FDI spillover in the Oil Industries

by Murat M. Issabayev

B.A. in Economics, June 2001, Suleyman Demirel University in Kazakhstan
M.A. in Economics, September 2005, Northeastern University

A Dissertation is submitted to

The Faculty of
The Columbian College of Arts and Sciences
of The George Washington University
in partial fulfillment of the requirements
for the degree of Doctor of Philosophy

August 31, 2015

Dissertation directed by

Joseph Pelzman
Professor of Economics and International Affairs

The Columbian College of Arts and Sciences of The George Washington University certifies that Murat M. Issabayev has passed the Final Examination for the degree of Doctor of Philosophy as of June 30, 2015. This is the final and approved form of the dissertation.

FDI spillover in the Oil Industries

Murat M. Issabayev

Dissertation Research Committee:

Joseph Pelzman, Professor of Economics and International Affairs, Dissertation Director

Sumit Joshi, Professor of Economics, Committee Member

Frederick L. Joutz, Professor of Economics, Committee Member

© Copyright 2015 by Murat M. Issabayev
All rights reserved

Dedication

The author wishes to dedicate this dissertation to his parents, his wife and his kids. Without their praying this dissertation would not have been possible. This document is a testament to their patience, encouragement and faith throughout the years.

Acknowledgements

I am very thankful to my dissertation adviser and committee members for all their professional consult and encouragement. Additional thanks to external readers Professor Arun Malik and Professor Hossein G. Askari for tirelessly reading my dissertation and providing valuable comments for improvement. Finally, I am very thankful to my classmates Ferhat Bilgin and Ahmed Rostom for all their time and friendship in my pursuit of this endeavor.

Abstract of Dissertation

FDI spillover in the Oil Industries

In the first essay, a theoretical model establishes why there are NO negative spillover effects from foreign investment in the oil industries of developing countries. This is done with specific focus on side-payment transfers from foreign partners to host government officials in such resource-rich host countries along with government quality in such instances. In addition, this essay starts with a simple model to analyze the bargaining relationship between two parties: host government and International Oil Company (IOC).

As oil interests in developing countries are largely publically owned, foremost it is important to understand that any IOC going abroad to invest in the extractive sectors of those countries must negotiate with the host government on oil project equity shares. Thus from the onset of relations, restriction and conflicts of interests are obviously born of this public versus private orientation. This becomes most notable in the distinct goals of the parties. For thereby the host government seeks to maximize revenue from the oil business on behalf of the common purse and the rent seeking IOC focuses on the profits due its largely foreign individual shareholders.

In the second essay, complexity is added to the aforementioned first model by introducing more than two parties. For focus is placed on distinguishing the advantages and or capabilities inherit in the government negotiating with multiple IOCs and deciding between a *simultaneous multilateral offer* and a *sequential bilateral offer* on equity shares from resource value. In so doing, particular attention is given to the government's

imposition of a spillover requirement as to diversify the local economy and the trade-offs of that choice. Thence it will be further outlined how the government's request for "spillover", or those beyond the interaction of the IOC's basic extraction protocol, traditionally leads to sacrifice of more direct revenue from equity shares pertaining to host country.

Furthermore, provided that the host government treats all its foreign partners in a simultaneous negotiation as a single entity, it is argued that the government is predicted to gain a higher equity share from a simultaneous multilateral bargaining deal than a sequential bilateral one with each player. This is held consistent with the *Stakelberg* leader-follow model as supported by anecdotes of real world case studies. For thereby in a sequential offer the first firm gets a larger share than the second firm.

The third essay develops a simple framework to analyze the links between local contents promotion associated with FDI in the oil industry and several elements of fiscal policy in a resource-rich host country. In particular, focus is placed on the role of side-payments in promoting local content policies and its interaction with fiscal instruments to analyze its impacts on the host country's welfare, subject to both binding and non-binding constraints. Despite the case study results provided by the World Bank or United Nations regarding the role of local content promotion with FDI in the oil industry, the body of microeconomic theory modeling these phenomena in this particular industry is rather silent.

Table of Contents

Dedication....…….…….iv

Acknowledgements ……...v

Abstract of Dissertation……vi

List of Figures….…….....xi

List of Tables……xii

Chapter 1: Overview……..1

1.1 Introduction…….…….....3

1.2 Motivating facts……..…….……5

1.3 Research Questions.…….…....7

1.4 Contributions……..…….....8

Chapter 2: Bilateral Bargaining Game: Host Government and International Oil Company..…….…….....12

2.1 Introduction……..…….….…12

2.2 The Model.…….……..20

2.2.1 General Case…….…..…….....22

2.2.2 A Specific linear equity share case.……..……27

2.3 Equilibrium Characteristics …….….29

2.4 Comparative Statics…….…….….….33

2.5 Policy Responses…….……...44

2.6 Conclusion …….…….……...47

Chapter 3: Coalitional Bargaining in the Oil Industry……49

3.1 Introduction……..…….……..49

3.2 Basic Model…….……...54

3.2.1 Benchmark Model: No Spillover and No Outside Options……..……58

3.2.2 No Spillover, But Outside Options ……..……....63
3.3 Bargaining With Spillover Requirements …….……66
3.3.1 Simultaneous Multilateral Bargaining…….……..67
3.3.2 Sequential Bilateral Bargaining …….……...71
3.4 Spillover Impacts…….…….....78
3.5 Policy Responses ……..…….……81
3.6 Conclusion ……..…….…….....85
Appendix – Chapter 3…….…….…….…..87
3. A: Simultaneous Multilateral Bargaining……..…….87
3. A.1: Benchmark in Simultaneous Game …….…….88
3. A.2: No Spillover, But Outside Options...…….…….……..88
3. A.3: Spillover and Outside Options …….…….…….....89
3. B: Sequential Bilateral Bargaining..……..…….……..90
3. B.1: Benchmark in the Sequential Game..…….……..91
3. B.2: No Spillover, But Outside Options.…….…….....92
3. B.3: Spillover and Outside Options..…….…….....96
Chapter 4: Local Contents in the Oil Industry...……..98
4.1 Introduction.……98
4.2 Model A – An Exogenous Royalty...……...……103
4.2.1 Production and Cost……..…….…….105
4.2.2 Oil Profit.…….……105
4.2.2.a: No Minimum Requirements…….106
4.2.2.b: Minimum Requirements…….…….108
4.2.3 Payoff to Players…….109
4.3 Model B – An Endogenous Royalty……...…..114
4.3.1 Oil Profits.……...116
4.3.2 Simultaneous Bargaining on Multiple Issues.…….……116

4.4 Heterogeneous Local Contents……122

4.4.1 Heterogeneous Local Contents under Nonbinding Constraints……....126

4.4.2 Heterogeneous Local Contents under Binding Constraints……..……127

4.5 Policy Responses…….……..…...130

4.6 Conclusion…….……..….136

Appendix - 4.A..……..……..……...…138

Appendix - 4.B…….…….....139

Appendix – 4.C…..……...…….....140

Chapter 5: Summary, Conclusion and Further Extensions……..……....143

References……...……...…….148

List of Figures

Figure 1: Game Tree……...…….62

List of Tables

Table 1. Benchmark Summary of Optimal Equity Shares of Each Player……59

Table 2. A Summary of Payoffs of Each Player with Positive disagreements……65

Table 3. Summary of Equity Shares of Players along with Disagreements and Spillovers……...……76

Table 4. Reduced Form of Payoff Comparison for Each Player under Two Scenarios…….....77

Chapter 1

OVERVIEW

This dissertation is about the "*spillover effects*" of foreign direct investment (FDI) from extractive industries. For it is quite common that the main purpose of any resource abundant host government attracting foreign investors is to stimulate the domestic fiscal and market condition via spillover effects. Yet, global anecdotes or case studies by organizations such as the World Bank and United Nations argue that spillover effects harbor undesirable consequences. Also, though not exactly the same, this scholarly negation shares theoretical elements with the "*natural resource curse*" or the general notion implying that rich resources seem to generate negative impact on the economic performance of the countries that possess them.

Along this guise, early literature on the "resource curse" implemented two waves of models: "***Dutch disease***" (van Vijnbergen, 1984; Krugman, 1987; Sachs and Warner, 1995) and "***rent-seeking***" (Lane and Tornell, 1996; Tornell and Lane, 1999; Torvik, 2002). Nevertheless, all of these works imply that there is an unconditional negative relationship between resource abundance and growth (See Mehlum et al, 2010).

On the other hand, empirical papers regarding said "curse" provided mixed results. Summarizing those findings, Frankel et al (2010) considered six aspects of commodity wealth and concluded that the most decisive one is "types of institutions". That is, sound public sector organizations seem to influence positively on economic performance, while the inverse is true of fragile or compromised ones. Even further, Mehlum et al (2006) provides a theoretical model using two types of institutions, grabber-friendly and producer-friendly. In so doing the theory is tested premised on

Sachs and Warner's work. However, contrary to Sachs and Warner, it argues that institutions play a key role in augmenting the resource curse.

In turn, dissecting the underpinnings of this purported resource malediction, this work assesses both distinct postures, that of governments that host FDI contracts and disquisitions such as the aforementioned opposing it.

Moreover, though there could be many more theoretical models providing different mechanisms of explaining the resource curse, this work proves novel in in two respects. (1) There is a limited number of studies that fathom any correlation between said purported malediction and "***international trade***" or the "***FDI***" framework (See McMillan et al, 2007; and Corato, 2013). Yet, in most resource-rich countries the operators in extractive industries are foreign investors, which in the instance addressed herein are *international oil companies (IOC*). (2) Second, extensive alternative analysis of the negotiation protocol and its accompanying **"bargaining"** tools is also largely another original idea, particularly on the matter of negative spillover. This discourse is provided in lieu of seeking rationale for cases where FDI did not provide domestic market growth.

In turn, the matter of negative spillover is presented as having many causes by which low income countries are characterized. Among them limited financial resources, low human capital, weak technology and low industrial base. Yet, the *side-payment concept* and the *low governance* associated with it is treated as the main suspected culprits. Thus, as these two concepts were borrowed from "natural resource curse" literature, they were inserted into "bargaining" framework formulations to arrive at

substitute interpretations. In this vain, the first essay reasons that government quality determines the net spillover effects from oil industry FDI. Further, it cites that depending on government quality, side-payments can be both "good and bad".

The second essay proposes negotiations among more than two players. Therein focus is placed on comparisons between two bargaining approaches, *sequential* or separate meetings with each oil firm and *simultaneous* which is defined by an assembly of all parties.

In the final essay, a model is built where the government and IOC bargains on different elements of tax policy and government thereby imposes local content requirements on said firm. In turn, it is argued that government is not a beneficiary of local content policy, instead local suppliers are. Then ultimately it is deemed that it is this revenue drought that pushes government to engage in side-payments or so-called "kickbacks".

1.1 Introduction

The years, both past and recent, bear witness to negative spillover effects from foreign investment in resource rich countries[1]. Consistent with this reality, McPherson and MacSearraigh (2007) elaborates on the role of unorthodox arrangements in such relations in stating:

"*Corruption in a sector as rich and as powerful as petroleum can be expected to have major* ***negative spillover effects*** *on the governance not only of other sectors but also*

[1] Yet this is this not the case in countries with effective institutions such as Norway.

of the economy as a whole. Hence the sector vulnerabilities listed above have an importance for policymakers that go far beyond oil…"

In turn, this dissertation is a collection of three essays aimed at addressing spillover effects from FDI in the oil industry. In signing a leasing contract with investors, alongside bargaining on equity shares from the oil project, the host government or National Oil Company (NOC) imposes the additional investment cost of a spillover requirement on said foreign partners, consistent with its goal to diversify the domestic economy. As such, though traditionally such measures are referenced as "performance requirements", for the convenience of this dissertation's discourse they will be termed "spillover requirements" in the first two chapters and "local content requirements" in the last. For to not consider spillover requirements would equate to a simple model of short-term rent seeking attached to the specter of depleting the host nation's savings or what amounts to little to no foreseeable incentive for the NOC's engagement based on current expectations. With this in mind, this dissertation's focus is on developing a microeconomic model of the bargaining process for a spillover requirement contract between a resource abundant country and a foreign partner in the upstream segment of relations. Further, this work also considers that this contracting process is not a simple bilateral game but rather a multi-party one.

Moreover, extending a two-player game to a multiple-party one in lieu of accounting for coalition effects, consideration will be given to the trade-off between a simultaneous multilateral deal and a sequential bilateral deal between the host country and several foreign partners. For in tying these two prototypes to reality, this dissertation is intended to enrich the explanations for spillover effects.

Finally, as both additional support as well as a contending rationale for spillover effects, in the last essay this dissertation will also address the matter of local contents promotion and its impact on host country welfare.

Nevertheless, the above is stated noting that despite the close relation between these essays, their presentation allows for them to be read separately.

1.2 Motivating Facts

The presence of oil resources guarantees nothing to the economy of developing countries. Despite the promise of modern technology and capital investment by foreign partners, with few exceptions most resource-rich host countries continue to experience controversial effects on domestic growth.

Hence, first and foremost the challenge here is to dissect the matter amounting to the potential shortcomings of resource-rich host countries. For though the lion share of GDP in these countries come from oil revenues, drawbacks in development still persists. As such, this raises multiple questions, serving to motivate the quest herein for further explanation.

As its name suggests, the oil industry is oligopolistic in nature. Thereby, to the best of this author's knowledge there is no single paper providing an explanation to the adverse effects of foreign oil investment in host countries using the approach of "Industrial Organization". Conversely, both scientific and policy-oriented works often focus on the overall effect of FDI in the oil industry on macroeconomic growth. Of particular notation is the dynamics of engagement between private oil investors in needing to secure a license from such host governments to extract crude oil, with

elaboration on such resources being publically-owned. Yet licensure most often accounts solely for the first necessary condition of negotiations between such parties. Similarly, the fact that NOCs bear popular title (as ultimate owner of publically managed oil shares) is but one factor of consideration therein. Nevertheless, despite information on the complexity of such dialogue being readily available, the vast majority of prevailing work about such public-private partnerships is silent on matters beyond the rounds of initial engagement.

On the other hand, this is not to propose that discourse about more mature levels of negotiations has never been previously fathomed. For of major consideration, as to explaining why micro-level firm data is not readily available in developing countries, is the undeniable reality that in most instances the oil business structure is not transparent from upstream to downstream sectors. Thereby with the ability to conduct empirical analysis being vague, efforts to furnish thorough objective assessment are likewise overly ambitious. Along this guise, even the presence of macroeconomic data on energy in developing countries may neglect actuality, making empirical models largely improbable.

Similarly, while most of the empirical studies on natural resources devote one section for theoretical macroeconomic models, a very limited number of papers has employed bargaining tools, see McMillan et al. (2007); Corato (2013) and the unpublished Chavez (2010).

Fostered by all these considerations, the main objective of this dissertation is to build micro-theoretical models on spillover effects from foreign oil investment using bargaining framework.

1.3 Research Questions

Noting the aforementioned, this dissertation study focuses on finding an explanation for the persistence of negative spillover phenomena in developing countries coupled with foreign oil investment. In so doing the first essay expands on the bilateral Nash bargaining framework suggested by Chavez (2010) by introducing spillover parameters imposed as an additional cost on the foreign oil investor. So even though positive spillover effects are unceasingly always the expectation, the central question is *how to theoretically justify the opposite*. For that reason, the dissertation stresses those factors frequently discussed by people who have understood and accepted the importance of acknowledging the probability of this dismal reality of side-payments and waning government quality. Also to capture the possible interaction between these two factors, their depths of their joint effects are explored.

Giving way to complexity, the second essay concerns the role that investor coalitions play when the host government negotiates with multiple international oil companies. Of particular mention is the government's need as an agenda setter to decide whether to negotiate with these multiple prospective investors *simultaneously* in a round table fashion or approach each firm in *sequential* order. In a simultaneous multilateral scenario, it is actually customary and thereby herein treated as if the government bargains on equity shares of resource value with an exogenous coalition of foreign firms and imposes joint spillover contribution on them. Conversely, following a sequential bilateral format, it is herein rendered as if the government seeks to prevent a coalition of firms by bargaining on equity shares of resource value with each firm separately and requiring distinct individual spillover contributions. As a result, the most prominent subject

addressed at this juncture is, "*Which form of multi-party bargaining is expected to generate more spillover, simultaneous multilateral or sequential bilateral?"*

Finally, the last essay addresses the question of government choice between two policies: local content policy and fiscal policy. Local content requirements is one element of general performance or spillover standards imposed by government that forces foreign oil companies to procure a certain fraction of inputs used in crude oil extraction from local suppliers in the host country. This policy is conditioned upon the government's need to sacrifice royalty and corporate tax income revenues collected from oil companies. Hence, this poses the question whether it is possible to promote the host country's welfare by reconciling local content requirements with tax revenue reductions. More precisely, the major research questions would be:

Who benefits and who loses from local content promotion? Is this policy welfare enhancing or welfare reducing?

1.4 Contributions

World Bank studies on spillover effects in the extractive industries of resource abundant resource countries do not seem to be very conclusive (Campos et al, 2007). In fact, there is a strong accepted consensus that there are negative spillover effects. Along this guise it is equally important to note that the measure of spillover effects from foreign oil investment is not straightforward.

Thus, in the first essay this statement will be opposed by emphasizing an appropriate description of spillover effects. In so doing, first it will be outlined that, "*spillover*" is not exactly the same as "*spillover benefit*". For example, if the host

government imposes a requirement on its foreign partner to provide sponsorship to educate the local populous, the costs charged by the foreign partner for educational training can be treated as a contribution to spillover. Yet, the outcome of this training may not necessarily be beneficial. This is especially true if there is no capacity for locals to implement those skills in host country. Accordingly, there is no spillover benefit or negative spillover.

Following the first reasoning, it is also herein argued that there is a difference between "*spillover effects*" and "*net spillover effects*". For the host government would never sign a contract with foreign partners unless there is the prospect of a positive spillover. In turn, as there is no free lunch, government's request for more spillover is conditioned upon its need to concede more equity share in the project to its foreign partners. This implies spillover contribution by foreign partners provide two contradicting effects on government welfare: *negative effects by reducing the government equity share and positive effects by increasing value added to the economy*. The difference between the two results in net spillover effects. More concisely, if the concession of equity shares proves more profitable for the foreign investor than the gains of the government's spillover program, then there is a negative net spillover effect. Therefore, in support of World Bank evidence it would be more accurate to say that customarily there is a negative net spillover effect from FDI in oil the industry. Further, it is also argued that if government infrastructure is weak, then the net spillover effect from FDI in the oil sector usually follows suit in being negative. To match, theoretical results of the first essay have endogenously documented both the good and bad consequences of

side-payments on spillover. Stated differently, under a fragile public sector, side-payments predictably generate less spillover.

As multi-party bargaining is too complex by its nature, it is not easy to fully understand spillover effects unless simplified assumptions are provided. Hence the main focus of the second essay lies on a comparative analysis of two scenarios noted above, in lieu of answering the most central questions raised in this essay via a step-by-step analysis.

For starters, as to endorse the convenience of understanding the depth of these two scenarios, foremost the utility of all parties is assumed to be linear. This is consistent with the benchmark model where all oil investing parties, absent disagreement and spillover requirements, bargain only on equity shares of resource value. This format is endorsed by the government's expectation of gain from a simultaneous multilateral bargaining. Nevertheless, after adding disagreements into the benchmark model, the results did not seem to change. Yet inserting spillover into further analysis did not provide clear results as to whether the government gains more from a simultaneous multilateral or a sequential bilateral bargaining. Instead what proved more definitive was adding a strong assumption of *"superadditivity"*. For so doing aided the conclusion that more spillover is generated from a simultaneous multilateral bargaining.

Finally, the last chapter analyzes the trade-off that the host government faces between choosing local contents policy and fiscal policy. Considering the fact that the true beneficiaries of local contents promotion are local suppliers rather than the government, it induces the NOC to undertake diverse strategies. For local contents policy

is founded on the idea of government possessing the purview to direct its foreign partners to procure inputs from various local suppliers who exercise prominence in the supply market premised on close ties to public officials. Bearing this in mind, as there is a minimum target imposed on foreign partners to procure specific local inputs, the final impact of local contents promotion can result at best in zero and at worst negative returns for the domestic economy. Thence, for the purpose of arriving at a conclusion, more in depth analysis will be given to whether the constraints on minimum targets are truly binding.

Chapter 2

Bilateral Bargaining Game: Host Government and International Oil Company

2.1 Introduction

It is by far no longer secret that the most central intended purpose of developing countries engaging foreign direct investment is the prospects of positive spillover effects. Following this guise, foreign companies enter into developing countries either via the channel of merger and acquisitions (M&A) or by establishing joint-ventures (JV) with local companies in the host country or the host government.

In turn, there is much discourse on the existence of spillover effects arising from FDI by IOCs in developing countries. Yet as it stands there is no known economic model of spillover effects in the extractive oil sector.

To match, given the confidentiality of firm level data, there are no empirical papers dealing with this subject. So matters pertaining to topics such as payments to the host government or concise amounts of oil revenue remain unpublished or misreported.[2] Instead at best, information is limited to the work of policy outlets such as the World Bank whose publications being intended for the general reading public, are largely void of in depth empirical analysis. Yet all the while such work traditionally manages to maintain support for what can be described as a blanket conclusion that there are customarily no spillover effects in this sector.[3]

[2] See http://www.transparency.org/topic/detail/oil_and_gas
[3] See "Nigeria: NACCIMA Says Oil Sector is Killing Economy" at http://allafrica.com/stories/201302130929.html available on February 13, 2013.

Per case study, Nigeria is the most frequently discussed nation used to support the argument for zero to negative spillover. This is mirrored by the reality of polls taken of the Nigerian masses whom have been quoted as being unable to determine the benefits of oil company foreign direct investment. Nevertheless, the Nigerian case is not unique. Instead, analogically it is Venezuelan oil history. For with massive rapid entry of foreign oil companies in Venezuela there was a dramatic decline in agricultural production known as "The Dutch Disease"[4]. That demotion of farm goods was followed in short order by a decline in government infrastructure. In turn, this waning public sector amounted to pronounced negative growth in departments of health and education.

Despite the lack of economic literature on spillover effects from specific foreign investment in oil industries, there is a large body of economic and political science literature on how rich natural resources adversely affect economic performance (Ross, 2014; Sachs and Warner, 1991, 1995). Therein scholars who studied these issues provide explanations via dozens of means. Yet most find consensus in pointing to factors such as violent conflicts, crimes, thefts and unorthodox speculations as the main rationales. Even more, such classic empirical works examine these anomalies as exploited on a country-level or via macro data rather than firm-level micro data (See Sachs and Warner, 1991, 1995, 1997, 2001; Leite and Weidmann, 2002).

Yet as noted earlier it is hard to find an academic study using firm-level data to defend spillover effects from foreign oil investment. To match, according to the non-governmental agency Transparency International, many IOCs only publish data on a

[4] See "*The Economics, Culture, and Politics of Oil in Venezuela*" by Gregory Wilpert at http://venezuelanalysis.com/analysis/74 available on August 30, 2003.

country by country basis. Thus, of course this absence of firm-level data is in great part parcel to blame for the forced neglect of empirical analysis in justifying the arguments herein. For lack of firm data results in scholarly deprivation from studies of the spillover effects as it pertains to purported victims of the resource curse reviewed herein.

This lack of information becomes ever so obvious when noting that, as per hard copy empirical data, the spillover effects from oil industries is a mystery. Hence, this paper undertakes exploration of this subject defending the negative spillover effects from oil industry FDI via the review of alternate institutions and their associated side-payments.

This is done noting that, for unexplained reasons, numerous stylized facts by the World Bank and survey results by the United Nations claim that these spillover requirements are usually not examined appropriately. Yet as noted earlier, these claims prove to be within the purview of challenge in that none reference statistical data respective to the additional social requirements imposed upon IOCs by hosts. Thus bearing on this reality, spillover effect from oil investment appears as a highly misunderstood phenomenon, void of sufficient scholarly tests. In turn it is reasonable to say that there is a severe gap between the non-established theoretical model and various unsupported empirical works.

Nevertheless, thrusting into this discourse, in unusually high-rent oil sectors side-payments frequently lead to the weakening of institutions, quoting Acemoglu et al. (2000); Bhattacharyya, et al. (2009); Campos and Pradhan, (2007). Side-payments encourage political elites and other senior officials to dampen, if not eliminate, regulations that might constrain their ability to extract more out of resources. On the

other hand, lack of capital and technology in resource-rich developing countries may suggest that the oil market is dominated by foreign multinationals. Hence, strategic actions taken by dominant IOCs may block new entries of oil firms even those firms with the most up-to-date technology as well as support inclusive political institutions (Acemoglu et al, 2012).

To the best of this author's knowledge, the list of papers attempting to introduce the bargaining framework in the natural resource industry between hosts NOCs and IOCs are Chavez (2010), McMillan et al. (2007) and Corato (2013). It is likewise affirming to note that they all shared common arguments recognizing the importance of the bargaining or upstream phase in this industry. Thereby they mutually highlight that while each prospective investor has the sole purpose of maximizing individual payoff, to some extent each has to consider factors relative to joint surplus in order to maximize the effects of bargaining. Similarly, this literature also pursues various structures of negotiation within the upstream phrase. However, again strikingly they all manage to ignore what can justly be described as a vital item, the matter of "local content requirements" as an additional investment cost contractually imposed upon the IOC. Thus, this is yet another inevitable gap for this author's work here to fill.

Nevertheless, before proceeding further, it is useful to clarify what the term "local content" means. In principle, *Local content* development in the oil industry is a synonym for *spillover*. Yet the professions of economics, policy and law all have separate renderings of this definition. However, the consensus that meshes them all together is the key terms of "performance requirements", "local content requirements" or "value added as per the host economy". Even more all these references tend to equally describe an

additional indirect benefit, which is deemed as spillover in the case of economics, as used herein. With this in mind, per the issue of spillover being one of an interdisciplinary nature, the aforementioned terms rendered in law and policy will be used interchangeably. In short, foreign direct investment is a source of prospective revenue for domestic developing oil and gas rich countries. For starters, it is a source of job creation for local suppliers in that it gives way to the production of specific inputs for crude oil extraction. Similarly, foreseeably it customarily amounts to additional charges on the IOC for infrastructure as it pertains to building downstream works such as refineries.

Having stated the immediately above, among the papers mentioned earlier the one by Chavez (2010) is the closest to our model in exploiting a common Nash (1950) framework. Yet his work remains different from this author's noting a number of reasons. First, Chavez's sole purpose was to develop a pure theoretical approach applicable to the oil industry. Hence, to make a better explanation, he added the Edgeworth box which will not be done here. In so doing, Chavez contends a belief that the Edgeworth outline is crucial to the bargaining process. Second, Chavez accounts for the factor of "delay" following an offer and a counter-offer process and the possibility of "risk of breakdown" associated with it and Chavez proposes the Rubinstein model as an alternate explanation. With this in mind, another point of distinction is that this author finds Chavez's model to be a bit too general or even "axiomatic". For it considers only certain properties to satisfy particular axioms. Whereas the discourse herein is geared towards more in depth exploration of the strategic interactions of specific parties, for example the roles of the NOC as opposed to that of the IOC during the course of various forms of negotiations.

As for the second paper written by McMillan et al. (2007), its model differs from this in that they introduced a "generalized" version of Nash (1950). The aim of that paper was to estimate the role of bargaining strength on rent sharing. Yet this was originally suggested by Roth (1979) per the discourse on violating the axiom of "symmetry". Nevertheless, McMillan et al. (2007) used Roth's 1979 model for basically two reasons. First, to account for asymmetry among parties, host government and IOC. Second, to distinguish their "bargaining power" and to make meaningful empirical estimation accordingly. Furthermore, in difference to this author's work, McMillan et al. (2007) analyzed outward FDI rather than inward FDI. More precisely, they used firm-level US direct investment abroad to multiple countries for 23 periods. Plus, contrary to this work, they assessed royalty, taxes and profit sharing collectively as a single government take.

On the other hand, the most recent work on this subject, Corato (2013) provides the most innovative and profound theoretical approach for bargaining consistent with reality in the natural resource industry. Thereby it differs from others in manifold ways. First of all, the form of negotiations is dynamic in that initially a foreign investor bears heavy sunk costs before the parties sit to the table about the share of projects. During the period of initial investment in exploration as is associated with successful discovery stages, he considers common forthcoming factors such as "uncertainty" and "nationalization". Using the American call options framework, he argued that the threat of nationalization does not affect the investment threshold, only the Nash bargaining solution set.

So the main questions addressed in this Chapter are: (1) *What conditions lead to negative spillover?* (2) *What is the net spillover impact on government welfare?* (3) *To what degree, if any, do side-payments cause the negative spillover effect?*

In turn, the results of the model herein show that side-payments transferred by the IOC to the host government are both good and bad. Thus, though all the previous writings support the idea that side-payments ambiguously cause negative spillover effects, this paper finds objection in part. This distinction is made via outlining the factor of government quality. Thence, it is noted that there is a positive correlation between specific ways of how side-payments are allocated and spillover. Further, it is added that per equity share size or ownership-control, the increase in resource values may or may not create side-payment. Finally, it is likewise noted that, the equity share size of parties has an effect on both the resource amount as well as serving as a catalyst for change in government quality.

Thus the goals of this paper are manifold. This mantra is pursued first by illustrating that negative spillover effect does not necessarily imply side-payment. This is done via delving into the arenas of both negative spillover and side-payment separately via analysis of various hypothetical impacts of government "take". Even more, consistent with the work of Bhattacharyya et al. (2010), government is categorized into two types[5]. The assessment that fragile government is concerned more with side-payments rather than positive spillover effects is consistent with expectation herein and survey results conducted by the World Bank. Along this guise, it is deemed that sound

[5] Government type is distinguished here from government quality, with the former referencing political structure and the latter character.

public infrastructure is equipped with barriers to prevent side-payments. Hence in such environs side-payment revenue is socially relegated to the stature of hindrance to the common good. Thus, furtive public sectors are by far more concerned with the long-term or substantial prospective external benefits accruing from FDI, as oppose to the immediate pay-offs associated with factors such as tax revenue and the domestic share of resource projects.

Second, to illustrate the rationale of why side-payments are not always harmful, it is useful to build an endogenous relationship between such sources of revenue and spillover. Thereby it is defended that, there is a positive correlation between the two in a number of cases of high-quality government. This shows that benevolent host governments use side-payments for the purpose of local economic diversification. As for low-quality governments, there appears to be a trade-off between the two. That is, side-payments in the case of low governance imply negative spillover effects. This is to say that government in such cases is worried more about its own personal status rather than the maximization of national value creation by means of the O&G value chain.

Furthermore, it is also argued that, depending on the equity shares of players in the PSA[6] alongside government quality, the high resource value itself creates an incentive for NOC-IOC parties to act in response to spillover as outlined by side-payments and the residual whereabouts of various local sectors. However, the resource value itself is endogenously[7] determined by world oil prices, which is customarily deemed highly parcel to the so-called resource curse (See Venables et al., 2012). Elaborating on this

[6] PSA stands for Production Sharing Agreement.
[7] In this paper for simplicity reasons a resource value is determined exogenously.

discourse it is shown that if the IOC possesses a higher share in the PSA, then rich resources lead to poor institutions as in Hodler (2006) as well as to lower positive spillover. As for intensive rent-seeking, the impact of resources on it depends both on equity share size and on government quality. The IOC's possession of a lower equity under the regulation of high-quality government fosters bureaucratic corruption. The model used in this instance is partly consistent with previous studies conducted by the likes of Ades and Di Tella, (1999); Bhattacharyya et al., (2010); Treisman, (2000); and Aslaksen, (2007).

The rest of the paper is organized as follows. Section 2 will present the general abstract and strategic structure of the bargaining process between two parties. Section 3 will describe the characteristics and existence of the equilibrium results of section 2. Section 4 will provide the comparative statics results for Section 3. Section 5 provides policy responses to this chapter. Finally, section 6 concludes the chapter.

2.2 The Model

We start with the assumption that a host government of a resource-rich country aiming to maximize national value at the expense of resource wealth introduces a well-designed mandatory local content policy for the IOC. The transaction between the IOC and the host government can be modeled in the following way: The direct payment to the government is considered as a simple share or trade-off of the IOC's profits from in country operations. The cost of providing spillover may be treated as another oil sector specific charge that government collects in-kind if there is "local content requirements"

or in cash to invest in non-resource sectors, downstream sectors, education and or regional development.

For benchmark purposes, a simple bilateral Nash model of the bargaining forum is hereby constructed between the hosting NOC (G) and a single IOC. To provide the starting point for this theoretically neglected complicated scenario, the model is restricted to the world of certainty. Hence, initially the parties will be negotiating on equity shares from the project in a PSA contract. In addition, the revenue-seeking government will impose a requirement on the IOC to finance the development of oil-related sectors in the host country, rendered here as a "spillover"[8]. In turn rather ambitiously, considering that there is complete silence in scientific papers particularly on the matter of bargaining framework, that FDI oil industry "spillover" will be incorporated as part of that assessment.[9] Thereby it is treated as holding the potential of being an investment into local human capital, in the downstream phase of infrastructure development consisting of both local suppliers and as well as many other potential variables. So the payoff of each player in the market is rendered as a function of both equity shares of resource value and spillover. As such on the on the one hand, the provision of spillover is an additional cost to the IOC enforced by the host government. On the other, it is acknowledged as a source of additional indirect revenue to the host country's economy.

[8] Based on contract terms, multiple issues (in this case equity shares and spillover) can be solved endogenously. We assume spillover to be exogenous mainly for two reasons: for model tractability and for comparative statics purposes.

[9]Not only spillover, there is even a lack of research concerning bargaining in the oil industry between players (Chavez, 2010). Chavez (2010) is the first who attempted to incorporate a pure bargaining model in the oil industry.

Upon said formulation, consider the environment of the two parties, NOC-IOC, bargaining for a share of *known*[10] resource value (V) underground. More precisely, $V(\pi) = \int_0^\infty e^{-\rho t}\pi_t dt$ is the net present value of total rents from crude oil extraction, where $\pi_t = p_t q_t - C(q_t, R_{t-1})$ is a flow of rents over periods and $\rho \in (0,1)$ is a discount factor. Rent in a single period depends on world price (p_t) of crude oil (q_t) extracted, and production cost of oil depends on quantity of crude oil extracted and reserves left from the previous period (*t-1*). The government thereby owns the huge oil reserve, but lacks the technological skills and human capital to extract it. On the other hand, the IOC has the factors necessary to production, the most prominent of which is specialized or professional experience. Thus, to make bargaining worthwhile in accordance with current expectations in the oil industry FDI sector, the host government is placed in the position it left to concede larger equity share of V to maximize positive spillover effects by promoting the use of local content obligations. Due to the complexity of the petroleum industry, the applications of local content policies in various resource-rich countries have provided mixed results (Tordo et al, 2013). Therefore, before analyzing the net effect from spillover by the IOC, it is useful to start with a hypothetical framework via carefully describing all the necessary assumptions that would hold irrespective of the construct used and then meaningfully suggesting a specific model that requires further analysis.

2.2.1 General Case

The utility of the IOC from the PSA agreement is:

$$\widetilde{U}_{IOC}(\beta, s) = U_{IOC}(\beta V) - \varphi(s) \qquad [1]$$

[10] Assume that V is *known* to make information perfect.

so that the utility function is a separate additive in profit share and the cost of spillover, where $\beta \in [0\,,1]$ is an IOC's share of the value of resource, the rest belongs to the host government. Hence it is deemed that $\frac{\partial U_{IOC}}{\partial \beta} > 0 \; and \; \frac{\partial^2 U_{IOC}}{\partial \beta^2} \leq 0$. In the second expression, $\varphi(s)$, can be defined as a disutility of the IOC for providing exogenous spillover, *s,* to the host country since it is treated as part of its social responsibility. This could appear as charges for the use of existing infrastructure or providing jobs for the local workforce to build or add to the existing landscape via new projects. Thus, here we further let $\varphi(0) = 0$. Similarly, consideration is given to the related matter involving local workers not possessing the specialized skills to fulfill the requirements of foreign oil firms, which a potential source of raising spillover costs even more. Hence, the costs of providing spillover is likely to have diseconomies of scale: $\varphi' > 0 \; and \; \varphi'' > 0$.

Before proceeding further, it might be worth commenting on the exogenous nature of this model's spillover parameter. With this in mind, it is important to note that in practice, equity share is not the only term negotiable in the contract between parties. In other words, there are multiple issues in such prospective arrangements that may be negotiated either simultaneously or sequentially. As such the latter is preferable since considering multiple issues at one time may be too complicated (see Ponsati and Watson, 1997). Thereby it seems natural to assume that spillover is also endogenous, making matters of equity share and spillover curable at the host's table even to the point where identical optimal equilibrium for equity shares can be reached.

This being said, in maintaining focus on exogenous spillover the goal of this chapter is to lend itself to practical analysis and easy comprehension on this phenomena's

impact on host government welfare. In particular, this course is taken in lieu of variables such as side-payments and resource value being closely tied to foreignness, both of investors and international pricing dictates.

On the other hand, the utility of the host consists of two sources of revenue from oil industry FDI herein formulated as:

$$\widetilde{U}_G(\beta, s) = U_G[(1-\beta)V] + f(s) \qquad [2]$$

The first expression - $U_G[(1-\beta)V]$ - is the direct revenue to government from domestic share, whereas $f(s)$ is a value-added brought to the host government from infrastructure development. In other words, value-added is a social benefit to the host country created as a result of huge investment by the IOC in developing local content relations. Since the payoffs from a certain fraction of equity shares for NCO and IOC are opposite sides of the same coin, we can assume $\frac{\partial U_G}{\partial \beta} < 0 \; and \; \frac{\partial^2 U_G}{\partial \beta^2} \geq 0$. So the value-added function is subject to increasing returns: $f'(s) > 0 \;\; and \; f''(s) > 0.$ For example, high world oil prices increase the pace of crude oil extraction, which in turn leads to the acceleration of infrastructure development and to employment associated with it. Thus, infrastructure costs associated with high prices is very expensive for the IOC and very beneficial to the host country. Therefore, when the amount of crude oil extracted is large, both spillover cost function for the IOC and spillover benefit function for the host government are convex due to increasing returns.

It is also important to mention that the government faces a *trade-off* between the two sources of revenue: $\frac{d(1-\beta)}{ds} = \frac{-f\prime(s)}{VU_G\prime(1-\beta)} < 0$. This implies that the objective of government is not just limited to maximizing revenue from the extraction of crude oil,

but also to stimulate overall economic development. So in order to induce the IOC to generate spillover to the domestic economy, the host government must be willing to sacrifice extra revenue from equity share.

Further as the parties have a choice as to whether to negotiate a deal or not, there is a need to introduce opportunity cost for each player. That is, both players have outside options, $d_{IOC}\ and\ d_G$. If the IOC refuses to sign the PSA agreement, its outside option would be payoffs it could get from an alternative country project. Outside options for the host country refer to payoffs generated by NOC. Thus, assuming that an individual rationale for each party holds such that:

$$\widetilde{U}_{IOC} - d_{IOC} \geq 0 \qquad [2a]$$

$$\widetilde{U}_G - d_G \geq 0 \qquad [2b]$$

the solution to the common Nash product of two welfares is as follows:

$$\beta^* = argmax\left[\widetilde{U}_{IOC} - d_{IOC}\right]\left[\widetilde{U}_G - d_G\right] s.t. \beta \in (\underline{\beta}, \bar{\beta}) \qquad [3]$$

From [2a] the minimum requested share by the IOC is $\underline{\beta} = \frac{U_{IOC}^{-1}[\varphi(s)+d_{IOC}]}{V}$ >0 and from [2b] the corresponding maximum offered share by the host government is $\bar{\beta} = \frac{V-U_G^{-1}[d_G-f(s)]}{V}$ <1. Thence the minimum requested share is the ratio of disutility from total costs over resource value. The maximum offered share is the ratio of difference between resource value and inverse function (of the difference between the government's disagreement and spillover benefit) over resource value. As such the equity share must range between the minimum positive and maximum which is lower than 1 so that the individual rationality constraint holds for each player. Share size outside this range leads

to negotiation failure. Needless to say that the host government cannot offer all ($\beta = 1$) or nothing ($\beta = 0$) to its foreign partner. Taking the First Order Condition (FOC herein) we obtain:

$$(\widetilde{U}_{IOC}')[\widetilde{U}_G - d_G] = (\widetilde{U}_G')[\widetilde{U}_{IOC} - d_{IOC}] \Rightarrow \frac{\widetilde{U}_G'}{\widetilde{U}_G - d_G} = \frac{\widetilde{U}_{IOC}'}{\widetilde{U}_{IOC} - d_{IOC}} \qquad [4]$$

This equation implies that, at the optimum, the marginal utility of an equity share per net economic gain for each player is equal. If this equality did not hold, for example per the formulation $\frac{\widetilde{U}_{G'}}{\widetilde{U}_G - d_G} > \frac{\widetilde{U}_{IOC'}}{\widetilde{U}_{IOC} - d_{IOC}}$, the foreign partner may increase its utility by investing more on its outside options and less on the host country project that provided lower marginal utility per economic gain.

Lemma 1: Given that the two parties have identical preferences ($U_{IOC} = U_G = U$) and equal outside options ($d_{IOC} = d_G = d$) with no spillover (*s = 0*), then in the Nash Bargaining Solution both players reach agreement on an equal split ($\beta^* = 1 - \beta^* = \frac{1}{2}$).

Proof: The result immediately following from equation [4] subject to the above conditions is:

$$\frac{U'[(1-\beta)V]}{U[(1-\beta)V] - d} = \frac{U'(\beta V)}{U(\beta V) - d}$$

The fact that a portion of the equation is alternating the prominence of the function of (β) implies that there exists a unique equilibrium at $\beta^* = \frac{1}{2}$. ■

Hence, in so noting so far we have provided propositions for equilibrium equity shares in a general model using conventional Nash bargaining. Yet since our main goal is to

analyze the impact of spillover effects from FDI in the oil industry upon a host country, the theoretical expressions in the general model cannot suffice alone. Therefore, it is advisable to switch from the general model to the specific model which will be done in the next subsection.

2.2.2 A Specific Linear Equity Share Case

In order to get a better picture of the interplay between the players, only the first argument pertaining to party equity share is considered in its simplest form as:

$$\widetilde{U}_{IOC}(\beta, s) = \beta V - \varphi(s) \qquad [5a]$$

$$\widetilde{U}_{G}(\beta, s) = (1-\beta)V + f(s) \qquad [5b]$$

Noting the above, considering that the optimal shares are determined by negotiations between two parties it is within reason to express the Nash product as

$$\beta^* = argmax(\beta V - \varphi(s) - d_{IOC})\big((1-\beta)V + f(s) - d_G\big) \qquad [6]$$

For consistent with successful bargaining we assume that the individual rationale constraints for each party holds: $\beta V - \varphi(s) \geq d_{IOC}$ and $(1-\beta)V + f(s) \geq d_G$, so that each participant in the negotiation for equity share (along with spillover costs/benefits) procures at least as high a rate as would be achieved from alternative options. This further implies that the *minimum* equity share that the IOC requests must be equal to the ratio of the sum of any subsidy it provides to the host government as well as any disagreement payoff it would secure from alternative options over the resource value: $\underline{\beta} = \frac{\varphi(s)+d_{IOC}}{V} > 0$. Thus, the minimum equity share for the IOC is equal to the ratio of total costs over

resource value. Here the total cost is a sum of accounting cost charged on local content promotion and opportunity cost, any outside option foregone by the foreign partner.

At the same time, the *maximum* equity share the host government provides to the IOC must be equal to the ratio of the difference between the resource value with spillover benefit and its outside options over the resource value: $\overline{\beta} = \frac{V+f(s)-d_G}{V} < 1$. Hence, there is further need to assume that $f(s) < d_G$ so that the maximum share does not exceed 1. Then, the equity share the parties negotiate would be within this range: $\beta \in \left(\underline{\beta}, \overline{\beta}\right)$. This is stated noting that the strongest assumption for the existence of the equilibrium share in bargaining assigned herein is a very high value of resource such that $V > |\varphi(s) + f(s) + d_{IOC} - d_G|$. Here, the right-hand-side of the equation reflects the difference between the government's disagreement utility and the sum of the IOC's disagreement utility, spillover cost to the IOC and spillover benefit to the host government. That signifies that there is no other country as rich in oil resources as this one, and in turn no other potential competitor that could yield more gain from this negotiation.

From FOC in [6] we get:

$$\beta^* = \frac{1}{2} + \frac{1}{2}\left\{\frac{\varphi(s)+d_{IOC}+f(s)-d_G}{V}\right\} \qquad [7a]$$

$$1 - \beta^* = \frac{1}{2} - \frac{1}{2}\left\{\frac{\varphi(s)+d_{IOC}+f(s)-d_G}{V}\right\} \qquad [7b]$$

Even more precise, the equity share of each player depends on: the cost and benefit of spillover effects, the disagreements of each party as well as the value of resources. For example, if the equity share of the IOC is higher, the higher the intended

spillover to its host country and in turn the higher the IOC's deemed outside option. Yet even more, if the equity share of the IOC is higher, this likewise means that the value of resources is more expensive and the higher the host's outside option in lieu of its ability to locate cheaper alternatives and larger equity share. With this in mind, the converse is actualized in cases whereby IOC equity share is lower than the host. For under such conditions the host is justifiably more content. In addition, by design IOCs are natural hedgers, whom place spoons in multiple pots or subsidiaries in many countries. Thus, they can better sustain the blight of lower equity share than their far more unidimensional hosts.

2.3 Equilibrium Characteristics

In this section, brief discussion is made respective to the characteristics of party equilibrium equity shares via the below equations found in [7a] and [7b].

Lemma 2: *The optimal equity share of the IOC is the average of the minimum it requires and the maximum the host government can propose*.

Proof: Equation [7a] can be rewritten as

$$\beta^* = \frac{1}{2}\left\{\frac{V + f(s) - d_G}{V} + \frac{\varphi(s) + d_{IOC}}{V}\right\} = \frac{1}{2}\left\{\bar{\beta} + \underline{\beta}\right\} \qquad \blacksquare$$

From here it is sufficient to prove that the optimal equity share of the IOC ranges within the minimum requested and maximum offered. For it is already known from the previous section that the government would never offer equity share size below $\underline{\beta}$ and above $\bar{\beta}$, as this would amount to the pay-off for each player in the PSA project being lower than the payoff from disagreement. That is, for $\beta < \underline{\beta}$ the payoff to IOC is

$$\beta V - \varphi(s) < \underline{\beta} V - \varphi(s) = d_{IOC}$$

and for $\beta > \bar{\beta}$ the payoff to the host government is

$$(1-\beta)V + f(s) < \left(1-\bar{\beta}\right)V + f(s) = d_G$$

If on the other hand, the government offers $\beta = \underline{\beta}$, then the IOC would be indifferent to participating in the PSA project, refusing to join. Similarly, if the government offers $\beta = \bar{\beta}$, then the IOC would get the highest possible payoff such that $\bar{\beta}V - \varphi(s) > \underline{\beta}V - \varphi(s) = d_{IOC}$ but there would be no economic gain to the host country. This raises the question, what is the framework under which the optimal equity share of the IOC is the average of $\underline{\beta}$ and $\overline{\beta}$? This, which is explained via the assumption that both parties have linear payoff from equity share and symmetric bargaining power, is the purview of Remark 1 below.

Remark 1: *The optimal share of the host government does not necessarily fall within the same range as that of the IOC.*

Proof: Consider an example of $\underline{\beta} = 0.6$ and $\overline{\beta} = 0.8$. Then $\beta^* = 0.7$ and the corresponding share of the host government is $1 - \beta^* = 0.3 \notin \left[\underline{\beta}, \overline{\beta}\right]$ ■

Lemma 3: *An equal-split between the two players is possible if and only if the sum of maximum shares proposed and minimum equity share requested equals 100%.*

Proof: Take an example of $\underline{\beta} = 0.4$ and $\overline{\beta} = 0.6$. Then $\beta^* = 1 - \beta^* = \frac{1}{2}$ ■

In fact, Lemma 3 can further be argued that an equal-split is possible provided that the host government has a huge outside option such that it is equal to the sum of total costs charged by the IOC and spillover benefit to the host country. But if the outside option of the government exceeds that sum, then the IOC would get a lower share. That is, if $\varphi(s) + f(s) + d_{IOC} = (or <)\, d_G$, then $\beta^* = (or <)\frac{1}{2}$. Thus, there is no reason to expect that different parties would have equal outside options in order to acquire equal shares from the project. This can be explained by the true facts about the successful "equal split" of shares between the Kazakhstan government and the oil company Chevron in the early 1990's.[11] The outside option for Chevron was "Prudhoe Bay" off Alaska that had approximately 2.5 times less reserves than the "Tengiz" oil field in Kazakhstan. To acquire 50% of the equity share in the Tengiz oil field in Kazakhstan, Chevron, in exchange, was required to pay the government bonuses, in the form of taxes, royalties and $50 million for regional development under the financial terms of a 40-year venture. Yet despite all the prospects of the arrangement, the Kazakh government found it most beneficial to maintain a second outside option, Exxon. The fact that Exxon is as equally competitive as Chevron and that the resource value in Kazakh land was estimated to be higher than that of Prudhoe Bay in Alaska leads to the conclusion that the Kazakh government had a higher outside option. Given this information, the Kazakh government found it most sound to agree on an equal-split conditioned on an additional contribution by Chevron.

Proposition 1: *The government <u>with</u> zero outside option will benefit solely from spillover.*

[11] See http://www.nytimes.com/1992/05/19/world/chevron-to-spend-10-billion-to-seek-oil-in-kazakhstan.html Accessed May 19, 1992.

Proof: If $d_G = 0, then\ \overline{\beta} = \frac{V+f(s)-d_G}{V} > 1$. Since there is a constraint that the maximum equity share that a host government can offer to an IOC cannot exceed 1, the equilibrium is $\beta^* = 1$. In such a case, the host government will benefit solely from spillover: $U_G(0, s) = f(s) > 0$. ■

Proposition 2: *If outside options are equal, but there is a positive spillover requirement, then the equity share of a foreigner will be higher. That is,*

$$if\ d_{IOC} = d_G\ and\ s > 0, then\ \beta^* > \frac{1}{2}$$

Proof: Plugging $d_{IOC} = d_G$ into the equation [7a] the optimal equity share of the IOC becomes $\beta^* = \frac{1}{2} + \frac{1}{2}\left(\frac{\varphi(s)+f(s)}{V}\right) > \frac{1}{2}$. ■

This is intuitively appealing. Thereby, if the IOC has the same preference for equity share as the host government and both has equal outside options, then the IOC would have no incentive to provide a spillover benefit in return for an equal-split share. Mathematically, in the case of equal-split along with equal outside options we obtain $f(s) = -\varphi(s)$. If the government does not provide a higher share to its foreign partner in return for spillover, then each party obtains its respective outside option, which is lower than the payoff from bargaining. Thus, in order to induce the IOC to provide spillover under the conditions posed by equal outside options, the host government must sacrifice an extra share to its foreign partner.

Proposition 3: *If there was no spillover requirement and the outside options of two players are different, then the size of equity share depends on whoever has higher outside options. That is,*

$$if\ s = 0\ and\ d_{IOC} > d_G, then\ \beta^* > \frac{1}{2}\ and\ otherwise.$$

Proof: Equation [7a] becomes $\beta^* = \frac{1}{2} + \frac{1}{2}\left(\frac{d_{IOC} - d_G}{V}\right)\begin{cases} > \frac{1}{2}, if\ d_{IOC} > d_G \\ < \frac{1}{2}, if\ d_{IOC} < d_G \end{cases}$ ■

Again, as noted earlier, intuition is straightforward. The IOC with higher outside options not only is reluctant to provide a spillover benefit to the host government, but also has the bargaining power to claim a higher equity share. As per proposition 3, notice that excluding a spillover tenant in the contract ($s = 0$) does not automatically lead to negotiation failure, provided that the government's rationale constraint holds: $U_G(\beta, 0) \geq d_G$. Yet though the host government may not increase value-added from oil industry FDI, it can still increase the budget revenue from the domestic share of the project if the opportunity cost of the project negotiation for itself is lower.

2.4 Comparative Statics

Having determined optimal equity share is a function of spillover, in this section, we will analyze the impact of spillover on government welfare particularly as it pertains to the matter of side-payments. In turn, in depth review will be given to the impact of resource value as it correlates to soundness of public infrastructure and side-payments. Noting that there is no free lunch, in this scenario the host government faces a trade-off between the two sources of oil revenue it collects from its foreign partner. While more spillover could lead to higher payoffs to a host government due to $f'(s) > 0$, it would also lower benefit from its' share of the project, $\frac{\partial(1-\beta^*)}{\partial s} < 0$. In other words, on the one hand, the host government has a gain from higher local content requirements. On the

other, it also experiences the cost of reduced equity share. Thus, the optimal payoff of the host government as a function of *s* can be written as:

$$\widetilde{U}_G^*(\beta^*(s), s) = \big(1 - \beta^*(s)\big)V + f(s) \qquad [8]$$

In turn, the corresponding comparative statics from here can be shown as:

$$\frac{\partial \widetilde{U}_G^*}{\partial s} = \frac{-\varphi'(s) + f'(s)}{2} \qquad [9]$$

As for condition [9] it states that the net impact of spillover on government welfare depends on the difference between the marginal disutility of the IOC to provide extra subsidy to the local economy and the marginal utility to the host government from this provision. If the latter is greater, then the net spillover effect on government welfare as a result of the actions of an IOC is positive. Hence as just outlined, to better capture the extent of spillover effects, it is useful to specify the relationship between the value-added function, $f(s)$, of the government and the IOC's cost incurred thereabouts, $\varphi(s)$. Another reason for this specific relationship is that since spillover effects are indirect gains for the host government, the channel of this transfer may not be transparent. Hence this immediately brings to mind Nash's theorem for two parties:

$$\max_{\beta}(\beta V - \varphi(s) - d_{IOC})((1 - \beta)V + f(s) - d_G)$$

Thereby in a PSA contract the government collects cash from its foreign partner the IOC via a myriad of ways. Among them royalty, signature bonuses, in-kind payment, split profit oil, and, last but not least, corporate income tax. More specifically, different types of revenues are collected from various sources of government organizations. The income tax proves to be major sources of income, being customarily a main component

of the host government's take in the development of oil properties (see Inkpen and Hoffett, p 225). Thereby let us assume that the government has two sources of tax revenue from foreign investors. While oil profit $(1-\beta)V$ is directly collected by the NOC from its foreign partner, the income tax or VAT, *f(s)*, is collected indirectly through the likes of the Tax Department of the Ministry of Finance or while making purchases from local suppliers. In turn these additional taxes can be spent on other non-resource sectors or used to support economic diversity. Then it should not be surprising that there are various forms of revenue that may not fully be transferred to the host government from some of its ministerial arms (see Ross 2014). In approaching this question more empirically, the work of Bhattacharyya et al. (2010) is hereby referenced. There the relationship between corruption and natural resources is explained using various forms of institutions and per a democratic model of government. Hence it is assumed that the IOC does not transfer the full amount of spillover benefit to local suppliers or to the Tax Department. Instead, a certain fraction of it, say $c \in [0,1]$, goes to the host government directly and the remaining (*1-c*) goes to a third party in the host country. So that:

$$\varphi(s) = c\varphi(s) + (1-c)\varphi(s) \qquad [10]$$

Further following along this guise, the government has two sources of cash flow from local content requirements: side-payment revenue $c\varphi(s)$ and cash flows generated through spillover from local parties, $\theta(1-c)\varphi(s)$, so that $f(s) = c\varphi(s) + \theta(1-c)\varphi(s)$ is a strictly increasing function of *s*. Here the parameter "θ" plays a key role in our analysis. This is attached to social welfare as compared to the side-payment revenue that the government directly collects from its foreign partner. It denotes different qualities of government: θ_H is high quality and θ_L is low quality, and $0 < \theta_L \leq 1 < \theta_H$ as

in Bhattacharrya et al. (2010). Even more, of particular discourse herein is the role of government quality in designing the tax collection system from the IOC. So the formal statement of Nash product can be rewritten as:

$$\max_{\beta\in(\underline{\beta},\overline{\beta})}(\beta V-\varphi(s)-d_{IOC})\big((1-\beta)V+c\varphi(s)+\theta(1-c)\varphi(s)-d_G\big) \qquad [11]$$

The *theta* for low-quality government ranges between 0 and 1. This implies that low-quality government is always concerned about the earmarking of revenue for special purposes rather than revenue flow into the country budget. So it prefers side-payment revenue to spillover as we shall soon see. Thereby the *theta* exceeding 1 implies that government is of high-quality, with the public sector being committed to the welfare of the whole society. Here "$c\varphi(s)$" can be considered as side-payment revenue. Hence, from FOC we get:

$$\beta^*=\frac{1}{2}+\frac{[(1+c)+\theta(1-c)]\varphi(s)+d_{IOC}-d_G}{2V} \qquad [12]$$

The optimal equity change with respect to spillover and side-payments are:

$$\frac{\partial\beta^*}{\partial s}=\frac{[1+c+\theta(1-c)]\varphi'(s)}{2V}>0 \qquad [13]$$

$$\frac{\partial\beta^*}{\partial c}=\frac{(1-\theta)\varphi(s)}{2V}\begin{cases}\geq 0, & if\ \theta=\theta_L\\ <0, & if\theta=\theta_H\end{cases} \qquad [14]$$

Proposition 4: *The higher the local content requirements imposed on the IOC, the higher the equity share the host government must be willing to sacrifice*.

Proof: Proof is straightforward. In equation [13] by definition we have $\theta, V>0$, $c\in[0,1]$ and $\varphi'(s)>0\ for\ \forall s>0$. ■

The statement in proposition [4] is consistent. A resource-rich low-income country government suffering from an absence of technological knowledge, human capital and financial capital has to design an effective system for raising tax revenue from non-renewable natural resources. For the government there is a trade-off between the revenue from equity share and indirect benefit from spillover. Not adding the spillover term in the PSA contract would end up with a simple split from resource depletion. This in turn would never accelerate the economic development of the host country. To prevent this loss, the government has to provide diverse solutions for revenue collection.

Proposition 5: *The higher the side-payment made to the host government, the higher the equity share the IOC gets if government quality is low.*

Proof: By definition we have $0 < \theta_L \leq 1 < \theta_H$. ■

The politician who cares about his society will reduce the equity share of the IOC, Bhattacharyya et al. (2010). For good government recognizes the urgent necessity of poverty reduction and thereby uses increased side-payment revenue to benefit ordinary citizens. Examples of such expenditures include but are not limited to, scholarships provided to children from indigent families or funding directed to technological education and innovation. To the contrary, a fragile public sector is characterized by actions quite opposite. Among the most notorious, earmarking side-payments for purposes other than what they were originally intended and diverting said funds into the personal bank accounts of members of government (Daniel et al, 2010). Thus the welfare activities of government derived from spillover revenue is formulized as:

$$\frac{\partial U_G^*}{\partial s} = \frac{\varphi\prime(s)(1-c)(\theta-1)}{2} \begin{cases} > 0, & if\ \theta = \theta_H \\ \leq 0, & if\ \theta = \theta_L \end{cases} \qquad [15]$$

The interpretation in [15] is that to get a net positive impact from spillover requirements, the government quality must be high. The low-quality government which values more side-payment revenue will get a net *negative impact* from spillover requirements associated with foreign investment in the oil industry.

Remark 2: *If government, regardless of its quality, takes all (c=1) indirect benefits, then the net impact from a spillover requirement on government welfare will be zero.*

Proof: Inserting *c=1* into equation [15] we get $\frac{\partial U_G^*}{\partial s} = 0$. ■

If the government directly collects all spillover costs charged by the IOC, the optimal equity share of the foreign partner in [12] and the government's welfare in [8] becomes $\beta^* = \frac{1}{2} + \left[\frac{2\varphi(s)+d_{IOC}-d_G}{2V}\right]$ and $\widetilde{U}_G^* = (1-\beta^*)V + \varphi(s)$, respectively. The foreign firm's share for the extra spillover it provides to the host government increases by $\frac{\partial \beta^*}{\partial s} = \frac{\varphi\prime(s)}{V} > 0$, while the government for extra spillover reduces its share by the same amount, $-\frac{\partial \beta^*}{\partial s} = \frac{-\varphi'(s)}{V} < 0$. For readers familiar with different tax forms in public finance literature, it should not be surprising that full side-payment revenue transferred as lump sum taxes provides zero net impact from the spillover requirement to government welfare. Making lump sum payments to government implies no investment in human capital and no technology transfer by the IOC to the local economy. In short, the host government, by itself, is not able to efficiently allocate the full amount of side-payment revenue on different projects within the country.

Even further, an increase in side-payments on government welfare is expressed as follows:

$$\frac{\partial U_G^*}{\partial c} = \varphi(s)\left(\frac{1-\theta}{2}\right)\begin{cases} < 0, & if\ \theta = \theta_H \\ \geq 0, & if\ \theta = \theta_L \end{cases} \quad [16]$$

Along with [14] where side-payment with low governance leads to a higher equity share of rents for the foreign investor, it also leads to a higher profitability to the host government. This is consistent with the traditional wisdom that low governance does not produce desirable economic outcomes for the host country. In short, to derive a huge gain from the project, there is an incentive for the rent-seeking IOC to foster side-payment by exploiting weak governments. Furthermore, this increased side-payment for weak governments may generate even more than the apparent gain. Now it poses another fundamental question: *Is there a trade-off between side-payments and the spillover amount for the government?*

In turn, using comparative statics from the partial differential of FOC above equates to:

$$\frac{ds}{dc} = \frac{-\varphi(s)(1-\theta)}{\varphi\prime(s)[1+c+\theta(1-c)]}\begin{cases} \leq 0, & if\ \theta = \theta_L \\ > 0, & if\ \theta = \theta_H \end{cases} \quad [17]$$

Equation [17] implies that the sign of side-payment impact on spillover generation depends on governance[12] type. This is consistent with economist Daniel Kaufmann's theory when he stated, "*We estimated that with good governance, there is a threefold increase in per capita income as funds that should be allocated toward the gross domestic product are not siphoned out*"[13]. As supported by numerous natural resource studies, this simply says that under sound governance side-payments lead to higher spillover. In other words, a benevolent government takes strong control over local content

[12] See Oil, Cash and Corruption at http://www.nytimes.com/2006/11/05/business/yourmoney/05giffen.html?pagewanted=all&_r=0 available on November 5, 2006.
[13] Ibid.

development. In turn, it is characterized by earmarking side payment revenues for development projects throughout the host country. Thus, such money is spent on efforts such as building infrastructure and cultivating human capital. On the other hand, a fragile public sector is more easily comprised by personal interests and thus is less likely to be concerned about spillover benefits. The impact of rich natural resources on side-payments, spillover and governance also raises a number of points as can be noted from the total differential of FOC, herein expressed as:

$$(1-2\beta)dV + \varphi(s)(1-\theta)dc + \big(1+c+\theta(1-c)\big)\varphi'(s)ds + (1-c)\varphi(s)d\theta = 0 \qquad [18]$$

Using this implicit function theorem permits comprehension of the role of resource value as:

$$\frac{dc}{dV} = \frac{-(1-2\beta)}{\varphi(s)(1-\theta)} \qquad [19]$$

Thereby, side-payments can be seen as one form of rent-seeking (Bhattacharyya et al. 2010). This becomes most obvious when noting that the sign of resource impact on side-payment depends on two parameters: equity share of the IOC and government type. If $\beta < \frac{1}{2}$, then:

$$\frac{dc}{dV} = \frac{(-)}{\varphi(s)(1-\theta)}\begin{cases} > 0, & if\ \theta = \theta_H \\ \leq 0, & if\ \theta = \theta_L \end{cases} \qquad [19a]$$

Similarly if $\beta > \frac{1}{2}$, then:

$$\frac{dc}{dV} = \frac{(+)}{\varphi(s)(1-\theta)}\begin{cases} < 0, & if\ \theta = \theta_H \\ \geq 0, & if\ \theta = \theta_L \end{cases} \qquad [19b]$$

Remark 3: *If players have an equal-split of equity share, then high resource value does not have impact on side-payment, regardless of government quality.*

Proof: Plugging $\beta = \frac{1}{2}$ into [19] gives $\frac{dc}{dV} = 0$. ■

In practice, governments in resource-rich low-income countries rarely offer a 50% equity share to foreign partners. For in such cases partners immediately sign a long-term contract on a 50% split with additional requirements to the host country so that the terms in the contract hardly change until the end of the project's life. In great part this is precluded by the abundance of the resources themselves. For rich natural resources induce the incentives for the IOC with low ownership to hedge its interests, particularly in cases entailing a host with a fragile public sector and empty pockets. Nevertheless, rich natural resources do not in and of itself cause the rent-seeking IOC to bribe its host. For if a host with a strong public sector offers a higher equity share to its foreign partner, then rich resources do not lead a rent-seeking IOC to offer side-payments. As such, the frequency of side-payments in cases entailing fragile hosts is largely symptomatic of an IOC possessing a higher equity share seeking to maintain its status and using the empty pocket variable to achieve it.

This further leads to the question as to whether rich-resources lead to higher spillover. Yet, as noted below, within short course one finds that it depends on whether the IOC holds a higher equity share from the PSA regardless of government quality:

$$\frac{ds}{dV} = \frac{-(1-2\beta)}{[1+c+\theta(1-c)]\varphi'(s)} \begin{cases} < 0, & if\ \beta < \frac{1}{2} \\ > 0, & if\ \beta > \frac{1}{2} \end{cases} \qquad [20]$$

Remark 4: *In the case of an equal-split of equity share, the rich resource value does not generate extra spillover to the host country, regardless of governance type.*

Proof: Plugging $\beta = \frac{1}{2}$ into [20] gives $\frac{ds}{dV} = 0$. ■

Hence, Remark 4 notes that once the long-term contract on equal-split between the players is signed, it is natural to assume that it is not possible to change the terms regarding the spillover requirements. For the change of contract terms may distort the incentives of the IOC and generate even more administrative burdens to the host country, such as expenditures spent on court costs to enforce contractual rights.

An increase in resource value, say occurring as a result of high world oil prices, leads the IOC finding a need to possessing a higher share. To maintain its high-share status, the IOC may want to make sure that local suppliers are able to provide specific inputs to meet the high international standards for safety and quality purposes. Furthermore, the need to meet world demand for crude oil at costly international prices may create another incentive for the IOC to invest in infrastructure development. However, if the opposite is true whereby the host government has higher ownership from the PSA, it may give a forward-looking IOC an incentive to under-invest in local content and make it reluctant to transfer proprietary technology.

Finally, this makes room to question whether the value of resource abundance changes government quality. In so doing one finds that it also depends on the amount of the IOC's equity share and can be ascribed as;

$$\frac{d\theta}{dV} = \frac{-(1-2\beta)}{(1-c)\varphi(s)} \begin{cases} > 0, & if\ \beta > \frac{1}{2} \\ < 0, & if\ \beta < \frac{1}{2} \end{cases} \quad [21]$$

Remark 5: *In case of the equal-split of equity shares, the rich resource value does not change governance quality.*

Proof: Plugging $\beta = \frac{1}{2}$ into [21] gives $\frac{d\theta}{dV} = 0$. ■

Notice that a corollary to Remark 5 is that in an equal-split of equity share among players, the change in resource value does not have an impact either on spillover, side-payment or government quality.

Thus, Equation [21] states that the greater the government ownership in the PSA, the greater the likelihood of poor quality governance. This is because there is less incentive to develop other sectors of the economy if most of the revenue of elites is resource dependent. Similarly, the lower the government ownership in the PSA is, the greater the likelihood for high quality governance. In early periods of contract, the host government with limited bargaining capacity may agree to offer a higher share to the IOC. However, with the passage of time, this may change per an increasing amount of oil resources associated with high oil prices in the world market. Thus while the goal of the IOC is to increase its rent from oil, the goal of the host government is to increase its revenue. If oil prices increase with constant marginal costs, this will lead for the oil margin to double, triple or even increase manifold. With this in mind, if government does not undertake respective actions regarding adjustments in equity size, big losses are inevitable. Therefore, the government must become more knowledgeable about resource

value and use its bargaining power over its foreign partner to change contract terms on equity shares and local content requirements.

2.5 Policy Responses

It is, in fact, very difficult to provide a good policy based on outcomes obtained from the simplest model. Nevertheless, as comparative statics results in Section 4 suggests, there is reason to question the factors by which low-income resource-rich countries are characterized.

- *The decision to collect side-payments*

Note, that we previously assumed that the host government collects a certain, $c \in (0,1)$, fraction of spillover costs, $\varphi(s)$, from its foreign partner directly as side-payment revenue, $c\varphi(s)$. This income is then used to fund other non-resource sectors of the domestic economy. However, an alternative hypothetical would be if the government collects the full amount of that spillover costs and render the matter of spillover contribution to be handled directly by third parties. In other words, why does the government need to have IOCs perform spillover requirements?

Note, a collection of full spillover contribution, $c = 1$, from foreign investors mathematically transcribes to $f(s) = \varphi(s)$. Plugging it into the equation [9] obtains $\frac{\partial U_G^*}{\partial s} = 0$. This leads to the conclusion that regardless of government quality, $\theta = \theta_L \; or \; \theta = \theta_H$, the full amount of side-payment revenue collection is *not preferable* since net spillover impact on government welfare turns out to be zero. Intuitively, this may be related to the fact that governments in resource-rich developing countries are generally less knowledgeable than its private partners in how to efficiently allocate those funds to

address a wide range of developmental goals. In addition, there is no knowledge transfer from foreign partners to third parties. Thus, full public investment to local content promotion can be very problematic.

At the other extreme, one could ask what would happen to government welfare if the full amount of spillover costs by IOC is transferred to third parties in the economy, such as local suppliers, for example. Stated differently, there remain questions as to research results on the matter of the IOC exercising the alternate option of signing a contract with local suppliers without government participation. Further along this guise, what if the government collects $\theta\varphi(s)$ from local suppliers? Bearing these propositions in mind, mathematically, $c = 0$ leads to $f(s) = \theta\varphi(s)$. Again, plugging these all into the equation [9] we can see that the net spillover impact on government welfare depends only on government quality:

$$\frac{\partial U_G^*}{\partial s} = \frac{\varphi'(s)(\theta - 1)}{2} \begin{cases} > 0 \; if \; \theta = \theta_H \\ < 0 \; if \; \theta = \theta_L \end{cases}$$

Here government quality can be interpreted in terms of transparency and accountability in the natural resource sectors. That is, the business of investment and financial operations must be transparent and subject to public oversight. In short, as long as there is no secrecy in government operations or shade cast on the public's eyes, the net spillover impact on the host country from full spillover transfer to local suppliers turns out to be positive. If the opposite is true, then negative. *Hence, the optimal policy for the government is NOT to collect a full amount of side-payments and to strengthen the transparency issue.*

- *Response to world oil price change*

Of course, since low-income countries have lower monopoly power than their high-income counterparts, the matter of foreign partner policy implementation in cases where oil prices increase is undoubtedly a reasonable question. As noted earlier, we defined the resource value, V, to be a flow of resource rents, π_t, over time, where $\pi_t = p_t q_t - C(q_t, R_{t-1})$. As such, price increase expectation leads to higher resource rents, $\frac{\partial \pi}{\partial p} = q > 0 \; for \; \forall t > 0$. Hence, high oil prices lead to higher resource value, $\frac{\partial V}{\partial p} = \frac{\partial V}{\partial \pi}\frac{\partial \pi}{\partial p} > 0$. On the one hand, this would induce an IOC to extract fast and export more, as long as it possesses higher equity share sizes for contributing to spillover. On the other hand, it would also change the government incentive to renegotiate IOC equity share sizes. This being said, from equation [12] it is not difficult to derive $\frac{\partial \beta^*}{\partial V} < 0$. Then, $\frac{\partial \beta^*}{\partial p} = \frac{\partial \beta^*}{\partial V}\frac{\partial V}{\partial p} = (-)(+) < 0$. This is consistent with the hypothesis stating that high oil prices lead to lower equity shares to foreign partners. In turn the matter of increasing oil prices raises the other central question respective to the whereabouts of government welfare when facing a trade-off between payoffs of domestic equity shares and indirect spillover benefit. Nevertheless, as per transcription, the oil price impact on government welfare is:

$$\frac{\partial U_G^*}{\partial p} = -\frac{\partial \beta^*}{\partial p} V + (1 - \beta^*)\frac{\partial V}{\partial p} + f'(s)\frac{\partial s}{\partial p}$$

As is already known, the first two expressions on the right hand side are positive. However, the last one is a bit tricky. Yet using the equation [20] and remark [4], derives:

$$\frac{\partial s}{\partial p} = \frac{\partial s}{\partial V}\frac{\partial V}{\partial p}\begin{cases} > 0, & if\ \beta^* > \frac{1}{2} \\ < 0, & if\ \beta^* < \frac{1}{2} \end{cases}$$

The solution is to grant at least 51% of equity shares to the foreign partner. If the government grants less than 50%, then further analysis is needed.

2.6 Conclusion

This paper has applied a simple, user-friendly Nash bargaining model that attempts to understand net spillover effects from FDI in the oil industry. The analysis presented here is elementary in that it did not capture all the instruments of the tax regime that would affect the incentives of an IOC in developing and extracting the resource base. For example, the only topics considered are revenue from domestic equity share and corporate income tax as a government take. Even more, it is also only assumed that the latter is used to finance the development of the local economy, not mentioning royalty as an alternate means of taxing the IOC. Nevertheless, while it would prove insufficient not to consider the potential of royalty revenue in a true analysis, not including it here did not encroach upon the accuracy of theoretical results and in turn cannot potentially serve to curtail discourse entailing a preliminary defense. This in large part is not a fundamental or root part of NOC- IOC negotiations. Instead, it is customarily added to contract as an optional inducement for the NOC to partake, at the expense of the IOC's sales revenue.

Although the model omitted a number of other key tax instruments imposed on IOCs, it still managed to provide explanations for the signal for FDI spillover effects that are consistent with previous findings. With this in mind, this work proves novel in being

one of the few economic models that recognize bargaining as an essential tool in dealing with FDI in the oil industry. Nevertheless, there still remain a number of other topics to be incorporated into the applied theoretical model to fully comprehend existing methodology herein.

Chapter 3

Coalitional Bargaining in the Oil Industry

3.1 Introduction

The aim of Chapter 2 is to provide a starting point for spillover analysis in oil investment. Thereby focus is placed on bilateral negotiations involving only the host government and a single IOC. Yet, due to the complex structure of the oil industry, many important and interesting bargaining situations should involve more than two players. Moreover, it is crucial to notice that multiple-party negotiations add more complexity. One such factor is the potentiality for coalition formation between two or more players before they make a bargaining deal with non-coalition players. Hence, the main goal of this chapter is to extend the contributions of Chapter 2 by developing this coalitional bargaining framework.

Over the years the concept of multi-party negotiations has attracted a large amount of attention among economists and other social scientists. The most frequently debated issues in all fields of social sciences are multilateralism, regionalism, preferential trade agreements, multilateral or bilateral negotiations, labor union, political parties, cartels and so on. Though these terms at first may sound different from each other, the fundamental idea behind them all is the same. That is, as long as there are more than two players in multi-party negotiations there is always a choice between whether all players should make a deal with each other simultaneously or sequentially, depending on their preferences and payoffs. In fact, this sort of choice is also a very common issue in other social and behavioral sciences such as international relations and so on. For example, any country willing to make trade agreements with Ukraine and Russia is less likely to offer a

simultaneous trade agreement, in lieu of the current stand-off in relations between those two countries. On the other hand, any Asian country willing to negotiate with the US and Canada will most likely prefer a simultaneous multilateral trade arrangement to a sequential bilateral one, considering a history of close ties between them.

The fact that the same tools can also be applied in the oil industry is not surprising. For there are a number of reasons making it practical to do so. Among them:

a) *Superaddivity*: is a reference that derives from the coalition point of view with the intent to maximize the grand payoff by means of risk-sharing [14] in cost, technology and any other applicable resource to procure the contract.
b) *Individual rationality*: is a reference that derives from the IOC's point of view per the intent to utilize the coalition as a means to cultivate its prospects of individual outside options and maximize payoff.

Thereby, depending on how far upstream negotiations are, the government of a resource-rich host country should make a decision as to its preference for sequential or simultaneous bargaining. Yet what is certain is that this segment of the bargaining process is time consuming in that it often spans decades. For it consists of talks on at least three distinct economic activities: exploration, development and extraction of crude oil. In turn, this fosters an extensive multi-million dollar budget, bearing many sub-facets. Hence, in some respects multiparty negotiations is indeed the only or most practical of means. The issue of time is particularly pertinent in cases entailing limited resources.

[14] We will not introduce uncertainty; hence we will exclude the concept of "risk" as well.

Under such conditions it would be fair to reason that the government would have strong incentive to sign a simultaneous contract on equity shares with multiple foreign partners[15].

On the other hand, in the exploration stage of upstream not every investor is willing to take the risk associated with making vast expenditures and not locating resources. Hence, in such cases the host government or NOC will make a sequential first offer to the one which takes the higher exploration risk. The fact that less risk-averse investors gain a higher equity share from negotiation is consistent with bargaining theory. Furthermore, the fact that a first-mover gains a larger share in a sequential game is also consistent with the Stackelberg Leader-Follower model[16]. Normally only large private IOCs such as BP, Shell, Chevron or Exxon-Mobil are able to bring a positive return on exploration efforts. This risk taking nature is due in large part to such firms not being owned or operated on behalf of a government, thus making maximizing profit their primary objective (see Inkpen and Moffett, pp 16 – 17).

Yet, the reasons why a government may continue to entertain negotiations with other IOCs in the second phase of upstream are manifold. For example, (1) the NOC might not be able to recover huge exploration costs, (2) crude oil may not be extracted at full capacity (which leads to lower budget revenue) and it may need extra funding by

[15] The Soviet Union's downturn and eventual collapse gave way to Kazakhstan's government conducting simultaneous negotiations with multiple foreign parties in lieu of rebuilding the Karachaganak oil field. In turn, the European concerns ENI and BG won the contract by gaining equal share.

[16] Global case studies illustrate that Chevron as a first-mover is a leader-operator of big projects in host countries, while ExxonMobil is a follower which joins later and gains comparatively lower share than Chevron. For example, the shares of Chevron and ExxonMobil both in the TCO project in Kazakhstan and JV Gorgon in Australia are 50% and 25%, respectively.

imposing "spillover requirements" [17] on new-comers for economic diversification purposes; and, last but not least, (3) it may need to collect side-payments to maintain its political status within the country by providing a comfortable package of conditions to new-comers. These are the precursors for a sequential bargaining format.

Yet the sequential format or that which ascribes to meeting separately with investors is not sound proof or without fault. For like the "preferred nation" status found in free trade agreements in the international policy arena, the host government may be locked out of an arrangement upon discovery by two prospective investors that they would prefer doing business or create a tighter bond with each other, whether in the host's territory or another jurisdiction. Thereby, in their collusion, they take on the contour of inadvertent competitors of the intending host. Such conflicts are more apt to arise in cases involving symmetric parties and equal split brought about through simultaneous negotiations. For not willing to pay huge taxes, there is a strong incentive for foreign partners to provide misreports displaying (1) "underproduction" in the volume of crude oil, (2) "cost-inflation" during the development stages, (3) transfer pricing, and other forms of fraud. Consequently losing positive spillover effects, the host government is forced to adjust the contract and take on different strategies to obtain other forms of revenue from IOCs.

Yet in the largest picture, coalitional bargaining has both advantages and disadvantages. One of the advantages is that individual IOCs may have distinct

[17] Such requirements in extractive industries have been called "local content". However, herein the term "spillover" will be used since the benefit of FDI in the oil industry exceeds local content promotion. For example, the government may obligate the IOC to provide additional funding for regional development or to invest in non-resource sectors of the host economy.

complementary skills or expertise. On the other hand, rent-seeking IOCs may form a partition coalition by combining their bargaining power against the government to both increase the equity share from the project and reduce the costs associated with upstream activities. So if IOCs behave cooperatively and upstream costs are high, then the government of the resource-rich low-income country will most likely offer a simultaneous multilateral deal to quickly increase the budget revenue and make IOCs provide spillover employment to local suppliers. However, if the government is more concerned with a political objective such as increasing its bargaining power or securing its position within the country, then it is more likely to prefer a sequential bilateral bargaining deal with each firm.

Certainly the host government's requirements are not restricted just to a simple division of equity shares from the project, but also it is responsible for increasing the other domestic monetary non-tax obligations of the IOCs in return for the rights to use the oil fields it granted. With the intent of further engaging the subject of non-tax spillover revenue derived from IOCs, for the sake of simplicity we will restrict the number of parties to three. This is done in lieu of this chapter's main question revolving around the comparative benefits and shortcomings of simultaneous multilateral offers and sequential bilateral offers as it pertains to generating greater spillover effects.

Though bargaining literature on multiple parties is extensive, most omit the importance of coalition formation among parties and their impacts on negotiating non-members (see Ambrus et al, 2008). In addition, even if the matter of coalition is addressed it is usually treated as an exogenous phenomenon (Hart and Kurz, 1983). Very few apply endogenous coalition structure (Aghion et al. 2007; Lucas, 2002; Bagwell and

Staigler, 2010). With this in mind, a model similar to that found in the work of Aghion et al. (2007) will be used here, departing slightly from it in referencing procedures of negotiation. More precisely, said coalition structure is distinguished in that it focuses on the cake-division per the Nash rule. Also we will address the contour of FDI spillover in multiparty bargaining in two ways. First, by specifying the payoffs using Nash bargaining. Second, in the matter of a potential side-deal in a partition coalition scenario as undertaken by two foreign partners in cases where the host government pursues a simultaneous offer. Third, for the sequential scenario different forms of charges will be attached to each firm, as found in real world cases. Then finally, the spillover effect amounting from this hypothetical will be tested.

The rest of the chapter is organized as follows. In Section 2 we develop a three-player bargaining game where the government faces a choice between simultaneous and sequential offers. This section is divided into two subsections to compare payoff allocation from all parties under the benchmark model, noting distinction between those with no disagreements and others with positive disagreements. In Section 3 the benchmark model will be extended by inserting spillover into the framework. Then in Section 4 the net spillover impacts on government payoffs under these two scenarios will be analyzed. Section 5 provides a policy reference to this chapter and Section 6 concludes it.

3.2 Basic Model

The negotiations in this scenario consist of three contracting parties: the host government (G) and two IOCs (1 and 2). The game is described in partition form as Γ of

$\{1,2,G\}$. A coalition $C \subset \Gamma$ is interpreted as a Production Sharing Agreement (PSA) formed between *G* and the IOCs. The value function $v(C;\ \Gamma)$ is a payoff assigned to the parties in the coalition generated by joint commitment.

Negotiations occur in the following order: *G* decides whether to offer either a *simultaneous multilateral* or *sequential bilateral* deal to potential foreign partners as illustrated in Figure 1.

If *G* chooses simultaneous[18] bargaining, it will make an offer of equity shares, β, of *known*[19] resource value (V) to the partition coalition to be formed between 2 IOCs. G chooses this coalition as its PSA partners for acquiring the largest possible amount of side-payments[20] and spillover. Equity shares of "β" will be divided among IOCs in any possible means. Since V is given it is designated 1 without loss of generality. The payoff[21] from the grand project to firms i and j in the PSA is $U_i = \gamma(\beta) - s_i \; and \; U_j = (1-\gamma)(\beta) - s_j$, respectively, where γ is a share of firm i within the sub-coalition of

[18]Kazakhstan's Karachaganak PSA Project is a good case study of *simultaneous* multilateral bargaining. In this PSA, the European companies BG and ENI (formerly Agip) won exclusive rights to the field in 1992 and since then have held equal shares. Even more relevant is that they agreed to pay $75 million on signing the PSA contract and invest an additional $70 million for oil industry development. The $75 million was a bonus or side-payment and the $70 million was apparently spillover costs per procurement of local supplies, purchase of property, plant and equipment, oil and gas assets or deposits for future site restoration and abandonment.

[19] For the purposes of tractability the *information is made perfect herein*. Subscripts are used to distinguish outcomes under different scenarios. Here $V = \int_0^\infty e^{-\rho t}\pi_t dt$ represents the net present value of total rents from crude oil extraction, where $\pi_t = p_t q_t - TC(q_t, R_{t-1})$ is a flow of rents over periods and $0 < \rho < 1$ is a discount factor. p_t and q_t are price and quantity of crude oil, respectively. R_{t-1} is a resource reserve left from the previous period, so that the total cost of extraction is a function of both the amount of crude oil produced and resource reserve from the previous period.

[20] Side-payment refers to the lump-sum transfer made between players as to reallocate the benefits gained through the coalition. Note, this can include bonus payments by the IOCs to G.

[21] For model tractability linear payoffs will be considered.

firms. And s_i for $i \neq j$ is a spillover requirement imposed on firm i by the host government. The corresponding payoff to G is $U_G = (1-\beta) + f(s)\ where\ s = s_i + s_j$. The first expression is revenue collected from the domestic share of the PSA project and the second expression is value-added to the government or *spillover benefit*. As in chapter 2 we assume spillover benefit to the government exhibits increasing returns of scale: $f'(s) > 0\ and\ f''(s) > 0$. So if the deal is made successfully, the coalition structure is $\Gamma_M = (\{1,2,G\})$ and negotiations end. This type of union among parties is defined as a *grand* coalition. However, if at least one party rejects the offer, then the contracting is severed amounting to zero coalition. This structure is represented as follows $\Gamma_O = (\{1\},\{2\},\{G\})$. The respective payoff for each party from zero coalition would be outside options: $d_1, d_2\ and\ d_G$. That is, the outside option is opportune for each player participating in the current PSA. This outside alternative equates to the payoff these firms can earn in a different country. On the other hand for the host government it would be the payoff generated by the National Oil Company.

However, if *G* chooses a sequential bilateral offer then subgames would need to be considered. *G* has to decide the order of offering to each player. If it makes the first offer to firm *1* to form the PSA and bargain over the size of β_1 with spillover requirements, s_1, then the payoff to 1 is $U_1 = \beta_1 - s_1$. If $U_1 < d_1$. The deal thereby fails with the entire game and the corresponding coalition structure is $\Gamma_O = (\{1\},\{2\},\{G\})$. However if the agreement is reached, then *G* with remaining $(1-\beta_1)$ decides whether to make the next offer to firm *2* and bargain over the fraction, γ, of the remaining $(1-\beta_1)$ with additional requirements, s_2, directed at the domestic economy. Without loss of generality, the second firm accepts the offer if $U_2 = \beta_2 - s_2 > d_2$ where $\beta_2 \equiv \gamma(1-\beta_1)$

and rejects it if vice versa. If Firm 2 accepts the government's offer and signs a contract on the PSA, then they reach a grand coalition $\Gamma_{12} = (\{1,2,G\})$. Thus G's payoff equates to Γ_{12} is $U_G = (1-\beta_1-\beta_2) + f(s_1) + f(s_2)$. Spillover benefit provided to the government by each firm is subject to increasing returns of scale such that: $f'(s_i) > 0 \; and \; f''(s_i) > 0 \; for \; i = 1,2$. Yet if it rejects this union then the coalition structure becomes $\Gamma_{G1} = (\{G1\},\{2\})$. From Γ_{G1}, G's payoff is $U_G = (1-\beta_1) + f(s_1)$. The same steps can be repeated starting from the first offer to Firm *2*. Again if Firm 2 rejects the offer, the coalition structure is $\Gamma_O = (\{1\},\{2\},\{G\})$. If the firms accept the offer, the coalition structure is $\Gamma_{21} = (\{1,2,G\})$. Finally, if Firm 1 rejects the offer, the coalition structure is $\Gamma_{G2} = (\{G2\},\{1\})$. *G* chooses the bargaining method that maximizes its payoff.

Before making further analysis, some notations will be simplified and payoffs in different cases will be defined as:

- $U_N \equiv v(N; C_N = \{1,2,G\})$.
- $d_i \equiv v(i; C_O = [\{1\},\{2\},\{G\}]) \; for \; all \; i = 1,2,G$.
- $U_{-i} \equiv v\big(-i; C_{jG} = [\{i\},\{jG\}]\big) \; for \; all \; i,j = 1,2 \; and \; i \neq j$.
- $U_{iG} \equiv v(iG; C_{iG} = [\{iG\},\{j\}]) \; for \; i \neq j$.
- $U_{ij} \equiv v(ij; C_{ij} = [\{ij\},\{G\}])$

In this notation U_N is the joint payoff of the grand coalition (C_N); d_i is the payoff of parties *i* if there is no PSA (C_O); U_{-i} is the payoff to party *i* when it is not in the coalition and the other two parties are in (C_{jG}). Finally, $U_{iG} = U_i + U_G$ is a coalition payoff (C_{iG}) formed by player *i* and *G* excluding player *j*. $U_{ij} = U_i + U_j$ is a payoff of the sub-

coalition (C_{ij}) formed between two firms in order to simultaneously bargain on equity shares against the government.

Definition 1: Coalition Gain/Loss

There is a coalition gain for p i and G when $U_{iG} > d_i + d_G$, coalition loss if $U_{iG} < d_i + d_G$, and no coalition gain/loss if $U_{iG} = d_i + d_G$.

Definition 2: Grand-coalition (GC) is superadditive if

- $U_N > d_1 + d_2 + d_G$ ($efficiency$[22])
- $U_N > U_{iG} + U_{-j}\ for\ i \neq j$

Superadditivity implies that the payoff from the grand coalition is higher than the sum of outside options for all parties. Also it is consistent with the payoff from the grand coalition being greater than the sum of the payoff for the partial coalition and any contractor outside of it.

3.2.1 The Benchmark Model: No Spillover and No Outside Options

Before dealing with the issue of whether the host government should offer a sequential or simultaneous deal on profit share, it is worth beginning by first addressing basic bargaining on oil project equity shares *without* spillover requirements. Assume for simplicity that all players have identical preferences and the outside options of all players are zero. Thereby this allows for the following summary (See **Appendices 3.A.1** and **3.B.1** for derivation):

[22] Superadditivity does not necessarily imply efficiency, see Hafalir (2007).

Bargaining type	Firm 1	Government	Firm 2
Simultaneous Multilateral	$\frac{1}{4}$	$\mathbf{\frac{1}{2}}$	$\frac{1}{4}$
Sequential Bilateral	$\mathbf{\frac{1}{2}}$	$\frac{1}{4}$	$\frac{1}{4}$

Table1. Benchmark Summary of Optimal Equity Shares of Each Player

Adhering to these tenants in sequential bilateral bargaining, assume G makes the first offer to Firm 1. In so doing from Table-1 it can be seen that under the benchmark condition (where parties have identical preferences and there are no outside options for bargaining on equity share of the resource value), Firm 2's equity share is the same under either choice of negotiation. That is, for Firm 2 it does not make a difference whether to partake of sequential bargaining or simultaneous if G first approaches Firm 1: $(\frac{1}{4} = \frac{1}{4})$. Noting that G clearly prefers a sequential game to a simultaneous one: $(\frac{1}{2} > \frac{1}{4})$, as long as no player has any outside options$(d_1 = d_2 = d_G = 0)$. Loosely speaking these firms do not even have strong bargaining power[23] against the government in simultaneous bargaining. Finally, Firm 1's preference for a sequential deal is formulated as : $(\frac{1}{4} < \frac{1}{2})$ and bring to mind the Benchmark Model .

Benchmark Proposition: *If there is no outside option for each player, then:*

(i) the second firm is indifferent to whether negotiations are conducted per a simultaneous multilateral or a sequential bilateral format;

[23] Bargaining power is assumed to be incorporated in disagreement points, which in this instance are outside options. Yet it is important to note that bargaining power and disagreements are not always the same.

(ii) the first firm gets a higher share from a sequential bilateral game than from a simultaneous multilateral one;

(iii) the host government gets a higher share from a simultaneous multilateral game than from a sequential bilateral one.

Proof: See **Appendices 3.A.1** and **3.B.1**. ■

Figure 1 shows that a simple 3-party bargaining format allows for six different coalition structures: $\Gamma_M, \Gamma_O, \Gamma_{12}, \Gamma_{21}, \Gamma_{1G}$ *and* Γ_{2G} . Each coalition structure provides different payoffs for each party. In case of a grand coalition under a simultaneous multilateral bargaining framework (Γ_M), the payoff vector is:

$$U_M^* = [U_1^*, U_2^*, U_G^*] = \left[\frac{1}{4}, \frac{1}{4}, \frac{1}{2}\right].$$

Similarly, under empty coalition (Γ_O), each player's payoff is just their outside options:

$$d = [0,0,0].$$

Notice the payoffs under the grand coalition structure do not appear the same in the two scenarios, in consideration of them being different. Further along this guise, in a sequential negotiation where the host government makes a successful offer to Firm 1 in the first stage, two cases are obtained in the second stage: Γ_{12} and Γ_{1G}. That is, if the second firm also accepts the offer, the payoff vector under $\Gamma_{12}$is:

$$U_B^* = [U_1^*, U_2^*, U_G^*] = [\frac{1}{2}, \frac{1}{4}, \frac{1}{4}]$$

Similarly, if Firm 2 rejects the offer the payoff vector under Γ_{1G} is:

$$U^*_{B,1} = [U^*_1, U^*_2, U^*_G] = [\tfrac{1}{2}, 0, \tfrac{1}{2}].$$

Assuming that Firm 2 is also rational it has to accept an offer by the host government in the second stage of the bargaining game, since it has no outside option. On the other hand, in the benchmark case for the government it would be optimal to make either a simultaneous negotiation with both firms or a single one with the first firm in a sequential offer: $(\frac{1}{2} = \frac{1}{2})$.

In confirming the efficiency of the government's choice of offer one can take further steps by posing again the hypothetical where outside options for all players are zero, just changing the variables a bit. Thereby it is assumed that Firm 2 knows that it would not get a higher share than Firm 1 from sequential negotiation. Thus, Firm 2 have less incentive to make extra efforts and may just continue with the idea of an easier path or free-ride. Nevertheless, for the government to make an additional offer to Firm 2 in the second stage, it must ensure that there would be positive marginal contributions to the project. Therefore, departing from Aghion et al (2007), this hypothetical extends the game tree by adding a choice after the first stage of sequential negotiations.

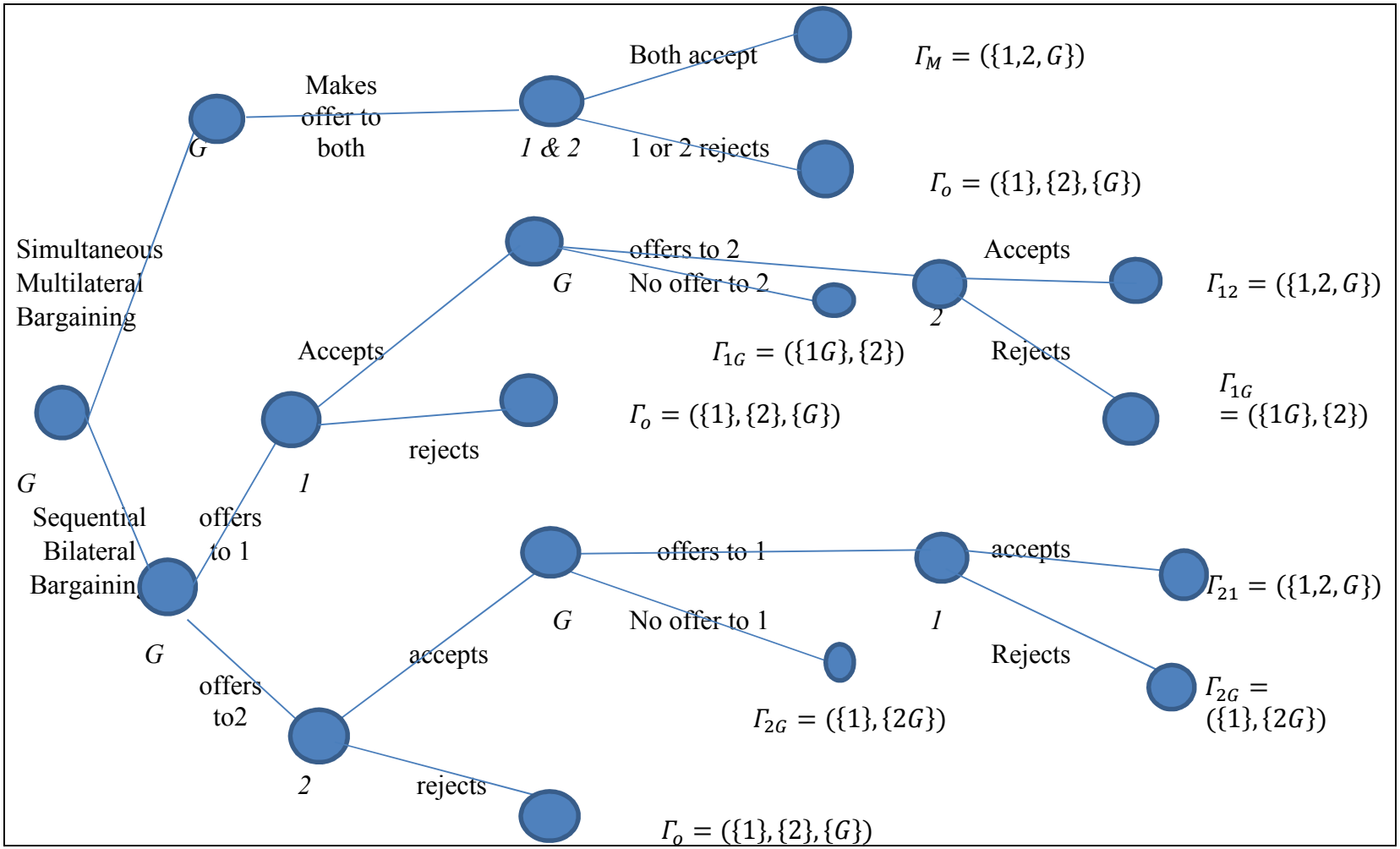

Figure 1. Game Tree.

3.2.2 No Spillover But Outside Options

As there are no parties without alternatives, in this subsection the essential element of "outside options" in bargaining procedure is introduced.

With this in mind, focus will be placed on the hypothetical of a simultaneous multilateral framework whereby the host government makes a deal on equity shares with a coalition of two firms. That being so, the central theorem here is that w*hile IOCs behave cooperatively to maximize their sub-coalitional surplus, they jointly compete against the host government in a non-cooperative Nash way.* Provided that a negotiation is superadditive in payoff, the parties have incentives for cooperation. In other words, the grand payoff for the parties is greater than the payoff of parties gained separately:

$$v(N) \equiv v\big(\{\{1,2\},\{G\}\}\big) \geq v(\{1,2\}) + v(\{G\})$$

The value of the partition coalition $v(\{1,2\})$ is a payoff that parties can gain cooperatively from alternative options, for example, from another resource producing country. The value function – $v(\{G\})$ - serves as the opportunity cost for the host government relative to the current offer. Without loss of generality, this can be written as $v(\{G\}) = d_G$ and $v(\{1,2\}) = \hat{d}_{12} > d_1 + d_2$. Hence, from here it turns out that the grand coalition satisfies: $v(N) > d_1 + d_2 + d_G$. A distribution of the grand coalition payoff between the parties subject to the efficiency principle is:

$$v(N) = U_{12} + U_G$$

The first expression on the right side is the payoff to both firms, which then is to be divided among themselves via a side-deal. The second expression is a payoff to the

government from a simultaneous multilateral deal. In adhering to the individual rationality principle, it is required that $U_{12} \geq \hat{d}_{12}$ and $U_G \geq d_G$.

In a sequential bilateral game in order to prevent the formation of sub-coalition among firms, the host government offers a deal on equity shares by approaching each firm individually. Assume the government first approaches Firm 1 and the value for the two parties generated from a successful deal is $v(\{1, G\}) > d_1 + d_G$. This payoff is then distributed between the two players as $U_{1G} = U_1 + U_G^1$. To distinguish the government's payoff in each stage, superscript 1 and 12 should be inserted. That is, if the game ends at the first stage, then the payoff to the government is $U_G^1(U_G^{12})$. In the second stage, the host government makes another offer of equity shares to Firm 2 if the superadditivity property holds: $v(N) \geq v(\{1, G\}) + d_2$. The grand payoff would be distributed among the three parties as $U_N = U_1 + U_2 + U_G^{12}$. The government makes an offer to another firm if and only if $U_G^{12} > U_G^1$ and the second firm gets higher payoff from joining the coalition, $U_2 > d_2$. Extra gain to the grand coalition generated in the second stage of the sequential game is:

$$v(N) - v(\{1G\}) = U_N - U_{1G}.$$

This is divided between the second firm and host government as:

$$U_N - U_{1G} = \Delta U_G + U_2.$$

In turn, this expression provides an interesting result. For it says that after subtracting the payoff of Firm 2 from the extra gain generated in the grand coalition, the government

payoff increases by $U_G^{12} - U_G^1 \equiv \Delta U_G = U_N - U_{1G} - U_2$. As long as $U_G^{12} > U_G^1$ holds, then $\Delta U_G > 0$ and the government makes a sequential offer forming a grand coalition.

Assuming that the grand coalition is formed and parties have positive outside options, we can provide another summary of payoffs for each player under two scenarios as (See in **Appendices 3.A.2** and **3.B.2** for derivation):

Bargaining type	Firm 1	Government	Firm 2
Simultaneous Multilateral	$\frac{1 + 3d_1 - d_2 - d_G}{4}$	$\boldsymbol{\frac{1 - d_1 - d_2 + d_G}{2}}$	$\frac{1 + 3d_2 - d_1 - d_G}{4}$
Sequential Bilateral	$\boldsymbol{\frac{1 + d_1 - d_2 - d_G}{2}}$	$\frac{1 - d_1 - d_2 + 3d_G}{4}$	$\frac{1 - d_1 - d_G + 3d_2}{4}$

Table2. A Summary of Payoffs of Each Player with Positive Disagreements

Comparing the results of Table-2 with those of Table-1, we can see that the numerators are complicated due to positive disagreements, but the denominators are the same. Therefore, it is impossible to conclude whether the values[24] in each cell of Table-2 are greater or smaller than the values in the respective cells of Table-1. Moreover, comparing the payoffs of every player in each row of Table-2, it is hard to predict who gains more unless numerical values for each disagreement are given. However, it is possible to compare each player's payoff under the two scenarios. From the last column one can conclude that for the second-mover (Firm 2) it does not make a difference whether negotiations are of a simultaneous bilateral framework or a sequential multilateral one. As for the results of the first two columns, assuming that the grand

[24] If we assume $d_1 + d_2 > d_G$ as in the next section, it can be concluded that the government payoff from a simultaneous multilateral deal is lower than that in the benchmark case: $\frac{1-d_1-d_2+d_G}{2} < \frac{1}{2}$.

coalition superadditivity holds$(1 - d_1 - d_2 - d_G > 0)$, the payoffs to the government and the first-mover differ under two scenarios. From the first column, one can conclude that the first-mover Firm 1 gains more from a sequential bilateral deal. Finally, from the middle column, we see that the government prefers simultaneous multilateral bargaining to a sequential bilateral framework.

Proposition 1: *If players have positive outside, then:*

(i) *the second player is indifferent to whether the framework is simultaneous multilateral or sequential bilateral;*

(ii) *the first firm gains a higher payoff from a sequential bilateral game than from a simultaneous multilateral one;*

(iii) *the host government gets a higher payoff from a simultaneous multilateral game than from a sequential bilateral one.*

Proof: See **Appendices 3.A.2** and **3.B.2**. ■

3.3 Bargaining With Spillover Requirements

In this section we introduce the concept of "spillover" into the bargaining framework as an additional requirement imposed on multinational oil and gas firms by the government of the host country. Thereby we characterize equilibria for games with GC superadditivity and no coalition externalities to an additional firm refusing to join the PSA in the second stage of a sequential bilateral bargaining. For the government of a resource-rich country making a simultaneous multilateral offer to a group of firms is similar to a two-player negotiation. It is less costly than making a sequential bilateral

offer to each firm at every stage. Hence, analysis begins with a simultaneous multilateral offer though a sequential bilateral negotiation is more common in practice.

3.3.1 Simultaneous Multilateral Bargaining

In this bargaining procedure the G of a resource-rich low-income country makes a PSA offer for resource value equity shares to the partition coalition of two oil firms. It is expected that if at least one IOC in that coalition rejects an offer, the payoff to each player is $d_i \equiv v(i; C_O) > 0 \; for \; \forall i = 1,2,G$. The maximum payoff that G can gain without the PSA is $U_G = d_G$. To form a grand coalition, G must offer an equity share to the partial coalition so that the coalition rationality holds: $U_{12} \geq d_{12}, where \; U_{12} = \beta - s \; and \; d_{12} = d_1 + d_2 > d_G$. Notice that the payoff of parties is a function of two variables: equity share of the project and exogenous spillover. Each foreign partner in the PSA contributes to the spillover costs and shares the benefits of operations according to contract terms. Here s is the cost of spillover imposed on the partition coalition {1, 2}. Provided that {1,2} is able to negotiate on a larger share of resource value than a single government alone (at the expense of a greater joint disagreement point, d_{12}), then the greater the IOC's ability to provide funding to costs whether infrastructural or transactional. Therefore, G's highest payoff from the grand coalition C_N is

$$U_G^M = U_N - d_1 - d_2 \qquad [1]$$

From superadditivity we have $U_N - d_1 - d_2 > d_G$. Therefore, in the subgame of simultaneous multilateral bargaining, G has to make an offer that the IOCs will accept, which leads to the formation of the grand coalition, $C_N = \{1,2,G\}$. The payoff from the grand coalition is

$$U_N = U_{12} + U_G \quad [2]$$

While the goal of G is to increase the budget revenue and spillover, the goal of each foreign partner is to increase its own profit. It is important to recognize that the incentive to form the coalition is not only to share equity benefits, but also to efficiently allocate costs among its members. The equity share of the partial coalition of two firms left after deducting the government's share will be split according to a side-deal among each (See **Appendix 3.A.3**). That is, if firm i's share from a side-deal is γ, then its contribution to spillover is $s_i = \gamma s \; where \; s = s_i + s_j$.

Then individual rationality constraint for each player is:

$$\gamma U_{12} - d_1 \geq 0 \quad [3a]$$

$$(1-\gamma)U_{12} - d_2 \geq 0 \quad [3b]$$

$$(1-\beta) + f(s) - d_G \geq 0 \quad [3c]$$

The fraction of Firm 1 in a cost-sharing agreement is $\gamma \in [0,1]$.

For the existence of equilibrium equity share, we further put the restriction that the value of the resource is so large that:

$$2 > |1 + s + f(s) + d_{12} - d_G| \quad [4]$$

So the Nash product from simultaneous[25] multilateral bargaining is:

[25] It's easy to prove that the *simultaneous* solution for *n >2* players can be derived from a generalized version of Nash's axioms as for *n =2* cases. However, the approach of pure bargaining is *not* widely used for *n >2* cases because of possible coalitions among sub-players. See Osborne and Rubinstein (p. 23) and Montet and Serra (p. 249).

$$\max_{\beta \in [\underline{\beta}, \overline{\beta}]} [\beta - s - d_{12}][(1-\beta) + f(s) - d_G] \quad [5]$$

$$s.t. \underline{\beta} = s + d_{12} \ and \ \overline{\beta} = 1 + f(s) - d_G$$

As before, we will assume that disagreement points indirectly capture bargaining power[26].

Returning back to equation [5], the FOC will yield us:

$$\beta^* = \left(\frac{1+s+f(s)+d_{12}-d_G}{2}\right) \quad [6]$$

Notice that this equation looks similar to the one from Chapter 2, where the government bargains over equity shares with a single firm. This is because in a simultaneous multilateral bargaining deal the government is treating two firms which already formed a coalition among themselves as a single entity. Therefore, equation [6] can be interpreted in the same way as in the previous chapter. From a successful bargaining deal, the equity share of sub-coalition consists of two parts: an average of the minimum share requested by the two firms (which is then to be split among them) and the maximum share offered by the host government.

Proposition 2: *If a coalition of two firms has a greater outside option than the government, then the equity share of a coalition is more than 50%.*

[26] According to McMillan et al (2007), the bargaining power of the host government in a developing country is a function of institutional factors, transparency in governance, technical expertise of bureaucrats, side-payments and adherence to the democratic policies. It is more common that in resource-rich low-income host countries where the outcomes of negotiation are less transparent (as associated with weak institutions) that the bargaining power of the government is lower than that of its foreign partners. Lack of technological knowledge, lower human capital and limited technical expertise also leads to relatively lower outside options for the host government.

Proof: Optimal equity share of a coalition can also be written as $\beta^* = \frac{1}{2} + \left(\frac{s+f(s)+d_{12}-d_G}{2}\right)$. As $d_{12} > d_G$, the expression in the bracket is positive. Hence, $\beta^* > \frac{1}{2}$. ■

Notice that even without spillover requirements, the government is predicted to get a lower share from a simultaneous multilateral bargaining deal as long as it has a lower outside option than that of a coalition. The higher outside options for a sub-coalition means that it sacrifices more opportunity cost from the current PSA than that of the government. Hence, it is less likely that foreign partners would ever sign a PSA contract for a small amount of equity shares. Also, again note that it is assumed that the outside option of a given party to some extent captures bargaining power. This leads to the point that the coalitional bargaining powers of two firms should exceed that of government. If that is so, then equation [7] implies: $\beta^* > \frac{1}{2}$. These tenants are all consistent with bargaining theory.

Proposition 3: *The higher the spillover requirement imposed on a coalition, the greater the equity share firms receive.*

Proof: A partial derivative of equity share with respect to spillover is positive, $\frac{\partial \beta^*}{\partial s} = \frac{1+f\prime(s)}{2} > 0 \; since \; f'(s)$ by definition.

This is interpreted to mean that the government has two sources of revenue collected from a coalition of firms. Yet, it cannot maximize both simultaneously. Stated differently, to increase more revenue from the domestic equity share, the government has to reduce spillover requirements imposed on firms. On the contrary, the more spillover foreign

partners provide to the domestic economy, the higher the share they negotiate for and usually obtain.

Thence the individual payoff for each firm in a sub-coalition is treated as $U_1 = \gamma U_{12}$ and $U_2 = (1-\gamma)U_{12}$. More precisely, this is a security level of payoffs for each firm from the sub-coalition which is expected to be greater than the outside option for each firm. Otherwise, firms would be indifferent between forming a coalition and acting independently. So the formulation for a sub-coalition side-deal on equity shares is determined as:

$$\max_{\gamma \in (\underline{\gamma}, \overline{\gamma})} [\gamma\beta^* - s_1 - d_1][(1-\gamma)\beta^* - s_2 - d_2] \qquad [7]$$

subject to constraints: $\underline{\gamma} = \frac{s_1 + d_1}{\beta}$ and $\overline{\gamma} = \frac{\beta - s_2 - d_2}{\beta}$. Taking FOC we obtain:

$$\gamma^* = \frac{1}{2} + \left[\frac{(s_1 + d_1) - (s_2 + d_2)}{2\beta^*}\right] \qquad [8]$$

$$1 - \gamma^* = \frac{1}{2} + \left[\frac{(s_2 + d_2) - (s_1 + d_1)}{2\beta^*}\right] \qquad [9]$$

Comparing the equations [8] and [9] one sees the firm that contributes the highest cost gets a higher share in the second stage. That is, if $s_1 + d_1 > s_2 + d_2$, then Firm 1 gets a higher share, $\gamma^* > \frac{1}{2}$. If not, then otherwise.

3.3.2 Sequential Bilateral Bargaining

In this scenario we consider the matter of subcontract within the context of a sequential bilateral framework. Hereby *G* makes a PSA offer first to Firm 1, then to Firm 2. From the simultaneous multilateral bargaining scenario in the previous section, it is

already known that for *1* to accept the offer, *G* has to offer at least $d_1 > 0$. If *1* accepts and *2* rejects the offer, then *G*'s payoff and a sub-coalition payoff respectively are:

$$U_G = U_{1G} - d_1 \quad [10a]$$

$$U_{1G} = U_1 + U_G = 1 - s_1 + f(s_1) \quad [10b]$$

However, if both IOCs accept, then G's payoff and the grand payoff respectively are

$$U_G = U_N - d_1 - d_2 \quad [11a]$$

$$U_N = U_1 + U_2 + U_G = 1 - s_1 - s_2 + f(s_1) + f(s_2) \quad [11b]$$

From GC superadditivity we have:

$$U_N - d_1 - d_2 > U_{1G} - d_1 =>$$

$$f(s_2) > s_2 + d_2 \quad [12]$$

Therefore, *G* prefers to make an offer to both IOCs rather than to one firm if and only if superadditivity holds. Notice that *G* in the second stage will make a PSA offer to the second firm only if the spillover benefit from the second firm exceeds the total costs by Firm 2 (sum of spillover cost to Firm 2 and Firm 2's outside option). Given that superadditivity holds, a grand coalition is optimal equilibrium. Yet this is true, if and only if the additional resource value with an additional spillover benefit is greater than the sum of spillover cost to the second firm and the second firm's outside option.

In a sequential game it is plausible to assume that the government can distinguish between two foreign partners. It can be that one firm may be technologically more

advanced than the second one, which would allow for economies of scale[27]. So then, what does this all mean? Well, it all leads to the point that the first-comer responsible for initial development of an oil field gains exploration rights and claims a higher equity share for providing higher spillover to the host country.

Now, this gives way to a need to describe the bargaining procedure in a sequential bilateral game. In the first stage of the contracting, the government negotiates a deal with Firm 1. After a successful deal with the first firm, the government bargains over the remaining portion of shares with the second firm in stage 2.

Stage 1:

So taking into account that the government will bargain over the remaining equity shares with firm 2, the more productive firm for example (Firm 1) will engage in Nash bargaining with the government in the first stage as follows:

$$\hat{\beta}_1 = \underset{\beta_1 \in [\underline{\beta}_1, \overline{\beta}_1]}{\operatorname{argmax}} [\beta_1 - s_1 - d_1][(1 - \beta_1 - \beta_2) + f(s_1) - d_G]$$

$$\text{where } \underline{\beta}_1 = s_1 + d_1 \text{ and } \overline{\beta}_1 = \left(1 - \underline{\beta}_2\right) + f(s_1) - d_G \qquad [13]$$

[27] Another reason is that one may be more knowledgeable in the exploration stage in realizing a recoverable amount of non-renewable crude oil under tough geological conditions. In the early 1990's in Kazakhstan, for example, Kazakh Energy Ministry had as predicted 5 billion barrels of crude oil reserves in Tengiz's oil field. But according to US Chevron forecasts, the reserve was overestimated to be up to 25 billion barrels. That is more than 5 times what the Kazakh Energy Ministry projected. Considering the information advantage of Chevron regarding the reserves in the Kazakh underground and realizing the technological necessity of the West, the President of Kazakhstan rendered up to 50% of the oil revenues to that firm provided that it agreed to sign a joint-venture contract. Moreover, Chevron was not expected to recover initial capital investment in the initial periods of extraction, but instead it would be required to bring technology for the tiny local petrochemical industry. See Chevron Drills Headed for Kazakhstan at http://www.themoscowtimes.com available on November 16, 1992

Stage 2:

In stage 2, the government decides whether to make another offer to the second firm. To attract the second firm, the government must be able to carefully balance the additional gain for sacrificing an additional equity share (β_2). So stage-2 bargaining is:

$$\max_{\gamma}[\gamma(1-\beta_1)-s_2-d_2][(1-\gamma)(1-\beta_1)+f(s_2)-d_G]$$

$$where\ \gamma(1-\beta_1)\equiv\beta_2 \qquad [14]$$

Using backward induction from FOC we get the Nash bargaining share of Firm 2:

$$\gamma^* = \frac{(1-\beta_1)+s_2+f(s_2)-d_G+d_2}{2(1-\beta_1)} \qquad [15]$$

Then,

$$\hat{\beta}_2 \equiv (1-\beta_1)\gamma^* = \frac{(1-\beta_1)+s_2+f(s_2)-d_G+d_2}{2} \qquad [16]$$

Notice the higher the share devoted to the first firm, the lower the share that is left to the second firm $\left(\frac{\partial\hat{\beta}_2}{\partial\beta_1} = -\gamma^* < 0\right)$. Using backward induction, the forward-looking Firm 1 and the government will negotiate as:

$$\hat{\beta}_1 = \underset{\beta_1\in[\underline{\beta}_1,\overline{\beta}_1]}{\operatorname{argmax}}\,[\beta_1-s_1-d_1][(1-\beta_1-\beta_2(\beta_1))+f(s_1)-d_G]$$

Thereby the corresponding equilibrium share for all parties is:

$$\hat{\beta}_1 = \frac{1+s_1-s_2+2f(s_1)-f(s_2)+d_1-d_2-d_G}{2} \qquad [17]$$

$$\hat{\beta}_2 = \frac{1-s_1+3s_2-2f(s_1)+3f(s_2)-d_1-d_G+3d_2}{4} \qquad [18]$$

$$\hat{\beta}_G \equiv 1 - \hat{\beta}_1 - \hat{\beta}_2 = \frac{1 - s_1 - s_2 - 2f(s_1) - f(s_2) - d_1 - d_2 + 3d_G}{4} \qquad [19]$$

Notice that the share of firm i positively depends on the spillover amount it provides to the host country ($\frac{\partial \hat{\beta}_i}{\partial s_i} > 0$) and negatively on spillover amounts provided by another firm j as ($\frac{\partial \hat{\beta}_i}{\partial s_j} < 0$). Before analyzing what the net spillover effect of each firm on government welfare would be, it is useful to make a partial analysis of equity shares:

$$\frac{\partial \hat{\beta}_G}{\partial s_1} = \left(\frac{-1-2f\prime(s_1)}{4}\right) < 0 \qquad [19a]$$

$$\frac{\partial \hat{\beta}_G}{\partial s_2} = \left(\frac{-1-f\prime(s_2)}{4}\right) < 0 \qquad [19b]$$

Also, before analyzing spillover impacts on government welfare under two scenarios, it is useful to summarize the payoff of every player in each case. Provided that inserting just disagreements into the model in Table-2 complicated the equity expressions, it should not be surprising that adding spillover would also not give precise comparison about which party obtains the highest share under each bargaining type. Nevertheless, it is not difficult to derive comparative statics analysis of equity shares with respect to each parameter and provide consistent hypothetical results. That is, notice that the equity share of each firm positively depends on the spillover amount it notice that the equity share of each firm positively depends on the spillover amount it contributes on its own disagreement: $\frac{\partial \beta_i^*}{\partial s_i} > 0 \; and \; \frac{\partial \beta_i^*}{\partial d_i} > 0$. On the other hand, it also negatively depends on the spillover contribution and disagreement by another firm: $\frac{\partial \beta_i^*}{\partial s_j} < 0 \; and \; \frac{\partial \beta_i^*}{\partial d_j} < 0 \; for \; i \neq j$. Moreover, one can

see how taking partial differentials with respect to spillovers and disagreements by foreign firms would reduce the government equity share.

Bargaining type	Simultaneous Multilateral	Sequential Bilateral
Firm 1	$\frac{1}{2}\beta^* + \left[\frac{s_1 + d_1 - s_2 - d_2}{2}\right]$	$\frac{1}{2} + \frac{s_1 + 2f(s_1) + d_1 - s_2 - f(s_2) - d_2 - d_G}{2}$
Government	$\frac{1}{2} - \left[\frac{s + f(s) + d_{12} - d_G}{2}\right]$	$\frac{1}{4} + \frac{3d_2 - s_1 - 2f(s_1) - d_1 - s_2 - f(s_2) - d_2}{4}$
Firm 2	$\frac{1}{2}\beta^* + \left[\frac{s_2 + d_2 - s_1 - d_1}{2}\right]$	$\frac{1}{4} + \frac{3[s_2 + f(s_2) + d_2] - s_1 - 2f(s_1) - d_1 - d_G}{4}$

Table-3. Summary of Equity Shares of Players along with Disagreements and Spillovers.

This gives way at this juncture to comparing the payoffs within each row of Table-3. *Note, to save space we will write only the final results of each party's payoff comparisons as:*

Bargaining type	Simultaneous Multilateral	Sequential Bilateral
Firm 1	$s_1 + s_2 + d_1 + d_2 + d_G + [f(s) + 2f(s_2) - 4f(s_1)]$	1
Government	1	$s_1 + s_2 + 2[f(s) - 2f(s_1) - f(s_2)] + d_1 + d_2 + d_G$
Firm 2	$f(s)$	$-2f(s_1) + 3f(s_2)$

Table-4. Reduced Form of Payoff Comparison for Each Player Under Two Scenarios.

Relying on Table-4 results above, one can reasonably say that if the value on the left exceeds the value on the right in each row, every party would definitely prefer simultaneous multilateral bargaining to a sequential bilateral deal. If not, then otherwise. Again note that without loss of generality the resource value is normalized to be $(V = 1)$. Replacing the coefficient 1 with *"V"* in Table-4 one obtains Proposition 4 below.

Proposition 4: *If the value of the resource is big enough to cover all expenses, then:*

(i) Firm 1 would prefer a sequential bilateral bargaining game to a simultaneous multilateral one,

(ii) the government would prefer a simultaneous multilateral bargaining game to a sequential bilateral one.

For Firm 2, one can see that there is no clear decision as whether to prefer simultaneous multilateral or sequential bilateral bargaining. Nevertheless, adding a couple of reasonable assumptions may provide soft results. As such it is ripe to reason that the spillover benefit to the government from joint efforts of the firms is greater than the sum of individual spillover benefit provided by each firm (*superadditive*):

$$f(s) = f(s_1 \cup s_2) > f(s_1) + f(s_2) \qquad [20]$$

On the other hand, if Firm 2 is a second-mover in a sequential game it is expected to get a lower equity share than Firm 1. Accordingly, it is natural to assume that the government would expect lower spillover from Firm 2 than from Firm 1: $f(s_2) < f(s_1)$. Then comparing the values in the last row of Table-4, one can express the following:

$$f(s) \gtreqless -2[f(s_1) - f(s_2)] + f(s_2)$$

$$f(s) + 2[f(s_1) - f(s_2)] \gtreqless f(s_2) \qquad [21]$$

Even further, since $f(s_1 \cup s_2) > f(s_1) + f(s_2) > f(s_2)$, one can conclude that the left–hand side expression is greater than the one on the right-hand side. Therefore, this allows for another tenant, Proposition 5.

Proposition 5: *If the spillover benefit to the government from joint efforts of firms is greater than the sum of individual spillover benefits, and if Firm 2 is a second-mover in a sequential bilateral bargaining framework, then Firm 2 would prefer simultaneous multilateral bargaining to a sequential bilateral..*

Proof: Note the last equation:

$$f(s_1 \cup s_2) + 2[f(s_1) - f(s_2)] > f(s_2). \blacksquare$$

3.4 Spillover Impacts

Having derived the payoff allocation of each party in two bargaining scenarios so far, in this section we will analyze spillover impacts from oil industry FDI in each of these cases separately. However before proceeding, an optimal payoff will be rewritten of

the government under simultaneous multilateral bargaining($\widetilde{U}_G^M$) and sequential bilateral bargaining(U_G^B), respectively, as:

$$\widetilde{U}_G^M = (1 - \beta^*) + f\ (s) \qquad [22]$$

$$U_G^B = \left(1 - \hat{\beta}_1 - \hat{\beta}_2\right) + f(s_1) + f(s_2) \qquad [23]$$

Hereby it is important to note again how in a simultaneous framework the government treats two firms as a single entity. In this scenario the government bargains with a coalition of two firms over a single equity share of size, β, and imposes *joint* spillover requirements, $(s = s_1 + s_2)$, on them. In other words, the host government does not care how the two firms split the remaining equity share and spillover contribution among themselves. To the contrary, in a sequential game it approaches each firm, *i*, separately to bargain over the equity share, $\beta_i\ for\ i = 1,2$, and to require separate spillover, $s_1\ and\ s_2$. Summarizing the set of propositions in the previous sections regarding the government equity share in two scenarios one can state:

$$1 - \beta^* > 1 - \hat{\beta}_1 - \hat{\beta}_2 \qquad [24]$$

On the other hand, assuming that spillover benefit from the joint efforts of the two firms exceeds the sum of the spillover benefits from separate actions, one can add:

$$f\ (s) > f(s_1) + f(s_2) \qquad [25]$$

After all, considering the last two inequalities one can claim that the overall "government take" is predicted to be *higher* in simultaneous multilateral bargaining than in a sequential bilateral setting: $\widetilde{U}_G^M > U_G^B$.

Reviewing the trade-off between spillover and equity share, the net impact from spillover requirements on government welfare in each scenario (See **Appendices 3.A.3** and **3.B.3** for derivation) is given by:

$$\frac{\partial \widetilde{U}_G^M}{\partial s} = \left(\frac{-1 + f'(s)}{2}\right)\begin{cases} > 0, & if\ f'(s) > 1 \\ < 0, & if\ f'(s) < 1 \end{cases} \quad [26]$$

$$\frac{\partial U_G^B}{\partial s_1} = \left(\frac{-1 + 2f'(s_1)}{4}\right)\begin{cases} > 0, & if\ f'(s_1) > \frac{1}{2} \\ < 0, & if\ f'(s_1) < \frac{1}{2} \end{cases} \quad [27]$$

$$\frac{\partial U_G^B}{\partial s_2} = \left(\frac{-1 + 3f'(s_2)}{4}\right)\begin{cases} > 0, & if\ f'(s_2) > \frac{1}{3} \\ < 0, & if\ f'(s_2) < \frac{1}{3} \end{cases} \quad [28]$$

The first expression *"-1"* on the right-hand-side of each equation shows us how much of an additional share the government has to sacrifice to get a higher spillover benefit. In a simultaneous multilateral bargaining scenario, if the marginal benefit from a joint spillover is *greater* than 1(the marginal cost of spillover), then the net spillover impacts on government welfare is *positive.* Notice, in a sequential bilateral bargaining case, the contribution to spillover by each firm is predicted to be different. As Firm 1 is a first-mover in a sequential game, the government expects more spillover benefit from it than from Firm 2: ($\frac{1}{2} > \frac{1}{3}$). To state it differently, for net positive spillover effects in each stage of sequential bargaining, the government expects the marginal benefit from Firm 1 to be greater than $\frac{1}{2}$ and Firm 2 to be more than $\frac{1}{3}$.

3.5 Policy Responses

So far, in this chapter in order to compare the two tracks of coalitional bargaining in the oil industry we have focused entirely on simple assumptions. Among them, *identical party tastes and no coalitional externality* in a sequential negotiation framework. As such, the question of *whether tastes are not identical* is indeed reasonable. For it is more natural to assume that parties have different utility shapes respective to the project's equity size. Also, the fact that one party is more risk averse in the upstream than the second is quite plausible. Even further, one party may possess less skills than the other party, making the matter of sharing potential profits and associated risks of issue. In such cases it appears that it would be more practical for the government to make a sequential offer to each firm rather than negotiating with them simultaneously. Related to this note, in sequential bargaining, it is also natural to consider the fact that the government's outside option (including bargaining power) may change at the end of round one negotiation (per the first firm existing in externality at said juncture). This motivates another question. *Does externality shape government choice regarding the order of negotiation in a sequential game?* To understand such a scenario it is useful to start with the easier question of framework format, the decision to negotiate simultaneously or sequentially.

- *The decision to negotiate simultaneously or sequentially*

As noted in the previous sections, for the convenience of model tractability and closed-form solutions, we restrict the assumption on identical linear utility payoffs. Now for the sake of simplicity, it is reasoned that the utility of the government is concave, thus being formulating as:

$$U_G = \sqrt{1-\beta}$$

However, the payoff for each IOC is $U_i = \beta_i \; for \; all \; i = 1,2$. This being so, for clarity, let the outside options of each player be zero. So if the government makes a simultaneous multilateral offer, the Nash product is:

$$\max_{\beta} \beta\sqrt{1-\beta}$$

FOC yields us $\beta^* = \frac{2}{3}$ and $U_G^M = 1 - \beta^* = \frac{1}{3}$. Notice, that in the case of identical linear tastes, the government would gain $1 - \beta^* = \frac{1}{2}$ in a simultaneous multilateral negotiation. This is consistent with the hypothesis that risk-averse government gains lower share than a risk-neutral one.

Then if this hypothetical is switched to a sequential bilateral format, such that the government first approaches Firm 1 in the first stage, then Firm 2 appears in the second stage as:

Stage 1: $\max_{\beta_1} \beta_1\sqrt{1-\beta_1-\beta_2}$

Stage 2: $\max_{\beta_2} \beta_2\sqrt{1-\beta_1-\beta_2}$

By backward induction this equates to the reaction function of Firm 2 as $\beta_2(\beta_1) = \frac{2}{3}(1 - \beta_1)$. This implies that in the second stage of sequential negotiations, Firm 2 gains 2/3 of the government share left from round one bargained with Firm 1. Inserting this expression into Stage 1, the final payoff of each player will be:

$$U_1 = U_2 = \frac{2}{5} \; and \; U_G^B = \frac{1}{5}$$

Notice, since two firms are symmetric and risk-neutral, each ends up with 40 per cent equity shares while the government's share is only 20 per cent. Comparing government payoffs under different scenarios, once again it becomes convincingly clear that *the optimal policy for the government is to prefer a simultaneous negotiation as opposed to a sequential one*: $\frac{1}{3} > \frac{1}{5}$. This conclusion stems from the fact that, using a simultaneous framework, the government treats all its foreign partners as a "single entity". In turn, in that way it looks as if the government is negotiating with only one firm. This result is also consistent with the discussion by McMillan et al (2007). That work asserts that the higher the number of firms in the consortium is, the tougher the competition among firms as well as reduced firm bargaining power versus government interests. This, in turn, enables the government to increase its bid for higher "take".

- *Who approaches first in a sequential game?*

Appendix 3.B.2 illustrates that in a sequential bilateral negotiation the order of bargaining does not make a difference for the government. This poses questions respective to cases where firm bargaining powers and outside options are not the same. Thus in response it is hereby argued that this is possible only if there is no coalitional externality either to the second firm or to the government before the second round of negotiation.

Before providing mechanical proofs, it is useful to briefly discuss coalitional externality or that which refers to the effect of the first round of negotiations between any two players on a third party in the second round. Aghion et al (2007) provides cases

where the bilateral free trade agreement (FTA) between two countries influences decisions of the third country to join FTA and form a grand coalition. However, our case here is a bit different. For after the first round of negotiations with Firm 1, we assume the government's outside options will increase as it becomes more knowledgeable and experienced. This, in turn, increases government bargaining power against Firm 2 in the second round of negotiations. That is, as a result of externality provided by Firm 1 at the end of round one negotiation, the increased technical knowledge of local people is expected to bear positive influence on the government capacity to operate an oil business and affect its bargaining power. Thus, in most cases it would be erroneous to assume that the government's outside option is fixed for the entire stages of a sequential bilateral framework.

Thereby, for simplicity let us assume Firm 1 has more bargaining power, $d_1 > 0$, than Firm 2, $d_2 = 0$, and provides externality to the government it is approached. In turn, if the government's bargaining power at the end of round one negotiations is $\hat{d}_G = rd_G$ such that if $r > 1$, then there is a strong positive externality, and if $r < 1$, then otherwise. Also notice that if $r = 1$, then there is no externality. At this juncture, the government needs to decide the order of negotiation in a sequential game.

So thereby transcription begins with Firm 2 that has lower bargaining power and provides no externality to the government. Thus the order of formulation is:

Stage 1: $\max_{\beta_2} \beta_2(1 - \beta_1 - \beta_2 - d_G)$

Stage 2: $\max_{\beta_1}(\beta_1 - d_1)(1 - \beta_1 - \beta_2 - d_G)$

Using the same methods of sequential negotiation, backward induction and reasoning forward, one can derive the government payoff as: $U_G^{21} = \frac{1-d_1+2d_G}{3}$. Similarly, changing the order of the game we have:

Stage 1: $\max_{\beta_1}(\beta_1 - d_1)(1 - \beta_1 - \beta_2 - d_G)$

Stage 2: $\max_{2}\beta_2(1 - \beta_1 - \beta_2 - \hat{d}_G)$

Repeating the same steps, one derives: $U_G^{12} = \frac{1-d_1+(r+1)d_G}{3}$

Comparing government payoffs under the two scenarios above, the optimal policy is

$(*)$ in the case of a *strong* positive externality, $r > 1$, noting negotiation first with Firm 1, then with Firm 2.

$(**)$ in case of a *weak* externality, $r < 1$, noting negotiation first with Firm 2, then with Firm 1.

3.6 Conclusion

The goal of this chapter is mainly to provide cases for spillover effects from foreign direct investment in the oil industry under coalitional bargaining held between the government of a resource-rich host country and multiple foreign firms. The government dealing with multiple firms has a choice whether to negotiate with them simultaneously or sequentially. To answer these questions, we referred to classical Nash bargaining solutions, which include both payoffs and outside options for players. Payoff for firms consists of revenue from equity shares and costs invested on spillover requirements, while the payoff to the government consists of equity share and spillover benefit.

In simultaneous negotiations, the government is predicted to gain higher equity share from bargaining and impose a higher spillover on foreign partners than in a sequential scenario. That being said, it is important to note that this conclusion is based on the simplest assumption that all parties have equal taste (linear utility with respect to resource value) and information is perfect and complete.

For future extension one may consider parties with different tastes. One way is to assume that one party might be more risk-adverse than the others so that linear utility may be replaced by something nonlinear. In turn, one would proceed to see how the payoff is reallocated in this case.

Note, the rationale for maintaining perfection and completeness in this scenario is closely tied to simple Nash bargaining. That is, Nash bargaining outcomes strictly depend on properties of perfection and completeness of information. With this in mind, to insert more realistic oil industry features such as “uncertainty”, “time-consistency” and so on, alternative bargaining tools like the Rubinstein model could be employed. For they are pertinent to factors such as the risk of breakdown or commitment tactics for future extension.

Appendix – Chapter 3

Appendix 3. A: Simultaneous Multilateral Bargaining

Stage 1: The government negotiates with *two parties (=coalitions)* on equity shares of the project and imposes a "spillover" requirement on IOCs. This is done as an additional benefit to the host country alongside the tax revenue collected from domestic shares. By looking forward to the fact that the two IOCs will further negotiate on a split, the government bargains with the duo as a single entity according to the Nash rule:

$$\max_{\beta}[\beta - s - d_{12}][(1-\beta) + f(s) - d_G]$$

Letting *"s"* be a spillover amount provided to the domestic economy by the two firms, *f(s)* is a spillover benefit to the host economy with $f' > 0 \; and \; f'' > 0$. $d_{12} = d_1 + d_2$ being total disagreements by IOCs and d_G is an outside option for the government.

Stage 2: In the second stage, after negotiating with the government the two firms make a side-deal to split the rest of the equity shares left to the coalition. This transcribes as:

$$\max_{\gamma}[\gamma\beta - s_1 - d_1][(1-\gamma)\beta - s_2 - d_2]$$

Such that $s_1 + s_2 = \gamma s + (1-\gamma)s$.

By backward induction, from stage 2 we get:

$\gamma^* = \frac{1}{2} + \left[\frac{(s_1+d_1)-(s_2+d_2)}{2\beta}\right]$ and $1 - \gamma^* = \frac{1}{2} + \left[\frac{(s_2+d_2)-(s_1+d_1)}{2\beta}\right]$

If total costs charged by Firm 1 is higher than total costs charged by firm 2, $s_1 + d_1 > s_2 + d_2$, then Firm 1 obtains a higher share from the oil project left to the coalition.

Thence from the 1st stage we obtain:

$$\beta^* = \frac{1}{2} + \left[\frac{s + f(s) + d_{12} - d_G}{2}\right].$$

3.A.1. Benchmark: $s = 0, f(0) = 0, d_1 = d_2 = d_G = 0$

This formula assumes that all parties have equal taste in the sense that the utility payoff from resource value is linear. As such the equilibrium share for each party is:

$$\gamma^* = 1 - \gamma^* = \frac{1}{2};\ \beta^* = 1 - \beta^* = \frac{1}{2}$$

Therefore, the payoffs to all parties are:

$$U_1 = \gamma^* \beta^* = \frac{1}{4}$$

$$U_2 = (1 - \gamma^*)\beta^* = \frac{1}{4}$$

$$U_G = (1 - \beta^*) = \frac{1}{2}$$

Proposition: *If all parties have identical taste with zero outside options, and zero spillover, then the government's payoff is half of the resource value, while the payoff to each foreign partner is only a quarter of the resource value.*

3. A.2. No Spillover, But Outside Options

Stage 1:

$$\max_{\beta}[\beta - d_{12}][(1 - \beta) - d_G]$$

Stage 2:

$$\max_{\gamma}[\gamma\beta - d_1][(1 - \gamma)\beta - d_2]$$

By backward induction, from Stage 2 we get:

$\gamma^* = \frac{1}{2} + \left[\frac{d_1 - d_2}{2\beta}\right]$ and $1 - \gamma^* = \frac{1}{2} + \left[\frac{d_2 - d_1}{2\beta}\right]$

Then the 1st stage transcribes to:

$$\beta^* = \frac{1}{2} + \left[\frac{d_{12} - d_G}{2}\right]$$

Notice that if each firm has equal outside options and the government's outside option is equal to the sum of the outside options of both firms, then the equilibrium payoff to all players will be the same as in the benchmark case.

3. A.3. Spillover and Outside Options

Coming back to the optimal equity share on page 1, the payoffs to the government and the IOC sub-coalition are:

$$U_{12} = \beta^* - s$$

$$U_G = (1 - \beta^*) + f(s)$$

As such corresponding payoffs to each firm within the sub-coalition are:

$$U_1 = \gamma^* \beta^* - s_1$$

$$U_2 = (1 - \gamma^*)\beta^* - s_2$$

Along this guise, since the goal is to see what happens to the government's welfare from extra spillover requirements under a simultaneous bargaining scenario the formula immediately below is obtained:

$$\frac{\partial U_G}{\partial s} = \frac{-1 + f'(s)}{2} = \begin{cases} < 0, & if\ f'(s) < 1 \\ > 0, & if\ f'(s) > 1 \end{cases}$$

For simplicity, it is assumed the spillover "s" here is the additional payment (or additional tax revenue) to the government by a sub-coalition of two firms. These funds are intended to be reinvested by the government in infrastructure and other initiatives that can support the development and expansion of the industrial base. Such industrial activity adds broader value to the economy through employment via investment and additional tax revenue. Thereby the benefits are meant to have a national impact by flowing to other non-resource sectors of the economy (Esteves et al, 2013).

Based on this idea, function $f(s)$ is defined as the spillover benefit (or value-added) to the government for sharing additional tax revenue with entities such as subnational governments and non-resource investors. Further along this reasoning, the last equation shall consist of a single efficient level of spillover such that the net spillover impact on the government is zero. That is,

$$at\ s = s^*\ the\ f'(s^*) = 1.$$

Note, the formulation is due to a strict convexity assumption, $f'' > 0$, for $s > s^*$ the $\frac{\partial U_G}{\partial s} > 0$; and for $s < s^*$ the $\frac{\partial U_G}{\partial s} < 0$.

3. B. Sequential Bilateral Bargaining

This section assumes the government has made a bargain over an equity split with each firm separately, for example, to prevent coalition formation among the IOCs. Thence, the first sequence transcribes as:

Stage 1:

$$\max_{\beta_1}[\beta_1 - s_1 - d_1][(1 - \beta_1 - \beta_2) + f(s_1) - d_G]$$

At this juncture the government and IOC1 is aware that Firm 2 will enter the second stage to bargain over the rest of the shares left to the government: $\beta_2 \equiv \gamma(1 - \beta_1)$.

Stage 2:

$$\max_{\gamma}[\gamma(1 - \beta_1) - s_2 - d_2][(1 - \gamma)(1 - \beta_1) + f(s_2) - d_G]$$

Yet before providing a compilation of these sequences it would be useful to start from the Benchmark Model without spillover and outside options, as is hereby commenced in the proceeding 3.B.1.

3. B.1. Benchmark in Sequential Game

A compilation of the equations in both stages above would reduce to:

Stage 1:

$$\max_{\beta_1}[\beta_1][(1-\beta_1-\beta_2)]$$

Here the government and IOC1 know that in the second stage Firm 2 enters the market and bargains over the rest of the shares left: $\beta_2 \equiv \gamma(1-\beta_1)$.

Stage 2:

$$\max_{\gamma}[\gamma(1-\beta_1)][(1-\gamma)(1-\beta_1)]$$

Using backward induction from Stage 2 we get:

$$\gamma^* = \frac{1}{2}$$

Going back to Stage 1 obtains:

$$\max_{\beta_1}[\beta_1]\left[\frac{(1-\beta_1)}{2}\right]$$

FOC will yield us:

$$\beta_1^* = \frac{1}{2}$$

Then inserting these into the payoff to all parties we obtain:

$$U_1 = \frac{1}{2}$$

$$U_2 = \frac{1}{4}$$

$$U_G = \frac{1}{4}$$

In a sequential game with identical tastes in the benchmark case, the first IOC gets the highest share, which is one-half. On the other hand, the rest of the shares is equally shared between the government and Firm 2.

3.B.2. No Spillover, But Outside Options

Under this condition Stage 1 and Stage 2 will extend to:

Stage 1:

$$\max_{\beta_1}[\beta_1 - d_1][(1 - \beta_1 - \beta_2) - d_G]$$

Here the government and IOC1 know that in the Second Stage Firm 2 will enter the market and bargain over the rest of the shares left to the government: $\beta_2 \equiv \gamma(1 - \beta_1)$.

Stage 2:

$$\max_{\gamma}[\gamma(1 - \beta_1) - d_2][(1 - \gamma)(1 - \beta_1) - d_G]$$

In turn, taking FOC in Stage 2 we get:

$$\gamma^* = \frac{(1 - \beta_1) - d_G + d_2}{2(1 - \beta_1)}$$

Following sound logic this then allows for $\beta_2 \equiv (1 - \beta_1)\gamma^* = \frac{(1-\beta_1)-d_G+d_2}{2}$. Then inserting this into Stage 1 alongside FOC transcribes to:

$$\beta_1^* = \frac{1 + d_1 - d_2 - d_G}{2}$$

$$\beta_2^* = (1 - \beta_1^*)\gamma^* = \frac{1 - d_1 - d_G + 3d_2}{4}$$

$$1 - \beta_1^* - \beta_2^* = \frac{1 - d_1 - d_2 + 3d_G}{4}$$

Thereby the payoff to all parties from sequential bargaining would be:

$$U_G^* = \frac{1 - d_1 - d_2 + 3d_G}{4}$$

$$U_1^* = \frac{1 + d_1 - d_2 - d_G}{2}$$

$$U_2^* = \frac{1 - d_1 - d_G + 3d_2}{4}$$

Notice that as long as both firms have positive outside options, the order of bargaining in a simultaneous framework does not seem to make a difference. In turn, in order to find the profitable order of bargaining for the government, it is assumed that one firm has more of an outside option than the other. Using this logic, it is most practical to consider $d_1 > d_2 = 0$, so that Firm 1 has more bargaining power than Firm 2. Thus;

A: *Government makes first offer to firm 1, which is stronger than firm 2.*

B: *Government makes first offer to firm 2.*

Then commencing with A allows for:

Stage 1:

$$\max_{\beta_1}[\beta_1 - d_1][(1 - \beta_1 - \beta_2) - d_G]$$

Here the government and IOC1 know that in the Second Stage Firm 2 will enter the market and bargain over the rest of the shares left to the government: $\beta_2 \equiv \gamma(1 - \beta_1)$.

Stage 2:

$$\max_{\gamma}[\gamma(1 - \beta_1)][(1 - \gamma)(1 - \beta_1) - d_G]$$

Thereby taking FOC in Stage 2 we get:

$$\gamma^* = \frac{(1 - \beta_1) - d_G}{2(1 - \beta_1)}$$

Followed by $\beta_2 \equiv (1 - \beta_1)\gamma^* = \frac{(1-\beta_1)-d_G}{2}$. Plugging this into Stage 1 alongside FOC obtains:

$$\beta_1^* = \frac{1 + d_1 - d_G}{2}$$

$$\beta_2^* = (1 - \beta_1^*)\gamma^* = \frac{1 - d_1 - d_G}{4}$$

$$1 - \beta_1^* - \beta_2^* = \frac{1 - d_1 + 3d_G}{4}$$

Now consider case B.

Stage 1:

$$\max_{\beta_2}[\beta_2][(1-\beta_2-\beta_1)-d_G]$$

Here the government and IOC2 know that in the Second Stage Firm 1 will enter the market and bargain over the rest of the shares left to the government: $\beta_1 \equiv \gamma(1-\beta_2)$. In turn this gives way to:

Stage 2:

$$\max_{\gamma}[\gamma(1-\beta_2)-d_1][(1-\gamma)(1-\beta_2)-d_G]$$

Thereafter taking FOC in Stage 2 we obtain:

$$\gamma^* = \frac{(1-\beta_2)-d_G+d_1}{2(1-\beta_2)}$$

This is followed by $\beta_1 \equiv (1-\beta_2)\gamma^* = \frac{(1-\beta_2)-d_G+d_1}{2}$. Plugging this into Stage 1 and in lieu of FOC renders;

$$\beta_1^* = \frac{1-d_G+3d_1}{4}$$

$$\beta_2^* = \frac{1-d_1-d_G}{2}$$

$$1-\beta_1^*-\beta_2^* = \frac{1+3d_G-d_1}{4}$$

Notice that if the government changes the order of sequential bargaining, by first making an offer to Firm 2 followed by Firm 1, then the final payoff to the government does not seem to change. Hence, for two firms having linear utility with respect to the resource value, the order of the bargaining sequence for the government will not change the result.

Firm 1 has More Outside Option than Firm 2: $\boldsymbol{d_1 > d_2 = 0}$			
First Offer to Firm 1, then to Firm 2		First Offer to Firm 2, then to Firm 1	
$(\boldsymbol{A_{12}})$	$\beta_1^* = \frac{1 + d_1 - d_G}{2}$	$\beta_1^* = \frac{1 - d_G + 3d_1}{4}$	$(\boldsymbol{A_{21}})$
$(\boldsymbol{B_{12}})$	$\beta_2^* = \frac{1 - d_1 - d_G}{4}$	$\beta_2^* = \frac{1 - d_1 - d_G}{2}$	$(\boldsymbol{B_{21}})$
$(\boldsymbol{C_{12}})$	$1 - \beta_1^* - \beta_2^* = \frac{1 - d_1 + 3d_G}{4}$	$1 - \beta_1^* - \beta_2^* = \frac{1 + 3d_G - d_1}{4}$	$(\boldsymbol{C_{21}})$

In comparing the first row results it is argued that Firm 1 would get a higher share if the government approaches it first in a sequential bargaining game: $\boldsymbol{A_{12} > A_{21}}$. Analogously, comparing the second row results, we argue that Firm 2 would get a higher share if the government approaches it first in a sequential bargaining game: $\boldsymbol{B_{21} > B_{12}}$. As such, it then becomes clear that each firm would get a higher equity share from Stage-1 than from Stage-2 in a sequential bargaining game. Yet, since the government share does not change with respect to the bargaining order in a sequential bilateral game, it adds an interesting dimension of complexity to compare the shares of the parties in descending order with the highest ownership being in the first two rows. Thereby from $\boldsymbol{A_{12} > B_{12}}$ and $\boldsymbol{A_{21} > B_{21}}$, we can firmly deduce that if Firm 1 negotiates in Stage-1 with the government, it will get a higher share than Firm 2 in Stage-2 if it is party to a sequential bargaining framework. However, if the order is reversed, it is not clear which firm would get a higher share. Finally, the fact that $\boldsymbol{A_{12} > B_{21}}$ implies that when comparing the Stage-1 results of each order, as a result of having the most outside option and more

bargaining power Firm 1 would obtain a larger share. This leads one to consider that in such a case the government is likely to first approach the firm with the best international reputation, which for practical purposes in this instance can reasonably be treated as Firm 1.

3. B.3. Spillover and Outside Options

Now in returning to our original sequential bargaining with spillover requirements one finds:

Stage 1:

$$\max_{\beta_1}[\beta_1 - s_1 - d_1][(1 - \beta_1 - \beta_2) + f(s_1) - d_G]$$

Here the government and IOC1 knows that in the Second Stage Firm 2 will enter the market to bargain over the rest of the shares left to the government: $\beta_2 \equiv \gamma(1 - \beta_1)$.

Stage 2:

$$\max_{\gamma}[\gamma(1 - \beta_1) - s_2 - d_2][(1 - \gamma)(1 - \beta_1) + f(s_2) - d_G]$$

Thereby in lieu of FOC in Stage 2 we get:

$$\gamma^* = \frac{(1 - \beta_1) + s_2 + f(s_2) - d_G + d_2}{2(1 - \beta_1)}$$

This is followed by $\beta_2 \equiv (1 - \beta_1)\gamma^* = \frac{(1-\beta_1)+s_2+f(s_2)-d_G+d_2}{2}$. Then repeating the same steps as was done in section B.2, we obtain:

$$\beta_1^* = \frac{1 + s_1 - s_2 + 2f(s_1) - f(s_2) + d_1 - d_2 - d_G}{2}$$

$$\beta_2^* = (1 - \beta_1^*)\gamma^* = \frac{1 - s_1 + 3s_2 - 2f(s_1) + 3f(s_2) - d_1 - d_G + 3d_2}{4}$$

$$1 - \beta_1^* - \beta_2^* = \frac{1 - s_1 - s_2 - 2f(s_1) - f(s_2) - d_1 - d_2 + 3d_G}{4}$$

This illustrates that with the exception of spill over, the results in sections B.2 and B.3 are pretty much the same. As such the government payoff from the sequential offer is:

$$U_G^* = \frac{1 - s_1 - s_2 - 2f(s_1) - f(s_2) - d_1 - d_2 + 3d_G}{4} + f(s_1) + f(s_2)$$

In turn, if there is a higher requirement on spillover, government welfare is:

$$\frac{\partial U_G^*}{\partial s_1} = \frac{-1 + 2f'(s_1)}{4} \begin{cases} > 0, & if \frac{1}{2} < f'(s_1) \\ < 0, & if\ otherwise \end{cases}$$

$$\frac{\partial U_G^*}{\partial s_2} = \frac{-1 + 3f'(s_2)}{4} \begin{cases} > 0, & if \frac{1}{3} < f'(s_2) \\ < 0, & if\ otherwise \end{cases}$$

Further, considering the net positive spillover effects in the last two equations, we find that the government would expect a higher spillover from Firm 1 which is negotiated in Stage-1: $\frac{1}{2} > \frac{1}{3}$.

Chapter 4

Local Contents in Oil the Industry

4.1 Introduction

Capital and operational expenditures represent a direct means for the sector to contribute to local economic and social development (Willy H. Olsen, 2008).

Maximizing the benefits of local content is not the same as maximizing local content (Willy H. Olsen, Former Advisor to the President and CEO of Statoil & Senior Advisor to INSTOK, April 10, 2010).

Following the genre of negotiation frameworks and spillover effects of oil industry FDI, this chapter's objective is to provide an alternative explanation for the host economy's value added quotient via placing extensive focus on local content requirements. With this in mind, it is important to recognize that the host government has to attract international investors. For though it owns the natural resources underground, it lacks the technological knowledge to extract them. Upon entering into said government's domain (the host country) rent-seeking foreign investors sign a long-term contract respective to dividing oil profits via various forms of fiscal instruments. Yet, the sole purpose of the government is not confined to maximizing tax revenue from an oil business. Instead, its ultimatum is to (1) optimize the sustainable flow of resource rents consistent with developmental needs and (2) to promote local content in order to increase the domestic absorptive capacities. Related to this, it is also important to point out that the government faces a trade-off between generating tax revenue from those investors and requiring them to participate in local content promotion. The common metrics to judge the spillover effects in this case could be local industrial growth, infrastructural

development and or surplus analysis. Therefore, in this chapter we will evaluate the impact of local content requirements on a host country's welfare.

Undoubtedly the operators in the resource sectors are mostly IOCs that have the right requisite skills (technological knowledge, human resources and liquid capital) to extract those resources. However, at this juncture it is important to note that irrespective of any agreement sign or negotiation partaken of, the government ultimately remains the undisputed owner of the said raw commodities or natural resources. Actualizing this tenant, Norway is recognized as the first country that successfully implemented local content in the oil industries as a development policy plan in the early 70s, thereby serving as a role model for other resource-rich countries. Since then, almost all governments of resource-rich countries have imposed requirements of local content promotion on IOCs as part of their spillover or FDI value-added agenda. While these efforts have been addressed in different fields by varying terms, a more common source of reference as found in international trade law is "performance requirements"[28]. This concept is defined as an additional obligation imposed on foreign partners outside the parameters of direct tax revenue with the aim of diversification. Hence, local content has become a widely discussed issue in many industries of resource abundant nations, with the oil sector just being one of them. With this in mind the concentration in those environs and thus in this segment will be (1) methods used respective to the development of local human skills (such as education, technology transfer via joint-ventures and job provisions to a local workforce) and infrastructure development. Also focus will be placed on the decisions

[28] In some literature a general term "performance requirements" is imposed on FDI by developing countries. "Local content requirements" is treated as a subcategory of performance requirements. See Das and Pant (2006).

made by the host government in its goal of (1) allocating equity shares from the project between the IOCs and itself- the NOC, (2) design a tax system to increase budget revenue, (3) adhering to local developmental policies or in short possessing fiscal alternatives premised on balancing the interest of the public sector and investing ICOs.

Yet there is no one correct means to address FDI matters. Instead, it varies from country to country and from industry to industry. This becomes most obvious when noting that in the biggest picture, many local content promotion ambitions have resulted in a number of challenges of unique geographic quality. For example, among the most common in the oil industry is the environmental technicalities pertinent to subsoil operations.

Thus in this chapter we propose a model to analyze the effects of local content requirements on the welfare of resource-rich host countries. Along the guise of this purpose, "local contents" will be treated as valued-added per the revenue generated through mandating local supplies. Yet this will be done noting that to date limited study has been conducted in this arena, particularly as it pertains to side-payments being widely accepted custom upstream (Kazzazi et al. 2012). Similarly, it will also be outlined how government intervention in each of these parts of the contracting process creates opportunities for side-payments. In turn, this work shall serve to provide a microeconomic model whereby side-payments in local contents requirement programs is rendered as an inadvertent fiscal instrument accruing from oil industry FDI.

That being said, one of the earliest theoretical models on local content promotion was that proposed by Grossman (1981). Therein government officials' lack of awareness

regarding the effectiveness of local content requirement programs was identified as a key challenge. This original idea was later assumed by a number of other authors. Among them, Deardorff and Stern (1997), and Balasubramanyam (2001). In turn, both of these works outline various forms of inefficiency resulting from mandatory local content requirements.

As implementing local content policy does not automatically generate maximum benefits, it motivates skepticism among many policymakers. This allows for questions respective to (1) *whether it truly benefits local producers*, (2) *why are there a number of dismissal outcomes in terms of domestic inclusion* and (3) *what are the potential and inevitable drawbacks of such programs*?

Frequent rationales tend to refer to common features of resource abundant countries, particularly noting the usual symptoms associated with low gross domestic product; (1) high rates of low per capital income, (2) fragile industrial base, (3) poor infrastructure (4) low educational skills, (5) a compromised public sector and (6) universal financial constraint. Yet the aim of this chapter is to add further clarity to this main outline via microeconomic tools. This is done in two stages. First, at the point when the foreign oil company determines the optimal level of local contents used in the extraction of crude oil to maximize its oil profit. Then the second is at the juncture when the foreign oil company and the host government bargain over fiscal policy element(s) in lieu of attaining an oil split.

In turn, the outline of the chapter is as follows. In Section 2, we build a two-stage model with the benchmark case in which an exogenous royalty is imposed on oil

revenues. The starting point for the analysis in stage 1 is a Cobb-Douglas production function of a single input, local supplies. Our strategy is to begin with profit-maximization without constraints, with the aim of isolating the parameters of influence on local contents promotion programs. Our next strategy is to complicate the optimization by introducing both binding and nonbinding constraints in order to see whether a conclusion is robust enough to theorize. In stage 2 of the model, the host government and the IOC bargain over the corporate income-tax levied on the firm's oil profits per a given equity share. Thereby it is illustrated that if the shadow price does not exceed the input price of local contents, then royalty payments to the government do not seem to reduce alongside local contents promotion. To the contrary, royalty payments are shown to be consistent in cases where local content requirements are binding. For in such instances, it reduces the oil profit to the firm and consequently reduces corporate income tax. So it is deemed that a reduction in corporate income tax, coupled with an increase in royalty payments as a result of local content policy, provide ambiguous results for government revenue.

In Section 3 the same steps found in Section 2 are repeated, but with an *endogenous* royalty. That is, in Stage 2 of negotiations the parties bargain on multiple issues pertinent to *royalty and income-tax* for a given equity share. More specifically these fiscal instruments are deemed endogenous in that they originate in the domestic market. Along this guise it is found that the optimal royalty rate is determined at points where the elasticity of crude oil extraction per royalty rates is equal to IOC equity share. More precisely, there is a direct relationship between the equity share of the IOC and royalty rates imposed on the IOC by the host government. Comparative statics of the

minimum local content targets on government welfare tends to be zero at best if constraint is nonbinding and negative at worst if constraint is binding. It is deemed that this induces the host government to partake of side-payments.

Following the conclusions of Section 3, Section 4 introduces the factor of *heterogeneity* in local contents. This approach is motivated by the fact that homogenous local contents promotion is shown to have an adverse effect on the reduction of fiscal revenues. Even more, to match such homogenous efforts are frequently followed by alternate remedial courses of action to compensate for tax losses. One approach of doing so entails directing foreign partners to procure input from local suppliers with monopoly power in exchange for "kickbacks". Hence, the impact of "government-favored" local content promotion on a host country's welfare is analyzed. In so doing it is determined that outcomes depend on the sturdiness of industrial and public sector infrastructure as pertains to withstanding that level of fiscal loss. As to enable a practical review, the custom of exogenous royalty is used as the focal point.

Then the chapter concludes with a summary of the entire section alongside incorporating suggestions for future courses of work in the arena.

4.2 Model A- An Exogenous Royalty

To get a better sense of government and IOC negotiations, we begin here with an introduction of the most common tax instruments in Production Sharing Agreements and their impacts on local contents. This is done as a means of clarifying how various types of tax elements posed at different stages of negotiations influence the IOC's incentives to extract crude oil and to participate in local contents promotion programs. More

specifically the process is highlighted via the simplified Financial Statement table given in the formulation of **Appendix-4.A** as:

$$U_G = [1 - (1 - t)\gamma]\pi(Q) + \tau pQ \quad [1a]$$

$$U_{IOC} = (1 - t)\gamma\pi(Q) \quad [1b]$$

$$where\ \pi(Q) = (1 - \tau)pQ - C(Q) \quad [2]$$

Since the government has three sources of cash inflows collected from its foreign investors, [1a] can also be rewritten as: $U_G = \tau pQ + (1 - \gamma)\pi(Q) + t\gamma\pi(Q)$. These will be royalty, equity shares from an oil profit and a corporate income tax from foreign investor's profit[29], respectively shown on the right side. The IOC pays the government a royalty levied directly on the amount of crude oil it extracts. After deducting a royalty from sales revenue, the remaining oil profit is shared between the host government and the IOC according to the Nash Bargaining rule. Finally, the IOC is charged a fraction of the corporate income tax levied on a firm's gross profit[30].

Thus, the IOC's profit is the difference between net sales revenue and the cost of production[31]. As per price, it is assumed to be exogenous and a production function of crude oil consistent with the Cobb-Douglas form. However, crude oil is extracted using local inputs manufactured within a host country. So local contents will refer to the procurement of raw materials in every phase of a supply chain herein.

[29] In some sources, investor's profit is defined as gross corporate, as opposed to the traditional net rendering.
[30] In accounting, gross profit is defined as income before tax.
[31] Costs of production references expenditures charged during the development and extraction phases. For simplicity here it is assumed that the exploration cost is zero. Otherwise, exploration costs would also need to be recovered before development phase begins.

4.2.1 Production and Cost

In this scenario an IOC producing crude provides tax revenue to its host via partaking in a local inputs program. For simplicity, it is assumed that crude oil, Q, is produced from a single local input, s, such that:

$$Q = Q(s) = s^{\alpha} \; with \; \alpha < 1 \qquad [3]$$

Notice that it is assumed that the production function exhibits decreasing returns of scale. This serves to outline that in the early stage of sector development, just after a successful discovery of crude oil, capital and operating costs rise steeply as a result low capacity domestic inputs. Notably, there are several reasons for this. First, low-income resource rich countries are mainly characterized by a low industrial base (See Tordo et al, 2013). This implies that local service companies or suppliers generally are unable to provide IOCs with specific inputs needed to meet international standard requirements. So the culmination of mandatory local content policies and the inabilities of local suppliers to adhere to internal requirements leads to higher administrative costs. While in some cases this cost burden is distributed to all parties, in others it is treated as part of the price of investment during the development stages and is thus recoverable or tax deductible. As for the cost of production, it is rendered as:

$$C(s) = rs \qquad [4]$$

Here $r > 1$ is an input cost on the IOC for procurement of local supplies.

4.2.2 Oil Profit

So far both the production and cost functions associated with crude oil extraction have been stated. In turn, the matter of local inputs is intertwined with the interpretation

of those outcomes. So among the IOC's goals is determining the optimum level of local inputs that maximizes profit. As such, before analyzing the impacts of strict local content requirements on the host country's economy, for bench mark purposes a simple model of profit maximization without constraints is developed. This is followed by a switch to an optimization model with constraints, as to distinguish the two.

4.2.2.a: No Minimum Requirements

To determine the optimal level of local inputs during the development and extraction phases, the IOC will assess:

$$\max_{s} \pi = (1-\tau)ps^{\alpha} - rs \qquad [5]$$

FOC gives:

$$\frac{\partial \pi}{\partial s} = \frac{\alpha(1-\tau)p}{s^{1-\alpha}} - r = 0 \qquad [5a]$$

FOC implies that the IOC will procure local inputs until the value of their marginal product is discounted by a royalty equal to its respective input price. Thereby it formulates to:

$$s^{*}(\alpha, \tau, p, r) = \left[\frac{\alpha(1-\tau)p}{r}\right]^{\frac{1}{1-\alpha}} \qquad [5b]$$

This could be interpreted along the guises that the IOC carried out a local market survey and concluded that the optimal level of local procurements is a function of domestic inputs output elasticity, royalty payments imposed on oil revenue, the world oil price and input costs. Using partial differential for each parameter in [5b] this transcribes to:

$$\frac{\partial s^*}{\partial \alpha} > 0,$$

$$\frac{\partial s^*}{\partial p} > 0,$$

$$\frac{\partial s^*}{\partial r} < 0,$$

$$\frac{\partial s^*}{\partial \tau} < 0.$$

So the output elasticity with respect to inputs, α, and the world oil price, p, have positive impacts. On the other hand, local input costs, r, and royalty payments, τ, have negative impacts on local inputs procurement. Now this opens the floor for the optimal level of crude oil extraction to be formulated. In so doing, incorporating [5b] into the production function in [3] renders:

$$Q^*(\alpha, p, r, \tau) = \left[\frac{\alpha(1-\tau)p}{r}\right]^{\frac{\alpha}{1-\alpha}} \qquad [6]$$

It is within reason from this to hypothesize that local contents output elasticity and oil price have positive impacts on crude oil extraction, while the input price and royalty rates would have negative impacts on an oil extraction pace. For example, increased world oil prices for a given extraction would generate a large margin, making oil production more attractive. Similarly, for a given crude oil price, the high input costs would make oil extraction more expensive or less feasible. Moreover, since a royalty is levied directly on crude oil extraction or sales revenue rather than on oil profit, it would cause a reduction in the extraction pace. As crude oil production is positively related to local input

manufactured, $\frac{\partial Q}{\partial s} > 0$, one can derive signs for a full set of hypotheses described here with the local contents equilibrium. They are established as:

$$\frac{\partial Q^*}{\partial \alpha} = \frac{\partial Q^*}{\partial s^*}\frac{\partial s^*}{\partial \alpha} > 0,$$

$$\frac{\partial Q^*}{\partial p} = \frac{\partial Q^*}{\partial s^*}\frac{\partial s^*}{\partial p} > 0,$$

$$\frac{\partial Q^*}{\partial r} = \frac{\partial Q^*}{\partial s^*}\frac{\partial s^*}{\partial r} < 0,$$

$$\frac{\partial Q^*}{\partial \tau} = \frac{\partial Q^*}{\partial s^*}\frac{\partial s^*}{\partial \tau} < 0.$$

As a result, comparative statics for crude oil extraction analysis also provides outcomes consistent with a set of hypotheses mentioned above.

4.2.2. b: Minimum Requirements

Further along this path, here it is assumed that the host government establishes minimum local content ($\underline{s}$) targets (for example, a minimum percentage of 60%) on the IOC. Then, unlike in [5] the new profit maximization with constraints becomes:

$$\max_{s} \pi = (1-\tau)ps^{\alpha} - rs \;\; subject\ to \;\; s \geq \underline{s} > 0 \qquad [7]$$

The corresponding Lagrangean associated with the given constraints is:

$$\max_{s,\lambda} \mathcal{L} = (1-\tau)ps^{\alpha} - rs + \lambda(s - \underline{s}) \qquad [8]$$

Here $\lambda\ is\ a\ shadow\ price\ when \begin{cases} > 0, & then\ constraint\ is\ binding, s = \underline{s} \\ = 0, & then\ constraint\ is\ nonbinding, s > \underline{s} \end{cases}$

Inequality constraints necessitate exploiting Kuhn-Tucker conditions. Based on these tenants, optimization of a single variable yields 2 different interior solutions, the derivations all of which are referenced in **Appendix- 4.B**.

The first case involves an interior solution with a nonbinding constraint which leads to *over-fulfilment* of the minimum local content requirements: $(s - \underline{s} > 0)$. From here, we reach the same solution as in the case of an optimization with equality constraints: $s^* = \left[\frac{\alpha(1-\tau)p}{r}\right]^{\frac{1}{1-\alpha}} > \underline{s}$. Stated differently, when the government imposes a nonbinding minimum local content requirement on the IOC, which is lower than optimal level, it will lead to the same result as when there are no minimum target requirements. This is because nonbinding constraints have a zero shadow price. So any changes in minimum targets do not change the optimum profits of an IOC.

The second case of Kuhn-Tucker conditions implies that the binding constraints with a non-corner solution yields *exact fulfilment* of local content requirements:$s^* = \underline{s} = \left[\frac{\alpha(1-\tau)p}{r-\lambda}\right]^{\frac{1}{1-\alpha}} > 0$. In other words, a binding constraint with a positive shadow price captures the direct effect of small changes in minimum requirements on oil profit. That is, a small increase in $\underline{s}$ reduces oil profit by an amount given by the multiplier, λ.

4.2.3 Payoffs to Players

Once optimal oil profit is generated, it becomes ripe to allocate the share of oil profit to each party. Thus at this junction it is important to note that fiscal instruments are not limited to royalties. Instead, once extraction starts, parties are also obliged by income taxes charged on the equity shares from oil profits. Thus this chapter will serve to

illustrate this condition via assumption of an equal split of equity shares. This will be examined with the inclusion of variables such as: (a) negotiations on royalty and income-tax; (b) both simultaneous and sequential negotiation frameworks and (c) tractability.

For starters, in providing the appropriate subject matter background, we may assume hypothetically that the host government organizes a contract bid for several IOCs from different countries seeking a 50-50 partner. Therefore, before the full operation starts, parties begin negotiating on income-tax according to the Nash rule:

$$\max_{t\in[0,1]}\left\{\frac{(1-t)\pi}{2}-d_{IOC}\right\}\left\{\frac{t\pi}{2}+\tau pQ-d_G\right\} \qquad [9]$$

In case bargaining fails, each party obtains its respective payoffs from their alternative options. These are d_{IOC} and d_G. For the IOC, it could be payoffs from an investment in a downstream refinery in the host country as an alternative option, if income-tax was not imposed on it. As for the government, it could be payoffs from other sources of taxes on the IOC such as export tax rather than income-taxes. Thereby, from conventional FOCs we get the optimal income-tax as:

$$t^* = \frac{\frac{\pi}{2}-d_{IOC}+d_G-\tau pQ}{\pi} \qquad [10]$$

Notice that if the government's outside option is equal to the sum of royalty payments and the outside options of the IOC, then optimal income-tax paid by the IOC is estimated to be 50%. Since normally the range of income-tax varies within 20-30%, it is then reasonable to assume that the sum of the foreign firm's outside options and royalty payments is larger than the outside options of the host government: $d_{IOC}+\tau PQ > d_G$. Comparative statics on outside options for each party proves to be theoretically consistent

in noting that the higher the government's outside option for the IOC, the lower the rate of income-tax to be paid. Provided that $d_{IOC} + \tau PQ > d_G$ holds, the income-tax change on oil profits is estimated to be positive:

$$\frac{\partial t^*}{\partial \pi} = \frac{d_{IOC} - d_G + \tau pQ}{\pi^2} > 0 \qquad [11]$$

So a higher oil profit is predicted to induce the government to raise income-taxes on the IOC. Stated differently, an income-tax is treated to be a progressive tax that increases as oil profit increases. Otherwise, it would be designated as regressive.

As per the relationship between royalty and income-taxes, comparative statics of equation [10] predict that there is a trade-off between the two elements. That is,

$$\frac{\partial t^*}{\partial \tau} = \frac{-pQ\left[1 + \varepsilon_{Q,\tau}\right] + pQ[d_G - d_{IOC} - \tau pQ]}{\pi^2} < 0.$$

So in the first bracket of the numerator, the expression $\varepsilon_{Q,\tau} < 0$ denotes the elasticity of crude oil extraction with respect to royalty rates. In absolute terms, it is also estimated to be lower than 1, as noted in coming subsections herein. Further, as the expression in the second bracket of the numerator is assumed to be negative, we can see that the government cannot raise the levels of both tax elements simultaneously. As such, to reduce the income tax means to replace it with a higher royalty.

As for the choice between local content requirements and income-tax, note the minimum requirements ($\underline{s}$) formulated earlier in section 4.2.2.b. In turn, this transcribes to a higher target on local contents reducing the oil profit by the amount of a shadow

price, which is λ. Then, inserting this into optimal income-tax and taking partial derivatives with respect to minimum requirements, we obtain:

$$\frac{\partial t^*}{\partial \underline{s}} = \frac{\partial t^*}{\partial \pi}\frac{\partial \pi}{\partial \underline{s}} = \frac{\lambda(d_G - d_{IOC} - \tau pQ)}{\pi^2} < 0 \qquad [12]$$

So the implication is that for government with lower outside options, the promotion of higher local content requirements is successful at the expense of a higher income tax. If not, then otherwise. With this in mind, an important corollary is that under non-binding constraints ($s > \underline{s}$), local contents requirements do not have an impact on income-taxes.

Returning to the main research questions of the impact of local contents requirements on the host country's welfare, in providing a response it is assumed that the domestic economy's wellbeing is measured by government revenue and local supplier profits and rendered as follows:

$$W_{HC} = U_G + \pi^{SUP} \qquad [13]$$

To distinguish profits of firms and suppliers, the superscripts *"IOC"* and *"SUP"* are added, respectively. Since the government has two sources of tax revenues and the cost of production to the IOC is sales revenue to local suppliers, the expression in [13] can further be extended as:

$$W_{HC} = \frac{t^*\pi^{IOC}}{2} + \tau pQ^*(\alpha, p, r, \tau) + rs \qquad [13']$$

Also, for the sake of simplicity, it is assumed that local suppliers produce inputs to the IOC at no cost so that profit to local suppliers is equal to the revenues from input

manufacturing. Along this reasoning, the impact of local content requirements on the host country's economy is:

$$\frac{\partial W_{HC}}{\partial \underline{s}} = \frac{\partial t^*}{\partial \underline{s}}\frac{\pi^{IOC}}{2} + \frac{t^*}{2}\frac{\partial \pi^{IOC}}{\partial \underline{s}} + \tau p \frac{\partial Q^*}{\partial \underline{s}} + \frac{\partial rs}{\partial \underline{s}}$$

$$\frac{\partial W_{HC}}{\partial \underline{s}} = \frac{\lambda(d_G - d_{IOC})}{(\pi^{IOC})^2}\frac{\pi^{IOC}}{2} - \frac{t^*}{2}\lambda + \tau p \frac{\partial Q^*}{\partial \underline{s}} + \frac{\partial rs}{\partial \underline{s}}$$

$$\frac{\partial W_{HC}}{\partial \underline{s}} = -\frac{\lambda}{4} + \frac{\tau p}{2}\frac{\partial Q^*}{\partial \underline{s}} + \frac{\partial rs}{\partial \underline{s}} \qquad [14]$$

Clearly, the level of local content requirements would be sustaining if $s^* < \underline{s}$. Notice that if we had an interior solution with non-binding constraints ($s > \underline{s}$), as in the first case of the previous section, then because of monotonicity we also have $Q^*(s^*) > Q^*(\underline{s})$ for $s^* > \underline{s}$, and $rs^* > r\underline{s}$. Hence, the last two expressions of comparative statics analysis above would not make sense. Stated differently, under non-binding constraints higher requirements of minimum targets on local supplies do not change optimal extraction levels or oil profits. Accordingly, as long as the minimum target is lower than the optimal level of inputs determined by the IOC, higher local content requirements would not lead to higher government revenue. Thus, local content requirements under non-binding constraints do not necessarily change the host country's domestic economy.

On the other hand, if we had an interior solution with binding constraints($s = \underline{s}$), which would mean that the IOC fulfilled its requirements, then the impact on income-tax from local content requirements would be negative. The sourcing cost for the IOC or the revenues from local input would be $rs^* = r\underline{s}$.

Recall that $Q = s^{*\alpha}$, and $\frac{\partial Q}{\partial s} = \alpha s^{*\alpha-1} = \alpha\left\{\left[\frac{\alpha p(1-\tau)}{r-\lambda}\right]^{\frac{1}{1-\alpha}}\right\}^{\alpha-1} = \left[\frac{r-\lambda}{p(1-\tau)}\right]$.

For $\frac{\partial Q}{\partial s} > 0$, it is necessary to have a condition of $r > \lambda$. However, if $r = \lambda$, then an additional amount of local supplies used in production would be inefficient as it would not change extraction levels. Thence, assuming that $r > \lambda$ holds, the net local content impact on the host country welfare would be:

$$\frac{\partial W_{HC}}{\partial \underline{s}} = -\frac{\lambda}{4} + \frac{\tau}{2(1-\tau)}(r-\lambda) + r \qquad [14']$$

$$\frac{\partial W_{HC}}{\partial \underline{s}} = \frac{2(1-\tau)(4r-\lambda) + 4\tau(r-\lambda)}{8(1-\tau)} > 0 \; since \; r > \lambda.$$

Notice that under binding constraints, the minimum targets on local contents have *"trade-off"* impacts on government revenue, namely it would reduce income-tax and increase royalty payments (the first two expressions of RHS in [14']). So the net impact of local contents promotion on government revenue is ambiguous. However, it is clear that local suppliers are true beneficiaries from local content promotion policy. Finally, provided that an input price is greater than a shadow price, under binding constraints local content policy turns out to be welfare enhancing.

4.3 Model B- An Endogenous Royalty

In order to get a clearer sense of local contents impact on host country welfare, in the previous section royalty rate is treated as an exogenous parameter. However, from a government and IOC point of view, royalty payments are considered endogenous. For the largest share of a natural resource rich government's budget is generated by activities

centered on said raw commodities. This includes tax design and policy development for capturing revenues from this stream. Thus royalties from oil revenues would definitely fit into this category. Similarly the IOC also views royalty as an instrument intimately connected to itself, in that it directly impacts oil revenue as well as the crude oil extraction pace.

On the other hand, despite the one-time long-term PSA contract signed between parties, the terms of the contract is still subject to change over time depending on the state of the global economy. Uncertainty, associated with crude oil price volatility, asymmetric information in the value chain of an upstream industry and even government election news, definitely hold the potential for changing party preferences and a need to update negotiation deals. As such it is not surprising that parties may switch preference consistent with the later circumstances. A good example of this, due to economies of scale, is when contractors initially behave cooperatively during phases of oil field exploration and development and later change mode to a competitive posture in the extraction phase of crude oil operations. Therefore, time-inconsistency[32] in dynamic host government and IOC negotiations is a ubiquitous feature of natural resource development. Yet since our primary goal is not focused on commitment issues in this chapter, we will skip it here and modify a few steps in the previous section by taking into consideration

[32] In fact, the question of time-inconsistency is at the forefront of economic policymaking and foreign firm concern. For it raises the issue of government *commitment* under such circumstances, particularly since said host is a second-mover in such transactions. Having noted the immediately aforementioned, there are two common types of government commitments: (1) a *credible promise* of continuous favorable packages to the IOC or (2) a *threat of nationalization* during the upstream phase of extraction.

the fact that the royalty level is negotiated between parties along with corporate income taxes.

4.3.1 Oil Profits

With this in mind, this segment commences with the assumption that the profit-maximizing IOC will choose the optimal level of local content use in crude oil extraction, taking into account that royalty levels are to be negotiated in the next stage. Hence, adding an inequality constraint, the new profit function in [5] will transcribe to:

$$\max_{s} \pi = \big(1 - \tau(s)\big)ps^{\alpha} - rs \;\; s.t. \;\; s \geq \underline{s} > 0 \qquad [15]$$

As per traditional FOC and SOC we obtain:

$$\alpha p\big(1 - \tau(s)\big)s^{\alpha-1} - \tau'(s)ps^{\alpha} - r + \lambda = 0 \qquad [15']$$

$$\alpha(\alpha - 1)p(1 - \tau)s^{\alpha-2} - \tau''(s)ps^{\alpha} - \alpha\tau'(s)ps^{\alpha-1} \underset{<}{\overset{?}{}} 0$$

Though it is more complicated to find a closed-form solution for optimum inputs due to endogenous royalty, this is not a matter of concern here. For the main goal of this chapter is to analyze local content impacts on the host country's welfare, as will be done in the next subsection.

4.3.2. Simultaneous Bargaining on Multiple Issues: (t, τ).

It is understood that there is no unique tax system for all resource-rich countries. Nevertheless, as mentioned before, the most frequently negotiated forms of taxes are equity oil profit shares, corporate income and royalty payments deducted from oil revenue. To make our analysis simpler and to depart from the previous sections,

bargaining on multiple issues (income tax and royalty rates) will be introduced for a given equity share size.

So per the Nash rule if the host government and IOC bargains over income tax and royalty rates for a 50-50 equity share split in a PSA contract it is rendered as:

$$\max_{\tau,t}\left[\frac{(1-t)\pi^{IOC}}{2}-d_{IOC}\right]\left[\frac{t\pi^{IOC}}{2}+\tau pQ(\tau)-d_G\right]^{33} \qquad [16]$$

Here t is corporate income tax imposed on the IOC's profit and τ is a royalty tax imposed on oil revenues. Hence, the FOCs yield us:

$$\underline{t}: \quad U_G - d_G = U_{IOC} - d_{IOC} \qquad \text{(i)}$$

$$where\ U_G = \frac{t\pi^{IOC}}{2} + \tau pQ(\tau) \text{ and } U_{IOC} = \frac{(1-t)\pi^{IOC}}{2}$$

$$\underline{\tau}: \left(\frac{1-t}{2}\right)\frac{\partial\pi^{IOC}}{\partial\tau}[U_G - d_G] + \left(\frac{t}{2}\frac{\partial\pi^{IOC}}{\partial\tau} + pQ + \tau p\frac{\partial Q}{\partial\tau}\right)(U_{IOC} - d_{IOC}) = 0 \qquad \text{(ii)}$$

Interpretations of the FOCs are as follows. (i) they imply that the optimum income-tax is determined at equilibrium when the net economic payoff of each player is equal. However, the interpretation of (ii) seems to be more difficult. Hence, rewriting it would help us capture a better picture on royalty negotiations. So (ii) can be expressed as:

$$\frac{\left(\frac{1-t}{2}\right)\frac{\partial\pi^{IOC}}{\partial\tau}}{(U_{IOC} - d_{IOC})} = -\frac{\left(\frac{t}{2}\frac{\partial\pi^{IOC}}{\partial\tau} + pQ + \tau p\frac{\partial Q}{\partial\tau}\right)}{[U_G - d_G]}$$

[33] A multiple issue bargaining scenario can be done both simultaneously and sequentially. This case assumes a simultaneous negotiation. For it is not feasible for players to negotiate each tax element separately at different points in time.

The left-hand side of the equation is the marginal cost per economic gain to the IOC when it pays an additional royalty. The right-hand side is the marginal revenue from royalty per economic gain to the host government. Solving these requires inputting (i) into (ii) which enables:

$$\left(\frac{1-t}{2}\right)(-ps^{\alpha}) + \left(\frac{t}{2}(-ps^{\alpha}) + ps^{\alpha} + \tau p\frac{\partial Q}{\partial \tau}\right) = 0$$

Then with some algebraic incorporation we get:

$$\frac{pQ}{2} + (pQ)\mathcal{E}_{Q,\tau} = 0 \qquad [17]$$

Here $\mathcal{E}_{Q,\tau}$ stands for the elasticity of crude oil extraction with respect to royalty rates. So this implies that the optimal rate of royalty payments is determined by the elasticity of crude oil extraction with respect to royalty rates equal to one-half: $\mathcal{E}_{Q,\tau} = -\frac{1}{2}$.

Proposition 1: *The optimal royalty is negotiated at points where the elasticity of crude oil extraction with respect to royalty rates is equal to the equity share of the IOC.*

Proof: If the equity share split is 60-40% to the IOC and host government, respectively. Inserting them into [16], we obtain $\mathcal{E}_{Q,\tau} = -\frac{2}{3}$. ■

Following proposition 1 above, one can provide an alternative solution for optimal royalty rates through negotiations. If the equity share of the IOC ise β^*, then per elasticity royalty rates are derived as:

$$\tau^* = -\beta^*\left(\frac{\Delta\tau}{\frac{\Delta Q}{Q}}\right) \qquad [17']$$

This interprets to equilibrium royalty is the product of the extraction growth rate multiplied by IOC equity share. Note that the royalty rate imposed on the IOC is directly proportional to its equity share. So if for example the equity share of the IOC increases by 1%, the royalty rate will increase by the fraction inside the bracket. This is further illustrated in Example 1 immediately below.

Example 1. If royalty rates are reduced by $1, the foreign equity share is $\frac{2}{3}$ and extraction of crude oil grows by, let us say, from 100 to 300 million barrels. So inserting these numbers into $[17']$, the optimal royalty rates is estimated to be 33.3%:

$$\tau^* = -\frac{2}{3}\left(\frac{-1}{2}\right) = \frac{1}{3} \blacksquare.$$

Proposition 2: *The elasticity of crude oil extraction with respect to royalty rates is always inelastic.*

*Proof: T*he equity share of the IOC never exceeds 100%, the $\left|\mathcal{E}_{Q,\tau}\right| < 1$ ■.

So proposition 2 implies that the change in extraction of crude oil is less proportional than the change in royalty rates.

As the government is expected to face a trade-off between high royalty and local contents promotion, the relationship between the two will be derived here. As noted earlier $Q = s^{\alpha}$. So the derivative of Q with respect to royalty rates is:

$$\frac{\partial Q}{\partial \tau} = \frac{\partial Q}{\partial s}\frac{\partial s}{\partial \tau} = \alpha s^{\alpha-1}\frac{\partial s}{\partial \tau}$$

Then $\frac{\tau}{Q}\frac{\partial Q}{\partial \tau} = \frac{\tau}{s^{\alpha}}\alpha s^{\alpha-1}\frac{\partial s}{\partial \tau} = -\frac{1}{2}$ will yield us:

$$\frac{\partial s}{\partial \tau} = -\frac{s}{2\alpha\tau} < 0 \Leftrightarrow \frac{\partial \tau}{\partial s} = -\frac{2\alpha\tau}{s} < 0 \qquad [18]$$

Using differential equations we find optimal royalty rate as:

$$\int \frac{d\tau}{\tau} = -2\alpha \int \frac{ds}{s}$$

$$\ln(\tau) = -2\alpha \ln(s) + Constant$$

Taking exponential from both sides we get:

$\tau^* = s^{-2\alpha}A$ where $A = e^{Constant}$. Notice that the elasticity of royalty with respect to local contents is -2α. A negative sign implies that an increase of more local content would need royalties to fall.

As for optimal income-tax rates from (i) we obtain:

$$t^* = \frac{\frac{\pi^{IOC}}{2} + d_G - d_{IOC} - \tau pQ}{\pi^{IOC}} = \frac{1}{2} + \frac{d_G - d_{IOC} - \tau pQ}{\pi^{IOC}} \qquad [19]$$

There seems to be a trade-off between the two elements of tax instruments as:

$$\frac{\partial t^*}{\partial \tau} = \frac{pQ(-\frac{1}{2}\pi^{IOC} + d_G - d_{IOC} - \tau pQ)}{(\pi^{IOC})^2} < 0 \; if \; d_G \leq d_{IOC} + \tau pQ$$

For as previously noted, if the IOC maximizes its oil profit subject to the minimum target on local content as $s \geq \underline{s}$, in equation [9], the optimal oil profit would decline by λ with respect to an increase in input exploitation constraints. Thus, the matter of payoff to the government formulates as:

$$U_G = \frac{t^* \pi^{IOC}}{2} + \tau^* p Q^*(\tau^*)$$

Then, in addressing the impact of local content requirements on the government payoff, inserting optimal tax rates gives us:

$$U_G = \frac{\pi^{IOC}}{4} + \frac{1}{2}(d_G - d_{IOC}) + \frac{1}{2}\tau^* p Q^*(\tau^*)$$

Notice the government take after simultaneous negotiation turns out to consist of three separate parts: a quarter of oil profit, a half loss due to disagreement differences and a half of royalty payments. As such, taking a partial derivative with respect to the minimum targets results in:

$$\frac{\partial U_G}{\partial \underline{S}} = -\frac{\lambda}{4} + \frac{p}{2}\left(\frac{\partial \tau^*}{\partial \underline{S}} Q^* + \tau^* \frac{\partial Q^*}{\partial \tau^*}\frac{\partial \tau^*}{\partial \underline{S}}\right)$$

$$\frac{\partial U_G}{\partial \underline{S}} = -\frac{\lambda}{4} + \frac{p}{2}\frac{\partial \tau^*}{\partial \underline{S}}\left(Q^* + \tau^* \frac{\partial Q^*}{\partial \tau^*}\right)$$

$$\frac{\partial U_G}{\partial \underline{S}} = -\frac{\lambda}{4} + \frac{pQ^*}{2}\frac{\partial \tau^*}{\partial \underline{S}}\left(1 + \mathcal{E}_{Q,\tau}\right)$$

$$\frac{\partial U_G}{\partial \underline{S}} = -\frac{\lambda}{4} + \frac{pQ^*}{4}\frac{\partial \tau^*}{\partial \underline{S}} \qquad [20]$$

It is already know from [18] that there is a trade-off between the royalty and local content requirements: $\frac{\partial \tau^*}{\partial s} < 0$. Higher local content requirements also reduce the income-tax to the government through the channel of reducing oil profits to the IOC. After all, the net impact of local content promotion on the government's welfare is negative. Stated differently, local content maximization does not seem to generate government revenue

since the higher priority of that domestic promotion strategy is given to in country suppliers. Notice that even if the constraint was non-binding$(\lambda = 0)$, the income-tax designated for government revenue would not be impacted from higher local content, but the impact of it on royalty is still negative. This concludes that, regardless of constraint types, the government has to sacrifice its revenue from oil projects in order to benefit more from local content commitments.

Note: Also as noted *in Section 2, where royalty rate was given exogenously, the local contents requirements seemed to increase revenue to the government. Conversely, in the case of endogenous royalty, local contents promotion reduces revenue.*

4.4 Heterogeneous Local Contents

As noted in the previous section, local content promotion does not generate tax revenue. Instead it pushes the government to design and exercise alternative options to compensate for potential losses coupled with local content strategies. On the contrary, Hansen et al. (2014) accepts local content as another source of rents for government officials in resource-rich countries and a key ingredient to maintain ruling positions for a long period. As such, this naturally leads to discourse on how this is possible.

For starters, the most common form of activities undertaken by resource-rich countries under this situation is the notoriety of side-payments. Yet, before introducing this troublesome subject it would be useful first to describe the facts inducing parties to partake of this covert form of consideration. With this in mind, as stated in the previous section, the host country's welfare is described to also consist of government tax revenue from the IOC and the profits of local suppliers. Besides that, to classify various forms of

fiscal elements we allowed the government to collect taxes imposed on both oil profits (income-tax) and oil revenues (royalty) as:

$$U_G = \frac{t^* \pi^{IOC}}{2} + \tau^* p Q^*(\alpha, p, r, \tau) \qquad [21]$$

According to Esteves et al. (2013), local content promotion is a benefit to the host economy from FDI in the oil sector and is unrelated to government revenue. Contrary to this finding, according to [21], our model predicts that local content in the oil industry is indeed indirectly and negatively related to government tax revenues through two channels: (1) reducing income-tax revenues and (2) reducing royalty revenues. In support of Esteves et al. (2013), a textbook explanation mentions that trade policy aimed at local content protection does not seem to increase either government revenue or export tax[34].

In addition to designing local content policy, the government also has many other obligations such as national infrastructure development. Infrastructure investment is usually financed by government tax revenues. To avoid the risk of potential deficits in tax benefits in relation to infrastructure investment, IOCs create incentives for government to induce off paper payment activities with local suppliers who hold market monopoly power. The government is often able to exercise its influence on the IOC to procure local inputs directly from those suppliers who have close ties with public officials. In exchange it provides a favorable business climate for the IOC. Therefore, the aim of government officials is on capturing the local content market in backward linkages and restricting the development of unaffiliated suppliers whose interests are weakly represented in the

[34] See Paul R. Krugman and Maurice Obstfeld "*International Economics: Theory and Policy"*, 6th Edition, p. 205.

political process. Such kinds of support to elite suppliers seem to lead to the creation of monopolies and poor competition within the industry. In turn, this drives up capital and operational costs in upstream sectors.

Following the side-payment idea above, we assume that domestic suppliers are heterogeneous in manufacturing inputs. This is because from the IOC perspective, there is constant concern with both quality and cost of local contents. Nevertheless, the quality of inputs tends to be just one consideration in the selection of manufacturers for local contents programs. For in many resource-rich countries, government and monopolistic suppliers tend to bear close pre-existing relations that in some cases even extend to familial ties and other such acquaintances beyond professional scope.

Bearing the aforementioned in mind, for simplicity, one can create hypothetical featuring local inputs produced by two types of suppliers: government-favored (s_F) and un-favored(s_U). Further, the government-favored inputs are produced by a supplier that has a close relationship with public officials and exercises monopoly power to produce s_F. Accordingly, the price of such a commodity is $r(s_F) = a - bs_F > 1$. On the other hand, the other inputs (s_U) are produced by suppliers at a competitive cost, say 1. The idea is that local content policies create backward linkages to local suppliers who produce less competitive inputs.

Further along this guise, the host government imposes a certain requirement on the IOC to procure more local inputs of type s_F at price $r(s_F)$. As in Grossman (1981), if the IOC does not comply with these requirements, then it will be charged a penalty of $f > 0$. Assuming that total inputs used in crude oil extraction is $s_F + s_U$, the new

production function formulates to $Q(s_F, s_U) = (s_F + s_U)^{\alpha}$. Then the profit-maximizing level of input-combinations for the IOC will be determined by:

$$\max_{s_F,\, s_U} p(1-\tau)(s_F + s_U)^{\alpha} - (a - bs_F)s_F - (1+f)s_U \qquad [22]$$

$$s.t. \begin{cases} f = 0, & if\ s_U < (1-k)(s_F + s_U) \\ f > 0, & if\ s_U > (1-k)(s_F + s_U) \end{cases}$$

Here k is a minimum required fraction of the total local inputs to be procured from the government-favored suppliers. For benchmark purposes, assume that the IOC exactly fulfils the requirement as: $s_U = (1-k)(s_F + s_U)$. In other words, interior solutions are allowed for local inputs with binding constraints: $s_F > 0, s_U > 0\ and\ \lambda > 0$.

As such, the Lagrange satisfying this condition is given by:

$$\max_{s_F, s_U, \lambda} \mathcal{L} = (1-\tau)p(s_F + s_U)^{\alpha} - r(s_F) - s_U + \lambda\big((1-k)(s_F + s_U) - s_U\big)$$

The respective FOCs are:

$\underline{s_F}$: $\quad \alpha p(1-\tau)(s_F + s_U)^{\alpha-1} - (a - 2bs_F) + \lambda(1-k) = 0, \qquad (i)$

$\underline{s_U}$: $\quad \alpha p(1-\tau)(s_F + s_U)^{\alpha-1} - 1 - \lambda k = 0, \qquad (ii)$

$\underline{\lambda}$: $\quad (1-k)(s_F + s_U) - s_U = 0 \Leftrightarrow (1-k)s_F = ks_U. \qquad (iii)$

Using (i) and (ii), the shadow price of $\lambda = a - 2bs_F - 1 > 0$ is obtained. Then plugging it into (ii) and using (iii) yields:

$$\alpha p(1-\tau)s_F^{\alpha-1} + 2bk^{\alpha}s_F = (a-1)k^{\alpha} + k^{\alpha-1}$$

Though there is no closed-form solution for optimal inputs, they can still be expressed explicitly as:

$$s_F^* \equiv s_F^*(\alpha, p, r, \tau, k, a, b)$$

$$s_U^* \equiv s_U^*(\alpha, p, r, \tau, k, a, b)$$

Thereby, as witnessed in the previous sections, the impact of local content promotion on the host country's welfare depends on the type of constraints. It is easier to start analyzing the impacts with nonbinding constraints as they reduce mathematical difficulties. Thus, in the following section analysis is complicated further by inserting binding constraints. In so doing, to keep the results easy to interpret, the entire section is restricted to exogenous royalty[35]. This is done particularly in lieu of having already introduced heterogeneous local contents into the model.

4.4.1 Heterogeneous Local Contents Under Nonbinding Constraints

Before proceeding further, it is useful to reinterpret the meaning of nonbinding constraints in noting that they can be defined as contractual conditions absent shadow prices and effect on optimal solutions. Notice that if the constraint are non-binding, ($\lambda = 0$), and $s_U < (1-k)(s_F + s_U)$, the above FOCs reduce to:

$\underline{s_F}$: $\quad \alpha p(1-\tau)(s_F + s_U)^{\alpha-1} - (a - 2bs_F) = 0, \qquad (i)'$

$\underline{s_U}$: $\quad \alpha p(1-\tau)(s_F + s_U)^{\alpha-1} - 1 = 0, \qquad (ii)'$

[35] The assumption of exogenous royalty is for convenience only. Otherwise, in addition to closed-form solutions, even comparative statics results are hard to derive.

An interesting fact is that in case of nonbinding constraints, the input prices of two suppliers are equalized from the FOCs as: $a - 2bs_F = 1$. So the optimal level of government-favored input is$s_F^* = \frac{a-1}{2b}$. Inserting this expression into$(ii)'$ results in $s_U^* = [ap(1-\tau)]^{\frac{1}{1-\alpha}} - (\frac{a-1}{2b})$. Correspondingly, the optimal level of crude oil extraction is rendered as $Q^* = [ap(1-\tau)]^{\frac{\alpha}{1-\alpha}}$. For as noted earlier, government payoff consists of income-tax revenues, royalty payments, and kickbacks (a form of side-payment provided by government-affiliated suppliers). This transcribes to: $U_G^* = \frac{t\pi}{2} + \tau pQ^* + cr(s_F^*)s_F^*$. Here $c \in (0,1)$ is a fraction of the government-affiliated supplier's payoff kicked back to the government as an award for partnering with the IOC, where $r(s_F^*) = (a - bs_F^*)s_F^*$ is the payoff to those suppliers. In turn, the change in government welfare as a result of government-favored local content promotion is given by:

$$\frac{\partial U_G^*}{\partial k} = 0 + 0 + c(a - 2bs_F^*)\frac{\partial s_F^*}{\partial k}$$

The first two terms on the right-hand side are zero, and $a - 2bs_F^* = 1$ by FOCs under non-binding constraints. As input prices in the market are equalized, there is no impact on government-favored local supplies: $\frac{\partial s_F^*}{\partial k} = 0$. Hence, the government does not seem to benefit from favored local content policy at all.

$$\frac{\partial U_G^*}{\partial k} = 0.$$

4.4.2 Heterogeneous Local Contents under Binding Constraints

Here the nonbinding constraints are replaced with the binding ones. In so doing, from the FOCs we derive a shadow price of $\lambda = a - 2bs_F - 1 > 0$. This then raises the

central question about government revenue and welfare as a result of "favored" local content requirements on the IOC. With this in mind, the topic of government payoff is a good place to begin. This transcribes to:

$$U_G = \frac{t\pi}{2} + \tau p(s_F^* + s_U^*)^{\alpha} + cr(s_F^*)s_F^*$$

Yet again before making a full analysis, optimal tax rates for a given equity share and an exogenous royalty need to be determined. Assuming that the government and IOC bargain according to a Nash rule, the same equation found in [10], is obtained:

$$t^* = \frac{\frac{\pi}{2} - d_{IOC} - \tau pQ + d_G}{\pi}$$

Returning to the subject of government payoff summates to:

$$U_G^* = \frac{\pi}{4} - \left(\frac{d_{IOC} + \tau pQ^* - d_G}{2}\right) + \tau p(s_F^* + s_U^*)^{\alpha} + cr(s_F^*)s_F^* \qquad [23]$$

So the impact of minimum local "favored" content on government payoff becomes:

$$\frac{\partial U_G^*}{\partial k} = -\frac{\lambda(s_F^* + s_U^*)}{4} + \frac{\alpha\tau p(s_F^* + s_U^*)^{\alpha-1}}{2}\left(\frac{\partial s_F^*}{\partial k} + \frac{\partial s_U^*}{\partial k}\right) + c(a - 2bs_F^*)\frac{\partial s_F^*}{\partial k}$$

Notice the second expression implies that the increase or decrease of the royalty to the government (resulting from the minimum local "favored" content) depends on whether the crude oil extraction increases or not. To find its symptoms, comparative statics of FOCs in (i), (ii) and (iii) is needed. However, to save space we will embark upon this endeavor later in **Appendix – 4.C**.

Assuming that the determinant of Hessian matrix is positive, the promotion of local "favored" content seems to reduce the optimal crude oil extraction level, see **Appendix- 4.C.** This in turn reduces royalty payments to the government. Due to binding constraints, it also reduces income-tax revenue.

Again note that it is hereby assumed that the favored supplier exercises monopoly power. A higher requirement on the IOC to procure inputs from such a supplier increases extraction costs and reduces its profit. Also note that due to the mandatory promotion of (s_F), there is an input reallocation in crude oil extractions. So the magnitude of s_U^* reduction seems to far exceed the magnitude of an increase in s_F^*.

On the other hand, since $a - 2bs_F^* > 1$ by FOCs and $\frac{\partial s_F^*}{\partial k} > 0$ under binding constraints, the last expression of the partial analysis above turns out to be positive. Therefore, the net impact of local "favored" content promotion on the government's cut of the pie depends on the magnitudes of tax revenue losses associated with local "favored" contents and of a kickback gain from "favored" suppliers. Thus such an effect is deemed actualized if the kick-back (or inadvertent side-payment) exceeds the government's benefits from a local content policy. On the other hand, if the benefits from local content exceeds, the government is not a beneficiary of it. So again this begs the question about the impact of local content policy on country welfare, which as before is illustrated as:

$$W_{HC}^* = U_G^* + r(s_F^*)s_F^* + s_U^* \qquad [24]$$

Notice that since the favored supplier's payoff is shared between the government and itself as $r(s_F^*)s_F^* = cr(s_F^*)s_F^* + (1-c)r(s_F^*)s_F^*$, the above expression can also be written as:

$$W_{HC}^{*} = \frac{t^{*}\pi}{2} + \tau pQ^{*} + cr(s_F^{*})s_F^{*} + (1-c)r(s_F^{*})s_F^{*} + s_U^{*} \qquad [24']$$

Taking partial differential of it with respect to "k" obtains:

$$\frac{\partial W_{HC}^{*}}{\partial k} = \frac{\partial U_G^{*}}{\partial k} + (a - 2bs_F^{*})\frac{\partial s_F^{*}}{\partial k} + \frac{\partial s_U^{*}}{\partial k}$$

In **Appendix-4.C** it is proven that $(a - 2bs_F^{*})\frac{\partial s_F^{*}}{\partial k} + \frac{\partial s_U^{*}}{\partial k} > 0$. Hence,

$$\frac{\partial W_{HC}^{*}}{\partial k}\begin{cases} > 0, & if\ \frac{\partial U_G^{*}}{\partial k} < (a - 2bs_F^{*})\frac{\partial s_F^{*}}{\partial k} + \frac{\partial s_U^{*}}{\partial k} \\ < 0, & if\ \frac{\partial U_G^{*}}{\partial k} > (a - 2bs_F^{*})\frac{\partial s_F^{*}}{\partial k} + \frac{\partial s_U^{*}}{\partial k} \end{cases}$$

In essence this states that if net gains by suppliers exceed the loss of the government from local contents promotion, then the favored local content policy is welfare-enhancing. If not, then otherwise.

4.5 Policy Responses

Further along the path of the hypothetical above, in this section optimal policy responses to a rise in world oil prices is examined. More precisely, in cases where world price increase, the government will have a choice between *mandatory* requirements of minimum local contents target ($\underline{s} > 0$) and local contents promotion *without* minimum restriction($\underline{s} = 0$). The former may be treated as government *enforcement* respective to requiring local contents from an IOC, whereas the latter may be considered as an *incentive* for an IOC to promote local contents.

- *Exogenous Royalty Rates (=ad volerom royalty)*

To promote a sense of concreteness herein, focus at this juncture is placed on *exogenous* royalty rates where the government collects a fixed percentage of crude oil extracted. Along this background, it is easier to begin analyzing policy responses with NO mandatory targets.

Case 1: ($\underline{s} = 0$)

As noted earlier, when an IOC chooses input supplies to maximize its oil profit without constraints we obtain:

$$s^*(\alpha, \tau, p, r) = \left(\frac{\alpha(1-\tau)p}{r}\right)^{\frac{1}{1-\alpha}}$$

$$Q^*(\alpha, \tau, p, r) = \left(\frac{\alpha(1-\tau)p}{r}\right)^{\frac{\alpha}{1-\alpha}}$$

such that $\frac{\partial s^*}{\partial p} > 0$ and $\frac{\partial Q^*}{\partial p} > 0$. Simply stated, high oil prices induce an IOC to extract more crude oil, which in turn, increases demand for local supplies used for extraction per *fixed* royalty rates. Thence the main question in such a scenario probes the extent of the net impact of an oil price increase on government welfare. Mathematically, this amounts to:

$$\left.\frac{\partial U_G^*}{\partial p}\right|_{\underline{s}=0} = \underbrace{\tau Q^* + \tau p\left(\frac{\partial Q^*}{\partial p}\right)}_{>0} + \underbrace{\frac{1}{2}(1-t^*)\left(\frac{\partial \pi^*}{\partial p}\right)}_{>0} - \underbrace{\frac{1}{2}\pi^*\left(\frac{\partial t^*}{\partial p}\right)}_{?} \qquad (*)$$

The first expression on the right-hand side is positive due to fixed royalty rates imposed on a unit of crude oil extracted and sold. This can also be written as $\tau\left(1 + \mathcal{E}_{Q,p}\right)$ where

$\mathcal{E}_{Q,p} = \frac{\alpha}{1-\alpha} > 0$ which equates to the elasticity of the crude oil supply with respect to pricing. The second expression is also positive since the firm's oil profit would increase by: $\frac{\partial \pi^*}{\partial p} = (1-\tau)Q^* > 0$. Then the last expression proves to be a bit tricky. Yet, using equation [10] for the last expression and inserting the results into (*) obtains:

$$\frac{\partial U_G^*}{\partial p} = \underbrace{\frac{3\tau}{2}\left(1+\mathcal{E}_{Q,p}\right)}_{>0} + \frac{1}{2}(1-\tau)Q^*\left[\frac{\overbrace{(1-t^*)\pi^* - (\tau p Q^* + d_{IOC} - d_G)}^{?}}{\pi^*}\right]$$

Thereafter, what is left is for the purpose of analyzing the sign of the numerator in the second expression on the right. From [10] it is already known that $\frac{1}{2}\pi^* - (\tau p Q^* + d_{IOC} - d_G) > 0$. Since normally corporate income tax does not exceed 50%, $\left(t^* < \frac{1}{2}\right)$, we have $(1-t^*) > \frac{1}{2}$. This, in turn, implies that:

$$(1-t^*)\pi^* - (\tau p Q^* + d_{IOC} - d_G) > \frac{1}{2}\pi^* - (\tau p Q^* + d_{IOC} - d_G) > 0$$

Hence, $\frac{\partial U_G^*}{\partial p} > 0$.

At this junction the discussion on the whereabouts of the government's welfare under mandatory minimum local content targets is ripe for analysis. In turn, this pursuit begins with the formulation sequence as found in the second case:

Case 2: $(s = \underline{s} > 0)$

Notice, we assume the constraint is *binding*. Otherwise, the solutions would not differ from *Case 1* above. In turn, optimization under binding constraints yields:

$$s^*(\alpha,\tau,p,r)=\left(\frac{\alpha(1-\tau)p}{r-\lambda}\right)^{\frac{1}{1-\alpha}}$$

$$Q^*(\alpha,\tau,p,r)=\left(\frac{\alpha(1-\tau)p}{r-\lambda}\right)^{\frac{\alpha}{1-\alpha}}$$

Repeating the same steps in *Case I obtains*:

$$\left.\frac{\partial U_G^*}{\partial p}\right|_{\underline{s}>0}=\underbrace{\tau\left(1+\mathcal{E}_{Q,p}\right)}_{>0}+\underbrace{\frac{1}{2}(1-t^*)((1-\tau)Q^*-\lambda)}_{>0}-\underbrace{\frac{1}{2}\pi^*\left(\frac{\partial t^*}{\partial p}\right)}_{?} \qquad (**)$$

Subtracting (*) from (**) delivers $\left.\frac{\partial U_G^*}{\partial p}\right|_{\underline{s}>0}-\left.\frac{\partial U_G^*}{\partial p}\right|_{\underline{s}=0}=-\lambda\frac{1}{2}(1-t^*)<0$. This implies that if the government decided to mandate its foreign partner to perform minimum targets on local contents, the oil price increases will reduce government welfare by an amount of $\lambda\frac{1}{2}(1-t^*)$. Notice, this expression is a product of three terms: a shadow price, the size of equity shares and a fraction of corporate income tax left to an IOC, respectively. *In summary, under exogenous royalty conditions, the optimal local content policy is NOT to impose minimum targets on an IOC to induce performance. Instead local contents requirements are issued as a response to oil price increases. So in such cases the government should provide an incentive for its foreign partner to invest by eliminating mandatory requirements.*

- *Endogenous Royalty (Price-Based Windfall Tax)*

Now, we consider a policy response to world price changes and the tax rate on a sliding scale triggered by higher oil prices. Thereby the profit maximizing function in [15] is recalled:

$$\max_{s} \pi = \big(1 - \tau(s)\big) p s^{\alpha} - rs \quad s.t. \;\; s = \underline{s} > 0$$

So if the government imposes mandatory requirements on minimum targets of local contents, $\underline{s} > 0$, to be used in crude oil extraction, then FOC is:

$$\alpha p\big(1 - \tau(s)\big) s^{\alpha-1} - \tau'(s) p s^{\alpha} - r + \lambda = 0$$

Similarly, if the government does not restrict minimum targets, $\underline{s} = 0$, then FOC reduces to:

$$\alpha p\big(1 - \tau(s)\big) s^{\alpha-1} - \tau'(s) p s^{\alpha} - r = 0$$

Nevertheless, regardless of the FOCs above, the corresponding SOC in both cases would be:

$$\Omega = \alpha(\alpha - 1) p(1 - \tau) s^{\alpha-2} - \tau''(s) p s^{\alpha} - \alpha \tau'(s) p s^{\alpha-1} < 0$$

Before resolving the matter of world oil price impacts on government welfare, it is useful to partially analyze the effect of price changes on local contents programs. In so doing, the comparative statics of both FOCs with respect to prices above yields:

$$\left.\frac{ds^*}{dp}\right|_{\underline{s}=0} = \frac{-\frac{r}{p}}{\Omega} > 0$$

$$\left.\frac{ds^*}{dp}\right|_{\underline{s}>0} = \frac{-\left(\frac{r-\lambda}{p}\right)}{\Omega} \begin{cases} > 0, & if\ r > \lambda \\ < 0, & if\ r < \lambda \end{cases}$$

As long as there is no strict local contents requirement, the demand for local inputs used in crude oil extraction will increase as a response to high oil prices. However, when it

comes to strict minimum targets, the impact depends on the magnitude of input prices and as well as whether the variable of a shadow price is involved. From here, to promote local contents one would suggest that the government should *either eliminate minimum target requirements or keep a shadow price below input prices*. However, if the government still has to choose a policy recommendation, then the magnitude of the two impacts above should be compared. That is,

$$\left.\frac{ds^*}{dp}\right|_{\underline{s}>0} - \left.\frac{ds^*}{dp}\right|_{\underline{s}=0} = \frac{\left(\frac{\lambda}{p}\right)}{\Omega} < 0$$

At this point it is clear that in order to promote more local contents, subject to oil price increases, the most practical policy is to eliminate the mandatory minimum local input requirements used in crude oil extraction.

Now, let us see what happens to government welfare in cases where there are "no mandatory target" conditions. For beginners it is important to note that though the government has two channels of tax collection from its foreign partners as $U_G^* = \tau(s)pQ^* + \frac{1}{2}(1-t^*)\pi^*$, the price impact spreads into multiple parts as:

$$\frac{\partial U_G^*}{\partial p} = \underbrace{\tau'(s)\frac{\partial s^*}{\partial p}pQ^*}_{<0} + \underbrace{\tau Q^*}_{>0} + \underbrace{p\tau\frac{\partial Q^*}{\partial p}}_{>0} + \underbrace{\frac{1}{2}(1-t^*)\frac{\partial \pi^*}{\partial p}}_{>0} - \underbrace{\frac{1}{2}\pi^*\frac{\partial t^*}{\partial p}}_{?}$$

$$\frac{\partial U_G^*}{\partial p} = \underbrace{\frac{3}{2}\Psi}_{?} + \underbrace{\frac{1}{2}\frac{(1-\tau)Q^*}{\pi}\{(1-t^*)\pi - (\tau pQ^* + d_{IOC} - d_G)\}}_{>0}$$

Here $\Psi = \tau'(s)\frac{\partial s^*}{\partial p}pQ^* + \tau(1+\mathcal{E}_{Q,p})$ and $\mathcal{E}_{Q,p}$ is the elasticity of crude oil extraction with respect to oil prices. Notice it consists of the product of two elasticities as:

$$\mathcal{E}_{Q,p} = \frac{\partial Q}{\partial p}\frac{p}{Q} = \frac{\partial Q}{\partial s}\frac{\partial s}{\partial p}\frac{p}{s^{\alpha}} = \mathcal{E}_{Q,s}\mathcal{E}_{s,p}$$

Since the production function is of the Cobb-Douglas Model, then $\mathcal{E}_{Q,s} = \alpha$. Notice also

$$\tau'(s)\frac{\partial s^*}{\partial p}pQ^* = \tau'(s)\frac{\partial s^*}{\partial p}pQ^*\frac{s}{s} = \tau'(s)sQ^*\mathcal{E}_{s,p}.$$

Then using equation [18] we obtain $\Psi = \tau + \mathcal{E}_{s,p}\{-s^2Q + 2(\alpha\tau)^2\}\begin{cases} > 0 \; if \; s < \bar{s} \\ < 0 \;\; if \; s > \bar{s} \end{cases}$.

Here the maximum threshold for local contents is $\bar{s} = (2\alpha A)^{\frac{1}{2\alpha+1}}$. Then $\frac{\partial U_G^*}{\partial p}\begin{cases} > 0 \; if \; s < \bar{s} \\ ? \;\; if \; s > \bar{s} \end{cases}$.

Finally, we can conclude that the oil price impact on government welfare without mandatory restriction on local contents is, $\underline{s} = 0$, and below a certain threshold on local contents implementation, $s < \overline{s}$, will be positive. In other words, *under endogenous royalty rates the optimal policy for the government in response to oil price increases is to eliminate minimum local content requirements and to restrict the maximum use of local contents*.

4.6 Conclusion

The goal of this chapter has been to find the reasons why some local content policies in the oil industry are successful while others are not. To provide explanations for various possible scenarios, traditional model tools are used. Among them, an IOC profit-maximization decision in the crude oil extraction stage and a Nash bargaining negotiation consisting of various forms of government and IOC fiscal instruments.

Thus a two-stage model was built for two reasons. First and foremost, to approximate reality. Second, to make it realistic enough to understand how incentives given parties at various stages are interrelated.

It is also important to note that the model's simplicity is for the sake of tractability. To maintain practicality, a set of assumptions are provided at various stages that allowed the model to work. Bearing this in mind, it is fair to say that this model has provided clear convincing results consistent with anecdotal evidence.

Considering the last paragraph's caveats, it is necessary to provide a couple of suggestions as extensions for future work. One way to extend this work would be by bargaining on all fiscal elements sequentially. Another possibility to enrich the model would be by inserting the features of time-consistency, commitment, and uncertainty, coupled with price volatility. In Section 4, models where the IOC may be prone to corruption can be posed. This may further entail it offering a bribe to "favored" suppliers in order to procure input from more competitive suppliers. This of course would place the government at a disadvantage, distancing it from the center of negotiations. Thus, incorporating such a model would enable us to examine whether information asymmetry is a rationale for local content policy being welfare-reducing.

Appendix – 4.A.

Sales Revenue	$(p_{oil}Q)$
Less: Cost of goods sold (COGS)	$C(Q)$
Less: royalty = fraction of sales revenue $(0 < \tau < 1)$	τPQ
oil profit before split	$\pi = pQ - \tau pQ - C(Q)$
Less: fraction of oil profit to Government	$(1-\gamma)\pi$
oil profit to IOC after split	$\gamma\pi$
Less: income tax on oil split to IOC	$(t\gamma\pi)$
net oil profit to IOC	$(1-t)\gamma\pi$

Source: **Author's calculation based on an example of a financial income statement of an international oil company.**

Appendix- 4.B.

Here Lagrange in [10] associated with the given constraints is rewritten as:

$$\max_{s,\lambda} \mathcal{L} = (1-\tau)ps^{\alpha} - rs + \lambda(s - \underline{s}) \qquad [2.1]$$

Thereby the FOCs are:

$$\underline{s}: \ \frac{\alpha p(1-\tau)}{s^{1-\alpha}} - r + \lambda \leq 0; \quad s \geq 0; \ \ s\left(\frac{\alpha p(1-\tau)}{s^{1-\alpha}} - r + \lambda\right) = 0$$

$$\underline{\lambda}: \ s - \underline{s} \geq 0; \qquad \lambda \geq 0; \qquad \lambda(s - \underline{s}) = 0$$

By rule, the Lagrangian possessing a single variable inequality constraint provides 4 cases:

i. $s > 0 \ and \ \lambda = 0$ (an interior solution and a nonbinding constraint)

ii. $s > 0 \ and \ \lambda > 0$ (an interior solution and a binding constraint)

From case (i) we get $s^* = \left[\frac{\alpha(1-\tau)p}{r}\right]^{\frac{1}{1-\alpha}} > \underline{s}$ and from case (iv) $s^* = \left[\frac{\alpha(1-\tau)p}{r-\lambda}\right]^{\frac{1}{1-\alpha}} = \underline{s}$.

Appendix - 4.C.

To rewrite multiple optimizations under inequality constraints as found in Section 4 would equate to:

$$\max_{s_F, s_U, \lambda} \mathcal{L} = (1-\tau)p(s_F + s_U)^{\alpha} - r(s_F) - s_U + \lambda\big((1-k)(s_F + s_U) - s_U\big) \qquad [3.1]$$

The respective FOCs in this instance are:

s_F: $\quad \alpha p(1-\tau)(s_F + s_U)^{\alpha-1} - (a - 2bs_F) + \lambda(1-k) = 0, \qquad (i)$

s_U: $\quad \alpha p(1-\tau)(s_F + s_U)^{\alpha-1} - 1 - \lambda k = 0, \qquad (ii)$

λ: $\quad (1-k)(s_F + s_U) - s_U = 0 \Leftrightarrow (1-k)s_F = ks_U. \qquad (iii)$

The total differential of the FOCs is:

$$\begin{bmatrix} B+2b & B & 1-k \\ B & B & -k \\ 1-k & -k & 0 \end{bmatrix} \begin{bmatrix} ds_F \\ ds_U \\ d\lambda \end{bmatrix} = \begin{bmatrix} \alpha p(s_F + s_U)^{\alpha-1} & \lambda \\ \alpha p(s_F + s_U)^{\alpha-1} & \lambda \\ 0 & s_F + s_U \end{bmatrix} \begin{bmatrix} d\tau \\ dk \end{bmatrix}$$

Here $B \equiv \alpha(\alpha-1)p(1-\tau)(s_F + s_U)^{\alpha-2} < 0$.

The determinant of the Hessian matrix is:

$$|\Delta| = -2k(1-k)B - \big((1-k)^2 B + k^2(B+2b)\big)$$

$$|\Delta| = -(B + 2bk^2) \underset{>}{?} 0 \qquad [3.2]$$

Then comparative statics for s_F and s_U with respect to "k" are:

$$\frac{ds_F^*}{dk} = \frac{\begin{vmatrix} \lambda & B & 1-k \\ \lambda & B & -k \\ s_F + s_U & -k & 0 \end{vmatrix}}{|\Delta|}$$

$$\frac{ds_F^*}{dk} = \frac{-B(s_F + s_U) - \lambda k}{|\Delta|}$$

From (ii) we have $B - 1 = \lambda k$. Inserting this back into the last equation we obtain:

$$\frac{ds_F^*}{dk} = \frac{-B(s_F + s_U + 1) + 1}{|\Delta|} = \frac{(+)}{|\Delta|}\begin{cases} > 0, & if\ |\Delta| > 0 \\ < 0, & if\ |\Delta| < 0 \end{cases} \qquad [3.3]$$

Similarly for s_U

$$\frac{ds_U^*}{dk} = \frac{\begin{vmatrix} B + 2b & \lambda & 1 - k \\ B & \lambda & -k \\ 1 - k & s_F + s_U & 0 \end{vmatrix}}{|\Delta|}$$

$$\frac{ds_U^*}{dk} = \frac{-\lambda(1 - k) + B(s_F + s_U)}{|\Delta|} = \frac{(-)}{|\Delta|}\begin{cases} > 0, & if\ |\Delta| < 0 \\ < 0, & if\ |\Delta| > 0 \end{cases} \qquad [3.4]$$

Finally,

$$\frac{\partial Q^*}{\partial k} = \alpha(s_F^* + s_U^*)^{\alpha - 1}\left(\frac{\partial s_F^*}{\partial k} + \frac{\partial s_U^*}{\partial k}\right)$$

$$\left(\frac{\partial s_F^*}{\partial k} + \frac{\partial s_U^*}{\partial k}\right) = \frac{-\lambda}{|\Delta|}\begin{cases} > 0, & if\ |\Delta| < 0 \\ < 0, & if\ |\Delta| > 0 \end{cases} \qquad [3.5]$$

$$\text{So } \frac{\partial Q^*}{\partial k} = \frac{-\lambda}{|\Delta|}\alpha(s_F^* + s_U^*)^{\alpha - 1}\begin{cases} > 0, & if\ |\Delta| < 0 \\ < 0, & if\ |\Delta| > 0 \end{cases}. \qquad [3.6]$$

For the purpose of maximization, the Hessian Matrix determinant must be positive. Assuming that it holds, then from strong minimum content promotion, the overall optimal crude oil extraction seems to fall.

Since the net payoff of suppliers is $r(s_F^*)s_F^* + s_U^*$ and the net gain in the supply industry from local content policy transcribes to:

$$(a - 2bs_F^*)\frac{\partial s_F^*}{\partial k} + \frac{\partial s_U^*}{\partial k} = \frac{(a - 2bs_F^*)(-B(s_F^* + s_U^*) - \lambda k) - \lambda(1 - k) + B(s_F^* + s_U^*)}{|\Delta|}$$

Using some algebraic equations we arrive at:

$$(a - 2bs_F^*)\frac{\partial s_F^*}{\partial k} + \frac{\partial s_U^*}{\partial k} = \frac{-\lambda B(s_F^* + s_U^*)}{|\Delta|} > 0 \; since \; B < 0 \qquad [3.7]$$

Notice, that in the instance of nonbinding constraints ($\lambda = 0$), the net payoff to industry suppliers from local content policy is zero. To the contrary, in cases of binding constraints ($\lambda > 0$), it is positive.

Chapter 5

Summary, Conclusions and Further Extensions

The main purpose of spillover requirements, as imposed by government per the oil and gas industries, is to encourage domestic participation and development as well as to transfer technological knowledge and financial capital within said local domain. Nevertheless, the final outcome of spillover contribution seems to depend on various forms of side-payments and government qualities. That is, if the governmental is of a fragile or compromised nature, making its implementation of policy difficult, the spillover may be subject to side-payments as incentives.

In turn, this dissertation tries to provide some theoretical insights into this scenario using microeconomic models, due to the unavailability of data and the difficulty to measure spillover outcomes from oil investment. Thus, the models herein prove novel in that at best similar ones are limited and at worst absent to this author's knowledge. More precisely, this work exploits the Nash bargaining framework in which the host government and its foreign partners negotiate on oil split and said IOCs provide spillover to the government.

Along this guise, the first essay begins with simple Nash bargaining where the host government negotiates on equity shares with a single IOC and imposes a spillover requirement on it in order to develop the local economy. Also the variables of side-payments and government quality were inserted into the model. In so doing, it is argued that side-payments are both good and bad. A high quality government is defined as being one that correctly implements side-payments, whereas a low quality government abuses its power and direct side-payments for its private use. After all was said and done, we

found that net spillover effects from oil investment depend on government quality. If it is high, the net spillover effect is positive and the inverse if low.

The second essay builds on the model developed in the first essay by extending the number of foreign investors. That is, this time the government negotiates equity shares with more than one IOC project and requires spillover contribution from them. Multilateral bargaining, unlike bilateral, raises the specter of coalition among some parties within the grand coalition. Hence, the government as owner of resources decides whether to negotiate with all firms simultaneously or to approach each one sequentially. Assuming that all parties have equal tastes (linear utility), the main finding in this essay is that the government is predicted to gain more equity shares and more spillover from a simultaneous multilateral deal than from a sequential bilateral one.

Finally, the third essay addresses the role of local contents promotion and its impact on the host country's welfare. This section differs from the previous essays in that it builds a two-stage model. In the first stage, the IOC makes a decision on optimal use of local contents in the extraction of crude oil. In the second stage, the government imposes various taxes, such as royalties and corporate income, on the IOC. More precisely, unlike the previous essays, in this section the government or NOC and the IOC negotiate on royalties and corporate income taxes for a given equity share. It is argued that in such a scenario the government faces a trade-off between two forms of policies, local content and fiscal. In making this assessment it is noted that local content promotion does not appear to benefit the host government, but rather it serves the interests of local suppliers. Another finding is that if the government abuses its power by directing foreign partners to

procure local inputs from certain "favored" suppliers only, the local content impact in the government's return turns out to be at best zero and at worst negative.

Summarizing the three essays' results, the tools of simple Nash bargaining models have provided the insight to comprehend the interactions between parties. One could extend the first essay results by introducing the concept of "risk-averseness" into the model. Thus, instead of linear utility functions, results could amount to all others that possess concave shape. Despite the absence of closed-form solutions for equilibriums arising in this hypothetical, the comparative statics analysis still provides rationale for the research questions if the net spillover effects are positive.

As for the second essay, there exist important features of bargaining protocols under the two scenarios mentioned above. In a simultaneous multilateral framework the agenda-setter (government) normally has an information disadvantage in upstream operations as compared to foreign partners. Theoretically, this information asymmetry creates inefficiencies in the host country. Therefore, one could extend this section of the second essay by inserting uncertainty into the bargaining framework. On the other hand, the focal point of sequential bilateral bargaining is transfer and commitments. Again, one could add to discourse here by considering these issues in the bargaining framework. Nevertheless, this is in lieu of a caveat. For simple Nash bargaining is not applicable in either scenario. This is due to Nash bargaining outcomes being subject to perfect and complete information. Moreover, in cases of non-credible commitment in sequential bargaining each party would walk away from negotiations. Hence, as an alternative to Nash bargaining, one could propose a Rubinstein model instead.

Though the last chapter has a practical and special role, the methodology of using tax negotiations per their links to local contents can further be explored respective to suggesting future courses of research. For this work began with scenarios in which the equity size of each party is predetermined. However, it is more reasonable to assume that share portions can also be defined through the bargaining process and or derived from other elements of tax policy not referenced herein. With this in mind, an alternate framework could suggest sequential bargaining on multiple issues. For example, such that in the first stage the parties negotiate on the equity shares and in the next they may bargain simultaneously on corporate income tax and royalty levels. Second, it would be interesting to study the presence of imports as a substitute to local contents. For it is important to acknowledge the importance of imports in decisions relating to domestic input as well as to understand how they impact government "take" and host country welfare as a whole. Third, our model excludes government institutions that play a key role in rent distribution arising from a potential windfall. Fourth, this model is static. On the other hand, a more realistic assumption would involve a dynamic negotiation whereby party incentives change over time as a response to uncertainty and time inconsistency associated with flexing oil prices. In turn, also noteworthy for future work is more in depth consideration of the host country nationalizing its resources. For not preparing against or recognizing nationalization as a potential threat may lead the value of resources eventually to zero. Finally, another prospective extension of the work herein could feature a methodology to empirically measure the spillover effects from local contents promotion in extractive industries.

References

Acemoglu, Daron and James Robinson., 2012. Why Nations Fail: The Origins of Power, Prosperity and Poverty. Crown Business. New York.

Acemoglu, Daron and Thierry Verdier, 2000. The Choice between Market failures and Corruption. The American Economic Review, Vol. 90, No 1, 194 – 211.

Adaramola, Zakariyya "Nigeria: NACCIMA Says Oil Sector is Killing Economy". Available at http://allafrica.com/stories/201302130929.html. Accessed on February 13, 2013.

Ades, A., Di Tella, R., 1999. Rents, Competition, and Corruption. American Economic Review 89, 982–993.

Aghion, P., Antras, P., Helpman, E., 2007. Negotiating Free Trade. Journal of International Economics 73, 1 – 30.

Ambrus, Attila and Shin En Lu, 2008. A Continuous Model of Multilateral Bargaining with Random Arrival Times. Department of Economics, Harvard University, Cambridge MA.

Aslaksen, S., 2007. Corruption and Oil: Evidence from Panel Data. Unpublished Manuscript.

Bagwell, K. and Staigler R.W., 2004b. Multilateral Trade Negotiations, Bilateral Opportunism and the Rules of GATT/WTO. Journal of International Economics 63, 1 - 29.

Bagwell, K. and Staigler, R.W., 2004a. Backward Stealing and Forward Manipulation in the WTO. National Bureau of Economic Research Working Paper, vol. 10420.

Bagwell, Kyle & Staiger, Robert W., 2010. "Backward Stealing and Forward Manipulation in the WTO," Journal of International Economics, Elsevier, vol. 82(1), pages 49-62, September.

Basu, K. Sudipto Bhatacharya and Ajit Mishra, 1992. Notes on Bribery and the Control of Corruption. Journal of Public Economics 48, 349 – 359.

Bhattacharyya, S., Hodler, R., 2010. Natural Resources, Democracy and Corruption. European Economic Review 54, 608 – 621.

Boadway, R. and Michael Keen (2010), 'Theoretical Perspectives on Resource Tax Design' in Philip Daniel, Michael Keen, and Charles McPherson (Eds.) *The Taxation of Petroleum and Minerals: Principles, Problems and Practice.*

Boadway, R. and Michael Keen, 2009. Theoretical Perspectives on Resource Tax Design. Queen's Economics Department Working Paper No. 1206.

Burbidge, J.B., Brecher, R.A., Hatta, T., 1983. The Generalized Theory of Transfer and Welfare (I): Bilateral Transfers in a Multilateral World. American Economic Review 73, 606 – 618.

Burbidge, J.B., DePater, J.A., Myers, G.M., Sengupta, A., 1997. A Coalition-Formation Approach to Equilibrium Federations and Trading Blocs. American Economic Review 87, 940 - 956.

Chavez, Ramiro Martin Lujan., 2010. The Bargaining Process and the Risk of Breakdown in a Model About Negotiation: A Theoretical Approach for the Oil Industry. Central Bank of Bolivia, Oruro, Bolivia. Unpublished.

Collier, P. and Anthony J. Venables, 2011. Illusory Revenues: Import Tariffs in Resource-Rich and Aid-Rich Economies. Journal of Development Economics, 94, 202 – 6.

Collier, P., and Frederick van der Ploeg, Michael Spence and Anthony J. Venables, 2010. Managing Resource Revenues in Developing Economies. IMF Staff Papers, 57, 84 – 118.

Corato, Luca Di. 2013. Profit Sharing Under the Threat of Nationalization. Resource and Energy Economics 35, 295 – 315.

Cordahi, Cherif "*Chevron Drills Headed for Kazakhstan*". Available at http://www.themoscowtimes.com. Accessed on November 16, 1992.

Crable, Alexander D.G. 2009. Multiparty Bargaining Strategies: Comparing Nash Bargaining Payoffs of Bilateral and Multilateral Negotiation Strategies during Conflict Bargaining. Mimeo Duke University.

Daniel, P., Keen, M and Charles McPherson, 2010. The Taxation of Petroleum and Minerals: Principles, Problems and Practice (Routledge Explorations in Environmental Economics).

Das, S. K. & Manoj Pant, 2006. "Incentives for Attracting FDI in South Asia," International Studies, vol. 43(1), pages 1-32, January.

Deardorff, Alan V. & Robert M. Stern, 1997. "Measurement of Non-Tariff Barriers," OECD Economics Department Working Papers 179, OECD Publishing.

Esteves, A. M., Bruce Coyne and Ana Moreno., 2013. Local Content Initiatives: Enhancing the Subnational Benefits of the Oil, Gas and Mining Sectors. New York: Revenue Watch Institute.

Frankel, Jeffrey A. "The Natural Resource Curse: A Survey," HKS Faculty Research Working Paper Series, RWP10-005, John F. Kennedy School of Government, Harvard University, 2010.

Genicot, G., and D. Ray, 2003. Group Formation in Risk-Sharing Agreements. Review of Economic Studies, 50, 221 – 247.

Greenhouse, Steven "*Chevron to spend $10 billion to seek oil Kaz*akhstan". Available at http://www.nytimes.com/1992/05/19/world/chevron-to-spend-10-billion-to-seek-oil-in-kazakhstan.html. Accessed on May 19, 1992.

Grossman, Gene M, 1981. "The Theory of Domestic Content Protection and Content Preference," The Quarterly Journal of Economics, MIT Press, vol. 96(4), pages 583-603, November.

Hafalir, Isa E. 2007. Efficiency in Coalition Games with Externalities. Games and Economic Behavior 61, 242 – 258.

Hart, S., and Kurz, M., 1983. The Endogenous Formation of Coalitions. *Econometrica*, Vol. 51, No. 4, pp. 1047-1064.

Hodler, R., 2006. The Curse of Natural Resources in Fractionalized Countries. European Economic Review 50, 1367–1386.

Inkpen, Andrew and Michael H. Moffett., 2011. "The Global Oil and Gas Industry: Management, Strategy and Finance", PennWell Books.

IPIECA, 2011. *Local Content Strategy: A Guidance Document for Oil and Gas Industry.* London.

Kazzazi, A. and B, Nouri., 2012. A Conceptual Model of Local Content Development in the Petroleum Industry. Management Science Letters. Vol. 2 Issue 6 pp. 2165-2174.

Krishna, Vijay and Roberto Serrano, 1996. Multilateral Bargaining. The Review of Economic Studies, Vol. 63, No.1, 61 – 80.

Krugman, P., 1987. The narrow moving band, the Dutch disease, and the competitive consequences of Mrs. Thatcher: notes on trade in the presence of dynamic scale economies. Journal of Development Economics 27, 41– 55.

Krugman, Paul R. and Obstfeld, M. 2002. International Economics: Trade and Policy, 6th edition. Addison Wesley.

Lane, P.R., Tornell, A., 1996. Power, growth and the voracity effect. Journal of Economic Growth 1, pp. 213– 241.

Leite, C. and Weidmann, J., 2002. "Does Mother Nature Corrupt? Natural Resources, Corruption, and Economic Growth in Governance, Corruption and Economic Performance" (Eds.) by G.T. Abed and S. Gupta, International Monetary Fund, Washington, DC, pp. 71-99.

Martini, M. 2014. Local Content Policies and Corruption in the Oil and Gas Industry, Transparency International.

Mayer, Frederick W. 1992. Managing Domestic Differences in International Negotiations: The Strategic Use of Internal Side-Payments International Organization, Vol. 46, No. 4, 793 – 818.

McMillan, M., Andrew R. Waxman and Shang-Jin Wei. Profit Sharing Between Governments and Multinationals in Natural Resource Extraction: Evidence from a Firm-Panel, L. *Brookings Trade Forum*, Foreign Direct Investment (2007), pp. 149 -175. Brookings Institution Press.

McPherson, C. and Stephen MacSearraign (2007), 'Corruption in the Petroleum Sector' in Edgardo Campos and Sandjay Pradhan (Eds.) *The Many Faces of Corruption: Tracking Vulnerabilities at Sector Level. World Bank Press.*

Mehlum, H., Karl Moene, and Ragnar Torvik, "Institutions and the resource curse," The Economic Journal 116 (508), pp. 1–20, 2006.

Mehlum, Halvor & Lind, Jo Thori (2010). With or Without U? The Appropriate Test for a U-Shaped Relationship. *Oxford Bulletin of Economics and Statistics*. ISSN 0305-9049. *72*(1), s 109- 118 . doi: 10.1111/j.1468-0084.2009.00569.x

Mnookin, Robert H., 2003. Strategic Barriers to Dispute Resolution: A Comparison of Bilateral and Multilateral Negotiations. Harvard Negotiation Literature Reviews 1.

Montet, C. and Daniel Serra, 2003. Game Theory and Economics. Palgrave MacMillan.

Muthoo, Abhinay 1999. Bargaining Theory with Applications. Cambridge University Press. Cambridge, UK.

Nakhle, C. (2010), 'Petroleum Fiscal Regimes: Evolution and challenges' in Philip Daniel, Michael Keen, and Charles McPherson (eds.) *The Taxation of Petroleum and Minerals: Principles, Problems and Practice.*

Nash, John F. Jr. 1950. The Bargaining Problem. *Econometrica*, Vol. 18, No. 2, 155 – 162.

Oil and Gas. (n.d.). In *Transparency International: the global coalition against corruption*. Retrieved from http://www.transparency.org/topic/detail/oil_and_gas.

Olsen, Willy H. (2008, March). "*Local content development – what will it take?*" PowerPoint presentation in Cambodia.

Osborne, Martin J. and Ariel Rubinstein, 1990. Bargaining and Markets. Academic Press, INC.

Osborne, Martin J. and Ariel Rubinstein. 1994. "A Course in Game Theory". The MIT Press.

Ray, D. and R. Vohra, 2001. Coalitional Power and Public Goods. Journal of Political Economy, 109, 1355 – 1383.

Ross, Michael L. 2014. What Have We Learned About the Resource Curse? UCLA Department of Political Science, Los Angeles, CA.

Roth, A., 1979. Axiomatic Models of Bargaining (Berlin:Springer-Verlag).

Rotillon, G., Tarik Tazdait, and Sylvain Zeghni, 1996. Bilateral or Multilateral Bargaining in the Face of Global Environmental Change? Ecological Economics, Vol. 18, 177 – 187.

Sachs, J-D & Warner, A-M, 1995. "Natural Resource Abundance and Economic Growth," Papers 517a, Harvard - Institute for International Development.

Sachs, Jeffrey D & Warner, Andrew M, 1997. "Sources of Slow Growth in African Economies," Journal of African Economies, Centre for the Study of African Economies (CSAE), vol. 6(3), pages 335-76, October.

Sachs, Jeffrey D. & Warner, Andrew M., 1997. "Sources of Slow Growth in African Economies," Journal of African Economies, Centre for the Study of African Economies (CSAE), vol. 6(3), pages 335-76, October.

Sachs, Jeffrey D. & Warner, Andrew M., 2001. "The Curse of Natural Resources," European Economic Review, Elsevier, Vol. 45(4-6), pages 827-838, May.

Smith, J., 2013. Issues in Extractive Resource Taxation: A Review of Research Methods and Models. Resources Policy, Vol. 38, 320 – 331.

Smith, J., 2014. A Parsimonious Model of Tax Avoidance and Distortions in Petroleum Exploration and Development. Energy Economics, Vol. 43, 140 – 157.

Stodghill, Ron "Oil, Cash and Corruption". Available at http://www.nytimes.com/2006/11/05/business/yourmoney/05giffen.html?pagewanted=all&_r=0. Accessed on November 5, 2006.

Tordo, Silvana, Michael Warner, Osmel E. Manzano, and Yahya Anouti. 2013. Local Content Policies in the Oil and Gas Sector. World Bank Study. Washington, DC: World Bank. Doi:10.1596/978-0-8213-9931-6. License: Creative Commons Attribution CC BY 3.0.

Tornell, A., Lane, P.R., 1999. The voracity effect. American Economic Review 89, 22–46.

Torvik, R., 2001. Learning by doing and the Dutch disease. European Economic Review 45, 285– 306.

Torvik, R., 2002. Natural resources, rent seeking and welfare. Journal of Development Economics, Vol. 67, 455– 470.

Treisman, D., 2000. The Causes of Corruption: A Cross-National Study. Journal of Public Economics 76, 399–457.

van der Ploeg, F. and Anthony J. Venables, 2011. Harnessing Windfall Revenues: Optimal Policies for Resource-Rich Developing Economies. Economic Journal, 121, 1 – 30.

van der Ploeg, F. and Anthony J. Venables, 2012. Natural Resource Wealth: The Challenge of Managing a Windfall. Annual Review of Economics, 4, 315 – 37.

van Wijnbergen, S., 1984. The 'Dutch disease': a disease after all? Economic Journal 94, 41–55 (March).

Venables, Anthony J. 2010. Resource Rents: When to Spend and How to Save. International Tax and Public Finance. 17, 340 – 56.

Venables, Anthony J. and P. Collier, 2010. International Rules for Trade in Natural Resources. Journal of Globalization and Development, 1, Issue 1, Article 8.

Vivoda, Vlado 2011. Bargaining Model for the International Oil Industry. *Business and Politics*: Vol. 13:Iss. 4, Article 3.

Wilpert, Gregory "*The Economics, Culture, and Politics of Oil in Venezuela*". Available at http://venezuelanalysis.com/analysis/74. Accessed on August 30, 2003.

Yeboah, Stephen "*How content would Ghana's Local Content Policy be*?" Available at http://www.modernghana.com/news/270556/1/how-content-would-ghanas-local-content-policy-be.html. Accessed on April 8, 2010.

Yi, S.-S., 1996. Endogenous Formation of Customs Unions Under Imperfect Competition: Open Regionalism is Good. Journal of International Economics 41, 153 – 177.