Resource-based FDI and Expropriation in Developing Economies

Christopher Hajzler
Department of Economics
P.O. Box 56, University of Otago, Dunedin, New Zealand
Email: chris.hajzler@otago.ac.nz

Abstract

Expropriation of FDI is more likely to occur in resources compared to other sectors. Despite this higher risk of expropriation in resources, countries with a high propensity to expropriate also have higher shares of FDI in resources, even though they are not more resource dependent. An incomplete markets model of FDI is developed to account for this puzzle. The key innovation is the ability of the government to offer mineral rights cheaply to foreign investors in order to compensate for high political risk. When political risk is low, resource FDI is restricted instead to avert a costly future expropriation.

JEL Codes: F23, F41, F51, F59
Keywords: Expropriation, Foreign Direct Investment

1 Introduction

Political risk, which includes risk associated with corruption, war, and expropriation, is frequently cited as an important determinant of foreign direct investment (FDI) in developing countries.[1] A relatively severe but not uncommon form of political risk is expropriation, where a host-country government seizes company assets without fair compensation. Historically, foreign multinationals in a wide range of sectors have proven to be vulnerable to expropriation. However, the problem appears to be more acute in resource-based sectors, particularly in mining and petroleum. Compared to the relative importance of these sectors in aggregate investment and output, foreign investment is expropriated more often in mining and petroleum than in other industries.[2] This observation has motivated several authors to examine industry-specific factors influencing the propensity to expropriate. The factors proposed include the prevalence of sunk costs in resources and mineral price volatility (Nellor 1987; Monaldi 2001; Engel and Fischer 2008), varying uncertainty over project returns at its various phases (Kobrin 1980), and issues related to national economic security and strategic political objectives (Kobrin 1980; Shafer 1985).

Much less attention has been devoted to explaining the apparent willingness of foreign investors to continue investing in resource extraction in several high-risk countries. In Bolivia, Ecuador, Russia, and Venezuela, for instance, large amounts of FDI are currently being expropriated in these industries, and yet the mining and petroleum industries have been nationalized (in some cases multiple times) in these countries before. Repeating cycles of foreign investment and expropriation in extractive industries are also documented elsewhere.[3] There is also evidence to suggest that developing countries that are likely to expropriate even do better in attracting resource-based FDI relative to the other sectors. Hajzler (2010) documents international expropriations from 1993 to 2006, building on the work of Kobrin (1984) and Minor (1994), and constructs inward FDI stock estimates by sector for 42 developing countries during this period. These data reveal that the average share of resources in total FDI is higher among recently expropriating countries (35%) in comparison to non-expropriating countries (16%). This observation is surprising in view of the higher risk associated with resource-based investments, and given that expropriating countries do not appear more highly resource-dependent.[4] The relatively high resource-based FDI

[1] According to a recent survey conducted by IMF's Capital Markets Consultative Group (2003), most managers of companies engaged in FDI rank access to the legal system and the enforceability of contracts first in assessing the political risks associated with investing. See Albuquerque (2003), Alfaro, Kalemli-Ozcan and Volosovych (2005), Geiger (1989), Jensen (2006) and Wei (2000) for empirical evidence for the adverse impact of political risk on FDI.

[2] See Truitt (1970), Kobrin (1984), and Kennedy (1993) for discussion and evidence on this point for the 1960s and 1970s. Historically, utilities and banking have also been relatively vulnerable to expropriation.

[3] See Gadano (2007) and Hogan, Sturzenegger, and Tai (2007). The latter note that host-countries, having felt the negative consequences of expropriation, will often offer very favorable deals to investors to entice them back: then "the cycle may start again, with similar costs to both parties as before" (p.3).

[4] It would be less puzzling if these expropriating countries were also found to be particularly resource-dependent. In this case, one explanation would be that sectoral FDI patterns are driven primarily by a country's comparative advantage, and that countries with a comparative advantage in the relatively risky resource sectors, in turn, have a higher propensity to expropriate. However, a comparison of sector output shares does not reveal substantial differences between the two groups.

in countries that are likely to expropriate can perhaps help to explain why expropriations in resources are relatively common and are recurrent in many countries. Yet there is still a challenge in explaining what makes resource-based FDI relatively attractive in these countries. The interpretation in Hajzler (2010), citing published investor survey and other anecdotal evidence, is that governments offer incentives to foreign investors in the form of low royalty rates in risky investment climates. Still, it is unclear under what circumstances this arrangement would be desirable from the host-country's perspective, and what the implications are for investment patterns.

This paper explores these questions formally by developing an incomplete markets model of FDI that emphasizes the role of government in managing the economy's stock of minerals when FDI can be expropriated. Host-country governments typically decide how mineral rights are allocated, as well as the terms of the associated contracts, and may exercise a special influence over FDI in this sector that is not paralleled in other sectors. Of particular interest is if there are circumstances in which governments would want to indirectly subsidize resource-based FDI by offering mineral rights more cheaply in order to partially offset the negative impact of expropriation risk. The idea that governments are able to offset expropriation risk by providing "sweet deals" to foreign investors in the resource sector is not a new one (see, for example, Monaldi 2001). However, what remains unclear is whether the host-country can benefit from adopting such policies.[5] In countries where a relatively low capital stock is a primary motivation for attracting FDI, this policy tool is potentially an important substitute for direct subsidies because the latter would necessarily draw on already scarce domestic capital. The provision of resource sector contracts that are more favorable to foreign investors when expropriation is more likely can lend some insight into why high-risk countries are able to attract relatively large amounts of FDI to this sector.

The model we develop considers a two-sector, small open economy. As in the one-sector models of expropriation of Eaton and Gersovitz (1984) and Cole and English (1991), we consider a government whose aim is to maximize host-country welfare by attracting foreign capital, but where the relative future costs and benefits of seizing foreign assets are uncertain. The host country is assumed to have "too little" capital, with a domestic interest rate that exceeds the world rate. When contracts are incomplete, however, capital returns are not equalized by capital inflows due to the risk faced by foreign investors. If the host-country government is unable to implement contracts that commit it to never expropriating, foreign investors will always invest less than the efficient amount. The novel approach taken here is to consider the role of the host-country mineral contract in determining the patterns of foreign investment and expropriation at the sector level. The government's optimal allocation and pricing of mineral rights, as well as required investments in the resource sector, are evaluated at different levels of political risk. Of particular interest are the implications for FDI at the sector level.

In the model, uncertainty is derived from stochastic resource output prices and from a random external penalty to the host-country if it expropriates. The latter can be viewed as a change in the external sanctions foreign investors (or their governments) can impose on the host-country. Alternatively, the varying costs might be a function of changes in domestic political costs associated with expropriation arising from shifts in voter preferences. This cost is modeled as a deadweight loss in terms of host-country income that is not recovered by any party. All countries draw either a high or low penalty, with high risk countries facing relatively low associated penalties (implying a greater net gain from expropriating a given quantity of foreign investment). No inherent differences in the relative risk across sectors is assumed within a given economy. This permits an assessment of the extent to which responses in equilibrium resource contracts to aggregate country risk are consistent with the sectoral patterns of FDI and expropriation we observe.

We find that very high risk countries can benefit from offering mineral rights cheaply to foreign investors in order to raise FDI in the natural resource sector, while relatively low risk countries do better by restricting FDI to this sector. Underlying this is the desire of the host-country government to balance the goal of larger capital inflows, which it will occasionally be tempted to expropriate, with a credible commitment to not (or rarely) expropriate, which is costly. Only in a low penalty regime is the government tempted to expropriate, and this temptation is increasing in the realized mineral output price. When this penalty is moderately high (i.e. country risk is low), for given levels of aggregate FDI, the risk of expropriation is amplified as FDI is tilted towards resources. The reason is that, in addition to the ordinary returns to capital received by foreign firms investors in both sectors, investors in resources stand to earn positive *ex post* rents (or "windfall profits") when faced with above average output prices. In order to reduce the temptation to expropriate in low penalty regimes, mineral rights are allocated to domestic investors, shifting FDI to the non-resource sector. As country risk rises (the value of the sanction falls), the government is willing to expropriate at successively lower mineral output prices, and at some point windfall profits are fully appropriated by the host-country in the low penalty regime (at some point expropriation occurs whenever the price is above a threshold approximately equal to the average price in a low penalty regime). This implies that the foreign resource firm, given it has not been expropriated, receives a below average return (and possibly operating at a loss). Tilting FDI towards this sector therefore dampens the temptation to expropriate in low penalty states,

[5] One argument is that host-countries typically do not benefit at all from offering such incentives to foreign investors. Rather, the lack of transparency and accountability in many countries can allow corrupt governments to sell off mineral rights cheaply and to pocket much of the gains.

and the government prefers to allocate mineral rights to foreign investors. When the country is very high risk, minimizing expropriation risk requires FDI to be far below the efficient level. Here, the gains from increasing investment are large relative to the direct cost of expropriating. Thus the government raises investment in the resource sector (which increases the likelihood of expropriating in a low penalty regime) by lowering the price of mineral rights sufficiently to compensate foreign investors for the additional risk. Taken together, these results imply a positive average relationship between risk and the share of FDI in resources.

The qualitative predictions of the model are broadly consistent with the data. First, countries most likely to expropriate are predicted to have higher average shares of FDI located in the natural resource sector, with little difference in sector output shares. As a consequence, the volume of foreign assets seized is biased towards resources relative to the sector's average importance in GDP.[6] Moreover, the timing of expropriation in natural resource sectors often coincides with above average commodity prices both in the model and in the data.

An interesting prediction of the model is that the host-country's *ex post* share of the returns in the resource sector, or the payment for the mineral rights, is much lower for the high risk country. Due to data limitations, it is very difficult to verify the extent of this relationship in practice.[7] This prediction is, however, consistent with the low host-country share of resource rents observed in several developing countries.[8]

Our findings also provide a rationale for why some countries, such as Venezuela and Bolivia, have managed to attract large amounts of FDI in mining and petroleum despite having a prior history of nationalization of foreign interests in these sectors – typically amidst waves of "revolutionary nationalism." The Bolivian government, for instance, expropriated Standard Oil Company in 1937 (nationalization of the mining sector followed). In 1964 President Barrientos began re-privatizing the minerals sector, granting concessions to Gulf Oil, but these concessions were expropriated in 1969 following a military coup. After another successful re-privatization and large inflows of resource-based FDI, the Bolivian government is expropriating resource FDI yet again. Similarly, Venezuelan President Carlos Perez had nationalized petroleum in 1976, bringing the assets of Exxon, Shell, and Gulf under the state monopoly. During the 1992-1997 privatization, many exploration and operating contracts were bought by foreign companies (including Exxon) and for many, royalty rates had been reduced to a mere 1 percent of revenues (the constitutional minimum). Recently, Exxon as well as several other foreign companies have had their assets seized by the Venezuelan state.[9] Moreover, these expropriations accompany government claims of "abusive profits" and "robbery" on the part of foreign companies.[10] While it may seem that foreign investors (and host-country governments) have simply failed to learn important lessons from the past, we argue that these cycles of FDI and expropriation in resources are consistent with forward-looking behaviour. Our analysis also lends insight into why foreign ownership in these sectors has been very limited by the governments of several other resource-rich countries, and even banned by decree, as in the case of Mexico.[11]

The rest of the paper is organized as follows. Section 2 provides an overview of the empirical facts and literature that relate to this paper. In Section 3, we present a model which is consistent with these facts, proceeding in three stages. The main intuition for offering mineral rights cheaply in very high risk countries is first emphasized in a simple version of the model with no price uncertainty. A simple distribution over resource output prices is then considered, which has additional implications for the effect of country risk on the optimal choice of resource contract. Finally, a royalty-based contract that more closely resembles the type of mineral contract commonly observed is considered, and we show that all of the results obtained under the more general contract are preserved. Section 4 concludes.

2 Stylized Facts

Several of the "stylized facts" relating to expropriation of FDI that are studied in this paper are based primarily on empiri-

[6] Strictly speaking, the results presented here relate to volumes of FDI and do not automatically generalize to forming predictions regard the relative frequency of expropriation or number of "acts", which is the unit of measurement in these statistical comparisons. This disconnect can be resolved, however, if we think of expropriations being carried out over elongated periods that are increasing in the amount of FDI being seized.

[7] As noted in Hajzler (2010), reliable and complete information on mining and petroleum contracts is particularly difficult to find for most countries. Developing country governments are often criticized for lacking transparency over these contracts, and information pertaining to industry-wide production and expenses are often suppressed due to confidentiality restrictions.

[8] Stiglitz (2007) and McMillan and Waxman (2007) offer alternative perspectives on the dependence host-country returns in the natural resource sectors and the country's institutional and political environment.

[9] Approximately U.S. $4 billion has been claimed against Bolivia for the expropriation of four foreign-owned oil companies in 2006. This compares to an estimated $2.5 billion in total primary sector FDI in 2002 (the most recent year in which sector FDI data are available). In Venezuela, at least $1.7 billion in mining and petroleum investments has been expropriated between 2001 and 2006. The value of claims can exceed stock of direct investment because claims will often include all equity in the foreign affiliate, not just the shares belonging to direct investors. Valuation is based on the total amount claimed to have been invested by foreign investors in Bolivia's oil sector since 1997. These data are described in more detail in Hajzler 2010.

[10] The full context of these statements are reported in *Times Online*, May 3, 2006 (www.timesonline.co.uk) in the case of Boliva President Evo Morales and *New York Times*, February 11, 2008 in the case of Venezuela President Hugo Chavez.

[11] Resource FDI shares are relatively low in Thailand and Malaysia, for example, even though minerals account for a large share of GDP. Neither country has a record of nationalizing resources.

cal investigations of a half-century of developing country expropriations of FDI. Extensive historical coverage of expropriation worldwide can be found in the cumulative efforts of Kobrin (1980; 1984), Minor (1994), Hajzler (2010) and Tomz and Wright (2010). These data report expropriations of FDI (typically identified as 10% or more ownership belonging to a single foreign investor or company) and report the primary industry classification of the affiliate firm. Kobrin's work represents the initial phase of this research agenda, documenting expropriations for the 1960-1979 period, and providing the framework for subsequent extensions of these data to cover additional years.[12] Kobrin's measure of expropriation, the expropriation "act", is defined as the forced divestment of any number of foreign affiliate firms in a given industry and in a given year. This measure provides a means for comparing the relative degree or intensity of expropriation when reliable data on the value of assets involved are not available. It makes the goal of arriving at a reasonably exhaustive list of developing countries expropriations feasible.[13]

The set of facts documented in a number of studies of expropriation that are of primary interest in this paper are:

1. The share of primaries sector expropriation is high relative to the importance of this sector in developing country output.
2. Expropriation in extractive industries is more likely when mineral prices are high.
3. The share of FDI in resources tends to be higher in high-risk countries, though differences in sector output shares are small.

We briefly review each of these facts and related literature in this section, and report some key statistics employing the expropriation data described above.

Examining the sectoral patterns of expropriation acts over time (beginning in 1960), the proportion of acts in the primaries sector is high (typically around 40%) compared to the average developing country production shares (about 22%), with the bulk of these acts occur in mining and petroleum (See Table 2 in the Appendix). Although expropriations are not particularly high in services overall, the utilities industry appears to be a relatively frequent target for expropriating governments.[14] We also note that the sector distribution of acts appears fairly stable over time.

One concern might be that the unit of measurement, an 'act', does not adequately capture the degree to which these sectors are targets of expropriation (perhaps owing to there being more 3-digit industry classifications for one group, or large differences in the number and value of firms taken during each act). However, alternate measures of the sectoral distribution of takings, such as number of firm's affected and estimated value of assets, give very similar results. (See Kobrin 1984 and Hajzler 2010).[15]

The relative vulnerability of resource-based FDI to expropriation, and to a lesser extent utilities and banking and insurance, have been widely documented. Explanations and empirical tests have tended to focus on factors that render FDI in these sectors especially risky. These accounts are diverse, addressing: (i) the industries' strategic and security importance in the cases of resource extraction, utilities, rail, and communications[16], (ii) the technological and industrial structure characteristics that raise the value of foreign managerial control relative to indigenous or state ownership in many manufacturing and service industries[17], and (iii) fluctuations in the return to FDIs relative to host-country share or benefit from these projects.[18]

A specific factor that is related to the last of these explanations for differences in sector risk is commodity price variability. Under standard output- or sales- based royalty contracts, a significant rise in the mineral output price would represent an increase in foreign investor returns relative to the host country revenues. Therefore a high variance in output prices in many extractive industries, given that the host-country revenues from these projects are based on the value of output rather than income, is one factor that can exacerbate differences between foreign investor and host-country returns, contributing to the relative riskiness of this sector.[19]

More generally, however, host-country governments may have a greater temptation to expropriate when the value of assets is high (whether they seek to maximize host-country welfare or to line their own pockets). This relationship is consid-

[12] Minor (1994) extends Kobrin's data to include the 1980-1992 period. Hajzler (2008) covers expropriations from 1993 to 2006, including 3 cases during the 1989-1992 period apparently missed by Minor (1992). Tomz and Wright (2010) extend Kobrin's database backward to the first half of the century. Taken together, these data cover all developing country expropriations of FDI over the 1900-2006 period.

[13] See Kobrin (1980; 1984) for more details on measurement.

[14] Although the utilities sector is not considered explicitly in this paper, it has important similarities to the extractive industries in the context of this analysis. Specifically, host-countries exercise substantial control over who is permitted to invest, the investment obligations borne by the investors, and the profitability of the project by specifying the rates charged to customers or the degree of monopoly power the subsidiary will have.

[15] The distribution over expropriation acts is nevertheless the preferred measure, owing to differences in average firm size across sectors and the lack of reliable data for value of assets affected. (Hajzler (2010) derives estimates for value of assets expropriated during the 19990-2006 period based largely on arbitration claims, which do not include any compensation paid and which will likely over-estimate the market value of assets. The effect of this measurement error on sector share estimates is not clear.)

[16] See Rood (1976), Kobrin (1980; 1984), Minor (1994) and Kennedy (1993).

[17] See Rood (1976), Kobrin (1980), and Eaton and Gersovitz (1984).

[18] See Knudsen (1974), Jodice (1980), Mikesell (1984), Jones (1984) and Picht and Stüven (1991).

[19] The importance of this factor would be amplified if mineral contracts were negotiated during a period in which the expected average or trend price for mineral output is particularly low.

ered in the models developed by Eaton and Gersovitz (1984), Cole and English (1992), and Thomas and Worrall (1994). A tendency for governments to expropriate FDI when the mineral price is above trend is documented in Duncan (2006), and this relationship with respect to the expropriation data considered here has been documented in Hajzler (2010). This second fact from the above list will play an important role in the model developed in the next section.

The final empirical finding, which is the focus of this paper, is relatively large average shares of resource-based FDI in seemingly high risk countries. Hajzler (2010) compares the sectoral distribution of FDI of countries that have expropriated during the recent 1990-2006 period to countries that had not expropriated during this period, and finds that the primaries FDI share in expropriating countries is twice that of the non-expropriating group, while the manufacturing and services FDI shares were smaller. (These comparisons are reproduced in Table 3 in the Appendix.) Comparing specifically mining and petroleum FDI shares, using data for U.S. affiliate investments, the difference between expropriating and non-expropriating groups is even more pronounced. However, this difference is not reflected in average sector production shares. This suggests that it is not merely a large dependence on mining and petroleum production which is responsible for the relatively high shares of FDI and which in turn may have, as a result of the exogenous factors that raise the relative riskiness of FDI in these industries, increased their likelihood of expropriating.

It is also worthwhile noting that many of the countries that are included in the expropriating group have heavily expropriated in at least one industry at multiple points over the past century.[20] In these traditionally high risk industries, then, these expropriating countries should be considered relatively high risk locations for foreign investments where one can expect, at least over a longer time horizon, a sudden shift in the government's incentives to expropriate FDI. Our objective is to understand the high foreign investment in one high-risk sector, relative to other sectors, during periods when the political regime is more favorable privatization and foreign investment.

We argue that the ability of governments to offer mineral rights cheaply in order to offset inherent risks (in addition to the standard policy options such as "tax holidays" that can be employed equally in all industries) provides a plausible explanation for the additional incentives to invest in resources. For instance, governments typically manage the economy's stock of mineral wealth, which is a significant input into the value of overall production of tradeable minerals, and determine the cost of mineral rights (typically by setting the royalty rate for that mineral). There are very few counterparts to this measure of control over profitability in any other industry.[21] Hajzler (2010) cites anecdotal evidence for the importance foreign investors place on access to mineral rights as a motivation to invest in relatively risky investment climates. Yet this explanation for observed sectoral patterns of investment is not entirely convincing without a rationale for why offering mineral rights cheaply benefits the host-country (or its government). The theoretical analysis in the next section considers an environment in which these benefits can be rationalized when political risk is high, and where relatively low risk countries instead do better by restricting FDI in the mineral sector when volatile mineral prices are taken into account.

Finally, there is a growing resource curse literature which identifies the inability of governments to secure the the "full value" of minerals as one of the central problems facing resource rich countries. Many poor countries do not have the capital or technical know-how to independently exploit their natural resource bases, and must therefore enter into agreements with foreign companies. As Stiglitz (2007) points out, these countries often face difficulties in securing favorable agreements because of poor public sector management and corrupt officials who are easy to bribe. McMillan and Waxman (2007) find empirical support for this idea in a cross-country analysis of the share of host-country returns from mineral contracts. Countries with low measures of institutional quality tend to have a lower government take, which they attribute to a poor bargaining position. In this paper, we emphasize conditions in which a contract that specifies a low relative return for the host-country can make the country better off. Since these conditions are associated with poor institutional quality, one lesson from this research is that the combination of cheap mineral rights for foreign firms and bad institutions does not necessarily imply the citizens of these countries are loosing out. Still, the host-country is unambiguously better off with the improvement of institutional quality.

Having presented an overview of the empirical facts and related literature, we now turn to a description of the formal model.

[20] Mining and petroleum has been nationalized during several distinct periods in Argentina (1963, 1974), Bolivia (1937, 1952, 1969, 2006), the Democratic Republic of Congo (1976, 1993), Ecuador (1969-1979, 2006), Indonesia (1960, 1965), Russia (1918, 2006) and Venezuela (1975, 2005), and several large expropriations of FDI in utilities have occurred throughout this period in Indonesia (1966, 1976, 1998) and in Venezuela (1963, 1969). These observations are based on Tomz and Wright (2010), who have compiled data on developing county expropriations of FDI over the 1928-1960 period. There are many other historical examples of "serial expropriators" that are not among those countries that have expropriated since 1990, but have nevertheless nationalized and re-privatized an industry multiple times.

[21] In some industries, however, host-country governments can guarantee monopoly rights, which may be equally effective tools for attracting foreign investment in the presence of risk. Nevertheless, the management of mineral rights by governments is almost universal, whereas prices most other inputs employed heavily in all other sectors (most types of labour and capital, for example) are typically competitively determined.

3 The Model

This section presents a static, two-sector model of foreign investment and expropriation that is broadly consistent with the empirical observations outlined in the previous section. The focus of the analysis is on the role of government in managing the economy's stock of minerals in the resource sector. As managers of the nation's natural resources governments can, for instance, lower the cost of extracting minerals by lowering royalty rates or income taxes, making investment in resources relatively attractive. In industries where the mineral contributes a large proportion to the total value of output, this tool for attracting foreign investment can be particularly effective.[22]

The basic environment considered builds on the single-sector, incomplete markets models of Eaton and Gersovitz (1984) and Cole and English (1992). In the environments they study, a capital poor country benefits from capital inflows, or FDI, but aggregate investment remains inefficiently low due to expropriation risk. There are no enforceable international regulations to protect investors, and a host-country government that maximizes domestic welfare (or perhaps even its own coffers) is tempted to take these investments when their value is high. Contracts are assumed to be incomplete: the host-country government is unable to condition the payments it collects from the foreign investor on the future profitability of the investment or on the penalty it faces for expropriation, even though this would lead to a more desirable *ex ante* outcome.[23] In our model, the host-country government's key decision is the choice of resource contract, which specifies investment levels as well as the price for each mineral concession. This price does not depend on the state of nature, which is in line with the types of mineral contracts most commonly observed in developing countries. A fixed payment schedule also implies that expropriations can actually occur in the context of endogenous expropriation (and expropriation is also something we observe in the data).

In order to justify positive FDI in an environment where the host-country government can expropriate these investments, it is necessary to specify a cost to expropriating. In Eaton and Gersovitz (1984), a host-country government can expropriate foreign capital but is unable to appropriate foreign managerial expertise. A host-country with a higher domestic managerial capacity receives a comparatively low amount of FDI because the cost in terms of output associated with expropriation is relatively low. Cole and English (1992) consider expropriation risk in a dynamic context where the only cost of expropriating is a trigger-strategy cutting off of all future investments, which reduces the discounted value of the domestic factor of production.[24] We will consider a two-period model where the costs of expropriating are captured by an exogenous, stochastic penalty on period-2 output. This penalty is described fully in the next section.

Our two-sector model of FDI allows us to compare optimal investment patterns in each sector in response to expropriation risk, and these patterns largely depend on the chosen mineral contract. Recently, Hogan, Sturzenegger, and Tai (2007) and Engel and Fischer (2008) have examined resource contracts in the presence of expropriation risk. They note that, historically, investors' returns in this sector tend to be lower than what is stipulated in their contracts when prices are high (due to expropriation), yet are offered very favorable concessions when prices are low (which are not likely to be kept). Engel and Fischer (2008) show that deviations from a fixed payment schedule such as this can be an optimal response to expropriation risk in industries with large sunk investments. In their model, however, the probability of expropriation is an exogenous, positive function of project return and all investment is sunk investment. These assumptions allow the authors to focus on the effects of risk on the optimal allocation of returns in the resource contract. The model that we consider assumes a much more limited set of contracts, and instead focuses on the implications for sectoral patterns of expropriation and FDI.

Our findings suggest that very high risk countries can benefit from offering mineral rights cheaply to foreign investors in order to raise FDI, and relatively low risk countries do better by heavily restricting FDI to this sector when the resource output is volatile. In relatively low risk countries the expropriation penalty is large. The implication is that, for a given amount FDI in each sector, it is only worthwhile to expropriate when resource output prices are particularly high and investors in resources would otherwise earn windfall profits. The probability of expropriation rises as FDI is more highly concentrated in resources since, in addition to the ordinary return to capital, the prospects of realizing an above average resource output price makes expropriation even more likely when there is a large amount of FDI in this sector.[25] Restricting FDI in the resource sector therefore minimizes risk for a given level of aggregate FDI. However, for countries above a certain threshold level of risk, the opposite is true because the penalty is sufficiently and, conditional on not being expropriated, foreign firms receive low (possibly negative) returns in this state. In this case increasing FDI in resources raises the probability of expropriation by less than an equal increase in

[22] Particularly when governments are constrained financially or politically from offering direct subsidies to foreign investors in any sector, contracts guaranteeing cheap access to the country's mineral deposits provide one alternative to direct subsidies in the minerals sectors.

[23] For an analysis of the effects of expropriation risk on patterns of FDI when contracts are complete, see Thomas and Worrall (1994). The equilibrium contract delivers a positive share of the returns to the host-country only as necessary to deter expropriation – this allows the investor to recover its sunk investment costs sooner so that investment can be raised towards the efficient level, and expropriation never occurs.

[24] Domestic agents or governments are not permitted to save in their model.

[25] More precisely, it is not the unconditional average price that is the relevant benchmark here, but the conditional expectation given expropriation does not occur, since it is this average upon which the host-country share of the resource rents is based.

non-resource FDI, and shifting FDI to the resource sector is the way to minimize risk for given levels of foreign investment. Taken together, these results imply a positive average relationship between risk and the share of FDI in resources.

3.1 *Environment*

The basic environment consists of a large number of foreign investors that compete for a limited number of projects in each of two sectors of the host-country. The host-country is capital poor and is unable to finance these projects itself. For simplicity, it is assumed that there is no foreign borrowing, so all capital inflows take the form of FDI. The high returns to capital in the host-country provide a motivation for foreign investors to invest – domestic and foreign capital are perfect substitutes in production.

Investment is risky - there is a positive probability that output and capital are seized by the host-country government. The relative costs and benefits to the host-country from expropriating are unknown to both investors and the government at the time that investments are made. The two sources of uncertainty that relate to these costs and benefits are (i) an exogenous penalty if the host-country expropriates, and (ii) the relative price of resource sector output. The penalty can be interpreted as either an external sanction that is imposed by the foreign investors (or their governments) or changing domestic pressures that influence the political costs of expropriating or not expropriating (as in the case of an extreme socialist government being elected), or some combination of both. It is treated as a deadweight loss in the model, and so a given amount of host-country output is dissipated in the event expropriation occurs.[26] Countries characterized by higher default risk are those with a high probability of facing low costs of expropriating once investments are made.

This approach is similar in spirit to that adopted by Cole, Dow, and English (1995) in their analysis of sovereign default, where a government transits through different political states that affect its valuation of future investments. In contrast to theirs and other dynamic models of sovereign default, however, the costs of expropriating are entirely exogenous in this static environment because future investor strategies are not relevant.

3.1.1 Production

Production in each sector employs foreign and/or domestic capital and a sector-specific domestic input. In the resource sector, this input is a mineral right. In the non-resource sector, domestic labour is employed. I assume that aggregate output in each sector is produced using Cobb-Douglas production functions:

$$\begin{aligned} R_j &= K_{Rj}^{\alpha} M_j^{1-\alpha} \quad \alpha \in (0,1) \\ X_j &= K_{Xj}^{\gamma} L_j^{1-\gamma} \quad \gamma \in (0,1) \end{aligned}$$

where R_j is the quantity of resource-sector output produced by firm of type j: either foreign ($j = f$) or domestic ($j = h$). M_j is the quantity of the mineral rights leased by firm of type j. Similarly, L_j denotes labour employed by each firm type, and $K_{i,j}$ is investment in sector i. The aggregate quantity of domestic production inputs are denoted by M (mineral rights), L (labour), and K (capital), giving the following resource constraints:

$$\begin{aligned} M &\geq M_f + M_h \\ L &\geq L_f + L_h \\ K &\geq K_{X,h} + K_{R,h} \end{aligned}$$

For simplicity, domestic labour L is normalized to 1 throughout the analysis.

In the non-resource sector (henceforth "manufacturing"), both foreign and domestic firms compete for access to domestic labour and face a common labour price w_L. In the resource sector, by contrast, the mineral rights are allocated by the government in the form of resource contracts.

3.1.2 Host-Country Government

An altruistic host-country government is the owner or manager of the mineral rights, and chooses a resource contract that maximizes what we refer to as host-country income. This objective function is defined fully in Section 3.2 – it is a linear aggregator with a relative resource output price, and which takes into account the expected penalty incurred from expropriation.

The choice of resource contract is the main policy tool available to the government. The key feature of the resource contract is that it specifies both the price of the mineral concession as well as the amount of capital to be invested.[27] One way to interpret the standard resource contract is as follows. For each concession and corresponding investment amount, investors compete by offering payment amount w_M (which is paid after revenues are received and only in the event their assets are not expropriated). This results in a schedule $[K_{Rf}, w_M]$ corresponding to foreign investment. The government then chooses the preferred contracts among foreign and domestic bidders and allocates mineral rights accordingly. In what follows we

[26] What is essential in this static environment is that there is some positive, exogenous cost component associated with expropriation. Whether this is interpreted as a loss in output, as in the case of externally imposed sanctions, or as a lack of political support for such actions, does not matter. In the former case, the government objective function is expected national income, and in the latter case it is instead a government utility function that is linear over expected national income and the expected default penalty.

[27] To illustrate the importance of specifying investment levels, this contract is contrasted with the case where investors are free to choose optimal investment levels once a resource concession is granted.

will not be interested directly in the price charged to domestic investors – instead we consider the domestic capital allocation problem faced by the government, assuming that the appropriate price is charged to make this allocation profitable for domestic investors.

The resource contracts held by foreign and domestic investors therefore determine the allocation of mineral rights (M_f), as well as foreign and domestic capital stocks in this sector, K_{Rf} and K_{Rh}. In turn, the amount of domestic capital located in the manufacturing sector is $K - K_{Rh}$. Foreign investors decide whether or not to add to the stock of capital in this sector, and this foreign competition determines the equilibrium labour wage as well as optimal quantities of labour employed by each type of firm.

This very simple type of resource contract approximates a variety of mineral contracts observed often in practice. Depending on the particular mineral and on the type of contract, specific terms will jointly determine the quantity and form of payment for the mineral concession and the quantity of investment per concession. In the extreme, the entire set investment obligations of each contracting party will be explicitly negotiated.[28] More often, however, only part of the investment will be specified, as in the case of minimum investment requirements or when the development of specific infrastructure such as roads or ports is included in the contract, leaving the remaining capital investments up to the investor. Inducing higher or lower investment can also be managed in other ways. Many mineral contracts, for instance, specify cost-recovery limits which cap the amount of investment expenditures that can be deducted from taxable income. Raising these limits (or removing them altogether) can make investment more attractive. This mechanism can be especially important when decided in conjunction with the size and configuration of the exploration territory which forms the basis for the tax and exemptions.[29] A range of other contractual elements can also influence the costs of investing, such as environmental regulations (for instance, clean-up and restoration of the site at the end of production).

The key assumption in terms this model is that the host-country government can exercise a significant influence over investment incentives as part of such resource contracts that it does not generally have in other sectors. Because the government controls the supply and price of an essential input in production in this sector, but typically does not in other sectors, this hardly seems unreasonable.[30]

[28]Specified investment amounts are also common in the utilities sector and for build-to-operate contracts in other industries.

[29]If the areas are large and contain "frontier" regions that require considerable exploration expense, relaxing cost-recovery limits can raise the amount of exploration (and future development) that takes place because exploration costs can be deducted from the income generated on the more profitable tracts. A thorough comparison of different types of contracts in the petroleum production sector is provided by Johnston (2007).

[30] Important exceptions may arise in industries where the government can guarantee market power, such as telecommunications and public works. Here the essential input is market access itself, and it is reasonable to think that governments should exercise a commensurate degree of influence in these industries as well.

3.1.3 Timing

Once the successful bidders for the resource contract as well as investors in the non-resource sector have invested and output is produced, the government may decide it is worthwhile to expropriate foreign investor assets. Uncertainty is derived from an uncertain penalty that can be imposed on the host-country if it expropriates, $a \in \mathcal{A}$, as well as a random resource output price $p \in \mathcal{P}$. A particular state $\{a, p\}$ is denoted $s \in S = \mathcal{A} \times \mathcal{P}$. The timing of the model is summarized as follows:

Government announces resource contracts
↓
$K_{R,f}$, $K_{X,f}$, $K_{R,h}$, and $K_{X,h}$ is invested and output is produced
↓
$s \in S$ is realized
↓
Government decides whether or not to expropriate
↓
Investors pay w_M and w_L if not expropriated

3.2 *Host Country Income*

Expected host-country income depends on how likely (and in what states) the government expropriates, which in turn depends on the the resource contracts selected by the government as well as investor decisions. Defining

$$\theta = (M_f, K_{R,f}, K_{R,h}, K_{X,f}, K_{X,h}, w_M, L_f, L_h)$$

to be the vector of joint actions taken, it is useful for exposition to define $D(\theta) \subset S = \mathcal{A} \times \mathcal{P}$, the set (possibly empty) states in which the government expropriates corresponding to that set of actions. We refer to $D(\theta)$ as the "default set". Note that the cost of expropriating, a, is independent of the value of output and investment seized. Hence there is no incentive for the government to partially expropriate foreign assets. All output and capital in both sectors will be expropriated if expropriation occurs at all.

As described in the previous section, if the government does not expropriate, the host-country receives revenues w_M specified in the resource contract and w_L is paid to labour. If, on the other hand, the government expropriates, the host-country claims the entire value of output of both sectors including the value of left over capital. The country also incurs penalty a

and forgoes domestic factor payments w_M and w_L from investors whose assets have been seized.[31]

Given any realization of a particular state, if the government does not expropriate, expected national income is therefore

$$\begin{aligned} Y^N(p,\theta) &= pK_{Rh}^{\alpha}(M_h)^{1-\alpha} + K_{Xh}^{\gamma}L_h^{1-\gamma} \\ &\quad +(1-\delta)(K_{Rh}+K_{Xh}) + w_L(\theta)L_f \\ &\quad +w_M M_f. \end{aligned}$$

If instead the government chooses to expropriate, income is

$$\begin{aligned} Y^E(p,\theta) - a &= \sum_{j=h,f}\Big(pK_{Rj}^{\alpha}(M_j)^{1-\alpha} + K_{Xj}^{\gamma}L_j^{1-\gamma} \\ &\quad +(1-\delta)(K_{Rj}+K_{Xj})\Big) - a \end{aligned}$$

where $w_L(\theta)$ is the equilibrium price of labour. Ex ante host-country income is

$$\begin{aligned} V(\theta) = &\int_{s\in D(\theta)}\Big(Y^E(p,\theta)-a\Big)f(s)ds \\ &+\int_{s\notin D(\theta)} Y^N(p,\theta)f(s)ds \end{aligned} \tag{1}$$

where $f(\cdot)$ is the joint probability density function over $\mathcal{A}\times\mathcal{P}$.

3.3 *Investor Returns*

Denoting by $\pi(\theta) = Prob(s \in D(\theta))$ the probability that expropriation occurs, expected returns to the representative foreign investor in the manufacturing and resource sectors are given by

$$\begin{aligned} E[\Pi_{Xf}] =&(1-\pi(\theta))\Big(K_{Xf}^{\gamma}L_f^{1-\gamma} + (1-\delta)K_{Xf} \\ &- w_L(\theta)L_f\Big) - (1+r)K_{Xf} \\ E[\Pi_{Rf}] =&(1-\pi(\theta))\Big(E[p|s\notin D(\theta)]K_{Rf}^{\alpha}M_f^{1-\alpha} \\ &+ (1-\delta)K_{Rf} - w_M M_f\Big) - (1+r)K_{Rf} \end{aligned}$$

where $E[p|s \notin D(\theta)]$ is the expected price of the resource good given that expropriation has not occurred, and where δ is the capital depreciation rate and r is the world risk-free rate of return. Domestic investors receive analogous returns, but where by assumption the probability of being expropriated is zero.

[31] In the manufacturing sector, we assume that the government pays all workers from the revenues of its newly acquired state enterprise.

3.4 *Government Strategy*

The host-country government selects resource contracts and adopts an expropriation strategy that maximizes (1), given the strategy adopted by foreign investors in the non-resource sector. The analysis is simplified by considering the government strategy in two stages. In the first stage, foreign and domestic investors competitively bid for a menu of resource contracts by indicating the price they are willing to pay for a contract specifying a particular investment amount per mineral concession, and in anticipation of the equilibrium responses of the other agents. This results in a schedule $w_M(K_{Rf}/M_f,\theta)$ for foreign investors (and an analogous schedule for domestic investors). This schedule leaves the foreign investor with zero expected profits:

$$\begin{aligned} w_M(K_{Rf}/M_f,\theta) =&E[p|s\notin D(\theta)]\left(\frac{K_{Rf}}{M_f}\right)^{\alpha} \\ &-\left(\frac{r+\delta+\pi(\theta)(1-\delta)}{1-\pi(\theta)}\right)\frac{K_{Rf}}{M_f}. \end{aligned} \tag{2}$$

The second stage collapses to a simultaneous decision over (K_{Rf}, K_{Rh}, m_f) (the selection of preferred contracts). This solves

$$\max_{\{K_{Rf},K_{Rh},M_f\}} V(\theta)$$

such that, for each $\{a,p\} \in S$ and for all θ:

$$s \in D(\theta) \quad \Leftrightarrow \quad a < Y^E(p,\theta) - Y^N(p,\theta).$$

The condition simply defines the default set in terms of the government's optimal expropriation strategy. The government expropriates whenever the direct costs or penalty from expropriating are less than the net gain in income.

3.5 *Foreign Investor Strategies*

Successful bidders for the the resource-sector contracts simply carry out the investment and payments specified in the contract chosen by the government (since all contracts deliver non-negative expected profits). In the non-resource sector, $K_{X,f}$ is chosen by the representative foreign investor to maximize $E[\Pi_{Xf}]$ given the strategy of the government and the implied default set. $E[\Pi_{Xf}] \geq 0$ implies

$$\hat{K}_{Xf}(\theta) \leq \bar{K}_{Xf}(\theta) = \left(\frac{(1-\pi(\theta))\gamma}{r+\delta+\pi(\theta)(1-\delta)}\right)^{\frac{1}{1-\gamma}} L_f(\theta).$$

where $\hat{K}_{Xf}(\theta)$ is the actual investment strategy given θ, and $\bar{K}_{Xf}(\theta)$ is optimal amount of investment whenever the actions of any single investor do not influence the probability of expropriation $\pi(\theta)$. Whenever the government strategy is such that an incremental increase in K_{Xf} implies a discrete change in the default set $D(\theta)$, resulting in jump in $\pi(\theta)$, it is possible for a single investor to go from strictly positive to strictly negative expected returns. In this situation no investor

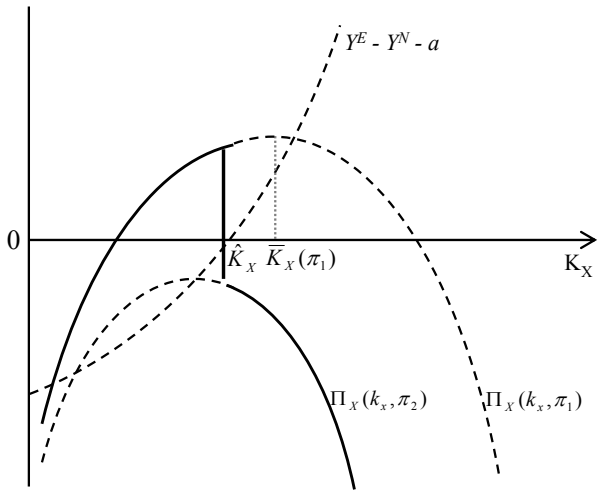


Figure 1: Investor Strategy in the Non-Resource Sector

would choose higher investment than $\hat{K}_{Xf}(\theta)$, even though they may be earning positive expected profits.

This scenario is depicted in Figure 1. For clarity, the resource output price is assumed to be constant in this example. The figure plots the expected profit functions Π_X (for the representative foreign firm) corresponding to two different expropriation probabilities, $\pi_1 < \pi_2$. Assuming for the moment that the representative firm is able to take probability π_1 as given (hence facing profit function $\Pi_X(K_x, \pi_1)$), the profit maximizing level of investment is $\bar{K}$.[32] Contrast this with the case where increasing K_X past $\hat{K}$ results in a discrete change in the default set. In the figure, this threshold is marked by a change in $Y^E - Y^N - a$ from a negative to a positive value for some penalty $a \in S$. In other words, for values of K_X below $\hat{K}$, the net gain from expropriating when penalty a is realized is negative and therefore a is not included in the default set. For values of K_X above $\hat{K}$, however, a enters the default set and the probability of expropriation rises to π_2. Taking into account the expropriation decision of the government, then, the actual profit function of the firm is the solid curve, with the dashed portions corresponding to infeasible default sets. From this function it is clear that, if the jump in probability is large enough to result in negative expected profits for all foreign firms in the resource sector, no firm is willing to invest beyond $\hat{K}$.

More formally, consider any K^1_{Xf} (and corresponding default set $D(\theta_1)$) such that, for some $(a_i, p_j) \notin D^1$,

$$a_i = Y^E(p_j, \theta_1) - Y^N(p_j, \theta_1).$$

Given θ and p, an increase in K_{Xf} holding other elements of θ constant increases $Y^E(p, \theta) - Y^N(p, \theta)$. Consider θ_2, the initial vector of actions θ_1 but with an arbitrarily small increase in K_{Xf}. Then $\{a_i, p_j\} \in D(\theta_2)$. If $K^1_{Xf} < \bar{K}_{Xf}(\theta_2)$, then all firms are still earning positive expected returns after a very small increase in investment, and it is optimal to raise K_{Xf}. Otherwise increasing K_{Xf} results in negative expected returns and optimal investment is K^1_{Xf}.

[32] In equilibrium, labour is paid it's marginal product, shifting this curve downward such that profits are zero at this level of investment.

3.6 *Equilibrium with Constant Mineral Price*

We now explore the relationship between country default risk and sectoral patterns of FDI using a stylized example. Differences in country risk are considered by varying the distribution over potential expropriation costs. To keep the analysis simple, it assumed that all countries face either a high or a low cost:

$$\mathcal{A} = \{a_l, a_h\} \sim \{\pi_l, 1 - \pi_l\}$$

All countries are assumed to face the same probability of observing the low cost a_l, but a relatively high risk country is characterized by a relatively low value for a_l. Without loss of generality, a_h is fixed at a value just above the level such that it could never be optimal for the government to expropriate, while a_l is varied from 0 up to a_h.

The principal connections between country risk and equilibrium investments are first illustrated in the case without price uncertainty. In this case, the probability of expropriation occurring is either zero or the probability of the low penalty, π_l. The main results are:

1. For moderately low values of a_l, lowering investment per mineral concession in the resource sector minimizes risk of expropriation ($\pi(\theta) = 0$) while keeping FDI in manufacturing high. Lower manufacturing FDI is undesirable because lower investment along with zero expropriation risk produces positive rents in this sector, whereas all rents are captured by the host-country in the resource sector. Yet once a_l becomes low enough, reducing resource FDI further becomes inefficient, and relative manufacturing FDI is permitted to fall with a_l.

2. For very low a_l, however, the government expropriates in this state. Resources FDI is high as a result of offering much lowering mineral concession prices, which are paid in the event expropriation does not occur. The increase in risk results in lower manufacturing FDI, further raising the resources FDI share.

In describing the equilibrium, it is convenient to reframe the analysis in terms of the ratios of capital per unit of the sector-specific input; the ratio of domestic resource investment per mineral concession is denoted by $\tilde{k}_{Rh}$ (so that the actual quantity of capital invested can be written as $\tilde{k}_{Rh}(M - M_f)$) and capital per unit of labour is $\tilde{k}_{Xj}$.

Because both foreign and domestic firms face a competitive labour market, both firms pay

$$w_L = (1-\gamma)\tilde{k}_X^{\gamma}$$

per unit of labour in equilibrium and choose a common capital to labour ratio $\tilde{k}_X$. Here, labour employed by foreigners and domestics in each sector is proportional to capital invested. Given that $\tilde{k}_X$ is aggregate capital invested in the non-resource sector, and $K - \tilde{k}_{Rh}(M - M_f)$ is the domestic quantity of investment in this sector, the share of labour employed by foreign firms is therefore

$$L_f = 1 - L_h = \frac{\tilde{k}_X - (K - \tilde{k}_{Rh}(M - M_f))}{\tilde{k}_X}.$$

Finally, given a fixed resource output price p, we have

$$w_M = p\tilde{k}_{Rf}^{\alpha} - \left(\frac{r + \delta + \pi(\theta)(1-\delta)}{1-\pi(\theta)}\right)\tilde{k}_{Rf}$$

Together, these conditions imply

$$\begin{aligned} Y^E - Y^N =& \Big(\gamma\tilde{k}_X^{\gamma-1} + 1 - \delta\Big)\Big(\tilde{k}_X + \tilde{k}_{Rh}(M - M_f) - K\Big) \\ &+ \left(\frac{1+r}{1-\pi(\theta)}\right)\tilde{k}_{Rf}M_f \end{aligned}$$

Consistent with the optimal government strategy, expropriation occurs whenever the value of this function exceeds a_l. Host country income is

$$\begin{aligned} V(\theta) =& \tilde{k}_X^{\gamma} + p\tilde{k}_{Rh}^{\alpha}(M - M_f) + \Big(p\tilde{k}_{Rf}^{\alpha} - (r+\delta)\tilde{k}_{Rf}\Big)M_f \\ &- \Big\{\Big((1-\pi(\theta))\gamma\tilde{k}_X^{\gamma-1} - \pi(\theta)(1-\delta)\Big)\times \\ &\Big(\tilde{k}_X + \tilde{k}_{Rh}(M - M_f) - K\Big)\Big\} + (1-\delta)K \\ &- \pi(\theta)a_l \end{aligned} \tag{3}$$

since expropriation can only occur in the low penalty state ($E[a|a \in D(\theta)] = a_l$).

If we restrict our attention to case where expropriation risk matters (the interesting case), then a_l must satisfy

$$a_l < (1+r)\Big(\tilde{k}_X^{FB} + \tilde{k}_R^{FB}M - K\Big)$$

where $\tilde{k}_i^{FB}$ is the efficient capital ratio in sector i. In this case efficient levels of investment in both sectors is not feasible, and either the government's choice of $(M_f, \tilde{k}_{Rh}, \tilde{k}_{Rf})$ as well as optimal $\tilde{k}_X$ chosen by investors satisfy

$$\begin{aligned} a_l =& \Big(\gamma\tilde{k}_X^{\gamma-1} + (1-\delta)\Big)\Big(\tilde{k}_X + \tilde{k}_{Rh}(M - M_f) - K)\Big) \\ &+ (1+r)\tilde{k}_{Rf}M_f \end{aligned} \tag{NE}$$

and expropriation never occurs, or this constraint is violated and expropriation occurs whenever a_l is realized. We refer to this as condition as the no-expropriation constraint (NE). The host-country problem therefore reduces to a choice of $(M_f, \tilde{k}_{Rh}, \tilde{k}_{Rf})$ that maximizes (3), where $\tilde{k}_X$ chosen by investors corresponds to one of two possible scenarios: either $\tilde{k}_X$ is determined by NE and $\pi(\theta) = 0$, or else $\tilde{k}_X$ violated NE and $\pi(\theta) = \pi_l$. In the latter case, it follows from Section (3.5) that

$$\tilde{k}_X = \left(\frac{(1-\pi_l)\gamma}{r + \delta + \pi_l(1-\delta)}\right)^{\frac{1}{1-\gamma}}$$

as a single investor's decision does not influence the probability of being expropriated.[33] In equilibrium, $\tilde{k}_X$ is the larger of the two capital ratios defined by these cases since both result in non-negative expected profits (as well as strictly positive profits, potentially, in the case that NE binds).

A number characteristics of the equilibrium, and in particular how they relate to varying degrees of country risk, are summarized in the following lemma (the proof is in the Appendix):

Lemma 3.1 *For all $a_l \in [0, a_h]$, $\tilde{k}_{R,h} = \tilde{k}_{R,f} = \tilde{k}_R$. Furthermore, define $\bar{a}_l$ to be the value of a_l above which efficient investment levels are attainable in both sectors. There exists $a_l^{'}, a_l^{''} \in [0, \bar{a}_l]$ such that*

1. *for $a_l \in [0, a_l']$, $\tilde{k}_R = k_R^{FB}$ and $\tilde{k}_X < k_X^{FB}$; the host-country government is indifferent towards the allocation of M_f; expropriation occurs if and only if $a = a_l$.*
2. *for $a_l \in (a_l', a_l^{''}]$, $\tilde{k}_R < k_R^{FB}$ and $\tilde{k}_X < k_X^{FB}$; M_f is raised to M or until $K_{Xf} = 0$; expropriation never occurs.*
3. *for $a_l \in (a_l^{''}, \bar{a}_l]$, $\tilde{k}_R < k_R^{FB}$ and $\tilde{k}_X = k_X^{FB}$; M_f is raised to M or until $K_{Xf} = 0$; expropriation never occurs.*

Summarizing,the host-country government always chooses resource contracts consistent with equal capital to mineral ratios for both foreign and domestic investors. However, the optimal ratio depends on country risk.

For very high risk countries, the efficient level of investment is supported by a low mineral concession price, but the allocation of rights between foreign and domestics is not uniquely

[33] Note that, although the determination of $\tilde{k}_X$ is framed in terms of the optimal choices of foreign investors only, capital in the manufacturing sector is the sum of both domestic and foreign capital. More precisely, then, the domestic capital stock in this sector is a residual from the government decisions $\tilde{k}_{Rh}$ and M_f, while foreign investors "choose" $\tilde{k}_X$ by choosing how much to invest and allowing equilibrium in the labour market ensure equal capital to labour ratios by both types of firms.

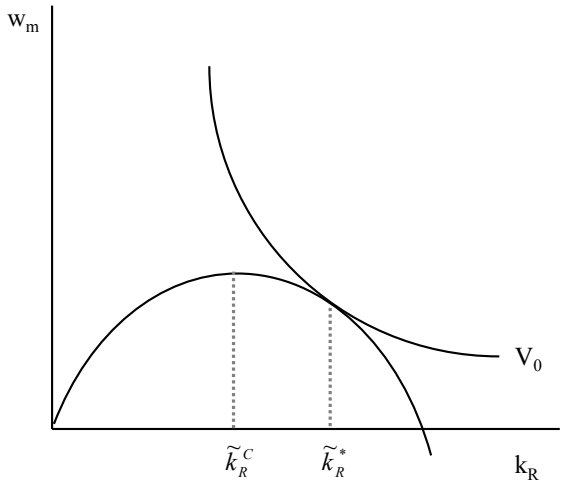


Figure 2: Resource Investment Subsidy

determined. Expropriation occurs whenever the low sanction is realized. The host-country's optimal choice of resource contract corresponding to this risk region is depicted in Figure 2. The concave function is $w_M(k_R)$, defined by equation 2, evaluated at $\pi(\theta) = \pi_l$. V_0 is a host-country indifference curve over w_M and k_R. As shown in the Mathematical Appendix, these indifference curves are strictly downward sloping for k_R over the range $[0, k_R^{FB}]$. If the government did not specify the investment ratio as part of the contract, the equilibrium ratio would be $\tilde{k}_R^C$ in this figure, and w_M is maximized given π_l. However, the point of tangency between V_0 and w_M always occurs at $\tilde{k}_R^* = k_R^{FB}$, which corresponds to a lower mineral price, and it is in this sense that high risk countries subsidize resource-sector investment.

In the more moderate risk group, expropriation is averted but at the cost of low capital ratios in both sectors. However, there is a tendency towards higher resource FDI because the host-country strictly prefers to allocate rights to foreigners. The purpose is to concentrate domestic capital in the manufacturing sector, where the host-country is otherwise unable to capture all rents from foreign investment – because investors are investing less than the efficient amount even though the probability of expropriation is zero, wages are low and the marginal product of capital is high, and firms earn positive profits. This is also true for the lowest category of risk, but the zero-profit level of investment is attained in the manufacturing sector by keeping investment levels low in resources by comparison.

These results imply that relative capital ratios in each sector, $\tilde{k}_R/\tilde{k}_X$, follow an inverted U-Shaped pattern as country risk (a_l) rises, with the highest value among high risk countries ($a_l < a_l'$). The minimum ratio corresponds to relatively moderate risk countries ($a_l = a_l''$), with higher values for countries with little or no risk. How relative sector FDI varies with risk, however, is less clear. Because the allocation of mineral rights between domestic and foreign investors is indeterminate at some levels of country risk, only implications for average FDI shares can generally be assessed.

The average relationship between FDI and risk is examined using a series of numerical examples in Section 3.7, where we introduce random resource output prices. Price uncertainty has substantive implications for the optimal resource contract in moderate risk countries. In contrast to the example of this section, relatively low risk countries in the moderate risk category will heavily restrict the foreign presence in resources when the output price is uncertain, resulting in a lower average resources FDI share. Still, Lemma 3.1 serves to illustrate the key predictions for resource contracts in very high risk countries. Comparing a very high risk country such as Bolivia to a very low risk country such as Malaysia, we expect the resource contract in the high risk country to offer mineral rights more cheaply to foreign investors, leaving the host-country with a lower share of the resource rents when expropriation does not occur, and to feature higher investment intensities. Whether or not this relatively high investment takes the form of FDI depends on how mineral rights are allocated between foreign and domestic investors. The numerical examples in the next section demonstrate that high risk countries will, "on average", have higher shares of FDI in resources.

3.7 *Equilibrium with Price Uncertainty*

So far we have not considered variation in resource output prices and consequently have not been able to address the positive correlation between mineral prices and the likelihood of expropriation. In this section, the assumption of a fixed resource output price is relaxed. We find that, in addition to influencing the timing of expropriation, price uncertainty has important implications for moderate risk countries in allocating mineral rights between foreign and domestic investors. Governments in countries in the moderate to low risk category aim minimize the *ex ante* risk of expropriating by limiting FDI to the resource sector and maximizing non-resource FDI, while countries in the moderate to high risk group minimize the likelihood of expropriation by maximizing FDI in resources instead.

For simplicity, it is assumed that prices are uniformly distributed over a non-negative interval:

$$p \sim U[\underline{p}, \bar{p}].$$

The key implication of continuous prices in terms of player strategies is that the government's expropriation decision can be summarized by a choice of cutoff values for resource price, one for each penalty a, above which is optimal to expropriate. This implies that the expropriation set is described by

$$D(p_l^*(\theta), p_h^*(\theta)) = \left\{(p_l^*(\theta), \bar{p}], (p_h^*(\theta), \bar{p}]\right\}$$

where $p_k^*(\theta)$ is the cutoff resource price whenever expropriation penalty a_k is realized. So, for instance, if the govern-

ment strategy is to never expropriate when facing the high penalty, but to expropriate when the penalty is low and the price is above some p_l^*, $p_h^*(\theta) = \bar{p}$ and the expropriation set is simply $D(p_l^*(\theta), p_h^*(\theta)) = \{(p_l^*(\theta), \bar{p}]\}$. If, in addition, $p_l^*(\theta) = \bar{p}$, this signifies that expropriation is never optimal and $D(p_l^*(\theta), p_h^*(\theta))$ is empty. The probability of expropriation is

$$\begin{aligned}\pi(p_l^*(\theta), p_h^*(\theta)) =& \pi_l \int_{p_l^*(\theta)}^{\bar{p}} \frac{1}{\bar{p} - \underline{p}} dp \\ &+ (1 - \pi_l) \int_{p_h^*(\theta)}^{\bar{p}} \frac{1}{\bar{p} - \underline{p}} dp \\ =& \frac{\bar{p} - \pi_l p_l^*(\theta) - (1 - \pi_l) p_h^*(\theta)}{\bar{p} - \underline{p}}.\end{aligned}$$

As in the previous example, the optimal resource contracts satisfy $k_{Rh} = k_{Rf} = k_R$. The main difference with the introduction of price uncertainty is that, whenever there is a positive amount of FDI in the resource sector, aggregate investment in the non-resource sector is

$$\tilde{k}_X(\theta) = \left(\frac{(1 - \pi(p_l^*(\theta), p_h^*(\theta)))\gamma}{r + \delta + \pi(p_l^*(\theta), p_h^*(\theta))(1 - \delta)} \right)^{\frac{1}{1-\gamma}} \quad (4)$$

and foreign firms earn zero profits. This is because, with a continuum of prices, each investor has a negligible influence on $\pi(\theta)$ and taking this as given when making investment decisions. Substituting into (1), and using the same expressions for $w_L(\theta)$ and $w_M(\theta)$ as well as $k_{Rh} = k_{Rf} = k_R$, national reduces to

$$\begin{aligned}V(\theta) \quad = \quad & \tilde{k}_X(\theta)^\gamma + E[p]\tilde{k}_R^\alpha M + (1 - \delta)K \\ & -(r + \delta)\Big(\tilde{k}_X(\theta) + \tilde{k}_R M - K\Big) \\ & -\pi(p_l^*(\theta), p_h^*(\theta)) E[a | s \in D(p_l^*(\theta), p_h^*(\theta))]\end{aligned}$$

where $E[p]$ is the unconditional expectation of p. The threshold values $p_k^*(\theta)$ $(k = l, h)$, are defined by the following system of equations: for each k,

$$p_k^*(\theta) = \begin{cases} \bar{p} & \text{if} \quad a_k \geq Y^E(\bar{p}, \theta) - Y^N(\bar{p}, \theta) \\ \underline{p} & \text{if} \quad a_k < Y^E(\underline{p}, \theta) - Y^N(\underline{p}, \theta) \end{cases}$$

and for all other θ, $p_k^*(\theta)$ is implicitly defined by

$$a_k = Y^E(p, \theta) - Y^N(p, \theta).$$

Note that $Y^E(p, \theta) - Y^N(p, \theta)$ is strictly increasing in p (provided $k_R M_f > 0$). After making the same substitutions as above, the previous relationship reduces to

$$\begin{aligned}a_k = \quad & \left(\frac{1 + r}{1 - \pi(p_l^*(\theta), p_h^*(\theta))} \right) \Big(\tilde{k}_X(\theta) + \tilde{k}_R M - K \Big) \\ & + \Big(p_k^*(\theta) - E[p | s \notin D(p_l^*(\theta), p_h^*(\theta))] \Big) \tilde{k}_R^\alpha M_f. \quad (5)\end{aligned}$$

When instead the quantity of mineral rights allocated to foreign investors is zero, however, equilibrium is identical to the case without price uncertainty (with no resources FDI). This implies that, in the event $M_f = 0$ is chosen, the probability of expropriation may also be zero and investment in the manufacturing sector is again implicitly defined by NE, rather than by (4). As before, it is possible that foreign investors earn positive expected profits in this case.

Introducing price uncertainty does not have any impact on equilibrium for the very high risk group, as these countries still expropriate whenever the low penalty is realized (regardless of the price). However, for the more moderate risk group, price uncertainty has an important effect on equilibrium outcomes. The main difference is that, when there is positive FDI in the resource sector, it is no longer rents in the manufacturing sector that are relevant, but instead it is (ex post) rents in the resource sector that matter. In particular, the direct gain from expropriating is increasing in the difference between the realized price of resource output and the effective marginal revenues received by foreign investors, $p - E[p | s \notin D(p_l^*(\theta), p_h^*(\theta))]$. The effective marginal product determines the price of the resource concession, and hence also the share of resource rents going to the host-country. Because these payments are not contingent on the price of output, investors earn high profits *ex post* when the price is high and assets are not expropriated (compared to returns in the manufacturing sector). This results in a greater temptation to expropriate in high-price states, and this temptation increases in amount of resource-based FDI.[34]

For those countries that anticipate relatively high expropriation penalties, reducing the temptation to expropriate (which is costly) is a preferred strategy. For a given quantity of FDI, this is achieved by funneling all domestic capital into the resource sector. This raises overall investment and host-country income, even though foreign firms in the manufacturing sector receive positive rents. Note that this strategy is the opposite of the one adopted by moderate risk countries in the case with no price uncertainty. For higher risk countries (yet not so risky that the government subsidizes resource FDI), concentrating FDI resource-sector is the preferred location for FDI. The reason is that foreign firms in this sector, conditional on not being expropriated, earn relatively low or negative returns in the low-penalty regime (when the temptation to expropriate is relatively high). Increasing FDI in resources therefore raises the probability of expropriation by less than an equal increase in non-resource FDI.

To provide a sharper illustration of these relationships, consider the case where it is never optimal to expropriate when

[34] A positive difference $p - E[p | s \notin D(p_l^*(\theta), p_h^*(\theta))]$ is related to "windfall" profits in the sense that it captures the returns per unit of output in excess of what is received in the manufacturing sector (when expropriation does not occur). The average windfall profits could be reduced by setting a concession payment schedule that varies positively with the resource output price. This is commonly a feature of the optimal contract in a dynamic, complete markets framework.

sanctions are high ($p_h^*(\theta) = \bar{p}$).[35] Defining $Q(x) = x - E[p|s \notin D(x, \bar{p})]$, $Q(x)$ is increasing in x for $x \in [\underline{p}, \bar{p}]$ and the assumed distribution over prices. Evidentally $Q(\bar{p}) > 0$. Examining equation (5), if a_l is not too small, then for any amount of resource FDI ($k_R M_f$) there is a unique p_l^* satisfying this equality (taking into account the effects of p_l^* on the probability of expropriation and manufacturing sector investment), and such that $Q(p_l^*) > 0$. In this case it is optimal to lower m_f (to zero, if the domestic capital stock is sufficient to attain desired investment in this sector), because this permits a rise in k_R, a rise in p_l^* and therefore a rise in $k_X(\theta)$, while $V(\theta)$ does not directly depend on M_f. Expropriation risk is minimized, and the probability of expropriating is even zero if there is sufficient domestic capital to optimally allocate all mineral rights to domestic investors.

Evidentally this policy is reversed whenever $Q(p_l^*) \leq 0$, given the maximum attainable aggregate FDI. This condition holds for countries having a relatively low a_l (but not so low, however, that it is always optimal to expropriate whenever a_l is realized). In this case rasing M_f is optimal, since this permits a rise in k_R and a rise in $k_X(\theta)$. The reason for this is that, when $Q(p_l^*) < 0$, any "windfall" profits in the high-price, low penalty states are entirely appropriated by the host country in the low penalty regime when expropriation occurs. Conditional on not being expropriated in this state, the *ex post* returns received by foreign firms in the resource sector are below that received by firms in the non-resource sector (and possibly even negative). Shifting FDI from the non-resource sector to the resource sector makes expropriation less attractive in the low penalty regime, for a given level of aggregate FDI.

We illustrate the implied relationships between country risk, sector FDI shares, and the probability of expropriation in a series of numerical examples. The full set of parameters used in the numerical examples are listed in Table 1. In each example, a_h is fixed at a value above the level such that it could never be optimal for the government to expropriate (this threshold depends on the domestic capital stock), while a_l is varied from a low value (high risk) up to a_h (low risk). However, the qualitative results are not affected by changes in this assumption. The value of M assumed gives an average resource output share of 22% (in the absence of expropriation risk), which roughly matches the average developing country primaries GDP share. The numerical results are summarized in the figures contained in Section C of the Appendix.

Figure 3 plots the share of resources in total FDI (panel a), the resources average output share (panel b), and the probability of expropriation for different values of a_l when K is small ($K = 0.1$). Lower values of a_l represent higher country risk, so that a country that would never expropriate is represented at the far right of each figure. Shaded regions in Figure 4(a) correspond to the range of equilibrium FDI shares, indicating the region of indifference for the allocation of mineral rights. The upper curve represents the upper bound on the resource FDI share. We therefore focus on the relationship between country risk and the "average" FDI share implied by the midpoint of the shaded regions.

[35] When only two possible penalties is assumed, this becomes the relevant case to consider. In the numerical example used throughout, $p_h^*(\theta) < \bar{p}$ occurs only when a_h is sufficiently low and very close to a_l, and where there is very large variance in the resource output price.

Table 1: Numerical Example: Parameter Values

Parameter	Value	Parameter	Value
r	0.05	δ	0.1
α, γ	0.3	π_l	0.1
M	0.2	K	0.1, 1
$\underline{p}$	0.5	$\bar{p}$	2
a_h	3.6	a_l	$0.5 \rightarrow a_h$

There is a monotonic, increasing relationship between country risk and the probability of expropriation, as we might expect. The relationship between risk and the average resource FDI share is, however, non-monotonic, decreasing in risk at very low risk levels and increasing in risk for the moderate to high risk categories. (For clarity, we identify 3 country risk regions of primary interest.)

At the highest risk category (Region 1 in the figure), expropriation always occurs in the low-penalty regime, and there is a range of possible equilibria as the host-country government is indifferent in terms of mineral rights allocation between domestic and foreign investors. (Due to the low domestic capital stock, there is a positive lower bound on the share of resource rights allocated to foreign investors.) In this region, resource-based FDI is subsidized so that the first-best level of investment is achieved in this sector, as depicted in Figure 2. As in the case without price uncertainty, for sufficiently low a_l the host-country government is willing to expropriate and to incur the low penalty in order to raise resource-sector FDI, increasing host-country income during periods of expropriation at a cost of a lower share of resource-sector returns when expropriation does not occur.

For lower risk levels (Region 2), there is a unique allocation of mineral rights (this is the region where NE binds). All mineral rights are allocated to foreign investors (but investment per mineral concession is lower compared to the higher risk group) and the resources FDI share is increasing in risk. For small positive risk (Region 3), a larger share of mineral rights are instead allocated to domestic investors, and FDI in resources is reduced relative to non-resource FDI in order to minimize the probability of expropriation. However, resource-based FDI is not restricted completely (owing to the low domestic capital stock) and expropriation still occurs whenever the resource output price is high and the penalty is low. Finally, when there is no risk of expropriation, FDI inflows result

in the first-best investment levels in both sectors, and the host-country government is again indifferent regarding the allocation of mineral rights. The average resources share is lower when compared to the average for the highest risk category owing to the relatively high investment rates in resources for the highest risk group.

Although the relationship between the average resource FDI share and country risk is non-monotonic, there is a strong positive relationship between the average FDI share and the likelihood of expropriation over the 3 regions emphasized (where there is positive risk). Although FDI is more highly concentrated in resources, on average, among those countries more likely to expropriate, Panel (b) indicates that the differences in output shares across different risk groups are quite small in comparison. The average resource FDI share ranges from 0.05 to 0.41 across risk categories, while the resource output share remains between 0.17 and 0.26.

When the domestic capital stock is high, the allocation of mineral rights according to risk has a more pronounced effect on sector FDI shares, although the pattern is qualitatively very similar (see Figure 4). The key difference is that governments of moderate risk countries (Region 3) find it optimal to allocate all mineral rights to domestic investors, pushing out FDI entirely from the resource sector. This fully mitigates any risk of expropriation. Only when a_l is sufficiently low does the government allocate mineral rights to foreign investors, such that it is worthwhile to expropriate when prices are high and sanctions low. For the highest risk category, there is again a range of possible resource FDI shares. The range is wider compared to the case of a low capital stock because, with more domestic capital, there is less aggregate FDI for any given level of risk. Again, however, the resource output share varies little across categories of country risk.

Figure 5 shows that the price paid by foreign investors for mineral rights, w_M, declines with risk when the domestic capital stock is both low and high. Comparing the moderate risk categories, this decline is gradual. Comparing these categories with the highest risk group (Region 3), the difference is more pronounced, reflecting the subsidy to resource FDI.

A final relationship worth noting is is between the resource output price and the timing of expropriation. This relationship is driven by the expropriation strategies of governments in moderate risk countries. When expropriation does occur, the resource output price tends to be above average. For the highest risk group, there is no relationship between expropriation and the resource output price because expropriation always occurs in a low penalty regime.

3.8 *Ad Valorem Royalty*

In this section, a variation on the resource contract of the previous example is considered where, rather than charging foreign investors a price for each mineral concession, the government levies a tax on the value of resource-sector output. This type of payment arrangement is more closely related to a standard royalty contract.

We are interested in this alternate resource contract because when resource output prices are variable it is conceivable that the fixed payment schedule assumed in the previous examples exaggerates the risk associated with resource FDI compared to a royalty contract. Royalty payments are perfectly correlated with the resource output price. This implies that the temptation of governments in moderate risk countries to expropriate when the price is high is, at least partially, reduced. However, we show that the results of the previous section are robust under a royalty contract.

Denoting the royalty rate by ρ, the foreign investor's expected profits in the resource sector are now

$$E[\Pi_{Rf}] = (1-\pi(\theta))\Big((1-\rho)E[p|s \notin D(\theta)]k_{Rf}^{\alpha}M_f + (1-\delta)k_{Rf}M_f\Big) - (1+r)k_{Rf}M_f$$

and where k_{Rf} is again the level of FDI per mineral concession M_f. The optimal royalty rate renders foreign investors indifferent between investing and not investing:

$$\rho(k_{Rf},\theta) = 1 - \left(\frac{r+\delta+\pi(\theta)(1-\delta)}{1-\pi(\theta)}\right)\left(\frac{k_{Rf}^{1-\alpha}}{E[p|s \notin D(\theta)]}\right).$$

($D(\theta)$ and $\pi(\theta)$ are again determined by the price cutoff rules derived previously, but have are expressed as functions of θ to reduce notation.) Note that this rule for pricing mineral rights results in the host-country receiving the same expected share of resource rents given a particular level invested:

$$\begin{aligned}\rho(k_{Rf},\theta)E[p|s \notin D(\theta)]k_{Rf}^{\alpha}M_f = & \\ & E[p|s \notin D(\theta)]k_{Rf}^{\alpha}M_f \\ & - \left(\frac{r+\delta+\pi(\theta)(1-\delta)}{1-\pi(\theta)}\right)k_{Rf}M_f \\ & = w_M(k_{Rf},\theta)M_f.\end{aligned}$$

Given foreign and domestic investment levels in each sector, expected national income following expropriation does not depend on the type of contract. Manufacturing sector investment is again given by equation (4). As a result, the objective function of the host-country government is identical to that under the previous type of contract:

$$\begin{aligned}V(\theta) \;=\; & \tilde{k}_X(\theta)^{\gamma} + E[p]\tilde{k}_R^{\alpha}M + (1-\delta)K \\ & -(r+\delta)\Big(\tilde{k}_X(\theta) + \tilde{k}_R M - K\Big) \\ & -\pi(\theta)E[a|s \in D(\theta)]\end{aligned}$$

However, the net gain from expropriating, given $s \in S$ and θ, is different under the royalty. The corresponding price cutoff rules are given by

$$a_k = \left(\frac{1+r}{1-\pi(\theta)}\right)\left(\tilde{k}_X(\theta) + \tilde{k}_R M_f + \tilde{k}_R(M - M_f) - K\right) + \left(\frac{r+\delta+\pi(\theta)(1-\delta)}{1-\pi(\theta)}\right)\left(\frac{p_k^*(\theta)}{E[p|s \notin D(\theta)]}\right)\tilde{k}_R M_f + (1-\delta)\tilde{k}_R M_f.$$

Following the same logic of the previous section, the host-country government will find it optimal to lower M_f towards zero (until all domestic capital is located in the resource sector) whenever

$$\left(\frac{1+r}{1-\pi(\theta)}\right) < \left(\frac{r+\delta+\pi(\theta)(1-\delta)}{1-\pi(\theta)}\right)\left(\frac{p_l^*(\theta)}{E[p|s \notin D(\theta)]}\right) + (1-\delta).$$

This reduces to

$$p_l^*(\theta) \geq E[p|s \notin D(\theta)]$$

which is the same condition derived for the original contract. When the opposite inequality holds, the optimal policy is to raise M_f towards M until all manufacturing sector investment is domestic capital.

Again, $p_l^*(\theta)$ and $\pi(\theta)$ are decreasing in country risk. For countries in the moderate risk group, therefore, the relationship between country risk and the allocation of mineral rights has not changed under the royalty contract. Still, investment levels may differ under this type of contract, and therefore we illustrate equilibrium outcomes from our numerical example.

Figure 6 illustrates the variation in the resource FDI share and royalty rate according to country risk when domestic the capital stock is low. Figure 7 illustrates the same relationships when the domestic capital stock is high. There is remarkably little difference in these patterns when comparing them to those under the original contract. The resource FDI share is, on average, increasing in risk, and this relationship is stronger when the domestic capital stock is relatively high. For the highest risk countries, the efficient level of investment in the resource sector is achieved by setting a low royalty rate, and expropriation always occurs in the low penalty state. For more moderate levels of country risk, patterns of FDI are almost identical to those obtained under the type of contract considered in the previous sections. Although the royalty contract transfers some of the high resource rents in the high price states to the host-country, the foreign investor is nonetheless receiving higher returns and the host-country government is still tempted to expropriate in these states. When the expected expropriation penalty is relatively high, the government again minimizes this risk by restricting FDI in the resource sector.

4 Conclusions

By focusing on government choice of mineral contract in the context of a small, two-sector open economy where FDI is risky and the future costs and benefits of expropriating are unknown, this paper provides a rationale for relatively high extractive industry FDI shares in countries most likely to expropriate. Specifically, the qualitative predictions of the incomplete markets model of FDI and expropriation considered in this paper reconcile a number of stylized facts. These are (i) a high global share of resource sector FDI in total expropriation compared to the sector's average production share; (ii) a positive relationship between mineral output prices and the timing of resource-sector expropriation; and (iii) an average share of primaries in total FDI that is higher expropriating countries compared to non-expropriating countries, particularly in mining and petroleum, even though on average these country groups do not differ significantly in terms of sector production shares. The first two facts are well-documented in the literature, and have used to support and/or motivate explanations for why FDI in extractive sectors is more vulnerable to expropriation. The third fact presents somewhat of a puzzle if expropriating countries are perceived by foreign investors as more likely to expropriate, and if resource-based FDI is particularly risky. We argue that the capacity (and incentive) for governments to offer mineral rights to foreign investors cheaply in countries characterized by a high degree political risk can help explain this puzzle.

The exogenous political risk factor is modeled as the degree to which a future government is expected to have a high motive for expropriating a given level of FDI, which for simplicity we take to be inversely related to the expected size of a random penalty or sanction that is imposed on expropriating governments.[36] We find that countries in the highest risk category benefit from promoting FDI in the resource sector (and by lowering the cost of mineral rights) because, although this raises the likelihood that a future government will choose to expropriate and lowers FDI in the non-resource sector, the expected value of expropriated assets more than compensates for this loss. Governments in moderate risk countries instead aim minimize the probability of expropriation for given levels of aggregate FDI. For the lower risk countries in this group, this is accomplished by restricting resource-sector FDI because higher-than-average prices result in "windfall profits", and this tends to increase the temptation to expropriate. In contrast, governments of higher risk countries within this moderate risk group manage risk by concentrating FDI in resources – in the low penalty regime, when the government is most tempted to expropriate, resource sector firms earn below-average returns on their investments (conditional on not being expropriated), and the government is less likely to expropriate as FDI is concentrated in resources. These patterns are ro-

[36] As outlined in the text, it is immaterial whether we view the temptation to expropriate as being related to government regime characteristics or some other state of nature, such as the size of external sanctions imposed.

bust to alternate types of resource contract (such as a standard royalty payment) provided investment levels are also specified and contracts are incomplete.

These predictions for government policy towards resource-based FDI imply a positive average relationship between resource FDI shares and the probability of expropriation among countries of similar resource wealth and domestic capital stocks.[37] This relative concentration of FDI in resources among countries most likely to expropriate implies that the total share of resources in FDI expropriated globally will be higher than the average share of this sector in GDP. Although the model does not account for selective expropriation in any one sector, the expected value of assets expropriated in the resource sector are predicted to be higher in comparison to expropriation in non-resource sectors.

Our findings also suggest that countries that have a poor record of expropriation, such as Bolivia, Ecuador and Venezuela, may find that promoting relatively large amounts of FDI in resources is desirable and, for as long default risk in these countries remains high, this suggests that a cycle of privatization and nationalization will persist. Moreover, because this implies that mineral rights should be offered to foreign investors on very favorable terms, this paper offers a novel perspective for the low government take in resources that has been documented in many countries. That foreign investors must be compensated for political risk if they are willing to invest is evident. However, this paper emphasizes that (i) large subsidies to foreign investment will be most effective in resource sectors, where governments manage a key factor input and influence investment, and (ii) this policy is not likely to produce desirable results for countries at all levels of default risk. In particular, very high risk countries are expected to benefit from subsidizing resource FDI, while countries countries characterized by relatively low default risk do not. Governments of relatively low risk countries have a stronger incentive to minimize the *ex ante* risk of expropriating by restricting FDI in the resource sector if they anticipate the costs of expropriating will be high *ex post*.

5 Acknowledgements

I thank Jim MacGee and Igor Livshits for their generous supervision and guidance at the University of Western Ontario, as well as Hiro Kasahara for many valuable discussions. I also thank Jon Rosborough, Martin Gervais, Claudiu Tunea, Yao Li, participants of the Money/Macro seminar at the University of Western Ontario, the Small Open Economies in a Globalized World conference (2008), the Canadian Economics Association meetings (2008), and seminar participants at the Department of Finance, Canada, and the University of Otago, for insightful comments on early drafts of this paper. All errors are mine.

[37] This relationship is predicted "on average" because there are multiple equilibria for some risk levels. Moreover, because it is not monotonic, it depends to some extent on how countries are distributed according to political risk.

6 References

Albuquerque, Rui (2003). "The composition of international capital flows: risk sharing through foreign direct investment." *Journal of International Economics.* 61: 353-383.

Alfaro, Laura, Sebnem Kalemli-Ozcan, and Vadym Volosovych (2005). "Why Doesn't Capital Flow From Rich to Poor Countries? An Empirical Investigation." NBER working paper 11901.

Cole, Harold L. and William English (1992). "Expropriation and Direct Investment." *Journal of International Economics*, 30: 201-227.

Cole, Harold L., James Dow, and William B. English (1995). "Default, Settlement, and Signalling: Lending Resumption in a Reputational Model of Sovereign Debt." *International Economic Review*, 36 (2): 365-385.

Duncan, Roderick (2005). "Price or politics? An investigation of the causes of expropriation." *Australian Journal of Agricultural and Resource Economics*, March, 50(1): 85-101

Eaton, Jonathan and Mark Gersovitz (1984). "A theory of expropriation and deviations from perfect capital mobility." *The Economic Journal*, 94: 16-40.

Engel, Eduardo and Ronald Fischer (2008). "Optimal Resource Extraction Contracts under Threat of Expropriation." NBER working paper 13742.

Gadano, Nicolas (2007). "Urgency and Betrayal: Three Attempts to Foster Private Investment in Argentina's Oil Industry." Working paper.

Geiger, Linwood T. (1989). "Expropriation and External Capital." *Economic Development and Cultural Change*, 37 (3):535-556.

Guriev, Sergei, Anton Kolotilin, and Konstantin Sonin (2009). "Determinants of Nationalization in the Oil Sector: A Theory and Evidence from Panel Data." *Journal of Law, Economics, and Organization*, (June): 1-23.

Hogan, William, Federico Sturzenegger and Laurence Tai (2010). "Contracts in natural resources: a primer" in *The Natural Resources Trap: Private Investment without Public Commitment*, edited by William Hogan and Federico Sturzenegger. Cambridge, MA: MIT Press.

IMF Capital Markets Consultative Group (2003), "Foreign direct investment in emerging market countries." Online publication. (Retrieved on July 10, 2007 at: http://www.imf.org/external/np/cmcg/2003/eng/091803.pdf.)

Jensen, Nathan M. and Daniel J. Young (2005). "Investment Risk: What Makes Developing World Countries Seem Prone to Violence?" mimeo.

Jodice, David (1980). "Sources of Change in Third World Regimes for Foreign Direct Investment, 1968-1976." *International Organization*, 34 (Spring): 177-206.

Johnston, David (2007). "How to Evaluate the Fiscal Terms of Oil Contracts" in *Escaping the Resource Curse*. Macartan Humphreys, Jeffrey D. Sachs, and Joseph E. Stiglitz, eds. New York : Columbia University Press.

Jones, Randall Jr. (1984). "Empirical Models of Political Risks in U. S. Oil Production Operations in Venezuela." *Journal of International Business Studies*, 15 (1): 81-95.

Kennedy Jr., Charles R. (1993). "Multinational Corporations and Expropriation Risk." *Multinational Business Review.* Spring.

Knudsen, Harald (1974). "Explaining the National Propensity to Expropriate," *Journal of International Business Studies*, 5 (Spring):51-71.

Kobrin, Stephen J. (1980). "Foreign Enterprise and Forced Divestment in LDCs." *International Organization*, 34(1): 65-88.

Kobrin, Stephen J. (1984)."Expropriation as an Attempt to Control Foreign Firms in LDCs: Trends from 1960 to 1979." *International Studies Quarterly*, 28 (3): 329-348.

McMillan, Margaret and Andrew Waxman (2007). "Profit Sharing Between Governments and Multinationals in Natural Resource Extraction: Evidence from a Firm-Level Panel." Working paper (forthcoming in *Brookings Trade Forum.*

Mikesell, R.F. (1984). *Petroleum Company Operations in Developing Countries.* Washington D.C.: Resources for the Future.

Minor, Michael S. (1994). "The Demise of Expropriation as an Instrument of LDC Policy, 1980-1992." *Journal of International Business Studies*, 25: 177-88.

Monaldi, Fransisco (2001). "Sunk-Costs, Institutions, and Commitment: Foreign Investment in the Venezuelan Oil Industry." Mimeo.

Nellor, David C.L. (1987). "Sovereignty and Natural Resource Taxation in Developing Countries." *Economic Development and Cultural Change.*, 35(2): 367-392.

Rood, Leslie L. (1976). "Nationalization and Indigenization in Africa." *Journal of Modern African Studies*, 14(3): 427-447.

Shafer, Michael (1983). "Capturing the Mineral Multinationals: Advantage or Disadvantage?" *International Organization*, 37(1): 93-119.

Stiglitz, Joseph (2007). "What is the role of the state?" in *Escaping the Resource Curse*. Macartan Humphreys, Jeffrey D. Sachs, and Joseph E. Stiglitz, eds. New York : Columbia University Press.

Thomas, J. and T. Worrall (1994). "Foreign Direct Investment and the Risk of Expropriation." *Review of Economic Studies*, 61(1), pages 81-108

Tomz, Michael and Mark Wright (2010). "Sovereign Theft: Theory and Evidence about Sovereign Default and Expropriation." in*The Natural Resources Trap: Private Investment without Public Commitment*, edited by William Hogan and Federico Sturzenegger. Cambridge, MA: MIT Press.

Truitt, Frederick J.(1970). "Expropriation of Foreign Investment: Summary of the Post-World War II Experience of American and British Investors in Less Developed Countries." *Journal of International Business Studies* (Fall): 21-34.

Wei, Shang-Jin (2000). "How Taxing is Corruption on International Investors?" *The Review of Economics and Statistics*, 82(1): 1-11.

Appendices

A Mathematical Appendix

A.A *Proof of Lemma* 3.1

The proof proceeds by first describing the optimal decisions $\tilde{k}_{Rf}$, $\tilde{k}_{Rf}$, and M_f in each of the three regions of interest. We then argue that each of these regions correspond to distinct country risk categories.

Consider first the cases where NE binds. $V = Y^N$, and the optimization problem faced by the host country is therefore to chose M_f, $\tilde{k}_{Rh}$, and $\tilde{k}_{Rf}$ to maximize

$$\begin{aligned} V =& \tilde{k}_X^{\gamma} + p\tilde{k}_{Rh}^{\alpha}(M - M_f) \\ & - \gamma\tilde{k}_X^{\gamma-1}\Big(\tilde{k}_X - (K - \tilde{k}_{R,h}(M - M_f))\Big) \\ & + \Big(p\tilde{k}_{Rf}^{\alpha} - (r+\delta)\tilde{k}_{Rf}\Big)M_f + (1-\delta)K \end{aligned}$$

and where $\tilde{k}_X$ is defined implicitly by NE. Here $p\tilde{k}_{Rf}^{\alpha} - (r+\delta)\tilde{k}_{Rf}$ is the "surplus return" per mineral concession from foreign investment in the resource sector, which is captured by the host country given equation (2). It will be useful to rewrite the objective and NE constraint functions slightly as

$$\begin{aligned} V =& \tilde{k}_X^{\gamma} - \gamma\tilde{k}_X^{\gamma-1}(\tilde{k}_X - K) + (1-\delta)K \\ & + \Big(p\tilde{k}_{Rh}^{\alpha-1} - \gamma\tilde{k}_X^{\gamma-1}\Big)\tilde{k}_{Rh}(M - M_f) \\ & + \Big(p\tilde{k}_{Rf}^{\alpha-1} - (r+\delta)\Big)\tilde{k}_{Rf}M_f \end{aligned}$$

and

$$\begin{aligned} a_l =& \Big(\gamma\tilde{k}_X^{\gamma-1} + (1-\delta)\Big)(\tilde{k}_X - K) \\ & + \Big(\gamma\tilde{k}_X^{\gamma-1} + (1-\delta)\Big)\tilde{k}_{Rh}(M - M_f) + (1+r)\tilde{k}_{Rf}M_f. \end{aligned}$$

A. $K < k_X^{FB}$ **and** NE **binds:** Suppose $K < k_X^{FB} = (\gamma/(r+\delta))^{1/(1-\gamma)}$. It is optimal for the host country government to set $\tilde{k}_{Rf} = \tilde{k}_{Rh} = \tilde{k}_R$ and to lease all resource rights to the foreign firm (at least up to the point where the efficient level of manufacturing investment can by supplied by domestic capital) in this case. If $\gamma\tilde{k}_X^{\gamma-1} > r + \delta$ (or, equivalently, $\gamma\tilde{k}_X^{\gamma-1} + (1-\delta) > 1 + r$ and therefore $\tilde{k}_X < k_X^{FB}$) one way to relax the constraint is to lower the domestic capital stock in the resource sector, $\tilde{k}_{Rh}(M - M_f)$, and to increase the FDI stock in this sector, $\tilde{k}_{Rf}M_f$, an equal amount. This also increases V whenever $p\tilde{k}_{Rh}^{\alpha-1} - \gamma\tilde{k}_X^{\gamma-1} > p\tilde{k}_{Rf}^{\alpha-1} - (r+\delta)$. So for as long as $\gamma\tilde{k}_X^{\gamma-1} > r + \delta$, one solution is $\tilde{k}_{Rh} = \tilde{k}_{Rf}$ and $M_f = M$. A further increase in V comes from the fact that the constraint is relaxed, permitting an increase in total manufacturing investment $\tilde{k}_X$. Alternatively, it is possible to vary the capital to mineral ratios only, increasing $\tilde{k}_{Rf}$ relative $\tilde{k}_{Rh}$, but concavity ensures that this leads to successively small (and limited) increases in V. In fact, provided $M_f < M$, $\tilde{k}_{Rf} = \tilde{k}_{Rh}$ is optimal.

Now suppose $K \geq k_X^{FB}$. As M_f is increased towards M, eventually $\tilde{k}_X = K - \tilde{k}_{Rh}(M - M_f)$ is raised above k_X^{FB} and $\gamma\tilde{k}_X^{\gamma-1} > r + \delta$ can no longer be satisfied. At the point where $K - \tilde{k}_{Rh}(M - M_f) = \tilde{k}_X = k_X^{FB}$, the constraint implies $\tilde{k}_{Rf} = a_l/(1+r)M_f$. Increasing m_f further results in outflows of domestic capital, which is not optimal as long as $\tilde{k}_{Rh} < k_R^{FB}$. When $\tilde{k}_X = k_X^{FB}$, aggregate income is

$$\begin{aligned} V =& \Big(\tilde{k}_X^{\gamma} - (r+\delta)\tilde{k}_X\Big) + \Big(p\tilde{k}_{Rh}^{\alpha} - (r+\delta)\tilde{k}_{Rh}\Big)(M - M_f) \\ & + \Big(p\tilde{k}_{Rf}^{\alpha} - (r+\delta)\tilde{k}_{Rf}\Big)M_f + (1+r)K. \end{aligned} \tag{6}$$

and the NE constraint is

$$\begin{aligned} a_l =& (1+r)(\tilde{k}_X - K) + (1+r)\tilde{k}_{Rh}(M - M_f) \\ & + (1+r)\tilde{k}_{Rf}M_f. \end{aligned} \tag{7}$$

Again, because $\tilde{k}_{Rh}$ and $\tilde{k}_{Rf}$ enter symmetrically, $\tilde{k}_{Rf} = \tilde{k}_{Rh}$ - increasing $\tilde{k}_{Rh}$ above $\tilde{k}_{Rf}$ would permit further increases in M_f, but it is straightforward to see that, with $\tilde{k}_{Rf} < \tilde{k}_{Rh}$, further increases M_f reduce V rather than increase it. Therefore M_f is defined by

$$\tilde{k}_{Rh} = \frac{K - k_X^{FB}}{M - M_f} = \frac{a_l}{(1+r)M_f} = \tilde{k}_{Rf}$$

or

$$M_f = \frac{a_l M}{a_l + (1+r)(K - k_X^{FB})}.$$

The corresponding bounds for the allocation of mineral rights (which in turn determines investment levels) are

$$M_f^{low} = \max\left\{0, M - \frac{K}{k_R^{FB}}\right\},$$

$$M_f^{high} = \min\left\{M, M - \frac{K - \tilde{k}_X}{k_R^{FB}}\right\}$$

B. $K = k_X^{FB}$ **and** NE **binds:** If $\gamma\tilde{k}_X^{\gamma-1} = r + \delta$, the host-country is indifferent between domestic investment and foreign investment in the resource sector (this is evident after substituting this equality into V and the NE to obtain expressions (6) and (7) above). But in this case, $\tilde{k}_{Rf} = \tilde{k}_{Rh} = \tilde{k}_R$ is again optimal.

If, on the other hand, $\gamma\tilde{k}_X^{\gamma-1} < r + \delta$ ($\tilde{k}_X > k_X^{FB}$), the returns to investment in the manufacturing sector are less than the opportunity cost of capital, and there is no FDI in this sector.

C. NE does not bind: Now consider the case where expropriation occurs whenever the low penalty is realized ($\pi(\theta) = \pi_l$). The profit maximizing quantity of foreign investment per worker in the manufacturing sector is

$$\tilde{k}_X = \hat{k}_X = \left(\frac{\gamma(1-\pi_l)}{r+\delta+\pi_l(1-\delta)}\right)^{\frac{1}{1-\gamma}}.$$

This is also the capital to labour ratio chosen by domestic investors. Substituting this expression and $E[a|a \in D(\theta)] = a_l$ into the national income equation yields

$$\begin{aligned} V =& \Big(\tilde{k}_X^{\gamma} - (r+\delta)\tilde{k}_X\Big) \\ &+ \Big(p\tilde{k}_{Rh}^{\alpha} - (r+\delta)\tilde{k}_{Rh}\Big)(M - M_f) \\ &+ \Big(p\tilde{k}_{Rf}^{\alpha} - (r+\delta)\tilde{k}_{Rf}\Big)M_f + (1+r)K - \pi_l a_l \quad (8) \end{aligned}$$

where $\tilde{k}_X$ is defined by the previous equation. Evidentally, $\tilde{k}_{Rf} = \tilde{k}_{Rh} = \tilde{k}_R$, as in the case of a binding NE constraint. Because the constraint does not bind, however, the maximum of V over $\tilde{k}_{Rh}$ is given by

$$\tilde{k}_{Rf} = \tilde{k}_{Rh} = k_R^{FB} = \left(\frac{p\alpha}{r+\delta}\right)^{\frac{1}{1-\alpha}}.$$

Moreover, identical capital to mineral ratios in the resource sector implies that the host-country is indifferent between foreign and domestic investment in this sector, and M_f is not uniquely determined in this case.

These results also obtain in the more general case with price uncertainty. See Section A.C of this Appendix.

Three Categories of Country Risk: In equilibrium, each of these cases correspond to distinct intervals over $a_l \in [0, \bar{a}_l]$ ($\bar{a}_l$ is the penalty above which it is never worthwhile to expropriate). First consider values of a_l just below $\bar{a}_l$. Note that in all cases, $\tilde{k}_{Rf} = \tilde{k}_{Rh} = \tilde{k}_R$. If *Case A* obtains, $\tilde{k}_X < k_X^{FB}$ and, rewriting the NE constraint, we have

$$\tilde{k}_R M = \frac{a_l}{\gamma\tilde{k}_X^{\gamma-1} + (1-\delta)} + K - \tilde{k}_X.$$

Host-country income is

$$V = \tilde{k}_X^{\gamma} + p\tilde{k}_R^{\alpha}M - \gamma\tilde{k}_X^{\gamma-1}\Big(\tilde{k}_X + \tilde{k}_R M - K\Big) + (1-\delta)K$$

Case A is simply a special case, with $\tilde{k}_X = k_X^{FB}$. With a_l just below $\bar{a}_l$, the host-country government chooses between the two cases by either reducing $\tilde{k}_R$ so that $\tilde{k}_X = k_X^{FB}$, or allowing a reduction in $\tilde{k}_X$. However,

$$\lim_{\tilde{k}_R \to k_R^{FB}} \frac{\partial V(\tilde{k}_R, k_X^{FB})}{\partial \tilde{k}_R} = 0,$$

$$\begin{aligned} &\lim_{\tilde{k}_X \to k_X^{FB}} \frac{\partial V(k_R^{FB}, \tilde{k}_X)}{\partial \tilde{k}_R} \\ &\quad = \gamma(k_X^{FB})^{\gamma-1}\left(1 + \frac{(1-\delta)(1-\gamma)a_l}{k_X^{FB}(k_X^{FB})^{\gamma-1} + (1-\delta))^2}\right) \\ &\quad > 0. \end{aligned}$$

This indicates that, when it is possible to attain close to the efficient investment levels, a reduction in $\tilde{k}_R$ to accommodate a $a_l < \bar{a}_l$ is less costly compared to reductions in $\tilde{k}_X$. This is also apparent examining the objective function and constraint – reducing $\tilde{k}_X$ raises $\tilde{k}_R$ less than one-for-one and, for a given quantity of aggregate FDI, reduces income owing to a rise in the marginal product of capital in the non-resource sector, $\tilde{k}_X^{\gamma-1}$, which adds to the profits of foreign investors. The optimal government strategy will therefore correspond to *Case B* for values of a_l just below $\bar{a}_l$.

For sufficiently low a_l ($a_l \in (a_l', a_l'']$), it is optimal to reduce $\tilde{k}_X$ as well. This is mainly due to concavity of the objective function, but also because a lower value of a_l implies that reductions in $\tilde{k}_X$ correspond to larger increases in $\tilde{k}_R$. Hence the optimal government strategy will correspond to *Case A* over this range of a_l.

For $a_l \in [0, a_l']$, the optimal government strategy will correspond to *Case C*. At $a_l = 0$, there can be no FDI if expropriation never occurs. If K is not too large, FDI is strictly positive if the host-country expropriates in the low-penalty regime. Since the direct cost of expropriating is also zero in this case, this is strictly preferred to never expropriating. For K below some $\bar{K}$ the value of a_l', where the host-country government is indifferent between *Case A* and *Case C*, is strictly positive, and zero otherwise.

A.B *Equilibrium when Resource Investment is Unspecified*

In the case where investors in both sectors can choose investment levels, the host country government's only policy instrument is the allocation of mineral rights M_f. In this case the marginal product of capital will be equalized across sectors and $\tilde{k}_{Rf} = \tilde{k}_{Rh} = \tilde{k}_R$, yielding the following relationship:

$$\tilde{k}_R = \left(\frac{p\alpha}{\gamma}\tilde{k}_X^{1-\gamma}\right)^{\frac{1}{1-\alpha}}.$$

In the case where NE binds, substituting $\tilde{k}_{Rf} = \tilde{k}_{Rh} = \tilde{k}_R$ in the constraint and simplifying yields

$$\begin{aligned} a_l =& \Big(\gamma\tilde{k}_X^{\gamma-1} + (1-\delta)\Big)(\tilde{k}_X - K + \tilde{k}_R M) \\ &- \Big(\gamma\tilde{k}_X^{\gamma-1} - (r+\delta)\Big)\tilde{k}_R M_f. \end{aligned}$$

Here $\gamma\tilde{k}_X^{\gamma-1} - (r+\delta)$ is the "net rent" in the manufacturing sector associated with a binding constraint. Aggregate income becomes

$$V = \tilde{k}_X^{\gamma} + p\tilde{k}_R^{\alpha}M - \gamma\tilde{k}_X^{\gamma-1}(\tilde{k}_X + \tilde{k}_R M - K) + \Big(\tilde{k}_X^{\gamma-1} - (r+\delta)\Big)\tilde{k}_R M_f + (1+r)K.$$

As long as $\tilde{k}_X^{\gamma-1} - (r+\delta) > 0$ it is evident that raising M_f simultaneously relaxes the constraint and raises V. As in the case where investment in resources is constrained, then, it is desirable from the perspective of the host-country to raise M_f towards M until all manufacturing investment is domestic capital. A binding NE constraint and the condition of equal marginal products of capital in each sector imply that M_f is the only policy variable. M_f pins down levels of FDI in each sector.

However, it may be the case that the constraint cannot bind given investor strategies in the non-resource sector. If the constraint is not binding, then $\pi(\theta) = \pi_l$ and

$$\tilde{k}_X = \left(\frac{\gamma(1-\pi_l)}{r+\delta+\pi_l(1-\delta)}\right)^{\frac{1}{1-\gamma}},$$

$$\tilde{k}_R = \left(\frac{p\alpha(1-\pi_l)}{r+\delta+\pi_l(1-\delta)}\right)^{\frac{1}{1-\alpha}},$$

$$w_M = (1-\alpha)p\tilde{k}_R^{\alpha}.$$

Income in the case where NE does not bind becomes

$$V = \hat{k}_X^{\gamma} + p\hat{k}_R^{\alpha}M - \Big(r+\delta\Big)(\hat{k}_X + \hat{k}_R M - K) + (1-\delta)K - \pi_l a_l.$$

Since this expression does not depend on M_f, the allocation of mineral rights is not uniquely determined, as in the case of the contract that specifies investment levels in the resource sector when NE does not bind.

A.C *Indifference Curves are Downward Sloping over* $\tilde{k}_R$ *and* w_m *when* $\pi(\theta) = \pi_l$

In the case where the host-country government expropriates whenever $a = a_l$, so that $\pi(\theta) = \pi_l$, the indifference curves over $\tilde{k}_R$ and w_m are downward sloping (for $\tilde{k}_R < k_R^{FB}$ and $M_f > 0$). Host country income as a function of $\tilde{k}_R$ and w_m is

$$V = \Big(E[p]\tilde{k}_R^{\alpha} - (r+\delta)\tilde{k}_R\Big)M - \Big((1-\pi_l)E[p]\tilde{k}_R^{\alpha} - (r+\delta+\pi_l(1-\delta))\tilde{k}_R\Big)M_f + (1-\pi_l)w_M M_f + \tilde{k}_X^{\gamma} - (r+\delta)(\tilde{k}_X - K) + (1-\delta)K + \pi_l a_l.$$

This expression is evidentally increasing in w_M. To determine whether indifference curves slope downward over the region of interest, we must verify that the expression is also strictly increasing in $\tilde{k}_R$. The slope with respect to $\tilde{k}_R$ is

$$\Big(\alpha E[p]\tilde{k}_R^{\alpha-1} - (r+\delta)\Big)(M - (1-\pi_l)M_f) + \pi_l(1+r)M_f.$$

This is strictly positive for $\tilde{k}_R \leq k_R^{FB}$. In fact, it is straightforward to verify that, at $\tilde{k}_R = k_R^{FB} = ((\alpha E[p])/(r+\delta))^{(1/(1-\alpha))}$, this slope is equal to $(1-\pi_l)M_f$ times the slope of w_M with respect to $\tilde{k}_R$ (defined by equation (2), and noting that $E[p|s \notin D] = E[p]$ in this case). In other words, the point of tangency in Figure 2 is at k_R^{FB}.

The significance of this result is that the government's optimal choice of $\tilde{k}_R$ is above $\tilde{k}_R^C$ in this Figure, the value that would result if investment were chosen by the investors, while w_M is lower.

B Tables

Table 2: Sector and Time Patterns of Expropriation Acts: 1960-2006.

	1960-69	1970-79	1980-89	1990-99	2000-06
Primaries	**36.8**	**40.4**	**52.9**	**31.8**	**48.1**
Agriculture	8.8	8.7	35.3	0.0	11.1
Mining	11.8	12.3	0.0	22.7	18.5
Petroleum	16.2	19.4	17.6	9.1	18.5
Manufacturing	**25.7**	**27.4**	**23.5**	**13.6**	**14.8**
Services	**37.5**	**31.4**	**23.5**	**54.5**	**37.0**
Banking and Insurance	12.5	11.6	0.0	0.0	0.0
Communication	1.5	2.4	0.0	0.0	7.4
Construction	0.0	1.9	0.0	9.1	0.0
Trade	7.4	4.0	5.9	4.5	3.7
Transportation	5.9	3.3	5.9	4.5	3.7
Utilities	10.3	4.5	0.0	18.2	11.1
Other Services	0.0	3.8	11.8	18.2	11.1
Unallocated	**0.0**	**0.7**	**0.0**	**0.0**	**0.0**
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Number of Acts	136	423	17	22	27

Source: Expropriation data is from Kobrin (1984), Minor (1994) and Hajzler (2010).

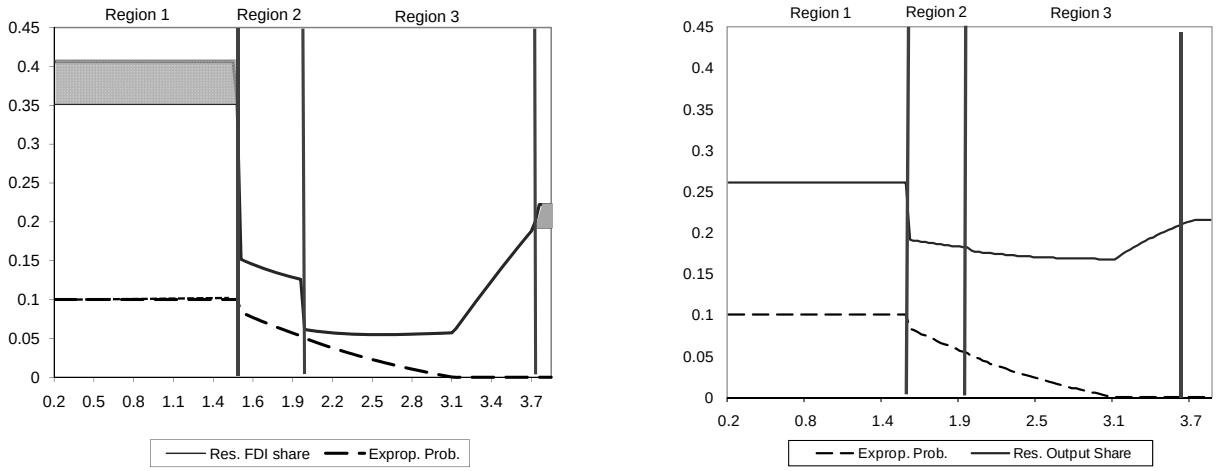
Table 3: Sector FDI and Output: Expropriators vs Non-Expropriators

	Non-Expropriators		Expropriators	
	Average	N	Average	N
FDI (% total)				
Primaries	0.159	39	0.345	9
Manufacturing	0.354	39	0.246	9
Services	0.487	39	0.409	9
Mining & Petroleum (U.S. firms)	0.141	9	0.400	7
Value Added (% total)				
Primaries	0.218	39	0.165	9
Manufacturing	0.179	39	0.179	9
Services	0.603	39	0.657	9
Mining & Petroleum	0.060	9	0.067	7
ONDD insurance class	3.47	100	4.49	14

Source: Hajzler (2010).

C Figures for Numerical Examples

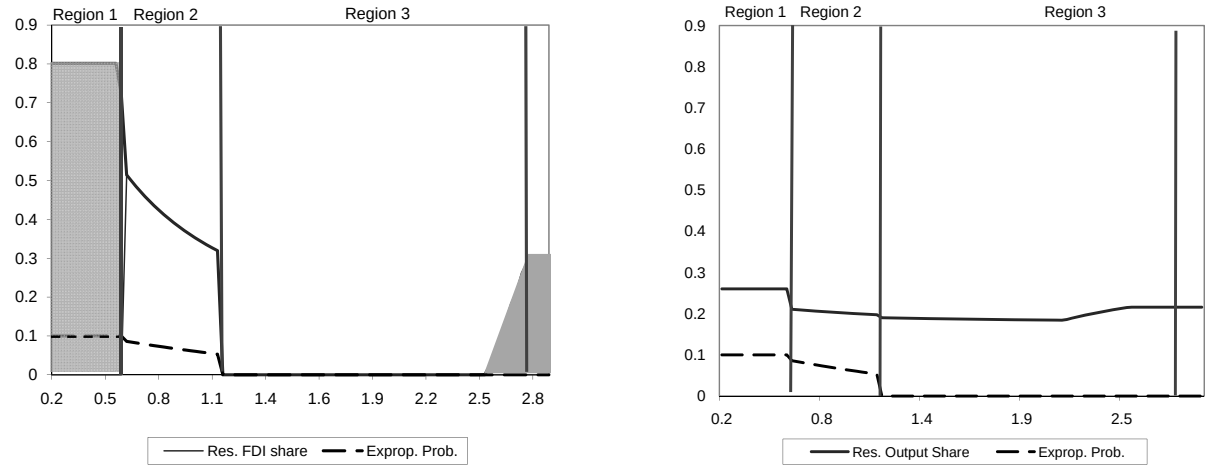
Figure 3: Resource FDI and Output Shares and Risk: Low K



(a) FDI Share

(b) Output Share

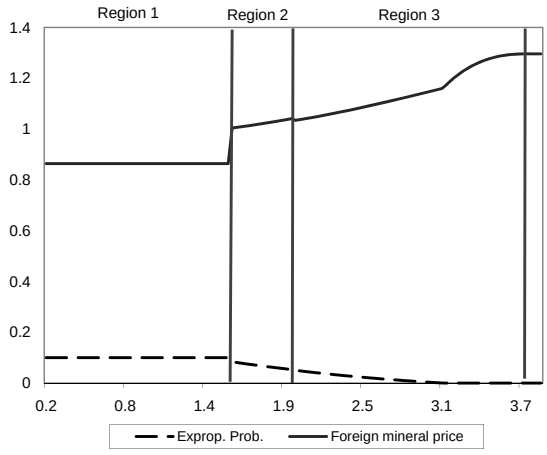
Figure 4: Resource FDI and Output Shares and Risk: High K



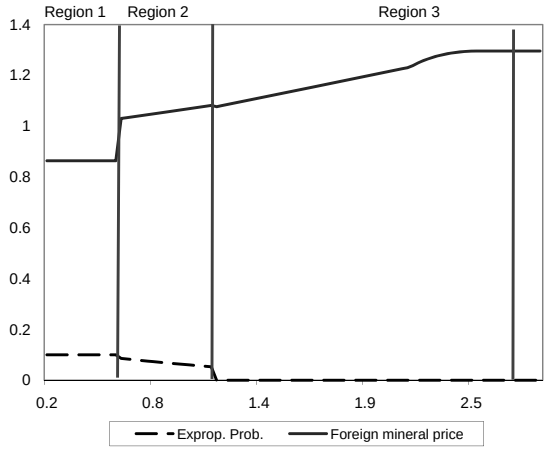
(a) FDI Share

(b) Output Share

Figure 5: Mineral Price and Risk: Low and High K

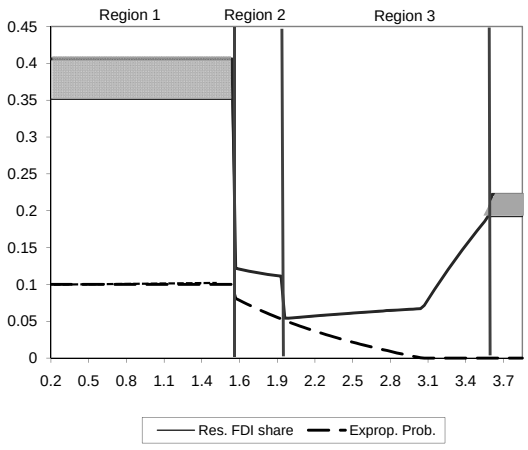


(a) Low K

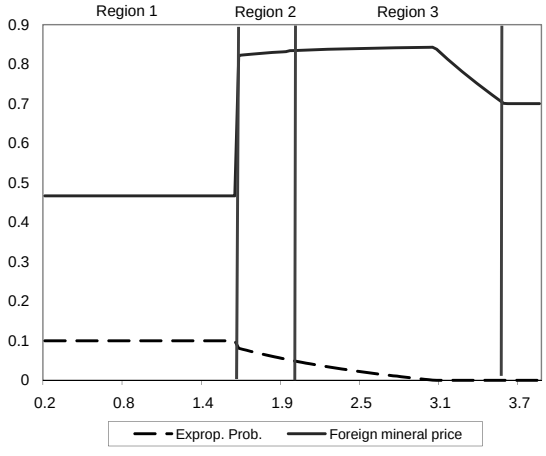


(b) High K

Figure 6: Resource FDI, Royalty Rate and Risk: Low K

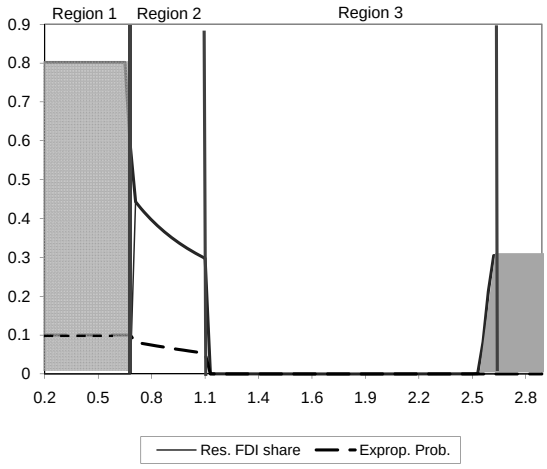


(a) FDI Share

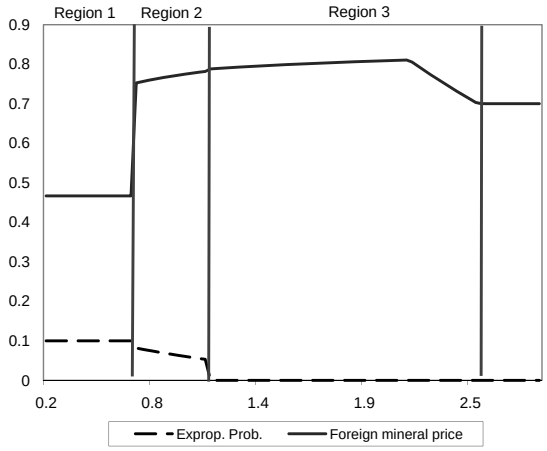


(b) Royalty

Figure 7: Resource FDI, Royalty Rate and Risk: High K



(a) FDI Share



(b) Royalty