Ownership structure, input control and bargaining in China's processing firms

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Motivation

Vertical integration or outsourcing is fundamental to any issue of industrial organization, especially when applied to international firms.

An increasing tendency indicates that firms seem to subcontract an ever expending set of activities.

Vertical disintegration is especially evident in international trade (Abraham and Taylor 1996, Grossman and Helpman 2005).

Motivation (cont.)

Provide a frame which enables us to compare different ownership and input control arrangements in the scope of Cooperative and Non cooperative Game.

As Barbara Spencer (2005) describes:

"The growing importance of the international procurement of intermediate inputs either through outsourcing or within the firm, through foreign direct investment, cannot be explained by traditional trade theories that abstract from vertical fragmentation and contractual relationships between buyers and suppliers. Consequently, researchers have been motivated to enrich international trade theory with concepts from industrial organization and contract theory that explain the organizational form of the firm. The combination of trade with the choice of organizational form represents an important new area for both theoretical and empirical research."

Questions

1. When is the engagement in the processing firm more desirable for the parties than contractual outsourcing in the market?

2. When is the ownership of the processing firm essential and important? Or in other words, what is the condition for the foreign firm or local manager to control the firm, and which is optimal for both parties?

3. When is it efficient to split or unify the rights, which include ownership and input control between foreign investor and local manager?

My conclusion

Market efficiency and firm’s rights structure in a Bargaining framework

Thickness of the market,

Ownership,

Input control,

Integrated or separated

Or Outsourcing

When the market is thin, parties prefer owning the processing firm and controlling input purchases at the same time.

When thickness of the market is increased, the processing firm tends to split factory ownership and input control in the equilibrium arrangement.

Foreign investor will gravitate towards controlling the ownership of the processing firm, while local managers will incline to take charge of input sourcing.

As the market becomes thicker and transactions are more efficient, contractual outsourcing with unrelated parties in the spot market will be more desirable and pervasive than pure engagement in the processing firm.

This implication fits well with Feenstra and Gordon's (2005) empirical finding about the organizational form of China's processing firms.

Literature

GE approach

Antras (2003, 2005), Antras and Helpman (2004), Grossman and Helpman (2004), and Feenstra and Hanson (2005), address the choice between vertical integration and the purchase of a specialized input through contractual outsourcing.

Literature (cont. 1)

Thickness of the market

McLaren (2000) and Grossman and Helpman (2002, 2005) emphasize the importance of the “thickness of the market” in determining the probability that final-good firms and suppliers of specialized inputs find an appropriate match so that investment and production can take place.

Literature (cont. 2)

Partial equilibrium approach

Spencer and Qiu (2001), Qiu and Spencer (2002), Head, Ries, and Spencer (2004), and Feenstra and Spencer (2005), take a partial equilibrium approach and suggest outsourcing rather than vertical integration as a solution to this decision.

Literature (cont. 3)

Feenstra and Hanson (2003, 2005)

The significance of the arrangement of ownership and input control rights in the processing firms was initially demonstrated by them

They developed a property-right model, which applies a Nash bargaining solution to explain surplus division between foreign firm and Chinese manager, and they applied this model to estimate China’s export processing industry

Literature (cont. 4)

However, their model is incomplete

Only analyzed effort inputs

Their model failed to demonstrate sufficiently the threat points

The modularity of the surplus function is measured by **a third party**, who is not involved in the bargaining. They failed to further the story by illustrating their own interactive and strategic decision process.

Their paper fails to ask an interesting question: when is it optimal for the foreign firm or the local manager to control the input or the ownership of the factory?

Literature (cont. 5)

Biform Game

Non-cooperative and cooperative game

Two stages: Structural choice and distribution

Adam Brandenburger and Harborne Stuart (2006)

Background:

Export processing firms in China: two regulatory regimes for export processing in China

Pure-Assembly regime

The factory in China receives orders from a foreign client and processes imported materials, which belong to the foreign client. Final goods will be sold by that foreign client. The factory in China only receives a payment for its processing service

Background (cont.)

Import-and-Assembly regime

The processing factories in China import the materials they need in the production and control the ownership of these materials.

They can also process goods for multiple foreign firms

The factory in China controls both the inputs and the export of the processed goods, but the marketing and sale of the good is still controlled by the foreign firm

Model

Players: foreign investor and local manager

Target: integration (and how to integrate?) or outsourcing

Ownership and progress rights

Ownership	Progress rights		
	Input sourcing	Processing	Selling
Foreign control	By foreigner	By domestic only	By foreigner only
	By domestic manager		
Domestic control	By foreigner		
	By domestic manager		

Why two stage game?

Structural choice and distribution

Biform Game’s spirit

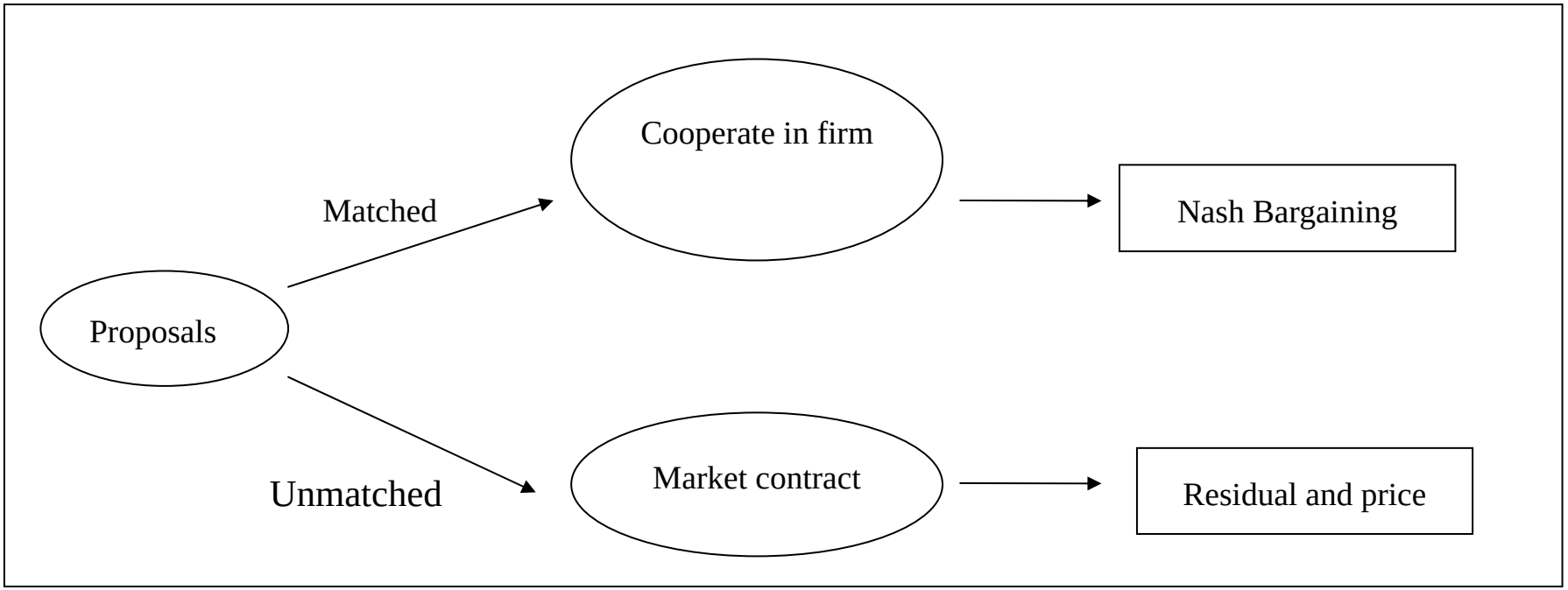
Why Nash bargaining?

Since such a contract is incomplete, each person involved in the firm has an incentive to achieve a larger component in the final distribution by bargaining.

Path dependent relationship between the initial arrangement and later bargaining opportunities

Incomplete contracts are increasingly applied in recent trade models (Spencer 2005)

Timing of the game



Actions, strategies, and outcomes

α to present the ownership,

where $\alpha = 0$ means the foreign firm will control the ownership of the processing firm,

and $\alpha = 1$ means that the domestic manager is the owner.

β to present the input sourcing right,

and $\beta = 0$ means that foreign firm will do the input sourcing,

or $\beta = 1$ means domestic manager will do the input sourcing.

(α, β) will be the action combination for both parties. For foreign firm, (0, 1) means he will control the ownership but ask the domestic manager to do the input sourcing.

Strategies

The strategic actions of one party according to the other party’s action.

For example, for foreign firm, the strategy [(0, 1), (0, 1)]

Two interrelated assumptions (transaction efficiency or cost)

A1: when there is a failure to match, the party owning the firm is entitled to the residual profits and completes the job by contracting for the services in the spot market. The party who does not own the firm will sell his service in the market.

A2: Under the spot market contract, parties earn only a fraction of their marginal productivity. The marginal productivity of their efforts are reduced by ψ, with $0 \leq \psi \leq 1$, so the payoff are $(1-\psi)$ times the first-best level. The owner of the firm also earns only $(1-\psi)$ times the profit. ψ could be considered as a coefficient of transaction cost or loss.

Efforts, production and profit

Following the literature (Baker et al 2003, Feenstra and Gordon 2005)

e_1 , effort devoted to searching for a low-priced input, by either foreigner or local manager;

e_2 , effort devoted to processing the input to produce final good by the local manager;

e_3 , effort devoted to marketing and selling the final good, by the foreign firm.

Cost of input sourcing is given by the linear function

$P \cdot (1 - e_1)$, where $P > 0$ and $0 \leq e_1 \leq 1$

The cost of input processing is given by

$A \cdot (1 - e_2)$, where $A > 0$ and $0 \leq e_2 \leq 1$

Revenue from final sale is given by

$B \cdot (1 + \lambda e_2 + e_3)$, where $0 \le \lambda \le 1$, $0 \le e_3 \le 1$ and $B > A + P > 0$

$$\pi = (B - A - P) + P \cdot e_1 + (B\lambda + A) \cdot e_2 + B \cdot e_3$$

Cost for foreign firm is $C_F(e_1, e_3) = \frac{1}{2}(e_1^2 + e_3^2)$

Cost for local manager is $C_L(e_1, e_2) = \frac{1}{2}(e_1^2 + e_2^2)$

Profit distribution and Nash bargaining

$$\underset{\pi_F,\pi_L}{Max}(\pi_F - \bar{U}_F)(\pi_L - \bar{U}_L) \qquad \text{s.t.} \quad \pi_F + \pi_L = \pi$$

Here $\pi = (B - A - P) + P \cdot e_1 + (B\lambda + A) \cdot e_2 + B \cdot e_3$, and

π_F is the bargaining outcome for foreign firm to get from the total profit π,

$\bar{U}_F$ is the threat point for foreign firm. Similarly,

π_L is the bargaining outcome for local manager to get from the total profit π,

$\bar{U}_L$ is the threat point for local manager.

To simplify, we assume both parties have the same bargaining skill.

We get the solution for this maximization of Nash Product as below:

$$\pi_F = \frac{1}{2}(\pi + \bar{U}_F - \bar{U}_L) \quad \text{and} \quad \pi_L = \frac{1}{2}(\pi + \bar{U}_L - \bar{U}_F)$$

Then each party will choose their effort levels to maximize the difference between these payoffs and their cost of effort:

For foreign firm:

$$\underset{(1-\beta)e_1,e_3}{Max}\ U_F = \pi_F - C_F[(1-\beta)\cdot e_1, e_3]$$

For local manager:

$$\underset{\beta e_1,e_2}{Max} U_L = \pi_L - C_L(\beta \cdot e_1, e_2)$$

Where $\beta = 0$ means foreign firm will do the input sourcing,

and $\beta = 1$ means domestic manager will do the input sourcing.

Threat points

Threat point means the breaking down of the bargaining.

Threat points will depend on different situations which will be described by the parameters α and β, that means different arrangement of the ownership and progress rights will lead to different threat points (two-stages game, biform game).

$$\bar{U}_F = \bar{\pi}_F(\alpha,\beta) - C_F(\alpha,\beta) \quad \text{and} \quad \bar{U}_L = \bar{\pi}_L(\alpha,\beta) - C_L(\alpha,\beta),$$

where $\alpha \in \{0,1\}$ and $\beta \in \{0,1\}$

Profit in threat points under specific arrangement of the ownership and progress rights

		β	
		$\beta = 0$	$\beta = 1$
α	$\alpha = 0$	$\bar{\pi}_F(0,0) = (1-\psi)[(B-A-P)+P\cdot e_1+B\cdot e_3]$ $\bar{\pi}_L(0,0) = (1-\psi)[(B\lambda+A)\cdot e_2]$	$\bar{\pi}_F(0,1) = (1-\psi)[(B-A-P)+B\cdot e_3]$ $\bar{\pi}_L(0,1) = (1-\psi)[P\cdot e_1+(B\lambda+A)\cdot e_2]$
	$\alpha = 1$	$\bar{\pi}_F(1,0) = (1-\psi)(P\cdot e_1+B\cdot e_3)$ $\bar{\pi}_L(1,0) = (1-\psi)[(B-A-P)+(B\lambda+A)\cdot e_2]$	$\bar{\pi}_F(1,1) = (1-\psi)(B\cdot e_3)$ $\bar{\pi}_L(1,1) = (1-\psi)[(B-A-P)+P\cdot e_1+(B\lambda+A)\cdot e_2]$

Utility level of threat points under specific arrangement of the ownership and progress rights

		β	
		$\beta = 0$	$\beta = 1$
α	$\alpha = 0$	$\bar{U}_F(0,0) = (1-\psi)(B-A-P) + \frac{1}{2}(1-\psi)^2(P^2+B^2)$ $\bar{U}_L(0,0) = \frac{1}{2}(1-\psi)^2(B\lambda + A)^2$	$\bar{U}_F(0,1) = (1-\psi)(B-A-P) + \frac{1}{2}(1-\psi)^2 B^2$ $\bar{U}_L(0,1) = \frac{1}{2}(1-\psi)^2[P^2 + (B\lambda + A)^2]$
	$\alpha = 1$	$\bar{U}_F(1,0) = \frac{1}{2}(1-\psi)^2(P^2+B^2)$ $\bar{U}_L(1,0) = (1-\psi)(B-A-P) + \frac{1}{2}(1-\psi)^2(B\lambda + A)^2$	$\bar{U}_F(1,1) = \frac{1}{2}(1-\psi)^2 B^2$ $\bar{U}_L(1,1) = (1-\psi)(B-A-P) + \frac{1}{2}(1-\psi)^2[P^2 + (B\lambda + A)^2]$

Outcomes and utility level

$$\pi_F = \frac{1}{2}(\pi + \bar{U}_F - \bar{U}_L),$$

$$\pi_L = \frac{1}{2}(\pi + \bar{U}_L - \bar{U}_F),$$

Then we will calculate $\pi_F(\alpha, \beta)$ and $\pi_L(\alpha, \beta)$ respectively,

And maximize $\underset{e}{Max} U_F(\alpha, \beta) = \pi_F(\alpha, \beta) - C_F(e)$ and $\underset{e}{Max} U_L(\alpha, \beta) = \pi_L(\alpha, \beta) - C_L(e)$

Nash Bargaining outcome and utility level

		β	
		$\beta = 0$	$\beta = 1$
α	$\alpha = 0$	$U_F(0,0) = \frac{2(2-\psi)(B-A-P)+[\frac{1}{2}+(1-\psi)^2]P^2+(2\psi-\psi^2)(B\lambda+A)^2+[\frac{1}{2}+(1-\psi)^2]B^2}{4}$ $U_L(0,0) = \frac{2\psi(B-A-P)+(2\psi-\psi^2)P^2+[\frac{1}{2}+(1-\psi)^2](B\lambda+A)^2+(2\psi-\psi^2)B^2}{4}$	$U_F(0,1) = \frac{2(2-\psi)(B-A-P)+(2\psi-\psi^2)P^2+(2\psi-\psi^2)(B\lambda+A)^2+[\frac{1}{2}+(1-\psi)^2]B^2}{4}$ $U_L(0,1) = \frac{2\psi(B-A-P)+[\frac{1}{2}+(1-\psi)^2]P^2+[\frac{1}{2}+(1-\psi)^2](B\lambda+A)^2+(2\psi-\psi^2)B^2}{4}$
	$\alpha = 1$	$U_F(1,0) = \frac{2\psi(B-A-P)+[\frac{1}{2}+(1-\psi)^2]P^2+(2\psi-\psi^2)(B\lambda+A)^2+[\frac{1}{2}+(1-\psi)^2]B^2}{4}$ $U_L(1,0) = \frac{2(2-\psi)(B-A-P)+(2\psi-\psi^2)P^2+[\frac{1}{2}+(1-\psi)^2](B\lambda+A)^2+(2\psi-\psi^2)B^2}{4}$	$U_F(1,1) = \frac{2\psi(B-A-P)+(2\psi-\psi^2)P^2+(2\psi-\psi^2)(B\lambda+A)^2+[\frac{1}{2}+(1-\psi)^2]B^2}{4}$ $U_L(1,1) = \frac{2(2-\psi)(B-A-P)+[\frac{1}{2}+(1-\psi)^2]P^2+[\frac{1}{2}+(1-\psi)^2](B\lambda+A)^2+(2\psi-\psi^2)B^2}{4}$

Nash equilibrium analysis

		Local manager's actions			
		{0, 0}	{0, 1}	{1, 0}	{1, 1}
Foreign firm's Actions	{0, 0}	$U_F(0,0),\ U_L(0,0)$	$\bar{U}_F(0,0),\ \bar{U}_L(0,1)$	$\bar{U}_F(0,0),\ \bar{U}_L(1,0)$	$\bar{U}_F(0,0),\ \bar{U}_L(1,1)$
	{0, 1}	$\bar{U}_F(0,1),\ \bar{U}_L(0,0)$	$U_F(0,1),\ U_L(0,1)$	$\bar{U}_F(0,1),\ \bar{U}_L(1,0)$	$\bar{U}_F(0,1),\ \bar{U}_L(1,1)$
	{1, 0}	$\bar{U}_F(1,0),\ \bar{U}_L(0,0)$	$\bar{U}_F(1,0),\ \bar{U}_L(0,1)$	$U_F(1,0),\ U_L(1,0)$	$\bar{U}_F(1,0),\ \bar{U}_L(1,1)$
	{1, 1}	$\bar{U}_F(1,1),\ \bar{U}_L(0,0)$	$\bar{U}_F(1,1),\ \bar{U}_L(0,1)$	$\bar{U}_F(1,1),\ \bar{U}_L(1,0)$	$U_F(1,1),\ U_L(1,1)$

For the case {(0, 0), (0, 0)}, the conditions for a Nash equilibrium is given by:

$U_F(0,0) > \bar{U}_F(0,1)$ $\qquad$ $U_L(0,0) > \bar{U}_L(0,1)$

$U_F(0,0) > \bar{U}_F(1,0)$ $\qquad$ $U_L(0,0) > \bar{U}_L(1,0)$

$U_F(0,0) > \bar{U}_F(1,1)$ $\qquad$ $U_L(0,0) > \bar{U}_L(1,1)$

We get the conditions:

$$\frac{1}{2}[1-(1-\psi)](B-A-P)+\frac{1}{4}[\frac{1}{2}+(1-\psi)^2]P^2+\frac{1}{4}[1-(1-\psi)^2](B\lambda+A)^2+\frac{1}{4}[\frac{1}{2}-(1-\psi)^2]B^2>0$$

$$\frac{1}{2}[1+(1-\psi)](B-A-P)+\frac{1}{4}[\frac{1}{2}-(1-\psi)^2]P^2+\frac{1}{4}[1-(1-\psi)^2](B\lambda+A)^2+\frac{1}{4}[\frac{1}{2}-(1-\psi)^2]B^2>0$$

$$\frac{1}{2}[1-3(1-\psi)](B-A-P)+\frac{1}{4}[1-3(1-\psi)^2]P^2+\frac{1}{4}[\frac{1}{2}-(1-\psi)^2](B\lambda+A)^2+\frac{1}{4}[1-(1-\psi)^2]B^2>0$$

We can find that when $(1-\psi)$ is small enough, for instance, in the extreme, $1-\psi=0$, that means the transaction cost is extremely high, all the inequalities above will hold at the same time.

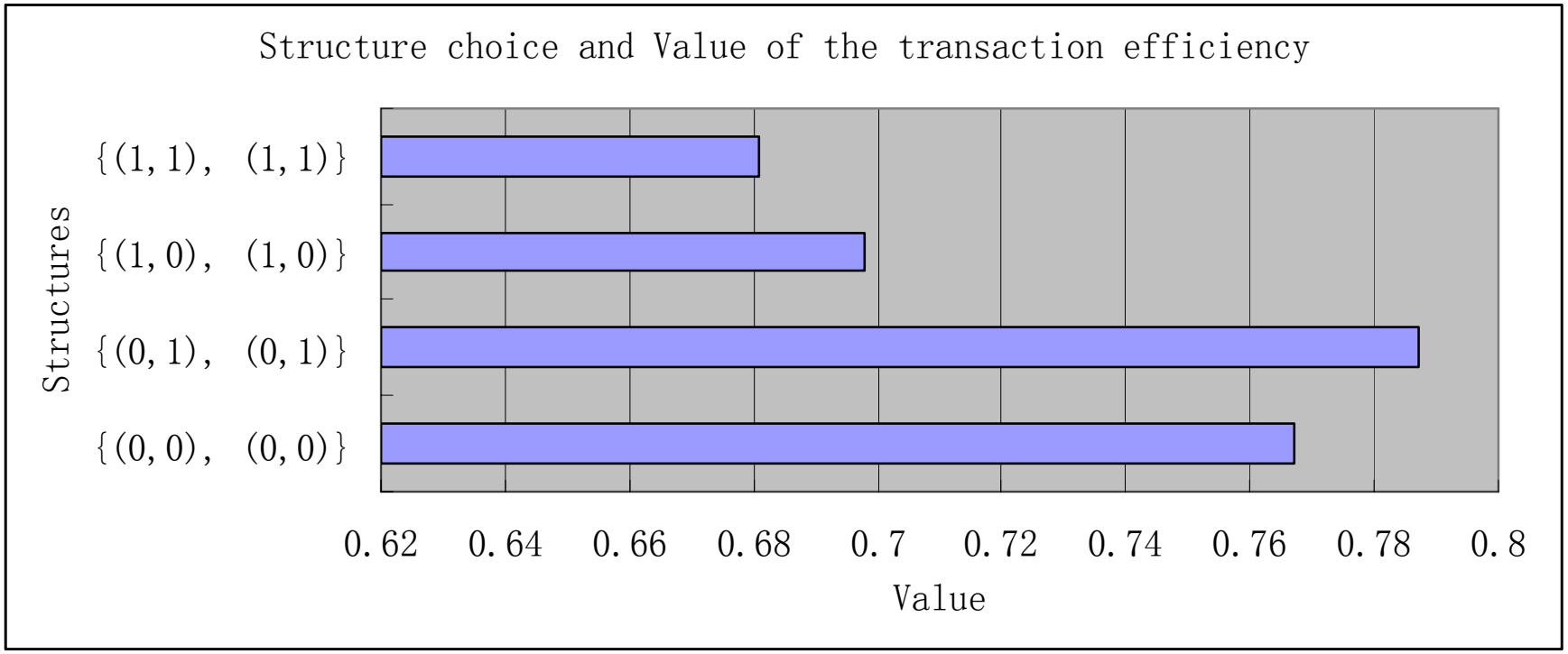
But when $(1-\psi)$ is large enough, the inequalities will not hold.

Economic explaining

Similarly, we get conditions for the case {(0, 1), (0, 1)}, {(1, 0), (1, 0)}, {(1, 1), (1, 1)}

A significant case

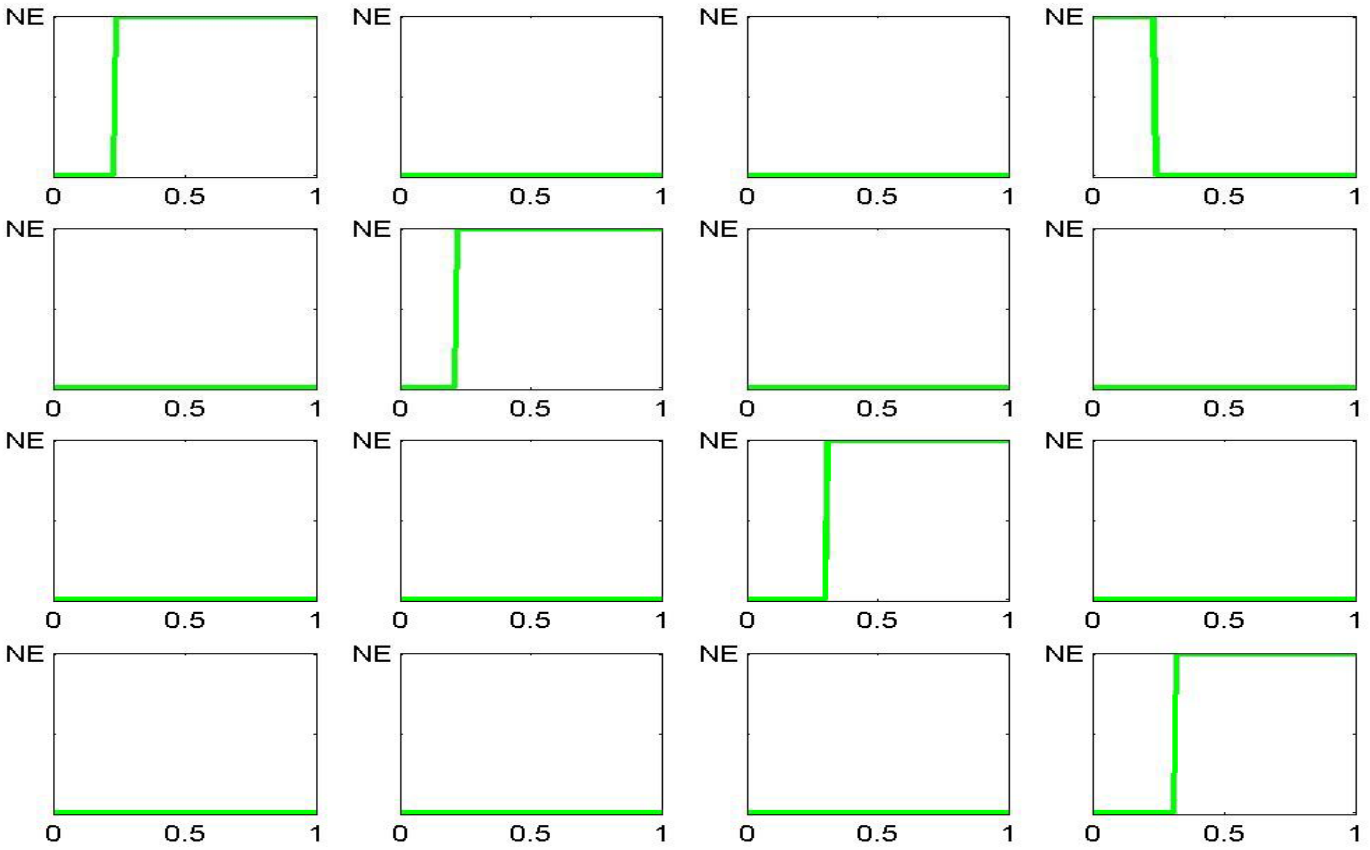
We test the case when $P=1, A=1, B=3, \lambda=\frac{1}{3}$,

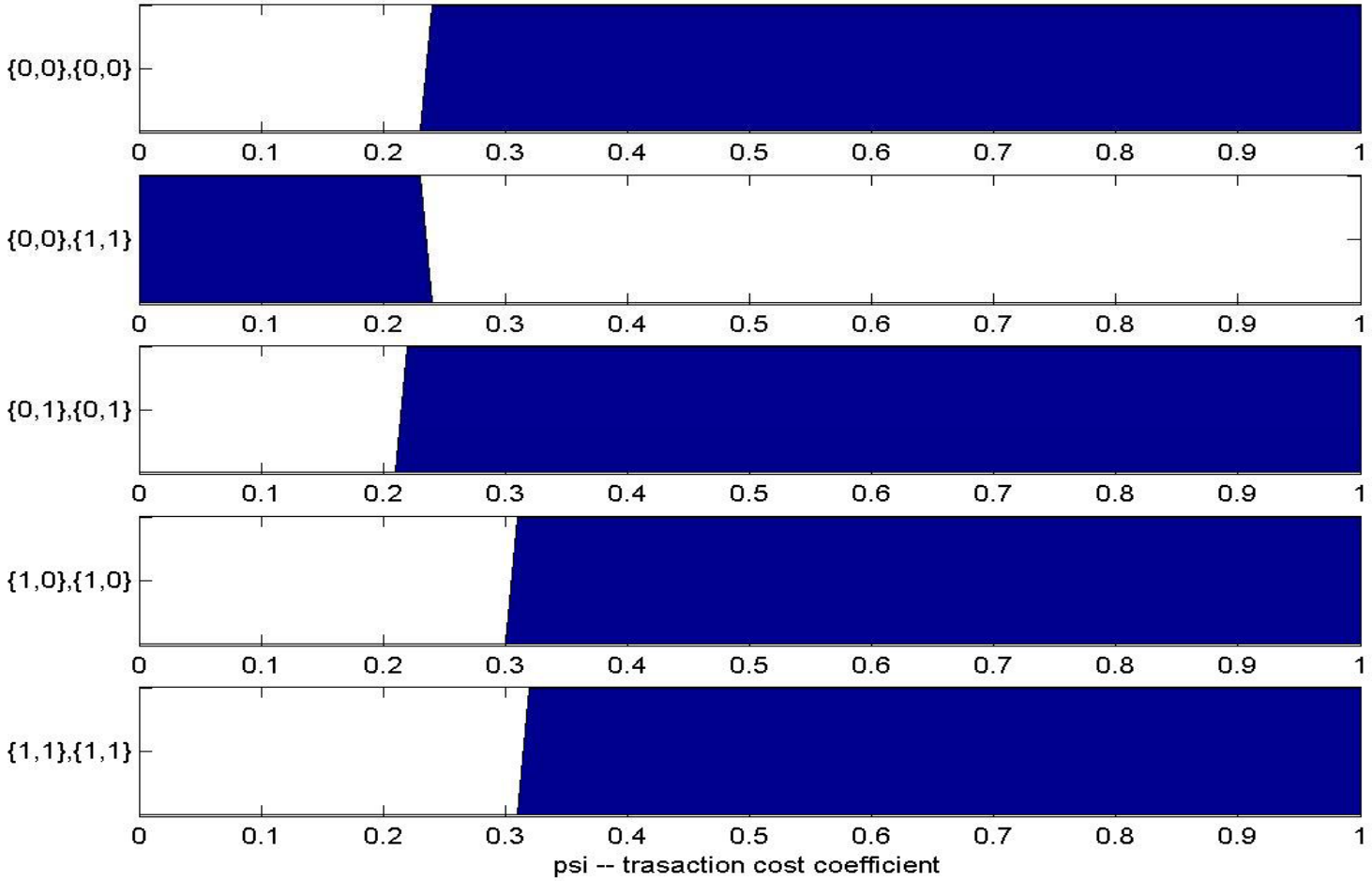


Especially, when $0.767 < 1-\psi < 0.787$, there is only one arrangement {(0, 1), (0, 1)} which is sustainable,

The case that the foreigner owns the processing firm, but the local manager controls the input sourcing

More Nash equilibria and their relationship with $1-\psi$, transaction efficiency

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0.4
0.5
0.6
0.7
0.8
0.9
1
psi -- trasaction cost coefficient

Conclusion and further agenda

Thanks