Direct Transfer and Guanxi in Resolving Contractual Failure*

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ABSTRACT

Guanxi (relationship-building in China) has a mixed reputation. It can be used to implement corruption, e.g. to get a job for an underqualified relative, but it can also be used to facilitate beneficial trade. In this paper I compare guanxi to direct transfers. Both facilitate transactions, good and bad. The results show that if most projects are bad, it could be good to ban both guanxi and transfers. Otherwise, guanxi alone can be more helpful in facilitating beneficial transaction than a direct transfer alone, but having both channels can be even better for useful self-selection and therefore blocking transfers can be bad. Specifically, blocking transfer causes a decreased reliance on guanxi if the official's motive is aligned with the rest of the world, but it causes an increased reliance on guanxi if the official's motive is not so aligned.

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1 Introduction

"Tian-shi, di-li, ren-he. (Right timing, right place, right people.)"[1] – Chinese saying.

Guanxi (relationship-building) is an important feature in Chinese society, but it has a mixed reputation. It's notorious for its usage to implement corruption and encourage unfairness, but it can also be used to facilitate beneficial transactions.

In a world with asymmetric information, the official may not want to bear the risks of an unknown project, and therefore "business in underdeveloped countries is difficult", as claimed by Akerlof (1970) . To conquer the obstacle, entrepreneurs acting in their own interest either compensate the official by directly transferring some rents, or resolve the information issue by relying on guanxi. On the other hand, the rent-seeking official may try to raise barriers to enter the market to squeeze more rents. Indeed, Krueger (1974) **?** claims that "government restrictions upon economic activities are pervasive facts of life."

In this paper I study guanxi and direct transfer in facilitating trade in the world where legislation is not well established. Unlike Krueger (1974) who takes the government constraints as given, I endogenize the choices of barriers as the officials in the government institutions are economic agents. Specifically, I want to ask what endogenously determines the use channels as a choice of the economic agents, how policies that outlaw direct transfer or both channels change the behaviors of the agents, and what impact they have on the relevant social welfare.

To answer these questions, I set up a game theory model where competition is absent. While there is criticism about such an unrealistic assumption, it may be reasonable to think that the market is not so competitive when the economy just started to take off. Moreover, in China's case the government usually grants the officials power and money in desperate searching for investment opportunities in order to stimulate economy.

Guanxi and direct transfer in the model both facilitate trade, but they differ in two fundamental ways: first, the direct transfer channel is to use physical (money) resources paid in advance to compensate lack of information and trust, and probably the entrepreneur will have distorted incentives because of this money constraint; while the "guanxi" channel does not have this limitation. Second, going through the guanxi channel reveals information about the entrepreneurs, whereas going through the transfer channel does not.

The model has the two sides of agents: the official and the entrepreneurs. The economy determines which channel(s) is(are) available at the time, and the official makes the game rules for

[1] Mentioned by Mengzi and Xunzi, two Confucian philosophers living between 400-200 B.C, the saying originally conveys the ideas of three aspects of efficient farming (Xunzi), or aspects of good battle arrangement (Mengzi). In the recent decades, however, it is more of a concern about achieving business success. Guanxi, a term that describes interpersonal relationship in China, makes up the "right people" portion of the saying.

the heterogeneous entrepreneurs. Given the available channels and game rules, rent-seeking entrepreneurs choose which channel to go through or just exit. Going through the direct transfer channel does not directly reveal types and behaviors of the entrepreneurs[2], but the disutility from the risk of encountering a bad project can be compensated by the transfers from the entrepreneurs. The official will have to set the required transfer amount to maximize utility, trading off the rent per entrepreneur against the number who will pay, as well as the number of good projects. Guanxi, on the other hand, resolves information asymmetry and defines norms of acceptable behavior among the two parties, making consensus possible. The trust-based commitment of how to conduct the project and how to share the rents is determined by the joint utility maximization problem, which also means that once entering the relationship, optimal contract is determined and there is no exit by either side.

The results show that if almost all the projects are bad, it tends to be good to block them by shutting down both guanxi and transfers. Otherwise, guanxi alone can be more helpful in facilitating beneficial transaction than a direct transfer alone. This is not so surprising since in the direct transfer channel the rent-seeking official will probably distort good incentives into undertaking bad projects for more rents to bribe when the official's motive is not aligned with the motives of the rest of the world, but guanxi can make such an official compromise to conducting a good project.

It is probably easy for policy makers to come up with policies to outlaw transfer (or even guanxi, but guanxi is hard). The surprising results in this paper, however, suggest that it might not be the right thing to do if the official is not too bad. Blocking transfers does not change the dynamics of the economy if entrepreneurs are less prosocial, and could be harmful if otherwise.

More specifically, if a large fraction of entrepreneurs care about people's well-beings, it gives a good official incentives to let both good and bad entrepreneurs in. If direct transfers are available, the official will extract mild rents and let both them enter, through license fee or bribery, which gives incentives for whoever can afford to paying the overhead to cultivate guanxi, and guanxi is always benign. By blocking transfer, the official will still let all applicants in without any barrier. This pushes all the entrepreneurs out of guanxi, and the bad type of entrepreneurs will choose to undertake projects beneficial to themselves but harmful socially because there is nothing to discipline their behavior.

An uncertain case is when the official is mildly bad. With both channels the official will still set up mild barrier in the transfer channel, but absent transfer, the official would close the gate for entrepreneurs who don't give proceeds. This encourages guanxi building, and the bad type of entrepreneurs are end up with undertaking good projects because of the disciplinary relationship with the official. This effect increase the social welfare. However, the good type of entrepreneurs favors guanxi more, and as a result fewer of them are in the pool outside guanxi, further undermining

[2]It's possible that the types are revealed through self-selection in some equilibrium cases.

incentives for the official to open the gate for them. The expected social value outside guanxi will still be possible and letting them in would still be value enhancing, but the official would not do so because nobody would give proceeds through guanxi. This effect reduces social welfare. Then whether it is good or bad depend on how big each effect is. In one numerical example, it appears to be bad.

These two harmful cases do not appear when there are a lot of bad entrepreneurs, and blocking transfers does not influence the outcome. However, if we count in the social costs of legislature and law enforcement, no change in the model is not good news.

The paper is arranged as follows...

2 The Model

I want to look at the setting where entrepreneurs are seeking opportunities for investment in a relatively imperfect market which is both non-competitive[3] and with high barrier to enter. The high barrier can be high license fee, very limited placements, or unnecessary long and tedious procedure to get approval. An entrepreneur manages to enter the market and can choose whether to conduct the project in a socially beneficial manner or a self-beneficial manner, which are mutually exclusive. The official, whose job is to grant license, possibly has a conflict of interest with the entrepreneurs on how the projects are conducted. Because of information asymmetry in the conduction method and moral hazard problem, project applications are sometimes shelved.

The projects are abstract, and include many categories of production like constructions of residential or commercial building, or businesses in food manufacturing or automotives, etc. In the production process, however, the entrepreneur either chooses to conduct it properly or poorly. In the former case, the entrepreneur may use quality control method to generate a positive cash return of r for the entrepreneur and a strictly positive social benefit S_G. I thus call the properly conducted project a good project (G project). In the latter case, the entrepreneur cuts corners and has an extra return δ, but generates a strictly negative social benefit S_B. I thus call the poorly conducted project a bad project (B project). For instance, a good construction of a residential building is one in which a safe and green technology is applied, a good production of food is one in which carefully selected and tested ingredients are utilized, and a good manufacturing of vehicles is one in which nicely designed and polished models and makes are adopted. After a production cycle the products are sold, entrepreneurs make decent profits, and the society benefits from the process because of the variety of goods that the productions provide with that improve people's well being. However, a "Jerry-built" project is a bad one which generates higher private cash returns but would be so-

[3]This assumption excludes the consideration of scarce resources allocation and influence of other projects on the decision making of the official evaluating a specific project.

cially harmful because of potential safety problems. Additionally, there is no cost in switching a good/bad project into a bad/good one for an entrepreneur, and is unobservable for the official in the short run. (By "short run" I mean the period within the project conducting cycle.) Indeed, the destructive effect of a poorly conducted project could be very long term. A bridge built with cheaper inferior steel and cement boards may stand for years, but would easily collapse in case of flood or earthquake years later. These are, indeed, negative externalities.

The following chart concludes the structure of a project[4]:

Type (T)	Self profit (R)	Social welfare(S)
Good (G)	r	$S_G > 0$
Bad (B)	$r+\delta$	$S_B < 0$
–	0	0

The two sides of players are more or less prosocial. This difference in preference leads to the contrasting choices of project conduction, resulting in conflicts of interest. More specifically, individuals in this economy care about both private cash flows and social welfare, but may weigh them differently. A more prosocial entrepreneur would probably feel better not to harm others by cutting corners and causing potential damage, whereas a self-interested entrepreneur might have less sense of guilt for the misdeeds. Thus, the utility function of an entrepreneur can be written as the cost of guanxi cultivation (if any), plus the weighted average of self profits and social welfare:

$$u_e(t) = -\mathbb{1}_{\{guanxi\}}\bar{\omega} + (1-\lambda_e)(R-t) + \lambda_e S.$$

The first term is the cost for guanxi cultivation, where $\mathbb{1}_{\{guanxi\}}$ is an indicator function which has a value of 1 if guanxi is cultivated and 0 if otherwise, and $\bar{\omega}$ is a fixed cost of guanxi cultivation for the entrepreneur. t is the transfer from the entrepreneur to the official, and thus $R-t$ represents private profits that remain in the pocket of the entrepreneur. The prosocial parameter, $\lambda_e \in [0,1)$, indicates the weight that the entrepreneur puts on social welfare. Other things being equal, the more prosocial entrepreneur with high λ_e is more likely to choose a good project because of higher valuation in social welfare, whereas an entrepreneur with low λ_e may prefer a bad project because utility from private cash flow covers disutility from the negative social welfare. Notice that λ_e for each entrepreneur is private knowledge, absent guanxi. A special case is when $\lambda_e = 0$, which is reduced to the standard assumption in the traditional economics theory with risk neutrality.

For simplicity I assume that there are two types of entrepreneurs with prosocial parameter

[4] If for some reason, the entrepreneur does not enter the market, both self profit and social welfare are zero.

$\lambda_e \in \{\lambda_e^H, \lambda_e^L\}$, which satisfies

$$\frac{\delta}{\delta - S_B} > \lambda_e^H \geq \frac{\delta}{\delta + \Delta S} > \lambda_e^L \cdots (*),$$

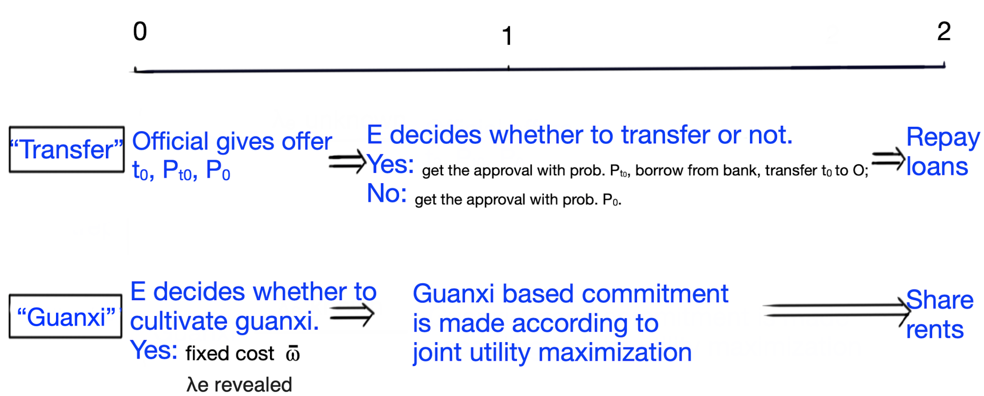
where "H" is for high prosocial type of entrepreneurs, and "L" for low prosocial type. ΔS defined as $S_G - S_B$, is the difference in social welfare of the two projects. The parameters are set such that high type entrepreneurs prefer good projects, other conditions unchanged, while the low type prefer bad projects. Also, λ_e^H is not too high because if it is the case, they always prefer good projects no matter the outside conditions[5]. and I am only interested in the case where different contracts distort the incentives of the entrepreneurs.

Conflicts of interest take place when the decision making relies also on the other party - the official. Like the entrepreneurs, the official has preference over self interest and social well being, whose prosocial parameter is $\lambda_o \in (0, 1)$ and is public information[6]. The utility function is thus

$$u_o(t) = (1 - \lambda_o)t + \lambda_o S.$$

Without guanxi, what the official knows is probability p_H with which an applicant comes up is high type, and $p_L = 1 - p_H$ with which an applicant is low type, rather than the λ_e of a specific entrepreneur. The official also knows about the project structure, i.e. the private profits and social welfare of each type of project due to the past experience.

The timelines of the two channels are shown below.



Entrepreneurs know their own prosocial levels and fixed costs of guanxi cultivation. The cost is random within a population, but is fixed and known to all for any particular individual. Based on

[5]Take an extreme case where λ_e^H is close to 1, i.e. the entrepreneur is purely altruistic so that he would do good no matter what. This is either unrealistic, or not interesting at all to study.

[6]It really does not matter if it's public or private, because it does not enter the decision problem of an entrepreneur. Besides, it is reasonable to assume it is public information because there is only one official, who is probably in the position for awhile, and whose behavior has been observed by public.

this information, and the offer that the official provides (will be explained in detail later), each entrepreneur determines which channel to go through. And they can always choose to apply directly.

If going through transfer channel, the official announces an offer $\{t_0, P_{t_0}, P_0\}$ to the entrepreneurs. If an entrepreneur agrees to transfer t_0 cash to the official, then the project will be approved with probability P_{t_0}; otherwise the entrepreneur chooses to transfer 0, then with probability P_0 the project will get approved. After approval and before the project starts, the entrepreneur borrows from banks and transfers the contracted amount to official, and at the end of production period repays the loans when profits are realized. The reason that the official requires cash paid in advance is lack of trust when there is no guanxi link to discipline behavior. The entrepreneur has no reason to keep the promise to transfer at the end of period and could just run away with the money. However, banks have ways of dealing with debts, but only issue loans when the entrepreneurs have a license issued by the official.

If an entrepreneur decides to go through guanxi channel, fixed cost $\bar{\omega}$ of successful guanxi cultivation would occur. This cost is seen as disutility that can either be physical or non-physical, and is individual specific and independent of other characteristics since guanxi here is an emotional-based relationship rather than cognitive-based. If an entrepreneur happens to share the same hometown with the official, or went to the same college, it is likely that his cost is lower; on the contrary, a high cost would occur when the official dislikes the entrepreneur for personal reasons. Here I also assume that the fixed cost is sunk, which means that it does not bring any utility to the official. I assume this because it is unsure whether the cultivating process brings utility to the official; even if it does, the question is how much? For example, the formation might cost much effort for an entrepreneur to seek acquaintance of the official, but it does not actually render as much immediate benefit to the official, and it is possible that this relationship link is formed just in favor of another guanxi.

Now at time 1 if guanxi is formed, the entrepreneur and the official would sit down and make a commitment on which project should be implemented and how rents are to be shared based on joint utility maximization. During the production process the entrepreneur would follow the social norm and stick to the commitment, or their reputation would be harmed because guanxi links are strongly valued. According to social norm, rents can be shared after realization, or even further, and is a form of personal debt to the other. I only require that the shared rents remain the same present value for both of them.

I assume that discount rate is 1, or, everything is in terms of present value. Though what I am trying to model is a long-run reciprocal relationship, instead of focusing on the cultivation process, what is of interest is the decision of whether to cultivate guanxi and the result of having it. Thus, a reduced form model will serve the purpose and is simple to solve.

3 Solutions

A sufficient condition for first best solution is when information is complete and perfect, and legislation is well formed, i.e., the official knows all the information and observes the behaviors of the entrepreneurs, and any form of transfer is strictly forbidden. Under these conditions, the official would prefer the good type of projects, and all the entrepreneurs would commit to good projects because that is the only way they can enter and gain positive utility.

However, in the world with incomplete information (the types of entrepreneurs are private) and imperfect information (the actions the entrepreneurs take cannot be verified), when direct transfer is not forbidden, rational agents would form contracts, either formally and/or informally, to enforce business and maximize their own utilities based on available information.

In this section I will first discuss a benchmark case when both channels do not exist or are shut down; then I will solve the problem when one of the channels is not available, and then if both channels are available. By comparing social welfare of the cases, I will discuss when guanxi is good, when it is bad, and whether and under which conditions shutting down one or both channels is beneficial for the society, just in hope that I can provide some insight in the optimal policy making for relevant situations.

3.1 Benchmark: No Channel

When no channel is available, types of entrepreneurs are private information. The utility of an entrepreneur is

$$\begin{aligned} U_e &= (1-\lambda_e)R + \lambda_e S \\ &= (1-\lambda_e)r + \lambda_e S_G + \mathbb{1}_{\{T=B\}}[(1-\lambda_e)\delta - \lambda_e \Delta S] \end{aligned}$$

$\mathbb{1}_{\{T=B\}}$ is equal to 1 if the entrepreneur chooses bad project. By assumption $(*)$, H-type entrepreneurs prefer good projects, while L-type entrepreneurs stick to bad projects. Since the official knows the probability of applicants who are having good/bad projects, either all applications are approved or rejected, depending on whether the official's expected utility is positive or negative.

$$\mathbb{E}U_o = p_H \lambda_o S_G + p_L \lambda_o S_B = \lambda_o[S_G - p_L(S_G - S_B)] = \lambda_o \mathbb{E}\$,$$

where $\mathbb{E}\$$ is the expected social welfare if there is free entry. This suggests that the official's decision coincides with the social expected utility. If $p_L > \frac{S_G}{S_G - S_B}$, then $\mathbb{E}U_o < 0$, the official will reject all the applications; vise versa.

3.2 Transfer Channel: Formal Contracting

When only 'the direct transfer channel is possible, due to information asymmetry, the official simply gives two offers to let the entrepreneurs choose: to transfer t_0 and get approved with probability P_{t_0} or not to transfer and get approved with probability P_0[7]. Thus, the entrepreneur's problem (E's problem) is stated below.

E's problem: given $\{P_{t_0}, P_0, t_0\}$, an entrepreneur chooses $T^* = T(H/L, P_{t_0}, P_0, t_0) \in \{G, B\}$ and $\tau^* = \tau(H/L, P_{t_0}, P_0, t_0) \in \{t_0, 0\}$ (whether to transfer or not) that maximize utility:

$$\begin{aligned}\underset{T,\tau}{\text{Max}} U_e &= \underset{\tau}{\text{Max}}\{\underset{T}{\max} P_{t_0} u_e(t_0), \underset{T}{\max} P_0 u_e(0)\} \\ &= \underset{\tau}{\text{Max}}\{\underset{T}{\max} P_{t_0}[(1-\lambda_e)(R-t_0)+\lambda_e S], \underset{T}{\max} P_0[(1-\lambda_e)R+\lambda_e S]\}\end{aligned}$$

The first part is the expected utility of the entrepreneur if transfer t_0 is chosen, and the second part is the expected utility if otherwise. Given the contract announced by the official, an entrepreneur not only decides whether to transfer, but also what type of project is to be conducted. Knowing the strategy, the official's problem is to design the contract:

O's problem: given $T(H/L, P_{t_0}, P_0, t_0)$ and $\tau(H/L, P_{t_0}, P_0, t_0)$, the official chooses $\{P^*_{t_0}, P^*_0, t^*_0\}$ that maximizes utility:

$$\underset{P_{t_0},P_0,t_0}{\text{Max}}\ U_o = \underset{P_{t_0},P_0,t_0}{\text{Max}} \left\{ (1-\lambda_o)\text{Prob.}(\tau = t_0)t_0 + \lambda_o[\text{Prob.}(T = G)S_G + \text{Prob.}(T = B)S_B] \right\}$$

where Prob.$(\tau = t_0)$ is the probability of entrepreneurs who choose to transfer t_0 amount, and Prob.$(T = G)$ and Prob.$(T = B)$ are the probabilities of entrepreneurs who conduct good or bad projects, respectively, over the whole entrepreneurs' population.

To solve this problem, the key is to find out the conditions that incentivize each type of entrepreneurs to choose a particular project. The thresholds are:

$$\text{Thresholds} \begin{cases} t_M = r \text{ (money constraint for doing G project)} \\ t_0^H = r + \delta + \frac{\lambda_e^H}{1-\lambda_e^H} S_B > r \\ t_0^L = r + \delta + \frac{\lambda_e^L}{1-\lambda_e^L} S_B > t_0^H > r \end{cases}$$

[7]This is kind of like Rothschild and Stiglitz(1978) **?** in solving adverse selection problem. Given preferences of the two types of entrepreneurs, the official could offer separate strategy to distinguish the hidden types. However, the official's objective is to maximize utility, and separate strategies does no necessarily generate the best outcome. Indeed, we will see the equilibrium is pooling all the time

For H-type, if the required transfer is lower than r, which is the cash amount the entrepreneurs could afford when conducting properly, then a good project will be chosen; if the required transfer is between r and t_0^H, then having good projects is no longer affordable, but a bad project will generate non-negative profits, which distorts incentive; both types of projects are unaffordable if the transfer is higher than t_0^H, driving H-type entrepreneurs out of market. For L-type of entrepreneurs, when a bad project is unaffordable, so is a good one. Then the cutoff t_0^L determines whether the L-type entrepreneurs are in or out.

I assume that at the critical points an entrepreneur always first ensures that he/she makes a living, and then considers social well being. One example is when transfer is exactly t_0^H, though conducting a project poorly has the same utility as staying outside, and a bad project definitely makes society worse off, but the entrepreneur chooses to stay in because staying in has the priority [8].

Mark intervals $[0,r]$, $[r,t_0^H]$, $[0,t_0^L]$ as (1), (2), (3). By assumption $(*)$, $r < t_0^H < t_0^L$, indicating that the official can always extract higher rents from entrepreneurs who choose a bad project. I first solve in each interval the best contract(s) $\{P_{t_0}^*, P_0^*, t_0^*\}$ on the official's side. Then the global optimum is among these contracts which contribute to the highest utility for the official.

$$\{P_{t_0}^{**}, P_0^{**}, t_0^{**}\} = \arg\max U_o^*.$$

To guarantee the unique solution, assume that if two contracts generate the same utility for the official, the one that has higher social welfare should be the actual solution. Figure 1 shows the results[9].

Figure 1 (a) shows the official's utility with respect to different prosocial levels (λ_o) and probabilities of entrepreneurs that belong to the L-type. The three surfaces in blue, green and yellow represent utility of the official when transfer is constrained to the intervals (1),(2) and (3). By getting the upper limit of the surfaces, we find the solutions of the problem, which are shown in the Figure 1 (b). Formally,

Proposition 1.1 $P_0^* = 0$ is the(an) equilibrium solution for any case.
Proof: See Appendix A.1-A.3.

Proposition 1.2
1). If $\lambda_o \geq \frac{1}{1+\frac{p_H \Delta S}{t_o^H - r}}$, and $p_L \leq \min\{1 - \frac{t_0^L - r}{t_0^L + \frac{\lambda_o}{1-\lambda_o} S_G}, (\frac{1}{\lambda_o} - 1)\frac{r}{\Delta S} + \frac{S_G}{\Delta S}\}$, then the optimal contract $\{P_{t_0}^*, P_0^*, t_0^*\}$ is $\{1, [0, \kappa_1], r\}$.

[8] This is also to ensure the existence of solution.
[9] $r = 1.5; S_G = 4; S_B = -1; \delta = 2; \lambda_e^H = 0.5; \lambda_e^L = 0.1$

2). If $p_L > \frac{S_G}{\Delta S}$, then $\mathbb{E}\$ < 0$; if $p_L \leq \frac{S_G}{\Delta S}$, then $\mathbb{E}\$ \geq 0$.

Proof: See Appendix A.4

In area (1) when average entrepreneurs and officials are good, i.e. p_L relatively small and λ_o relatively large, the official will try to keep both types of entrepreneurs in the direct transfer channel and extract rents as much as possible. Consequently in this region prosocial entrepreneurs are doing good projects, while non-prosocial entrepreneurs are doing bad projects. But because the official can get rents from projects, compensating disutility from negative social welfare, it is possible that expected social welfare is negative. But generally this area is not the worst compared to benchmark model.

Proposition 1.3

1) If $\lambda_o < \min\{\frac{1}{1+\frac{p_H \Delta S}{t_o^H - r}}, \frac{1}{1-S_B/t_0^H}\}$, and $p_L \leq 1 - \frac{t_0^L - t_0^H}{t_0^L + \frac{\lambda_o}{1-\lambda_o} S_B}$, then the optimal contract $\{P^*_{t_0}, P^*_0, t^*_0\}$ is $\{1, 0, t_o^H\}$.

2) $\mathbb{E}\$ < 0$.

Proof: See Appendix A.5

In area (2) with good average entrepreneurs but a bad official, i.e. both p_L and λ_o relatively small, then it is possible that the official wants all the good entrepreneurs in the transfer channel, and tries to squeeze the maximum from them. Because of the "money constraint", the H-type entrepreneur's are not able to afford the transfer when conducting good projects, but have to switch to the bad one and obtain non-negative utility. This is the worst situation because the incentives of the good entrepreneurs are twisted by the self-interest-driven official.

Proposition 1.4

1) If $\lambda_o < \frac{1}{1-S_B/t_0^L}$, and $p_L > \max\{1 - \frac{t_0^L - r}{t_0^L + \frac{\lambda_o}{1-\lambda_o} S_G}, 1 - \frac{t_0^L - t_0^H}{t_0^L + \frac{\lambda_o}{1-\lambda_o} S_B}\}$, then the optimal contract $\{P^*_{t_0}, P^*_0, t^*_0\}$ is $\{1, 0, t_o^L\}$.

2) $\mathbb{E}\$ < 0$.

Proof: See Appendix A.6

In area (3) when the entrepreneurs and the official are both bad, i.e. p_L large and λ_o small, the official would squeeze maximum rents from L-type entrepreneurs, and completely "abandon" the H-type. This drives away all the good projects.

Proposition 1.5

1) If $p_L > (\frac{1}{\lambda_o} - 1)\frac{r}{\Delta S} + \frac{S_G}{\Delta S}$ and $\lambda_o > \frac{1}{1-S_B/t_0^L}$, then all the projects will be rejected.
2) $\mathbb{E}\$ = 0$.
Proof: See Appendix A.7

When p_L and λ_o are large, meaning that average entrepreneurs are bad but the official is good, then the official actually chooses not to approve any project, ascribed to asymmetric information and the gigantic disutility from bad projects.

It is very interesting to see with an insufficient supervision mechanism how destructive it can be when the official is self-interested and has ultimate power, especially when applicants are "good" in the sense of the prosocial level. It explains how bad things are done by even good-natured entrepreneurs and how society suffers from this when good people are "ruled" by bad officials.

What can we say about the opposite combination of entrepreneurs and officials? If the economy has a prosocial official but not such socially-concerned entrepreneurs, the prosocial official may not want to approve any projects. Another takeaway from this is that, when a project is very risky, or has huge damage to society if not properly done, it is possible that the official has "action through inaction".

"Transfer" in this setting is not necessarily illegal activity like "bribery". In order to squeeze profits justifiably and conveniently, officials do have motivations to "legalize" this behavior by imposing barriers and control to enter, either in a form of license fee, or in a form of complicated approval process such as loads of paper work and prolonged waiting time. This actually argues that entry control causes the worst outcome when people are prosocial but the official is evil. Moreover, legislation can deal with illegal activities to forbid transfer, but cannot really help with regulating the legalized rents squeezing behaviors.

3.3 Guanxi Channel: Informal Contracting

In this subsection and the next by introducing the guanxi channel, my aim is to find the condition(s) under which entrepreneurs choose to cultivate guanxi, and whether it is good or bad compared to the case when the guanxi channel is no longer available.

I first put the constraint that only the guanxi channel is available, then add the transfer channel in the next subsection. Logically I should do the opposite to analyze the effect of eliminating one channel or both. However, it is arranged in this order because the one channel case is easier to solve, and will help with solving the more complicated problem when there are both channels.

The steps of going through the guanxi channel are as follows:

1. given fixed cost $\bar{\omega}$ an entrepreneur decides whether to cultivate guanxi;

2. if not, the official approves with probability P^o; if yes, λ_e is revealed and guanxi-based commitment $\{T, t_i\}$ is determined according to joint utility maximization;

3. Rents sharing.

One remark may be made at this point. In the guanxi channel it cannot be a take-it-or-leave-it offer, or the official would extract all the rents given complete and perfect information. Then due to the existence of sunk cost for almost all the entrepreneurs, no entrepreneur would have chosen the channel. On the other hand, a take-it-or-leave-it offer that allows the official to extract all the rents is against the spirit of "guanxi", and is violating what we have understood as a social norm.

Before the project application an entrepreneur decides whether to build guanxi with the official. Again, $\bar{\omega}$ is fixed for each individual but varies for different people. I assume it to be independent of the type of entrepreneur, and is completely random. This is a reasonable assumption: an entrepreneur happened to know the official's brother back in college, which is a random event, would find it easier to cultivate this emotionally-based relationship with the official; on the contrary, with no proper background and necessary connections, it might be very hard to form guanxi. For simplicity, I assume $\bar{\omega}$ to be uniformly distributed within a certain range.

After formation, both parties have to agree on the contract based on joint utility maximization. In other words, the project type and rents sharing strategy are chosen such that the overall well being is the largest for the official and the entrepreneur as a whole. Formally, the joint utility maximization problem can be explained as

$$\begin{aligned}
\underset{T,t}{\text{Max}} U = \underset{T,t}{\text{Max}} & \left\{ [(1-\lambda_e)(R-t)+\lambda_e S][(1-\lambda_o)t+\lambda_o S] \right\} \\
\text{s.t. } & U_o(T,t) = (1-\lambda_o)t + \lambda_o S \geq 0 \\
& t \geq 0
\end{aligned}$$

which is the multiplication of the two utility functions[10] but excludes sunk cost, since there is no reason to think that intimacy brings about higher rents transferring, but sunk cost does enter the constraints of entrepreneurs' guanxi cultivation decision. This is exactly an example of Nash Bargaining with equal bargaining power of the two sides[11]. I assume that if a good project and a

[10]Let t be the amount of committed shared rents, thus

$$\begin{aligned}
u_e(t) &= -\bar{\omega} + (1-\lambda_e)(R-t) + \lambda_e S, \\
u_o(t) &= (1-\lambda_o)(R-t) + \lambda_o S.
\end{aligned}$$

[11]The outcome of disagreement for the entrepreneur is exactly 0, instead of whatever the reservation utility is before guanxi formation. This means that there should not be disagreement within guanxi channel, or the entrepreneur should not cultivate guanxi ex ante.

bad project have the same joint utility value, then the good project should be chosen because it is has higher social welfare.

I assume the optimal rent sharing is t_G^* when an entrepreneur chooses good project, and t_B^* when choosing a bad project. Let the optimal contract to be $\{t^*, T^*\}$, where $t^* \in \{t_G^*, t_G^*\}$ is the optimal rents sharing, and $T^* \in \{G, B\}$ is the contracted type of project. Then

$$
\begin{aligned}
t_G^* &= \max\left\{0, t_G^{foc}\right\}, t_G^{foc} = \frac{1}{2}[r + (\frac{\lambda_e}{1-\lambda_e} - \frac{\lambda_o}{1-\lambda_o})S_G] \\
t_B^* &= \max\left\{\bar{t_B}, t_B^{foc}\right\}, \\
\bar{t_B} &= \frac{\lambda_o}{1-\lambda_o}(-S_B), t_B^{foc} = \frac{1}{2}[r + \delta + (\frac{\lambda_e}{1-\lambda_e} - \frac{\lambda_o}{1-\lambda_o})S_B] \\
\{t^*, T^*\} &= \arg\max\{U(t_G^*, G), U(t_B^*, B)\}
\end{aligned}
$$

The joint utility maximization problem has the following properties due to the characteristics of multiplication: first, if they choose a good project, $S = S_G > 0$; and if $\lambda_e > \lambda_o$, which means that the entrepreneur is more prosocial than the official, then the entrepreneur has to compensate the official a little bit more. And vice versa. Second, if they choose a bad project, $S = S_B < 0$; and if $\lambda_e < \lambda_o$, which means that the entrepreneur is less prosocial than the official, then the official has to compromise and accept less rents. And vice versa.

Since the committed rents sharing is not required to be paid off immediately, but rather in a form of an "IOU" that becomes the liability of the entrepreneur to the official, which could be paid off either by future money or services that transfer equal utility, "money constraints" is no problem here.

Foreseeing the optimal contract that has to be adhered to, the entrepreneurs are in the position of making guanxi cultivation decisions. Should an entrepreneur choose to directly go to the official, the project would be approved with probability P^o. Similarly, outside of the guanxi channel the H-type entrepreneurs choose good projects, and the L-type choose bad projects. The Reservation utility for an entrepreneur is $\bar{U} = P^o[(1-\lambda_e)R + \lambda_e^S]$.[12]

E's problem: given fixed cost $\bar{\omega}$, P^o and $\{T^*, t^*\}$, an entrepreneur chooses whether to cultivate guanxi:

$$\max U_e = \max\{\bar{U}, -\bar{\omega} + (1-\lambda_e)(R - t^*) + \lambda_e S\}$$

[12]Specifically, reservation utility function $\bar{U}^H$ and $\bar{U}^L$ for H-type and L-type entrepreneurs respectively are

$$
\begin{aligned}
\bar{U}^H &= P^o[(1-\lambda_e^H)r + \lambda_e^H S_G] = P^o u_e^H(0, G), \\
\bar{U}^L &= P^o[(1-\lambda_e^L)(r+\delta) + \lambda_e^L S_B] = P^o u_e^L(0, B).
\end{aligned}
$$

The threshold for the decision is thus

$$\bar{t} = R + \frac{\lambda_e}{1-\lambda_e}S - \frac{\bar{\omega}+\bar{U}}{1-\lambda_e}$$

i.e. if $t^* \leq \bar{t}$, meaning the cost of guanxi (rents shared with the official, plus the fixed cultivating cost) is relatively small, the entrepreneur would cultivate guanxi at the beginning, otherwise go to the official directly.

O's problem: given $\{T^*, t^*\}$, E's strategy and the distribution of sunk cost $f(\bar{\omega})$, the official chooses P^o such that the expected utility is maximized:

$$\underset{P^o}{\text{Max}}\mathbb{E}U_o = \underset{P^o}{\text{Max}}\Bigg\{ \int_{\bar{\omega}} u_o(t^*) f(\bar{\omega}|\text{guanxi}) d\bar{\omega} \\ + P^o \lambda_o [\text{Prob.}(T=G, \text{no guanxi}) S_G + \text{Prob.}(T=B, \text{no guanxi}) S_B] \Bigg\}$$

Since the only problem considering the composition of H-type and L-type entrepreneurs is the official's problem, which is to solve P^o, I first solve the optimal contract problems for the two types of entrepreneurs separately, and see who has what contract and under which condition(s).

Proposition 2.1 The optimal contract for the official and an H-type entrepreneur is always to have a good project. More specifically,

1) if $\lambda_o \in (0, \lambda_o^*]$, where $\frac{\lambda_o^*}{1-\lambda_o^*} = \frac{r}{S_G} + \frac{\lambda_e^H}{1-\lambda_e^H}$ (see Appendix B.1 for details), then the optimal contract is $\{T^*, t_H^*\} = \{G, t_G^{foc}\}$;

2) if $\lambda_o \in (\lambda_o^*, 1)$, then the optimal contract is $\{T^*, t_H^*\} = \{G, 0\}$.

Proof: The only assumption used is $\lambda_e^H \geq \frac{\delta}{\delta + \Delta S}$ $(*)$. See Appendix B.2.

Why is it true? It is true because λ_e^H is big enough such that no matter what value λ_o is, a good project is always the optimal choice. When λ_o is very small, the entrepreneur has to share some of the rents (determined by the first order condition) to make the official happy; when λ_o is big enough, rents can even be acquired fully by the entrepreneur and both parties are happy[13].

Proposition 2.2 For the official and an L-type entrepreneur,

[13] If negative rents sharing is allowed, the joint utility could be even higher. However, this assumption is not reasonable because there is never a case that the official "owes" an entrepreneur in project approval.

1) if $2\frac{\lambda_e^L}{1-\lambda_e^L} > \frac{\delta}{\Delta S} - \frac{r}{S_G}$: if $\lambda_o \in (0, \lambda_o''')$[14], the optimal contract is $\{T^*, t_L^*\} = \{B, t_B^{foc}\}$; if $\lambda_o \in [\lambda_o''', \lambda_o')$, the optimal contract is $\{T^*, t_L^*\} = \{G, t_G^{foc}\}$; and if $\lambda_o \in [\lambda_o', 1)$, the optimal contract is $\{T^*, t_L^*\} = \{G, 0\}$.

2) if $2\frac{\lambda_e^L}{1-\lambda_e^L} \leq \frac{\delta}{\Delta S} - \frac{r}{S_G}$: if $\lambda_o \in (0, \lambda_o'''')$[15], the optimal contract is $\{T^*, t_L^*\} = \{B, t_B^{foc}\}$; and if $\lambda_o \in [\lambda_o'''', 1)$, the optimal contract is $\{T^*, t_L^*\} = \{G, 0\}$.

Proof: See Appendix B.3.

There is no surprise that when the official is very bad and the entrepreneur is not so prosocial, the bad project is contracted. Disutility from the bad project does not bring much harm to either of them, but the rents sharing of higher private profits derives much higher utility for both. But then if the official is very prosocial, a bad project brings about huge disutility that dramatically decreases joint utility value, so that a good project is contracted in this case. Then if the official is not too good and not too bad, the contract depends on the preference of the L-type entrepreneur: a good project is implemented if the entrepreneur is mildly bad, whereas a bad project is implemented if the entrepreneur is very bad.

To conclude, if we categorize the types of the official and entrepreneurs as “good”, “mildly bad”, and “bad” according to their prosocial level[16], we have the following proposition:

Proposition 2.3 If either the entrepreneur or the official is “good”, or if both the entrepreneur and the official are “mildly bad”, then a good project is contracted; otherwise a bad project is contracted.

Proof is easy to get from propositions 2.1 and 2.2. This suggests the necessary and sufficient condition for a bad project to be contracted, which is that at least one side should be “bad” and no sides should be “good”.

Now the question is, knowing the commitment under relationship, would the entrepreneur choose to cultivate guanxi ex ante? As an example, the next two figures (Figure 3 and Figure 4) show the choices of an H-type and an L-type entrepreneur respectively, when $2\frac{\lambda_e^L}{1-\lambda_e^L} > \frac{\delta}{\Delta S} - \frac{r}{S_G}$, i.e. the entrepreneur is “mildly bad”. The same parameters values are still used[17].

This graph assumes $P^o = 0$. Above the solid curve is the area where fixed sunk cost is too

[14] for details about λ_o''', see Appendix B.3.

[15] for details about λ_o'''', see Appendix B.3.

[16] An H type entrepreneur should be defined as “good”, and an L type entrepreneur could be either “mildly bad” or “bad”

[17] $r = 1.5; S_G = 4; S_B = -1; \delta = 2; \lambda_e^H = 0.5; \lambda_e^L = 0.1; \bar{\omega} \in [0, 3.5]; P_o = 0.$

high such that the entrepreneurs are not willing to cultivate guanxi; below the solid curve is the area where the entrepreneurs choose to cultivate it. Given distribution of $\bar{\omega}$, the fraction of H-type entrepreneurs out of guanxi can be solved. After solving the official's problem and obtaining the optimal P^{o*}, the green solid line will probably shift up or down, changing the fraction of H-type entrepreneurs who are in and out of the guanxi channel.

Figure 4 shows the joint utility maximization problem for the official and an L-type entrepreneur (up), and the choices of guanxi cultivation (down). In the upper figure, the red curve depicts the joint utility when contract G, t_G^{foc} is chosen; the blue curve depicts the joint utility when contract B, t_B^{foc} is chosen; and the yellow line is the the joint utility with contract $G, 0$. Then the solid curve "blue-red-yellow" is the optimal choice. Notice that the yellow solid line is the optimal when λ_o is large, because the red curve is not feasible.

The bottom figure in Figure 4 is the choice of guanxi for the L-type, which coincides with the joint utility maximization problem.

To solve P^o, assume $\bar{\omega}$ is uniformly distributed in $[0, \omega_0]$, and is independent of types of entrepreneurs. Also assume $\omega_0 > \max\{U_H, U_L\}$, which means that there are always entrepreneurs who cannot afford the fixed cost. The utility maximization problem is

$$
\begin{aligned}
&\underset{P^o}{\text{Max}}\mathbb{E}U_o = \underset{P^o}{\text{Max}}\Bigg\{ \int_{\bar{\omega}} u_o(t^*) f(\bar{\omega}|\text{guanxi}) d\bar{\omega} \\
&\quad + P^o \lambda_o [\text{Prob.}(T = G, \text{no guanxi}) S_G + \text{Prob.}(T = B, \text{no guanxi}) S_B] \Bigg\} \\
&\mathbb{E}U_o = \frac{\max\{\bar{\omega} + U_e^H - \bar{U}^H, 0\}}{\omega_0} p_H U_o^*(H) + \frac{\max\{\bar{\omega} + U_e^L - \bar{U}^L, 0\}}{\omega_0} p_L U_o^*(L) \\
&\quad + P^o \lambda_o \left[(1 - \frac{\max\{\bar{\omega} + U_e^H - \bar{U}^H, 0\}}{\omega_0}) p_H S_G + (1 - \frac{\max\{\bar{\omega} + U_e^L - \bar{U}^L, 0\}}{\omega_0}) p_L S_B \right] \\
&\quad = P^o \lambda_o (p_H S_G + p_L S_B) \\
&\quad + \frac{\max\{\bar{\omega} + U_e^H - P^o u_e^H(0, G), 0\}}{\omega_0} p_H U_o^*(H) + \frac{\max\{\bar{\omega} + U_e^L - P^o u_e^L(0, B)\}}{\omega_0} p_L U_o^*(L) \\
&\quad - P^o \lambda_o \left[\frac{\max\{(\bar{\omega} + U_e^H) - P^o u_e^H(0, G), 0\}}{\omega_0} p_H S_G + \frac{\max\{(\bar{\omega} + U_e^L) - P^o u_e^L(0, B)\}}{\omega_0} p_L S_B \right]
\end{aligned}
$$

I thus solve it numerically, and have the following propositions:

Proposition 2.4 If $\lambda_o \to 0$, then $P^{o*} = 0$.

Proof: If $\lambda_o \to 0$, then

$$\mathbb{E}U_o \to \frac{\max\{\bar{\omega} + U_e^H - P^o u_e^H(0,G), 0\}}{\omega_0} p_H U_o^*(H) + \frac{\max\{\bar{\omega} + U_e^L - P^o u_e^L(0,B)\}}{\omega_0} p_L U_o^*(L),$$

is non-increasing in P^o. Thus it reaches maximum when $P^o = 0$.

This can be shown in Figure 5 and Figure 6. Figure 5 shows the entrepreneurs' choices of guanxi in equilibrium, and Figure 6 shows the rule set by the official and social welfare in equilibrium. When λ_o is small enough, the best strategy for the official is to keep as many entrepreneurs as possible into guanxi to extract rents. Thus, $P^o = 0$, any project outside guanxi would be rejected.

Proposition 2.5 (1) If p_H is small enough, specifically, if $p_H < \hat{p_H}$[18], then $P^{o*} = 0$, i.e., business can only go through guanxi to get approval.
(2) If p_H and λ_o are big enough, more specifically, if $p_H \geq \hat{p_H}$ and $\lambda_o \geq \lambda_o'$, then $P^{o*} = 1$, and almost no guanxi exists.

Proof: See Appendix B.4.

Intuitively, when entrepreneurs are generally bad and the official is good, then entrepreneurs outside guanxi even have a higher fraction of L-type and generate more negative expected social welfare. Thus, the benigh official would let $P^o = 0$, first to hinder guanxi outsiders from entering, second to increase the fraction of entrepreneurs who are entering guanxi. Noice that, $p_H S_G + p_L S_B \leq 0$ and $\lambda_o \geq \lambda_o'$ are sufficient conditions for $P^{o*} = 0$. Even when sometimes p_H not that small, we still have the result. See figure 6 (up) in the region where $p_L > 0.4$. As shown, the parameters chosen make $P^{o*} = 0$ for every λ_o.

In the second situation allotted here, the prosocial official would want all the entrepreneurs conduct projects, as long as most of whom are H-type entrepreneurs. Because there is no any cost outside guanxi to get approval, no one will get into guanxi channel. Thus, we are expecting a situation where everyone is doing business , with H-type entrepreneurs conducting good projects, and L-type entrepreneurs conducting bad.

Figure 5 shows that when the official is prosocial ($\lambda_o > 0.6$), higher fraction of H-type's tend to cultivate guanxi. When p_L is decreasing from 1, we should first expect that more people are cultivating guanxi, and among whom the fraction of H-type is increasing. Then to a certain point when there are enough H-type entrepreneurs in the economy (in the figure it is when p_L decreases to 0.2), there is a dramatic drop in the fraction of people cultivating guanxi. The reason for the drop

[18] $\hat{p_H} = \frac{((1-\lambda_e^L)r + \lambda_e^L S_G) - \omega_0 S_B/S_G}{\omega_0 \Delta S/S_G - (\lambda_e^H - \lambda_e^L)(S_G - r)}$ see Appendix B.4 for detail

is the change of outside option, which is shown in Figure 6(up). The guanxi commitment favors H-type entrepreneurs when official is prosocial, so it is expected that among each group H-type entrepreneurs are more likely to enter guanxi channel and less likely to apply directly. When the prosocial official knows that in general there are more L-type entrepreneurs, there could be even more L-type outside guanxi, thus fully rejecting the outsiders is optimal. On the other hand, as p_H getting higher eventually there are sufficient H-type entrepreneurs in the economy, even outside guanxi, then the good official would approve all the direct applications. Thus, for both types of entrepreneur going through transfer is the optimum, so they both won't go through guanxi.

Social welfare, in this case, is increasing when entrepreneurs are more prosocial. This result is not at all surprising. When p_H is relatively small, when it's increasing, higher fraction of entrepreneurs are entering into good guanxi, and who are out of guanxi do not conduct projects. When p_H is relatively large, all the people are having projects, and guanxi is no longer needed.

On the contrary, when the official is not prosocial ($\lambda_o < 0.2$), the commitment through guanxi is more appealing to the L-type entrepreneurs, thus higher fraction of L-type tend to enter bad guanxi. As explained in proposition 2.4, the bad official would want to extract rents from people who are entering guanxi, outside guanxi channels are thus shut down. If p_L is high, the economy ends up with higher fraction of bad guanxi, resulting in negative social welfare; as p_L getting lower, less guanxi is cultivated; among people who are having guanxi, more good projects are conducted, and social welfare grows eventually above zero.

Generally in only guanxi case, social welfare is only negative when both official and entrepreneurs are bad, and that is when bad guanxi dominates good guanxi. Social welfare increases as either party becomes more prosocial.

There are some interesting interpretations. First, if it is a good economy, which means that both the official and the entrepreneurs are prosocial, guanxi would not exist, even if there is no screening or monitoring devices and legislation. People are purely good. However, in other cases, guanxi is the only way that an entrepreneur can get business approved, and those who can afford it enter the market. Second, It also infers that guanxi is more commonly exercised when the official is prosocial, and consequently business is more thriving.

The result would be different if transfer channel is allowed, because it changes the outside guanxi decision of the official. In next section I bring transfer channel into the model as an outside option of guanxi. Then I will discuss in particular what are the differences.

3.4 The Interaction of Two Channels and Policy

The addition of transfer channel does not influence the optimal commitment when entering guanxi, but the reservation utility. Individual entrepreneur could also go through no channel process to get approved.

The timeline is as follows:

1. Given fixed cost $\bar{\omega}$ an entrepreneur decides whether to cultivate guanxi, or go through transfer, or just submit application;

2. If going through guanxi channel, λ_e is revealed and guanxi-based commitment $\{T, t_i\}$ is determined according to joint utility maximization; if going through transfer, then the transfer amount is t_0, and project will be approved with probability P_{t_0}; if do nothing and submit the application, then the project will be approved with probability P_0.

3. Rents sharing.

However, when transfer channel is available, the problem outside of guanxi is the same as in subsection 3.2 when there is only transfer channel, and probability of being approved is zero as proven in Proposition 1.1.

As in subsection 3.3, $\{T^*, t^*\}$ is the solution of joint utility maximization problem. Then the entrepreneur's and the official's problems can be stated formally as follows:

E's problem: given $\{H/L, \bar{\omega}, \{T^*, t^*\}, \{P_{t_0}, P_0, t_0\}\}$, an entrepreneur chooses the optimal channel $C \in \{\text{gaunxi}, \text{trasfer}, \text{none}\}$ to maximize his own utility:

$$\max_{C,\tau,T} U_e = \max\left\{ -\bar{\omega} + (1-\lambda_e)(R-t^*) + \lambda_e S, \operatorname*{Max}_{\tau}\{\max_{T} P_{t_0} u_e(t_0), \max_{T} P_0 u_e(0)\}\right\}$$

O's problem: given $f(\bar{\omega})$, $\{\tau(H/L, P_{t_0}, P_0, t_0), T(H/L, P_{t_0}, P_0, t_0)\}$, and $C(H/L, \bar{\omega}, \{T^*, t^*\}, \{P_{t_0}, P_0, t_0\})$, chooses $\{P_{t_0}^*, P_0^*, t_0^*\}$ that maximizes utility:

$$\begin{aligned}\operatorname*{Max}_{P_{t_0}, P_0, t_0} \mathbb{E}U_o = \operatorname*{Max}_{P^o}\Bigg\{ & \int_{\bar{\omega}} u_o(t^*) f(\bar{\omega}|\text{guanxi}) d\bar{\omega} \\ & + P_{t_0}[\text{Prob.}(T=G, \text{no guanxi}) U_o^*(H) + \text{Prob.}(T=B, \text{no guanxi}) U_o^*(L)]\Bigg\}\end{aligned}$$

where

$$U_o^*(H) = U_o^H(\tau(H, P_{t_0}, P_0, t_0), T(H, P_{t_0}, P_0, t_0)),$$
$$U_o^*(L) = U_o^L(\tau(L, P_{t_0}, P_0, t_0), T(L, P_{t_0}, P_0, t_0)).$$

Figure 7 shows the percentage of each type of entrepreneurs entering guanxi channel, and Figure 8 shows the rules set by the official as outside options of guanxi and the social welfare in equilibrium. When the official is prosocial ($\lambda_o > 0.6$), the H-type who are in favor of guanxi would have higher within-group fraction to cultivate guanxi. If in the economy the official expects the entrepreneurs to be more prosocial, the outside option falls to the contract as in region (1) when only direct transfer is available, i.e., any entrepreneur approaches the official without guanxi would be granted a license only if r transfer is made. On the contrary, when the official expects the entrepreneurs to be less prosocial, projects outside guanxi would all be rejected given that they have high probability to be bad. Similarly as in the only guanxi setting, as the entrepreneurs become more prosocial (p_H increases from 0 to 1), we are expected to observe increasing fraction of H-type entrepreneurs among those who cultivate guanxi, but with a jump at a certain point because of the change of outside contract.

On the other hand, when the official is bad ($p_H < 0.2$), guanxi with the H-type entrepreneurs are good guanxi, and guanxi with the L-type are bad guanxi. If in the economy the official expects the entrepreneurs to be less prosocial, the outside contract would be in region (3) such that the H-type entrepreneurs would be pushed out of the market. Thus, all the L-type are approved and end up with conducting bad projects, while only a fraction of H-type who can afford to cultivate guanxi are conducting good projects. On the other hand, if the official expects the entrepreneurs to be prosocial, as explained in the direct transfer section, the outside contract would be such that the H-type's incentives would be changed. Thus, all the entrepreneurs are conducting projects, but only the L-type inside guanxi would be conducting good ones. As the entrepreneurs become more prosocial (p_H increases from 0 to 1), what we are expecting is increasing fraction of bad guanxi among those who cultivate guanxi but with a downward jump at a certain point. Social welfare is negative at the beginning, and increases as more entrepreneurs are prosocial; however, at that certain point social welfare would have a drop because of the change of the outside contract.

Next I am going to discuss specifically the welfare change when we don't allow direct transfers with two "cities", one with a more prosocial official, and the other with a less.

Numerical Examples: the tale of two cities

It is the best of the world; it is the worst of the world. And the reason for the crucial difference is the official.

In this section I pick the two different but not extreme fractions of the H-type entrepreneurs, say, 0.4 and 0.8.

Figure 9 and Figure 10 are depicting the equilibrium in the setting of only guanxi channel when the fractions of the H-type entrepreneurs are 0.4 and 0.8 respectively, and Figure 11 shows social welfare with the two fractions; Figure 12 and Figure 13 are the equilibrium when both channels are available with $p_H = 0.4$ and $p_H = 0.8$ respectively, and Figure 14 depicts the social welfare. Then I analyze the changes of social welfare when eliminating channel(s)[19] given different prosocial values of the official, and discuss policy implications within these two different regimes.

City 1: prosocial official with not prosocial entrepreneurs

In the given example when $\lambda_o > 0.6$ and $p_H = 0.4$, Figure 12 (a)(b) show that roughly 80% of the H-type entrepreneurs are choosing guanxi, while only 50% of the L-type entrepreneurs are choosing guanxi. Then among those who are cultivating guanxi, half is H-type and half is L-type. Since there are sufficient many bad projects outside guanxi, then the good official would prefer not to approve any project without guanxi (Figure 14 (a)). Then Figure 12 (c) shows that among the outsiders only 20% are H-type officials. The expected social welfare is 2.5 (figure 14(b)).

Comparing to regime with no implementation of guanxi but with transfer channel, it is much better. Figure 1 shows that when only transfer is available, it is at best falling into region (1) with slightly positive social welfare. But when p_H gets lower, it is even worse because the social welfare is either zero($\lambda_o > 0.$) or negative. It infers that in this case regimes with guanxi is much better-off than regimes without guanxi.

Then if transfer channel is eliminated, the good official would still reject all the guanxi outsiders. Thus, the fraction of good and bad projects conducted is not changed, as well as the expected social welfare. Which means that policies regulating direct transfers does not help. This is because a prosocial official has the incentives to regulate their own behavior as well as the entrepreneurs' behavior whenever it is possible (for example, inside guanxi channel). In reality, it might be worse. The regulation itself is costly (which is not counted in the model), and it will raise another concentration of power. Can the good official get rid of the influence? Probably not. Nobody is flawless and the regulators sometimes have the incentives to investigate and testify those officials to satisfy the public and draw in their own career lives a thick and heavy in colors.

Eliminating both channels has a huge cost but is not impossible to do. However, this does nothing good but decreases social welfare. When there are enough L-type entrepreneurs, what we should be expecting is that business is shut down and the official with low salary would do nothing

[19]It is probably easier for social planners to outlaw transfer channel, either in forms of bribery or license fee. Eliminating guanxi is hard, though not completely impossible, we could think of it as a regime where guanxi does not exist at all.

(regardless of his/her prosocial value). This "action of inaction" is actually observed in China when the regulation become harsh since 2008. For regimes with good official this is definitely bad.

City 1: prosocial official with prosocial entrepreneurs

When $p_H = 0.8$ instead, Figure 13 (a)(b) show that roughly 20% of the H-type entrepreneurs are choosing guanxi, comparing to nearly zero of the L-type entrepreneurs. Outside guanxi mostly are H-type(Figure 13 (c)) because originally there are sufficient of them. Then Figure 14 (c) shows that region (1) is the outside choice of the official, allowing for all the entrepreneurs conducting business. The expected social welfare is around 3 (figure 14(d)).

Again, if we compare it to regime with only direct transfers, it is a bit better. Figure 1 shows that when only transfer is available, it falls into region (1) as if there is free entry. The only difference is the very few L-type entrepreneurs are into guanxi and conducting good projects. Direct transfer here is in fact good.

Then if transfer channel is eliminated, the good official would accept all the guanxi outsiders. Since every entrepreneur outside guanxi is better-off because extraction of rents are forbidden, so that less entrepreneurs are seeking guanxi. This does not influence H-type in choosing project, but will push some L-type out of good guanxi and conduct bad projects. However, this may not have very big impact because the fraction is already very low.

Eliminating both channels again makes it as if there is free entry of market. Since there are sufficient H-type entrepreneurs, disutility is infinitesimal. Again, regulation does not make society better-off, but a little bit worse. The concern is the same as above, which is that the huge social cost of implementing the regulatory law may be a waste and sources of some other corruption.

City 2: not prosocial official with not prosocial entrepreneurs

City 2: not prosocial official with prosocial entrepreneurs

An Example : airline industries in Indonesia and China

4 Further Considerations (still broken pieces)

Regulation and deregulation, stability and aggressive economic growth are always concerns of policy makers. when somehow the three parties-the rule maker, the game players, and the society - have conflicts of interests, and any two of their interests do not necessarily coincide, it is not obvious that more information or less rents seeking make society better-off. However, the results suggest that with guanxi regulating behavior and building trust among the official and entrepreneurs, it is usually beneficial.

Imformation friction is costly. True. But this friction is good when people who are using is bad. If a good official is having more information, rules are set such that good behaviors are encouraged and society benifits from this, because the interest of the official is more aligned with social interest. Thus regulation seems useless. However, if a bad official is having more information, rules are set such that bad behaviors are encouraged and society will suffer. In this case regulation is probably needed.

There is huge space for research topics on guanxi.

Notice that, in this paper resources is not that scarce, and the fixed cost used to cultivate guanxi and transfers paid to the official do not influence productivity, but only the choices of types of projects and channels. However, it is still arguable that whether they do influence productivity, when resources are scarce and there is competition in winning them. One of the next things we could probably do is exactly to introduce competition: transfer tend to be good because only the more productive entrepreneurs can afford the transfer; guanxi could be bad because guanxi is independent of ability.

Another assumption in this paper is that official subsidy is not allowed because it directly enters the private pocket of the entrepreneur by the model setting. However, when the official cares enough about social welfare, and if the subsidy generates positive social outcome, then she might subsidize the good projects (possibly by using rents squeezed from bad projects), and this possibly increases social welfare.

Some other crucial features of guanxi are ignored or largely simplified here. For example, the reciprocal obligations to respond to request for assistance (Luo, 2000) **?** could be showed in a repeated game. It is interesting to understand the role reusible information plays and the dynamics of the change of importance of guanxi with different social status. This model explains why guanxi is beneficial in an emerging market setting, but does not suggest why it exists and widely implimented in the Confusian tradition instead of other cultures, and this, could be related to social, economical, cultural and historical factors.

The paper has limitations, and not every important feature of Guanxi and transfer is captured. Below are some of the concerns:

1. When guanxi can be evil. In the model the role of guanxi has the benefit of revealing information, forming consensus between the official and the entrepreneurs, and enforcing contract (of course, it could be bad consensus), and the only cost is the overhead paid by the entrepreneurs. However, in the real world there could be some situations where guanxi is probably very bad. For example, the implementation of guanxi could misplace human resources through pull; the ex ante incentives are probably bad, because people would rather use resources to build up this "social capital", instead of human capital, which may result in a lot of dead weight loss.

2. The dynamics of channel changing. there is an interesting "observation" (don't know if it's true) that in China people were using more guanxi before, but more transfer now. It might be because before there were less proceeds to share, and therefore people could only rely on guanxi.

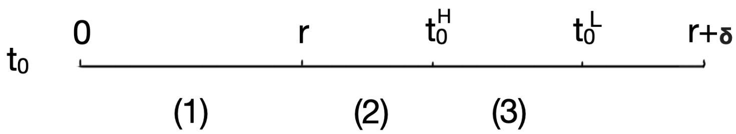
3. It works before but maybe not today. If we think about the "good" and "bad" projects as not risky and risky projects, before the businesses are largely labor-intensive or capital intensive, then getting the approval from the official is a guarantee of debt from banks and is therefore a guarantee of rents. However, nowadays when more projects are trying to enter the high-end technological sector and investing in R&D, there are huge risk of failing, and therefore there are probably fewer socially beneficial firms, not to say that the entrepreneurs can cut a larger piece out of a larger pie.

4. Competition and ability based projects. There is no competition in the model. But if there is, guanxi is a way of excluding competitors. Another limit of the model is it does not consider the ability of the entrepreneurs and the productivity loss from guanxi cultivation. Transfer in this case could be good because only productive firms have the proceeds to pay the transfer, and guanxi is probably bad because it does not favor productive projects.

5. The dynamics of guanxi cultivation and information reusability. Guanxi seems to have stronger power in the long run.

A Appendix A: Proof of propositions 1.1-1.5

The range of t_0 is divided into four subsets. The main focus is on the first three, which are the regions (1), (2), and (3) shown in the following graph. The fourth subset is the complement.



I first solve for the possible candidates of the global optimal solution within each subset, by getting the local optima or eliminating the strictly dominated solutions. Then I have the following chart, showing the candidates of solutions. **A.1-A.3** show in detail the process of getting the result, as well as the proof of **Prop. 1.1**. Then **A.4-A.7** prove **Prop. 1.2-1.5**.

t_0 interval	(1) $[0,r]$	(2) $[r,t_0^H]$	(3) $[t_0^H,t_0^L]$
$\{P_{t_0}^*,P_0^*,t_0^*\}$	$\{1,[0,\kappa_1],r\}$	$\{1,0,t_0^H\}$	$\{1,0,t_0^L\}$
Prob.$(\tau=t_0)$	1	1	p_L
Prob.$(T=G)$	p_H	0	0
Prob.$(T=B)$	p_L	1	p_L
U_o^*	$(1-\lambda_o)r+\lambda_o(p_HS_G+p_LS_B)$	$(1-\lambda_o)t_0^H+\lambda_oS_B$	$p_L[(1-\lambda_o)t_0^L+\lambda_oS_B]$
U_e^{H*}	$\lambda_e^HS_G$	0	0
U_e^{L*}	$(1-\lambda_e^L)(t_0^L-r)$	$\frac{\lambda_e^H-\lambda_e^L}{1-\lambda_e^H}(-S_B)$	0
$\mathbb{E}\$$	$p_HS_G+p_LS_B$	S_B	p_LS_B

A.1 $t_0\in[0,r]$

Both types of entrepreneur always chooses $T=G$, and an L-type chooses $T=B$. The utility functions of them, respectively, are

$$U_e^H=\underset{\tau}{\mathrm{Max}}\{P_{t_0}[(1-\lambda_e^H)(r-t_0)+\lambda_e^HS_G],P_0[(1-\lambda_e^H)r+\lambda_e^HS_G]\}$$
$$U_e^B=\underset{\tau}{\mathrm{Max}}\{P_{t_0}[(1-\lambda_e^L)(r+\delta-t_0)+\lambda_e^LS_B],P_0[(1-\lambda_e^L)(r+\delta)+\lambda_e^LS_B]\}$$

Define

$$\kappa_1 \equiv \min[1-\frac{t_0}{r+\frac{\lambda_e^H}{1-\lambda_e^H}S_G}, 1-\frac{t_0}{t_0^L}],$$
$$\kappa_2 \equiv \max[1-\frac{t_0}{r+\frac{\lambda_e^H}{1-\lambda_e^H}S_G}, 1-\frac{t_0}{t_0^L}].$$

It is obvious that $P_{t_0}^* > 0$, and $t_0^* > 0$. Given $t_0 \in (0,r]$, if $\frac{P_0}{P_{t_0}} \leq \kappa_1$, then both types of entrepreneurs will transfer; if $\kappa_2 \geq \frac{P_0}{P_{t_0}} > \kappa_1$, in which case $P_{t_0} > P_0$, only H type or L type will transfer, depending on which threshold is larger; otherwise both types will not transfer. Then the utility functions for the official under these three circumstances are:

$$\begin{aligned}
U_o^1 &= P_{t_0}[(1-\lambda_o)t_0 + \lambda_o(p_H S_G + p_L S_B)] \\
U_o^2 &= P_{t_0} p_H[(1-\lambda_o)t_0 + \lambda_o S_G] + P_0 p_L \lambda_o S_B \\
\text{or, } U_o^2 &= P_{t_0} p_L[(1-\lambda_o)t_0 + \lambda_o S_B] + P_0 p_H \lambda_o S_G \\
U_o^3 &= P_0 \lambda_o (p_H S_G + p_L S_B)
\end{aligned}$$

We have $\max U_o^1 > \max U_o^2 > \max U_o^3$, so that

$$\{P_{t_0}^*, P_0^*, t_0^*\} = \{1, [0,\kappa_1], r\},$$

and

$$\max U_o^1 = (1-\lambda_o)r + \lambda_o(p_H S_G + p_L S_B).$$

The results can be shown in the above chart (1).

A.2 $t_0 \in [r, t_0^H]$

Both types of entrepreneurs choose $T = B$ while transfering. The utility functions of them, respectively, are

$$\begin{aligned}
U_e^H &= \underset{\tau}{\text{Max}}\{P_{t_0}[(1-\lambda_e^H)(r+\delta-t_0) + \lambda_e^H S_B], P_0[(1-\lambda_e^H)r + \lambda_e^H S_G]\} \\
U_e^B &= \underset{\tau}{\text{Max}}\{P_{t_0}[(1-\lambda_e^L)(r+\delta-t_0) + \lambda_e^L S_B], P_0[(1-\lambda_e^L)(r+\delta) + \lambda_e^L S_B]\}
\end{aligned}$$

From assumption $(*)$, we have

$$\frac{\delta}{-S_B} > \frac{\lambda_e^H}{1-\lambda_e^H} \geq \frac{\delta}{\Delta S} > \frac{\lambda_e^L}{1-\lambda_e^L}$$

so that when $t_0 \in [r, t_0^H]$,

$$\frac{t_0^H - t_0}{r + \frac{\lambda_e^H}{1-\lambda_e^H} S_G} < 1 - \frac{t_0}{t_0^L}$$

Define

$$\kappa_3 \equiv \frac{t_0^H - t_0}{r + \frac{\lambda_e^H}{1-\lambda_e^H} S_G},$$
$$\kappa_4 \equiv 1 - \frac{t_0}{t_0^L}.$$

If $\frac{P_0}{P_{t_0}} \leq \kappa_3$, then both types of entrepreneurs will transfer; if $\kappa_4 \geq \frac{P_0}{P_{t_0}} > \kappa_3$, only L type will transfer]; otherwise both types will not transfer. Then the utility functions for the official in these three circumstances are:

$$U_o^1 = P_{t_0}[(1-\lambda_o)t_0 + \lambda_o S_B] \tag{1}$$
$$U_o^2 = P_{t_0} p_L[(1-\lambda_o)t_0 + \lambda_o S_B] + P_0 p_H \lambda_o S_G \tag{2}$$
$$U_o^3 = P_0 \lambda_o (p_H S_G + p_L S_B) \tag{3}$$

This is a little bit more complex than the first case. The point is to compare functions (1), (2), and (3). It is easy to show that for (1):

$$\max U_o^1 = (1-\lambda_o)t_0^H + \lambda_o S_B$$

For (2), P_0^* should be as big as possible: $P_0^* = (1 - \frac{t_0}{t_0^L})P_{t_0}^*$.

$$\begin{aligned}
\max U_o^2 &= \max\{P_{t_0}^* p_L[(1-\lambda_o)t_0 + \lambda_o S_B] + (1 - \frac{t_0^*}{t_0^L})P_{t_0}^* p_H \lambda_o S_G\} \\
&= \max P_{t_0}^* \{p_L(1-\lambda_o)t_0^* + (1 - \frac{t_0^*}{t_0^L}) p_H \lambda_o S_G + p_L \lambda_o S_B\} \\
&= \max_{t_0 = r, t_0^H} \{0, [p_L(1-\lambda_o) - p_H \lambda_o \frac{S_G}{t_0^L}]t_0^* + \lambda_o(p_L S_B + p_H S_G)\} \\
&= \max\{0, [p_L(1-\lambda_o) - p_H \lambda_o \frac{S_G}{t_0^L}]t_0^H + \lambda_o(p_L S_B + p_H S_G)\} \text{ if } \frac{1}{1 + \frac{p_H S_G}{p_L t_0^L}} \geq \lambda_o \\
&= \max\{0, [p_L(1-\lambda_o) - p_H \lambda_o \frac{S_G}{t_0^L}]r + \lambda_o(p_L S_B + p_H S_G)\} \text{ if } \frac{1}{1 + \frac{p_H S_G}{p_L t_0^L}} < \lambda_o
\end{aligned}$$

For (3),

$$\max U_o^3 = \max\{0, \lambda_o(p_H S_G + p_L S_B)\}$$

A.3 $t_0 \in [t_0^H, t_0^L]$

Only L type will probably choose to transfer.

$$\begin{aligned}
U_e^H &= P_0[(1-\lambda_e^H)r + \lambda_e^H S_G] \\
U_e^B &= \operatorname*{Max}_{\tau}\{P_{t_0}[(1-\lambda_e^L)(r+\delta-t_0)+\lambda_e^L S_B], P_0[(1-\lambda_e^L)(r+\delta)+\lambda_e^L S_B]\}
\end{aligned}$$

To maximize utility, the official will keep L type choosing transfer, and also try to make P_0 large so that he gains from social welfare from good projects, i.e.

$$P_{t_0}^* = 1,\ P_0^* = 1 - \frac{t_0^*}{t_0^L}.$$

Utility of the official:

$$\begin{aligned}
\max U_o &= (1-\lambda_o)p_L t_0^* + \lambda_o[(1-\frac{t_0^*}{t_0^L})p_H S_G + p_L S_B] \\
&= [(1-\lambda_o)p_L - \lambda_o p_H \frac{S_G}{t_0^L}]t_0^* + \lambda_o(p_H S_G + p_L S_B) \\
&= \max\{0, [p_L(1-\lambda_o) - p_H\lambda_o \frac{S_G}{t_0^L}]t_0^L + \lambda_o(p_L S_B + p_H S_G)\} \text{ if } \frac{1}{1+\frac{p_H S_G}{p_L t_0^L}} \geq \lambda_o \\
&= \max\{0, [p_L(1-\lambda_o) - p_H\lambda_o \frac{S_G}{t_0^L}]t_0^H + \lambda_o(p_L S_B + p_H S_G)\} \text{ if } \frac{1}{1+\frac{p_H S_G}{p_L t_0^L}} < \lambda_o
\end{aligned}$$

Comparing the utility functions of the official in **A.1**, **A.2** and **A.3**, if

$$\frac{1}{1+\frac{p_H S_G}{p_L t_0^L}} < \lambda_o,$$

then

$$\max U_o(\mathbf{A.3}) < \max U_o^2(\mathbf{A.2}) < \max U_o^3(\mathbf{A.2}) < \max U_o^1(\mathbf{A.1}),$$

which means that **A.2** and **A.3** can never be the global optimal solution.

If

$$\frac{1}{1+\frac{p_H S_G}{p_L t_0^L}} \geq \lambda_o,$$

then

$$\max U_o(\mathbf{A.3}) > \max U_o^2(\mathbf{A.2}),$$

which means that **A.2** can never be the global optimal solution. Since $t_0^* = t_0^L$, we have $P_0^* = 0$.

In conclusion, when $t_0 \in [0, r]$, the local optimal solution is $\{P_{t_0}^*, P_0^*, t_0^*\} = \{1, [0, \kappa_1], r\}$, in which both types of entrepreneurs choose to transfer and get approved with probability 1. Particularly, H type chooses good project, while L type chooses bad project. Let the relative utility function for the official be

$$U_o^{1*} = (1-\lambda_o)r + \lambda_o(p_H S_G + p_L S_B).$$

When $t_0 \in [r, t_0^H]$, the possible candidate for global optimal solution is $\{P_{t_0}^*, P_0^*, t_0^*\} = \{1, 0, t_0^H\}$, in which both types choose to transfer and have bad projects, and will get approved with probability 1. Let the relative utility function for the official be

$$U_o^{2*} = (1-\lambda_o)t_0^H + \lambda_o S_B.$$

When $t_0 \in [t_0^H, t_0^L]$, the possible candidate for global optimal solution is $\{P_{t_0}^*, P_0^*, t_0^*\} = \{1, 0, t_0^L\}$, in which only L type will choose to trasfer and get approved with probability 1, and H type will not transfer and will never get approved. Let the relative utility function for the official be

$$U_o^{3*} = p_L[(1-\lambda_o)t_0^L + \lambda_o S_B].$$

In all three cases, $P_0^* = 0$ is the(an) equilibrium. Thus proved the propositions 1.1.

A.4

$$U_o^* = \text{Max}\{0, U_o^{1*}, U_o^{2*}, U_o^{3*}\}$$

The necessary and sufficient conditions for $\{P_{t_0}^*, P_0^*, t_0^*\} = \{1, [0, \kappa_1], r\}$ are as follows

$$U_o^{1*} \geq U_o^{2*},$$
$$U_o^{1*} \geq U_o^{3*},$$
$$\text{and } U_o^{1*} \geq 0.$$

Which is equivalent to

$$\begin{aligned}\lambda_o &\geq \frac{1}{1+\frac{p_H \Delta S}{t_o^H - r}},\\ p_L &\leq 1-\frac{t_0^L - r}{t_0^L + \frac{\lambda_o}{1-\lambda_o} S_G},\\ \text{and } p_L &\leq (\frac{1}{\lambda_o}-1)\frac{r}{\Delta S}+\frac{S_G}{\Delta S}.\end{aligned}$$

Since $\mathbb{E}\$ = p_H S_G + p_L S_B$, the threshold for $\mathbb{E}\$ \geq 0$ is $\frac{S_G}{\Delta S}$. Proposition 1.2 proved.

A.5

The necessary and sufficient conditions for $\{P_{t_0}^*, P_0^*, t_0^*\} = \{1, 0, t_0^H\}$ are

$$\begin{aligned}U_o^{2*} &> U_o^{1*},\\ U_o^{2*} &\geq U_o^{3*},\\ \text{and } U_o^{2*} &\geq 0.\end{aligned}$$

Which is equivalent to

$$\begin{aligned}\lambda_o &< \frac{1}{1+\frac{p_H \Delta S}{t_o^H - r}},\\ p_L &\leq 1-\frac{t_0^L - t_0^H}{t_0^L + \frac{\lambda_o}{1-\lambda_o} S_B},\\ \text{and } \lambda_o &\leq \frac{1}{1-S_B/t_0^H}.\end{aligned}$$

We have $\mathbb{E}\$ = S_B < 0$. Proposition 1.3 proved.

A.6

The necessary and sufficient conditions for $\{P_{t_0}^*, P_0^*, t_0^*\} = \{1, 0, t_o^L\}$ are

$$\begin{aligned}U_o^{3*} &> U_o^{1*},\\ U_o^{3*} &> U_o^{2*},\\ \text{and } U_o^{3*} &\geq 0.\end{aligned}$$

Which is equivalent to

$$
\begin{aligned}
p_L &> 1 - \frac{t_0^L - r}{t_0^L + \frac{\lambda_o}{1-\lambda_o} S_G}, \\
p_L &> 1 - \frac{t_0^L - t_0^H}{t_0^L + \frac{\lambda_o}{1-\lambda_o} S_B}, \\
\text{and } \lambda_o &\leq \frac{1}{1 - S_B/t_0^L}.
\end{aligned}
$$

We have $\mathbb{E}\$ = p_L S_B < 0$. Proposition 1.4 proved.

A.7

The necessary and sufficient conditions for no projects entering are

$$
\begin{aligned}
U_o^{1*} &< 0, \\
U_o^{2*} &< 0, \\
\text{and } U_o^{3*} &< 0.
\end{aligned}
$$

Which is equivalent to

$$
\begin{aligned}
p_L &> (\frac{1}{\lambda_o} - 1)\frac{r}{\Delta S} + \frac{S_G}{\Delta S}, \\
\lambda_o &> \frac{1}{1 - S_B/t_0^H}, \\
\text{and } \lambda_o &> \frac{1}{1 - S_B/t_0^L}.
\end{aligned}
$$

We have $\mathbb{E}\$ = 0$. Proposition 1.5 proved.

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B Appendix B: Proof of Propositions 2.1-

B.1 Solution for joint utility maximization problem

Assume the optimal rents sharing is t_G^* when an entrepreneur chooses good project, and t_B^* when chooses bad project. Let the optimal contract be $\{t^*, T^*\}$, where $t^* \in \{t_G^*, t_G^*\}$ is the optimal rents sharing, and $T^* \in \{G, B\}$ is the contracted type of project. Then

$$\begin{aligned}
t_G^* &= \max\{0, t_G^{foc}\}, t_G^{foc} = \frac{1}{2}[r + (\frac{\lambda_e}{1-\lambda_e} - \frac{\lambda_o}{1-\lambda_o})S_G] \\
t_B^* &= \max\{\bar{t_B}, t_B^{foc}\}, \\
\bar{t_B} &= \frac{\lambda_o}{1-\lambda_o}(-S_B), t_B^{foc} = \frac{1}{2}[r + \delta + (\frac{\lambda_e}{1-\lambda_e} - \frac{\lambda_o}{1-\lambda_o})S_B] \\
\{t^*, T^*\} &= \arg\max\{U(t_G^*, G), U(t_B^*, B)\}
\end{aligned}$$

To solve the joint utility maximization problem, I first find the conditions under which we have corner solutions. Define the thresholds of λ_o to be $\{\lambda_o^*, \lambda_o^{**}\}$ for the official with an H-type entrepreneur, such that at which the solution of the first order condition is equal to the corner solution:

$$t_G^{foc}(\lambda_o^*, \lambda_e^H) = 0, t_B^{foc}(\lambda_o^{**}, \lambda_e^H) = \bar{t_B}(\lambda_o^{**});$$

Again, define the thresholds to be $\{\lambda_o', \lambda_o''\}$ for the official with an L-type entrepreneur, such that at which

$$t_G^{foc}(\lambda_o', \lambda_e^L) = 0, t_B^{foc}(\lambda_o'', \lambda_e^L) = \bar{t_B}(\lambda_o'').$$

Thus we have

$$\frac{\lambda_o^*}{1-\lambda_o^*} = \frac{r}{S_G} + \frac{\lambda_e^H}{1-\lambda_e^H} \qquad \rightarrow \text{when } t_G^{foc}(\lambda_o^*, \lambda_e^H) = 0; \tag{4}$$

$$\frac{\lambda_o^{**}}{1-\lambda_o^{**}} = \frac{r+\delta}{(-S_B)} - \frac{\lambda_e^H}{1-\lambda_e^H} \qquad \rightarrow \text{when } t_B^{foc}(\lambda_o^{**}, \lambda_e^H) = \bar{t_B}(\lambda_o^{**}); \tag{5}$$

$$\frac{\lambda_o'}{1-\lambda_o'} = \frac{r}{S_G} + \frac{\lambda_e^L}{1-\lambda_e^L} \qquad \rightarrow \text{when } t_G^{foc}(\lambda_o', \lambda_e^L) = 0; \tag{6}$$

$$\frac{\lambda_o''}{1-\lambda_o''} = \frac{r+\delta}{(-S_B)} - \frac{\lambda_e^L}{1-\lambda_e^L} \qquad \rightarrow \text{when } t_B^{foc}(\lambda_o'', \lambda_e^L) = \bar{t_B}(\lambda_o''). \tag{7}$$

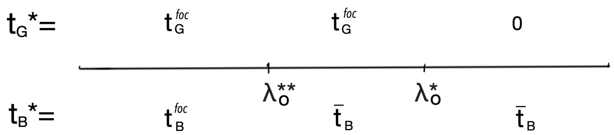
B.2 Solution with an H-type entrepreneur

With an H-type entrepreneur:
if $\lambda_o \geq \lambda_o^*$, $t_G^* = 0$; and if $\lambda_o < \lambda_o^*$, $t_G^* = t_G^{foc}(\lambda_e^H)$;
if $\lambda_o \geq \lambda_o^{**}$, $t_B^* = \bar{t_B}$; and if $\lambda_o < \lambda_o^{**}$, $t_B^* = t_B^{foc}(\lambda_e^H)$.
Define $\Lambda_H^+ \equiv \frac{\lambda_e^H}{1-\lambda_e^H} + \frac{\lambda_o}{1-\lambda_o}$.

To decide which is the optimal contract, we have to compare the joint utility function of a good with that of a bad project. There are different cases with respect to different values of λ_o:

---

1. $\frac{r+\delta}{-S_B} - \frac{r}{S_G} \leq \frac{2\lambda_e^H}{1-\lambda_e^H} \Leftrightarrow \lambda_o^{**} \leq \lambda_o^*$.



The above figure shows the optimal solutions of rents sharing amount when having a good or bad project respectively, and with different prosocial value of the official. For example, if the H-type entrepreneur cooperates with an official whose λ_o is below λ_o^{**}, then we should compare contract $\{G, t_G^{foc}\}$ with $\{B, t_B^{foc}\}$.

(1) $\lambda_o \in (0, \lambda_o^{**}]$. Contract $\{G, t_G^{foc}\}$ versus $\{B, t_B^{foc}\}$.

$$\begin{aligned}
U(t_G^*, G) &= U(t_G^{foc}, G) \\
&= \frac{1}{4}(1-\lambda_e^H)(1-\lambda_o)(r + \Lambda_H^+ S_G)^2 \\
U(t_B^*, B) &= U(t_B^{foc}, B) \\
&= \frac{1}{4}(1-\lambda_e^H)(1-\lambda_o)(r + \delta + \Lambda_H^+ S_B)^2
\end{aligned}$$

since

$$\begin{aligned}
&(r + \Lambda_H^+ S_G) - (r + \delta + \Lambda_H^+ S_B) \\
&= (\frac{\lambda_e^H}{1-\lambda_e^H}\Delta S - \delta) + (\frac{\lambda_o}{1-\lambda_o}\Delta S) \\
&> 0 \\
&(\frac{\lambda_e^H}{1-\lambda_e^H}\Delta S \geq \delta \text{ by assumption}(*).)
\end{aligned}$$

Thus we have $U(t_G^*, G) > U(t_B^*, B)$. i.e. $\{T^*, t_H^*\} = \{G, t_G^{foc}\}$.

(2) $\lambda_o \in (\lambda_o^{**}, \lambda_o^{*}]$. Contract $\{G, t_G^{foc}\}$ versus $\{B, \bar{t_B}\}$.

$$
\begin{aligned}
U(t_G^*, G) &= U(t_G^{foc}, G) \\
&= \frac{1}{4}(1-\lambda_e^H)(1-\lambda_o)(r+\Lambda_H^+ S_G)^2 \\
U(t_B^*, B) &= U(\bar{t_B}, B) = 0 \\
\Rightarrow U(t_G^*, G) &> U(\bar{t_B}, B)
\end{aligned}
$$

So that $\{T^*, t_H^*\} = \{G, t_G^{foc}\}$.

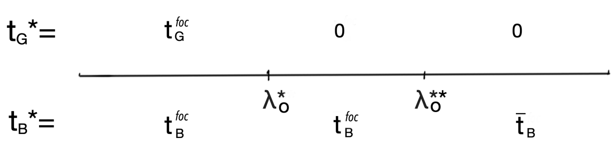
(3) $\lambda_o \in (\lambda_o^*, 1)$. Contract $\{G, 0\}$ versus $\{B, \bar{t_B}\}$.

$$
\begin{aligned}
U(t_G^*, G) &= U(0, G) \\
&= (1-\lambda_e^H)\lambda_o(r+\frac{\lambda_e^H}{1-\lambda_e^H}S_G)S_G > 0 \\
U(t_B^*, B) &= U(\bar{t_B}, B) = 0 \\
\Rightarrow U(0, G) &> U(\bar{t_B}, B)
\end{aligned}
$$

So that $\{T^*, t_H^*\} = \{G, 0\}$.

---

2. $\frac{r+\delta}{-S_B} - \frac{r}{S_G} > \frac{2\lambda_e^H}{1-\lambda_e^H} \Leftrightarrow \lambda_o^{**} > \lambda_o^*$.



(1) $\lambda_o \in (0, \lambda_o^*]$. Contract $\{G, t_G^{foc}\}$ versus $\{B, t_B^{foc}\}$. The same as in the above case, and we have $\{T^*, t_H^*\} = \{G, t_G^{foc}\}$.

(2) $\lambda_o \in (\lambda_o^*, \lambda_o^{**}]$. Contract $\{G, 0\}$ versus $\{B, t_B^{foc}\}$.

$$
\begin{aligned}
U(t_G^*, G) &= U(0, G) \\
&= (1-\lambda_e^H)\lambda_o(r+\frac{\lambda_e^H}{1-\lambda_e^H}S_G)S_G \\
U(t_B^*, B) &= U(t_B^{foc}, B) \\
&= \frac{1}{4}(1-\lambda_e^H)(1-\lambda_o)(r+\delta+\Lambda_H^+ S_B)^2
\end{aligned}
$$

Since $\lambda_o > \lambda_o^*$, we have $\frac{\lambda_o}{1-\lambda_o} \geq \frac{\lambda_o^*}{1-\lambda_o^*} = \frac{r}{S_G} + \frac{\lambda_e^H}{1-\lambda_e^H}$. Do a little transformation,

$$\begin{aligned} U(t_G^*, G) &= (1-\lambda_e^H)(1-\lambda_o)(r + \frac{\lambda_e^H}{1-\lambda_e^H} S_G) \frac{\lambda_o}{1-\lambda_o} S_G \\ &> (1-\lambda_e^H)(1-\lambda_o)(r + \frac{\lambda_e^H}{1-\lambda_e^H} S_G)^2 \end{aligned}$$

I want to prove that $U(t_G^*, G) > U(t_B^*, B)$. A sufficient condition is $r + \frac{\lambda_e^H}{1-\lambda_e^H} S_G > \frac{1}{2}(r + \delta + \Lambda_H^+ S_B)$. Indeed,

$$\begin{aligned} & 2(r + \frac{\lambda_e^H}{1-\lambda_e^H} S_G) - (r + \delta + \Lambda_H^+ S_B) \\ &= r + 2\frac{\lambda_e^H}{1-\lambda_e^H} S_G - \delta - \frac{\lambda_e^H}{1-\lambda_e^H} S_B - \frac{\lambda_o}{1-\lambda_o} S_B \\ &\geq r + 2\frac{\lambda_e^H}{1-\lambda_e^H} S_G - \delta - 2\frac{\lambda_e^H}{1-\lambda_e^H} S_B + \frac{r(-S_B)}{S_G} \\ (\text{again } & \frac{\lambda_o}{1-\lambda_o} \geq \frac{\lambda_o^*}{1-\lambda_o^*} = \frac{r}{S_G} + \frac{\lambda_e^H}{1-\lambda_e^H}) \\ &= r + 2\frac{\lambda_e^H}{1-\lambda_e^H} \Delta S - \delta + \frac{r(-S_B)}{S_G} \\ &= r + \frac{\lambda_e^H}{1-\lambda_e^H} \Delta S + (\frac{\lambda_e^H}{1-\lambda_e^H} \Delta S - \delta) + \frac{r(-S_B)}{S_G} \\ &> 0 \\ (\text{since } & \frac{\lambda_e^H}{1-\lambda_e^H} \Delta S > \delta \text{ by assumption}(*).) \end{aligned}$$

So that $\{T^*, t_H^*\} = \{G, 0\}$.

(3) $\lambda_o \in (\lambda_o^{**}, 1)$. Contract $\{G, 0\}$ versus $\{B, \bar{t_B}\}$.
The proof and result are the same as the above case. Thus $\{T^*, t_H^*\} = \{G, 0\}$.

To summarize, for H-type of entrepreneur we have the following results:

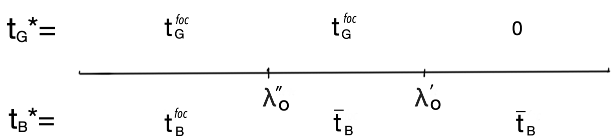
range of λ_o	(A) $(0, \lambda_o^*]$	(B) $(\lambda_o^*, 1)$
$\{T^*, t_H^*\}$	$\{G, t_G^{foc}\}$	$\{G, 0\}$
U_o^*	$\frac{1}{2}(1-\lambda_o)(r + \Lambda_H^+ S_G)$	$\lambda_o S_G$
U_e^H	$-\bar{\omega} + \frac{1}{2}(1-\lambda_e^H)(r + \Lambda_H^+ S_G)$	$-\bar{\omega} + (1-\lambda_e^H) r + \lambda_e^H S_G$
U_e^{H*}	$\max\{\bar{U}^H, U_e^H\}$	$\max\{\bar{U}^H, U_e^H\}$

B.3 Solution with an L-type entrepreneur

Similarly,
if $\lambda_o \geq \lambda_o'$, $t_G^* = 0$; and if $\lambda_o < \lambda_o'$, $t_G^* = t_G^{foc}(\lambda_e^L)$;
if $\lambda_o \geq \lambda_o''$, $t_B^* = \bar{t_B}$; and if $\lambda_o < \lambda_o''$, $t_B^* = t_B^{foc}(\lambda_e^L)$.
Define $\Lambda_L^+ \equiv \frac{\lambda_e^L}{1-\lambda_e^L} + \frac{\lambda_o}{1-\lambda_o}$.

---

1. $\frac{r+\delta}{-S_B} - \frac{r}{S_G} \leq \frac{2\lambda_e^L}{1-\lambda_e^L} \Leftrightarrow \lambda_o'' \leq \lambda_o'$.



(1) $\lambda_o \in (0, \lambda_o'']$. Contract $\{G, t_G^{foc}\}$ versus $\{B, t_B^{foc}\}$.

$$
\begin{aligned}
U(t_G^*, G) &= U(t_G^{foc}, G) \\
&= \frac{1}{4}(1-\lambda_e^L)(1-\lambda_o)(r + \Lambda_L^+ S_G)^2 \\
U(t_B^*, B) &= U(t_B^{foc}, B) \\
&= \frac{1}{4}(1-\lambda_e^L)(1-\lambda_o)(r + \delta + \Lambda_L^+ S_B)^2
\end{aligned}
$$

Define

$$
\frac{\lambda_o'''}{1-\lambda_o'''} \equiv \frac{\delta}{\Delta S} - \frac{\lambda_e^L}{1-\lambda_e^L} < \frac{\lambda_o''}{1-\lambda_o''},
$$

then

$$
\begin{aligned}
(r + \Lambda_L^+ S_G) - (r + \delta + \Lambda_L^+ S_B) &= \left(\frac{\lambda_e^L}{1-\lambda_e^L}\Delta S - \delta\right) + \left(\frac{\lambda_o}{1-\lambda_o}\Delta S\right) \\
&< 0 \text{ if } \lambda_o \in (0, \lambda_o''') \\
&\geq 0 \text{ if } \lambda_o \in [\lambda_o''', \lambda_o''].
\end{aligned}
$$

Thus we have $\{T^*, t_L^*\} = \{B, t_B^{foc}\}$ if $\lambda_o \in (0, \lambda_o''')$, and $\{T^*, t_L^*\} = \{G, t_G^{foc}\}$ if $\lambda_o \in [\lambda_o''', \lambda_o'']$.

(2) $\lambda_o \in (\lambda_o'', \lambda_o']$. Contract $\{G, t_G^{foc}\}$ versus $\{B, \bar{t_B}\}$.

$$\begin{aligned}
U(t_G^*, G) &= U(t_G^{foc}, G) \\
&= \frac{1}{4}(1-\lambda_e^L)(1-\lambda_o)(r+\Lambda_L^+ S_G)^2 \\
U(t_B^*, B) &= U(\bar{t_B}, B) = 0 \\
\Rightarrow U(t_G^*, G) &> U(\bar{t_B}, B)
\end{aligned}$$

So that $\{T^*, t_L^*\} = \{G, t_G^{foc}\}$.

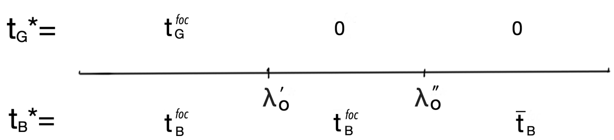
(3) $\lambda_o \in (\lambda_o', 1)$. Contract $\{G, 0\}$ versus $\{B, \bar{t_B}\}$.

$$\begin{aligned}
U(t_G^*, G) &= U(0, G) \\
&= (1-\lambda_e^L)\lambda_o(r+\frac{\lambda_e^L}{1-\lambda_e^L} S_G)S_G > 0 \\
U(t_B^*, B) &= U(\bar{t_B}, B) = 0 \\
\Rightarrow U(0, G) &> U(\bar{t_B}, B)
\end{aligned}$$

So that $\{T^*, t_L^*\} = \{G, 0\}$.

---

2. $\frac{r+\delta}{-S_B} - \frac{r}{S_G} > \frac{2\lambda_e^L}{1-\lambda_e^L} \Leftrightarrow \lambda_o'' > \lambda_o'$.



(1) $\lambda_o \in (0, \lambda_o']$. Contract $\{G, t_G^{foc}\}$ versus $\{B, t_B^{foc}\}$.

- If $\lambda_o''' < \lambda_o'$, i.e. $\frac{\delta}{\Delta S} < \frac{r}{S_G} + 2\frac{\lambda_e^L}{1-\lambda_e^L}$, we have the similar result as in 1.(1):

$$\begin{aligned}
(r+\Lambda_L^+ S_G) - (r+\delta+\Lambda_L^+ S_B) &= (\frac{\lambda_e^L}{1-\lambda_e^L}\Delta S - \delta) + (\frac{\lambda_o}{1-\lambda_o}\Delta S) \\
&< 0 \text{ if } \lambda_o \in (0, \lambda_o''') \\
&\geq 0 \text{ if } \lambda_o \in [\lambda_o''', \lambda_o'].
\end{aligned}$$

Thus we have

$$\{T^*, t_L^*\} = \{B, t_B^{foc}\} \text{ if } \lambda_o \in (0, \lambda_o''');$$

and

$$\{T^*, t_L^*\} = \{G, t_G^{foc}\} \text{ if } \lambda_o \in [\lambda_o''', \lambda_o'].$$

- If $\lambda_o''' \geq \lambda_o'$, i.e. $\frac{\delta}{\Delta S} \geq \frac{r}{S_G} + 2\frac{\lambda_e^L}{1-\lambda_e^L}$, we will have

$$\{T^*, t_L^*\} = \{B, t_B^{foc}\} \text{ for } \lambda_o \in (0, \lambda_o')$$

(2) $\lambda_o \in (\lambda_o', \lambda_o'']$. Contract $\{G, 0\}$ versus $\{B, t_B^{foc}\}$.

$$\begin{aligned}
U(t_G^*, G) &= U(0, G) \\
&= (1-\lambda_e^L)\lambda_o(r + \frac{\lambda_e^L}{1-\lambda_e^L}S_G)S_G \\
U(t_B^*, B) &= U(t_B^{foc}, B) \\
&= \frac{1}{4}(1-\lambda_e^L)(1-\lambda_o)(r+\delta+\Lambda_L^+ S_B)^2
\end{aligned}$$

- If $\lambda_o''' < \lambda_o'$, i.e. $\frac{\delta}{\Delta S} < \frac{r}{S_G} + 2\frac{\lambda_e^L}{1-\lambda_e^L}$. Since $\lambda_o > \lambda_o'$, we have $\frac{\lambda_o}{1-\lambda_o} \geq \frac{\lambda_o'}{1-\lambda_o'} = \frac{r}{S_G} + \frac{\lambda_e^L}{1-\lambda_e^L}$. Do a little transformation,

$$\begin{aligned}
U(0, G) &= (1-\lambda_e^L)(1-\lambda_o)(r + \frac{\lambda_e^L}{1-\lambda_e^L}S_G)\frac{\lambda_o}{1-\lambda_o}S_G \\
&\geq (1-\lambda_e^L)(1-\lambda_o)(r + \frac{\lambda_e^L}{1-\lambda_e^L}S_G)^2
\end{aligned}$$

To compare the utility functions:

$$\begin{aligned}
&2(r + \frac{\lambda_e^L}{1-\lambda_e^L}S_G) - (r+\delta+\Lambda_L^+ S_B) \\
&= r + 2\frac{\lambda_e^L}{1-\lambda_e^L}S_G - \delta - \frac{\lambda_e^L}{1-\lambda_e^L}S_B - \frac{\lambda_o}{1-\lambda_o}S_B \\
&\geq r + 2\frac{\lambda_e^L}{1-\lambda_e^L}\Delta S - \delta + \frac{r(-S_B)}{S_G} \\
&= \Delta S(\frac{r}{S_G} + 2\frac{\lambda_e^L}{1-\lambda_e^L} - \frac{\delta}{\Delta S}) > 0
\end{aligned}$$

So that we have $U(0, G) > U(t_B^{foc}, B)$, thus $\{T^*, t_H^*\} = \{G, 0\}$.
- if $(\lambda_o'' >)\lambda_o''' \geq \lambda_o'$, i.e. $\frac{\delta}{\Delta S} \geq \frac{r}{S_G} + 2\frac{\lambda_e^L}{1-\lambda_e^L}$

Since

$$U(0, G, \lambda_o''') \leq U(t_G^{foc}, G, \lambda_o''') = U(t_B^{foc}, B, \lambda_o'''),$$

and

$$U(0,G,\lambda_o'') > U(t_B^{foc},B,\lambda_o'') = U(\bar{t_B},B) = 0$$

so that

$$U(0,G,\lambda_o''') - U(t_B^{foc},B,\lambda_o''') \leq 0$$
$$U(0,G,\lambda_o'') - U(t_B^{foc},B,\lambda_o'') > 0$$

Because $U(0,G) - U(t_B^{foc},B)$ is continuous and monotonically increasing, we know that there $\exists! \lambda_o'''' \in [\lambda_o''', \lambda_o'')$, such that $U(0,G) - U(t_B^{foc},B) = 0$. thus we have

$$\{T^*, t_L^*\} = \{B, t_B^{foc}\} \text{ if } \lambda_o \in [\lambda_o', \lambda_o'''');$$

and

$$\{T^*, t_L^*\} = \{G, 0\} \text{ if } \lambda_o \in [\lambda_o''', \lambda_o'].$$

(3) $\lambda_o \in (\lambda_o'', 1)$. Contract $\{G,0\}$ versus $\{B, \bar{t_B}\}$.

Since

$$U(0,G) > 0 = U(\bar{t_B}, B),$$

we have

$$\{T^*, t_L^*\} = \{G, 0\} \text{ for } \lambda_o \in (\lambda_o'', 1).$$

To summarize for L-type entrepreneurs:

- If $2\frac{\lambda_e^L}{1-\lambda_e^L} > \frac{\delta}{\Delta S} - \frac{r}{S_G}$

range of λ_o	(A) $(0,\lambda_o''')$	(B) $[\lambda_o''', \lambda_o')$	(C) $[\lambda_o', 1)$
$\{T^*, t_L^*\}$	$\{B, t_B^{foc}\}$	$\{G, t_G^{foc}\}$	$\{G, 0\}$
U_o^*	$\frac{1}{2}(1-\lambda_o)(r+\delta+\Lambda_L^+ S_B)$	$\frac{1}{2}(1-\lambda_o)(r+\Lambda_L^+ S_G)$	$\lambda_o S_G$
U_e^L	$-\bar{\omega} + \frac{1}{2}(1-\lambda_e^L)(r+\delta+\Lambda_L^+ S_B)$	$-\bar{\omega} + \frac{1}{2}(1-\lambda_e^L)(r+\Lambda_L^+ S_G)$	$-\bar{\omega} + (1-\lambda_e^L)r + \lambda_e^L S_G$
U_e^{L*}	$\max\{\bar{U}^L, U_e^L\}$	$\max\{\bar{U}^L, U_e^L\}$	$\max\{\bar{U}^L, U_e^L\}$

- If $2\frac{\lambda_e^L}{1-\lambda_e^L} \leq \frac{\delta}{\Delta S} - \frac{r}{S_G}$

range of λ_o	(A) $(0,\lambda_o'''')$	(B) $[\lambda_o'''',1)$
$\{T^*,t_L^*\}$	$\{B,t_B^{foc}\}$	$\{G,0\}$
U_o^*	$\frac{1}{2}(1-\lambda_o)(r+\delta+\Lambda_L^+ S_B)$	$\lambda_o S_G$
U_e^L	$-\bar{\omega}+\frac{1}{2}(1-\lambda_e^L)(r+\delta+\Lambda_L^+ S_B)$	$-\bar{\omega}+(1-\lambda_e^L)r+\lambda_e^L S_G$
U_e^{L*}	$\max\{\bar{U}^L,U_e^L\}$	$\max\{\bar{U}^L,U_e^L\}$

B.4 Proof for Prop. 2.5

The expected utility function is

$$\begin{aligned}
\mathbb{E}U_o &= P^o\lambda_o(p_H S_G + p_L S_B) \\
&+ [U_o^*(H) - P^o\lambda_o S_G]\frac{max\{\bar{\omega}+U_e^H - P^o u_e^H(0,G),0\}}{\omega_0}p_H \\
&+ [U_o^*(L) - P^o\lambda_o S_B]\frac{max\{\bar{\omega}+U_e^L - P^o u_e^L(0,B),0\}}{\omega_0}p_L
\end{aligned}$$

Take the second order derivative:

$$\begin{aligned}
\frac{d^2\mathbb{E}U_o}{dP^{o2}} &= \frac{U_e^H(0,G)}{\omega_0}p_H U_o^*(H) + \frac{U_e^L(0,B)}{\omega_0}p_L U_o^*(L) > 0 \\
\text{or } &= \frac{U_e^H(0,G)}{\omega_0}p_H U_o^*(H) > 0 \\
(\text{or } &= \frac{U_e^L(0,B)}{\omega_0}p_L U_o^*(L) > 0 \text{(depending on which reaches 0 first)}) \\
\text{or } &= 0
\end{aligned}$$

Then it is concave. It reaches the maximum either at $P^o = 0$ or $P^o = 1$, or $P^o = \bar{P^o}$, where $\bar{P^o} \in (0,1]$ is the probability such that both “max's” just reach 0. This exists because when $P^o = 0$ both“max's” are positive, and when $P^o = 1$ both are 0. They are both continuous and non increasing in P^o.

$$\begin{aligned}
\mathbb{E}U_o(P^o = 0) &= \frac{\bar{\omega}+U_e^H}{\omega_0}p_H U_o^*(H) + \frac{\bar{\omega}+U_e^L}{\omega_0}p_L U_o^*(L) \\
\mathbb{E}U_o(P^o = \bar{P^o}) &= \bar{P^o}\lambda_o(p_H S_G + p_L S_B) \\
\mathbb{E}U_o(P^o = 1) &= \lambda_o(p_H S_G + p_L S_B)
\end{aligned}$$

(1) If $p_H S_G + p_L S_B < 0$, then $\mathbb{E}U_o(P^o = 0) > 0 > \mathbb{E}U_o(P^o = 1)$.

When $p_H S_G + p_L S_B > 0$, it is not obvious whether expected utility for the official reaches the maximum is at $P^o = 0$ or $P^o = 1$ because both are positive.

(2) If $\lambda_o \geq \lambda_o'$, $U_o^*(H) = U_o^*(L) = \lambda_o S_G$. Thus,

$$\mathbb{E}U_o(P^o = 0) = \lambda_o(\frac{(1-\lambda_e^H)r + \lambda_e^H S_G}{\omega_0} p_H S_G + \frac{(1-\lambda_e^L)r + \lambda_e^L S_G}{\omega_0} p_L S_G)$$

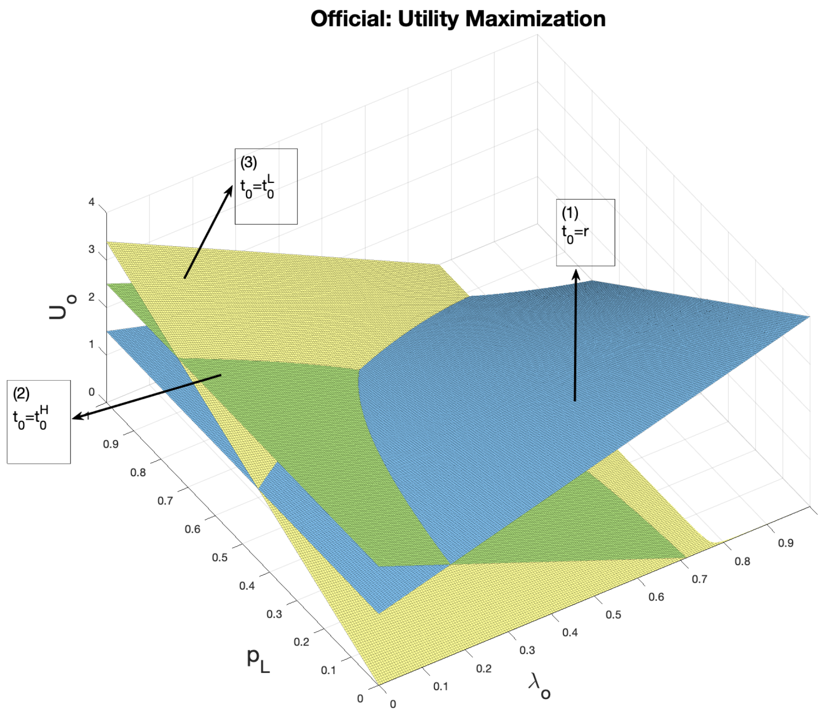
.

Compare $\mathbb{E}U_o(P^o = 0)$ with $\mathbb{E}U_o(P^o = 1)$:

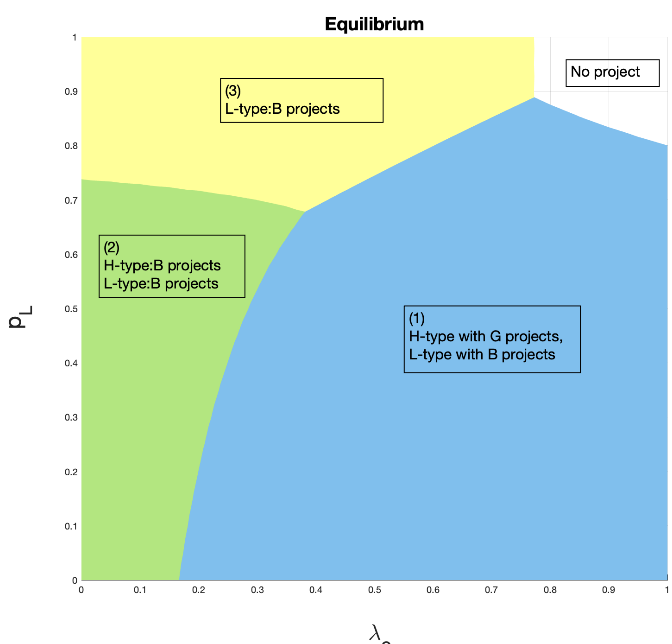
- if $p_H \geq \frac{((1-\lambda_e^L)r + \lambda_e^L S_G) - \omega_0 S_B / S_G}{\omega_0 \Delta S / S_G - (\lambda_e^H - \lambda_e^L)(S_G - r)}$, then $\mathbb{E}U_o(P^o = 1) \geq \mathbb{E}U_o(P^o = 0)$, $P^{o*} = 1$;
- otherwise, $\mathbb{E}U_o(P^o = 1) < \mathbb{E}U_o(P^o = 0)$, $P^{o*} = 0$;

Thus finishes the proof.

List of Figures

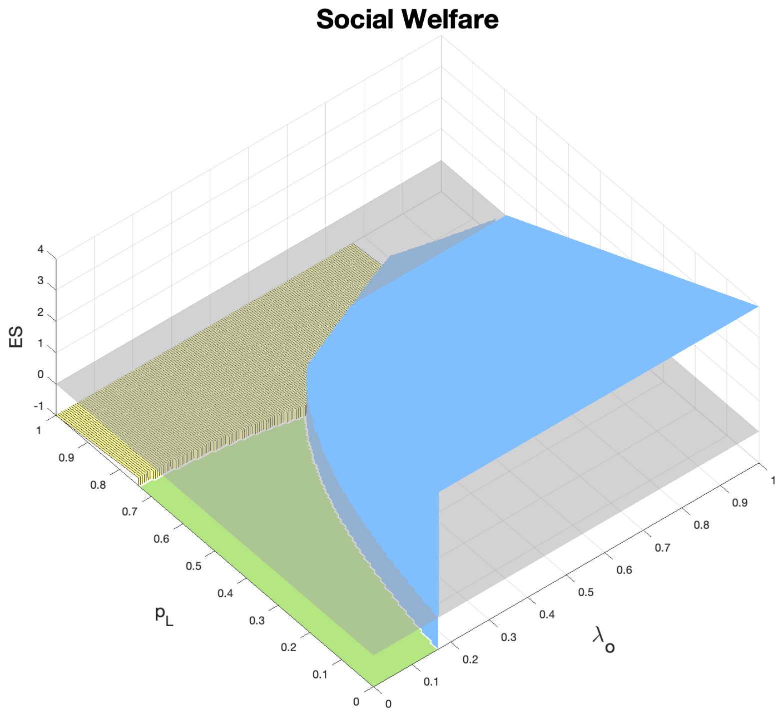


(a)

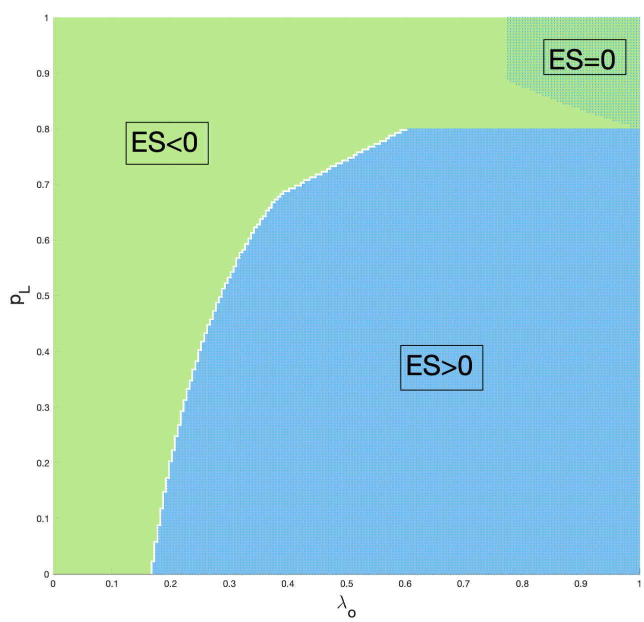


(b)

Figure 1: Official's utility maximization problem: (a) surfaces of maximized utility in three regions; (b) project choices in equilibrium.



(a)



(b)

Figure 2: Social welfare for different λ_o and p_L: (a) social welfare in equilibrium; (b) social welfare: positive and negative regions.

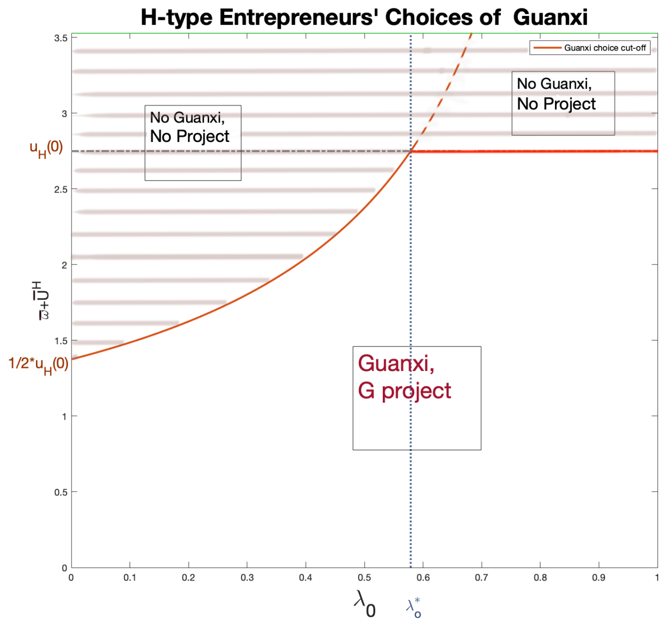
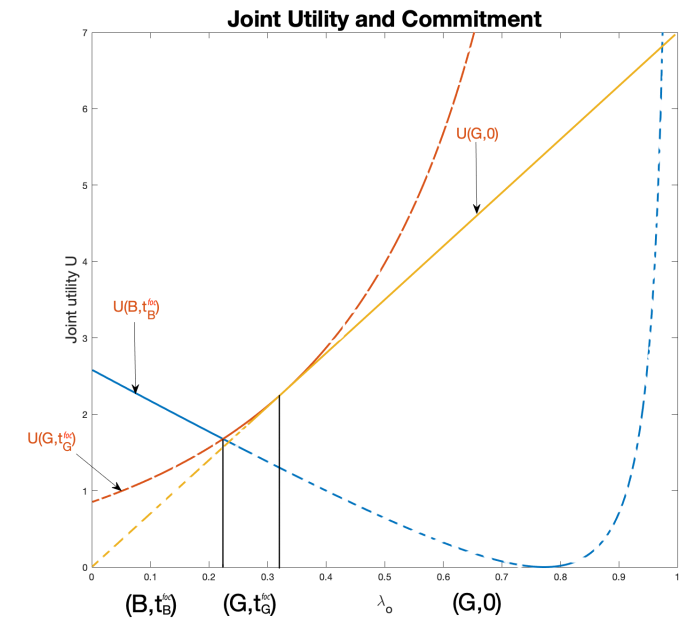
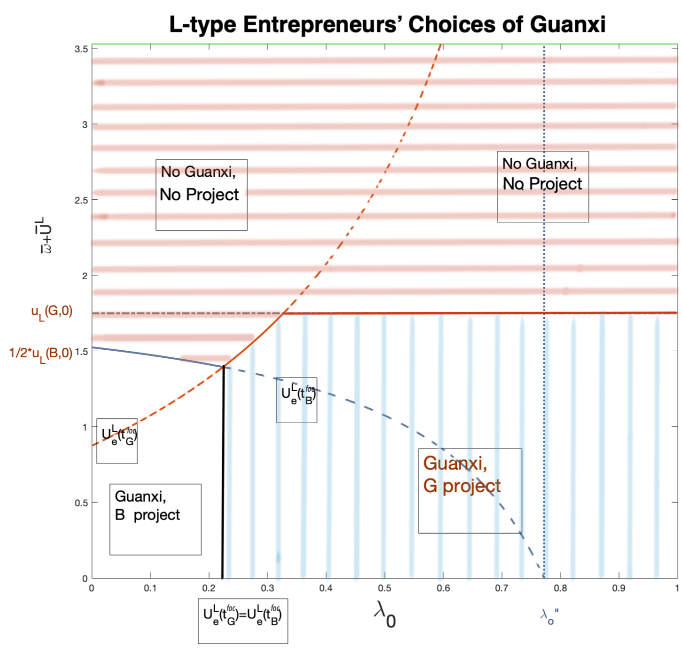


Figure 3: H-type entrepreneurs: choices of guanxi



(a)



(b)

Figure 4: L-type entrepreneurs: (a) joint utility maximization, where the solid line is the commitment in guanxi channel; (b) choices of guanxi.

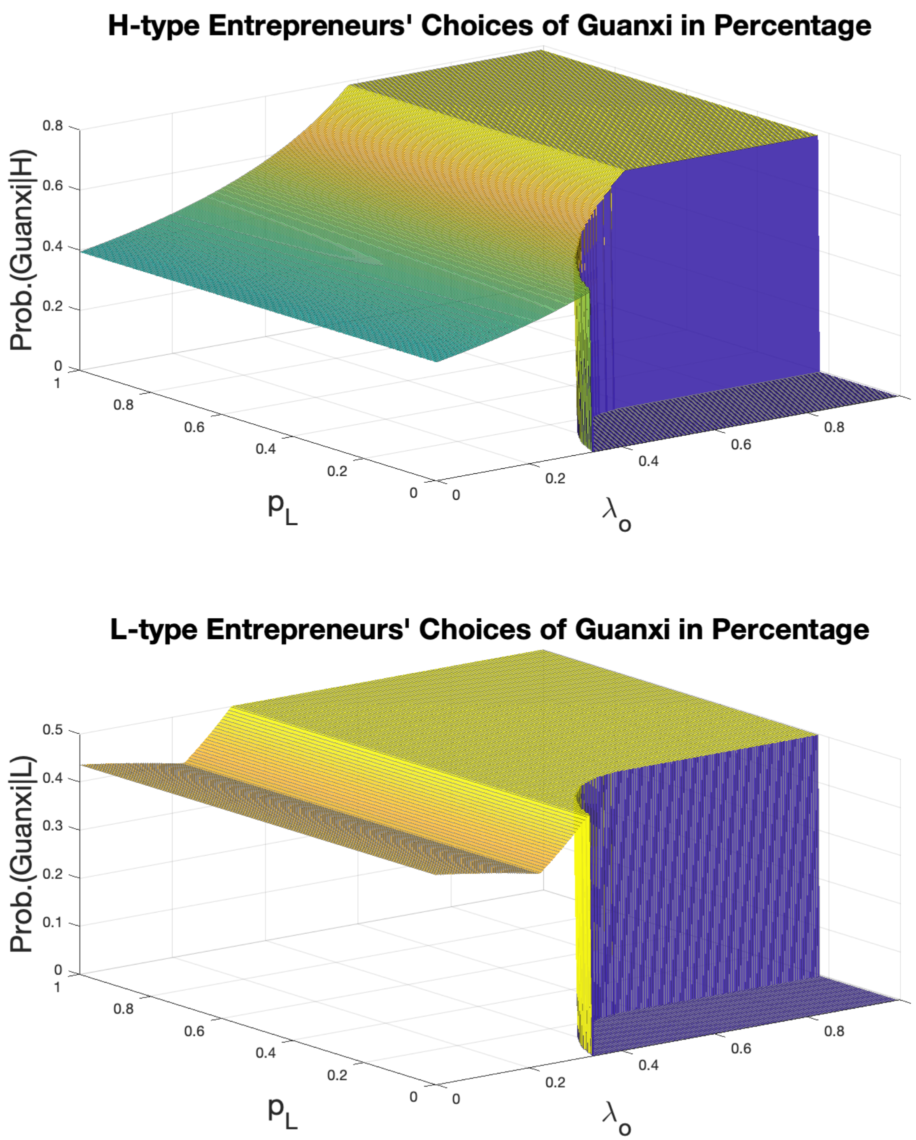


Figure 5: Entrepreneurs: Choices of Guanxi

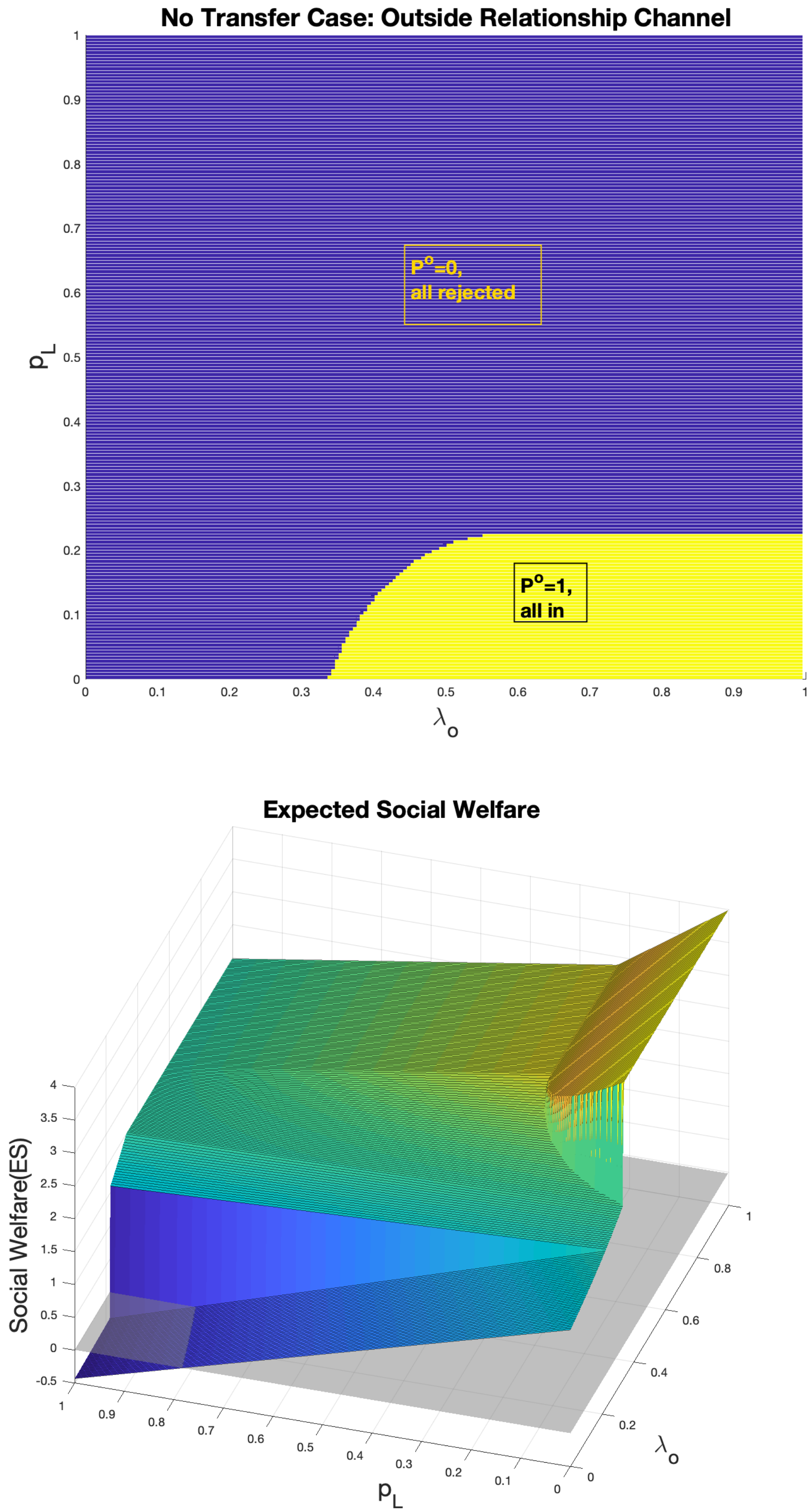
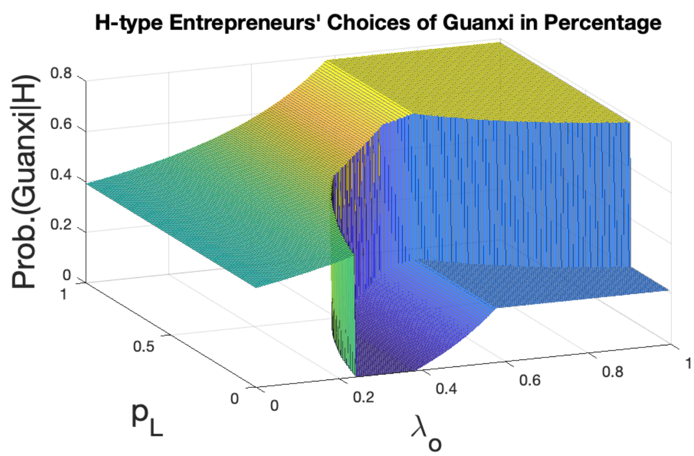


Figure 6: Equilibrium: the probability of project approval out of guanxi, and social welfare.



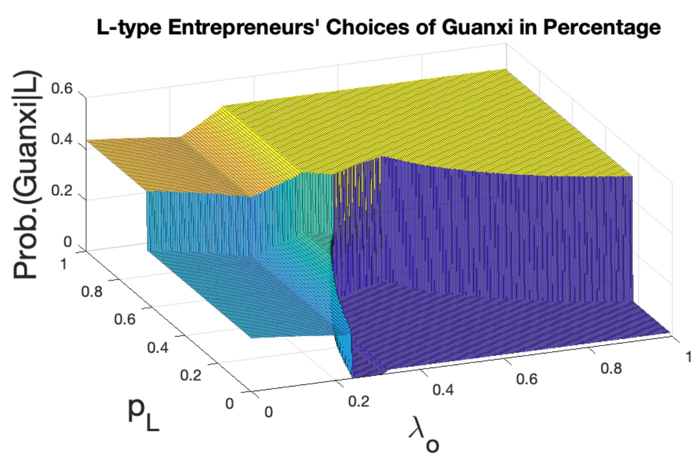


Figure 7: Entrepreneurs: Choices of Guanxi

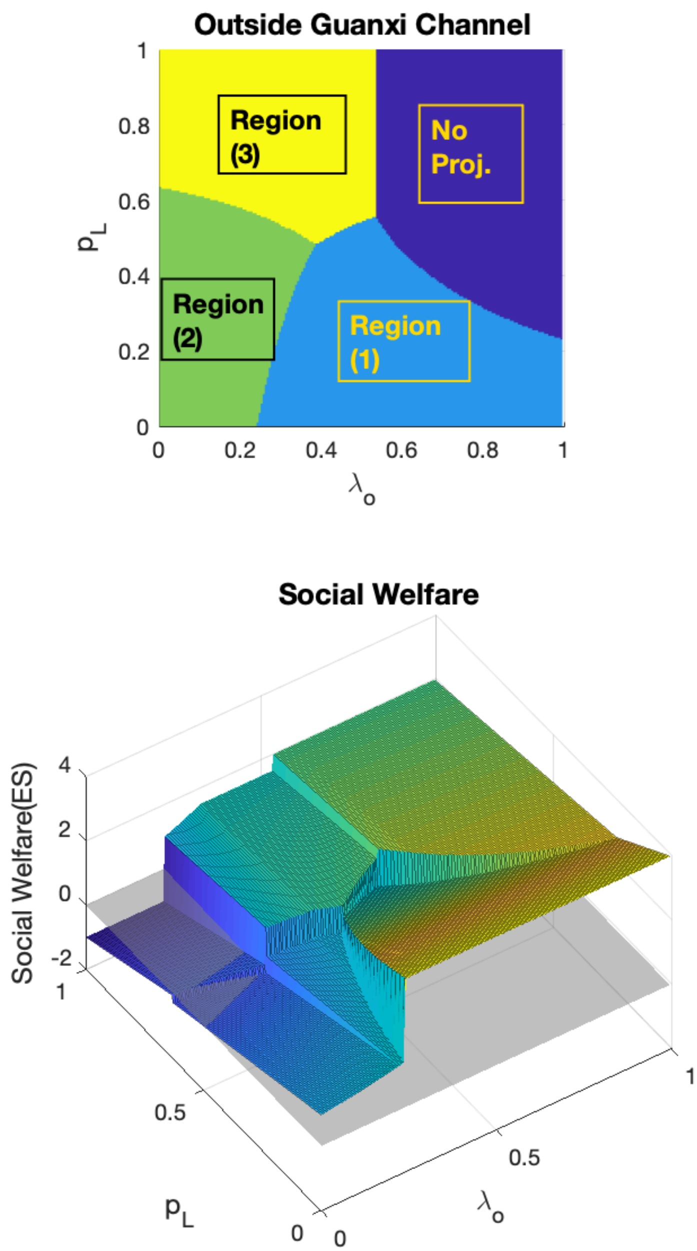


Figure 8: Social Welfare

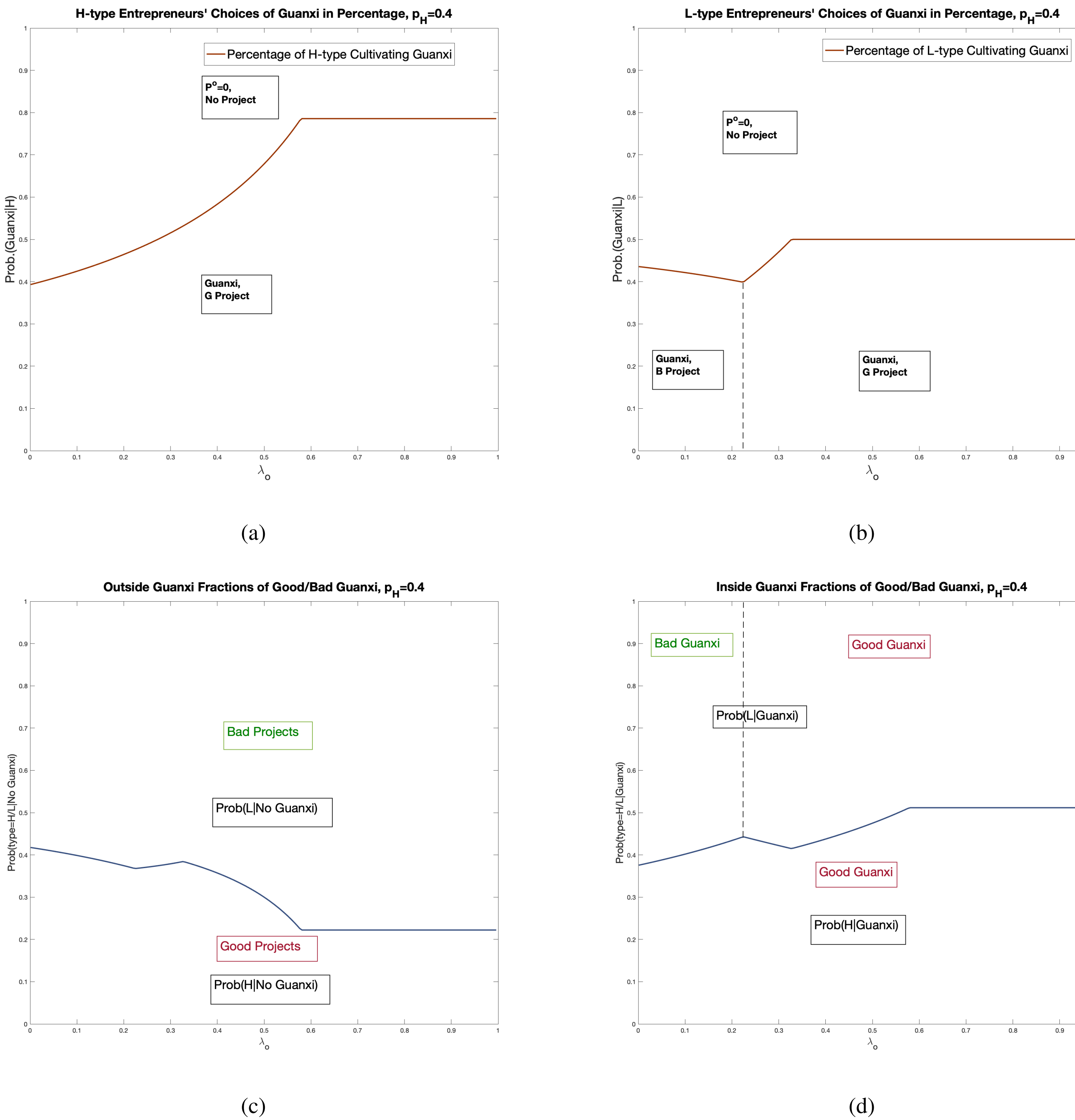


Figure 9: Guanxi Channel: Entrepreneurs' Choices of Guanxi and Equilibrium Outside and Inside Guanxi when $p_H = 0.4$.

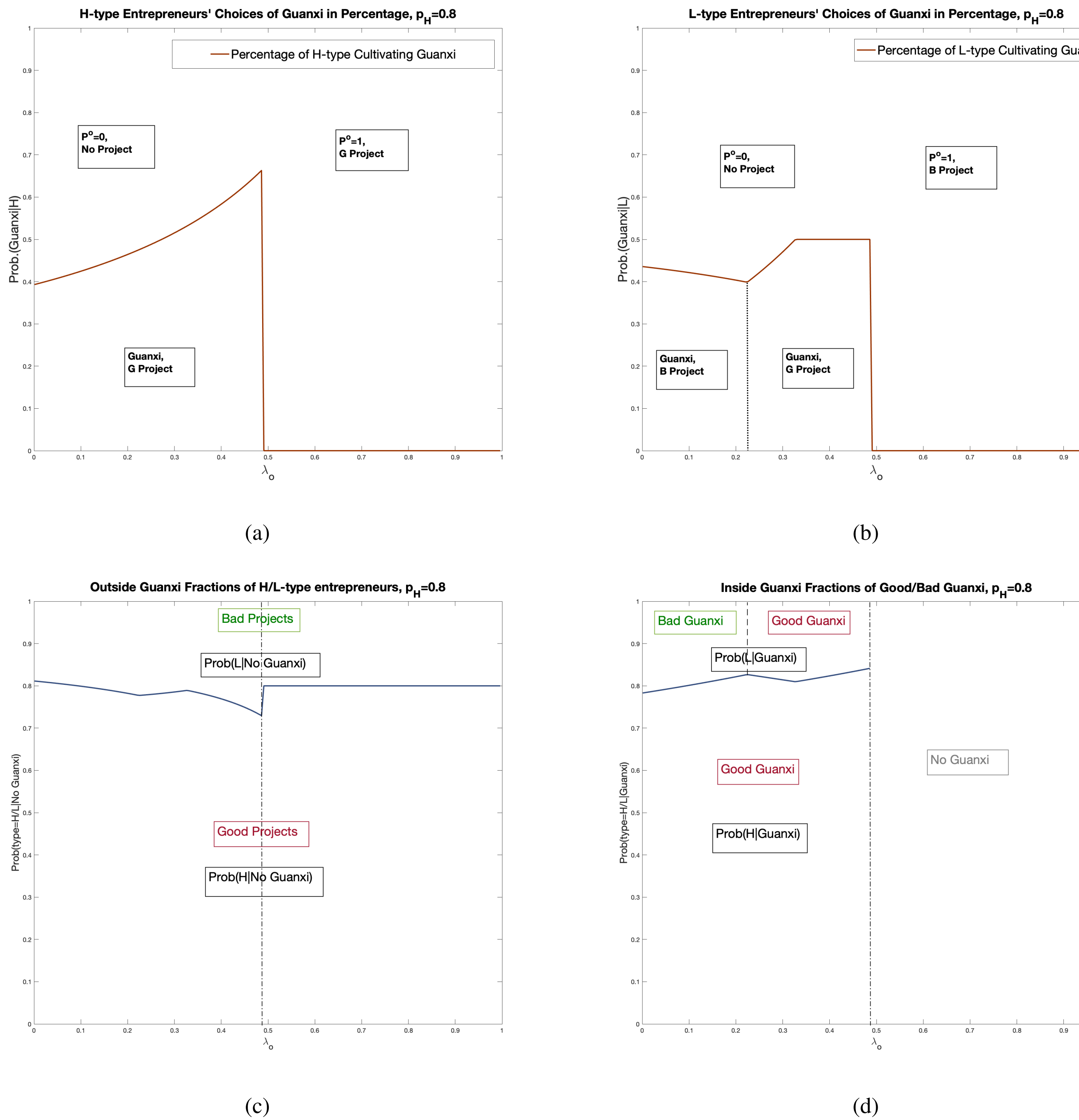
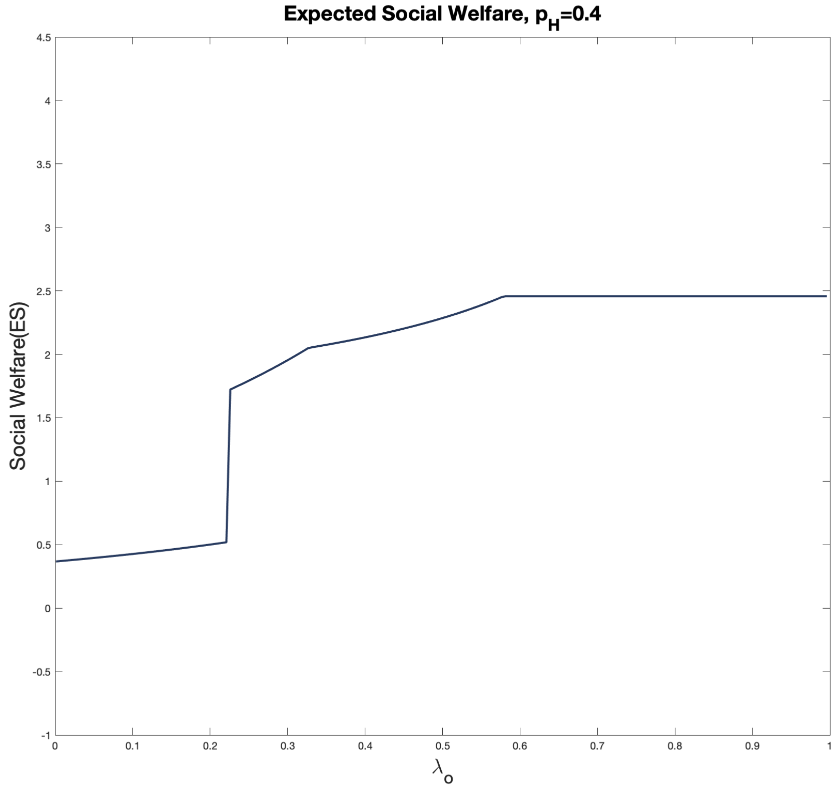
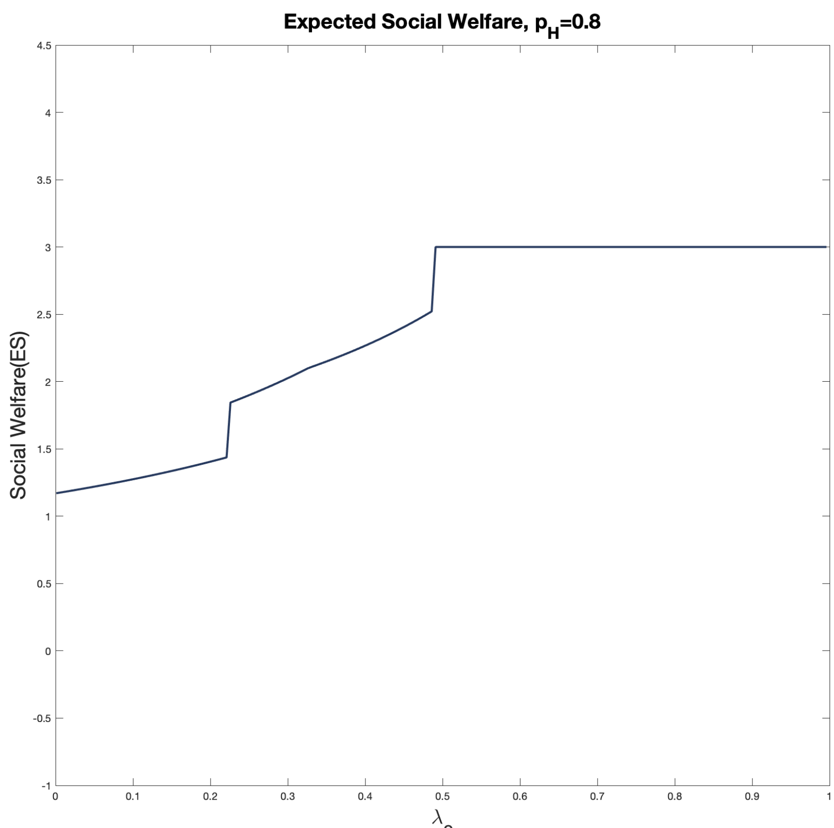


Figure 10: Guanxi Channel: Entrepreneurs' Choices of Guanxi and Equilibrium Outside and Inside Guanxi when $p_H = 0.8$.



(a)



(b)

Figure 11: Social welfare when $p_H = 0.4$ (a) and $p_H = 0.8$ (b)

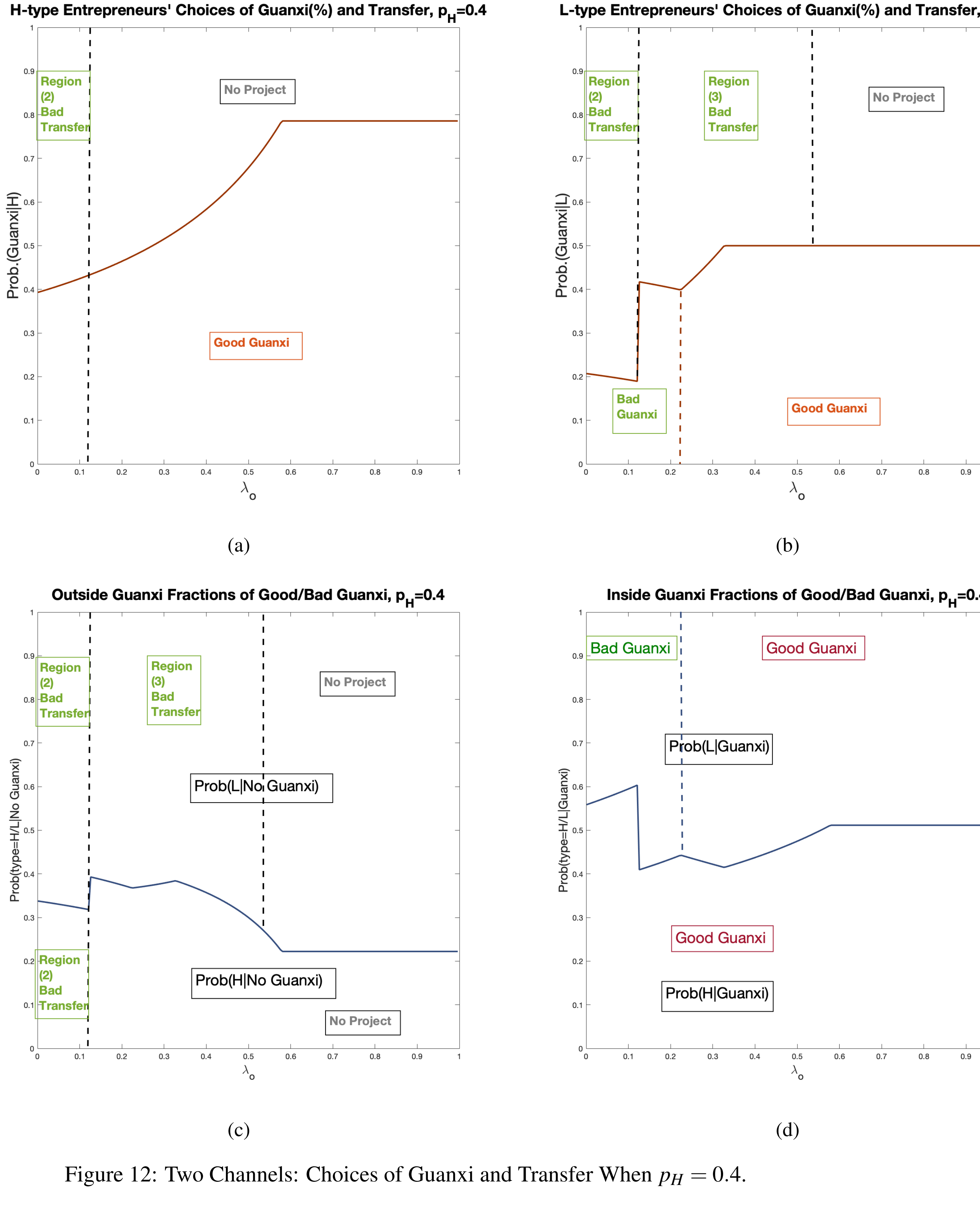


Figure 12: Two Channels: Choices of Guanxi and Transfer When $p_H = 0.4$.

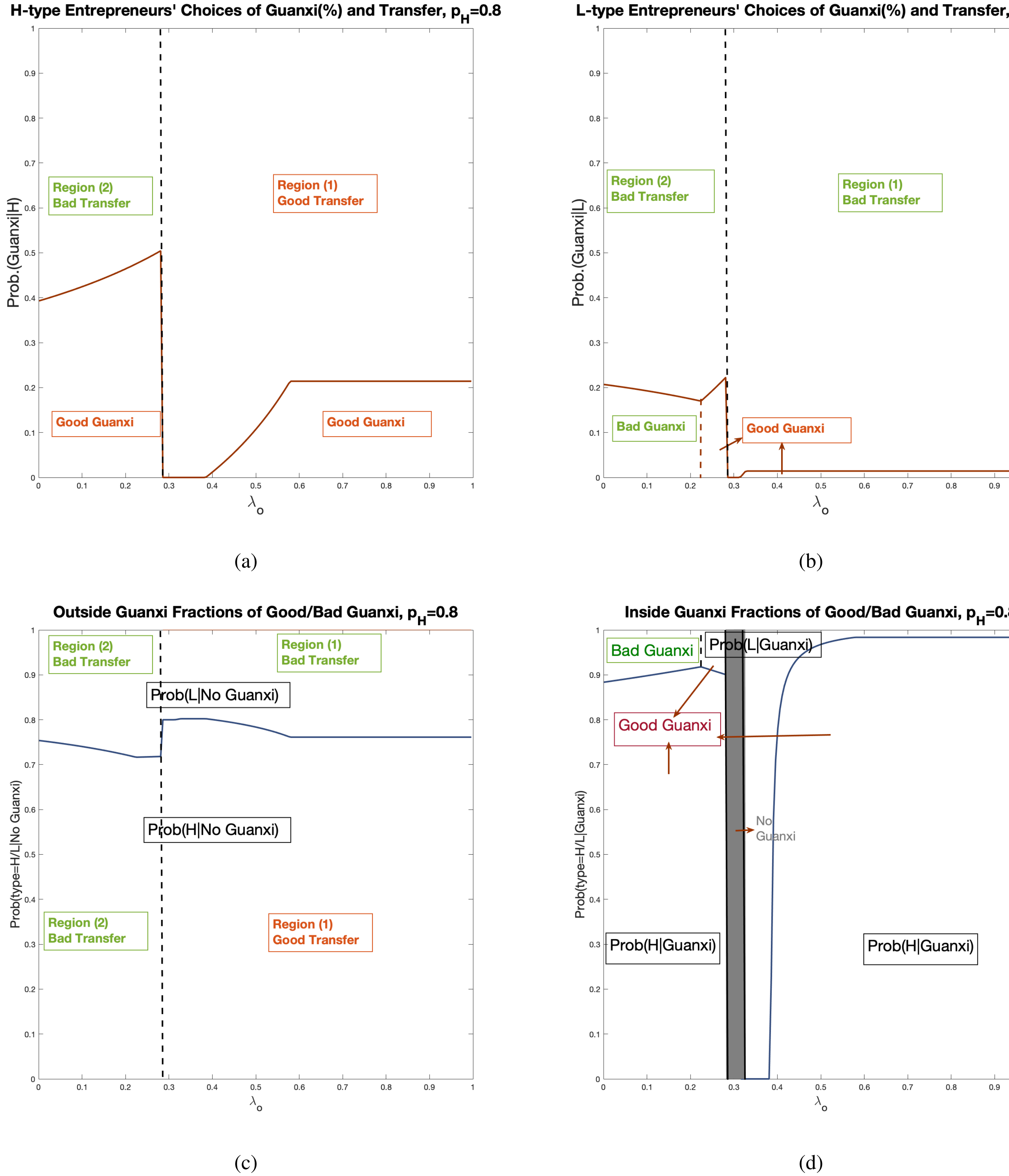


Figure 13: Two Channels: Choices of Guanxi and Transfer When $p_H = 0.8$.

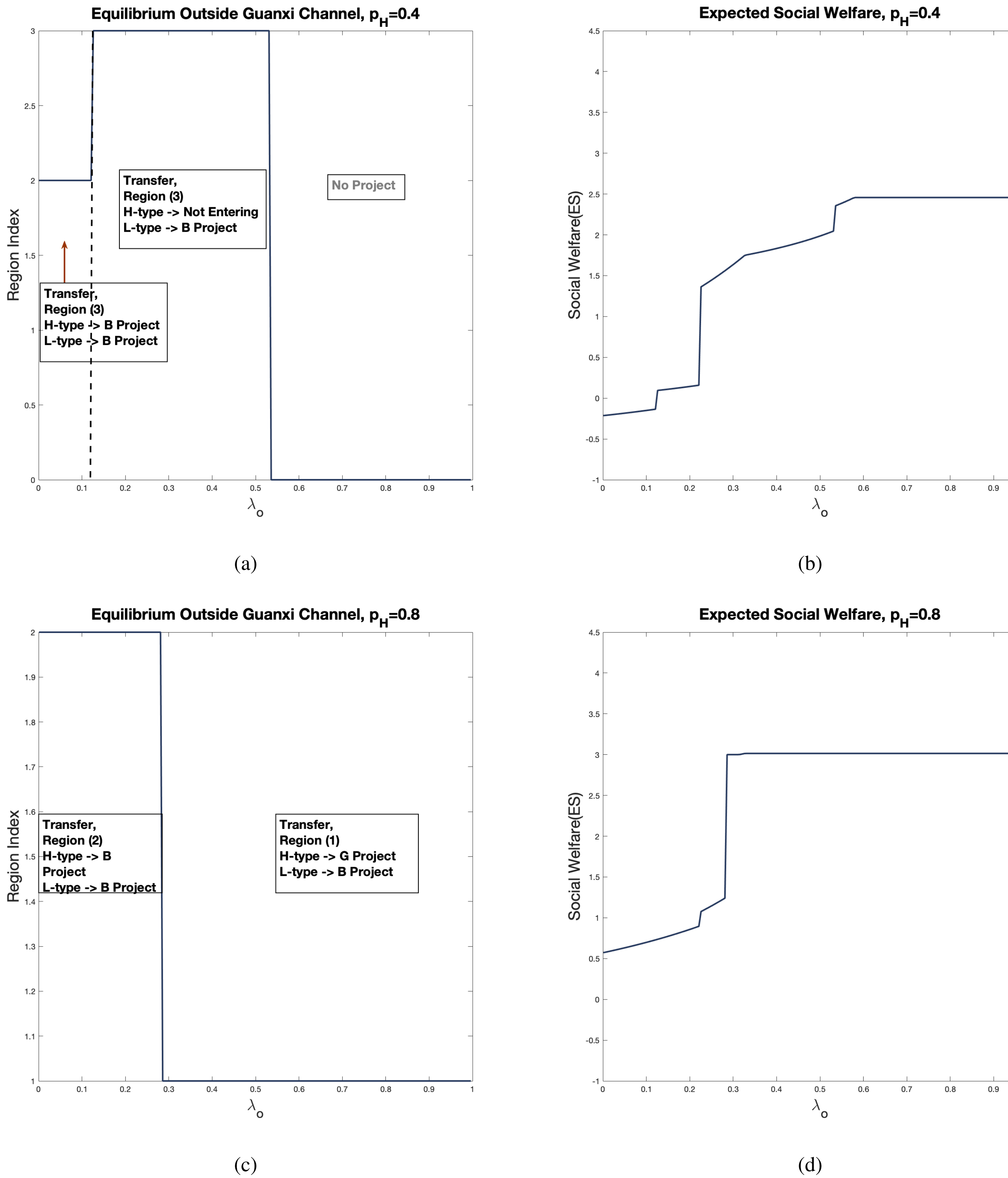


Figure 14: Two Channels: Equilibrium Outside Guanxi Channel and Social Welfare When $p_H = 0.4$ (up) and $p_H = 0.8$ (down).