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Revenue Sharing and Control Rights in Team Production: Theories and Evidence from Joint Ventures.*

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Abstract

This paper presents a model of the joint venture that is grounded in the stylized facts we found from a sample of 200 joint venture contracts. The model incorporates the revenue-sharing contract into the incomplete contract frameworks of Grossman-Hart-Moore Property Rights Theory and the Transaction Cost Theory of the firm, and emphasizes the impact of expropriation. Joint control can be optimal as well as unilateral control. Our econometric analysis of the revenue-sharing and control arrangements offers strong support to our Property-Rights-Theory motivated model with self investment but rejects that with cooperative investment. The Transaction-Cost-Theory motivated model leaves some important empirical findings unexplained. Our findings also reject some of the existing theories of joint ownership.

Keywords: Joint Ventures, Control Right, Revenue-Sharing Contracts, Expropriation, Theory of the Firm. *JEL Classification Numbers:* D23, L14, L23

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1 Introduction

The joint venture is an increasingly popular form of organization. In China, the second largest recipient of inward foreign direct investment (FDI) in the world after the United States, 183,015 among 304,821 approved FDI projects between 1979 and 1997 were equity joint ventures; in the same period, 51% of the total value of FDI was invested in equity joint ventures (according to the statistics provided by China's Ministry of Foreign Trade and Economic Cooperation or *MOFTEC*). Despite its importance in the real world, the joint venture has not received as much attention as it should from economists. In particular, no work has been done to systematically document and explain the revenue sharing and control arrangements in joint ventures. Such work is important not only for understanding the joint venture but also for testing the empirical relevance of some theories of the firm. This paper attempts to fill this void.

Our empirical work is based on a unique sample of 200 joint venture contracts. For each joint venture, we have information about the assignment of tasks among joint venture partners, the distribution of revenue shares and voting shares, and the decision making rules for a number of decisions. A few stylized facts stand out. First, the partners in a joint venture are assigned different tasks. Second, both revenue-sharing and control arrangements figure prominently in the joint venture contracts. Third, control arrangements are made for a number of issues in each joint venture; some issues are under joint control by both partners and others are under unilateral control by one partner. Finally, revenue sharing and control arrangements vary across firms.

These findings suggest that a joint venture is a production team in which its partners play complementary roles. Three strands of the literature are particularly relevant to the understanding of such team production. The first one emphasizes the importance of revenue sharing contracts for solving the moral hazard problem (for example, Holmstrom, 1982). The other two, the Transaction Cost Theory (TCT) of the firm (Williamson, 1975, 1979, 1985; Klein, Crawford, and Alchian, 1978) and the Property Rights Theory (PRT) of the firm (GHM: Grossman and Hart, 1986; Hart and Moore, 1990; Hart, 1995), both consider control rights in the context of incomplete contracting, but with different focuses. The TCT approach focuses on the implication of control rights on transaction costs while the PRT approach focuses on the implication of ownership arrangements

on the distortion to ex ante investment incentives. All three strands of literature offer important insights but each is incomplete for the understanding of the joint venture. Specifically, the first literature does not address control issues, while the latter two are silent on revenue sharing. Furthermore, the Property Rights Theory focuses on ownership as the only control arrangement. In light of the empirical findings in the last paragraph, for a model to describe joint ventures, it needs to consider both revenue sharing and control arrangements, and their possible interaction, in the context of team production; it should also consider control arrangements beyond ownership; and finally it should predict joint control in some cases and unilateral control in others.[1]

Building on aforementioned strands of literature, we present a theoretical model with a few alternative specifications to describe joint ventures. Under the main specification, two partners start with a production plan, a revenue sharing contract, and the governance rule over a decision (not necessarily about the access to an asset). Then they each make some investment, which will affect their private benefits and a verifiable revenue that is to be shared between them. The initial plan is incomplete in that it is not fully contingent. Therefore, after the investment is made, there may be opportunities for the partners to adjust the initial production plan to respond to the changing market condition. The adjustment may be used to benefit both partners at least weakly, and it may also be abused to benefit one partner at the expense of the other, relative to their payoffs under the initial plan. We call the former type a Pareto-improving action and the latter a value-redistributing action. The two partners bargain over the adjustment decision, possibly with side payments. However, in the case of bargaining failure, the controlling partner adjusts the plan to maximize his payoff if the governance rule is unilateral control, and no adjustment is made to the plan if the rule gives the two partners joint control. We study the optimal revenue sharing and control arrangements in this model.

The value-redistributing action discussed above corresponds to what is often called expropriation of minority shareholders by majority shareholders. Recent research by Claessens et al. (1999) and La Porta et al. (2000) reveals that such expropriation is

[1] To the extent that our model considers both revenue sharing and control arrangements, it is related to Aghion and Bolton (1992) and Dewatripont and Tirole (1994). These papers address the relationship between an investor and an entrepreneur while our model studies the relationship between two partners in team production.

an important problem in publicly traded firms, perhaps more so than the conflict of interest between owners and managers. In closely held firms, oppression or squeeze-out of minority shareholders by majority shareholders is even worse due to the lack of legal and market protection for minority shareholders (see O'Neal, 1987, and O'Neal and Thompson, 1995).[2]

Under unilateral control, the inefficient value-redistributing action may or may not be taken without renegotiation, depending on the controlling partner's revenue share as the action reduces the amount of revenue to be shared. Under joint control, the Pareto-improving action will not be taken without renegotiation. The revenue sharing and control arrangements thus affect the partners' payoffs and consequently their investment incentives, even if renegotiation is possible because they affect the disagreement payoffs in the bargaining. An important determinant of the optimal control arrangements is the relative strength of the Pareto-improving action and the value-redistributing action.

There are two types of initial investment. The first type, self investment, increases the investor's own private benefit but has no effect on the other partner's. The second type, cooperative investment, has no effect on the investor's own private benefit but has a positive effect on the other partner's. The optimal control arrangement and the way the revenue sharing arrangement interacts with the control arrangement depend on the type of investment. We also consider two extreme assumptions about bargaining efficiency.

The model under the main specification incorporates the revenue sharing contract into the PRT of the firm. To facilitate comparison, we also do the same to the TCT. We accomplish this by eliminating the investment stage from the model. To highlight the cost of bargaining toward efficient decision, we also assume that bargaining cannot succeed in bringing the partners out of their disagreement position. The remainder of the main specification is maintained.

Given the plurality of assumptions and their corresponding implications, more empirical analysis is useful in addition to those findings reported earlier. The analysis can potentially help us compare the empirical relevance of alternative assumptions and deter-

[2]By relying on the principle of majority control and/or the business judgment rule, American courts have been reluctant to interfere in the internal affairs of closely held firms. In addition, the lack of an efficient and developed market for interests in closely held firms diminishes the informativeness of share prices. This makes it difficult for future investors to infer whether the controlling shareholders have engaged in expropriation, thereby weakening the reputation concerns of the controlling shareholders.

mine whether the predictions of our model under some given specification are consistent with the empirical evidence. This would shed light on the empirical relevance of the existing theories on which our model is built and of various extensions of the theories. It would also help us assess the empirical relevance of some of the existing models of the joint venture. Section 6 presents our econometric analysis of the revenue sharing and control arrangements, and discusses the implication of the empirical findings on our theory and some other theories.

The rest of the paper is organized as follows. Section 2 presents some basic facts about joint ventures that we found from our sample. Section 3 sets up our theoretical model, which is analyzed under the main assumptions in Section 4 and under alternative assumptions in Section 5. After the empirical analysis, Section 7 concludes the paper.

2 Some Basic Facts about Joint Ventures

This section presents some basic findings about revenue-sharing and control arrangements in equity joint ventures from a unique data set. The data set resulted from a series of efforts made between 1997 and 1998. We started with a pilot sample of 20 international joint-venture contracts in China.[3] After studying these 20 contracts, we designed a questionnaire, which was then used to extract key contract clauses of 200 joint-venture contracts with the help of China's Ministry of Foreign Trade and Economic Cooperation.

2.1 Descriptive statistics

The contracts in the data set were signed in the period 1986-1996, with 66% of them concentrated in 1993-1994 (see Figure 1). The mean of registered capital is US$12 mil-

[3] To set up a joint venture, all parties must first reach an agreement on the project and sign a *contract* delineating each and every party's contributions to the proposed venture. This joint-venture contract specifies the equity-sharing arrangement and the composition of the board of directors. All parties must also agree on *articles of association* that specify the governance structure of the joint venture, including the rights and voting rules of the board of directors. Hence, the term *joint-venture contract* in this paper refers to these two legal documents. For description of procedures for forming a joint venture in China, see Rosen (1999).

lion. Of the 200 joint ventures, 92.5% have one (156) or two (29) Chinese partners, and 97.5% involve one (172 joint ventures) or two (23) foreign partners (see Tables 1a-1b). As in the overall population of joint ventures established in this period (China Statistical Yearbook, various years), the majority of the foreign partners in our sample are from Hong Kong (94), United States (39), and Japan (31); see Tables 2a for details. Chinese partners are from all provinces except six economically backward ones (Jiangxi, Guizhou, Yunnan, Tibet, Qinghai, and Ningxia). Not surprisingly, the Chinese partners are heavily concentrated in the more economically developed regions such as Beijing (122), Shanghai (26), Jiangsu (21), and Guangdong (21); see Table 2b for details. Consequently, 68.5% of the 200 joint ventures are physically located in these four regions (Table 2c).

Table 3a lists the range of businesses involved by the 200 joint ventures. Represented are all SIC single-digit businesses except A (Agriculture, Forestry, and Fishing), B (Mining), J (Public Administration), and K (unclassifiable Establishments). In addition, 18 out of 20 two-digit manufacturing industries are covered; and the two left out are tobacco products (SIC code 21), and petroleum and coal products (SIC code 29), which have been heavily protected industries in China due to their profitability or importance to the general economy (Table 3b).[4] The distribution of the 55 joint ventures in the category of services at the two-digit SIC level is shown in Table 3c. Overall, we have a rather balanced and representative sample of joint ventures.

2.2 Revenue-sharing and control arrangements

The joint venture has been argued as a means to utilize complementary skills of different corporations. Figure 2 depicts the pattern of task assignment to joint-venture partners in our sample. There is strong evidence of task specialization between the Chinese and foreign partners. The Chinese partners are typically assigned to help the joint ventures secure business license, hire local employees, procure local inputs and arrange supply of utilities, whereas the foreign partners are asked to contribute intellectual property,

[4] There are three joint ventures each covering 2 two-digit manufacturing industries (the first one has SIC codes 22 and 23; the second one has SIC codes 30 and 31; and the third one gets codes 36 and 38).

procure inputs from overseas market, provide staff training, and assist export. The observed pattern of task specialization reflects the comparative advantages of Chinese and foreign firms.

Figure 3 reveals the distribution of the foreign partner's equity share in our sample.[5] To the contrary of common perceptions, there is no upper limit on foreign ownership in China except for selected industries. However, there is a de facto lower limit on foreign ownership, as joint ventures with a minimum of 25% foreign ownership are entitled to preferential treatment with respect to corporate income tax (Rosen, 1999). This explains why there are 18 joint ventures (9% of the sample) in which the foreign partners hold 25% equity shares. It is also interesting to note that there are 43 joint ventures (21.5% of the sample) in which the foreign partners and Chinese partners each hold 50% equity shares; such joint ventures are also called 50-50 joint ventures.

The highest decision-making body in a joint venture is the *board of directors*. The joint-venture partners can nominate candidates to sit on the board and represent their interests. We find that the number of board members nominated by the foreign partner in a joint venture is generally proportional to its equity shares. The correlation between the equity share of the foreign partner and its voting share (defined as the percentage of board members nominated by the foreign partner) is 77.68%. As shown in Table 4, in 131 out of 157 non 50-50 joint ventures,[6] the majority partner has more than 50% representation on the board of directors. Of the forty-three 50-50 joint ventures, 28 involve equal board representation by the Chinese and foreign partners.

However, exercise of control rights in a joint venture depends on the voting rules as well as the board representation. We find that voting rules are specified in the joint venture contracts for some fifteen important decisions: (1) changing the corporate charter, (2) terminating or dissolving the joint venture, (3) increasing or transferring registered capital, (4) merging with other organizations, (5) approving important reports from management, (6) approving the budget and profit/loss allocation, (7) approving important joint venture regulations, (8) approving external borrowing, (9) hiring consultants, (10) designing employment contracts, (11) establishing/closing subsidiaries, (12)

[5] If two or more foreign partners are involved in a joint venture, their equity shares are added up.

[6] That is, either the Chinese partner or the foreign partner holds more than 50% equity shares.

hiring/firing CEO and other senior management staff, (13) liquidating assets upon completion or termination of the joint venture, (14) disposing other important assets, and (15) making other important decisions that should be made by the board. Furthermore, different voting rules, ranging from simple majority voting, two-thirds majority voting to unanimous voting, are stipulated for different decisions within each joint venture. As shown in Figure 4, unanimous voting is almost universally required for change of the corporate charter (191 out of 200 joint ventures), termination or dissolution of the venture (188), merger with other organizations (188), and increase or transfer of registered capital (187). Two-thirds majority voting is heavily used for approval of important reports from management (70 out of 200 joint ventures), and approval of the budget and profit/loss allocation (70). It should be noted, however, that simple majority voting rule is not the most commonly specified rule for any of the fifteen important decisions. Meanwhile, in some joint ventures, no voting rule is specified for some of the fifteen decisions such as hiring consultants (192 out of 200 joint ventures) and designing employment contracts (158 out of 200 joint ventures). We believe that simple majority voting is the default voting rule, which explains the above two observations.

Of the fifteen decisions listed above, CEO appointment receives special attention in joint venture contracts. There is a separate section on how the CEO is chosen in every joint venture contract in our sample. Specifically, 38 out of 200 joint venture contracts simply say that the board of directors decides on the CEO appointment; 66 contracts specify that the Chinese partner nominates a CEO candidate for board approval; 83 contracts specify that the foreign partner nominates a CEO candidate for board approval; and most interestingly, 13 contracts stipulate that the Chinese and foreign partners jointly nominate a CEO candidate for board approval.

Given the board composition of a joint venture, the control arrangements of the above-mentioned decisions except that of CEO appointment (i.e., decision #12) can be determined based on the specific voting rules adopted.[7] Joint control is said to be in place, (a) when a decision requires simple majority voting but one of the partners (Chinese or foreign) has a board representation of exactly 1/2, (b) when a decision

[7] Simple majority voting rule is assumed for any decision the voting rule of which is not specified in the contract.

requires two-thirds majority voting but one of the partners (Chinese or foreign) has a board representation between 1/3 and 2/3, and (c) when the decision requires unanimous voting. Under each of the above three circumstances, neither the Chinese partner nor the foreign partner can make the decision without the other partner's consent.

For the control arrangement of CEO appointment, we consider the specific CEO nomination process in addition to the comparison of voting rule vis-a-vis board composition discussed in the above paragraph. If one partner controls the CEO nomination but the other partner has unilateral control in the board, then joint control is said to be in place. If both partners need to agree upon the CEO nomination, then joint control is in place irrespective of who controls the board.

Overall we find that there is a high degree of joint control for all fifteen decisions (Figure 5). Even the lowest degree of joint control among the decisions, 48 out of 200 joint ventures for the decision of hiring consultants, is quite significant. For the decision of CEO appointment, joint control is in place for 130 out of 200 joint ventures. The degree of joint control is over 95% for decisions on change of the corporate charter, termination or dissolution of the venture, increase or transfer of registered capital, and merger with other organizations. These results also indicate that the degree of joint control versus unilateral control varies from one decision to another within each joint venture.

Conventional wisdom has that joint control is more likely in 50-50 joint ventures as compared with other joint ventures. To test this conjecture, we split our sample into two: one for 157 non 50-50 joint ventures, and the other for forty-three 50-50 joint ventures. We find that the degree of joint control is indeed much higher in the 50-50 joint ventures than in the non 50-50 joint ventures though there is little difference in terms of voting rules (see Figures 4a-b and 5a-b on voting rules and control arrangements, respectively). Even for the non 50-50 joint ventures, however, the degree of joint control is still significant for most of the fifteen decisions.

In summary, our main findings about joint ventures include: (1) Partners play complementary roles. (2) The revenue sharing rules vary across firms. (3) The revenue shares and the voting shares of the partners are highly positively correlated. (4) Rules are set for the making of many decisions and the rules vary across decisions. (5) Joint

control is prevalent.

3 A Theoretical Framework

In this section, we present a theoretical model that is motivated by the empirical findings reported in the last section.

3.1 Model primitives

We consider a joint project between two partners, henceforth called A and B. To ensure the joint project to be successful, the two partners come up with a detailed production plan about the quality and quantity of the goods or services to be produced and the mode of production. Following the existing literature on incomplete contracts, we assume that it is impossible to write a fully contingent production plan before the partners start to work on the project. Therefore, after the market condition is realized, the production plan written ex ante can be found to be inefficient for the given market condition and it should be modified. Then, it is important for the partners to specify rules (or control arrangements) according to which the ex ante production plan will be modified.

With the above considerations, the sequence of events is assumed as follows. At date 0, the two partners negotiate to settle on a production plan and rules for modifying the plan. They also sign a revenue-sharing contract. At date 1, A and B choose efforts, denoted by α and β, respectively. For ease of exposition, we also call a partner's effort his investment in the joint project.[8] At date 3, a decision is made about whether or not and, if yes, how to modify the ex ante contracted production plan, and the gains from trade are realized. We denote the decision by δ and normalize the ex ante contracted production plan to be $\delta = 0$. At date 2 – after the investments but before decision δ is made – the two partners may bargain over δ.

The joint project produces a verifiable revenue R. In addition, each partner derives some private benefit P_j (where $j = A, B$) from the joint project that is not contractible.

[8] In Section 5.4, we will consider an alternative model where no investment is made at date 1.

We assume that

$$\begin{aligned} R &= r(\delta)y(\alpha,\beta), \\ P_A &= a(\delta)y_A(\alpha,\beta), \\ P_B &= b(\delta)y_B(\alpha,\beta), \end{aligned}$$

where y is increasing and concave in (α,β), while y_A and y_B are non-decreasing and concave (possibly weakly) in (α,β). For simplicity of analysis, α and β are normalized to be the investment costs.

The investment of a partner (α or β) is often difficult to measure and then is not contractible. To induce investment, at date 0 the two partners sign a contract linking the partners' income to the outcome of the joint project. Since the private benefits are not contractible, the incentive contract is only on verifiable revenue R. For simplicity, we focus on linear revenue-sharing rules. Denote partner A's revenue share by s and the lump-sum transfer from B to A by F. Then the contract gives A a revenue of $sR+F$ and B a revenue of $(1-s)R-F$.

The partners also assign control rights over the joint project at date 0. There are two possible arrangements: (1) unilateral control by either A or B, and (2) joint control by A and B. Under unilateral control, the controlling party can modify the ex ante contracted production plan to maximize his own payoff instead of the total surplus, while under joint control, no modification to the ex ante contracted plan can be made without the two parties agreeing otherwise. Therefore, in both cases, there is room for the parties to bargain to reach a more efficient decision. We consider two extreme cases of bargaining. In the main case, we assume that, at date 2, decision δ becomes contractible and there is no asymmetric information about the benefits. Then, under each of the two possible control arrangements, the two parties will bargain successfully at date 2 without delay to reach an ex post efficient decision. In the other case, we assume that bargaining is so inefficient that it never succeeds in moving the partners beyond their disagreement payoffs. Except in Sections 5.3 and 5.4, we focus on the main case.

3.2 The ex post decision

Before analyzing the partners' bargaining over the ex post decision δ, we elaborate what the controlling partner can do with the decision-making power. First, the controlling partner can expropriate the revenue of the joint venture and the other partner's private benefit. Such expropriation can take a variety of forms. The controlling partner of a joint venture may sell the assets of the joint venture at below-the-market prices to another entity controlled by its parent company. It may also sell products of the joint venture to (or buy inputs from) its parent company at below-the-market (or above-the-market) prices. Such self-dealing activities benefit the parent company of the controlling partner at the expense of the joint venture. In other words, they redistribute values (or benefits) between the partners relative to their payoffs under the ex ante contracted production plan. For more and detailed examples, see O'Neal (1987), O'Neal and Thompson (1995), and Shishido (1987).

In addition to expropriation, the controlling partner can use his power to enhance the value of the joint venture. In the example of selling the products or the assets, the controlling partner can use his discretion to sell to a third party at the highest possible price given the prevailing market condition. Such activities result in Pareto improvements over the ex ante contracted production plan.

To formalize the above discussion, we assume that the ex post decision consists of three dimensions of actions. The first dimension of actions, denoted by d_A, increases partner A's private benefit at the expense of the verifiable revenue and partner B's private benefit. d_B is symmetric to d_A. In contrast to the first two, the third dimension of actions, denoted by d, increases both partners' private benefits as well as the verifiable revenue. Hence we have $\delta = (d_A, d_B, d)$. It should be clarified that d_A, d_B, and d are three dimensions of the same decision and cannot be assigned to different partners.

For simplicity, we further impose the following structure on $r(\delta)$, $a(\delta)$, and $b(\delta)$:

$$\begin{aligned} r(d_A, d_B, d) &= r_1 - r_2 d_A - r_3 d_B + r_4 d, \\ a(d_A, d_B, d) &= a_1 + a_2 d_A - a_3 d_B + a_4 d, \\ b(d_A, d_B, d) &= b_1 - b_2 d_A + b_3 d_B + b_4 d, \end{aligned}$$

where r_i, a_i, and b_i are all positive and d_A, d_B, $d \in [0, 1]$, with $(d_A, d_B, d) = (0, 0, 0)$

representing the ex ante contracted production plan.

As a benchmark, note that the ex post efficient decision maximizes the sum of the two partners' payoffs, namely $R + P_A + P_B$. Denote the ex post efficient choice by (d_A^*, d_B^*, d^*). It is clear that $d^* = 1$. We assume that expropriation is never efficient. That is,

$$\begin{aligned} a_2 y_A &< r_2 y + b_2 y_B, \\ b_3 y_B &< r_3 y + a_3 y_A. \end{aligned}$$

Then $(d_A^*, d_B^*) = (0, 0)$.

3.3 Specification of the bargaining game

We use the Nash bargaining solution to model the date 2 bargaining process between the partners. Let V_j be partner j's disagreement payoff, for $j = A, B$. Since the date 3 decision is usually inefficient without prior agreement, there is potential for efficiency gain from bargaining. We call this potential gain the *renegotiation surplus*, which is given by

$$RS = \max_{\delta}(R + P_A + P_B) - (V_A + V_B).$$

Under the Nash bargaining solution, the payoff to partner j is

$$W_j = V_j + \lambda_j RS$$

for $j = A, B$, where λ_j is partner j's bargaining power and $\lambda_A + \lambda_B = 1$. Denote $\lambda_A = \lambda$.

Under joint control, the ex ante contracted production plan cannot be modified, i.e., $(d_A, d_B, d) = (0, 0, 0)$ prevails, in the absence of bargaining between the two partners at date 2. Then the disagreement payoffs are

$$\begin{aligned} V_A &= a_1 y_A + s r_1 y, \\ V_B &= b_1 y_B + (1 - s) r_1 y. \end{aligned}$$

Note that, due to the ex ante production plan, the partners still jointly produce verifiable revenue $r_1 y(\alpha, \beta)$. Consequently, the ex ante revenue-sharing contract s affects the disagreement payoffs and therefore the investment incentives of the partners.

Under unilateral control by partner A, without successful bargaining at date 2, A chooses (d_A, d_B, d) at date 3 to maximize his own payoff, i.e.,

$$\max_{(d_A,d_B,d)} \quad (a_1 + a_2 d_A - a_3 d_B + a_4 d) y_A(\alpha, \beta) \\ + s(r_1 - r_2 d_A - r_3 d_B + r_4 d) y(\alpha, \beta).$$

Specifically, A chooses $d_B = 0$; $d = 1$; and $d'_A = 0$ if $s \geq a_2 y_A(\alpha, \beta)/[r_2 y(\alpha, \beta)]$, and $d'_A = 1$ otherwise, where d'_A denotes A's choice of d_A. A chooses $d = 1$ because d increases both the verifiable revenue and A's own private benefit, and $d_B = 0$ because d_B decreases both the verifiable revenue and A's private benefit. The choice of d_A is less straightforward, as d_A increases A's private benefit at the expense of the verifiable revenue. Intuitively, A chooses to shift money from the verifiable revenue to his private benefit if he does not have a significant revenue share. Note that, A's choice of δ is independent of the ex ante production plan. Therefore, the ex ante production plan is irrelevant under unilateral control by A. However, the ex ante revenue-sharing contract s affects the parties' disagreement payoffs as in the case of joint control, and hence the investment incentives of the partners.

Similar analysis can be carried out for the case that partner B has the unilateral control. His optimal choice is: $d_A = 0$; $d = 1$; and $d'_B = 0$ if $s \leq 1 - b_3 y_B(\alpha, \beta)/[r_3 y(\alpha, \beta)]$, and $d'_B = 1$ otherwise, where d'_B denotes B's choice of d_B.

The above analysis shows that both the revenue-sharing contract and the control arrangement affect investment incentives. In the remainder of this paper, we discuss the optimal choice of both revenue-sharing and control arrangements.

4 Optimal Revenue-Sharing and Control Arrangements

To highlight the main results of the model, we first focus on the case where a partner's private benefit depends only on his own investment and the verifiable revenue is a linear combination of the partners' private benefits. Specifically, $y_A(\alpha, \beta) = y_A(\alpha), y_B(\alpha, \beta) =$

$y_B(\beta)$, and $y(\alpha, \beta) = y_A(\alpha) + \mu y_B(\beta)$, where $\mu > 0$ is a constant. In this case, α and β are self investments regarding to the private benefits. In Section 5.1, we will consider the opposite case where α and β are cooperative (or cross) investments. In Section 5.2, we will consider the more general case where the investments contain both self-benefiting and cooperative elements and the verifiable revenue is not necessarily a linear combination of the private benefits.

Given the specification of revenue and private benefits, the partners' ex post payoffs are linear combinations of $y_A(\alpha)$ and $y_B(\beta)$.[9] At date 1, partner A chooses α to maximize his payoff W_A net of investment cost α, and partner B chooses β to maximize his payoff W_B net of investment cost β. Straightforward computation yields that the ex ante investments are determined by the following first-order conditions:

$$\begin{aligned} c_1^i y_A'(\alpha) &= 1, \\ c_2^i y_B'(\beta) &= 1, \end{aligned}$$

where the superscript $i = J$, A, or B, depending on whether the ex post decision is under joint control, the unilateral control by A, or the unilateral control by B, and

$$c_1^J = a_1 + sr_1 + \lambda(a_4 + r_4), \tag{1}$$

$$c_2^J = b_1 + (1-s)\mu r_1 + (1-\lambda)(b_4 + \mu r_4), \tag{2}$$

$$c_1^A = a_1 + a_4 + s(r_1 + r_4) + d_A'[a_2(1-\lambda) + r_2(\lambda - s)], \tag{3}$$

$$c_2^A = b_1 + b_4 + (1-s)\mu(r_1 + r_4) + d_A'[\mu r_2(s-\lambda) - \lambda b_2], \tag{4}$$

$$c_1^B = a_1 + a_4 + s(r_1 + r_4) + d_B'[r_3(\lambda - s) - a_3(1-\lambda)], \tag{5}$$

$$c_2^B = b_1 + b_4 + (1-s)\mu(r_1 + r_4) + d_B'[\mu r_3(s-\lambda) + \lambda b_3]. \tag{6}$$

We will call a pair of incentive coefficients (c_1, c_2) a reduced incentive structure. These coefficients are determined by the revenue sharing contract and the control arrangement.

As a result of efficient bargaining, the ex post efficient decision (i.e., $(d_A^*, d_B^*, d^*) = (0, 0, 1)$) will be taken at date 3, and then the total net surplus (the sum of the two

[9] We will focus on cases where d_A' and d_B' are independent of α and β.

partners' payoffs net of their investment costs) will be

$$(r_1 + r_4 + a_1 + a_4)y_A(\alpha) + (\mu r_1 + \mu r_4 + b_1 + b_4)y_B(\beta) - \alpha - \beta.$$

To facilitate exposition, we define $U(c_1, c_2)$ as the total net surplus when the ex post decision δ is chosen efficiently and the investment levels are determined by the reduced incentive structure (c_1, c_2), namely,

$$\begin{aligned} U(c_1, c_2) = \quad & (r_1 + r_4 + a_1 + a_4)y_A(\alpha) + (\mu r_1 + \mu r_4 + b_1 + b_4)y_B(\beta) - \alpha - \beta \\ s.t. \quad & c_1 y'_A(\alpha) = 1, \\ & c_2 y'_B(\beta) = 1. \end{aligned}$$

4.1 The Benchmark

Before comparing various control arrangements in terms of the total net surplus, we discuss a benchmark case of "central" control where the ex post efficient decision (i.e., $(d_A^*, d_B^*, d^*) = (0, 0, 1)$) is made by a fictitious "central authority" without renegotiation. Under "central" control, the incentive coefficients are $c_1 = s(r_1 + r_4) + a_1 + a_4$ and $c_2 = (1 - s)\mu(r_1 + r_4) + b_1 + b_4$, and the total net surplus is $U(c_1, c_2)$ for given revenue sharing contract s. As s increases from 0 to 1, the reduced incentive structure (c_1, c_2) moves along an incentive line of

$$\mu c_1 + c_2 = \mu(r_1 + r_4) + \mu(a_1 + a_4) + b_1 + b_4, \tag{7}$$

and choosing s is equivalent to choosing a pair (c_1, c_2) along the line. The sharing rule that maximizes $U(c_1, c_2)$ subject to constraint (7) is called the second-best sharing rule, or $s = s^{SB}$.[10] The corresponding investments are $\alpha = \alpha^{SB}$ and $\beta = \beta^{SB}$. This is the optimal outcome under "central" control. Figure 6 illustrates the second-best outcome with the help of the following lemma, both conditions of which are satisfied when y_A and y_B are power functions with the power between 0 and 1.

[10] We call this the second best because it is optimal under the constraint that effrot is not contractible and each partner chooses his effort level to maximize his own payoff. Under the first-best outcome where the partners' efforts are chosen to maximize their joint payoff, the incentive coefficients for partners A and B are, respectively, $r_1 + r_4 + a_1 + a_4$ and $\mu r_1 + \mu r_4 + b_1 + b_4$.

Lemma 1: *Let* $(y'_A)^{-1}(1/c_1)$ *denote the inverse function of* y'_A *evaluated at* $1/c_1$ *and similarly for* $(y'_B)^{-1}(1/c_2)$. *Suppose* $(y'_A)^{-1}(1/c_1)$ *is convex and* $y_A[(y'_A)^{-1}(1/c_1)]$ *is concave in* c_1, and $(y'_B)^{-1}(1/c_2)$ *is convex and* $y_B[(y'_B)^{-1}(1/c_2)]$ *is concave in* c_2. *Then* $U(c_1, c_2)$ *is a concave function of* c_1 *and* c_2. *Furthermore,* $\partial U/\partial c_1 > 0$ *if and only if* $c_1 < r_1 + r_4 + a_1 + a_4$, *and* $\partial U/\partial c_2 > 0$ *if and only if* $c_2 < \mu r_1 + \mu r_4 + b_1 + b_4$.

Contrary to the assumption for the second-best outcome, the ex post efficient decision may not be possible without renegotiation and therefore the second-best outcome is not necessarily achieved. The final payoffs after the renegotiation, and therefore the incentive coefficients c_1 and c_2, depend on the control arrangement.

4.2 Joint Control by A and B

Consider first joint control by A and B. Recall from (1)-(2) that the partners' incentive coefficients are $c_1 = sr_1 + \lambda r_4 + a_1 + \lambda a_4$ and $c_2 = \mu(1-s)r_1 + \mu(1-\lambda)r_4 + b_1 + (1-\lambda)b_4$, and the total net surplus under joint control is $U(c_1, c_2)$. As s increases from 0 to 1, the reduced incentive structure (c_1, c_2) moves along an incentive line of

$$\mu c_1 + c_2 = \mu(r_1 + r_4) + \mu(a_1 + a_4) + b_1 + b_4 - \mu(1-\lambda)a_4 - \lambda b_4. \tag{8}$$

The sharing rule that maximizes $U(c_1, c_2)$ subject to constraint (8) is the optimal sharing rule under the joint control, or $s = s^J$. However, as the incentive line for joint control is below that for the second-best [(8) as compared to (7)], joint control is always worse than the second-best.

Proposition 1 *Joint control is always worse than "central" control (or the second-best).*

To understand the intuition for Proposition 1, compare equations (7) and (8). Let us call the right-hand side of each equation the *total incentive power* for the corresponding case. We can see that the total incentive power under joint control is less than that under the second-best by $\mu(1-\lambda)a_4 + \lambda b_4$. The reason for this loss of total incentive power

under joint control is as follows. Under joint control, the ex post efficient decision is only made after the two partners reach an agreement in their bargaining. A requirement for the agreement is a swap of benefits between the partners: part of B's private benefit goes to A's final payoff and vice versa. Indeed, we can show that A's payoff contains $\lambda b_4 y_B$ and B's payoff contains $(1-\lambda)a_4 y_A$. Since neither of the partners cares about the other partner's payoff, such a swap of benefits reduces the total incentive power for the two partners. Under the second-best, however, the ex post efficient decision is made without renegotiation and thus there is no loss of total incentive power. It is this difference in the total incentive power that makes joint control less efficient than the second-best outcome.

We next consider unilateral control. To clearly illustrate the main points, we focus on two sets of parameter conditions specified below.[11]

4.3 Unilateral Control When Expropriation *Can* Be Avoided Without Renegotiation

Suppose $s^{SB} \geq a_2/r_2$. Then $s^{SB} > a_2 y_A(\alpha)/\{r_2[y_A(\alpha) + \mu y_B(\beta)]\}$ for any α and β. It follows from our analysis in Section 3.3 that, given $s = s^{SB}$, A as a controlling partner will always choose $d'_A = 0$ regardless the values of α and β. By substituting $d'_A = 0$ into (3) and (4), we obtain the partners' incentive coefficients: $c_1 = s(r_1 + r_4) + a_1 + a_4$ and $c_2 = (1-s)\mu(r_1+r_4)+b_1+b_4$. Note that the coefficients are the same as those under the second-best, because the ex post efficient decision is made by A without any bargaining. Hence, A and B will choose the second-best investments, α^{SB} and β^{SB}. Therefore, the second-best outcome is guaranteed under A's control. In summary, we have:

Proposition 2 *If $a_2 \leq s^{SB} r_2$, A's control can yield the second-best outcome and is thus better than joint control.*

[11] A complete analysis without these restrictions on the parameters yields qualitatively similar results, and the detailed proof is available upon request.

Proposition 2 says that unilateral control by A is better than joint control if A's gain in private benefit (a_2) from expropriating B is small relative to the total loss of verifiable revenue (r_2). This result is not surprising. When A cannot gain very much private benefit from his opportunistic behavior, the loss of his portion of the verifiable revenue dominates and he then has no incentive to engage in the opportunistic behavior. Then A as a controlling partner voluntarily makes only the Pareto-improving changes to the ex ante contracted production plans, which is the second-best outcome.

A result similar to Proposition 2 can also be derived for B's unilateral control. The suboptimality of joint control given in Proposition 2 corresponds to that derived from the GHM model.

The next result concerns the relationship between revenue sharing and control arrangements.

Proposition 3 *Suppose $a_2 = b_3$ and $r_2 = r_3$. Then: (i) If $min\{s^{SB}, 1 - s^{SB}\} \geq a_2/r_2$, A's control and B's control are equally efficient and are both better than joint control. (ii) If $min\{s^{SB}, 1 - s^{SB}\} < a_2/r_2 \leq max\{s^{SB}, 1 - s^{SB}\}$, the partner with majority revenue share should have the control right. (iii) In both cases, $s = s^{SB}$ and the second-best is achieved.*

Proposition 3 can be restated as follows. Suppose the effects of expropriation on the partner's own private benefit and on the verifiable revenue are the same across partners. Then: (i) If the gain in private benefit is small relative to the loss in verifiable revenue for both partners, unilateral control under each partner is better than joint control. (ii) If the gain in private benefit is small relative to the loss in verifiable revenue for one partner but the opposite is true for the other partner, the first partner should be assigned both the control right and the majority of revenue share. (iii) In both cases, the second-best can be achieved by giving the controlling partner the second-best level of revenue share.

Under the condition specified in Proposition 3(i), as a controlling partner, neither A nor B would choose an ex post inefficient decision. Thus the second-best outcome is obtained under each partner's unilateral control. Under the condition specified in Proposition 3(ii), however, the partner with a lower revenue share would choose an ex

post inefficient decision while the partner with a higher revenue share would choose the ex post efficient decision. Thus, the second-best outcome is obtained only when the partner with a higher revenue share has the control rights. Intuitively, a controlling partner's cost of expropriating the other partner is higher if he has a higher share of the verifiable revenue. To the extent that the controlling partner's expropriation can be made an empty threat and hence the second-best outcome can be obtained, he should be given a larger share of the revenue for this purpose. In this case, revenue-sharing contracts and control arrangements are complements in the provision of incentive for team production.[12]

4.4 Unilateral Control When Expropriation *Cannot* Be Avoided Without Renegotiation

Suppose $a_2 y_A(\alpha) > r_2[y_A(\alpha) + \mu y_B(\beta)]$ for all α and β. Then, for all s, we have $a_2 y_A(\alpha)/\{r_2[y_A(\alpha) + \mu y_B(\beta)]\} > 1 \geq s$. It follows from our analysis in Section 3.3 that A as a controlling partner will always choose $d'_A = 1$ regardless the values of α and β. By substituting $d'_A = 1$ into (3) and (4), we get the partners' incentive coefficients: $c_1 = s(r_1+r_4)+a_1+a_4+(\lambda-s)r_2+(1-\lambda)a_2$ and $c_2 = (1-s)\mu(r_1+r_4)+b_1+b_4+(s-\lambda)\mu r_2-\lambda b_2$. As s increases from 0 to 1, the reduced incentive structure (c_1, c_2) moves along an incentive line

$$\mu c_1 + c_2 = \mu(r_1 + r_4) + \mu(a_1 + a_4) + b_1 + b_4 + \mu(1 - \lambda)a_2 - \lambda b_2. \tag{9}$$

If $\mu(1-\lambda)a_4+\lambda b_4 < \lambda b_2-\mu(1-\lambda)a_2$, the incentive line under unilateral control by A [i.e., (9)] is below that under joint control [i.e., (8)]. If we further assume that the optimal revenue-sharing contract under joint control, s^J, is *interior* (hence, the indifference curve passing through s^J is above the incentive line under A's control), then unilateral control by A is worse than joint control. Therefore, we have

[12]For a widely held firm, the one-share-one-vote rule ensures that controlling shareholders sell their stake to a corporate raider who can manage a higher value of the firm's securities but not his private benefit of control (Grossman and Hart, 1988; Harris and Raviv, 1988).

Proposition 4 *Suppose* $a_2 y_A(\alpha) > r_2[y_A(\alpha) + \mu y_B(\beta)]$ *for all* α *and* β. *Further assume that the optimal revenue-sharing contract under joint control,* s^J, *is interior. Then, if*

$$\mu(1-\lambda)a_4 + \lambda b_4 < \lambda b_2 - \mu(1-\lambda)a_2, \tag{10}$$

A's control is worse than joint control.

Proposition 4 says that, given the loss of total incentive power under joint control $[\mu(1-\lambda)a_4 + \lambda b_4]$, A's control is worse than joint control if A's gain in private benefit (a_2) from expropriating B is small relative to the resulting loss in B's private benefit (b_2).

The intuition for Proposition 4 is related to that for Proposition 1. Given that $a_2 y_A(\alpha) > r_2[y_A(\alpha) + \mu y_B(\beta)]$ for all α and β, A as the controlling partner will choose $d'_A = 1$ unless he is bribed by B to do otherwise. The amount of bribe that B has to pay increases with A's potential gain, $a_2 y_A$, and B's potential loss, $b_2 y_B$, from $d'_A = 1$. Therefore, A has higher, and B has lower, incentives for investment. However, the total incentive power is reduced by $\lambda b_2 - \mu(1-\lambda)a_2$ [or the right-hand side of (10)] compared with the second-best. If b_2 is very large, so that this loss of total incentive power is larger than the loss of total incentive power under joint control [i.e., $\mu(1-\lambda)a_4 + \lambda b_4$, or the left-hand side of (10)], then the incentive line under A's control is below that under joint control. This implies that unilateral control by A is worse than joint control, because s^J is interior.

Finally, we address the question of whether the controlling partner should be given the majority of revenue share. To highlight our main point, we consider a (partially) symmetric case where $\mu = 1, a_1 = b_1, a_4 = b_4, \lambda = 1/2$, and $y_A(\cdot) = y_B(\cdot)$. The incentive line under A's control is higher than that under joint control if condition (10) is violated (i.e., $a_2 - b_2 + a_4 + b_4 > 0$), and it is also higher than that under B's control if $a_2 - b_2 + a_3 - b_3 > 0$. Thus, in this symmetric case, the mid point of the incentive line under A's control is the one closest to the first best, and it can be obtained by giving partner B a majority of revenue share if $a_2 + b_2 < 2(r_1 + r_4 - r_2)$. Intuitively, as partner A cannot be prevented from expropriating partner B, it obtains significant incentive from the control arrangement. Given the equal importance of the two partners in the

joint project, partner B should then be given the majority of revenue share to achieve a balance in the provision of incentive. Hence revenue-sharing contracts and control arrangements are substitutes, in contrast to the case of Proposition 3. We summarize the above results in Proposition 5.

Proposition 5 *Suppose* $a_2 y_A(\alpha) > r_2[y_A(\alpha) + \mu y_B(\beta)]$ *for all* α *and* β, $\mu = 1$, $a_1 = b_1$, $a_4 = b_4$, $\lambda = 1/2$, *and* $y_A(\cdot) = y_B(\cdot)$. *If* $a_2 - b_2 + a_4 + b_4 > 0$, $a_2 - b_2 + a_3 - b_3 > 0$, *and* $a_2 + b_2 < 2(r_1 + r_4 - r_2)$, *then A's control is uniquely optimal but the optimal revenue share for A is less than 50%.*

Note that this result of substitution between the control right and the revenue share is derived for the case with a great deal of symmetry between the partners. In the asymmetric case, as one partner's importance increases relative to the other partner's, the first partner's control right and revenue share should both increase, at least weakly.

Results similar to Propositions 4-5 can also be derived for B's unilateral control. An immediate implication of the propositions in this section and their counterparts for the case of unilateral control by B is that joint control can be optimal only when there is potential for expropriation.

5 Alternative Assumptions

In our analysis so far, we have maintained two important assumptions. One is that each partner's investment is self-investment that does not affect the other partner's private benefit. The other is that the ex post bargaining is efficient so that the ex post efficient decision will always be taken without delay after some transfer is made. In this section, we consider alternatives and extensions to these assumptions. We will also consider a model where there is no ex ante investment. To economize on exposition, we will omit explicit consideration of unilateral control by B in part of this section as it is symmetric to unilateral control by A.

5.1 Cooperative investment

Recent literature on the theory of the firm has paid considerable attention to cooperative investment, a party's investment that has a positive effect on the private benefit of his trading partner. For example, Che and Hausch (1999) show that it is optimal not to write any ex ante contract at all when the investments made by the trading partners are cooperative. Segal and Whinston (2000) argue that ex post renegotiation is desirable when one partner's investment has a direct externality on the other partner's payoff. Whinston (2002) investigates the empirical implications of the Property Rights Theory of the firm when investment contains both self and cross components. Bai and Tao (2000) consider the implication of investment externality on various legal remedies for the breach of contracts.

In this subsection, we consider the implication of assuming cooperative investment instead of self investment in our model. For this, we replace the assumptions in the first paragraph of Section 4 by the assumptions that $y_A(\alpha, \beta) = y_A(\beta), y_B(\alpha, \beta) = y_B(\alpha)$, and $y(\alpha, \beta) = y_A(\beta) + \mu y_B(\alpha)$, where $\mu > 0$ is a constant. We will still assume renegotiation efficiency in this subsection.

Similar to Section 4, the partners' ex ante investments are determined by

$$\begin{aligned} c_1^i y_B'(\alpha) &= 1 \\ c_2^i y_A'(\beta) &= 1 \end{aligned}$$

where partners' incentive coefficients c_1^i and c_2^i depend on the control arrangement i and the revenue sharing contract s. The optimal control and revenue sharing arrangements are chosen to maximize

$$\begin{aligned} U(c_1, c_2) = \quad & (r_1 + r_4 + a_1 + a_4) y_A(\beta) + (\mu r_1 + \mu r_4 + b_1 + b_4) y_B(\alpha) - \alpha - \beta \\ s.t. \quad & c_1 y_B'(\alpha) = 1, \\ & c_2 y_A'(\beta) = 1. \end{aligned}$$

Straightforward computation yields that

$$c_1^J = s\mu r_1 + \lambda(b_4 + \mu r_4),$$

$$c_2^J = (1-s)r_1 + (1-\lambda)(a_4 + r_4),$$

$$c_1^A = s\mu(r_1 + r_4) + d'_A[(\lambda - s)\mu r_2 + \lambda b_2],$$

$$c_2^A = (1-s)(r_1 + r_4) + d'_A[(s-\lambda)r_2 - (1-\lambda)a_2].$$

Furthermore, under the benchmark case of "central" control where the ex post efficient decision is taken at once without bargaining, the parties' incentive coefficients are:

$$c_1 = s\mu(r_1 + r_4),$$

$$c_2 = (1-s)(r_1 + r_4).$$

As s increases from 0 to 1, the reduced incentive structure (c_1, c_2) moves along an incentive line. Under joint control, the incentive line is

$$c_1^J + \mu c_2^J = \mu(r_1 + r_4) + \lambda b_4 + (1-\lambda)\mu a_4.$$

Under "central" control, the incentive line is

$$c_1 + \mu c_2 = \mu(r_1 + r_4).$$

It is easy to see that the incentive line under joint control is above that under "central" control. Therefore, if the optimal s under joint control is an interior solution, joint control is better than "central" control. This result is the opposite of Proposition 1 but is consistent with Segal and Whinston's (2000) result that renegotiation is desirable with cooperative investment.

Under unilateral control by A, the incentive line is

$$c_1^A + \mu c_2^A = \mu(r_1 + r_4) + d'_A[\lambda b_2 - (1-\lambda)\mu a_2].$$

If A does not expropriate even without renegotiation, that is $d'_A = 0$, then the incentive line is the same as under "central" control. Consequently, this case is dominated by joint control. This result is the opposite of Proposition 2. If A does expropriate without renegotiation, that is $d'_A = 1$, and the optimal s is an interior solution, then joint control is better than unilateral control by A if and only if

$$\mu(1-\lambda)a_4 + \lambda b_4 > \lambda b_2 - \mu(1-\lambda)a_2.$$

This result is the opposite of Proposition 4. That is, self investment and cooperative investment give us results about the relative optimality of joint control vs. unilateral control that are diagonal to each other. Particularly, in contrast to the case with self investment, when the partners' investments are cooperative, joint control is optimal if there is no expropriation. The counterpart of Proposition 4 is as follows.

Proposition 6 *Suppose the partners make cooperative investment and* $a_2 y_A(\beta) > r_2[y_A(\beta) + \mu y_B(\alpha)]$ *for all* α *and* β*. Further assume that the optimal revenue-sharing contract under joint control,* s^J*, is interior. Then joint control is better than unilateral control by A if and only if*

$$\mu(1-\lambda)a_4 + \lambda b_4 > \lambda b_2 - \mu(1-\lambda)a_2.$$

Regarding the relationship between the revenue sharing and control arrangements, note that d'_A has to be 1 for unilateral control by A to be optimal. This implies that A as a controlling shareholder should be given a low revenue share. It is because a low revenue share induces A to expropriate B, which would result in renegotiation that enhances the investment incentives of both partners in the case of cooperative investments. In addition, as A enjoys extra payoff from his control, he should be given a low revenue share to achieve balanced incentives between the partners. Similar result holds for unilateral control by B. Hence, control right and cash flow right are substitutes in this case where the partners make cooperative investment.

Proposition 7 *Suppose the partners make cooperative investment. Then, when it is optimal to give a partner unilateral control, it is also optimal to give him a low revenue share.*

This result gives us another difference between self investment and cooperative investment. Under the former, the revenue sharing and control arrangements can be complements as well as substitutes, while under the latter, the two arrangements can only be substitutes.

5.2 A General Setting of the Model

Section 4 and Section 5.1 considered the two extreme cases of pure self investments and pure cooperative investments (with respect to the private benefits) respectively. In this subsection, we consider a more general setting of the model to check the robustness of our main results. We maintain the specification of the private benefits and verifiable revenue given in Section 3, but use more general forms for functions $y_A(\alpha, \beta)$, $y_B(\alpha, \beta)$, and $y(\alpha, \beta)$, instead of the special forms considered in Section 4 and Sections 5.1. Specifically, we assume that

$$\begin{aligned} y_A(\alpha, \beta) &= a_5 + a_6\alpha + a_7\beta, \\ y_B(\alpha, \beta) &= b_5 + b_6\alpha + b_7\beta, \\ y(\alpha, \beta) &= r_5 + r_6\alpha + r_7\beta, \end{aligned}$$

where the a's, b's, and r's are non-negative. We use linear functions as in Whinston (2002) to facilitate comparison between our results and his as well as to make the analysis tractable. We further assume that the costs of investments α and β are $\phi_A(\alpha)$ and $\phi_B(\beta)$ respectively. The specification in Section 4 is a special case of the current general setting where $a_7 = 0$, $b_6 = 0$, $\phi'_A(\alpha) = 1/y'_A(\alpha)$, $\phi'_B(\alpha) = 1/y'_B(\beta)$, and $\mu = a_6 r_7 / r_6 b_7$. The assumption there that the verifiable revenue is a linear combination of the partners' private benefits is implied by the assumption that the partners' investments are purely self investments and functions $y_A(\alpha, \beta)$, $y_B(\alpha, \beta)$, and $y(\alpha, \beta)$ are linear. A similar statement can be made about the specification in Section 5.1. However, except for these two extreme cases, our more general specification here no longer requires the verifiable revenue to be a linear combination of the private benefits.

Similarly to Section 4, the partners' ex ante investments are determined by

$$\begin{aligned} c_1^i &= \phi'_A(\alpha), \\ c_2^i &= \phi'_B(\beta), \end{aligned}$$

where the partners' incentive coefficients c_1^i and c_2^i depend on the control arrangement i and the revenue sharing contract s. The optimal control and revenue sharing arrangements are chosen to maximize

$$\begin{aligned} U(c_1,c_2) = \quad & [(a_1+a_4)a_6+(b_1+b_4)b_6+(r_1+r_4)r_6]\alpha-\phi_A(\alpha) \\ & +[(a_1+a_4)a_7+(b_1+b_4)b_7+(r_1+r_4)r_7]\beta-\phi_B(\beta) \\ s.t. \qquad & c_1 = \phi'_A(\alpha), \quad c_2 = \phi'_B(\beta). \end{aligned}$$

Straightforward computation yields that

$$\begin{aligned} c_1^J &= (a_1+\lambda a_4)a_6+\lambda b_4 b_6+(sr_1+\lambda r_4)r_6, \\ c_2^J &= (1-\lambda)a_4a_7+[b_1+(1-\lambda)b_4]b_7+[(1-s)r_1+(1-\lambda)r_4]r_7, \\ c_1^A &= [a_1+a_4+(1-\lambda)a_2d'_A]a_6+\lambda b_2d'_Ab_6+[sr_1+sr_4+(\lambda-s)r_2d'_A]r_6, \\ c_2^A &= -(1-\lambda)a_2d'_Aa_7+(b_1+b_4-\lambda b_2d'_A)b_7+[(1-s)(r_1+r_4)+(s-\lambda)r_2d'_A]r_7. \end{aligned}$$

Furthermore, under the benchmark case of "central" control where the ex post efficient decision is taken at once without bargaining, the parties' incentive coefficients are:

$$\begin{aligned} c_1 &= (a_1+a_4)a_6+s(r_1+r_4)r_6, \\ c_2 &= (b_1+b_4)b_7+(1-s)(r_1+r_4)r_7. \end{aligned}$$

As s increases from 0 to 1, the reduced incentive structure (c_1,c_2) moves along an incentive line. The incentive lines are

$$\begin{aligned} r_7c_1^J+r_6c_2^J = \quad & (r_1+r_4)r_6r_7+[(a_1+\lambda a_4)a_6+\lambda b_4b_6]r_7+ \\ & \{(1-\lambda)a_4a_7+[b_1+(1-\lambda)b_4]b_7\}r_6, \end{aligned}$$

$$\begin{aligned} r_7c_1^A+r_6c_2^A = \quad & (r_1+r_4)r_6r_7+\{[a_1+a_4+(1-\lambda)a_2d'_A]a_6+\lambda b_2d'_Ab_6\}r_7+ \\ & [-(1-\lambda)a_2d'_Aa_7+(b_1+b_4-\lambda b_2d'_A)b_7]r_6, \end{aligned}$$

$$r_7c_1+r_6c_2=(r_1+r_4)r_6r_7+(a_1+a_4)a_6r_7+(b_1+b_4)b_7r_6.$$

respectively, under joint control, under unilateral control by A, and under "central" control. If

$$(1-\lambda)a_4a_7r_6+\lambda b_4b_6r_7<(1-\lambda)a_4a_6r_7+\lambda b_4b_7r_6, \tag{11}$$

then the incentive line under joint control is lower than that under "central" control and hence the bargaining needed to reach the decision $d=1$ has a negative effect on the

partners' total incentives, as is the case where the investment is purely self-benefiting. In this case, all the results in Section 4 hold qualitatively. This is not surprising because inequality (11) means that the self-benefiting element of the investment dominates its cooperative element. If the opposite of (11) is true, the cooperative element of the investment dominates its self-benefiting element and all the results in Subsection 5.1 hold qualitatively. Therefore, the main results we got in earlier analysis are not restricted to the extreme cases of pure self investment or pure cooperative investment; collectively, Section 4 and Section 5.1 cover all the possible results in our general setting considered in the current subsection. To highlight the key insights, we will revert to the consideration of the two extreme cases of pure self investments and pure cooperative investments in the remainder of this section.

5.3 Inefficient Ex Post Bargaining

In this subsection, we assume that ex post bargaining is so inefficient that it never succeeds in moving the partners beyond their disagreement payoffs. We consider the case of self investment and that of cooperative investment separately, and adopt the specification of private benefit and revenue functions in Section 4 and that of Section 5.1 respectively.

Self Investment

From the partners' disagreement payoffs, it is easy to compute their respective incentive coefficients under joint control and unilateral control by A. The case for the second-best is also straightforward. Specifically, we have:

$$c_1^J = a_1 + sr_1,$$

$$c_2^J = b_1 + (1-s)\mu r_1,$$

$$c_1^A = a_1 + d'_A a_2 + a_4 + s(r_1 - d'_A r_2 + r_4),$$

$$c_2^A = b_1 - d'_A b_2 + b_4 + (1-s)\mu(r_1 - d'_A r_2 + r_4),$$

$$c_1 = a_1 + a_4 + s(r_1 + r_4),$$

$$c_2 = b_1 + b_4 + (1-s)\mu(r_1 + r_4).$$

In contrast to the case with efficient bargaining, the decision taken at date 3 depends on the control arrangement because inefficient action can no longer be bargained away. The total surpluses between the partners under joint control, under unilateral control by A, and under the second best environment are respectively

$$U^J = (a_1 + r_1)y_A(\alpha) + (b_1 + \mu r_1)y_B(\beta),$$

$$U^A = (a_1 + a_2 d'_A + a_4 + r_1 - r_2 d'_A + r_4)y_A(\alpha) + [b_1 - b_2 d'_A + b_4 + \mu(r_1 - r_2 d'_A + r_4)]y_B(\beta),$$

$$U = (a_1 + a_4 + r_1 + r_4)y_A(\alpha) + [b_1 + b_4 + \mu(r_1 + r_4)]y_B(\beta).$$

It can be shown that Propositions 1-3 in Section 4 remain to hold without any modification. Proposition 4, however, has to be modified. When $d'_A = 1$, joint control provides better ex ante investment incentives than unilateral control by A if

$$\mu a_4 + b_4 + \mu r_4 < b_2 - \mu a_2 + \mu r_2. \tag{12}$$

Meanwhile, $U^J > U^A$ if

$$a_2 + a_4 + r_4 < r_2, \text{ and } b_4 + \mu r_4 < b_2 + \mu r_2. \tag{13}$$

It follows that joint control is better than unilateral control by A if conditions (12) and (13) are both satisfied. This result is qualitatively very similar to that in Proposition 4; it implies that joint control is better than unilateral control if the cost of expropriation is sufficiently large relative to the benefit of the Pareto improving action. Proposition 5 can be similarly modified and interpreted.

The above analysis suggests that the results of our model with self investment are robust with respect to various assumptions about the efficiency of the ex post bargaining. By the same token, it also suggests that with self investment we cannot empirically test the bargaining efficiency by looking at the control and revenue share arrangements.

Cooperative investment

The situation with cooperative investment is different. In this case, we have

$$c_1^J = s\mu r_1,$$

$$c_2^J = (1-s)r_1,$$

$$c_1^A = s\mu(r_1 - d'_A r_2 + r_4),$$

$$c_2^A = (1-s)(r_1 - d'_A r_2 + r_4),$$

$$c_1 = s\mu(r_1 + r_4),$$

$$c_2 = (1-s)(r_1 + r_4).$$

$$U^J = (a_1 + r_1)y_A(\beta) + (b_1 + \mu r_1)y_B(\alpha),$$

$$U^A = (a_1 + a_2 d'_A + a_4 + r_1 - r_2 d'_A + r_4)y_A(\beta) + [b_1 - b_2 d'_A + b_4 + \mu(r_1 - r_2 d'_A + r_4)]y_B(\alpha),$$

$$U = (a_1 + a_4 + r_1 + r_4)y_A(\beta) + [b_1 + b_4 + \mu(r_1 + r_4)]y_B(\alpha).$$

It follows immediately that joint control is worse than "central" control, which can be called the second best again in this case; that is, Proposition 1 holds in this case. If A does not expropriate when he has control, A's control is the same as the second best, just as in Section 4.3. Therefore, Propositions 2 and 3 also hold in this case. If A expropriates when he has control, i.e., $d'_A = 1$, then joint control provides better investment incentives than unilateral control by A if $r_2 > r_4$. In addition, $U^J > U^A$ if

$$r_2 - a_2 > r_4 + a_4, \text{and } b_2 + \mu r_2 > \mu r_4 + b_4.$$

These inequalities hold if r_2 is sufficiently large. However, if r_2 is large, A will not have strong incentive to expropriate because the loss of his share of the revenue would be large. This argument suggests that, the condition for joint control to be optimal in this case may be very stringent.

In summary, the qualitative results in the main case with self investment remain valid in this case but the likelihood for joint control to be optimal is low here. Furthermore, in view of the analysis in Section 5.1 (cooperative investment with efficient bargaining), it is clear that the results on cooperative investments are sensitive to the various assumptions on bargaining efficiency.

5.4 The Case of No Ex Ante Investment

One of the most important differences between the Transaction Cost Economics view of the organization championed by Williamson (1975, 1979, 1985) and Klein, Crawford, and Alchian (1978) and the Property Rights Theory of the organization due to GHM is that the former focuses on the costs of ex post decision making while the latter focuses on the distortion to ex ante investment incentives. Our analysis so far has taken the Property Rights Theory approach, although Section 5.3 also considered the costs of ex post decision making. In this subsection, we take the Transaction Cost Economics approach and consider a framework in which there is no ex ante investment.

We keep the same model specification as in Section 3, except that the project's verifiable revenue and the partners' private benefits collapse to the coefficients, $r(\delta)$, $a(\delta)$ and $b(\delta)$ respectively. That is:

$$R = r(\delta) = r_1 - r_2 d_A - r_3 d_B + r_4 d,$$

$$P_A = a(\delta) = a_1 + a_2 d_A - a_3 d_B + a_4 d,$$

$$P_B = b(\delta) = b_1 - b_2 d_A + b_3 d_B + b_4 d.$$

Subsequently, the conditions for expropriation to be inefficient collapse to $r_2 + b_2 > a_2$ and $r_3 + a_3 > b_3$. The ex post efficient decision remains $(d_A^*, d_B^*, d^*) = (0, 0, 1)$. If the bargaining about date 3 decision is efficient, efficient decision will always be taken independent of the control arrangements. Without ex ante investment, joint control and unilateral control are then equally efficient. To explore possible trade-offs between various control arrangements, we focus on the case of no renegotiation in the remainder of this subsection. The results will be the same for any positive probability of bargaining failure.

When there is no ex post renegotiation, the two partners' payoffs are equal to the default payoffs considered in Section 3.3, that is, $W_A = V_A$ and $W_B = V_B$. The default situation under joint control is that no modification can be made to the ex ante contracted production plan (i.e., neither expropriation nor the good action can be taken). It follows that:

$$\begin{aligned} W_A^J &= V_A^J = a_1 + sr_1, \\ W_B^J &= V_B^J = b_1 + (1-s)r_1, \\ W^J &= W_A^J + W_B^J = a_1 + b_1 + r_1, \end{aligned}$$

where W^J is the total payoff under joint control.

The default situation under unilateral control by A is that the controlling partner chooses δ to maximize his payoff, namely,

$$\begin{aligned} V_A^A &= \max_{\delta} \left[(a_1 + a_2 d_A - a_3 d_B + a_4 d) + s(r_1 - r_2 d_A - r_3 d_B + r_4 d)\right] \\ &= a_1 + a_4 + s(r_1 + r_4) + \max_{d_A}[(a_2 - sr_2)d_A]. \\ &= a_1 + a_4 + s(r_1 + r_4) + (a_2 - sr_2)d'_A. \end{aligned}$$

where d'_A denotes A's optimal choice of d_A, and it is equal to 1 if $a_2 > sr_{_2}$ but 0 otherwise. Subsequently, we have:

$$V_B^A = b_1 + b_4 + (1-s)(r_1 + r_4) - [b_2 + (1-s)r_2]d'_A.$$

$$W^A = V_A^A + V_B^A = a_1 + a_4 + b_1 + b_4 + \ r_1 + r_4 + (a_2 - b_2 - r_2)d'_A,$$

where W^A is the total payoff under unilateral control by A. The analysis for the unilateral control by B is similar. Specifically, we have:

$$V_A^B = a_1 + a_4 + s(r_1 + r_4) - (a_3 + sr_3)d'_B.$$

$$V_B^B = b_1 + b_4 + (1-s)(r_1 + r_4) + [b_3 - (1-s)r_3]d'_B.$$

$$W^B = V_A^B + V_B^B = a_1 + a_4 + b_1 + b_4 + \ r_1 + r_4 + (b_3 - a_3 - r_3)d'_B,$$

where d'_B is controlling partner B's optimal choice of d_B, and it is equal to 1 if $b_3 > (1-s)r_3$ but 0 otherwise.

With no ex ante investment by the partners, we only need to look at the total payoff in order to rank various control arrangements. Note first that the total payoff under the ex post efficient decision is $a_1 + a_4 + b_1 + b_4 + \ r_1 + r_4$, which is always higher than

the total payoff under joint control. The total payoff under unilateral control depends crucially on d'_A or d'_B; and it is equal to that under the ex post efficient decision if d'_A or d'_B turns out to be 0. Hence we have the first set of results.

Proposition 8 *Suppose there is no ex post renegotiation. (i) If $a_2 \leq r_2$, then there exists some s such that $a_2 \leq sr_2$ and $d'_A = 0$. In this case, $W^A > W^J$, i.e., unilateral control by A is better than joint control. (ii) If $b_3 \leq r_3$, then there exists some s such that $b_2 \leq (1-s)r_3$ and $d'_B = 0$. In this case, $W^B > W^J$, i.e., unilateral control by B is better than joint control. In both cases, the maximum surplus is obtained.*

The intuition for the above proposition is similar to that of Proposition 2 in Section 4.3. When the gain in private benefit from expropriating minority shareholder is lower than the loss in verifiable revenue, there exists some revenue sharing arrangement such that the controlling shareholder will voluntarily refrain from expropriating the other partner. Hence the decision taken by the controlling shareholder is ex post efficient, and the optimality of unilateral control follows immediately. If $a_2 > r_2$ and $b_3 > r_3$, the expropriation by controlling shareholder cannot be avoided under either form of unilateral control, and the resulting total payoff is lower than that under the ex post efficient decision. Then there is a trade-offs between joint control and unilateral control. Specifically,

Proposition 9 *Suppose there is no ex post renegotiation. Assume that $a_2 > r_2$ and $b_3 > r_3$. (i) Joint control is optimal if*

$$a_4 + b_4 + r_4 < \min\{r_2 + b_2 - a_2, r_3 + a_3 - b_3\}.$$

(ii) Unilateral control by A is optimal if

$$r_2 + b_2 - a_2 < \min\{a_4 + b_4 + r_4, r_3 + a_3 - b_3\}.$$

(iii) Unilateral control by B is optimal if

$$r_3 + a_3 - b_3 < \min\{a_4 + b_4 + r_4, r_2 + b_2 - a_2\}.$$

Similar to Proposition 4 in Section 4.4, the above proposition captures the fundamental trade-offs between unilateral control and joint control. The inefficiency of unilateral control ($r_2+b_2-a_2$ or $r_3+a_3-b_3$) arises from the possibility that the controlling partner may expropriate the minority shareholder. In contrast, the inefficiency of joint control ($a_4 + b_4 + r_4$) comes from the inability to take the good action. The optimal control arrangement is the one that has the lowest inefficiency.

Finally, we re-examine the interactions between control right and revenue sharing arrangements when there is no ex ante investment. Recall the condition under which controlling shareholder will voluntarily refrain from expropriating the minority shareholder, i.e., $a_2 \leq sr_2$ in the case of unilateral control by A or $b_2 \leq (1-s)r_3$ in the case of unilateral control by B. It is clear the condition is more likely to hold when the controlling shareholder has more revenue share. This implies that, so long as it is possible to induce the controlling shareholder to refrain from expropriating the minority shareholder by giving the former high revenue share, control right and revenue sharing arrangements should be complementary. When the controlling shareholder cannot be induced not to expropriate the minority shareholder (i.e., $a_2 > r_2$ and $b_3 > r_3$), however, there is no prediction about the relationship between revenue sharing and control right arrangements. It is because, unlike in Section 4, there is no ex ante investment, and therefore no need to balance incentive by giving the minority shareholder high revenue share to compensate for the expropriation by the majority shareholder. To conclude, we have:

Proposition 10 *When $a_2 < r_2$ or $b_3 < r_3$, revenue sharing and control right arrangements are complementary. Otherwise, there is no definitive relationship between the two arrangements.*

6 More Empirical Analysis

In Section 2, we presented some basic empirical findings about task allocation, revenue sharing and control arrangements in joint ventures. As far as we know, there is no

theoretical model in the existing literature that is consistent with all the basic facts. In Sections 3-5, we attempted to fill in this void by presenting and analyzing a theoretical model under various assumptions. Under the assumptions of cooperative investment and no bargaining, it is very difficult to satisfy the condition for joint control to be optimal. This is inconsistent with the prevalence of joint control that we reported in Section 2. The model under other assumptions is consistent with the basic facts. To further examine the empirical validity of these assumptions, we lay out and test more of their empirical implications in this section. We consider three cases separately. The first case is for self investment. For this case, we will not concern ourselves with bargaining efficiency as it does not affect the qualitative results. The second case is for cooperative investment with efficient bargaining. The third case focuses on the scenarios in which there is no ex ante investment.

6.1 Hypotheses under Self Investment and Data Description

We begin with the case of self-investment, and develop testable hypotheses about the determinants of control right and revenue sharing arrangements. For this purpose, we first quantify various possible control arrangements for each decision in the joint venture and then construct some aggregate measures. Consider decision i in joint venture j, where $i = 1, ..., 15$ and $j = 1, ..., 200$. The decision could be under unilateral control by the Chinese partner, or joint control, or unilateral control by the foreign partner, with increasing degrees of foreign control. Define FC_{ij} to be 1 if unilateral control by the Chinese partner, 2 if joint control, and 3 if unilateral control by the foreign partner. Then FC_{ij} is a measure of the degree of control by the foreign partner on decision i in joint venture j. The aggregate degree of control by the foreign partner in joint venture j can be proxied by $FC_j = \sum_{i=1}^{15} FC_{ij}$.[13] The degree of *joint control* in joint venture j, denoted by JC_j, can be proxied by the number of decisions that are under joint control in the joint venture (i.e., for given j, the number of FC_{ij}'s that are equal to 2 where $i = 1, ..., 15$).

[13] Equal weighting is assumed for the fifteen decisions in a joint venture.

Of the potential determinants of the control arrangements, two are readily available from the sample; they are the year of establishment ($YEAR$) and the size of investment (INV) of a joint venture. We believe that, as time progresses, three factors may have helped mitigate the expropriation problem. One is that the legal environment has been improving in China in the past twenty years and as a consequence there is better legal protection of minority shareholders, which limits expropriation by the controlling shareholders. The second is that, as time goes by, more domestic partners have achieved good reputation and therefore become less inclined to engage in expropriation for the fear of losing their hard-won reputation. Finally, more information becomes available about potential joint venture partners and more trust worthy partners can be identified. Because of these factors, the need for joint control to limit expropriation decreases over the years and we have the following hypothesis:

Hypothesis 1: *The degree of joint control decreases over time.*

The size of investment may affect the control arrangement in many different ways. For example, conventional wisdom has that foreign partners are contributors of capital and therefore should be given more control when the size of investment is large. On the other hand, large projects are more likely to be in industries considered strategic by the Chinese government and foreign control may be restricted in these industries. It is hard to guess *a priori* what the net effect is.

In addition to $YEAR$ and INV, we construct two potential explanatory variables from the sample. One variable, F_CHN, is a dummy variable indicating whether or not the foreign partner of a joint venture is from Hong Kong, Macau, Singapore or Taiwan, with $F\_CHN = 1$ if the answer is yes. Partners from Hong Kong, Macau, Singapore or Taiwan share a similar cultural background with the domestic partners. They speak the same language as, and may even have kinship relationships with, the domestic partners (Lin and Png, 2002). We believe that it is easier for them to find other ways to mitigate the expropriation problem and consequently they are less reliant on joint control than other foreign partners. For example, the spread of bad words by or among people of the same ethnicity may have very strong negative effect on future investment opportunities of the perpetrator of expropriation. Therefore, we hypothesize that

Hypothesis 2: *There is less joint control when the foreign partner is from a similar*

cultural background as the domestic partner than otherwise.

We also consider a variable *FTASK* defined as the number of tasks assigned to the foreign partner of a joint venture.[14] We believe that this variable is indicative of the level of contribution the foreign partner makes to the joint venture. We hypothesize that the degree of control by the foreign partner, *FC*, increases with his level of contribution to the joint venture, and so does the equity share of the foreign partner, denoted by *FESHARE*, of which data is also available from our sample. This seems to contradict Proposition 5 where the control right and the revenue share are substitutes as incentive devices. However, Proposition 5 only applies to the case where the relative importance of the two partners' contributions to the joint venture is given. When one partner's contribution becomes relatively more important and hence should be given stronger incentives, both his control right and revenue share should be increased. Thus, we have

Hypothesis 3: *The degree of control by the foreign partner increases with the number of tasks assigned to him.*

Hypothesis 4: *The equity share to the foreign partner increases with the number of tasks assigned to him.*

Besides the four potential explanatory variables discussed above, one piece of information in the sample that may be very useful in understanding the control arrangement is the line of business the joint venture is in. We assign a two-digit Standard Industrial Classification (SIC) code and a two-digit Chinese Industrial Classification code to each of the 200 joint ventures in our sample based on the line of business it is in.[15] According to the Chinese Industrial Classification, there are 101 joint ventures in 17 two-digit services industries and 99 joint ventures in 22 two-digit manufacturing industries. Given the large number of industries involved in the sample and relative small size, 200, of the sample, it is not feasible to include industry-specific effects in the estimates. In fact, we want to understand why control arrangements vary across industries. For these reasons,

[14] Equal weighting is assumed for various tasks in a joint venture.

[15] There are some substantial differences between the Chinese industrial classification and the Standard Industrial Classification.

we consider a few industry characteristics that we think are important for determining the control arrangement. These industry level explanatory variables are not readily available from one source. Given the poor data availability in China, a great deal of effort was made to acquire and/or construct them.

Variable *FTASK* introduced above is one measure of the level of contribution the foreign partner makes to the joint venture. However, this measure is incomplete; it is simply the unweighted count of the number of tasks performed by the foreign partner without any regard given to the intensity of each task. Fortunately, this incomplete measure can be supplemented due to the following observation: International joint ventures in China are really a marriage between foreign technologies and Chinese markets. Therefore, the importance of marketing is a measure of the domestic partner's contribution and the degree of technological sophistication is another indicator of the foreign partner's contribution. We use the industry average advertising expenditure relative to net sales, denoted by *AAD*, as a proxy for the importance of marketing in the industry and the industry-average R&D expenditure relative to net sales, denoted by *ARD*, as a proxy for the technological sophistication of the industry.[16] The information needed to compute *AAD* and *ARD* is taken from *Worldscope* and refers to 1993 or to the closest year for which the information is available.[17] Our discussion here and that proceeding Hypotheses 3 and 4 lead us to the following hypotheses:

Hypothesis 5: *The degree of control by the foreign partner increases with the R&D intensity of the industry.*

Hypothesis 6: *The equity share to the foreign partner increases with the R&D intensity of the industry.*

Hypothesis 7: *The degree of control by the foreign partner decreases with advertising expenditure of the industry.*

[16] We thank Beata K. Smarzynska at the World Bank for generously providing us data on *AAD* and *ARD* (Smarzynska, 2000). We also thank Shang-Jin Wei of the IMF and the Brookings Institution for bringing the data to our attention.

[17] Worldscope is a commercial database that provides detailed financial statements, business descriptions, and historical pricing information on thousands of public companies located in more than fifty countries.

Hypothesis 8: *The equity share to the foreign partner decreases with advertising expenditure of the industry.*

Two other industry characteristics we consider are the capital intensity of, and market power in, the industry. We use the industry-average capital-labor ratio, denoted by *KL*, as a proxy for capital intensity. Regarding market power in individual industries, we do not have the ideal measure of industry concentration indices, but we believe the overall profitability of the industry provides a good proxy. For this purpose, we consider the industry-average markup ratio, defined as the ratio of industry aggregate profit/loss with respect to industry aggregate sales and denoted by *MARKUP*. We construct *KL* and *MARKUP* from Chinese statistics. China had its first census of the service industries in 1993, from which we obtained the industry-aggregate capital, labor, profit/loss, and sales for year 1992. For the Chinese manufacturing industries, there has been an annual statistical yearbook since 1985. We used only the 1992 data for the purpose of consistency. Markup ratios and capital labor ratios thus calculated are then assigned to all joint ventures in the sample. It can be argued that when a joint venture does not face much competition and hence is very profitable, there is a large scope for the controlling shareholder to expropriate without being constrained by the concern for the firm's survival. As a result, the minority shareholder demands more protection, possibly through joint control. Then, we have:

Hypothesis 9: *The degree of joint control increases with the markup ratio.*

The effect of capital intensity on the control arrangement is more complicated, similar to the effect of investment size.

The decision in our model can be any one of the 15 decisions we observe in the sample of contracts. Our model predicts that the optimal control arrangement for each decision depends on the relative strength of the expropriation and the Pareto-improving action. Unfortunately, we don't have information about how the relative strength varies across the decisions. We also believe that any ad hoc speculation about it is unsatisfactory. Therefore, we cannot test our prediction about the heterogeneity of the control arrangement across decisions directly. It might be useful to find out whether the factors we considered in this subsection have different effects on the control arrangement of different decisions, which we will do in Section 6.4.

6.2 Hypotheses under Cooperative Investment

The hypotheses developed in the preceding subsection are for the case of self investment. In this subsection, we examine the relevance of these hypotheses for the case of cooperative investment with efficient bargaining. Our objective is to empirically differentiate between the two types of investment based on our sample of joint venture contracts. Therefore we focus solely on those hypotheses that will no longer hold under the assumptions of cooperative investment and efficient bargaining.

Recall that our model predicts very different results for cooperative investment than for self investment. The main reason is that ex post renegotiation increases incentives for cooperative investment but decreases those for self investment. Specifically, under unilateral control, the potential of expropriation increases the needs for ex post renegotiation and therefore increases incentives for cooperative investment. Therefore, the potential of expropriation increases the desirability of unilateral control relative to joint control. This argument implies that, with cooperative investment, Hypotheses 1, 2, and 9 in the last subsection about joint control should all be reversed; that is, the degree of joint control should increase over time and decrease with the markup ratio, and there should be more joint control when the foreign partner is from a similar cultural background as the domestic partner than otherwise. Thus, empirical testing of Hypotheses 1, 2 and 9 (see Section 6.4 below) should allow us to infer whether the assumption of self-investment is more relevant for our sample of joint venture contracts than that of cooperative investment.

6.3 Hypotheses for the Case of No Ex Ante Investment

In Section 5.3, we analyzed the case of no ex ante investment, as is assumed by the Transaction Cost Economics view of organization. There, we found that the basic tradeoffs between joint control and unilateral control that we discussed in Section 4 were still valid. Therefore, we expect that Hypotheses 1, 2 and 9 remain to hold even in the absence of ex ante investment. Hypotheses 3 - 8, however, are concerned with the relative importance of the partners' efforts and its implications for control right and

revenue sharing arrangements. A model without ex ante investment such as the one in Section 5.3 is silent on these implications. To the extent that there is empirical support for Hypotheses 3 - 8, it would suggest that our model with ex ante investment is more relevant for our sample of joint venture contracts than the model without ex ante investment.

6.4 Econometric Analysis

In this subsection, we estimate some econometric models about the control right and the revenue share to test the hypotheses discussed in Sections 6.1 - 6.3. Although the control right and the revenue share affect each other, both are determined by the exogenous variables in the end. We therefore examine how the control right and the revenue share are determined by the exogenous variables, i.e., estimating the reduced form equations of the control right and the revenue share.

Determinants of joint control

We perform a stepwise backward-selection search for regression model of *JC* on the independent variables, *AAD*, *ARD*, *F_CHN*, *FTASK*, *INV*, *KL*, *MARKUP*, and *YEAR*. *OLS* (Ordinary least square) regression of *JC* against all independent variables is performed. Then, the independent variable with the highest p value is eliminated and the regression of *JC* against the rest of the variables is carried out. The above process is repeated until all the remaining variables are significant at the 10% level (see Table 5 for details). Note that the coefficients of all the independent variables maintain the same signs throughout the regressions, implying that our finding is robust with respect to various model specifications.

Regression # 6 of Table 5 should be highlighted as the adjusted R^2 is the highest among all the regressions performed and all the independent variables involved are significant at the 10% level (p value is shown in the parenthesis).

$$\begin{array}{rcccccc} JC & = & 632.54 & +6.64 MARKUP & -0.31 YEAR & -1.59 F\_CHN \\ & & (0.071) & (0.086) & (0.075) & (0.014) \end{array}$$

There are three variables significantly affecting the degree of joint control: (1) *YEAR* is negative at 7.5% level, (2) *F_CHN* is negative at 1.4%, and (3) *MARKUP* is positive at 8.6% level. These findings provide strong empirical support to our Hypotheses 1, 2, and 9.

Determinants of foreign control

Joint control is just one of the three possible control arrangements for any decision in a joint venture. The measure of foreign control in a joint venture, namely, *FC*, is more comprehensive, and is the subject of analysis in the next few paragraphs. Stepwise backward-selection search for *FC* is carried out similar to that for *JC*, and the results are summarized in Table 6.

Regression #2 of Table 6 has the highest adjusted R^2.

$$\begin{array}{rcccc} FC & = & -654.98 & -1.97F\_CHN & +0.92FTASK & -0.05AAD \\ & & (0.277) & (0.075) & (0.006) & (0.054) \\ & & +0.04ARD & -0.008INV & +0.34YEAR & +0.001KL \\ & & (0.109) & (0.170) & (0.257) & (0.667) \end{array}$$

Four variables significantly affect the degree of foreign control in a joint venture: (1) *FTASK* is positive at 0.6% level, (2) *AAD* is negative at 5.4% level, (3) *ARD* is positive at 10.9% level, and (4) *F_CHN* is negative at 7.5% level.

The results about *FTASK*, *AAD*, and *ARD* offer strong empirical support to Hypotheses 3, 5, and 7. The result about F_CHN is unexpected. It says that the degree of foreign control is lower when the foreign partner is from Hong Kong, Macau, Singapore, or Taiwan. We have argued earlier that expropriation is less of a problem when the two joint venture partners share the same cultural background and therefore there is less need for joint control than otherwise. This argument is supported by the earlier empirical finding. When there is less joint control, there should be more unilateral control, by either the foreign partner or the domestic partner.[18] The result here says that, when the foreign partner is from Hong Kong, Macau, Singapore, or Taiwan, there is less

[18]Note that, according to our definition of the index *FC* and the corresponding definition of the index for domestic control, call it *DC*, *FC* and *DC* add up to a constant and cannot both increase at the same time.

foreign control and consequently more domestic control. One possible reason for this result is that the mitigation of the expropriation problem by the shared cultural background between the joint venture partners implies that the main issue behind the control arrangement is to ensure effective response to market conditions in the least costly way. The cost for the domestic partner to handle frequent decision making is probably lower than that for the foreign partner. If so, then the domestic partner should be given unilateral control.

Determinants of foreign equity share

Similar to the degree of foreign control, foreign equity share, *FESHARE*, is also determined by the exogenous variables. The results of stepwise backward-selection search for *FESHARE* are summarized in Table 7. Regression #6 in Table 7 has the highest adjusted R^2.

$$\begin{array}{rcccccc} FESHARE & = & 49.95 & -0.16AAD & +0.15ARD & +0.98FTASK \\ & & (0.000) & (0.002) & (0.002) & (0.160) \end{array}$$

Two variables are statistically significant determinants of foreign equity share. (1) *AAD* is negative at 0.2% level, and (2) *ARD* is positive at 0.2% level. At 16% level, *FTASK* is barely insignificant but it is positive. All these results support Hypotheses 4, 6, and 8, albeit weakly so in the case of Hypothesis 4.

Control arrangements for individual decisions

We next examine the control arrangements for individual decisions to see whether there is heterogeneity among them. Stepwise backward-selection search is carried out for the degree of foreign control in decisions # 5, ..., # 15 (namely, FC_i where $i = 5, ..., 15$),[19] and the results for regressions of the highest adjusted R^2 are summarized in Table 8. As in the case for the degree of foreign control in a joint venture, *FTASK*, *ARD*, *AAD*, and *F_CHN* are among the variables that significantly affect the degree of foreign control in various decisions; and their signs are the same as in Regression # 2 of Table 6, which

[19] The first four decisions are not examined as, for them, joint control is almost universially adopted and there is little variation in control arrangement.

have been explained earlier. However, *FTASK* is the only variable significantly affecting the degree of foreign control in *all* decisions. It is important to note that different sets of variables affect the degree of foreign control in different decisions. Particularly, for decisions #12 (hiring and firing of CEO and other senior management staff) and #15 (making other decisions deemed to be important by the board), there is a new statistically significant variable, *INV*.

The negative sign of *INV* implies that the Chinese partner demands more control in these two decisions when the size of investment is large. We discussed in Section 6.1 that there are two countervailing effects of *INV* in foreign control. Our finding here suggests that the second effect dominates the first one; that is, the positive effect of *INV* on *FC* is a result of the industrial policy in China. To provide more evidence for this conclusion, we examine the twenty joint ventures with the largest size of investment in our sample. It turns out that fourteen of the twenty are in four industries: electricity, automobile, raw chemical materials, and metal products, which are considered strategic industries in China. Government policy discourages foreign control of firms in these industries. Indeed, only two of the fourteen joint ventures give majority equity share to the foreign partner, and one of the two splits the voting share equally between the foreign and domestic partners despite of the majority equity share to the foreign partner.

For each of decisions #5, ..., #15, we also analyze the determinants of whether the decision is under joint control or not. We do this by performing a stepwise backward-selection search for the logit models. Since adjusted R^2 is no longer meaningful, we replace it with the significance level of the chi-squared test. The result is summarized in Table 9. The probit analysis yields almost identical results; to avoid repetition, we do not show the results here. As in the analysis of the degree of joint control in a joint venture, *F_CHN*, *MARKUP*, and *YEAR* are among the variables that significantly affect whether we have joint control in various decisions; and their signs are the same as in Regression # 6 of Table 5, which have been explained earlier. However, no variable significantly affects joint control for *all* decisions. Different sets of variables affect joint control in different decisions.

6.5 Implications of the empirical findings on theories

Our empirical findings above offer strong support to our theoretical model with self investment and reject the model with cooperative investment. The theoretical model without ex ante investment is consistent with the empirical findings about the determinants of the degree of joint control, but it does not offer any explanation to the findings about how the relative importance of the partners' contribution affects control right and revenue sharing arrangements. We believe that this indicates our Property Rights Theoretical model with self investment is more relevant than the Transaction Cost Economics based model in the context of this paper.

We don't know of any other theoretical model in the existing literature that is consistent with all of our empirical findings. Some existing theories can be viewed as partial models of joint ventures, by focusing on either the revenue sharing contract or the control arrangement. Our empirical results can also shed light on some of these theories.

Our findings offer support to the moral hazard models of team production (Holmstrom, 1982). Specifically, we find support to the assumption of complementary roles played by the partners. We also find evidence that the more important contributor to the team is given more revenue share.

The optimality of unilateral control (or ownership) predicted by some basic GHM models is not supported by the evidence in the context of joint ventures. However, our model builds on the GHM incomplete contract framework. Our findings here prove the usefulness of that framework.

Some variations of the basic GHM model also predict joint control (or joint ownership). One example is the models by Chiu (1998) and De Meza and Lookwood (1998). They replace the Nash bargaining game in GHM by the strategic bargaining game and show that ownership may weaken one's investment incentive. An implication of their argument is that the party with more contribution should be given *less* control rights, which is inconsistent with our empirical findings. Another example is Cai (1999). He argues that, under unilateral ownership, the owner overinvests in general capital and underinvests in specific capital to improve his disagreement payoff in ex post bargaining.[20]

[20] A similar idea is alluded to in Rajan and Zingales (1998) when studying the optimal allocation of access in an organization.

An implication of this argument is that the party whose specific investment is more important should be given less control, which is also inconsistent with our empirical findings.[21]

There are some recent papers specifically on the topic of joint venture (Minehart and Neeman, 1999; Noldeke and Schmidt, 1998), the empirical relevance of which is worth discussing. Minehart and Neeman (1999) focus on two problems in joint ventures. One is the moral hazard problem of effort coordination: inducing one (subordinating) partner to adopt the agenda favored by the dominant partner. The other problem is to facilitate efficient dissolution of the joint venture: buyout of the joint venture by the high-valuing partner of the low-valuing partner, in an environment where each partner's value of the joint venture is his private information. They examine contractual arrangements to solve these two problems, and hence there is no role for control arrangements in their model. In addition, the revenue share in their model plays two roles in different directions: the subordinating partner should be given more share for effort coordination, but he should be given less share to ensure the efficient dissolution of the joint venture. Hence there is no clear prediction on the relationship between a partner's effort importance and his revenue share. We, however, find in our testing of Hypotheses 4, 6, and 8 that the foreign partner's equity share increases in the importance of his effort as measured by $FTASK$ and ARD but decreases in the importance of the Chinese partner's effort as proxied by AAD.

Noldeke and Schmidt (1998) extend the GHM framework by considering a holdup problem in which the two trading partners make relationship-specific investments sequentially. As in GHM, they focus exclusively on control arrangements as the solution to the holdup problem and there is no role for revenue-sharing contracts in their model. The optimal ownership structure they derive is a contingent ownership structure, which involves one partner having unilateral ownership of the firm initially and the other partner having the option of acquiring the unilateral ownership of the firm at a set price at a later date; at each point in time, there is only unilateral control by either partner. In our empirical study, however, not only do we find revenue sharing contracts but also the prevalence of joint control for various decisions in the joint venture.

[21] The tasks the partners are assigned to in the joint venture contract are mostly firm specific.

7 Conclusion

This paper presents a theoretical model that is grounded in the stylized facts we found from a sample of 200 joint venture contracts and uses econometric analysis of the revenue sharing and control arrangements in these joint ventures to test the model, identify the right assumption for the model, and shed light on the empirical relevance of some existing theories of the firm, including the Property Rights Theory, the Transaction Cost Theory, and the moral hazard model of team production.

The stylized facts that motivated our model include: First, the partners in a joint venture are assigned different tasks. Second, both revenue-sharing and control arrangements figure prominently in the joint venture contracts. Third, control arrangements are made for a number of issues in each joint venture; some issues are under joint control by both partners and others are under unilateral control by one partner. Finally, revenue sharing and control arrangements vary across firms.

Our model incorporates the revenue-sharing contract into the incomplete contract frameworks of Grossman-Hart-Moore Property Rights Theory and the Transaction Cost Theory of the firm. Furthermore, we allow the controlling partner(s)' ex post decision to be value redistributing (expropriation) or Pareto improving. The predictions of the model depend on whether we assume self investment or cooperative investment, on the assumption about the ex post bargaining efficiency, and last but not the least, on whether we consider ex ante investment incentives.

We first adopt the Property Rights Theory approach and consider the case where ex ante investment incentives are important. With self investment, the ex post inefficient decisions themselves in the absence of renegotiation, or the ex post renegotiation that results from the threat of inefficient decisions, are harmful to ex ante investment incentives. We show that joint control is optimal if the value-redistributing action dominates the Pareto-improving action. In the opposite case where unilateral control is optimal, the value-redistributing action may be avoided even without renegotiation if the controlling partner is given large revenue share. In this case, control right and revenue share should be complements. Furthermore, the partner with more important contribution should be given more control and revenue share.

With cooperative investment and efficient bargaining, ex post renegotiation is bene-

ficial to ex ante investment incentives. Then, unilateral control is optimal if the value-redistributing action dominates the Pareto-improving action. Furthermore, control right and revenue share are substitutes. The relationship between the importance of a partner's contribution and his revenue share or control right is ambiguous. Under cooperative investment without bargaining, ex post inefficient decisions cannot be bargained away and the effects of various inefficient decisions are similar to those under self investment. However, for joint control to be optimal in this case, the controller under unilateral control has to find it in his interest to take the value-redistributing action, which requires the negative effect of the action on the verifiable revenue to be small, and the damage of the action has to be large, which in this case requires the negative effect of the action on the verifiable revenue to be large. These contradicting requirements imply that joint control is not common in this case.

We then adopt the Transaction Cost Theory approach and consider the case where ex ante investment incentives can be ignored. If a partner with unilateral control can be induced not to expropriate when given sufficient revenue share, then unilateral control by the partner is optimal. In this case, control and revenue share are complements. If it is impossible to induce the controlling partner to refrain from expropriation, then the optimal control arrangement depends on the relative importance of the value-redistributing action and the Pareto-improving action. These results are similar to those under the assumption of self investment. However, the Transaction Cost Theory approach does not readily yield predictions on the relationship between the importance of a partner's effort and his control right and revenue share.

Our econometric analysis shows that the degree of joint control decreases over time as the legal environment improves, with the cultural affinity between the joint venture partners, and with the competitiveness of the industry the joint venture is in. These findings suggests that the degree of joint control increases with the severity of the expropriation problem. We also find that the foreign partner's control right and revenue share increase with the number of tasks he is assigned in the contract and the technological sophistication of the industry, but decrease with the need for marketing in the industry. This supports the conclusion that the partner with more important contribution should be given more control and revenue share. Together with the descriptive stylized facts, these econometric findings offer strong support to our model with self investment and reject

the model with cooperative investment. In comparison, the Transaction-Cost-Theory based model receives weaker support because it leaves some of the empirical findings unexplained. Within the Property-Rights-Theory framework, our empirical findings reject some of the existing extensions to the GHM model that yields the optimality of joint ownership. Finally, our model attains the highest degree of consistency with the empirical findings among existing models of the joint venture.

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Figure 1: Time of Establishment

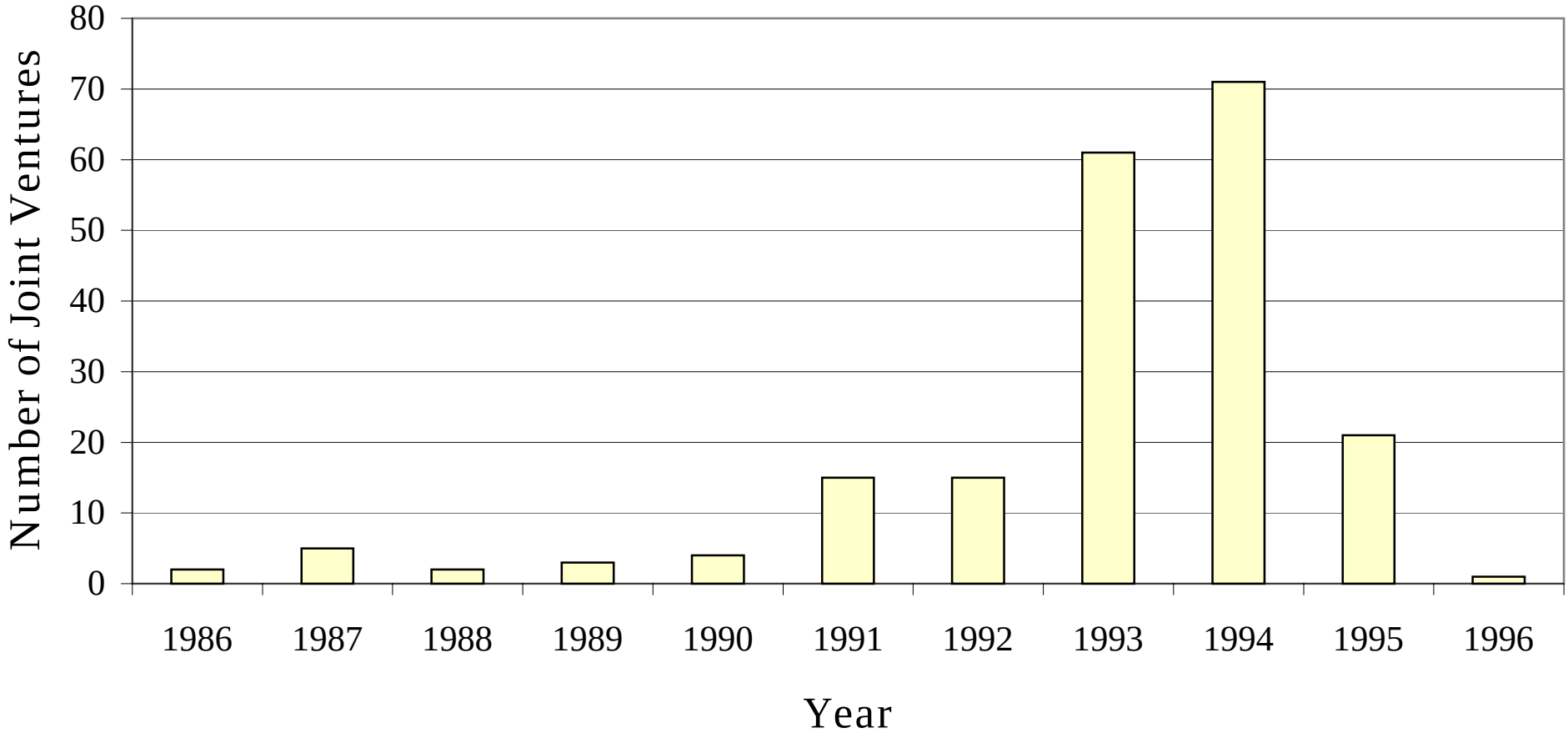

Figure 2: Task Assignment

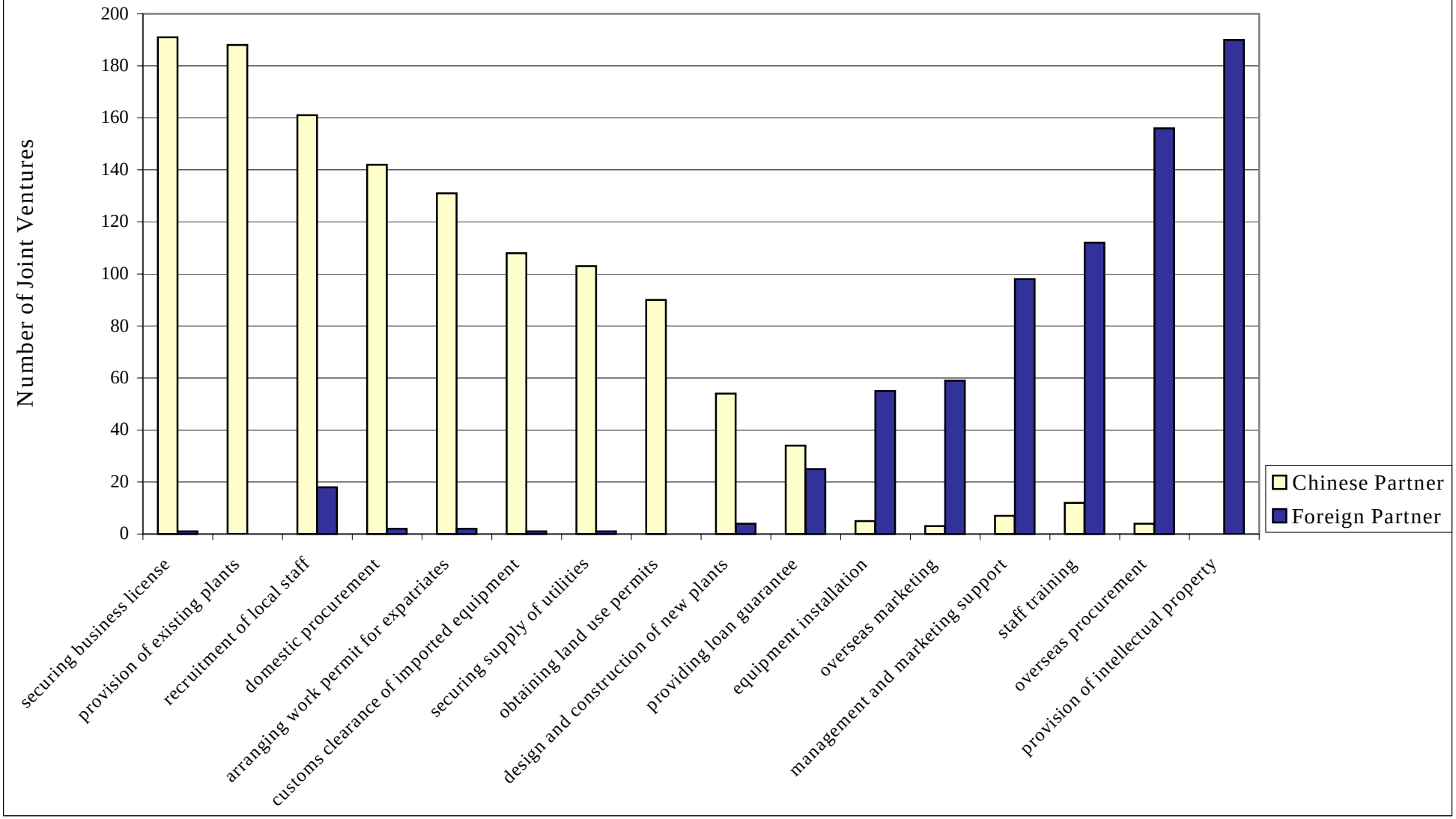

Figure 3: Distribution of Equity Share of Foreign Partners

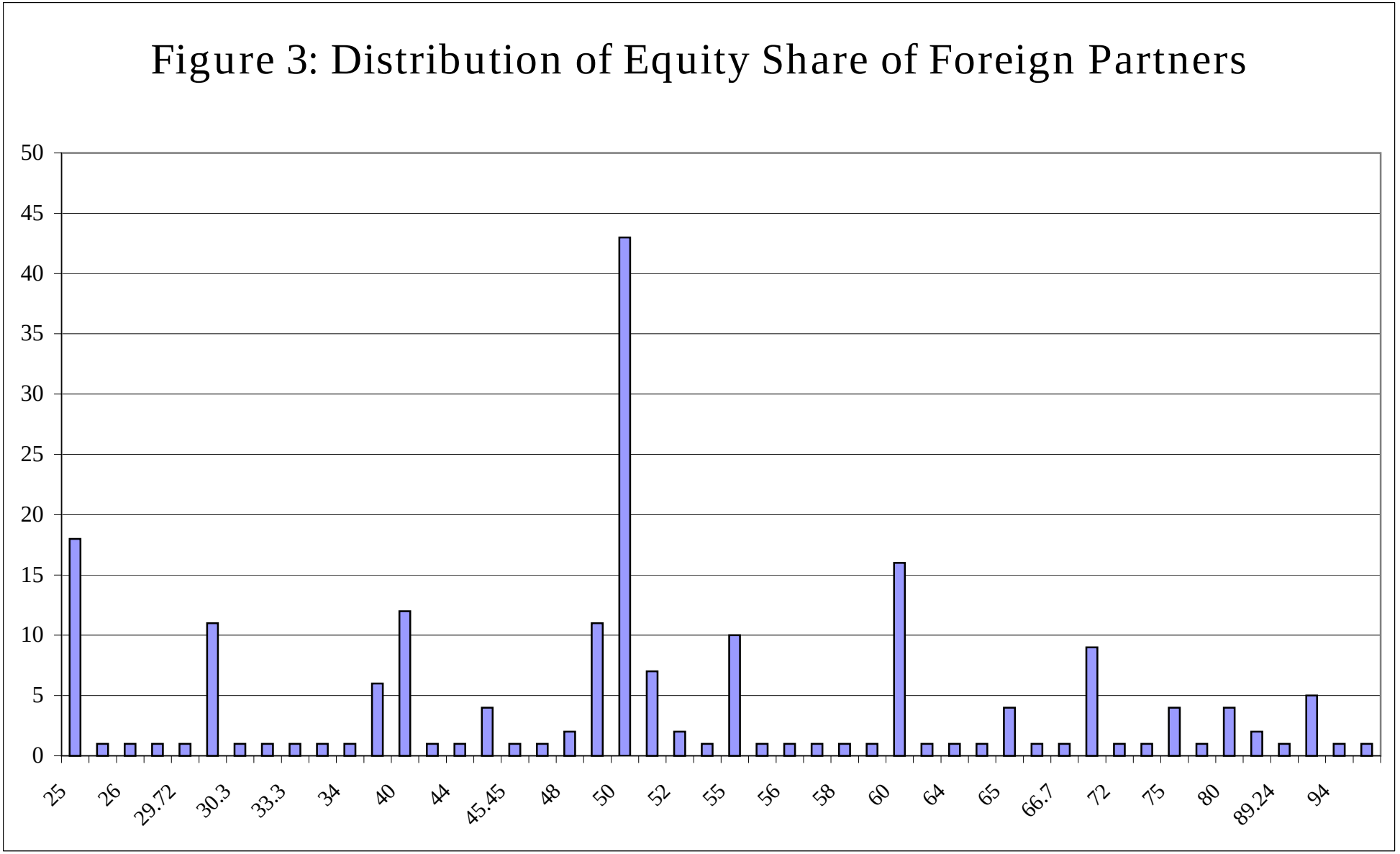

Figure 4: Voting Rules on Important Issues by the Board of Directors

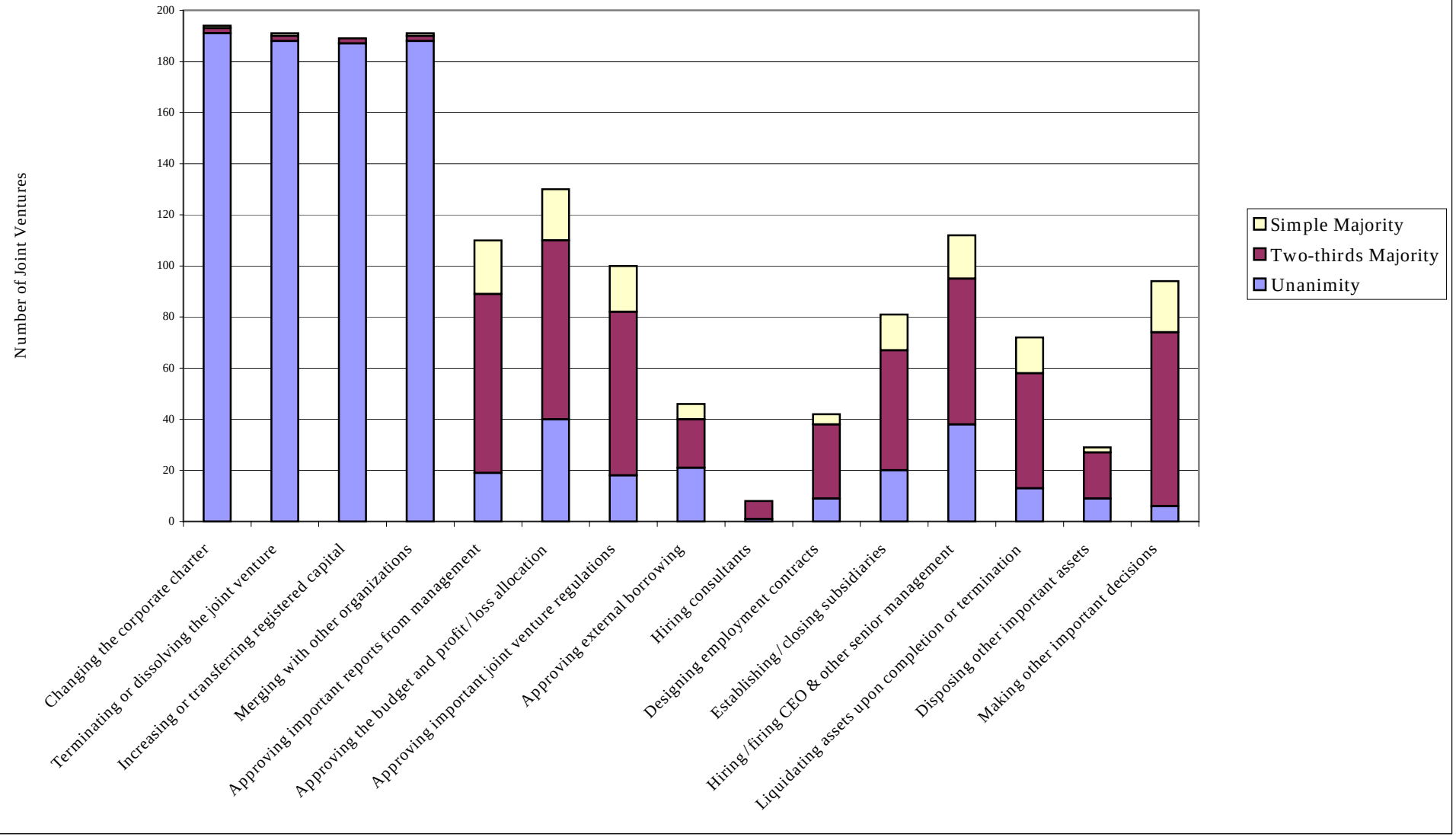

Figure 4a: Voting Rules on Important Issues by the Board of Directors (The Case of Non 50-50 JVs)

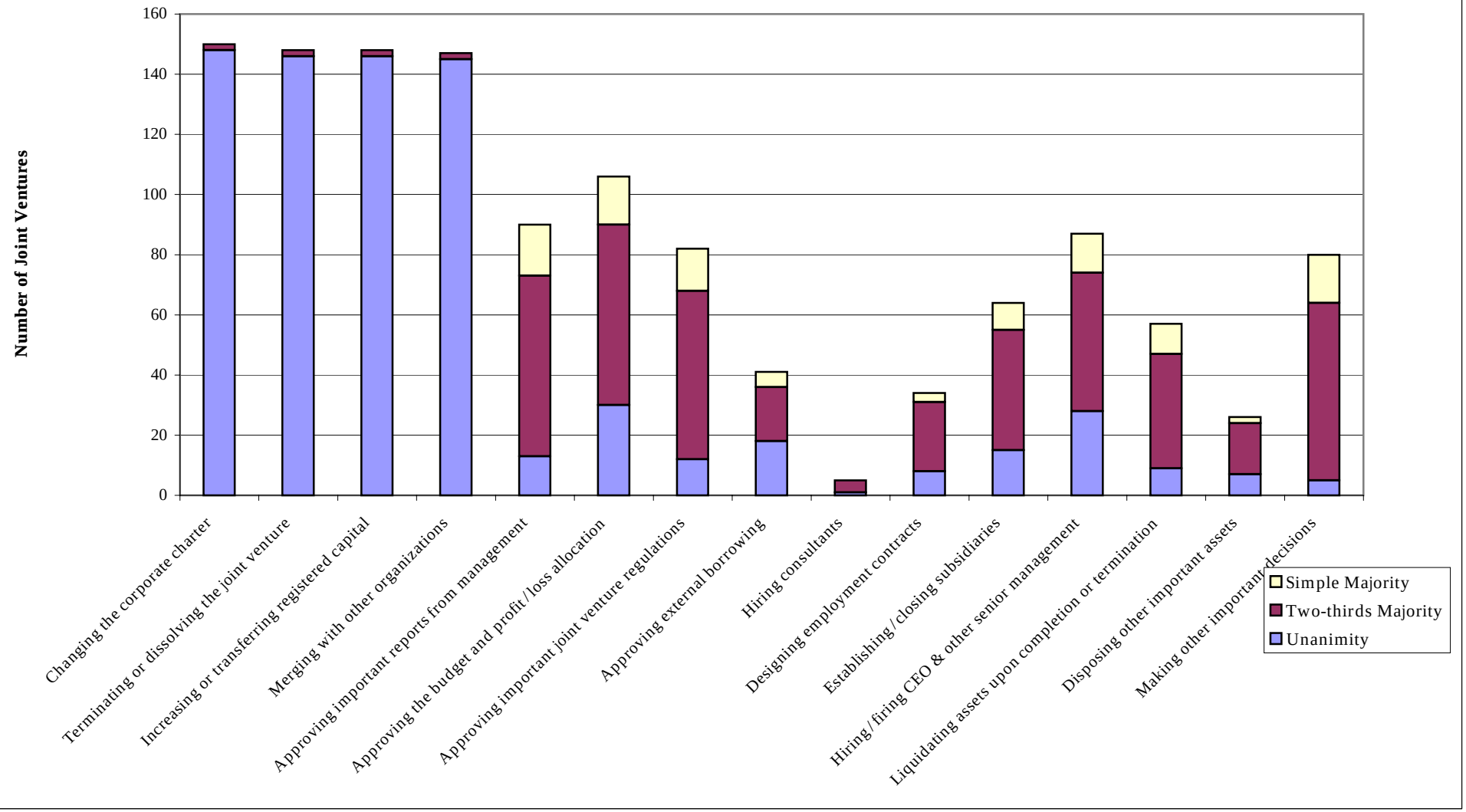

Figure 4b: Voting Rules on Important Issues by the Board of Directors (The Case of 50-50 JVs)

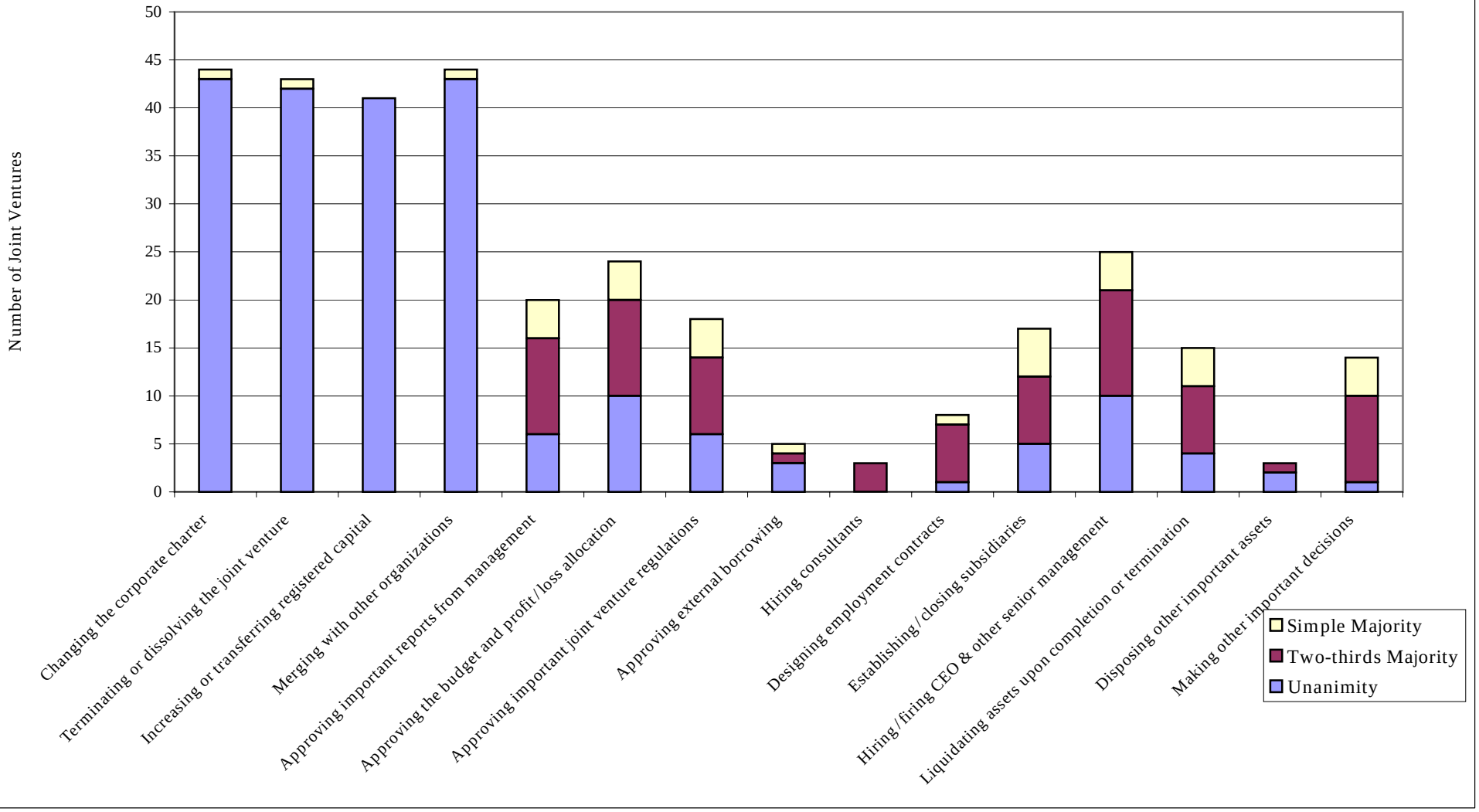

Figure 5: Joint Control Versus Unilateral Control on Important Issues

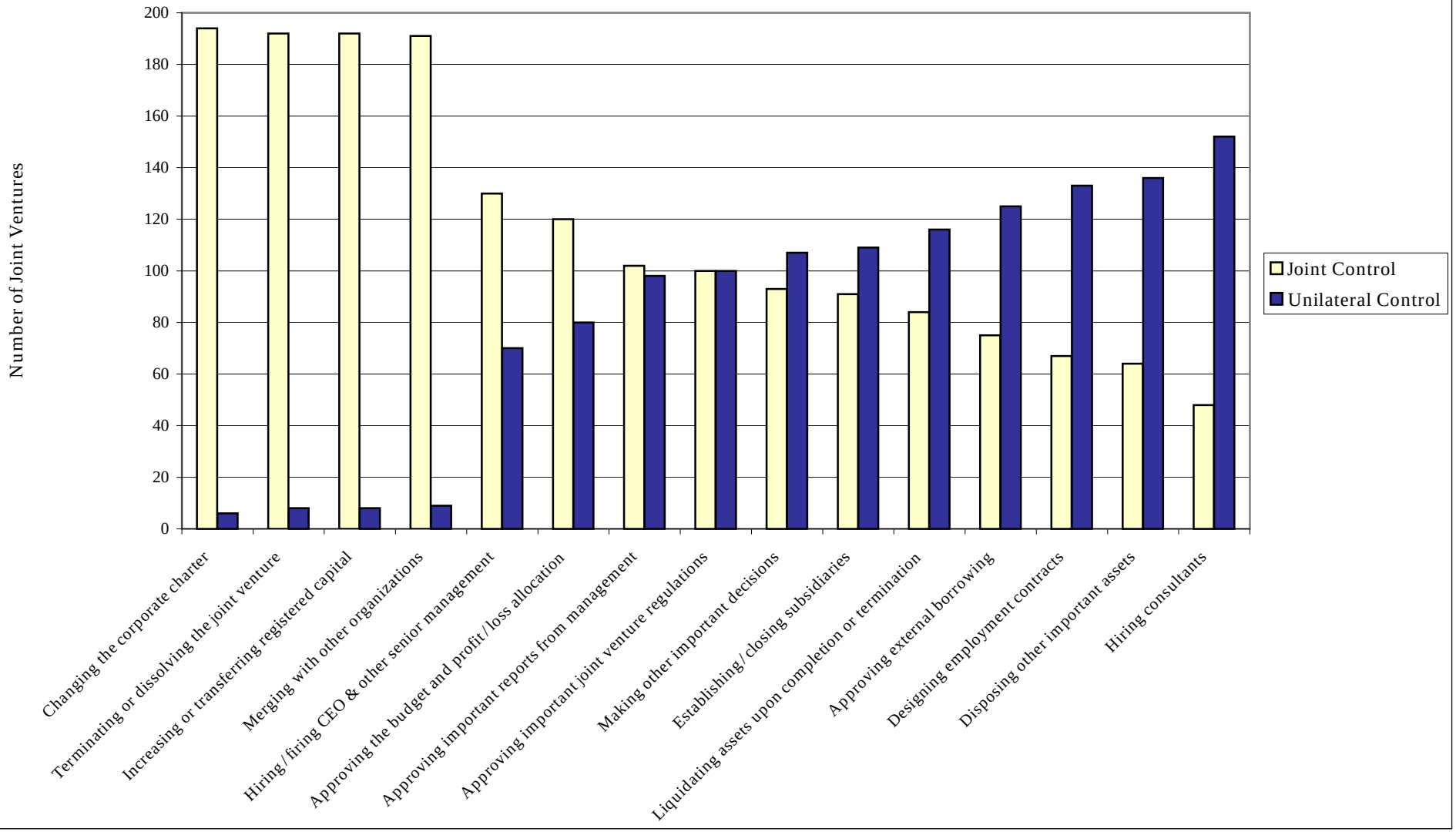

Figure 5a: Joint Control Versus Unilateral Control on Important Issues (The Case of Non 50-50 JVs)

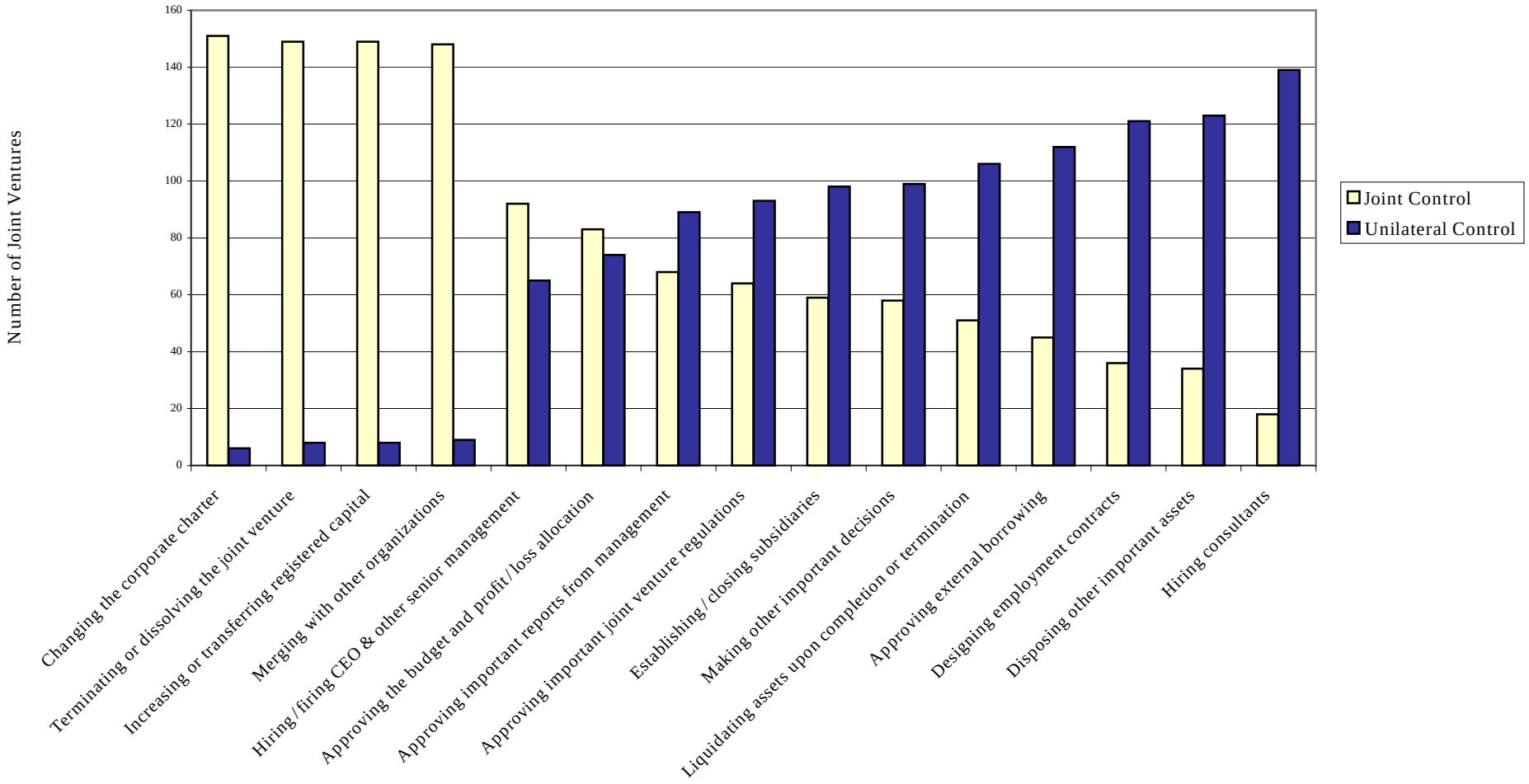

Figure 5b: Joint Control Versus Unilateral Control on Important Issues (The Case of 50-50 JVs)

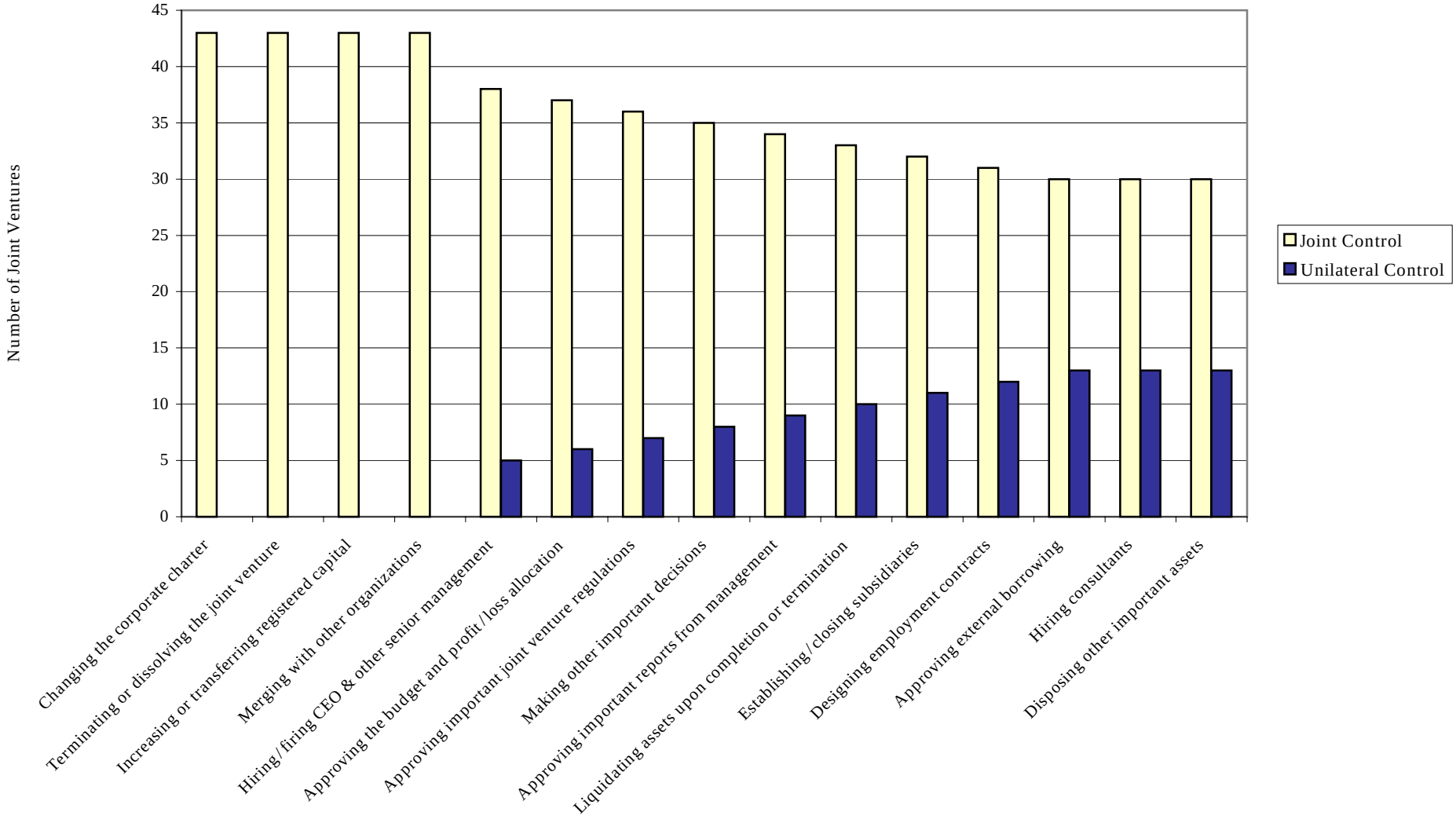

Figure 6: The First Best & the Second Best Outcomes

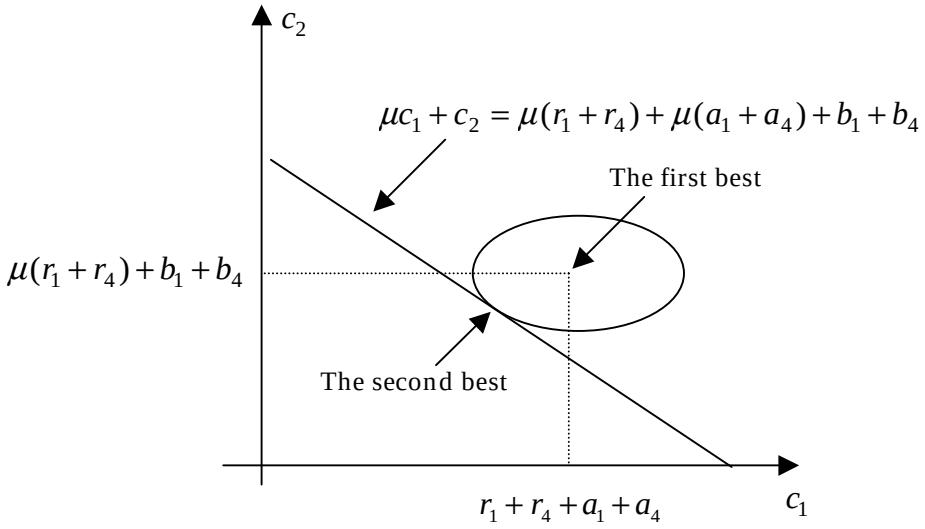

Table 1a: The Number of Chinese Partners in a Joint Venture

Number of Chinese Partners	Number of JVs
1	156
2	29
3	13
4	1
10	1

Table 1b: The Number of Foreign Partners in a Joint Venture

Number of Foreign Partners	Number of JVs
1	172
2	23
3	3
4	1
6	1

Table 2a: Country of Origin of Foreign Partners

Country / Area	Number
Japan	31
U.S.	39
Hong Kong	94
Macau	1
Korea	5
Taiwan	15
Panama	1
Singapore	10
U.K.	7
Germany	7
British Virgin Island	2
Norway	1
Bermuda	2
Canada	6
Denmark	1
Russia	2
Malaysia	2
Thailand	4
Switzerland	4
Western Samoa	1
France	2

Table 2b: Regional Origin of Chinese Partners

Province	Number
Beijing	122
Tianjin	5
Hebei	2
Shanxi	2
Inner Mongolia	2
Liaoning	10
Jilin	5
Heilongjiang	5
Shanghai	26
Jiangsu	21
Zhejiang	7
Anhui	2
Fujian	7
Jiangxi	0
Shandong	5
Henan	8
Hubei	4
Hunan	2
Guangdong	21
Guangxi	3
Sichuan	4
Guizhou	0
Yunnan	0
Tibet	0
Shannxi	2
Gansu	1
Qinghai	0
Ningxia	0
Xinjiang	1

Table 2c: Location of JVs

Location	Number of JVs
Beijing	97
Tianjin	3
Hebei	3
Shanxi	2
Inner Mongolia	1
Liaoning	8
Jilin	4
Heilongjiang	4
Shanghai	15
Jiangsu	11
Zhejiang	6
Anhui	2
Fujian	6
Jiangxi	0
Shandong	4
Henan	5
Hubei	3
Hunan	2
Guangdong	14
Guangxi	3
Sichuan	4
Guizhou	0
Yunnan	0
Tibet	0
Shannxi	1
Gansu	1
Qinghai	0
Ningxia	0
Xinjiang	1

Table 3a: Industry Distribution of Joint Ventures (SIC Code)

One-Digit SIC Code	Title	Number of JVs
A	Agriculture, Forestry, and Fishing	0
B	Mining	0
C	Construction	4
D	Manufacturing	93
E	Transportation and Public Utilities	33
F	Wholesale Trade	3
G	Retail Trade	5
H	Finance, Insurance, and Real Estate	7
I	Services	55
J	Public Administration	0
K	Nonclassifiable Establishments	0

Table 3b: Joint Ventures in the Manufacturing Industries (SIC Code)

Two-Digit SIC Code	Title	Number of JVs
20	Food and Kindred Products	17
21	Tobacco Products	0
22	Textile Mill Products	1
23	Apparel and Other Textile Products	5
24	Lumber and Wood Products	1
25	Furniture and Fixtures	1
26	Paper and Allied Products	1
27	Printing and Publishing	2
28	Chemicals and Allied Products	10
29	Petroleum and Coal Porducts	0
30	Rubber and Misc. Plastics Products	7
31	Leather and Leather Products	2
32	Stone, Clay, and Glass Products	3
33	Primary Metal Industries	4
34	Fabricated Metal Products	6
35	Industrial Machinery and Equipment	4
36	Electronic & Other Electric Equipment	8
37	Transportation Equipment	11
38	Instruments and Related Products	10
39	Miscellaneous Manufacturing Industries	3

Table 3c: Joint Ventures in the Service Industries (SIC Code)

Two-Digit SIC Code	Title	Number of JVs
70	Hotels and Other Lodging Places	0
72	Personal Services	2
73	Business Services	9
75	Auto Repair Services, and Parking	1
76	Miscellaneous Repair Services	1
78	Motion Pictures	1
79	Amusement & Recreation	0
80	Health Services	10
81	Legal Services	0
82	Educational Services	0
83	Social Services	0
84	Musems, Botanical, Zoological Gardens	0
86	Membership Organizations	0
87	Engineering & Manuagement Services	31
88	Private Households	0
89	Services, Nec	0

Table 4: Relationship Between Equity Share and Representation on the Boare of Directors

		Foreign Equity Share			
		Minority	50-50	Majority	Total
Foreign Voting Share	Minority	70	8	8	86
	50-50	5	28	11	44
	Majority	2	7	61	70
	Total	77	43	80	200

Table 5: Regression Results on Joint Control in Joint Ventures

Dependent Variable: JCj; Method: OLS

Explanatory Variables	Regression 1	Regression 2	Regression 3	Regression 4	Regression 5	**Regression 6**
Constant	582.5676	594.3608*	597.7425*	602.6401*	614.713*	**632.5431***
	(355.2417)	(353.5701)	(352.6433)	(351.3838)	(349.1293)	**(348.6559)**
	(0.103)	(0.094)	(0.092)	(0.088)	(0.080)	**(0.071)**
MARKUP	10.22837	7.986149*	7.23533*	7.624829*	7.755243*	**6.643384***
	(6.828568)	(4.751401)	(4.268198)	(4.035331)	(4.01139)	**(3.85196)**
	(0.136)	(0.094)	(0.092)	(0.060)	(0.055)	**(0.086)**
YEAR	-0.2882487	-0.2941019*	-0.295772*	-0.2983522*	-0.3044334*	**-0.3128939***
	(0.17824)	(0.1774114)	(0.1769482)	(0.1762949)	(0.1751579)	**(0.1749448)**
	(0.108)	(0.099)	(0.096)	(0.092)	(0.084)	**(0.075)**
F_CHN	-1.647943**	-1.643656**	-1.639142**	-1.61516**	-1.610247**	**-1.588301****
	(0.6557132)	(0.6542817)	(0.6526752)	(0.6457147)	(0.6441436)	**(0.6437429)**
	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	**(0.014)**
FTASK	0.2060104	0.2026575	0.2017258	0.1929082	0.1920409	
	(0.1976676)	(0.1971209)	(0.1966557)	(0.1937581)	(0.1933126)	
	(0.299)	(0.305)	(0.306)	(0.321)	(0.322)	
INV	-0.0016414	-0.0015224	-0.0014587	-0.0013093		
	(0.0035643)	(0.0035474)	(0.003535)	(0.0034878)		
	(0.646)	(0.668)	(0.680)	(0.708)		
AAD	-0.0100028	-0.0064958	-0.0017305			
	(0.0163855)	(0.0144569)	(0.0060516)			
	(0.542)	(0.654)	(0.775)			
ARD	0.0093293	0.0054613				
	(0.0172752)	(0.0150394)				
	(0.590)	(0.717)				
KL	-0.0008925					
	(0.0019484)					
	(0.647)					
R^2	0.0558	0.0547	0.0541	0.0537	0.053	**0.0481**
Adjusted R^2	0.0158	0.0199	0.0244	0.0290	0.0334	**0.0334**

*Note: For each explanatory variable in a regression, the estimate of its coefficient, the standard error and P-value are listed, with the latter two in brackets. ***,**, and * denote significant levels at 1%, 5%, and 10%, respectively.*

Table 6: Regression Results on Foreign Control in Joint Ventures

Dependent Variable: FCj; Method: OLS

Explanatory Variables	Regression 1	**Regression 2**	Regression 3	Regression 4	Regression 5	Regression 6	Regression 7
Constant	-655.4688	**-654.98**	-606.23	28.62724***	28.2386***	27.68969***	26.63021***
	(602.2185)	**(600.7696)**	(596.0846)	(2.008933)	(1.991175)	(1.963724)	(1.661883)
	(0.278)	**(0.277)**	(0.310)	(0.000)	(0.000)	(0.000)	(0.000)
F_CHN	-1.939307*	**-1.973299***	-1.718657	-1.820492*	-1.735666	-1.808263*	-1.618103
	(1.111589)	**(1.103029)**	(1.094475)	(1.090668)	(1.090878)	(1.093311)	(1.077131)
	(0.083)	**(0.075)**	(0.118)	(0.097)	(0.113)	(0.100)	(0.135)
FTASK	0.9036616***	**0.9197597*** **	0.8781599***	0.8543634***	0.8347036**	0.8812523***	0.8045553**
	(0.3350932)	**(0.3298892)**	(0.3272592)	(0.3266086)	(0.3268984)	(0.3264753)	(0.3175883)
	(0.008)	**(0.006)**	(0.008)	(0.010)	(0.011)	(0.008)	(0.012)
AAD	-0.0422182	**-0.0463786***	-0.0474214**	-0.0457963*	-0.0417538*	-0.0098305	
	(0.0277774)	**(0.0239319)**	(0.0235256)	(0.0234842)	(0.0233295)	(0.009708)	
	(0.130)	**(0.054)**	(0.045)	(0.053)	(0.075)	(0.312)	
ARD	0.0317551	**0.0371068**	0.0387693*	0.037155	0.0343463		
	(0.0292855)	**(0.023035)**	(0.022936)	(0.0228938)	(0.0228391)		
	(0.280)	**(0.109)**	(0.093)	(0.106)	(0.134)		
INV	-0.0083204	**-0.0082974**	-0.008468	-0.0078968			
	(0.0060423)	**(0.0060273)**	(0.0059893)	(0.0059673)			
	(0.170)	**(0.170)**	(0.159)	(0.187)			
YEAR	0.3433393	**0.3429016**	0.3184915				
	(0.3021589)	**(0.3014294)**	(0.2990386)				
	(0.257)	**(0.257)**	(0.288)				
KL	0.0016923	**0.0009888**					
	(0.003303)	**(0.0022975)**					
	(0.609)	**(0.667)**					
MARKUP	-3.4393						
	(11.57603)						
	(0.767)						
R^2	0.0794	**0.0789**	0.0726	0.0672	0.0587	0.0478	0.0428
Adjusted R^2	0.0404	**0.0450**	0.0438	0.0431	0.0394	0.0332	0.0331

*Note: For each explanatory variable in a regression, the estimate of its coefficient, the standard error and P-value are listed, with the latter two in brackets. ***,**, and * denote significant levels at 1%, 5%, and 10%, respectively.*

Table 7: Regression Results on Foreign Equity Share in Joint Ventures

Dependent Variable: FESHARE; Method: OLS

Explanatory Variables	Regression 1	Regression 2	Regression 3	Regression 4	Regression 5	**Regression 6**	Regression 7
Constant	-544.5971 (1289.046) (0.673)	-533.4328 (1282.317) (0.678)	-387.1778 (1275.564) (0.762)	-405.3262 (1267.345) (0.749)	-367.3615 (1258.82) (0.771)	**49.95174***** **(3.893024)** **(0.000)**	53.60437*** (2.914848) (0.000)
AAD	-0.1675445*** (0.0594573) (0.005)	-0.1642245*** (0.0524319) (0.002)	-0.1619191*** (0.0503425) (0.002)	-0.1616578*** (0.0501897) (0.001)	-0.1595199*** (0.0496243) (0.002)	**-0.1585969***** **(0.0494335)** **(0.002)**	-0.157981*** (0.0495558) (0.001)
ARD	0.160313** (0.0626856) (0.011)	0.1566512*** (0.0545446) (0.005)	0.1568302*** (0.0490808) (0.002)	0.1571773*** (0.0489098) (0.002)	0.1556112*** (0.04855) (0.002)	**0.1547494***** **(0.0483701)** **(0.002)**	0.16114*** (0.0482785) (0.001)
FTASK	1.069333 (0.7172656) (0.138)	1.066159 (0.714912) (0.138)	1.006478 (0.7003032) (0.152)	1.003898 (0.6983583) (0.152)	0.9927216 (0.6958681) (0.155)	**0.9774493** **(0.6927631)** **(0.160)**	
YEAR	0.2985172 (0.6467698) (0.645)	0.2929762 (0.6434302) (0.649)	0.2195334 (0.6399138) (0.732)	0.2285035 (0.6358645) (0.720)	0.2093711 (0.6315625) (0.741)		
INV	-0.0043789 (0.0129335) (0.735)	-0.0042664 (0.0128656) (0.741)	-0.0041717 (0.0128166) (0.745)	-0.0040679 (0.012768) (0.750)			
F_CHN	-0.8612431 (2.379351) (0.718)	-0.8571852 (2.372929) (0.718)	-0.3757966 (2.342071) (0.873)				
MARKUP	3.617971 (24.77845) (0.884)	1.495338 (17.23224) (0.931)					
KL	-0.0008449 (0.00707) (0.905)						
R^2	0.0661	0.0660	0.0646	0.0645	0.0640	**0.0635**	0.540
Adjusted R^2	0.0266	0.0316	0.0356	0.0404	0.0448	**0.0492**	0.444

*Note: For each explanatory variable in a regression, the estimate of its coefficient, the standard error and P-value are listed, with the latter two in brackets. ***,**, and * denote significant levels at 1%, 5%, and 10%, respectively.*

Table 8: Regression Results on Foreign Control in Various Decisions

Dependent Variables: FCi; Method: OLS

Explanatory Variables	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14	D15
Constant	-61.92949	1.900959***	-64.64258	-91.53029	1.762564***	-61.94893	1.841467***	2.158611***	-61.16577	-64.49815	-58.50733
	(54.29034)	(0.1708591)	(54.74815)	(61.91186)	(0.2278607)	(63.45781)	(0.1889764)	(0.1865165)	(58.26075)	(64.08108)	(55.62829)
FTASK	0.0940528***	0.0625393**	0.0799389***	0.0801817**	0.08479**	0.0898578**	0.0890449***	0.0476022*	0.0912778***	0.0926351***	0.0998702***
	(0.0298062)	(0.0271203)	(0.0301684)	(0.0345168)	(0.0370452)	(0.0353787)	(0.0310249)	(0.0257577)	(0.031986)	(0.0351876)	(0.0305407)
AAD	-0.0033134	-0.0009116	-0.0044519**	-0.0038687	-0.0054679**	-0.0043855*	-0.0036649*	-0.0015342*	-0.0065989***	-0.0050792**	-0.0048493**
	(0.0021427)	(0.0008279)	(0.0021681)	(0.0025315)	(0.0026637)	(0.0025947)	(0.0022141)	(0.0007929)	(0.0022994)	(0.0025527)	(0.0021955)
ARD	0.0020961		0.0038113*	0.0032521	0.0053479**	0.003752	0.0026815		-0.0058195***	0.0045073*	0.0035824*
	(0.002089)		(0.0021129)	(0.0026335)	(0.0025967)	(0.0026992)	(0.0021676)		(0.0022417)	(0.002457)	(0.0021405)
F_CHN	-0.1042152	-0.1808029**		-0.1934101*	-0.1274385	-0.1956292*	-0.2310587**	-0.1756317**	-0.1559221	-0.1726288	-0.2107767**
	(0.0996828)	(0.0908358)		(0.1145679)	(0.1237076)	(0.1174287)	(0.1035319)	(0.085293)	(0.1069729)	(0.1176545)	(0.1021395)
INV	-0.0006257	-0.0006522	-0.0005989	-0.0009121	-0.0009011	-0.0008202		-0.0008427*	-0.0009314	-0.000838	-0.0009387*
	(0.0005455)	(0.0004934)	(0.0005516)	(0.0006212)	(0.0006768)	(0.0006367)		(0.0004615)	(0.0005854)	(0.0006429)	(0.0005589)
KL		0.0002316								0.0001457	
		(0.0001884)								(0.0002451)	
MARKUP				0.2224594		-0.272393		-0.4844669			
				(0.8319936)		(0.8527687)		(0.5570038)			
YEAR	0.0319821		0.0333257	0.0468592		0.0320087			0.0316324	0.0332425	0.0302862
	(0.0272359)		(0.0274688)	(0.0310656)		(0.0318413)			(0.0292277)	(0.032152)	(0.0279071)
R^2	0.0694	0.0558	0.0604	0.0652	0.0610	0.0737	0.0737	0.0609	0.0951	0.0734	0.0986
Adjusted R^2	0.0405	0.0312	0.0362	0.0307	0.0368	0.0396	0.0547	0.0364	0.0669	0.0393	0.0706

*Note: For each explanatory variable in a regression, the estimate of its coefficient and the standard error are listed, with the latter in brackets. ***,**, and * denote significant levels at 1%, 5%, and 10%, respectively.*

Table 9: Regression Results on Joint Control in Various Decisions

Dependent Variables: JCi; Method: Logit

Explanatory Variables	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14	D15
Constant	-0.0045489	0.616529	226.6701	-1.443721*	569.9205***	271.9875*	2.79e-16	370.7493**	337.6971**	326.1328*	-0.1709149
	(0.2554916)	(0.5364821)	(162.8081)	(0.5812046)	(178.0344)	(165.4269)	(0.2108185)	(187.9117)	(164.6463)	(169.2449)	(0.2550754)
F_CHN	-0.4811875	-0.4091617	-0.4432151	-1.010866***		-0.8640215***	-0.3302417		-0.582341**	-1.130733***	-0.4799606
	(0.2958098)	(0.2996576)	(0.2991781)	(0.3177094)		(0.310385)	(0.286022)		(0.2949991)	(0.3210268)	(0.2959092)
MARKUP	3.215511*		3.710171**	5.671563***	3.356424*			3.850259**			2.999364*
	(1.78931)		(1.808953)	(2.006222)	(2.02725)			(1.924066)			(1.776575)
YEAR			-0.113793		-0.2867384***	-0.136597*		-0.1858871**	-0.1694504**	-0.1637398*	
			(0.0816914)		(0.0893673)	(0.0829984)		(0.0942835)	(0.0826043)	(0.0849132)	
FTASK		0.1109688		0.1999446**							
		(0.0889834)		(0.0990693)							
AAD		-0.0036388									
		(0.002656)									
ARD											
INV											
KL											
Prob>Chi^2	0.0804	0.2437	0.0799	0.0006	0.0023	0.0075	0.2476	0.0177	0.0227	0.0005	0.0969

*Note: For each explanatory variable in a regression, the estimate of its coefficient and the standard error are listed, with the latter in brackets. ***,**, and * denote significant levels at 1%, 5%, and 10%, respectively.*

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