the value of λ is taken as a given parameter in Stages 1,2,3 because it is fixed at Stage 0. Nonetheless, studying the strategic interactions between the initial regime choice and the choice of the degree of repurchase λ is an interesting extension of the model which may deserve further analysis.

For foreign firm's profits, there is a critical level $\gamma_3 \equiv 1 + \frac{2}{\ln(2)} \approx 3.9$ *such that*

$$\begin{aligned} &\text{if } \gamma < \gamma_3 \text{ then } \Pi^{\star}_{f\lambda} > \Pi^{\star}_{p} \text{ for any } \beta \in (0,1)\,; \\ &\text{if } \gamma > \gamma_3 \text{ then there exists } \beta_3(\gamma) \in (0,1) \text{ such that } \begin{cases} \Pi^{\star}_{f\lambda} > \Pi^{\star}_{p} \text{ for any } \beta > \beta_3(\gamma)\,, \\ \Pi^{\star}_{f\lambda} \leqslant \Pi^{\star}_{p} \text{ for any } \beta \leqslant \beta_3(\gamma)\,. \end{cases} \end{aligned}$$

The combined thresholds $\beta_2(\gamma)$ *and* $\beta_3(\gamma)$ *imply that, when both regimes are jointly agreeable, Partnership can be jointly optimal whereas Foreign Control cannot be jointly optimal.*

Figure 2 graphically represents the critical thresholds defined in Proposition 5 and compares them to the thresholds previously obtained in the basic model with $\lambda = 0$. The bold curves are the 'new' loci $\beta_2(\gamma)$ and $\beta_3(\gamma)$, the dotted curves are the 'old' loci $\beta_0(\gamma)$ and $\beta_1(\gamma)$. The three diagrams show that credible repurchase restricts the portions of the parameter space in which Partnership yields higher income and higher profits. This means that credible repurchase enhances the returns from implementing Foreign Control for both the State and the foreign firm. However, like in the basic model with $\lambda = 0$, the regime of Foreign Control cannot be jointly optimal: we cannot have $Y^{\star}_{f\lambda} > Y^{\star}_{p}$ and $\Pi^{\star}_{f\lambda} > \Pi^{\star}_{p}$ simultaneously. This is shown in Figure 2 (c), where the three parametrization sets $(\tilde{A}, \tilde{B}, \tilde{C})$ are defined analogously to (A, B, C). When both regimes are jointly agreeable, the only regime that can be jointly optimal is Partnership: credible repurchase restricts but does not eliminate this possibility.

Also, our previous results concerning the role of the reservation profit (section 3.3.2) are fully confirmed under credible repurchase. With $\lambda = \tilde{\lambda}$, the conditions determining the agreeability of Foreign Control in (15) are replaced by

$$Y^{\star}_{f\lambda} > Y^{\star}_{h} \quad \text{iff} \quad \Pi_0 < \tilde{\Pi}^{yf}_0, \qquad \Pi^{\star}_{f\lambda} > \Pi_0 \quad \text{iff} \quad \Pi_0 < \tilde{\Pi}^{\pi f}_0, \tag{23}$$

where the upper bounds $\tilde{\Pi}^{yf}_0$ and $\tilde{\Pi}^{\pi f}_0$ can be explicitly derived under technologies (2). In line with the basic model with confiscation, we can prove that

$$\Pi^{yp}_0 > \tilde{\Pi}^{\pi f}_0 \quad \text{and} \quad \Pi^{yp}_0 > \Pi^{\pi p}_0 \tag{24}$$

hold for every constellation of parameters. Result (24) is analogous to (16), and implies the same scenarios described in Table 2. The bottom line is that the main predictions of the basic model with confiscation ($\lambda = 0$) hold even under credible repurchase at the income-maximizing rate ($\lambda = \tilde{\lambda}$).

5 Empirical Evidence

There are two fundamental questions connected to the theoretical model above that deserve empirical scrutiny. The first concerns the relationship between control regimes and economic performance: do Partnership-like regimes imply higher or lower aggregate income than Foreign Control? Tackling this issue (henceforth **Question 1**) empirically is furthermore interesting in view of the fact that the existing literature on ownership and resource extraction (e.g., Megginson, 2005; Wolf, 2009) concentrates on the profitability, or efficiency, of the primary sectors without assessing the impact on aggregate income. The second point (**Question 2**) is suggested by the theoretical results of Table 2, namely that Partnership and Foreign Control are linked to high or intermediate relative profitability of the domestic resource endowment, whereas home control is associated with low relative profitability. We analyze these two questions using a new dataset on petroleum ownership structures for up to 68 countries between 1867-2008. Below, we first describe the dataset on oil control rights and the empirical methodology, and then discuss the estimation results.

5.1 Oil Control Rights Dataset

Our dataset includes information on 68 oil-producing countries from all regions of the world (see the Appendix for a detailed list). The main criteria for inclusion in the dataset were that the country had a minimum of 0.2 billion barrels in (proved) oil reserves between 1980-2008, and that it produced an average of at least 20'000 barrels of crude oil per day during at least one year over the same period. The principal source for this information was the U.S. Energy Information Administration (EIA).[23] Our sample includes 96.6 percent of known worldwide proved crude oil reserves in 1980, while in 2008 the share goes up to 99.9 percent.

The main variable of interest is the control rights structure of the petroleum industry. Following the theoretical model, we distinguish between domestic (i.e., "Home"), foreign, and mixed domestic-foreign (i.e., "Partnership") control rights regimes.[24] Our classification method-

[23] We cross-checked the entries from the EIA with the BP Statistical Review of World Energy (2010), which covers fewer countries in detail, but over a longer time period.

[24] We focus on oil exploration and extraction/ production. The oil refinery and petroleum-derived products industries are not considered, as these do not presume the presence of an actual oil production sector in a country and are therefore more similar to other manufacturing sectors.

ology is inspired by the one developed by Jones Luong and Weinthal (2001, 2010), but differs from it in that we distinguish between domestic, foreign, and mixed domestic-foreign control of the petroleum sector.[25] Moreover, our sample includes a wider range of countries from both the developed and the developing world, while Jones Luong and Weinthal (2001, 2010) concentrate mainly on transition economies. We code each country according to the following criteria:

Domestic control: The state or private domestic firm(s) holds the rights to develop the majority of petroleum deposits and owns the majority of shares (over 50%) in the oil sector. The managerial power lies mainly in domestic hands, with foreign involvement being limited to roles with little or no operational and managerial control (e.g., service contracts).

Partnership: The rights to develop the majority of petroleum deposits and the majority of shares (over 50%) in the oil sector lie in domestic hands, but there is substantial involvement by foreign firms. Both domestic and foreign oil firms (private or public) have operational and managerial competencies, e.g., through Production Sharing Agreements (PSAs).

Foreign control: Foreign (private or state-owned) firms hold the rights to develop the majority of petroleum deposits and own the majority of shares (over 50%) in the domestic oil sector. The managerial power lies mainly in foreign hands, e.g., via concessions.

As these criteria imply, control right structures are seldom absolute in the sense that either domestic or foreign firms hold the exclusive rights to all exploration and extraction of petroleum. For practical purposes, the essential point is who holds the majority rights to develop petroleum deposits *according to domestic legislation*. For the coding, we rely on the countries' constitutions, official laws and regulations governing the petroleum sector, sample petroleum contracts (where available), and secondary sources. The initial (post-independence) year of inclusion of each country is based on the date of the first national law, rule or regulation pertaining explicitly to the petroleum sector.[26] This method allowed us to gather information on

[25] Jones Luong and Weinthal (2001, 2010) draw up four categories of resource ownership: state ownership with control, state ownership without control, private domestic ownership, and private foreign ownership.

[26] The only exception is Canada, where petroleum-specific legislation is passed by the provincial governments, while the national government sets out the laws for the mining sector in general. The first mining sector law was passed in 1867, the year of Canada's independence from Great Britain. Given that oil refining (for kerosene

control regimes for 68 countries starting as early as 1867 up until 2008, with the average time period of a country's inclusion being around 53 years (see the Appendix for a detailed data description).

We condense the dataset into five-year periods to avoid capturing short-term fluctuations, starting with the period 1870-1874, 1875-1879, ..., until 2005-2008, for a total of potentially 28 periods and 762 observations. Since not all countries enter the dataset at the same time, we have an unbalanced panel. 206 country-periods had domestic control; 316 had foreign control; and 240 had partnership. 36 countries from all parts of the world changed their regimes at least once during the period of observation, for a total of nearly 60 switches. Many changed regimes twice or even more, with Bolivia showing a record five changes since 1920.[27]

5.2 Methodology

We use two different approaches to analyse the two questions. **Question 1** is explored with the following panel fixed-effects estimation (note that the Hausman test rejects random-effects estimation in favor of fixed effects):

$$Y_{it} = \alpha_1 + \alpha_2 regimedummy_{it} + \alpha_3 X_{it} + \omega_{it}, \tag{25}$$

where i is the country index and t is the period index. The dependent variable Y_{it} is (the natural logarithm of) real income per capita at the start of period t, taken from the historical dataset of Maddison (2006) and measured in 1990 Geary-Khamis PPP-adjusted USD. X_{it} is a vector of control variables, and ω_{it} is the composite error term. Our main variable of interest is $regimedummy_{it}$ and its coefficient α_2.

We have three 0-1 regime dummies for *Domestic Control*, *Foreign Control* and *Partnership*, constructed according to the classification described above. A dummy takes on value one if a country had the respective control regime for at least three of the five years in a given period.

production) was originally invented in Canada in the 1840s, and that the Canadian petroleum industry developed in parallel with that of the United States in the second half of the nineteenth century, we argue that the 1867 law fully applies to the petroleum sector. Canada therefore enters our dataset in 1867.

[27] Several of these regime changes, especially in the pre-1970 period, came in the wake of general national upheavals such as revolutions or other profound changes in the political regime. In more recent times, changes have usually come about more smoothly during the course of adapting the control regimes to new developments and learning processes.

In a first step, we exclude all country-periods with Domestic Control and take *Foreign Control* as our base regime to see whether *Partnership* leads to significantly higher income than *Foreign*. We term this the "basic version" of Question 1. In a second step, we also consider an interesting "extended version" of Question 1, which includes all control rights regimes and thus delivers a complete ranking of control regimes in terms of aggregate income. In this extended analysis, we take *Domestic control* as our base outcome, and check whether *Partnership* and *Foreign Control* (in this order) lead to higher incomes than *Domestic Control* at a given technology level. The challenge lies in finding a good proxy for technology level: we will consider two variables, average labor productivity per worker in a period, measured in thousands of 1990 USD (The Conference Board Total Economy Database, 2011), and average years of schooling (Barro and Lee, 2010).[28]

In addition to the proxies for technology levels described above, we include the following control variables. First, a dummy variable for OPEC countries to take into consideration the possible effects of the wave of privatizations that swept through the major oil producers in the late 1950s and 1960s and led to the Organization's creation. This provides a historical reason for the adoption of a particular control rights structure not considered by the theoretical model (see also the discussion below). We also include two political variables taken from the Polity IV dataset (Marshall et al., 2010) to control for the effects of institutional quality on the type of petroleum sector contracts that a country offers. Foreign or Partnership regimes would be less likely in countries with poor institutional quality and unstable or unpredictable political systems, as this increases the uncertainty for foreign firms evaluating an investment in the oil sector.[29] The first political measure is the composite variable *polity* (i.e., the *polity2* variable from the Polity IV dataset), and the second is one of the component variables of the total polity score, namely *executive constraints*.[30] We expect both political measures to enter with a positive sign. In further robustness tests, we also include period dummies.

All independent variables except for the OPEC and time dummies are lagged by one period to address endogeneity issues. Similar results were obtained for up to seven lags (i.e., 35 years)

[28] The correlation coefficient between labor productivity and schooling years is 0.51.

[29] For example, Jodice (1980) argues that the propensity to expropriate foreign firms is affected by political factors such as state capacity and the stability of the political system.

[30] The measure of *executive constraints* arguably also proxies for the strength of the legal system and particularly property rights (see Acemoglu and Johnson, 2005). Further details are given in the Appendix.

in the basic version of Question 1, and for up to five lags (i.e., 25 years) in the extended version. This robustness to using various time lags is particularly relevant when it comes to the question of reverse causality: although not considered by the theoretical model, it can be argued that the development level (i.e., the income) of a country influences its choice of control regime. However, income levels are surely less persistent than the 25-35 year period for which our results hold, making the hypothesized direction of influence from control regime towards income – instead of vice versa – more probable.[31]

The composite error term consists of the country-specific error component ϵ_i and the combined cross-section and time series error component u_{it}, according to $\omega_{it} = \epsilon_i + u_{it}$. We tackle the issue of serial correlation by reporting two different estimates of the standard errors.[32] The first uses robust clustered errors at the panel (i.e., country) level. This approach of one-level-up clustering - in this case, at the country instead of the country-period level - allows for unrestricted correlation of the residuals within clusters (Angrist and Pischke, 2009, ch. 8). The second approach uses adjusted standard errors according to the nonparametric covariance matrix estimator suggested by Driscoll and Kraay (1998) and adapted by Hoechle (2007) to unbalanced panels. This approach has the added advantage of producing heteroskedasticity-consistent standard errors that are robust to very general types of both temporal and spatial dependence. The latter point may be important when we consider the possible diffusion and contagion effects of events across oil producers, for example the signalling effect of the unsuccessful nationalization of the petroleum sector in Iran in 1951 or the formation of OPEC in

[31] We are not interested in dynamic effects and the partial adjustment of income to ownership structures over time, so we do not add a lagged dependent variable. Note however that the main results of the extended version of Question 1 are robust to the addition of lagged income.

[32] The assumption of the classical error component model is that any temporal persistence is due to the presence of the same country i across the panel, and that this effect can be captured by the fixed country term ϵ_i. However, this is likely to be too restrictive here, where a shock - e.g., a control regime change - in one period could affect the behavioral relationship for several periods (see e.g., Baltagi, 2008, ch. 5.2). The error component u_{it} would then be serially correlated across periods: tests following Wooldridge (2002) confirm this suspicion. Failing to correct standard errors for serial correlation leads to biased statistical inference and less efficient estimates.

1960.[33]

Question 2 is tested with a pooled multinomial logit estimation:

$$controlregime_{it} = \beta_1 + \beta_2 relprofit_{it} + \beta_3 X_{it} + \nu \tag{26}$$

where ν is the error term. The dependent variable *controlregime* is derived from a recoding of the previous control regime dummies to take on values 1 (*Domestic Control*), 2 (*Foreign Control*), or 3 (*Partnership*). 1 = *Domestic* is our base outcome.

Our main variable of interest here is *relprofit*, which measures the relative profitability of the domestic oil sector *vis-à-vis* other countries. The model suggests that the higher the relative profitability, the higher the likelihood of adopting either a mixed domestic-foreign (Partnership) or Foreign control regime; for intermediate levels of relative profitability, Partnership should be the most likely outcome; and Domestic Control should always be linked to the lowest profitability. In line with our interpretation of "international relative profitability" (see footnote 19), we identify *relprofit* with the country's share (in percent) of total proved crude oil reserves in a period, where the total oil reserves is the sum of all known and proved oil reserves in our sample of 68 oil producers. The main sources for the reserves data were the EIA (2010), BP (2010), Jenkins (1989), the UK Institute of Geological Sciences (IGS, various years), and the German Bundesanstalt für Geowissenschaften und Rohstoffe (various years).

The basic additional variables included in X_{it} are dummies for the top 20 oil countries, defined as the twenty countries with the highest relative oil shares in 1995 (and later), plus the USSR (and dropping the former Soviet republics) for the pre-1995 period.[34] Further control variables include the OPEC dummy and the political measures described above; labor productivity and years of schooling as proxies for the level of technology; and the average oil price over the previous five years (in constant 2009 USD, from BP, 2010). The latter captures the

[33] For example, Myers Jaffe (2007) argues that the events in Iran between 1951-54 - the failed oil sector nationalization - affected policy in Iraq, since the Iraqi government was considering similar measures to increase its share in foreign companies' oil profits, but then opted for a less aggressive ownership strategy. On diffusion as a possible exogenous explanation for nationalization (or lack thereof), see also Kobrin (1985).

[34] In addition to the USSR, the following country dummies are included: Saudi Arabia, Iraq, United Arab Emirates, Kuwait, Iran, Russia, Venezuela, Mexico, United States, Libya, Nigeria, China, Kazakhstan, Norway, Canada, Algeria, Brazil, India, Malaysia, Oman. Results remain robust when adding dummies for the top 30 oil countries.

incentives for regime change (particularly nationalization) that governments may have as a result of rising oil prices (see e.g., Guriev et al., 2011). Finally, we include the lagged dependent variable ($controlregime_{it-1}$) in some specifications to account for time dependence in control regimes: this should allow us to separate the transition to a certain regime from the persistence of a regime once adopted. Details for all variables are provided in the Appendix.

5.3 Estimation results

Question 1. Table 3 shows the results for the "basic version" of Question 1 without considering the country-periods with Domestic Control, which eliminates three out of the potential 63 countries for which we have all data available. The first and most important finding is that all specifications show that Partnership leads to significantly higher income than Foreign Control. The total income effect for choosing a mixed domestic-foreign control regime over mainly foreign control is estimated at 20-30 percent, keeping all else equal. Moreover, the effect remains significant even when we successively add measures of political institutions and the OPEC membership dummy.

Both measures of political institutions are positive and highly significant, which well accords with other studies demonstrating the importance of institutions for economic development. OPEC countries also seem to have had significantly higher income levels than non-OPEC members; this is probably due to the income effect of oil production and export among these large oil-exporting economies.

Table 4 shows the results for the estimations of our "extended version" of Question 1, including our full sample of countries and periods. The relevant base outcome is now Domestic Control, and we are exploring whether Partnership and Foreign Control (in this order) lead to higher income levels. This extended version of Question 1 presupposes that we effectively account for technology levels: failing to do so would bias the results, as our model assumes that a resource-rich country with high technology levels will choose to develop its endowment under Domestic Control. We concentrate on the results with labor productivity, which proved highly significant; the results with years of schooling are shown in the Appendix and briefly discussed below.

Column (1) of Table 4 gives a parsimonious specification for comparison without controlling for the technology level (i.e., labor productivity). We see that, *ceteris paribus*, Foreign Control leads to lower per-capita income levels, while partnership has a positive, albeit insignificant coefficient. More important are the results in columns (2)-(6), obtained when controlling for labor productivity. They show that both Partnership and Foreign Control lead to higher income levels than Domestic Control regimes, holding all other factors fixed, and that the difference is statistically significant. More remarkably still, the coefficients indicate that the ranking of control regime corresponds to the one suggested by the theory: Partnership has the highest positive impact on income levels (between 24-26 percent higher than Domestic Control), followed by Foreign Control (between 10-13 percent higher than Domestic). Wald tests confirm that this difference in the coefficients for Partnership and Foreign Control is indeed significant and systematic. The additional variables have the expected signs, and the estimation fits are remarkably good when we account for labor productivity.

In robustness tests, we consider several alternative specifications to analyse Question 1. First, we add period dummies to control for possible aggregate effects such as time-specific oil demand or supply shocks that may be more general than the effects captured by the OPEC membership dummy. Table 5 shows that the results for the basic version (columns (1)-(2)) are not robust to adding time effects, although the signs on the *Partnership* coefficient remain positive. However, the extended version in columns (3)-(4) remains consistent, particularly as regards the significance of the *Partnership* variable, although the size of the coefficients does diminish with respect to Table 4. Similarly, labor productivity remains positive and highly significant, but its magnitude decreases. Neither the polity variable nor the measure of executive restraints (not shown, available upon request) proves very robust to controlling for time effects, with polity even changing signs in the extended version.

Second, we substitute years of schooling for labor productivity as the proxy for the level of technology (see the Appendix). The findings are generally weaker: although both Partnership and Foreign Control lead to higher predicted incomes than Domestic Control, the coefficients are not always significant, particularly when using robust country-clustered standard errors. Foreign Control appears to have higher positive effects than Partnership, but the difference in the magnitudes of the two coefficients is not statistically significant.

Summing up the empirical findings for Question 1, we can say that they lend strong support to the model's insights: Partnership leads to higher income than Foreign Control, and moreover both Partnership and Foreign Control lead to higher income than Domestic Control.

Question 2. Table 6 shows the findings for the test of Question 2 using multinomial logit, where Domestic Control (regime=1) is the base outcome. The coefficients on the relative profitability measure therefore give the log probability of choosing either Foreign (regime=2) or Partnership (regime=3) over Domestic. Estimation (1) shows a parsimonious specification with only the oil reserves share, our proxy for relative profitability, and the dummies for the top 20 oil countries. Estimation (2) includes further control variables, and estimations (3) and (4) add the lagged dependent variable to focus only on the transition to a control regime, without considering its persistence.

The main result is that the log probability of choosing either Foreign or Partnership over Domestic Control increases with an increase in the oil reserves share, and hence in the relative profitability: this is in line with our expectations from the theoretical model. It is ambiguous whether Foreign Control or Partnership is linked to highest (or intermediate) relative profitability: although the magnitudes of the coefficients suggest that it may be *Foreign*, a simple Wald test shows that we cannot reject the hypothesis that the coefficients are the same in all estimations. This however does not contradict the model's point that either Foreign or Partnership will be associated with high relative profitability, while intermediate relative profitability is most likely associated with Partnership.

The control variables show some interesting results. An increasing oil price decreases the chances of having either Foreign or Partnership instead of Domestic Control, which probably lies in the greater temptation for nationalizing an increasingly lucrative industry. The polity measure suggests that an increase on the autocracy-democracy scale towards stronger democracy makes choosing Foreign over Domestic control more probable, while it has no significant effect on choosing Partnership. The alternative political measure executive constraints gave no significant results (not shown). Technology levels – measured by either labor productivity or schooling years (not shown) – tend to negatively affect the likelihood of any foreign involvement, either under majority Foreign Control or Partnership. A country with a high technology level is likely to choose Domestic control, which complies with our basic theoretical premise. Finally, the highly significant coefficient on the lagged dependent variable shows that there is indeed path dependency in control rights regimes: the likelihood of switching regimes is small.

In additional robustness tests in Table 7, we first confine the sample to the post-1970 period, and then to the post-1980 period, for which we have the most complete and reliable oil reserves data. This aims at checking whether the results crucially depend on a particular time span. In both cases, *Partnership* is consistently and significantly linked to higher relative profitability when we take into account the persistence of control regimes and is otherwise insignificant, though still positive. *Foreign* instead sometimes changes signs, becoming the least likely outcome as relative profitability increases. We also drop Saudi Arabia and the United States, two possible outliers which may be unduly influencing our results. Both *Foreign* and *Partnership* still have a consistent and significant higher log probability of being the observed outcome with growing relative profitability than *Domestic*.

In sum, the empirical results for Question 2 confirm that either Foreign Control or Partnership are the more likely control regimes when a country's oil sector is relatively highly profitable, with either one being chosen instead of Domestic Control.

6 Conclusions

In our analysis, the key mechanism through which control regimes affect economic activity is the non-contractibility of investment before resource extraction takes place. From the empirical point of view, this is an important element in the negotiations because extractive industries require high investment before production begins (see e.g., Eaton and Gersovitz, 1983). At the theoretical level, we have shown that partnerships can be jointly optimal and that assigning complete residual rights to foreign firms reduces domestic income via a Dutch-Disease mechanism. At the empirical level, a new dataset reveals that international partnerships tend to generate higher domestic income than regimes of 'pure' foreign control. Estimations also lend support to the theoretical model predicting that the typical control regime that arises as a bargaining equilibrium is either partnership or foreign control when the international relative profitability of the domestic resource endowment is high or intermediate, and home control with low relative profitability.

Our results concerning the degree of residual rights on local capital to be granted to foreign firms deserve attention. In our model, assigning complete residual rights to foreign firms is inefficient for the allocation of local capital in the host country and yields negative effects on total domestic income. The idea that there exists an optimal degree of residual rights suggests that there are strategic interactions between the choice of the regime and the extent to which foreign firms are allowed to exploit the domestic inputs required to extract resources. Addressing this issue at both the theoretical and empirical levels is an interesting topic for future research.

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Regime	Domestic income	Foreign firm's profits
Home Control	$Y_h \equiv q_z z_h + q_x x_h - s_h$	Π_0
Foreign Control	$Y_f \equiv q_z z_f + r_f k_f + \ell_f$	$\Pi_f \equiv q_x x_f - s_f - r_f k_f - \ell_f$
Partnership	$Y_p \equiv q_z z_p + \ell_p$	$\Pi_p \equiv q_x x_p - s_p - \ell_p$

Table 1: Domestic income (Y_i) and foreign firm's profits (Π_i) under alternative control regimes.

	Parametrizations and agreeable regimes			
Π_0	A	B	$C1$	$C2$
High	Home (optimal)	Home (optimal)	Home (optimal)	Home (optimal)
Intermediate	Partnership	Partnership	Partnership	Foreign
Low	Partnership optimal	Foreign/Partnership	Foreign/Partnership	Foreign/Partnership

Table 2: Agreeable and implemented regimes in relation to the foreign firm's reservation profit.

Table 3: Basic Question 1: Partnership vs Foreign control and income levels

	(1)	(2)	(3)	(4)	(5)
Partnership	0.300***	0.283***	0.203**	0.282**	0.198*
	(2.699)	(3.171)	(2.219)	(2.638)	(1.750)
	[4.44]	[3.80]	[2.80]	[4.22]	[2.85]
Polity		0.0367***	0.0345***		
		(4.011)	(4.190)		
		[4.38]	[4.17]		
Executive constraints				0.00279***	0.00226**
				(3.603)	(2.514)
				[4.12]	[2.71]
OPEC			0.639***		0.689***
			(6.316)		(3.796)
			[4.18]		[4.18]
Constant	8.242***	8.198***	8.146***	8.247***	8.187***
	(170.7)	(208.8)	(224.0)	(177.6)	(178.1)
	[75.49]	[88.45]	[91.13]	[76.72]	[78.46]
Observations	465	465	465	465	465
Number of countries	60	60	60	60	60
Ave obs per country	7.8	7.8	7.8	7.8	7.8
R^2within	0.035	0.126	0.174	0.044	0.099

Notes: Countries with *Domestic Control* are excluded, so *Foreign Control* is base outcome. The dependent variable is (log) income per capita at start of five-year period. All covariates except the OPEC dummy are lagged by one period. Estimations are fixed effects (within) panel estimations. T-statistics for robust country-clustered standard errors are in parentheses, and for Driscoll-Kraay standard errors in square brackets. *, **, *** statistically significant at 10, 5, and 1 percent levels, respectively (refers to country-clustered standard errors).

Table 4: Extended Question 1: control regimes and income levels

	(1)	(2)	(3)	(4)	(5)	(6)
Partnership	0.169	0.257***	0.241***	0.247***	0.254***	0.260***
	(1.251)	(4.788)	(4.527)	(4.911)	(4.744)	(5.045)
	[1.64]	[5.07]	[5.92]	[6.59]	[5.13]	[5.55]
Foreign	-0.290**	0.110**	0.099*	0.117**	0.113**	0.131***
	(-2.283)	(2.075)	(1.843)	(2.518)	(2.111)	(2.807)
	[-1.76]	[2.04]	[2.70]	[3.49]	[2.06]	[2.49]
Polity			0.01***	0.01***		
			(2.786)	(2.713)		
			[1.57]	[1.55]		
Executive constraints					0.001	0.001
					(1.108)	(1.152)
					[1.55]	[1.61]
OPEC				0.152		0.156
				(1.212)		(1.308)
				[2.08]		[2.31]
Labor productivity		0.027***	0.027***	0.027***	0.027***	0.027***
		(4.967)	(5.474)	(5.436)	(4.964)	(4.928)
		[6.19]	[6.81]	[6.76]	[6.23]	[6.20]
Constant	8.330***	7.904***	7.900***	7.866***	7.904***	7.870***
	(103.8)	(80.42)	(88.19)	(88.59)	(79.94)	(79.36)
	[78.97]	[65.31]	[66.13]	[72.53]	[65.49]	[70.80]
Observations	648	455	453	453	455	455
Number of countries	63	57	57	57	57	57
Ave obs per country	10.3	8.0	7.9	7.9	8.0	8.0
R^2 within	0.059	0.424	0.446	0.448	0.425	0.427

Notes: All countries in sample are included. *Domestic Control* is base outcome. The dependent variable is (log) income per capita at start of five-year period. All covariates except the OPEC dummy are lagged by one period. Estimations are fixed effects (within) panel estimations. T-statistics for robust country-clustered standard errors are in parentheses, and for Driscoll-Kraay standard errors in square brackets. *, **, *** statistically significant at 10, 5, and 1 percent levels, respectively (refers to country-clustered standard errors).

Table 5: Question 1: robustness analysis with time effects

	basic version (1)	basic version (2)	extended version (3)	extended version (4)
Partnership	0.022	0.022	0.145**	0.156**
	(0.331)	(0.333)	(2.162)	(2.398)
	[0.71]	[0.71]	[3.15]	[3.36]
Foreign			0.099	0.121*
			(1.374)	(1.717)
			[1.92]	[2.20]
Polity		0.001		-0.005
		(0.13)		(1.182)
		[0.10]		[-2.96]
Labor productivity			0.017***	0.018***
			(7.14)	(7.538)
			[16.27]	[17.79]
Constant	6.802***	6.804***	7.698***	7.673***
	(33.24)	(33.77)	(152.8)	(171.0)
	[39.99]	[40.11]	[213.42]	[171.44]
Observations	465	465	455	453
Countries	60	60	57	57
Ave obs per country	7.8	7.8	8.0	7.9
R^2 within	0.71	0.71	0.64	0.65

Notes: In columns (1)-(2) countries with *Domestic Control* are excluded, while in columns (3)-(4) all countries in the sample are included. The dependent variable is (log) income per capita at start of five-year period. Period dummies are included in all specifications. All covariates are lagged by one period. Estimations are fixed effects (within) panel estimations. T-statistics for robust country-clustered standard errors are in parentheses, and for Driscoll-Kraay standard errors in square brackets. *, **, *** statistically significant at 10, 5, and 1 percent levels, respectively (refers to robust country-clustered standard errors).

Table 6: Question 2: profitability and control regimes

	(1a) Foreign (regime=2)	(1b) Partnership (regime=3)	(2a) Foreign (regime=2)	(2b) Partnership (regime=3)	(3a) Foreign (regime=2)	(3b) Partnership (regime=3)	(4a) Foreign (regime=2)	(4b) Partnership (regime=3)
oil reserves share	0.306**	0.297**	0.260*	0.240*	0.516**	0.511**	0.555**	0.496*
	(2.509)	(2.269)	(1.894)	(1.706)	(2.135)	(2.057)	(2.095)	(1.837)
oil price			-0.0235**	-0.009			-0.023*	-0.020
			(-2.553)	(-1.148)			(-1.806)	(-1.350)
OPEC			-0.736	1.985**			-1.957	-0.510
			(-0.559)	(2.248)			(-0.807)	(-0.208)
polity			0.111***	0.0395			0.080**	-0.011
			(3.885)	(1.566)			(1.976)	(-0.227)
labor productivity			0.008	-0.037**			-0.042*	-0.07**
			(0.563)	(-2.459)			(-1.706)	(-2.375)
lag regime					3.787***	6.496***	3.954***	6.026***
					(7.74)	(11.01)	(6.224)	(8.343)
Constant	0.752***	0.694***	1.005**	1.396***	-4.862***	-11.46***	-3.720***	-8.080***
	-4.516	-4.12	(2.225)	(3.303)	(-7.067)	(-10.94)	(-4.338)	(-6.759)
Observations	476	476	414	414	458	458	397	397
Log likelihood	-371.2	-371.2	-286.0	-286.0	-204.9	-204.9	-161.1	-161.1
Pseudo R^2	0.28	0.28	0.36	0.36	0.59	0.59	0.63	0.63
Chi2	286.01	286.01	323.9	323.9	580.86	580.86	537.7	537.7

Notes: All estimations are pooled multinomial logit with dummies for top 20 oil countries included (not shown). The dependent variable is control regime, which ranges from 1 (Domestic) over 2 (Foreign) to 3 (Partnership). *Domestic Control (=regime 1)* is base outcome; the results show the log probability of choosing either *Foreign* or *Partnership* over *Domestic*. z-statistics in parentheses. *, **, *** statistically significant at 10, 5, and 1 percent levels, respectively.

Table 7: Question 2: robustness analysis

	(1a)	(1b)	(2a)	(2b)	(3a)	(3b)	(4a)	(4b)	(5a)	(5b)	(6a)	(6b)
	foreign	partnership	foreign	partnership	foreign	partnership	foreign	partnership	foreign	partnership	foreign	partnership
	(regime=2)	(regime=3)	(regime=2)	(regime=3)	(regime=2)	(regime=3)	(regime=2)	(regime=3)	(regime=2)	(regime=3)	(regime=2)	(regime=3)
oil reserves share	-0.651*	0.089	-0.266	1.239**	-3.595***	0.214	1.017	3.006***	0.253*	0.252*	0.813**	0.763**
	(-1.828)	-0.324	(-0.557)	-2.36	(-2.668)	(0.341)	(0.513)	-2.709	(1.761)	(1.732)	(2.507)	(2.334)
oil price	-0.019**	-0.007	-0.023*	-0.023	-0.030**	-0.024**	-0.104***	-0.1***	-0.02**	-0.008	-0.016	-0.013
	(-2.013)	(-0.866)	(-1.682)	(-1.485)	(-2.502)	(-2.135)	(-2.935)	(-2.740)	(-2.125)	(-0.919)	(-1.248)	(-0.856)
OPEC	-0.35	1.985**	-1.686	-1.121	1.221	2.741*	4.359**	6.536**	-0.826	1.984**	-2.202	-0.75
	(-0.266)	(2.237)	(-0.721)	(-0.463)	(0.713)	(1.921)	(1.99)	(2.212)	(-0.620)	(2.244)	(-0.808)	(-0.273)
polity	0.102***	0.036	0.066*	-0.025	0.093**	0.038	-0.053	-0.142*	0.108***	0.04	0.065	-0.024
	(3.578)	(1.437)	(1.658)	(-0.499)	(2.553)	(1.112)	(-0.714)	(-1.653)	(3.777)	(1.577)	(1.533)	(-0.472)
labor productivity	0.016	-0.034**	-0.029	-0.059**	-0.004	-0.066***	-0.167**	-0.196***	0.011	-0.038**	-0.038	-0.068**
	(1.07)	(-2.187)	(-1.172)	(-1.977)	(-0.207)	(-3.159)	(-2.301)	(-2.595)	(0.741)	(-2.477)	(-1.404)	(-2.114)
lag regime			3.990***	6.191***			12.36***	15.09***			4.376***	6.506***
			(6.043)	(8.206)			(3.452)	(4.182)			(6.0)	(8.009)
Constant	0.843*	1.268***	-3.851***	-8.524***	2.459***	2.745***	-7.172**	-13.59***	0.824*	1.327***	-4.584***	-9.076***
	-1.826	-2.995	(-4.431)	(-6.905)	-3.601	-4.351	(-2.375)	(-4.199)	(-1.784)	(3.116)	(-4.742)	(-6.921)
Observations	390	390	374	374	309	309	299	299	392	392	375	375
Log likelihood	-273.2	-273.2	-150.5	-150.5	-186.8	-186.8	-82.6	-82.6	-277.8	-277.8	-151.9	-151.9
Pseudo R^2	0.35	0.35	0.63	0.63	0.44	0.44	0.74	0.74	0.35	0.35	0.63	0.63
Chi2	296.1	296.1	507.8	507.8	289.9	289.9	475.6	475.6	295.4	295.4	510.9	510.9

Notes: All estimations are pooled multinomial logit with dummies for top 20 oil countries included (not shown). The dependent variable is ownership structure, which ranges from 1 (domestic) over 2 (foreign) to 3 (partnership). *Domestic ownership (=owner 1)* is base outcome; the results show the log probability of choosing either *foreign* or *partnership* over *domestic*. Specifications (1)-(2) refer to post-1980 period; specifications (3)-(4) look at the post-1980 period, and specifications (5)-(6) drop data for Saudi Arabia and the United States. z-statistics in parentheses. *, **, *** statistically significant at 10, 5, and 1 percent levels, respectively.

Figures

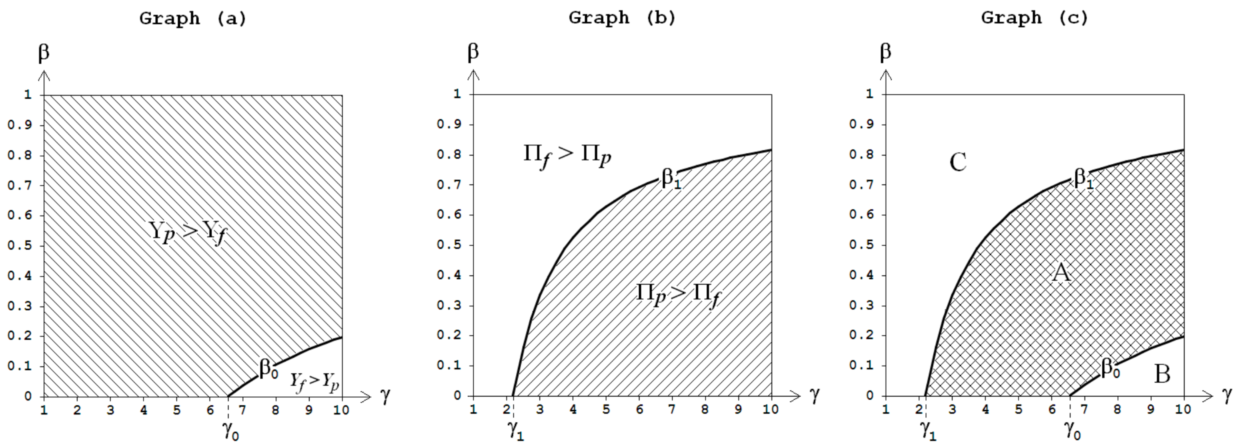

Figure 1: Regime rankings under confiscation. Partnership yields higher income in the area lying above the β_0 locus (Graph (a)) and higher profits in the area lying below the β_1 locus (Graph (b)). The joint rankings (Graph (c)) determine three parametrization spaces where set A is characterized by $Y_p^\star > Y_f^\star$ and $\Pi_p^\star > \Pi_f^\star$.

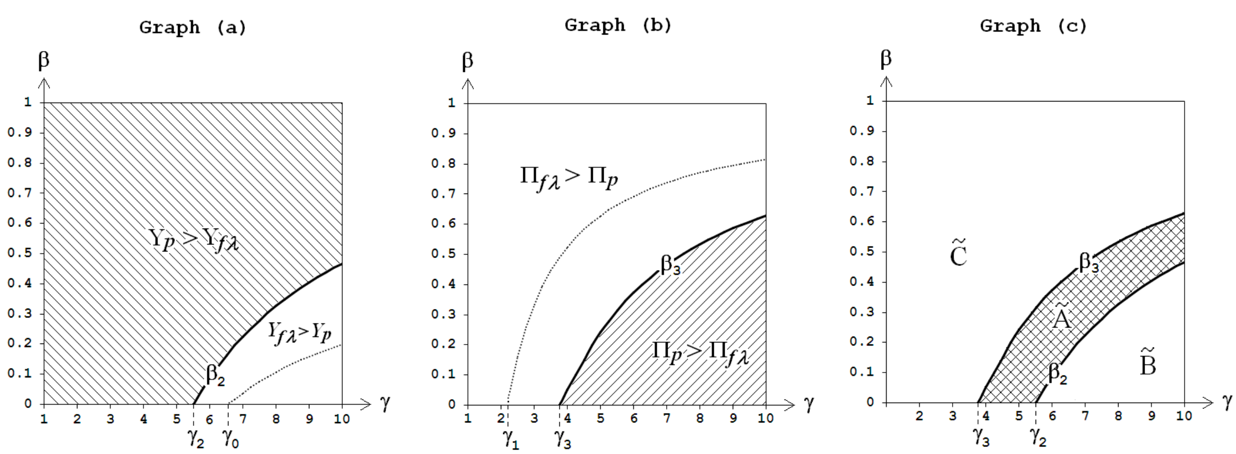

Figure 2: Regime rankings under credible repurchase with $\lambda = \tilde{\lambda}$. Partnership yields higher income in the area lying above the β_2 locus (Graph (a)) and higher profits in the area lying below the β_3 locus (Graph (b)). The joint rankings (Graph (c)) determine three parametrization spaces where set $\tilde{A}$ is characterized by $Y_p^\star > Y_{f\lambda}^\star$ and $\Pi_p^\star > \Pi_{f\lambda}^\star$.

Supplementary Material for Reviewers

International Partnerships, Foreign Control and Income Levels: Theory and Evidence

Christa N. Brunnschweiler and Simone Valente

A. Appendix – Empirical Evidence

B. Appendix – Model with Confiscation

C. Appendix – Model with Repurchase

A Appendix – Empirical Evidence

A.1 Data description

Countries for which control rights regime data is available, with period included (starting with beginning of first five-year period):

Albania (1930-2008), Algeria (1965-2008), Angola (1980-2008), Argentina (1910-2008), Australia (1905-2008), Azerbaijan (1995-2008), Bahrain (1975-2008), Bolivia (1920-2008), Brazil (1895-2008), Brunei (1985-2008), Cameroon (1965-2008), Canada (1870-2008), Chad (1965-2008), Chile (1930-2008), China (1950-2008), Colombia (1915-2008), Congo Brazzaville (1965-2008), Cuba (1955-2008), Denmark (1950-2008), East Timor (2005-2008), Ecuador (1910-2008), Egypt (1955-2008), Equatorial Guinea (1980-2008), France (1925-2008), Gabon (1965-2008), Germany (1990-2008), West Germany (1955-1989), Guatemala (1950-2008), India (1955-2008), Indonesia (1960-2008), Iran (1905-2008), Iraq (1955-2008), Italy (1930-2008), Kazakhstan (1995-2008), Kuwait (1965-2008), Libya (1955-2008), Malaysia (1970-2008), Mexico (1905-2008), Netherlands (1965-2008), Nigeria (1965-2008), Norway (1965-2008), Oman (1975-2008), Pakistan (1950-2008), Papua New Guinea (1980-2008), Peru (1925-2008), Philippines (1950-2008), Qatar (1975-2008), Romania (1895-2008), Imperial Russia (1875-1918), Russian Federation (1995-2008), Saudi Arabia (1935-2008), Sudan (1975-2008), Syria (1955-2008), Thailand (1975-2008), Trinidad and Tobago (1965-2008), Tunisia (1960-2008), Turkey (1930-2008), Turkmenistan (1995-2008), United Arab Emirates (1980-2008), Ukraine (2005-2008), United Kingdom (1935-2008), United States (1900-2008), USSR (1920-2008), Uzbekistan (1995-2008), Venezuela (1905-2008), Vietnam (1985-2008), Yemen (1990-2008), North Yemen (1975-1990), South Yemen (1980-1990).

Technical notes: For the case of former colonies, the simple act of maintaining colonial-era contracts upon independence until their expiry does not constitute a national law in the sense of it being passed deliberately by a sovereign government. The year of inclusion of a country in our dataset does therefore not necessarily coincide with its year of gaining independence. We are aware that there is often a time lag between the introduction of a new piece of legislation and its full implementation throughout the petroleum industry. E.g., the decision to switch from a domestic control structure to partnership may involve delineating the geographical sectors to be offered for tender to foreign companies, organizing the bidding rounds, and drawing up the final contracts, a process which can take several months or even years. However, a legislative change in control rights structures is usually transformed into a real change, which is why we concentrate on the date of the passing of the legislation rather than on the less precisely definable date of its full implementation. A borderline case is presented by Argentina between 1910-1963. The original executive decree of December 1907 excluded private concessions for the newly-discovered petroleum reserves, and therefore set up a majority domestic control structure. However, after Law 7059 of 1910, the deposits were little by little opened to exploitation by private (mostly foreign) investors, with the new national oil company being limited to the deposits on the shrinking Public Lands. We thus classify the control regime as mixed domestic-foreign from 1910-1963, even though several decrees passed between 1910-1955 tried to limit the activities of (foreign) private oil companies, with very little effect on the flourishing industry. There was therefore a certain discrepancy between formal regulation and practice on the ground, which persisted for several decades. It wasn't until nationalization in 1963 that all private oil companies' contracts were truly and finally declared null and void – a situation which however lasted only until 1966, when mixed domestic-foreign control was fully mandated by law (Solberg, 1979).

Data and sources

income per capita: natural logarithm of GDP per capita in 1990 international Geary-Khamis (PPP-adjusted) dollars. *Source*: Maddison (2006).

oil control rights regime: oil sector control rights variable categorized into majority domestic, majority foreign, or majority mixed domestic-foreign (i.e., partnership) control. *Source*: own coding.

oil reserves share: Share of total proved oil reserves (in million barrels) of sample in percent. Countries with less than 50 million barrels production were assigned reserves of 25 million (Thailand 1980-83, Vietnam 1987). The earliest available data on reserves are from 1935: at that time, the United States had around 63 percent of proved crude oil reserves. The U.S. oil reserves share drops to 21.8 percent in 1960, when data on Saudi Arabia becomes available, and to 8.6 percent in 1970, when oil reserves for most major current oil producers are known; in 2005, U.S. oil reserves made up for barely 2.5 percent of proved oil reserves, while Saudi Arabia alone had over 21 percent. *Sources*: BP (2010) for most countries since 1980; for earlier years Jenkins (1989); UK Institute of Geological Sciences (IGS) World Mineral Statistics (since 1970) and Statistical Summary of the Mineral Industry: World Production, Exports and Imports (since 1950s); Bundesanstalt für Geowissenschaften und Rohstoffe (2003 and 2007) conventional oil reserves for Albania, Bahrain, Bolivia, Cameroon, Chad, Cuba, France, Germany, Guatemala, Kazakhstan, Netherlands, Pakistan, Papua New Guinea, Philippines, Russia, Turkey, Turkmenistan, Ukraine (most 1995-2001 and 2005); Bundesanstalt für Geowissenschaften und Rohstoffe (1989) conventional oil reserves for years 1970, 1975, some countries also 1980, 1985-88.

oil price: average oil price over previous five-year period in constant 2009 US dollars. Source: BP (2010).

polity: revised Combined Polity Score. This variable modifies the combined annual POLITY score by applying a simple treatment, or "fix," to convert instances of "standardized authority scores" (i.e., -66, -77, and -88) to conventional polity scores, i.e., within the range -10 (strong autocracy) to +10 (strong democracy). *Source*: Polity IV database (Marshall et al., 2010).

executive constraints: measure of the decision rules that define the extent of institutionalized constraints on the decisionmaking powers of chief executives, whether individuals or collectivities. The measure ranges from 1 (unlimited authority) to 7 (executive parity or subordination). *Source*: Polity IV database (Marshall et al., 2010).

OPEC: dummy variable with value one in a period when a country is a member of the Organization of the Petroleum Exporting Countries. *Source*: own coding based on OPEC information on http://www.opec.org/opec_web/en/.

labor productivity: labor productivity per person employed in thousands of 1990 US$ (converted at Geary Khamis PPPs), average over previous five-year period. *Source*: The Conference Board Total Economy Database (2011).

years of schooling: Average years of total schooling of population over previous five-year period. *Source*: Barro Lee education dataset v. 2.0, 07/10 (Barro and Lee, 2010).

A.2 Additional table

Table 8: Extended Question 1: ownership structures and income levels, controlling for years of schooling

	(1)	(2)	(3)	(4)	(5)
partnership	0.099	0.112	0.127	0.096	0.111
	(1.19)	(1.37)	(1.61)	(1.16)	(1.38)
	[2.20]	[2.52]	[2.69]	[2.26]	[2.40]
foreign	0.101	0.137*	0.181**	0.102	0.145*
	(1.22)	(1.76)	(2.30)	(1.24)	(1.72)
	[1.45]	[1.90]	[3.02]	[1.49]	[2.58]
schooling years	0.12***	0.128***	0.126***	0.120***	0.118***
	(4.99)	(4.63)	(4.58)	(4.97)	(4.94)
	[4.23]	[4.10]	[4.29]	[4.22]	[4.47]
polity		-0.009	-0.008		
		(-1.54)	(-1.47)		
		(-2.13)	[-2.06]		
executive constraints				0.001*	0.001*
				(1.82)	(1.81)
				[1.47]	[1.26]
OPEC			0.450***		0.446***
			(4.62)		(4.31)
			[5.10]		[4.94]
constant	7.745	7.687	7.591	7.746	7.649
	(64.46)	(54.94)	(57.31)	(64.40)	(66.63)
	[40.19]	[36.88]	[41.06]	[40.51]	[45.68]
Observations	481	479	479	481	481
Countries	55	55	55	55	55
Ave obs per country	8.7	8.7	8.7	8.7	8.7
R^2 within	0.29	0.30	0.33	0.29	0.32

Notes: All countries in sample are included. *Domestic ownership* is base outcome. The dependent variable is (log) income per capita at start of five-year period. All covariates except the OPEC dummy are lagged by one period. Estimations are fixed effects (within) panel estimations. t-statistics for robust country-clustered standard errors are in parentheses, and for Driscoll-Kraay standard errors in square brackets. *, **, *** statistically significant at 10, 5, and 1 percent levels, respectively (refers to robust country-clustered standard errors).

B Appendix – Model with Confiscation

Nash Bargaining: derivation of (10)-(11). From (5) and (6), we have

$$\begin{aligned} S_f - D_f &= \ell_f - (q_x \chi_h (k_f) - s_h), \\ S_p - D_p &= \ell_p - (q_x \chi_h (k_p) + r_p k_p - s_h), \\ F_i - \Delta_i &= q_x \chi_i (k_i) - \Pi_0 - \ell_i \quad \text{for} \quad i = (f, p). \end{aligned}$$

Hence, defining

$$\Omega_f \equiv q_x \chi_h (k_f) - s_h \text{ and } \Omega_p \equiv q_x \chi_h (k_p) + r_p k_p - s_h, \tag{B.1}$$

we can write the Nash product in (9) for each regime $i = (f, p)$ as

$$(S_i - D_i) \cdot (F_i - \Delta_i) = (\ell_i - \Omega_i) \cdot (q_x \chi_i (k_i) - \Pi_0 - \ell_i)$$

and obtain the first-order condition for maximization

$$\ell_i^N = \frac{1}{2} \cdot (q_x \chi_i (k_i) - \Pi_0 + \Omega_i). \tag{B.2}$$

Plugging $\ell_i = \ell_i^N$ into the definitions of domestic income, Y_f and Y_p, in Table 1, we obtain

$$\begin{aligned} Y_f^N &= q_z z_f + r_f k_f + \frac{1}{2} \cdot \left(q_x \chi_f (k_f) - \Pi_0 + \Omega_f\right), \\ Y_p^N &= q_z z_p + \frac{1}{2} \cdot \left(q_x \chi_p (k_p) - \Pi_0 + \Omega_p\right), \end{aligned}$$

where we can substitute Ω_f and Ω_p from (B.1) to get

$$Y_f^N = q_z z_f + \frac{1}{2} \cdot \left[q_x \chi_f (k_f) + q_x \chi_h (k_f) - s_h - \Pi_0 + 2 r_f k_f\right], \tag{B.3}$$

$$Y_p^N = q_z z_p + \frac{1}{2} \cdot \left[q_x \chi_p (k_p) + q_x \chi_h (k_p) - s_h - \Pi_0 + r_p k_p\right]. \tag{B.4}$$

From (6), we have

$$D_f - \Delta_f = q_x \chi_h (k_f) - s_h - \Pi_0 + s_f + r_f k_f, \tag{B.5}$$

$$D_p - \Delta_p = q_x \chi_h (k_p) - s_h - \Pi_0 + s_p. \tag{B.6}$$

Substituting (B.5) and (B.6) in (B.3) and (B.4), respectively, we obtain

$$Y_i^N = q_z z_i + \frac{1}{2} \cdot [q_x \chi_i (k_i) + r_i k_i + D_i - \Delta_i - s_i]$$

in both cases $i = (f, p)$. Substituting $z_i \equiv \zeta (k_{\max} - k_i)$ in the above expression, we obtain (10). Next, we substitute $\ell_i = \ell_i^N$ from (B.2) into the definitions of profits, Π_f and Π_p, in Table 1, obtaining

$$\begin{aligned} \Pi_f^N &= q_x \chi_f (k_f) - s_f - r_f k_f - \frac{1}{2} \cdot \left[q_x \chi_f (k_f) - \Pi_0 + \Omega_f\right], \\ \Pi_p^N &= q_x \chi_p (k_p) - s_p - \frac{1}{2} \cdot \left[q_x \chi_p (k_p) - \Pi_0 + \Omega_p\right], \end{aligned}$$

where we can substitute Ω_f and Ω_p from (B.1) to get

$$\Pi_f^N = \frac{1}{2} \cdot \left[q_x \chi_f (k_f) - 2s_f - 2r_f k_f + \Pi_0 - q_x \chi_h (k_f) + s_h \right], \tag{B.7}$$

$$\Pi_p^N = \frac{1}{2} \cdot \left[q_x \chi_p (k_p) - 2s_p + \Pi_0 - q_x \chi_h (k_p) - r_p k_p + s_h \right]. \tag{B.8}$$

Plugging (B.5) and (B.6) in (B.7) and (B.8), respectively, we obtain result (11) in both cases $i = (f, p)$.

Proof of Proposition 1. Under Foreign Control, ex-post profits Π_f^N are given by (11) and can be re-written as in (B.7) above. Maximizing (B.7) with respect to k_f yields the first order condition (12). Under Partnership, ex-post income Y_p^N is given by (10) and can be re-written as in (B.4), or equivalently,

$$Y_p^N = q_z \zeta (k_{\max} - k_p) + \frac{1}{2} \cdot \left[q_x \chi_p (k_p) + q_x \chi_h (k_p) - s_h - \Pi_0 + r_p k_p \right]. \tag{B.9}$$

Maximizing (B.9) with respect to k_p yields the first order condition (13) and thereby (14). ■

Proof of Proposition 2. From (8), (B.3) and (B.4), equilibrium incomes read

$$Y_h^\star = q_z \rho (k_{\max} - k_h^\star) + q_x \chi_h (k_h^\star) - s_h, \tag{B.10}$$

$$Y_f^\star = q_z \rho (k_{\max} - k_f^\star) + \frac{1}{2} \cdot \left[q_x \chi_f (k_f^\star) + q_x \chi_h (k_f^\star) - s_h - \Pi_0 + 2 r_f^\star k_f^\star \right], \tag{B.11}$$

$$Y_p^\star = q_z \rho \left(k_{\max} - k_p^\star\right) + \frac{1}{2} \cdot \left[q_x \chi_p \left(k_p^\star\right) + q_x \chi_h \left(k_p^\star\right) - s_h - \Pi_0 + r_p^\star k_p^\star \right]. \tag{B.12}$$

From (7), (12) and (14), the rents paid by the commodity sector equal

$$r_h^\star k_h^\star = \beta \cdot q_x \psi \left(k_h^\star\right)^\beta, \tag{B.13}$$

$$r_f^\star k_f^\star = \frac{1}{2} (\varphi_2 - \varphi_1) \cdot \beta \cdot q_x \psi (k_f^\star)^\beta, \tag{B.14}$$

$$r_p^\star k_p^\star = (\varphi_2 + \varphi_1) \cdot \beta \cdot q_x \psi \left(k_p^\star\right)^\beta. \tag{B.15}$$

Combining (B.13)-(B.15) with the demand for local capital of the traditional sector (4), and using (2), we have the equilibrium levels

$$k_h^\star = \left[(q_x/q_z) (\beta/\rho) \psi \cdot \varphi_1 \right]^{\frac{1}{1-\beta}}, \tag{B.16}$$

$$k_f^\star = \left[(q_x/q_z) (\beta/\rho) \psi \cdot \frac{1}{2} (\varphi_2 - \varphi_1) \right]^{\frac{1}{1-\beta}}, \tag{B.17}$$

$$k_p^\star = \left[(q_x/q_z) (\beta/\rho) \psi \cdot (\varphi_2 + \varphi_1) \right]^{\frac{1}{1-\beta}}. \tag{B.18}$$

From (B.7) and (B.8), the equilibrium profits of the foreign firms read

$$\Pi_f^\star = \frac{1}{2} \cdot \left[q_x \chi_f (k_f^\star) - 2s_f - 2 r_f^\star k_f^\star + \Pi_0 - q_x \chi_h (k_f^\star) + s_h \right], \tag{B.19}$$

$$\Pi_p^\star = \frac{1}{2} \cdot \left[q_x \chi_p \left(k_p^\star\right) - 2s_p - r_p^\star k_p^\star + \Pi_0 - q_x \chi_h \left(k_p^\star\right) + s_h \right]. \tag{B.20}$$

Expressions (B.17)-(B.18) imply $k_p^\star > k_f^\star$ and, by technologies (2), this implies $x_p^\star > x_f^\star$. The remainder of the proof proceeds in three steps: (i) ranking domestic incomes, (ii) ranking foreign firm's profits, (iii) deriving the loci β_0 and β_1 as increasing functions of γ.

(i) Ranking Domestic Income Levels. By (4), condition $r_i^\star k_i^\star = q_z \rho k_i^\star$ holds in any regime i. Hence, using the technologies (2), equations (B.11) and (B.12) imply

$$\begin{aligned} Y_f^\star &= q_z \rho k_{\max} + \tfrac{1}{2} \cdot \left[q_x \left(\varphi_2 + \varphi_1 \right) \psi (k_f^\star)^\beta - s_h - \Pi_0 \right], \\ Y_p^\star &= q_z \rho k_{\max} + \tfrac{1}{2} \cdot \left[q_x \left(\varphi_2 + \varphi_1 \right) \psi \left(k_p^\star \right)^\beta - r_p^\star k_p^\star - s_h - \Pi_0 \right], \end{aligned} \tag{B.21}$$

from which, exploiting (B.15), we get

$$Y_p^\star - Y_f^\star = \frac{1}{2} q_x \left(\varphi_2 + \varphi_1 \right) \psi \cdot \left[(1-\beta) \left(k_p^\star \right)^\beta - (k_f^\star)^\beta \right]. \tag{B.22}$$

From (B.22), the gap $Y_p^\star - Y_f^\star$ is positive (negative) when the term in square brackets, or equivalently, the logarithm of the relevant ratio, $\ln[(1-\beta)(k_p^\star / k_f^\star)^\beta]$, is positive (negative). Using (B.17)-(B.18) to substitute for capital levels, we have

$$\ln[(1-\beta)(k_p^\star / k_f^\star)^\beta] = \ln(1-\beta) + \frac{\beta}{1-\beta} \ln \left(2 \frac{\varphi_2 + \varphi_1}{\varphi_2 - \varphi_1} \right),$$

which is positive if and only if

$$(1-\beta) \ln (1-\beta) + \beta \ln \left(2 \frac{\varphi_2 + \varphi_1}{\varphi_2 - \varphi_1} \right) > 0. \tag{B.23}$$

Defining the productivity-gap index $\gamma \equiv \varphi_2 / \varphi_1 > 1$, we can re-write inequality (B.23) as

$$\Xi_1 (\beta; \gamma) \equiv \beta \ln \left(2 \cdot \frac{\gamma + 1}{\gamma - 1} \right) > \Xi_2 (\beta) \equiv - \ln (1-\beta)^{1-\beta}. \tag{B.24}$$

Holding γ fixed, functions $\Xi_1 (\beta; \gamma)$ and $\Xi_2 (\beta)$ are graphically represented in Figure A1, graph (a). In particular, holding γ fixed, function $\Xi_1 (\beta; \gamma)$ is an increasing straight line satisfying

$$\lim_{\beta \to 0} \Xi_1 (\beta; \gamma) = 0 \text{ and } \frac{\partial}{\partial \beta} \Xi_1 (\beta; \gamma) = \ln \left(2 \cdot \frac{\gamma + 1}{\gamma - 1} \right), \tag{B.25}$$

whereas $\Xi_2 (\beta)$ is a hump-shaped function satisfying

$$\begin{aligned} &\lim_{\beta \to 0} \Xi_2 (\beta) = 0, && \lim_{\beta \to 1} \Xi_2 (\beta) = 0, \\ &\tfrac{\partial}{\partial \beta} \Xi_2 (\beta) = \ln (1-\beta) + 1, && \tfrac{\partial^2}{\partial \beta^2} \Xi_2 (\beta) = - (1-\beta)^{-1} < 0, \\ &\lim_{\beta \to 0} \tfrac{\partial}{\partial \beta} \Xi_2 (\beta) = 1, && \lim_{\beta \to 0} \tfrac{\partial^2}{\partial \beta^2} \Xi_2 (\beta) = -1. \end{aligned} \tag{B.26}$$

Properties (B.25) and (B.26) imply that, if $\Xi_1 (\beta)$ is steeper than $\Xi_2 (\beta)$ in $\beta \to 0$, then the two functions $\Xi_1 (\beta; \gamma)$ and $\Xi_2 (\beta)$ do not cross: we would have $\Xi_1 (\beta; \gamma) > \Xi_2 (\beta)$ for any $\beta \in (0,1)$ and, hence, $Y_p^\star > Y_f^\star$ for any $\beta \in (0,1)$. From (B.25) and (B.26), having

$$\lim_{\beta \to 0} \frac{\partial}{\partial \beta} \Xi_1 (\beta; \gamma) > \lim_{\beta \to 0} \frac{\partial}{\partial \beta} \Xi_2 (\beta)$$

requires satisfying $\ln\left(2 \cdot \frac{\gamma+1}{\gamma-1}\right) > 1$, that is, requires satisfying

$$\gamma < \frac{e+2}{e-2} \equiv \gamma_0 \approx 6.7. \tag{B.27}$$

Hence, satisfying the inequality $\gamma < \gamma_0$ ensures that $Y_p^\star > Y_f^\star$ for any $\beta \in (0,1)$. Now suppose that $\gamma > \gamma_0$. In this case,

$$\lim_{\beta \to 0} \frac{\partial}{\partial \beta} \Xi_1(\beta; \gamma) < \lim_{\beta \to 0} \frac{\partial}{\partial \beta} \Xi_2(\beta)$$

implies that there exists an intersection $\Xi_1(\beta;\gamma) = \Xi_2(\beta)$ such that $\Xi_1(\beta;\gamma)$ cuts $\Xi_2(\beta)$ from below, as shown in Figure A1 (a). Consequently, when $\gamma > \gamma_0$, there exists a unique value of β, which we denote by $\beta_0 \in (0,1)$, such that

$$\Xi_1(\beta;\gamma) = \Xi_2(\beta) \text{ for } \beta = \beta_0, \text{ and } \Xi_1(\beta;\gamma) \lesseqgtr \Xi_2(\beta) \text{ for } \beta \lesseqgtr \beta_0.$$

This implies that, when $\gamma > \gamma_0$, we have $Y_p^\star > Y_f^\star$ for $\beta > \beta_0$, and $Y_p^\star \leqslant Y_f^\star$ for $\beta \leqslant \beta_0$.

(ii) Ranking Foreign Firm's Profits. Using the technologies (2), equations (B.19) and (B.20) imply

$$\begin{aligned} \Pi_f^\star &= \tfrac{1}{2} \cdot \left[q_x (\varphi_2 - \varphi_1) \psi (k_f^\star)^\beta - 2 r_f^\star k_f^\star - 2 s_f + \Pi_0 + s_h \right], \\ \Pi_p^\star &= \tfrac{1}{2} \cdot \left[q_x (\varphi_2 - \varphi_1) \psi \left(k_p^\star\right)^\beta - r_p^\star k_p^\star - 2 s_p + \Pi_0 + s_h \right], \end{aligned} \tag{B.28}$$

where, setting $s_f = s_p$ and using (B.14) and (B.15) to eliminate $r_i^\star k_i^\star$, we get

$$\Pi_f^\star - \Pi_p^\star = \frac{1}{2} q_x \psi \left\{ (1-\beta)(\varphi_2 - \varphi_1)(k_f^\star)^\beta - [(\varphi_2 - \varphi_1) - \beta(\varphi_2 + \varphi_1)] \left(k_p^\star\right)^\beta \right\}. \tag{B.29}$$

Equation (B.29) already contains a critical condition on parameters: if $\beta > \frac{\varphi_2 - \varphi_1}{\varphi_2 + \varphi_1}$, the term in square brackets is negative, implying $\Pi_f^\star > \Pi_p^\star$. Exploiting the definition $\gamma \equiv \varphi_2/\varphi_1 > 1$, we can re-write this result as

$$\beta > \bar{\beta}(\gamma) \equiv \frac{\gamma - 1}{\gamma + 1} \Longrightarrow \Pi_f^\star > \Pi_p^\star. \tag{B.30}$$

Bearing result (B.30) in mind, the remainder of the proof focuses on the case $\beta < \bar{\beta}(\gamma)$. When $\beta < \bar{\beta}(\gamma)$, the profit gap $\Pi_f^\star - \Pi_p^\star$ is positive (negative) if and only if the term in square brackets, or equivalently, the logarithm of the relevant ratio

$$\ln\left[\frac{(1-\beta)(\varphi_2 - \varphi_1)}{(\varphi_2 - \varphi_1) - \beta(\varphi_2 + \varphi_1)} \left(\frac{k_f^\star}{k_p^\star} \right)^\beta \right], \tag{B.31}$$

is positive (negative). Using (B.17)-(B.18) to substitute for capital levels, and exploiting the definitions of γ and $\bar{\beta}(\gamma)$, expression (B.31) becomes

$$\ln\left[\frac{(1-\beta)(\varphi_2 - \varphi_1)}{(\varphi_2 - \varphi_1) - \beta(\varphi_2 + \varphi_1)} \left(\frac{\varphi_2 - \varphi_1}{2(\varphi_2 + \varphi_1)} \right)^{\frac{\beta}{1-\beta}} \right] = \ln\left\{ \bar{\beta}(\gamma) \cdot \frac{1-\beta}{\bar{\beta}(\gamma) - \beta} \cdot \left[\frac{1}{2} \bar{\beta}(\gamma) \right]^{\frac{\beta}{1-\beta}} \right\},$$

which is positive if and only if

$$\Xi_3(\beta;\gamma) \equiv \ln\left(\bar{\beta}(\gamma)\right) + (1-\beta)\ln\left(\frac{1-\beta}{\bar{\beta}(\gamma)-\beta}\right) > \Xi_4(\beta) \equiv \beta\ln(2). \tag{B.32}$$

Holding γ fixed (which implies that $\bar{\beta}(\gamma)$ is fixed), function $\Xi_4(\beta)$ is an increasing straight line satisfying

$$\lim_{\beta\to 0}\Xi_4(\beta) = 0 \text{ and } \frac{\partial}{\partial\beta}\Xi_4(\beta) = \ln(2), \tag{B.33}$$

whereas function $\Xi_3(\beta;\gamma)$ is an increasing convex function displaying

$$\begin{aligned}
&\lim_{\beta\to 0}\Xi_3(\beta;\gamma) = 0, && \lim_{\beta\to\bar{\beta}(\gamma)}\Xi_3(\beta;\gamma) = +\infty, \\
&\tfrac{\partial}{\partial\beta}\Xi_3(\beta;\gamma) = \tfrac{1-\bar{\beta}(\gamma)}{\bar{\beta}(\gamma)-\beta} - \ln\left(\tfrac{1-\beta}{\bar{\beta}(\gamma)-\beta}\right), && \tfrac{\partial^2}{\partial\beta^2}\Xi_3(\beta;\gamma) = \tfrac{1+\beta}{\left(\bar{\beta}(\gamma)-\beta\right)^2} + \tfrac{1}{1-\beta} > 0 \\
&\lim_{\beta\to 0}\tfrac{\partial}{\partial\beta}\Xi_3(\beta;\gamma) = \tfrac{1-\bar{\beta}(\gamma)}{\bar{\beta}(\gamma)} + \ln\bar{\beta}(\gamma) > 0, && \lim_{\beta\to\bar{\beta}(\gamma)}\tfrac{\partial}{\partial\beta}\Xi_3(\beta;\gamma) = +\infty.
\end{aligned} \tag{B.34}$$

Functions $\Xi_3(\beta;\gamma)$ and $\Xi_4(\beta)$ are graphically represented in Figure A1 (d). Properties (B.33) and (B.34) imply that, if $\Xi_3(\beta;\gamma)$ is steeper than $\Xi_4(\beta)$ in $\beta \to 0$, then the two functions $\Xi_3(\beta;\gamma)$ and $\Xi_4(\beta)$ do not cross: we would have $\Xi_3(\beta;\gamma) > \Xi_4(\beta)$ for any $\beta \in \left(0,\bar{\beta}(\gamma)\right)$ and, hence, $\Pi_f^\star > \Pi_p^\star$ for any $\beta \in \left(0,\bar{\beta}(\gamma)\right)$. From (B.33) and (B.34), having

$$\lim_{\beta\to 0}\frac{\partial}{\partial\beta}\Xi_3(\beta;\gamma) > \lim_{\beta\to 0}\frac{\partial}{\partial\beta}\Xi_4(\beta)$$

requires satisfying $\frac{1-\bar{\beta}(\gamma)}{\bar{\beta}(\gamma)} + \ln\bar{\beta}(\gamma) > \ln(2)$, that is, requires satisfying

$$\underbrace{\frac{\gamma+1}{\gamma-1} + \ln\left(\frac{\gamma-1}{\gamma+1}\right)}_{\equiv\Phi(\gamma)} > 1 + \ln(2). \tag{B.35}$$

The right hand side of (B.35) is independent of γ whereas the left hand side of (B.35), denoted as $\Phi(\gamma)$, is a decreasing hyperbula satisfying $\lim_{\gamma\to 1}\Phi(\gamma) = \infty$, $\lim_{\gamma\to\infty}\Phi(\gamma) = 1$, and $\Phi'(\gamma) < 0$ for each $\gamma \in (1,\infty)$. Consequently, there exists a unique critical level of γ, which we denote by $\gamma_1 \in (1,\infty)$, such that

$$\Phi(\gamma_1) = 1 + \ln(2) \quad \text{and} \quad \Phi(\gamma_1) \gtreqless 1 + \ln(2) \text{ for } \gamma \lesseqgtr \gamma_1. \tag{B.36}$$

Result (B.36) is graphically represented in Figure A1 (c). Note that the critical level γ_1 is exclusively determined by the condition $\Phi(\gamma_1) = 1 + \ln(2)$ and its value only depends on the elasticity of the logarithmic curve. We can thus denote it as $\gamma_1 \equiv \Gamma(e)$. In numerical terms, the value of $\gamma_1 \equiv \Gamma(e)$ is determined graphically in Figure A1 (c) and is equal to

$$\gamma_1 \equiv \Gamma(e) \approx 2.2.$$

Result (B.36) implies that, for any $\gamma < \gamma_1$, inequality (B.35) is satisfied and, consequently, $\Pi_f^\star > \Pi_p^\star$ must hold:

$$\gamma < \gamma_1 \Longrightarrow \Phi(\gamma) > 1 + \ln(2) \Longrightarrow \lim_{\beta \to 0} \frac{\partial}{\partial \beta} \Xi_3(\beta;\gamma) > \lim_{\beta \to 0} \frac{\partial}{\partial \beta} \Xi_4(\beta) \Longrightarrow ...$$
$$\Longrightarrow \Xi_3(\beta;\gamma) > \Xi_4(\beta) \text{ for any } \beta \in \left(0, \bar{\beta}(\gamma)\right) \Longrightarrow \Pi_f^\star > \Pi_p^\star \text{ for any } \beta \in \left(0, \bar{\beta}(\gamma)\right) \quad \text{(B.37)}$$

Instead, if $\gamma > \gamma_1$,we have $\Phi(\gamma) < 1 + \ln(2)$. In this case, $\Xi_3(\beta;\gamma)$ is less steep than $\Xi_4(\beta)$ in $\beta \to 0$ and there exists a unique intersection between the functions $\Xi_3(\beta;\gamma)$ and $\Xi_4(\beta)$. This is shown in Figure A1 (d): for a given value of $\gamma > \gamma_1$, there exists a unique value of β, which we denote by $\beta_1 \in \left(0, \bar{\beta}(\gamma)\right)$, such that $\Xi_3(\beta_1;\gamma) = \Xi_4(\beta_1)$. Since function $\Xi_3(\beta;\gamma)$ cuts $\Xi_4(\beta)$ from below in $\beta = \beta_1$, it follows that

$$\gamma > \gamma_1 \Longrightarrow \left\{ \begin{array}{c} \Xi_3(\beta;\gamma) < \Xi_4(\beta) \text{ for any } \beta \in (0, \beta_1) \\ \Xi_3(\beta;\gamma) \geqslant \Xi_4(\beta) \text{ for any } \beta \in \left(\beta_1, \bar{\beta}(\gamma)\right) \end{array} \right\} \Longrightarrow ...$$
$$... \Longrightarrow \left\{ \begin{array}{c} \Pi_f^\star < \Pi_p^\star \text{ for any } \beta \in (0, \beta_1) \\ \Pi_f^\star \geqslant \Pi_p^\star \text{ for any } \beta \in \left(\beta_1, \bar{\beta}(\gamma)\right) \end{array} \right\}. \quad \text{(B.38)}$$

Combining results (B.30), (B.37) and (B.38), we obtain the full ranking of foreign firm's profits. Specifically, combining (B.30) and (B.37), we have that $\gamma < \gamma_1$ implies $\Pi_f^\star > \Pi_p^\star$ for any $\beta \in (0, 1)$. Combining (B.30) and (B.38), we have that, if $\gamma > \gamma_1$, there exists a critical level $\beta_1 \in \left(0, \frac{\gamma-1}{\gamma+1}\right)$ such that $\Pi_f^\star < \Pi_p^\star$ when $0 < \beta < \beta_1$, and $\Pi_f^\star > \Pi_p^\star$ when $\beta_1 < \beta < 1$.

(iii) Deriving the loci β_0 and β_1 as increasing functions of γ. First consider the $\beta_0(\gamma)$ locus. For given γ, the critical level $\beta_0(\gamma)$ is determined by condition $\Xi_1(\beta;\gamma) = \Xi_2(\beta)$. As shown in Figure A1 (b), an increase in γ leaves $\Xi_2(\beta)$ unaffected whereas the straight line $\Xi_1(\beta;\gamma)$ rotates clockwise around the origin $\beta = 0$. As a consequence,

$$\beta_0(\gamma) \text{ is strictly increasing in } \gamma \text{ for any } \gamma \in (1, \infty). \quad \text{(B.39)}$$

However, the rotation of $\Xi_1(\beta;\gamma)$ exhibits decreased intensity as γ becomes high. Letting $\gamma \to \infty$, we have

$$\lim_{\gamma \to \infty} \Xi_1(\beta;\gamma) \equiv \beta \ln(2)$$

so that the condition $\Xi_1(\beta;\gamma) = \Xi_2(\beta)$ determining β_0 reduces (asymptotically as $\gamma \to \infty$) to:

$$\lim_{\gamma \to \infty} \beta_0 = \arg\text{solve} \left\{ \ln\left[(2)^{\beta_0} (1 - \beta_0)^{(1-\beta_0)} \right] = 0 \right\} = 0.5. \quad \text{(B.40)}$$

Results (B.39)-(B.40) imply that the critical level β_0 can be represented as an increasing locus $\beta_0(\gamma)$ bounded from above by 0.5. The locus is graphically represented in Figure 1 for the range $\gamma \in (0, 10)$. The enlarged picture with $\gamma \in (0, 100)$ is reported in Figure A1 (f).

Next consider the $\beta_1(\gamma)$ locus, with the help of Figure A1 (e). For given γ, the critical level $\beta_1(\gamma)$ is determined by condition $\Xi_3(\beta;\gamma) = \Xi_4(\beta)$. An increase in γ leaves $\Xi_4(\beta)$ unaffected. Instead, the effect of an increase in γ on $\Xi_3(\beta;\gamma)$ is twofold. First, the vertical asymptote $\bar{\beta}(\gamma)$ shifts to the right; second, the convex curve $\Xi_3(\beta;\gamma)$ rotates clockwise around the origin $\beta = 0$. Formally, from (B.30) and (B.32), we have

$$\begin{aligned} \bar{\beta}'(\gamma) &\equiv \partial\bar{\beta}(\gamma)/\partial\gamma = 2\cdot(\gamma+1)^{-2} > 0, \\ \frac{\partial}{\partial\gamma}\Xi_3(\beta;\gamma) &= -\frac{\beta\cdot\bar{\beta}'(\gamma)}{\left(\bar{\beta}(\gamma)-\beta\right)\cdot\bar{\beta}(\gamma)} < 0. \end{aligned}$$

As shown in Figure A1 (e), these effects imply that, following an increase in γ, the intersection point $\beta_1(\gamma)$ shifts to the right, that is,

$$\beta_1(\gamma) \text{ is strictly increasing in } \gamma \text{ for any } \gamma \in (1,\infty). \tag{B.41}$$

Moreover, following an increase in γ, the intersection point $\beta_1(\gamma)$ becomes closer to the asymptote $\bar{\beta}(\gamma)$. Since $\lim_{\gamma\to\infty}\bar{\beta}(\gamma) = 1$, we thus obtain

$$\lim_{\gamma\to\infty}\beta_1(\gamma) = 1. \tag{B.42}$$

Results (B.41)-(B.42) imply that the critical level β_1 can be represented as an increasing locus $\beta_1(\gamma)$ bounded from above by 1. The locus is graphically represented in Figure 1 for the range $\gamma \in (0,10)$. The enlarged picture with $\gamma \in (0,100)$ is reported in Figure A1 (f). ■

Further details on Figure 1. The loci $\beta_0(\gamma)$ and $\beta_1(\gamma)$ appearing in Figure 1 originate from two simple algorithms that calculate

$$\begin{aligned} &\beta_0(\gamma) \equiv \arg\text{solve}\left\{\Xi_1(\beta;\gamma) = \Xi_2(\beta)\right\} \text{ and} \\ &\beta_1(\gamma) \equiv \arg\text{solve}\left\{\Xi_3(\beta;\gamma) = \Xi_4(\beta)\right\} \end{aligned} \tag{B.43}$$

for each value of $\gamma \in (0,10)$. The shape of both loci is characterized analytically in step (iii) of the Proof of Proposition 2 above. The intuition for these results is as follows.

Concerning the $\beta_0(\gamma)$ locus, it follows from (B.22) that the income gap $Y_p^\star - Y_f^\star$ is positive when $(1-\beta)(k_p^\star/k_f^\star)^\beta > 1$. Here, $(1-\beta)$ represents the negative "rent effect", and $(k_p^\star/k_f^\star)^\beta$ represents the positive "accumulation effect" of Partnership relative to Foreign Control (see the main text, below Proposition 2). Now, the equilibrium conditions (B.17)-(B.18) imply that $(k_p^\star/k_f^\star)^\beta$ decreases with γ and increases logarithmically with β. Consequently, a sufficiently high γ combined with a sufficiently low β yield $(k_p^\star/k_f^\star)^\beta < (1-\beta)^{-1}$ and therefore $Y_p^\star < Y_f^\star$.

Concerning the $\beta_1(\gamma)$ locus, the intuition is twofold. On the one hand, an increase in γ increases the rental cost born by the foreign firm more than it increases commodity production under Foreign Control relative to Partnership; this implies $\Pi_p^\star > \Pi_f^\star$ for high values of γ.[35] On the other hand, an increase in β reduces the joint surplus more under Partnership

[35] To see this formally, note that, from (B.17)-(B.18), the equilibrium output ratio is $x_f^\star/x_p^\star = \left(\frac{1}{2}\cdot\frac{\gamma-1}{\gamma+1}\right)^{\frac{\beta}{1-\beta}}$, whereas the ratio between the shares of investment costs born ex-post by the foreign firm's (that reduce ex-post profits) is $(2r_f^\star k_f^\star)/(r_p^\star k_p^\star) = \frac{\gamma-1}{\gamma+1}\left(\frac{1}{2}\cdot\frac{\gamma-1}{\gamma+1}\right)^{\frac{\beta}{1-\beta}}$. Consequently, an increase in γ yields an increase in $(2r_f^\star k_f^\star)/(r_p^\star k_p^\star)$ that more than offsets the increase in $(x_f^\star/x_p^\star)$, thus favoring profits under Partnership relative to profits under Foreign Control.

than under Foreign Control because the State (foreign firm) overinvests (underinvest) in local capital, and this implies $\Pi_p^\star > \Pi_f^\star$ for low values of β.[36]

Proof of Proposition 3. The proof hinges on the fact that the $\beta_0(\gamma)$ locus always lies below the $\beta_1(\gamma)$ locus in the (γ, β) plane – that is, $\beta_1(\gamma'') > \beta_0(\gamma'')$ holds for any $\gamma'' \in (1, \infty)$. The proof is as follows. Substituting the definitions of (Ξ_1,Ξ_2,Ξ_3,Ξ_4) from (B.24) and (B.32) into expressions (B.43), the two loci $\beta_0(\gamma)$ and $\beta_1(\gamma)$ are determined by

$$\beta_0(\gamma) \equiv \arg\text{solve}\left\{\beta \ln(2) = \ln\left[\bar{\beta}(\gamma)\right] - \ln\left[\bar{\beta}(\gamma) \cdot (1-\beta)\right]^{1-\beta}\right\}, \quad \text{(B.44)}$$

$$\beta_1(\gamma) \equiv \arg\text{solve}\left\{\beta \ln(2) = \ln\left[\bar{\beta}(\gamma)\right] + \ln\left[(1-\beta) / \left(\bar{\beta}(\gamma) - \beta\right)\right]^{1-\beta}\right\}. \quad \text{(B.45)}$$

Given the properties (B.39)-(B.40) and (B.41)-(B.42), a sufficient condition for having $\beta_1(\gamma'') > \beta_0(\gamma'')$ for any $\gamma'' \in (1, \infty)$ is that $\beta_0(\gamma)$ and $\beta_1(\gamma)$ do not exhibit any intersection. This can be proved by contradiction: suppose that $\beta_0(\gamma) = \beta_0(\gamma)$. From (B.44)-(B.45), this would require that

$$-\ln\left[\bar{\beta}(\gamma) \cdot (1-\beta)\right]^{1-\beta} = \ln\left[(1-\beta) / \left(\bar{\beta}(\gamma) - \beta\right)\right]^{1-\beta}, \quad \text{(B.46)}$$

which is possible if and only if γ is such that

$$\gamma = \breve{\gamma} \Longrightarrow \bar{\beta}(\gamma) = \bar{\beta}(\breve{\gamma}) \equiv \frac{\beta}{1-(1-\beta)^2}. \quad \text{(B.47)}$$

However, when $\gamma = \breve{\gamma}$, both the equalities inside the curly brackets in (B.44)-(B.45) determining $\beta_0(\gamma)$ and $\beta_1(\gamma)$ are violated: substituting $\bar{\beta}(\gamma) = \frac{\beta}{1-(1-\beta)^2}$ in either equality we obtain

$$\ln(2) = \frac{1}{\beta} \ln \frac{\beta^\beta}{(1-\beta)^{1-\beta}}, \quad \text{(B.48)}$$

which is absurd because $\ln(2) > \frac{1}{\beta} \ln \frac{\beta^\beta}{(1-\beta)^{1-\beta}}$ for any $\beta \in (0,1)$.[37] The impossibility of satisfying (B.48) implies that the loci $\beta_0(\gamma)$ and $\beta_1(\gamma)$ do not exhibit any intersection. Given the properties (B.39)-(B.40) and (B.41)-(B.42), it follows that $\beta_1(\gamma'') > \beta_0(\gamma'')$ holds for any $\gamma'' \in (1, \infty)$. Consequently, there is no region of the parameter space (γ, β) in which $Y_p^\star < Y_f^\star$ and $\Pi_p^\star < \Pi_f^\star$ hold symultaneously. The proof that the parametrization sets (A, B, C) are non-empty follows immediately from Figures 1 and A1 (f). ■

Derivation of result (15). The proof consists of four steps, numbered (i)-(iv).

[36] To see this formally, note that, from (B.29), the profit gap $\Pi_f^\star - \Pi_p^\star$ is positive if and only if $\left[\frac{(\varphi_2-\varphi_1)-\beta(\varphi_2-\varphi_1)}{(\varphi_2-\varphi_1)-\beta(\varphi_2+\varphi_1)}\right] \cdot \frac{x_f^\star}{x_p^\star} > 1$, where the term in square brackets is the ratio between the shares of joint surplus received by the foreign firm. An increase in the capital share β increases the term in square brackets – that is, reduces ex-post profits more under Partnership than under Foreign Control – because $(\varphi_2 + \varphi_1) > (\varphi_2 - \varphi_1)$, where the factor $(\varphi_2 + \varphi_1)$ comes from the bargaining-power term that boosts investment under Partnership in eq.(13) while the factor $(\varphi_2 - \varphi_1)$ comes from the bargaining-power term that reduces investment under Foreign Control in eq. (12).

[37] Specifically, the right hand side of (B.48) is a hump-shaped function β over $\beta \in (0,1)$; it reaches a maximum in $\beta \approx 0.8$, where it takes the value $\frac{1}{\beta} \ln \frac{\beta^\beta}{(1-\beta)^{1-\beta}} \approx 0.18$, which is strictly less than $\ln(2) \approx 0.69$.

(i) Derivation of the upper bound Π_0^{yp}. From(B.10) and (B.12), using the technologies (3) and (2) and the equilibrium conditions $r_i = q_z\rho$, we obtain the income gap

$$Y_p^\star - Y_h^\star = \frac{1}{2}\cdot\left[q_x\psi\left(\varphi_2+\varphi_1\right)\left(k_p^\star\right)^\beta - r_p^\star k_p^\star\right] - \left[q_x\psi\varphi_1\left(k_h^\star\right)^\beta - r_h^\star k_h^\star\right] - \frac{1}{2}\left(\Pi_0 - s_h\right),$$

where we can substitute $r_h^\star k_h^\star$ and $r_p^\star k_p^\star$ by (B.13) and (B.15), obtaining

$$Y_p^\star - Y_h^\star = q_x\psi\left(1-\beta\right)\cdot\left[\frac{1}{2}\left(\varphi_2+\varphi_1\right)\left(k_p^\star\right)^\beta - \varphi_1\left(k_h^\star\right)^\beta\right] - \frac{1}{2}\left(\Pi_0 - s_h\right). \tag{B.49}$$

From (B.16) and (B.18), we have $k_h^\star = \left[\varphi_1/\left(\varphi_2+\varphi_1\right)\right]^{\frac{1}{1-\beta}} k_p^\star$, which can be substituted in (B.49), along with $k_p^\star$ from (B.18), to obtain

$$Y_p^\star - Y_h^\star = q_x\psi\left(1-\beta\right)\left[\left(q_x/q_z\right)\left(\beta/\rho\right)\psi\right]^{\frac{\beta}{1-\beta}}\varphi_1^{\frac{1}{1-\beta}}\cdot\frac{1}{2}\left[\left(\gamma+1\right)^{\frac{1}{1-\beta}}-2\right] - \frac{1}{2}\left(\Pi_0 - s_h\right). \tag{B.50}$$

This implies that the State prefers Partnership to Home Control if and only if

$$\Pi_0 < \Pi_0^{yp} \equiv s_h + \left\{q_x\psi\left(1-\beta\right)\left[\left(q_x/q_z\right)\left(\beta/\rho\right)\psi\right]^{\frac{\beta}{1-\beta}}\varphi_1^{\frac{1}{1-\beta}}\right\}\cdot\left[\left(\gamma+1\right)^{\frac{1}{1-\beta}}-2\right], \tag{B.51}$$

that is, if and only if

$$\Pi_0 < \Pi_0^{yp} \equiv s_h + Q\cdot\left[\left(\gamma+1\right)^{\frac{1}{1-\beta}}-2\right], \tag{B.52}$$

where Q is defined as the term in curly brackets in (B.51),

$$Q \equiv q_x\psi\left(1-\beta\right)\left[\left(q_x/q_z\right)\left(\beta/\rho\right)\psi\right]^{\frac{\beta}{1-\beta}}\varphi_1^{\frac{1}{1-\beta}}. \tag{B.53}$$

(ii) Derivation of the upper bound $\Pi_0^{\pi p}$. From (B.20) – or equivalently, the second expression in (B.28), the foreign firm prefers Partnership to no initial contract, $\Pi_p^\star > \Pi_0$, if and only if

$$s_h - 2s_p + q_x\psi\left(\varphi_2-\varphi_1\right)\left(k_p^\star\right)^\beta - r_p^\star k_p^\star > \Pi_0,$$

where we can substitute $r_p^\star k_p^\star$ from (B.15), and $k_p^\star$ from (B.18), to obtain

$$s_h - 2s_p + q_x\psi\left[\left(q_x/q_z\right)\left(\beta/\rho\right)\psi\right]^{\frac{\beta}{1-\beta}}\varphi_1^{\frac{1}{1-\beta}}\left[\gamma-1-\beta\left(\gamma+1\right)\right]\left(\gamma+1\right)^{\frac{\beta}{1-\beta}} > \Pi_0,$$

that is, $\Pi_p^\star > \Pi_0$ if and only if

$$\Pi_0 < \Pi_0^{\pi p} \equiv s_h - 2s_p + Q\cdot\left[\frac{\left(\gamma-1\right)\left(\gamma+1\right)^{\frac{\beta}{1-\beta}}}{1-\beta} - \frac{\beta\left(\gamma+1\right)^{\frac{1}{1-\beta}}}{1-\beta}\right]. \tag{B.54}$$

(iii) Derivation of the upper bound Π_0^{yf}. From (B.11) and (B.12), using the technologies (3) and (2) and the equilibrium conditions $r_i = q_z\rho$, we obtain the income gap

$$Y_f^\star - Y_h^\star = q_x\psi\left[\frac{1}{2}\left(\varphi_2+\varphi_1\right)\left(k_f^\star\right)^\beta - \left(1-\beta\right)\varphi_1\left(k_h^\star\right)^\beta\right] - \frac{1}{2}\left(\Pi_0 - s_h\right). \tag{B.55}$$

From (B.16) and (B.17), we have $k_h^\star = [2\varphi_1/(\varphi_2-\varphi_1)]^{\frac{1}{1-\beta}} k_f^\star$, which can be substituted in (B.55) to obtain

$$Y_f^\star - Y_h^\star = \frac{1}{2}\cdot q_x\psi\left(k_f^\star\right)^\beta \varphi_1\left[(\gamma+1)-2(1-\beta)\left(\frac{2}{\gamma-1}\right)^{\frac{\beta}{1-\beta}}\right]-\frac{1}{2}\left(\Pi_0-s_h\right),$$

where we can substitute $k_f^\star$ from (B.17) to obtain

$$Y_f^\star - Y_h^\star = \frac{1}{2}\cdot q_x\psi\left[\left(q_x/q_z\right)\left(\beta/\rho\right)\psi\right]^{\frac{\beta}{1-\beta}} \varphi_1^{\frac{1}{1-\beta}}\left[(\gamma+1)\left(\frac{\gamma-1}{2}\right)^{\frac{\beta}{1-\beta}}-2(1-\beta)\right]-\frac{1}{2}\left(\Pi_0-s_h\right),$$

where we can substitute the definition of Q to obtain

$$Y_f^\star - Y_h^\star = \frac{1}{2}\cdot Q\cdot\left[\frac{\gamma+1}{1-\beta}\left(\frac{\gamma-1}{2}\right)^{\frac{\beta}{1-\beta}}-2\right]-\frac{1}{2}\left(\Pi_0-s_h\right), \tag{B.56}$$

which implies that the State prefers Foreign Control to Home Control if and only if

$$\Pi_0 < \Pi_0^{yf} \equiv s_h + Q\cdot\left[\frac{\gamma+1}{1-\beta}\left(\frac{\gamma-1}{2}\right)^{\frac{\beta}{1-\beta}}-2\right]. \tag{B.57}$$

(iv) Derivation of the upper bound $\Pi_0^{\pi f}$. The second expression in (B.28) implies that the Foreign Firm prefers Foreign Control to no initial contract, $\Pi_f^\star > \Pi_0$, if and only if

$$s_h - 2s_f + q_x\left(\varphi_2-\varphi_1\right)\psi\left(k_f^\star\right)^\beta - 2r_f^\star k_f^\star > \Pi_0,$$

where we can use (B.14) to substitute $r_f^\star k_f^\star$, obtaining

$$s_h - 2s_f + q_x\psi\left(\varphi_2-\varphi_1\right)(1-\beta)\left(k_f^\star\right)^\beta > \Pi_0.$$

Eliminating $k_f^\star$ by (B.17), we have that $\Pi_f^\star > \Pi_0$ if and only if

$$s_h - 2s_f + q_x\psi(1-\beta)\left[\left(q_x/q_z\right)\left(\beta/\rho\right)\psi\right]^{\frac{\beta}{1-\beta}}\varphi_1^{\frac{1}{1-\beta}}(\gamma-1)^{\frac{1}{1-\beta}}\left[\frac{1}{2}\right]^{\frac{\beta}{1-\beta}} > \Pi_0,$$

that is, if and only if

$$\Pi_0 < \Pi_0^{\pi f} \equiv s_h - 2s_f + Q\cdot\left[(\gamma-1)^{\frac{1}{1-\beta}}\left(\frac{1}{2}\right)^{\frac{\beta}{1-\beta}}\right]. \tag{B.58}$$

Derivation of result (16). From (B.52) and (B.54), we have

$$\Pi_0^{yp} - \Pi_0^{\pi p} = 2s_p + Q\cdot\frac{2}{1-\beta}\cdot\left[(\gamma+1)^{\frac{\beta}{1-\beta}}-(1-\beta)\right] > 0,$$

so that $\Pi_0^{yp} > \Pi_0^{\pi p}$. From (B.52) and (B.58) we have

$$\Pi_0^{yp} - \Pi_0^{\pi f} = 2s_f + Q \cdot \left[(\gamma+1)^{\frac{1}{1-\beta}} - 2 - (\gamma-1)^{\frac{1}{1-\beta}} \left(\frac{1}{2}\right)^{\frac{\beta}{1-\beta}} \right],$$

the sign of which is the same as that of

$$\ln \left[2^{\frac{\beta}{1-\beta}} \frac{(\gamma+1)^{\frac{1}{1-\beta}} - 2}{(\gamma-1)^{\frac{1}{1-\beta}}} \right] = \ln \left[2^{\frac{\beta}{1-\beta}} \left(\frac{\gamma+1}{\gamma-1}\right)^{\frac{1}{1-\beta}} - \left(\frac{2}{\gamma-1}\right)^{\frac{1}{1-\beta}} \right] > 0,$$

which implies $\Pi_0^{yp} > \Pi_0^{\pi f}$ for all constellations of parameters. Next, consider (B.52) and (B.54): the gap $\Pi_0^{yp} - \Pi_0^{\pi p}$ equals

$$\Pi_0^{yp} - \Pi_0^{\pi p} = Q \cdot \left[(\gamma+1)^{\frac{1}{1-\beta}} - 2 - (\gamma+1)^{\frac{\beta}{1-\beta}} (\gamma-1) \right] + 2s_p,$$

where we can substitute $(\gamma+1)^{\frac{\beta}{1-\beta}} = (\gamma+1)^{\frac{1}{1-\beta}} (\gamma+1)^{-1}$ and rearrange terms to get

$$\Pi_0^{yp} - \Pi_0^{\pi p} = Q \cdot \left\{ (\gamma+1)^{\frac{\beta}{1-\beta}} - 1 \right\} + 2s_p,$$

where, given $\gamma > 1$, the sign of the term in curly brackets is always positive. Hence, $\Pi_0^{yp} > \Pi_0^{\pi p}$ for all constellations of parameters. ■

Proof of the results listed in Table 2. The general logic is the following. If Π_0 lies below the lowest of all upper-bounds, $\Pi_0 < \min\{\Pi_0^{yp}, \Pi_0^{yf}, \Pi_0^{\pi p}, \Pi_0^{\pi f}\}$, both Foreign Control and Partnership are jointly agreeable: in this case, the choice of the regime depends on the assumed values of (γ, β) and on the bargaining procedure followed at Stage 0, as explained in detail in section 3.3.1. If $\Pi_0 > \min\{\Pi_0^{\pi f}, \Pi_0^{yf}\}$, we exclude Foreign Control as a candidate outcome as it is not jointly agreeable. Similarly, we exclude Partnership if $\Pi_0 > \min\{\Pi_0^{\pi p}, \Pi_0^{yp}\}$. The proof of the results listed in Table 2 hinges on the following

Lemma 6 *The three sets (A, B, C) are associated with the following inequalities:*

$$A \implies \Pi_0^{yp} > \Pi_0^{yf} \text{ and } \Pi_0^{\pi p} > \Pi_0^{\pi f}, \tag{B.59}$$
$$B \implies \Pi_0^{yf} > \Pi_0^{yp} \text{ and } \Pi_0^{\pi p} > \Pi_0^{\pi f}, \tag{B.60}$$
$$C \implies \Pi_0^{yp} > \Pi_0^{yf} \text{ and } \Pi_0^{\pi f} > \Pi_0^{\pi p}, \tag{B.61}$$

Proof: Using the definitions of Π_0^{yp} in (B.52), Π_0^{yf} in (B.57), $\Pi_0^{\pi p}$ in (B.54) and $\Pi_0^{\pi f}$ in (B.58), expressions (B.50), (B.56), and (B.28) imply

$$Y_p^\star - Y_h^\star = \frac{1}{2} \cdot \{\Pi_0^{yp} - \Pi_0\} \text{ and } Y_f^\star - Y_h^\star = \frac{1}{2} \cdot \left\{\Pi_0^{yf} - \Pi_0\right\}, \tag{B.62}$$
$$\Pi_p^\star - \Pi_0 = \frac{1}{2} \cdot \{\Pi_0^{\pi p} - \Pi_0\} \text{ and } \Pi_f^\star - \Pi_0 = \frac{1}{2} \cdot \left\{\Pi_0^{\pi f} - \Pi_0\right\}. \tag{B.63}$$

Results (B.62) and (B.63) respectively imply that

$$Y_p^\star \gtrless Y_f^\star \implies \Pi_0^{yp} \gtrless \Pi_0^{yf}, \tag{B.64}$$
$$\Pi_p^\star \gtrless \Pi_f^\star \implies \Pi_0^{\pi p} \gtrless \Pi_0^{\pi f}, \tag{B.65}$$

Combining (B.64)-(B.65) with the definitions of sets (A, B, C), we obtain results (B.59), (B.60) and (B.61).

Given Lemma 6, the results reported in Table 2 can be obtained by considering each parametrization in turn.

Table 2: Parametrization A. Under parametrization A, the combination of results (16) and (B.59) implies three possible cases:

$$A \Longrightarrow \left\{ \begin{array}{c} \Pi_0^{yp} > \Pi_0^{\pi p} > \Pi_0^{\pi f} > \Pi_0^{yf} \\ \Pi_0^{yp} > \Pi_0^{\pi p} > \Pi_0^{yf} > \Pi_0^{\pi f} \\ \Pi_0^{yp} > \Pi_0^{yf} > \Pi_0^{\pi p} > \Pi_0^{\pi f} \end{array} \right\}.$$

This scenario is described in Figure A2, graphs (a)-(b)-(c). In all the three cases, both Partnership and Foreign Control are jointly agreeable for low levels of the reservation profit; only Partnership is jointly agreeable for intermediate levels of the reservation profit; only Home Control can arise for high levels of the reservation profit, and is possibly jointly optimal.

Table 2: Parametrization B. Under parametrization A, the combination of results (16) and (B.60) implies

$$B \Longrightarrow \Pi_0^{yf} > \Pi_0^{yp} > \Pi_0^{\pi p} > \Pi_0^{\pi f}.$$

Consequently, under Parametrization B, both Partnership and Foreign Control are jointly agreeable if the reservation profit is low ($\Pi_0 < \Pi_0^{\pi f}$); only Partnership is jointly agreeable if the reservation profit takes intermediate levels ($\Pi_0^{\pi f} < \Pi_0 < \Pi_0^{\pi p}$); only Home Control can arise if the reservation profit is high ($\Pi_0 > \Pi_0^{\pi p}$); moreover, Home Control is jointly optimal if $\Pi_0 > \Pi_0^{yf}$.

Table 2: Parametrization C. Under parametrization C, the combination of results (16) and (B.60) implies

$$C \Longrightarrow \left\{ \begin{array}{l} \left. \Pi_0^{yp} > \Pi_0^{\pi f} > \Pi_0^{\pi p} > \Pi_0^{yf} \right\} \Longrightarrow C1 \\ \left. \begin{array}{l} \Pi_0^{yp} > \Pi_0^{\pi f} > \Pi_0^{yf} > \Pi_0^{\pi p} \\ \Pi_0^{yp} > \Pi_0^{yf} > \Pi_0^{\pi f} > \Pi_0^{\pi p} \end{array} \right\} \Longrightarrow C2 \end{array} \right. .$$

The subcase $C1$ is described in Figure A2 (d), whereas the subcases $C2$ are described in Figure A2 graphs (e)-(f). In subcase $C1$, both Partnership and Foreign Control are jointly agreeable if the reservation profit is low ($\Pi_0 < \Pi_0^{yf}$); only Partnership is jointly agreeable if the reservation profit takes intermediate levels ($\Pi_0^{yf} < \Pi_0 < \Pi_0^{\pi p}$). In subcases $C2$, both Partnership and Foreign Control are jointly agreeable if the reservation profit is low ($\Pi_0 < \Pi_0^{\pi p}$); only Foreign Control is jointly agreeable if the reservation profit takes intermediate levels ($\min\left\{\Pi_0^{yf}, \Pi_0^{\pi f}\right\} < \Pi_0 < \Pi_0^{\pi p}$). In all cases, only Home Control can arise if the reservation profit is high and is jointly optimal if $\Pi_0 > \Pi_0^{yp}$.

C Appendix – Model with Repurchase

Derivation of (18)-(19). From (5) and (17), we have

$$\begin{aligned} S_f - D_{f\lambda} &= \ell_{f\lambda} - \left(q_x \chi_h (k_{f\lambda}) - s_h - \lambda r_{f\lambda} k_{f\lambda}\right), \\ F_f - \Delta_{f\lambda} &= q_x \chi_f (k_{f\lambda}) - \Pi_0 - \lambda r_{f\lambda} k_{f\lambda} - \ell_{f\lambda}. \end{aligned}$$

Hence, defining

$$\Omega'_{f\lambda} \equiv q_x \chi_h (k_{f\lambda}) - s_h - \lambda r_{f\lambda} k_{f\lambda} \quad \text{and} \quad \Omega''_{f\lambda} \equiv q_x \chi_f (k_{f\lambda}) - \Pi_0 - \lambda r_{f\lambda} k_{f\lambda}, \tag{C.1}$$

we can write the relevant Nash product as

$$(S_f - D_{f\lambda}) \cdot (F_f - \Delta_{f\lambda}) = \left(\ell_{f\lambda} - \Omega'_{f\lambda}\right) \cdot \left(\Omega''_{f\lambda} - \ell_{f\lambda}\right)$$

and obtain the first-order condition for the maximization of the Nash product:

$$\ell^N_{f\lambda} = \frac{1}{2} \cdot \left(\Omega'_{f\lambda} + \Omega''_{f\lambda}\right). \tag{C.2}$$

Plugging $\ell_{f\lambda} = \ell^N_{f\lambda}$ into the definitions of domestic income and profits, Y_f and Π_f in Table 1, we obtain

$$\begin{aligned} Y^N_{f\lambda} &= q_z z_{f\lambda} + r_{f\lambda} k_{f\lambda} + \frac{1}{2} \cdot \left(\Omega'_{f\lambda} + \Omega''_{f\lambda}\right), \\ \Pi^N_{f\lambda} &= q_x \chi_f (k_{f\lambda}) - s_f - r_{f\lambda} k_{f\lambda} - \frac{1}{2} \cdot \left(\Omega'_{f\lambda} + \Omega''_{f\lambda}\right), \end{aligned}$$

where we can substitute $\Omega'_{f\lambda}$ and $\Omega''_{f\lambda}$ from (C.1) to get (18) and (19).

Proof of results (20) and (21). At Stage 1, the foreign firm chooses $k^\star_{f\lambda}$ in order to maximize ex-post profits (19). The first order condition for an interior solution is (20). Under technologies (3) and (2), condition (20) reads

$$q_x (\varphi_2 - \varphi_1) \beta \psi \left(k^\star_{f\lambda}\right)^{\beta-1} = 2 (1-\lambda) r^\star_{f\lambda}, \tag{C.3}$$

from which an interior solution $0 < k^\star_{f\lambda} < k_{\max}$ is characterized by

$$r^\star_{f\lambda} k^\star_{f\lambda} = \frac{q_x (\varphi_2 - \varphi_1) \beta \psi}{2 (1-\lambda)} \left(k^\star_{f\lambda}\right)^{\beta}, \tag{C.4}$$

$$k^\star_{f\lambda} = \left[\frac{q_x (\varphi_2 - \varphi_1) \beta \psi}{2 (1-\lambda) q_z \rho}\right]^{\frac{1}{1-\beta}}, \tag{C.5}$$

where (C.5) follows from substituting the equilibrium interest rate $r_{f\lambda} = q_z \rho$ in (C.3). Notice that (C.5) implicitly defines the interior $k^\star_{f\lambda}$ as a function of λ with the following properties:

$$\lim_{\lambda \to 0} k^\star_{f\lambda}(\lambda) = k^\star_{f\lambda}(0) = k^\star_f = \left[\frac{q_x (\varphi_2 - \varphi_1) \beta \psi}{2 q_z \rho}\right]^{\frac{1}{1-\beta}}, \tag{C.6}$$

$$\frac{\partial k^\star_{f\lambda}(\lambda)}{\partial \lambda} = \frac{1}{(1-\beta)(1-\lambda)} \cdot k^\star_{f\lambda}(\lambda) > 0, \tag{C.7}$$

where (C.7) further implies the convexity property $\partial^2 k^\star_{f\lambda}(\lambda)/\partial\lambda > 0$. Since the term in square brackets in (C.5) tends to ∞ as $\lambda \to 1$, there must be a unique critical level $\lambda_{\max} \in (0,1)$ such that

$$\begin{aligned} k^\star_{f\lambda}(\lambda_{\max}) &= \left[\frac{q_x(\varphi_2-\varphi_1)\beta\psi}{2(1-\lambda_{\max})q_z\rho}\right]^{\frac{1}{1-\beta}} = k_{\max} < \infty, \\ k^\star_{f\lambda}(\lambda') &= \left[\frac{q_x(\varphi_2-\varphi_1)\beta\psi}{2(1-\lambda')q_z\rho}\right]^{\frac{1}{1-\beta}} < k_{\max} \text{ for any } \lambda' < \lambda_{\max}, \end{aligned} \tag{C.8}$$

which implies result (21). In particular, expression (C.8) implies that the upper bound is given by

$$\lambda_{\max} \equiv 1 - \frac{q_x(\varphi_2-\varphi_1)\beta\psi}{2q_z\rho(k_{\max})^{1-\beta}}, \tag{C.9}$$

and is therefore higher the higher is $k_{\max}$.

Proof of Proposition 4. First consider the income function $Y^\star_{f\lambda}(\lambda)$ assuming that λ is always such that we have an interior solution. Substituting $r_{f\lambda} = q_z\rho$ and $q_z z_{f\lambda} = r_{f\lambda}(k_{\max} - k_{f\lambda})$ in (18), the equilibrium ex-post income level reads

$$Y^\star_{f\lambda} = \frac{1}{2}q_x(\varphi_2+\varphi_1)\psi\left(k^\star_{f\lambda}\right)^\beta - \lambda\cdot r^\star_{f\lambda}k^\star_{f\lambda} + q_z\rho k_{\max} - \frac{1}{2}(s_h+\Pi_0),$$

from which, using (C.4) to substitute $r^\star_{f\lambda}k^\star_{f\lambda}$, we get

$$Y^\star_{f\lambda} = \frac{1}{2}q_x(\varphi_2+\varphi_1)\psi\left(k^\star_{f\lambda}\right)^\beta - \frac{\lambda\beta(\varphi_2-\varphi_1)}{1-\lambda}\cdot\frac{1}{2}q_x\psi\left(k^\star_{f\lambda}\right)^\beta + q_z\rho k_{\max} - \frac{1}{2}(s_h+\Pi_0). \tag{C.10}$$

Combining (C.5) with (C.10), equilibrium income $Y^\star_{f\lambda}$ can be represented as a function of λ,

$$Y^\star_{f\lambda}(\lambda) = \frac{1}{2}q_x(\varphi_2+\varphi_1)\psi\left(k^\star_{f\lambda}(\lambda)\right)^\beta - \frac{\lambda}{1-\lambda}\cdot\frac{1}{2}q_x\psi\beta(\varphi_2-\varphi_1)\left(k^\star_{f\lambda}(\lambda)\right)^\beta + q_z\rho k_{\max} - \frac{1}{2}(s_h+\Pi_0).$$

Defining the constants

$$\varsigma_0 \equiv \frac{1}{2}q_x\psi(\varphi_2+\varphi_1) \text{ and } \varsigma_1 \equiv \frac{1}{2}q_x\psi\beta(\varphi_2-\varphi_1), \tag{C.11}$$

we have

$$Y^\star_{f\lambda}(\lambda) = \left(\varsigma_0 - \varsigma_1\frac{\lambda}{1-\lambda}\right)\cdot\left(k^\star_{f\lambda}(\lambda)\right)^\beta + q_z\rho k_{\max} - \frac{1}{2}(s_h+\Pi_0). \tag{C.12}$$

Differentiating (C.12), we obtain

$$\frac{\partial Y^\star_{f\lambda}(\lambda)}{\partial\lambda} = \frac{\partial\left(\varsigma_0 - \varsigma_1\frac{\lambda}{1-\lambda}\right)}{\partial\lambda}\cdot\left(k^\star_{f\lambda}(\lambda)\right)^\beta + \left(\varsigma_0 - \varsigma_1\frac{\lambda}{1-\lambda}\right)\cdot\beta\left(k^\star_{f\lambda}(\lambda)\right)^{\beta-1}\frac{\partial k^\star_{f\lambda}(\lambda)}{\partial\lambda},$$

where we can substitute (C.7) to get

$$\frac{\partial Y_{f\lambda}^{\star}(\lambda)}{\partial \lambda} = \left[\beta\left(\varsigma_0+\varsigma_1\right)(1-\lambda)-\varsigma_1\right] \cdot \frac{\left(k_{f\lambda}^{\star}(\lambda)\right)^{\beta}}{(1-\beta)(1-\lambda)^2}. \tag{C.13}$$

The sign of $\partial Y_{f\lambda}^{\star}(\lambda)/\partial\lambda$ is determined by the term in square brackets in (C.13). In particular, there exists a critical value

$$\tilde{\lambda} \equiv \frac{\beta\left(\varsigma_0+\varsigma_1\right)-\varsigma_1}{\beta\left(\varsigma_0+\varsigma_1\right)} \tag{C.14}$$

such that $\partial Y_{f\lambda}^{\star}(\lambda)/\partial\lambda \gtreqless 0$ if $\lambda \lesseqgtr \tilde{\lambda}$. Consequently, $Y_{f\lambda}^{\star}(\lambda)$ achieves a maximum in $\lambda = \tilde{\lambda}$. Substituting (C.11) in (C.14), we obtain

$$\tilde{\lambda} \equiv \frac{\left(\varphi_2+\varphi_1\right)-\left(\varphi_2-\varphi_1\right)(1-\beta)}{\left(\varphi_2+\varphi_1\right)+\beta\left(\varphi_2-\varphi_1\right)}. \tag{C.15}$$

Recalling the definition of $\gamma \equiv \varphi_2/\varphi_1$, we can rewrite (C.15) as

$$\tilde{\lambda} \equiv \frac{2+\beta(\gamma-1)}{\gamma+1+\beta(\gamma-1)}. \tag{C.16}$$

Obviously, since $Y_{f\lambda}^{\star}(\lambda)$ is defined over $\lambda \in (0, \lambda_{\max})$, the maximum is actually an interior maximum provided that $\tilde{\lambda}$ lies within the range of interior solutions to the investment problem, that is, provided that parameters are such $\tilde{\lambda} < \lambda_{\max}$. As shown in (C.9), $\tilde{\lambda}$ lies within the range of interior solutions $(0, \lambda_{\max})$ provided that $k_{\max}$ is sufficiently large.

Next, consider the profit function $\Pi_{f\lambda}^{\star}(\lambda)$. Using (2) and result (C.4), equilibrium profits of the foreign firm read

$$\Pi_{f\lambda}^{\star}(\lambda) = \frac{1}{2} q_x (1-\beta)\left(\varphi_2-\varphi_1\right)\psi\left(k_{f\lambda}^{\star}(\lambda)\right)^{\beta} + \frac{1}{2}\cdot\left(\Pi_0+s_h-2s_f\right). \tag{C.17}$$

From (C.7), the first derivative reads

$$\frac{\partial \Pi_{f\lambda}^{\star}(\lambda)}{\partial\lambda} = \frac{\frac{1}{2} q_x (1-\beta)\left(\varphi_2-\varphi_1\right)\psi\beta}{(1-\beta)(1-\lambda)}\left(k_{f\lambda}^{\star}(\lambda)\right)^{\beta} > 0$$

and, consequently, $\partial^2 \Pi_{f\lambda}^{\star}(\lambda)/\partial\lambda^2 > 0$. ■

Proof of Proposition 5. From (B.18) and (C.4), the ratio $k_{f\lambda}^{\star}/k_p^{\star}$ equals

$$\frac{k_{f\lambda}^{\star}}{k_p^{\star}} = \left[\frac{1}{2(1-\lambda)}\cdot\frac{\varphi_2-\varphi_1}{\varphi_2+\varphi_1}\right]^{\frac{1}{1-\beta}}.$$

Substituting $\lambda = \tilde{\lambda}$ with $\tilde{\lambda}$ given by (C.15), we obtain

$$\frac{k_{f\lambda}^{\star}}{k_p^{\star}} = \left[\frac{\varphi_2+\varphi_1+\beta\left(\varphi_2-\varphi_1\right)}{2\left(\varphi_2+\varphi_1\right)}\right]^{\frac{1}{1-\beta}} > 1,$$

so that $k^\star_{f\lambda} < k^\star_p$ and $x^\star_{f\lambda} < x^\star_p$. The rest of the proof proceeds in three steps, concerning (i) the ranking of relative domestic income levels, (ii) the ranking of relative foreign firm's profits, and (iii) the fact that Partnership can be jointly optimal whereas Foreign Control with credible repurchase and $\lambda = \tilde{\lambda}$ cannot be jointly optimal.

(i) Ranking Domestic Income Levels. Under the technologies (2), the equilibrium income levels (B.12) and (18) read

$$Y^\star_{f\lambda} = \frac{1}{2}\left[q_x(\varphi_2+\varphi_1)\psi\left(k^\star_{f\lambda}\right)^\beta - 2\lambda r^\star_{f\lambda}k^\star_{f\lambda}\right] + q_z\rho k_{\max} - \frac{1}{2}(s_h+\Pi_0), \quad \text{(C.18)}$$

$$Y^\star_p = \frac{1}{2}\left[q_x(\varphi_2+\varphi_1)\psi\left(k^\star_p\right)^\beta - r^\star_p k^\star_p\right] + q_z\rho k_{\max} - \frac{1}{2}(s_h+\Pi_0). \quad \text{(C.19)}$$

Taking the difference, we get

$$Y^\star_p - Y^\star_{f\lambda} = \frac{1}{2}\left\{q_x(\varphi_2+\varphi_1)\psi\left(k^\star_p\right)^\beta - r^\star_p k^\star_p - \left[q_x(\varphi_2+\varphi_1)\psi\left(k^\star_{f\lambda}\right)^\beta - 2\lambda r^\star_{f\lambda}k^\star_{f\lambda}\right]\right\}$$

where we can use (B.15) and (C.4) to eliminate the terms $r^\star_i k^\star_i$, obtaining

$$Y^\star_p - Y^\star_{f\lambda} = \frac{1}{2}q_x\psi\left\{(1-\beta)(\varphi_2+\varphi_1)\left(k^\star_p\right)^\beta - \left[(\varphi_2+\varphi_1) - \frac{\lambda\beta(\varphi_2-\varphi_1)}{1-\lambda}\right]\left(k^\star_{f\lambda}\right)^\beta\right\}. \quad \text{(C.20)}$$

Substituting $\lambda = \tilde{\lambda}$ with $\tilde{\lambda}$ given by (C.15), the term in square brackets in (C.20) reduces to $(1-\beta)[(\varphi_2+\varphi_1)+\beta(\varphi_2-\varphi_1)]$, and expression (C.20) becomes

$$Y^\star_p - Y^\star_{f\lambda} = \frac{1}{2}q_x\psi(1-\beta)\left\{(\varphi_2+\varphi_1)\left(k^\star_p\right)^\beta - [(\varphi_2+\varphi_1)+\beta(\varphi_2-\varphi_1)]\left(k^\star_{f\lambda}\right)^\beta\right\}. \quad \text{(C.21)}$$

From (C.21), the gap $Y^\star_p - Y^\star_{f\lambda}$ is positive (negative) when the term in curly brackets, or equivalently, the logarithm of the relevant ratio,

$$\mathcal{L}_1(\lambda) \equiv \ln\left[\frac{(\varphi_2+\varphi_1)}{(\varphi_2+\varphi_1)+\beta(\varphi_2-\varphi_1)}\left(k^\star_p/k^\star_{f\lambda}\right)^\beta\right], \quad \text{(C.22)}$$

is positive (negative). Using (B.18) to substitute $k^\star_p$ and (C.4) to substitute $k^\star_{f\lambda}$, expression (C.22) becomes

$$\mathcal{L}_1(\lambda) = \ln\left\{\frac{\gamma+1}{\gamma+1+\beta(\gamma-1)}\left[2(1-\lambda)\frac{\gamma+1}{\gamma-1}\right]^{\frac{\beta}{1-\beta}}\right\},$$

which, substituting $\lambda = \tilde{\lambda}$ with $\tilde{\lambda}$ given by (C.16), equals

$$\mathcal{L}_1\left(\tilde{\lambda}\right) = \ln\left[2^\beta\frac{\gamma+1}{\gamma+1+\beta(\gamma-1)}\right]^{\frac{1}{1-\beta}}. \quad \text{(C.23)}$$

From (C.23), $\mathcal{L}_1\left(\tilde{\lambda}\right)$ is positive if and only if the term in square brackets exceeds unity, that is, if and only if

$$\Xi_5(\beta) \equiv \beta\cdot\ln 2 > \ln\left(1+\beta\cdot\frac{\gamma-1}{\gamma+1}\right) \equiv \Xi_6(\beta). \quad \text{(C.24)}$$

Function $\Xi_5(\beta)$ is an increasing straight line whereas function $\Xi_6(\beta)$ is increasing and concave with

$$\lim_{\beta\to 0}\Xi_6(\beta) = 0, \quad \lim_{\beta\to\infty}\Xi_6(\beta)=\infty, \quad \Xi_6'(\beta)=\frac{\gamma-1}{\gamma+1+\beta(\gamma-1)}, \tag{C.25}$$

$$\lim_{\beta\to 0}\Xi_6'(\beta) = \frac{\gamma-1}{\gamma+1}, \quad \lim_{\beta\to\infty}\Xi_6'(\beta)=0. \tag{C.26}$$

These properties imply two cases. First, if the $\Xi_5(\beta)$ is steeper than $\Xi_6(\beta)$ in $\beta=0$, then $\Xi_5(\beta)>\Xi_6(\beta)$ for all $\beta\in(0,1)$ and, hence, $\mathcal{L}_1\left(\tilde{\lambda}\right)>0$ for all $\beta\in(0,1)$. Formally,

$$\text{if } \ln 2>\frac{\gamma-1}{\gamma+1} \text{ then } \lim_{\beta\to 0}\Xi_5'(\beta)>\lim_{\beta\to 0}\Xi_6'(\beta) \text{ and, hence, } \mathcal{L}_1\left(\tilde{\lambda}\right)>0 \text{ for all } \beta\in(0,1),$$

which is equivalent to:

$$\text{if } \gamma<\gamma_2\equiv\frac{1+\ln 2}{1-\ln 2}\approx 5.52 \text{ then } Y_p^\star>Y_{f\lambda}^\star \text{ for all } \beta\in(0,1). \tag{C.27}$$

The second case implied by properties (C.25)-(C.26) for condition (C.24) is that, if $\gamma>\gamma_2$, then (i) $\Xi_6(\beta)$ is initially steeper than $\Xi_5(\beta)$ in $\beta=0$, and (ii) there exists a unique finite value of β, called β_2, in which $\Xi_6(\beta)$ cuts $\Xi_5(\beta)$ from above. Formally,

$$\text{if } \gamma>\gamma_2 \text{ then } \Xi_5(\beta)<\Xi_6(\beta) \text{ for } \beta<\beta_2 \text{ and } \Xi_5(\beta)\geqslant\Xi_6(\beta) \text{ for } \beta\geqslant\beta_2, \tag{C.28}$$

where the value of β_2 is determined by the condition $\Xi_5(\beta_2)=\Xi_6(\beta_2)$ and can be shown to be strictly less than unity.[38] Hence, result (C.28) can be equivalently restated as:

$$\text{if } \gamma>\gamma_2 \text{ then there exists } \beta_2\in(0,1) \text{ such that} \left\{\begin{array}{lll} Y_p^\star\geqslant Y_{f\lambda}^\star & \text{for} & \beta\geqslant\beta_2 \\ Y_p^\star<Y_{f\lambda}^\star & \text{for} & \beta<\beta_2 \end{array}\right\}.$$

(ii) Ranking Foreign Firm's Profits. Substituting technologies (2) in (19) and (B.20), respectively, equlibrium profits read

$$\Pi_{f\lambda}^\star = \frac{1}{2}\cdot\left[q_x(\varphi_2-\varphi_1)\psi\left(k_{f\lambda}^\star\right)^\beta-2(1-\lambda)r_{f\lambda}^\star k_{f\lambda}^\star+\Pi_0+s_h-2s_f\right],$$

$$\Pi_p^\star = \frac{1}{2}\cdot\left[q_x(\varphi_2-\varphi_1)\psi\left(k_p^\star\right)^\beta-r_p^\star k_p^\star+\Pi_0+s_h-2s_p\right].$$

Taking the difference $\Pi_{f\lambda}^\star-\Pi_p^\star$ with $s_f=s_p$ and using (C.4) and (B.15) to eliminate $r_{f\lambda}^\star k_{f\lambda}^\star$ and $r_p^\star k_p^\star$, we obtain

$$\Pi_{f\lambda}^\star-\Pi_p^\star=\frac{1}{2}\cdot q_x\psi\left\{(1-\beta)(\varphi_2-\varphi_1)\left(k_{f\lambda}^\star\right)^\beta-\left[(\varphi_2-\varphi_1)-\beta(\varphi_2+\varphi_1)\right]\left(k_p^\star\right)^\beta\right\}. \tag{C.29}$$

[38] The functions $\Xi_5(\beta)$ and $\Xi_6(\beta)$ exhibit the properties $\lim_{\beta\to 1}\Xi_5(\beta)=\ln 2$ and $\lim_{\beta\to 1}\Xi_6(\beta)=\ln\left(1+\frac{\gamma-1}{\gamma+1}\right)$ where $1+\frac{\gamma-1}{\gamma+1}<2$ implies that $\Xi_5(1)>\Xi_6(1)$. As a consequence, the intersection β_2 in which $\Xi_6(\beta)$ cuts $\Xi_5(\beta)$ from above must be such that $\beta_2<1$.

Equation (C.29) already contains a critical condition on parameters: if $\beta > \frac{\varphi_2-\varphi_1}{\varphi_2+\varphi_1}$, the term in square brackets is negative, implying $\Pi^\star_{f\lambda} > \Pi^\star_p$. We can re-write this result as

$$\beta > \bar{\beta} \equiv \frac{\gamma-1}{\gamma+1} \Longrightarrow \Pi^\star_{f\lambda} > \Pi^\star_p. \tag{C.30}$$

Restricting the attention to the case $\beta < \bar{\beta}$, result (C.29) implies that the gap $\Pi^\star_{f\lambda} - \Pi^\star_p$ is positive (negative) when the term in square brackets in (C.29), or equivalently, the logarithm of the relevant ratio,

$$\mathcal{L}_2(\lambda) \equiv \ln\left[\frac{(1-\beta)(\varphi_2-\varphi_1)}{(\varphi_2-\varphi_1)-\beta(\varphi_2+\varphi_1)}\left(k^\star_{f\lambda}/k^\star_p\right)^\beta\right], \tag{C.31}$$

is positive (negative). Using (B.18) to substitute $k^\star_p$ and (C.4) to substitute $k^\star_{f\lambda}$, expression (C.31) becomes

$$\mathcal{L}_2(\lambda) = \ln\left\{\frac{(1-\beta)(\gamma-1)}{(\gamma-1)-\beta(\gamma+1)}\left[\frac{1}{2(1-\lambda)}\cdot\frac{\gamma-1}{\gamma+1}\right]^{\frac{\beta}{1-\beta}}\right\},$$

which, substituting $\lambda = \tilde{\lambda}$ with $\tilde{\lambda}$ given by (C.16), equals

$$\mathcal{L}_2\left(\tilde{\lambda}\right) = \ln\left\{\frac{\gamma-1-\beta(\gamma-1)}{\gamma-1-\beta(\gamma+1)}\left[\frac{\gamma+1+\beta(\gamma-1)}{2(\gamma+1)}\right]^{\frac{\beta}{1-\beta}}\right\}. \tag{C.32}$$

Recalling the definition of $\bar{\beta}$, we can rewrite (C.32) as

$$\mathcal{L}_2\left(\tilde{\lambda}\right) = \ln\left\{\bar{\beta}\cdot\frac{1-\beta}{\bar{\beta}-\beta}\cdot\left(\frac{1+\beta\bar{\beta}}{2}\right)^{\frac{\beta}{1-\beta}}\right\}. \tag{C.33}$$

From (C.33), $\mathcal{L}_2\left(\tilde{\lambda}\right)$ is positive if and only if

$$\Xi_7(\beta) \equiv (1-\beta)\ln\left(\bar{\beta}\cdot\frac{1-\beta}{\bar{\beta}-\beta}\right) + \beta\ln\left(1+\beta\bar{\beta}\right) > \Xi_8(\beta) \equiv \beta\ln(2). \tag{C.34}$$

Function $\Xi_8(\beta)$ is an increasing straight line with

$$\Xi_8'(\beta) = \ln(2) > 0. \tag{C.35}$$

Function $\Xi_7(\beta)$, instead, is an increasing hyperbula displaying $\lim_{\beta\to 0}\Xi_3(\beta) = 0$ and $\lim_{\beta\to\bar{\beta}}\Xi_3(\beta) = +\infty$ over the relevant range $\beta \in \left(0,\bar{\beta}\right)$. In particular,

$$\begin{aligned} &\Xi_7'(\beta) = \tfrac{1-\bar{\beta}}{\bar{\beta}-\beta} + \ln\left[\tfrac{\left(1+\beta\bar{\beta}\right)\left(\bar{\beta}-\beta\right)}{\bar{\beta}-\beta\bar{\beta}}\right] + \tfrac{\beta\bar{\beta}}{1+\beta\bar{\beta}}, \\ &\lim_{\beta=0}\Xi_7'(\beta) = \tfrac{1-\bar{\beta}}{\bar{\beta}}, \qquad \lim_{\beta=\bar{\beta}}\Xi_7'(\beta) = \infty. \end{aligned} \tag{C.36}$$

Results (C.35) and (C.36) yield a sufficient condition for having $\Pi^{\star}_{f\lambda} > \Pi^{\star}_{p}$. Specifically, if $\lim_{\beta\to 0} \Xi'_7(\beta) > \Xi'_8(\beta)$, we surely obtain $\Pi^{\star}_{f\lambda} > \Pi^{\star}_{p}$ because then $\Xi_7(\beta) > \Xi_8(\beta)$ holds for any $\beta \in \left(0, \bar{\beta}\right)$. That is:

$$1 - \bar{\beta} > \bar{\beta} \ln(2) \Longrightarrow \Pi^{\star}_{f\lambda} > \Pi^{\star}_{p} \text{ for any } \beta \in \left(0, \bar{\beta}\right). \tag{C.37}$$

If $\lim_{\beta\to 0} \Xi'_7(\beta) < \Xi'_8(\beta)$, instead, there exists a region of the parameter space, $(0, \beta_3) \subset \left(0, \bar{\beta}\right)$, such that $\Pi^{\star}_{f\lambda} < \Pi^{\star}_{p}$ for $\beta \in (0, \beta_3)$ and $\Pi^{\star}_{f\lambda} > \Pi^{\star}_{p}$ for $\beta \in \left(\beta_3, \bar{\beta}\right)$, that is:

$$1 - \bar{\beta} < \bar{\beta} \ln(2) \Longrightarrow \begin{cases} \Pi^{\star}_{f\lambda} < \Pi^{\star}_{p} & \text{for} \quad \beta \in (0, \beta_3), \\ \Pi^{\star}_{f\lambda} > \Pi^{\star}_{p} & \text{for} \quad \beta \in \left(\beta_3, \bar{\beta}\right). \end{cases} \tag{C.38}$$

Notice that, given the definition of $\bar{\beta}$, we can define a specific restriction on the parameter γ that allows us to discriminate between cases (C.37) and (C.38). Using $\bar{\beta} \equiv \frac{\gamma-1}{\gamma+1}$, the critical inequality $1 - \bar{\beta} > \bar{\beta} \ln(2)$ can be equivalently re-written as

$$\gamma < 1 + \frac{2}{\ln(2)} \equiv \gamma_3 \approx 3.88.$$

Hence, we have a critical threshold γ_3 whereby results (C.37) and (C.38) can be equivalently restated as

$$\begin{array}{l} \gamma < \gamma_3 \Longrightarrow \Pi^{\star}_{f\lambda} > \Pi^{\star}_{p} \text{ for any } \beta \in \left(0, \bar{\beta}\right), \\ \gamma > \gamma_3 \Longrightarrow \begin{cases} \Pi^{\star}_{f\lambda} < \Pi^{\star}_{p} & \text{for} \quad \beta \in (0, \beta_3), \\ \Pi^{\star}_{f\lambda} \geqslant \Pi^{\star}_{p} & \text{for} \quad \beta \in \left(\beta_3, \bar{\beta}\right]. \end{cases} \end{array} \tag{C.39}$$

From (C.39) and (C.30), we obtain the two results concerning the foreign firm's profits reported in Proposition 5. First, the case $\gamma < \gamma_3$ in (C.39) combined with (C.30) implies that if $\gamma < \gamma_3$ then $\Pi^{\star}_{f\lambda} > \Pi^{\star}_{p}$ for any $\beta \in (0, 1)$. Second, the case $\gamma > \gamma_3$ in (C.39) combined with (C.30), implies that, if $\gamma > \gamma_3$, there exists a critical level $\beta_3 \in \left(0, \frac{\gamma-1}{\gamma+1}\right)$ such that $\Pi^{\star}_{f\lambda} < \Pi^{\star}_{p}$ when $0 < \beta < \beta_3$, and $\Pi^{\star}_{f\lambda} > \Pi^{\star}_{p}$ when $\beta_3 < \beta < 1$.

(iii) Joint optimality. Proceeding in the same way as for the proof of Proposition 2 above, the critical loci $\beta_2(\gamma)$ and $\beta_3(\gamma)$ represented in Figure 2 are obtained by running two simple algorithms that calculate

$$\begin{aligned} \beta_2(\gamma) &\equiv \arg\text{solve}\left\{\Xi_5(\beta) = \Xi_6(\beta;\gamma)\right\}, \\ \beta_3(\gamma) &\equiv \arg\text{solve}\left\{\Xi_7(\beta;\gamma) = \Xi_8(\beta)\right\}, \end{aligned}$$

for each value of γ. The resulting loci are such that $\beta_3(\gamma') > \beta_2(\gamma')$ is satisfied for any $\gamma \in (1, \infty)$. This implies that there is no region of the parameter space (γ, β) in which $Y^{\star}_{p} < Y^{\star}_{f\lambda}$ and $\Pi^{\star}_{p} < \Pi^{\star}_{f\lambda}$ hold symultaneously. The proof that the parametrization sets $\left(\tilde{A}, \tilde{B}, \tilde{C}\right)$ are non-empty follows immediately from Figure 2. ■

Derivation of conditions (23). First, consider the upper-bound $\tilde{\Pi}^{yf}_0$. From (C.18) and (B.10), using the technologies (3) and (2) and the equilibrium conditions $r_i = q_z \rho$, we obtain the income gap

$$Y^{\star}_{f\lambda} - Y^{\star}_{h} = \frac{1}{2}\left[q_x(\varphi_2 + \varphi_1)\psi\left(k^{\star}_{f\lambda}\right)^{\beta} - 2\lambda r^{\star}_{f\lambda} k^{\star}_{f\lambda}\right] - q_x \psi (1-\beta)\varphi_1 \left(k^{\star}_{h}\right)^{\beta} - \frac{1}{2}(\Pi_0 - s_h),$$

where we can substitute (C.4) to eliminate $r^{\star}_{f\lambda}k^{\star}_{f\lambda}$, obtaining

$$Y^{\star}_{f\lambda}-Y^{\star}_{h}=\frac{1}{2}q_x\psi\left[(\varphi_2+\varphi_1)-\frac{\lambda}{1-\lambda}\beta(\varphi_2-\varphi_1)\right]\left(k^{\star}_{f\lambda}\right)^{\beta}-q_x\psi(1-\beta)\varphi_1\left(k^{\star}_{h}\right)^{\beta}-\frac{1}{2}(\Pi_0-s_h).$$

Substituting $\lambda=\tilde{\lambda}$ with $\tilde{\lambda}$ given by (C.15), the term in square brackets reduces to

$$(1-\beta)\left[(\varphi_2+\varphi_1)+\beta(\varphi_2-\varphi_1)\right]$$

and we obtain

$$Y^{\star}_{f\lambda}-Y^{\star}_{h}=q_x\psi(1-\beta)\varphi_1\left\{\frac{1}{2}\left[(\gamma+1)+\beta(\gamma-1)\right]\left(k^{\star}_{f\lambda}\right)^{\beta}-\left(k^{\star}_{h}\right)^{\beta}\right\}-\frac{1}{2}(\Pi_0-s_h). \quad \text{(C.40)}$$

Equilibrium local $k^{\star}_{f\lambda}$ is given by (C.4): using $\lambda=\tilde{\lambda}$ with $\tilde{\lambda}$ given by (C.16), we obtain

$$k^{\star}_{f\lambda}\left(\tilde{\lambda}\right)=\left\{\frac{q_x\varphi_1\left[\gamma+1+\beta(\gamma-1)\right]\beta\psi}{2q_z\rho}\right\}^{\frac{1}{1-\beta}}. \quad \text{(C.41)}$$

From (C.41) and the first expression in (B.16), we have

$$\frac{k^{\star}_{h}}{k^{\star}_{f\lambda}\left(\tilde{\lambda}\right)}=\left\{\frac{2}{\gamma+1+\beta(\gamma-1)}\right\}^{\frac{1}{1-\beta}}. \quad \text{(C.42)}$$

Using (C.42), we can rewrite (C.40) as

$$Y^{\star}_{f\lambda}-Y^{\star}_{h}=q_x\psi(1-\beta)\varphi_1\left(k^{\star}_{f\lambda}\right)^{\beta}\left\{\frac{1}{2}(\gamma+1)+\frac{1}{2}\beta(\gamma-1)-\left[\frac{1}{2}(\gamma+1)+\frac{1}{2}\beta(\gamma-1)\right]^{-\frac{1}{1-\beta}}\right\}-\frac{1}{2}(\Pi_0-s_h),$$

and then substitute $k^{\star}_{f\lambda}$ by (C.41) to obtain

$$Y^{\star}_{f\lambda}-Y^{\star}_{h}=Q\cdot\left\{\frac{\left\{\frac{1}{2}(\gamma+1)+\frac{1}{2}\beta(\gamma-1)\right\}^{\frac{2-\beta}{1-\beta}}-1}{\frac{1}{2}(\gamma+1)+\frac{1}{2}\beta(\gamma-1)}\right\}-\frac{1}{2}(\Pi_0-s_h), \quad \text{(C.43)}$$

where $Q\equiv q_x\psi(1-\beta)\left[(q_x/q_z)(\beta/\rho)\psi\right]^{\frac{\beta}{1-\beta}}\varphi_1^{\frac{1}{1-\beta}}$ is defined in (B.53). Result (C.43) implies that the State prefers Foreign Control (with credible repurchase at rate $\lambda=\tilde{\lambda}$) to Home Control if and only if

$$\Pi_0<\tilde{\Pi}^{yf}_0\equiv s_h+Q\cdot\left\{2\frac{\left\{\frac{1}{2}(\gamma+1)+\frac{1}{2}\beta(\gamma-1)\right\}^{\frac{2-\beta}{1-\beta}}-1}{\frac{1}{2}(\gamma+1)+\frac{1}{2}\beta(\gamma-1)}\right\}. \quad \text{(C.44)}$$

Next consider the foreign firm's profits. From (C.17), the gap between the profits under Foreign Control with credible repurchase and the reservation profit equals

$$\Pi^{\star}_{f\lambda}(\lambda)-\Pi_0=\frac{1}{2}q_x(1-\beta)(\varphi_2-\varphi_1)\psi\left(k^{\star}_{f\lambda}(\lambda)\right)^{\beta}+\frac{1}{2}\cdot(s_h-2s_f-\Pi_0). \quad \text{(C.45)}$$

With $\lambda = \tilde{\lambda}$, we can substitute $k^{\star}_{f\lambda}(\lambda)$ with (C.41), obtaining

$$\Pi^{\star}_{f\lambda}(\lambda) - \Pi_0 = Q \cdot (\gamma - 1) \frac{1}{2} \left\{ \frac{1}{2} \left[\gamma + 1 + \beta (\gamma - 1) \right] \right\}^{\frac{\beta}{1-\beta}} + \frac{1}{2} \cdot (s_h - 2s_f - \Pi_0),$$

which implies that the Foreign Firm prefers Foreign Control to no initial contract, $\Pi^{\star}_{f\lambda} > \Pi_0$, if and only if

$$\Pi_0 < \tilde{\Pi}^{\pi f}_0 \equiv s_h - 2s_f + Q \cdot (\gamma - 1) \left\{ \frac{1}{2} \left[\gamma + 1 + \beta (\gamma - 1) \right] \right\}^{\frac{\beta}{1-\beta}}. \tag{C.46}$$

Derivation of result (24). The second inequality in (24), $\Pi^{yp}_0 > \Pi^{\pi p}_0$, is already proved in (16). The first inequality, $\Pi^{yp}_0 > \tilde{\Pi}^{\pi f}_0$, is proved as follows. From (B.52) and (C.46), we have

$$\Pi^{yp}_0 - \tilde{\Pi}^{\pi f}_0 = 2s_f + Q \cdot \left\{ (\gamma + 1)^{\frac{1}{1-\beta}} - 2 - (\gamma - 1) \left[\frac{1}{2} (\gamma + 1) + \frac{1}{2} \beta (\gamma - 1) \right]^{\frac{\beta}{1-\beta}} \right\}. \tag{C.47}$$

We now show that the term in curly brackets in (C.47) is always positive: re-writing it as a function

$$\Xi_9(\gamma) \equiv (\gamma + 1)^{\frac{1}{1-\beta}} - 2 - (\gamma - 1) \left[\frac{1}{2} (\gamma + 1) + \frac{1}{2} \beta (\gamma - 1) \right]^{\frac{\beta}{1-\beta}}, \tag{C.48}$$

the derivative with respect to γ is

$$\Xi'_9(\gamma) = \frac{1}{1-\beta} \left\{ (\gamma + 1)^{\frac{\beta}{1-\beta}} - \Lambda_\gamma \cdot \left[(\gamma + 1) + \beta (\gamma - 1) \right]^{\frac{\beta}{1-\beta}} \right\}, \tag{C.49}$$

$$\text{with } \Lambda_\gamma \equiv \left(\frac{1}{2} \right)^{\frac{\beta}{1-\beta}} \frac{\gamma + 1 + \beta (\gamma - 1) - \beta (\gamma + 1)}{\gamma + 1 + \beta (\gamma - 1)} < 1. \tag{C.50}$$

The sign of $\Xi'_9(\gamma)$ is positive for any $\gamma > 1$. The proof is by contradiction: suppose that $\Xi'_9(\gamma) < 0$. From (C.49)-(C.50), this would imply

$$\Lambda_\gamma > \left(\frac{\gamma + 1}{\gamma + 1 + \beta (\gamma - 1)} \right)^{\frac{\beta}{1-\beta}},$$

$$\frac{\gamma + 1 + \beta (\gamma - 1) - \beta (\gamma + 1)}{\gamma + 1 + \beta (\gamma - 1)} > \left(2 \cdot \frac{\gamma + 1}{\gamma + 1 + \beta (\gamma - 1)} \right)^{\frac{\beta}{1-\beta}}, \tag{C.51}$$

which is absurd because the left hand side of (C.51) is less than unity whereas the right hand side of (C.51) greater than unity.[39] As a consequence,

$$\Xi'_9(\gamma) > 0 \text{ for all } \gamma > 1.$$

[39] The fact that the right hand side of (C.51) is greater than unity can also verified by contradiction: imposing $2 \cdot \frac{\gamma+1}{\gamma+1+\beta(\gamma-1)} < 1$ we obtain $\beta > \frac{\gamma+1}{\gamma-1} > 1$, which is absurd because $\beta < 1$.

Combining this result with

$$\lim_{\gamma \to 1} \Xi_9(\gamma) = (2)^{\frac{1}{1-\beta}} - 2 > 0,$$

it follows that the term in curly brackets in (C.47) is positive for any value of $\gamma > 1$, which means that $\Pi_0^{yp} > \tilde{\Pi}_0^{\pi f}$ for any constellation of parameters.

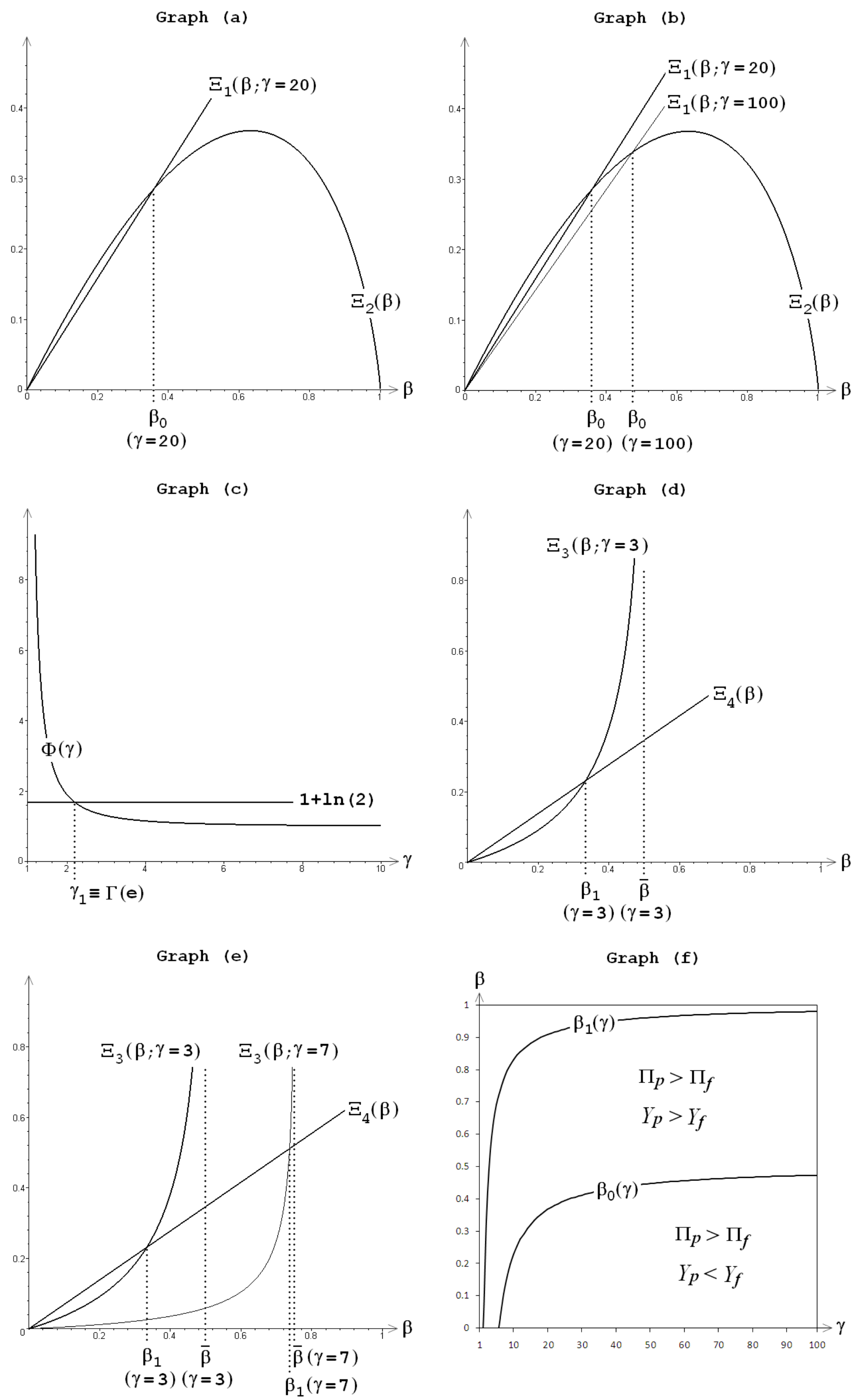

Figure A1. Graphical proof of Proposition 2.

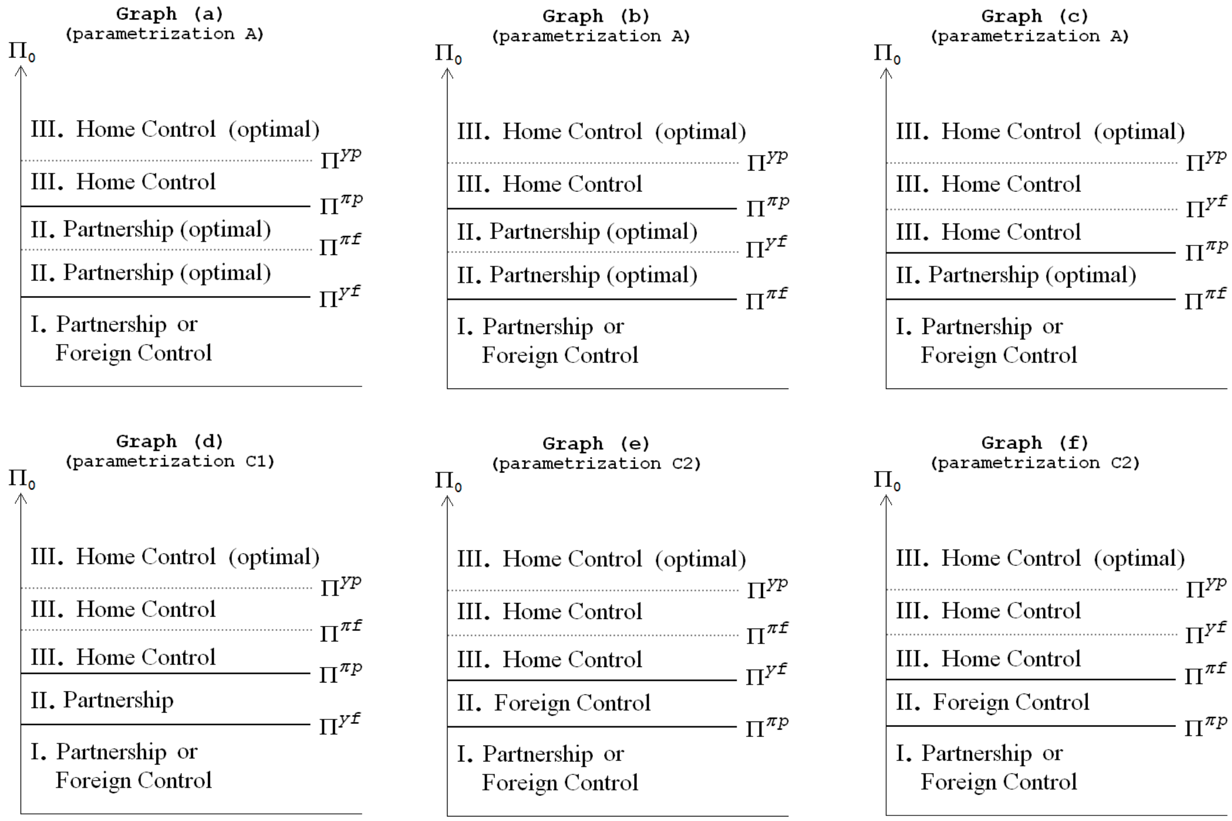

Figure A2. Agreeability of regimes: proof of the results reported in Table 2.