Favoritism or Markets in Capital Allocation?*

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Abstract

Casual observation suggests that capital allocation is often driven by favoritism and connections rather than by market mechanisms and information on future expected returns. We investigate when favoritism or markets emerge as an equilibrium outcome in the allocation of capital. We show that when information is unreliable and costly, financiers do not have incentives to investigate distant investment opportunities and allocate capital to entrepreneurs they are familiar with (favoritism). If the pool of saving is relatively small, favoritism can lead to an efficient allocation of investment. As the economy develops and its pool of saving increases, information production and the identification of distant investment opportunities (markets) become crucial for efficient investment decisions. Nevertheless, favoritism may still emerge in equilibrium and investors may find it optimal to fund low-quality entrepreneurs if they are familiar with them. Since competition for capital is lower in an equilibrium with favoritism, entrepreneurs can enjoy high rents. Even high quality entrepreneurs may thus have no incentive to join markets with high listing standards that can foster information acquisition, but they rather prefer to run inefficiently small firms.

Keywords: Crony capitalism; Information production

I Introduction

One of the main functions of a financial system is to facilitate capital flows from individual savers to the highest return investments (Levine, 2006). It is quite common that the highest return investments are new technologies or opportunities that investors are unfamiliar with. To fund such investment opportunities, financiers need to acquire information. However, financial systems often fail to foster information acquisition and to promote flows of capital to high productivity investments and new technologies. The empirical evidence shows that financial intermediaries often convey funds to their cronies (La Porta, Lopez-de-Silanes and Zamarripa, 2003); that entrepreneurs reinvest funds in their own businesses or in the ones of family members (Almeida and Wolfenzon, 2006); and that a large number of firms around the world choose not to be listed in a stock market and raise capital only from a narrow circle of family and friends (Pagano, Panetta and Zingales, 1998).

Capital allocation thus seems to be driven by favoritism and connections more than by market mechanisms and information on future expected returns. Favoritism in capital allocation may arise if investors are reluctant to acquire information because the available information is imprecise, unreliable or costly. High information acquisition costs as well as lack of disclosure can make the return to information acquisition so unattractive that financiers save the cost and pass on potentially good investment opportunities; instead, they choose to fund entrepreneurs whom they are already familiar with because of geographical proximity or personal connections. This tendency is accentuated if financiers enjoy non-pecuniary benefits – which may be associated with weak corporate governance or corruption – when funding close entrepreneurs.

In this paper, we explore the conditions under which financiers find it optimal to identify distant investment opportunities instead of favoring close entrepreneurs. We also analyze the implications of information acquisition (or the lack thereof) for capital allocation, investment returns and entrepreneurial rents. We show that when the pool of saving is relatively small, an efficient allocation of resources can be achieved even if financiers do not investigate new investment opportunities and fund only entrepreneurs they are familiar with. This is because the general technology, which is not subject to information asymmetry, offers a relatively high rate of return to financiers when the pool of saving is small. To receive funding, a close entrepreneur has to compete with the general technology by offering an even higher return, a return that low-productivity entrepreneurs

typically cannot afford. Hence, even in the absence of information acquisition, capital is allocated efficiently to the most productive investment opportunities. The only constraint to the growth of high-productivity entrepreneurs is the low level of saving in the economy.

As the economy develops and its pool of saving increases, information production and the identification of distant investment opportunities become crucial for achieving an efficient allocation of capital. A high level of initial saving drives down the return to the general technology. In the absence of information acquisition, financiers lack alternative investment opportunities and fund close entrepreneurs even if they have low productivity. High-productivity entrepreneurs' investment instead is lower than optimal as they receive funding only from close financiers; had they also employed distant financiers' capital, their and the whole economy's aggregate output would have been higher.

In addition to capital allocation, information production also dramatically affects entrepreneurial rents and the equilibrium return to financiers' investment. Financiers have limited investment opportunities if they do not acquire information, and thus end up funding even low-productivity entrepreneurs. Further, information acquisition has two opposite effects on the payoffs of high-productivity entrepreneurs. On the one hand, lack of information acquisition reduces competition to attract capital, allowing high-productivity entrepreneurs to offer low returns to financiers and thus to enjoy higher rents per unit of capital invested. This implies that in equilibrium high-productivity entrepreneurs may not have incentives to induce information acquisition by establishing higher disclosure standards. On the other hand, if financiers do not acquire information, high-productivity entrepreneurs can be funded only by close financiers and thus run inefficiently small firms. This should induce them to voluntarily improve disclosure.

We show that high-productivity entrepreneurs favor higher disclosure and stricter – though lower than optimal – listing standards only if they can attract a sufficiently large pool of capital. That high-productivity entrepreneurs may favor an improvement in disclosure and/or in listing standards when the supply of capital increases, for example, triggered by a financial liberalization, is consistent with the empirical evidence. Stulz (1999) notices that often, financial liberalization not only brings more funds to capital-poor countries, but also improves corporate governance, as more sophisticated foreign financiers start monitoring and domestic companies become targets of potential foreign takeovers. In this paper, we highlight another reason why financial liberalization

may spur an improvement in corporate governance: The gain from attracting distant financiers increases and entrepreneurs are willing to renounce to some rents in order to be able to invest more.

Mandatory disclosure and improved listing standards are crucial in economies with intermediate level of saving and with a closed capital market. In this case, the initial saving is high enough to drive down the return of the general technology so that even low productivity entrepreneurs are funded. However, financiers' information acquisition does not bring sufficiently larger investment to high productivity entrepreneurs to compensate for lower rents. Hence, high quality entrepreneurs would not have an incentive to voluntarily join an exchange that requires higher listing standards.

This paper contributes to the literature analyzing how different financial systems and institutions may affect economic performance at different stages of development (Allen and Gale, 2000). We show that institutions fostering information acquisition are unimportant for an efficient allocation of saving at early stage of development (low domestic saving). Listing standards and disclosure becomes crucial at intermediate stages of development as even high quality entrepreneurs may not have incentives to improve disclosure and listing standards. When an economy reaches high level of development (high domestic saving) or liberalizes capital flows, entrepreneurs may voluntarily improve disclosure and listing standards, even though to a level that does not completely eliminate inefficiency in capital allocation.

Bhattacharya and Ravikumar (2001) also study the relation between capital market development and investment. They show that families may have an incentive to sell their companies to outsiders only after companies have reached a certain size. Instead, we show that an economy's initial saving – not entrepreneurial firms' size – has an effect on the efficiency of capital allocation and on whether markets emerge.

In our model, information acquisition allows financiers to engage in winner-picking, similarly to headquarters in internal capital markets (Stein, 1997). Contrary to Stein however, we do not assume that some financiers (the headquarter in his model) have better information; instead, we endogenously model the incentives to produce information and analyze the (general) equilibrium implications of the "winner-picking" effect. The inefficiency of the equilibrium in which financiers allocate funds based on closeness and personal ties, rather than acquiring information on distant investment opportunities, is similar to the one highlighted by Almeida and Wolfenzon (2006). Almeida

and Wolfenzon show that, because of the limited pledgeability of externally funded projects' output, conglomerates may choose to fund mediocre projects internally when other firms in the economy have higher productivity projects that are in need of external capital. We abstract from problems of enforcement affecting the pledgeability of output and show that inefficiencies in investment allocation may arise also if financiers do not have an incentive to investigate new investment opportunities. Additionally, we explore the conditions under which financiers have incentives to produce information, the consequences on financiers' equilibrium return to investment, and entrepreneurial rents.

Our paper is also related to a vast literature on disclosure (Healy and Palepu, 2001). This literature generally analyzes the disclosure decisions of a firm in isolation. We analyze incentives to make information more readily available to financiers (thus reducing the information acquisition cost) in a (general) equilibrium model. We show that disclosure affects competition for external funds, and consequently financier's equilibrium returns. Like Fishman and Hagerty (1989), we propose that greater disclosure may improve investment efficiency. This arises however for very different reasons. Fishman and Hagerty, like most of the papers in the disclosure literature, analyze a secondary equity market. Disclosure improves efficiency only to the extent that gives stronger incentives to management. We analyze a primary equity market. In this context, disclosure improves efficiency because it allows a more efficient allocation of investment.

The rest of the paper is organized as follows. Section II describes the model. Section III derives the equilibrium implications. Section IV provides empirical evidence in support of the implications of the model. Section V concludes. All proofs are in the Appendix.

II The Model

In this section, we first describe the essentials of the model. We then present the timing and finally define the equilibrium. The model presented here is the most tractable framework in which we can obtain our results. Technical assumptions are relegated to Section III in which we derive the equilibrium.

We consider an economy with two types of risk neutral agents: a number N of penniless entrepreneurs and a continuum I of financiers.

A Financiers

Each financier is endowed with initial capital $k > 0$. Hence, the total capital available in the economy is kI. Financiers can fund the entrepreneurs or the general technology up to their endowment.

An entrepreneur can be either "close" or "distant" to a financier. An entrepreneur is close to a financier because of geographical proximity or personal connections. In this paper, we model "closeness" from the perspective of the *ex ante* information acquisition and normalize other costs (such as monitoring costs) to zero. In particular, we assume that financiers are aware of close entrepreneurs and can evaluate their type at no cost.

To be able to fund a distant entrepreneur, financiers have to acquire information at cost τ. One can interpret τ as the cost of becoming aware of new investment opportunities and evaluating a distant entrepreneur's business. In this way, we intend to capture that expanding the investment horizon beyond one's own neighborhood and close investment opportunities entails a cost. It will be clear later that spending τ also involves benefits whose magnitude depends on entrepreneurs' competition for capital.

Alternatively, all financiers can invest in the general technology that provides return per unit of capital invested – $g(\omega)$ – at no cost.

Definition 1 *(Favoritism versus Markets) We refer to situations in which financiers do not acquire information on any distant entrepreneur and, without knowing any alternative, invest in the close entrepreneur or the general technology as* favoritism*. We refer to situations in which financiers acquire information about some distant entrepreneurs as* markets*.*

Under favoritism, local markets for capital remain completely segmented. This segmentation in the local market for capital is partially overcome by *markets*, where financiers acquire information about some distant entrepreneurs and where capital allocation is driven by information on distant and close entrepreneurs' relative returns. For simplicity, we assume that when financiers evaluate two entrepreneurs, all financiers close to entrepreneur i evaluate the same entrepreneur j (and vice versa) if they choose to acquire information on a distant entrepreneur. That is, we posit that financiers belonging to a given clientele evaluate the same entrepreneurs. This technical assumption is not crucial to our results and simply ensures that financiers are equal *ex ante* and *ex post*. It is, however, consistent with empirical evidence suggesting that different companies cater to clienteles

of financiers who select companies with similar characteristics in terms of size, stock liquidity or dividend yields (Falkenstein, 1996).

In addition, we assume that entrepreneurs can offer different returns to financiers with different evaluation strategies: Financiers who acquire information can be offered a return different from that of the financiers who do not and who, consequently, can invest only in the close entrepreneur and the general technology. The fact that financiers are offered differential treatment finds support in the empirical evidence on the IPO process. Institutional financiers that are part of an investment bank's network are expected to participate repeatedly and indiscriminately to an investment bank's deals and to contribute to produce information. In exchange for this commitment, financiers that are part of the network are allocated stocks in the pre-IPO market at a better price than retail financiers and other institutional financiers that are not part of the network (who can buy stocks only at the first day trading price).[1] Financiers can also buy stocks at different prices in the grey market for IPOs (a when-issued market for IPO shares active before the subscription period, especially in European countries).[2] Finally, financiers are offered similar securities at different prices depending on their information when companies (or more often banks) raise funds through securitization (Firla-Cuchra and Jenkinson, 2006).

B Entrepreneurs and Technologies

Each entrepreneur is endowed with a project. We think of projects as new ideas with different return to investment. For simplicity, we assume that entrepreneurial projects have a constant return to scale technology with productivity A^H or A^L, where $A^H \geqslant A^L$. The productivity level defines the entrepreneur's type. The prior probabilities of A^H and A^L are α^H and $\alpha^L \equiv 1 - \alpha^H$, respectively.

Entrepreneurs have no capital endowment. They compete to attract capital from financiers. The more capital an entrepreneur attracts, the larger the investment and thus the size of the firm he runs.

We assume that in order to attract capital from financiers, entrepreneurs bid sequentially by offering a return per unit of capital invested. The bargaining game is as follows: an entrepreneur

[1] The discretionary allocation of IPOs to institutional investors is believed to promote information production (Ljungqvist and Wilhelm, 2002)

[2] See Cornelli, Goldreich and Ljungqvist (2006).

is randomly selected to make a first offer which is observed by the other entrepreneurs and all financiers that are aware of the entrepreneur. In order to attract capital, other entrepreneurs can counter-offer. Entrepreneurs continue to counter-offer for a given financier until when she accepts an offer. Financiers accept the highest credible offer on the basis of their information on the type of the entrepreneur. In equilibrium, entrepreneurs offer a return that is at most equal to the return of the alternative investment opportunities available to the financier. Thus, the outcome of the multi-period bargaining is the same of Bertrand competition with symmetric information.

Note that offering a return to financiers is equivalent to say that entrepreneurs offer financiers equity in the project at a price that guarantees a given return. Therefore, if an H entrepreneur offers return A^L, financiers will receive a fraction $\frac{A^L}{A^H}$ of the output produced per unit of capital invested. Similarly, an L entrepreneur offering return A^L promises 100 per cent of the output produced per unit of capital invested.

Similarly to Almeida and Wolfenzon (2005 and 2006), we assume that capital can also be invested in a general technology. The general technology captures any well-known activities that do not require new entrepreneurial skills (e.g., agriculture and any traditional sector in which innovation is not important). We assume that the general technology can be operated by any agent and provides a return per unit of capital invested $g(\omega)$, where ω is the total capital invested in the general technology. The return to the general technology is decreasing in the total capital invested (for instance, because the price of crops drops if too much is produced) and $\frac{\partial(\omega g(\omega))}{\partial \omega} > 0$. The latter assumption ensures that the total output from the general technology increases in the invested capital. For simplicity, we also assume $g(0) > A^H$, which ensures a positive investment in the general technology in equilibrium, and $\lim_{\omega \to \infty} g(\omega) < A^L$, which implies that even L entrepreneurs can be more productive than the general technology for a sufficiently large level of ω.

C Timing and Definition of Equilibrium

The timing of the events is as follows: At time 0, financiers choose whether to acquire information on a distant entrepreneur. For tractability, we make the following assumptions: (1) each entrepreneur has the same mass of close financiers; (2) each financier has only one close entrepreneur; (3) financiers can evaluate at most one distant entrepreneur; and (4) financiers choose whether to acquire information before observing the close entrepreneur's productivity. These are technical

assumptions that significantly simplify the derivations without affecting the qualitative implications of our results. In particular, the mechanisms we illustrate generalize readily to the case in which financiers acquire information about a finite number of distant entrepreneurs.

After observing the productivity of the close entrepreneur and of any distant entrepreneur they have evaluated, financiers decide how to allocate their capital between entrepreneur(s) and the general technology. At time 1, the returns are realized and payoffs are distributed.

Definition 2 *An equilibrium consists of financiers' beliefs, information acquisition decisions, capital allocations between the general technology and entrepreneurs, and returns offered by entrepreneurs, such that:*

- *Financiers decide whether to acquire information in order to maximize the expected return on their capital endowment net of the information acquisition cost;*
- *Taking as given the return offered by the general technology and the other entrepreneur when the financier evaluates a distant entrepreneur, entrepreneurs offer financiers a return that maximizes their payoffs;*
- *Financiers allocate their initial capital in order to maximizes the expected return on their capital endowment taking as given the return offered by the entrepreneur(s) and the general technology;*
- *All agents' beliefs are realized in equilibrium;*
- *At given returns, all financiers that wish to fund a given entrepreneur or the general technology do so.*

III Information Acquisition and Competition for Capital

A Benchmark Case: Perfect Markets

We first describe a benchmark case in which evaluating a distant entrepreneur involves no cost ($\tau = 0$). In this case, information is symmetric as any financier can identify *all* H entrepreneurs, regardless whether they are close or distant, at no cost.

In equilibrium, L entrepreneurs are not funded. When the economy's capital supply (kI) is lower than $g^{-1}\left(A^H\right)$, no entrepreneurs are funded. This is because the capital supply is so low that even if the entire capital endowment is invested in the general technology, the return of the general technology is higher than A^H – the highest possible return an entrepreneur can offer.

When the capital supply exceeds the threshold level $g^{-1}\left(A^H\right)$, the return of the general technology falls to A^H, and H entrepreneurs receive funding from close and distant financiers. Since entrepreneurs compete to attract capital, they end up offering return A^H per unit of capital invested. Then, ω_0 such that $g\left(\omega_0\right) = A^H$ is invested in the general technology, whereas the rest of the capital, $kI - \omega_0$, is invested in H entrepreneurs. On average, an H entrepreneur invest $\frac{kI-\omega_0}{\alpha^H N}$.

This implies that markets – interpreted as some investors acquire information and fund distant entrepreneurs – emerge only if the capital supply of the economy is larger than $g^{-1}\left(A^H\right)$. For any level of initial saving below this threshold, financiers invest directly in the general technology. Hence, favoritism can be an equilibrium outcome even without capital market imperfections. The capital allocation is also efficient as financiers optimally choose to directly invest only in the general technology. Markets are thus unnecessary because entrepreneurs do not receive funding in equilibrium.

As soon as capital exceeds the threshold $g^{-1}\left(A^H\right)$, the productivity of the general technology falls below A^H and financiers start funding H entrepreneurs. The possibility of identifying distant entrepreneurs affect the equilibrium in two important ways. First, because $\tau = 0$, all financiers are able to identify all H entrepreneurs. This prevents the productivity of the general technology to drop below A^H. Second, entrepreneurs have to compete for capital with other H entrepreneurs. In equilibrium, financiers receive return A^H.

Definition 3 *A capital allocation is efficient if the average productivity of capital is at least A^H.*[3]

The above definition of "efficient" capital allocation implies that (1) less productive entrepreneurs – L types – do not receive funding, and (2) investment in the general technology is not larger than $g^{-1}\left(A^H\right)$. This is because any amount of capital can be employed at A^H with a constant return to scale entrepreneurial technology. Therefore, if the capital allocation is efficient, for any initial level of capital greater than $g^{-1}\left(A^H\right)$, each H entrepreneur on average should invest $\frac{kI-\omega_0}{\alpha^H N}$.

[3] Note that in our model both the general and entrepreneurial technologies are linear. Therefore, average and marginal returns on capital are equal. Therefore, we use "average" and "marginal" returns interchangeably.

The distance between the efficient capital allocation and the actual capital allocated on average to an H entrepreneur captures the extent of the deviation from the efficient capital allocation. As will be clear later, the capital allocated to H entrepreneurs may be lower than optimal in equilibrium because financiers allocate too much capital to the general technology and fund L entrepreneurs.

When distant entrepreneurs can be evaluated without cost, markets are efficient as there is no excessive capital allocation in the general technology. In the next section, we discuss how markets emerge in equilibrium if $\tau > 0$, but remain inefficient.

B On the Emergence of Markets

In what follows, we explore the equilibrium implications of costly information acquisition ($\tau > 0$). We start by examining the equilibrium under favoritism. We then consider under what conditions financiers may want to acquire information about a distant entrepreneur. The latter exercise characterizes *imperfect markets* (i.e., equilibria in which some financiers fund distant entrepreneurs, but local capital markets are still partially segmented because of the information acquisition cost).

B.1 Favoritism

Here we characterize the equilibrium in which financiers do not acquire information about distant entrepreneurs and can invest only in the close entrepreneur or the general technology.[4] In other words, we describe an economy in which capital is allocated through favoritism.

The following proposition states the conditions under which different types of entrepreneurs are funded.

Proposition 1 *Suppose that financiers do not invest in information acquisition.*

- *Then, in equilibrium,*

  1. *if $kI < g^{-1}\left(A^H\right)$, no entrepreneur is ever funded and financiers return to capital is $g(kI)$;*
  2. *if $g^{-1}\left(A^H\right) \leq kI < \frac{g^{-1}\left(A^L\right)}{\alpha^L}$, only type H entrepreneurs are funded;*
  3. *if $kI \geqslant \frac{g^{-1}\left(A^L\right)}{\alpha^L}$, both types of entrepreneurs are funded.*

[4] This also describes the equilibrium of the model if $\tau \to \infty$.

- *Additionally, financiers' equilibrium return decreases in kI for $kI \leqslant \frac{g^{-1}(A^L)}{\alpha^L}$ and is A^L for $kI > \frac{g^{-1}(A^L)}{\alpha^L}$.*

Since there is no competition for capital, entrepreneurs offer at most the return of the general technology.[5] If an economy's initial capital is relatively small, no entrepreneur receives funding and the general technology attracts all investment because its return is relatively high. The equilibrium is thus the same regardless of the cost of information acquisition as entrepreneurs are not funded. The resulting capital allocation is efficient.

As the amount of capital grows, the return to the general technology decreases and eventually falls to A^H; H entrepreneurs can thus attract capital by offering return g. As long as the total capital supply is lower than $\frac{g^{-1}(A^L)}{\alpha^L}$, the marginal return to investment in the general technology remains relatively high. Since L entrepreneurs cannot offer a return higher than the general technology, they are not funded. When the economy's initial capital is larger than $\frac{g^{-1}(A^L)}{\alpha^L}$, even L entrepreneurs receive funding.

Favoritism leads to an increasingly inefficient allocation of capital as the initial saving grows. Capital allocation may be inefficient even if only H entrepreneurs are funded. Without information acquisition, many financiers are unable to identify H entrepreneurs and thus overinvest in the general technology. In equilibrium, H entrepreneurs' investment is below the optimal level and the productivity of the general technology lower than A^H. For higher levels of initial capital, not only is there overinvestment in the general technology, but also lower productivity entrepreneurs receive funding since the return of the general technology decreases. The average productivity of capital and financiers' equilibrium returns decrease in the economy's initial capital.

We can obtain interesting insights on different agents' welfare by comparing the payoffs in the equilibrium with favoritism and efficient markets.

Corollary 1 *(Financiers' welfare) Efficient markets lead to higher financiers' returns than favoritism.*

Financiers are clearly better off when markets are efficient and information is freely available, as they can obtain at least return A^H . If capital allocation is driven by favoritism, financiers' equilibrium return decreases in the initial capital of the economy. This effect is not due to a large

[5] This may be thought as if the entrepreneur competed *a la* Bertrand with the traditional technology.

amount of capital chasing limited investment opportunities – under our assumptions, any amount of capital could be invested with return A^H. A lower equilibrium return is due to asymmetric information leading to market segmentation. In some instances, financiers are not aware of any H entrepreneur. In other cases, H entrepreneurs, being aware that financiers do not have investment opportunities alternative to the general technology, offer low returns to financiers.

Contrary to financiers, entrepreneurs are better off with favoritism than with markets.

Corollary 2 *(Entrepreneurs' welfare) Both types of entrepreneurs are (weakly) better off with favoritism than with efficient markets. In particular, the payoff of H entrepreneurs is strictly larger when financiers are not aware of distant entrepreneurs.*

When information is freely available, L entrepreneurs are not funded as any amount of capital can be invested with return A^H. Under favoritism, if $kI > \frac{g^{-1}(A^L)}{\alpha^L}$, L entrepreneurs invest the same amount of capital of H entrepreneurs. However, the payoff to L entrepreneurs remains zero as they have to distribute all the output to external financiers.

More interestingly, even H entrepreneurs prefer favoritism to markets. Although H entrepreneurs are funded in both cases, they are better off with asymmetric information due to reduced competition for capital. When information is freely available, H entrepreneurs are funded with a larger amount of capital. The payoffs of H entrepreneurs, however, are zero, as competition with other H entrepreneurs drives the return offered to financiers up to A^H . When financiers do not acquire information, H entrepreneurs can offer financiers the return of their best alternative investment opportunity. H entrepreneurs' payoff is thus positive as $\left(A^H - \max\left(g, A^L\right)\right) > 0$. This implies that H entrepreneurs prefer to run smaller firms but offer lower returns to attract external capital.

B.2 Imperfect Markets

In this section, we show that if acquiring information involves a cost, markets arise but remain inefficient. Besides deriving the conditions under which some financiers find it optimal to acquire information about a distant entrepreneur, we also characterize to what extent acquiring information about one distant entrepreneur improves the capital allocation with respect to favoritism.

The cost of information acquisition τ induces a segmentation in the market for capital thus

potentially decreases competition among entrepreneurs to attract external funds. The extent of competition depends on financiers' actual decisions to acquire information and the average quality of the available investment opportunities. A financier evaluates a distant entrepreneur only if she expects a return sufficiently larger than the return of the general technology that she can cover the cost of information acquisition. By acquiring information, a financier can improve her expected return to investment because entrepreneurs face more competition for attracting capital from financiers with more investment opportunities and thus offer a higher fraction of future expected cash flows.

Some financiers find it optimal to acquire information only if the expected return from evaluating a distant entrepreneur is sufficiently large to cover the cost of information acquisition. We derive the equilibrium in the Appendix by comparing a financier's expected payoffs from acquiring information and from not doing so.

In equilibrium, favoritism is overcome and imperfect markets emerge only as capital increases. In fact, no financier acquires information when the initial capital is low and, thus, the expected return from investing in the general technology is close to A^H. In this case, expanding the investment opportunity set by observing a distant entrepreneur does not improve significantly the expected return, as the general technology already offers high return at no cost. Close entrepreneurs are able to attract capital only if they can compete with the general technology. The equilibrium is thus described by Proposition 1. If capital is relatively low, the efficient capital allocation can be achieved even with segmented markets (favoritism).

As capital grows, more capital is allocated to the general technology. The consequent decrease in financiers' expected return to capital eventually makes the return from spending τ and investigating a distant entrepreneur attractive enough that some financiers start acquiring information.

The following Proposition derives conditions under which it is optimal to acquire information and fund only H entrepreneurs.

Proposition 2 *(Early arrival of markets) Some financiers acquire information and fund only H entrepreneurs if* $\frac{I\tau A^L}{(\alpha^H)^2(A^H-A^L)} + I\tau < kI < \frac{g^{-1}(A^L)}{(\alpha^L)^2} + I\tau$.

Given the investment opportunities of the economy, return to capital is higher if financiers have an incentive to acquire information for relatively low levels of initial saving, as H entrepreneurs can

attract funding from distant financiers. Hence, less capital is inefficiently allocated to the general technology. Whether it is optimal for some financiers to acquire information and fund only H entrepreneurs depends on certain exogenous characteristics of the economy. In particular, some financiers begin to acquire information for a relatively low level of initial capital and fund only H entrepreneurs if (1) there are sufficiently many high productive entrepreneurs, (2) the difference in productivity between H and L entrepreneurs is relatively high, and (3) the cost of information acquisition is low relative to financiers' capital endowment. Under these conditions, markets emerge for relatively low levels of initial saving.

Proposition 2 states more formally the conditions under which this is the case. From a formal point of view, these conditions are equivalent to require that the interval $\left(\frac{I\tau A^L}{(\alpha^H)^2(A^H-A^L)}+I\tau, \frac{g^{-1}(A^L)}{(\alpha^L)^2}+I\tau\right)$ is well-defined (and thus the condition $A^L < g\left(\left(\frac{\alpha^L}{\alpha^H}\right)^2 \frac{I\tau A^L}{A^H-A^L}\right)$ holds). Intuitively, a lower proportion of L entrepreneurs affects incentives to acquire information because financiers benefit from discovering an H entrepreneur only if they are close to an H entrepreneur. Only in this case, competition for capital allows them to obtain return A^H. Otherwise, they are offered only the return of their next best investment opportunity, to which they have access without incurring the information acquisition cost. Similarly, financiers are more inclined to acquire information if this can yield them a relatively higher return, which, for given A^L, depends positively on A^H, or if the cost of information acquisition is relatively low. Then, if $kI \in \left[\frac{I\tau A^L}{(\alpha^H)^2(A^H-A^L)}+I\tau, \frac{g^{-1}(A^L)}{(\alpha^L)^2}+I\tau\right]$, an equilibrium in which some financiers acquire information and fund only H entrepreneurs exists.

Under the condition in Proposition 2, markets emerge for relatively low levels of initial saving. Capital market segmentations are thus partially overcome: Financiers allocate capital to the entrepreneur with highest productivity, whether distant or close. Markets remain inefficient however because with probability $\left(\alpha^L\right)^2$ some financiers do not identify any H entrepreneur. This leads to overinvestment in the general technology and drive down its return.

It is interesting to note that if $A^L \leqslant g\left(\frac{\alpha^L}{(\alpha^H)^2}\frac{I\tau A^L}{A^H-A^L}+\alpha^L I\tau\right)$, a more restrictive condition than the one necessary for the above interval to be well-defined, some financiers acquire information even though with no information acquisition they would fund only H entrepreneurs. They do so in order to improve their outside options and thus obtain return A^H if they happen to discover two H entrepreneurs (with probability $\left(\alpha^H\right)^2$). Also in this case, information acquisition improves the efficiency of capital allocation as more H entrepreneurs are identified. Thus, on average, investment

in the general technology decreases while H entrepreneurs invest more.

If $g\left(\frac{\alpha^L}{(\alpha^H)^2}\frac{I\tau A^L}{A^H-A^L}+\alpha^L I\tau\right)<A^L<g\left(\left(\frac{\alpha^L}{\alpha^H}\right)^2\frac{I\tau A^L}{A^H-A^L}\right)$, instead, financiers fund both H and L entrepreneurs without acquiring information for any level of capital in the interval $\left[\frac{g^{-1}(A^L)}{\alpha^L},\frac{I\tau A^L}{(\alpha^H)^2(A^H-A^L)}+I\tau\right]$. Only when capital reaches the threshold $\frac{I\tau A^L}{(\alpha^H)^2(A^H-A^L)}+I\tau$, they acquire information and stop funding L entrepreneurs. Information acquisition improves capital allocation even to a larger extent in this case, as L entrepreneurs would receive funding if financiers did not acquire information.

Proposition 3 *(Early arrival of markets) Some financiers acquire information and fund both H and L entrepreneurs if $kI>\max\left(\frac{g^{-1}(A^L)}{(\alpha^L)^2}+I\tau,\frac{I\tau A^L}{(\alpha^H)^2(A^H-A^L)}+I\tau\right)$.*

Proposition 3 describes the conditions under which funding both H and L entrepreneurs is optimal. First, consider the scenario described in Proposition 2, in which conditions are favorable to information acquisition for low levels of initial saving. In this case, Proposition 3 implies that as capital exceeds the threshold $\frac{g^{-1}(A^L)}{(\alpha^L)^2}+I\tau$, financiers continue to acquire information, but fund both H and L entrepreneurs. This depends on the fact that the initial capital is so high that when all financiers who identify two L entrepreneurs invest in the general technology, the return of the general technology is below A^L. Financiers thus acquire information in equilibrium because even fostering competition between low quality entrepreneurs can improve their return. That is, although markets mitigate the local market segmentation, they are clearly inefficient.

If $A^L\geqslant g\left(\left(\frac{\alpha^L}{\alpha^H}\right)^2\frac{I\tau A^L}{A^H-A^L}\right)$, conditions are less favorable to information acquisition. Hence, an equilibrium in which financiers acquire information for intermediate levels of capital and fund only H entrepreneur does not emerge. In this case, the probability of encountering an H entrepreneur and/or the difference in productivity between H and L entrepreneur are too low, and the information acquisition cost too high, in order to spur information acquisition. When the initial capital of the economy grows above $\frac{g^{-1}(A^L)}{\alpha^L}$, financiers choose not to evaluate any distant entrepreneur and fund the close entrepreneur whatever its type is. Favoritism thus remains an equilibrium and leads to an allocation of capital that is less efficient than the one that markets, even though imperfect, would lead to for the same level of initial capital.

Some financiers acquire information and market emerge only if $kI\geqslant\frac{I\tau A^L}{(\alpha^H)^2(A^H-A^L)}+I\tau$ (note that under this second scenario this condition implies a far higher level of capital than other the first scenario), as for this large level of capital the return offered by the general technology becomes

very low. Thus, spurring competition between low quality entrepreneurs becomes optimal from the point of view of financiers. As capital becomes sufficiently large markets emerge in this case as well, but they remain far more inefficient. The only function of markets is creating competition for capital among entrepreneurs and drive up financiers' equilibrium returns. However, since L entrepreneurs are funded, the emergence of markets causes a far lower proportional increase in the level of output than other the first scenario.

To summarize, markets do not emerge for low levels of initial saving – markets are a sort of luxury good that materializes only when economies reach a minimum level of initial capital. Moreover, markets do not deterministically appear for a given level of initial capital. In some economies with conditions favorable to information acquisition, markets emerge for intermediate levels of initial saving and significantly improve the allocation of capital because they prevent low productivity projects from being funded. In this case, markets cause large increases in domestic output and prosper for relatively high level of capital. Only when the initial saving becomes very large, if investors continue to investigate at most one distant entrepreneur, low productivity projects receive funding. In other economies, with conditions less favorable for information acquisition, segmentations in local markets for capital persist for a significantly larger range of initial saving. Favoritism is an equilibrium outcome even if it leads to a significant capital misallocation. When markets ultimately emerge, they only marginally improve capital allocation and have small positive effects on domestic output as L entrepreneurs continue to be funded. The most significant effect of markets is to create competition for capital and to drive up the return of financiers.

C Welfare Effects

So far we have shown that market segmentation decreases the average productivity of investment as financiers cannot observe all the investment opportunities and thus end up investing in lower productivity entrepreneurs. Different equilibrium configurations have dramatic effects not only on capital allocation but also on agents' payoffs. The following proposition compares financiers' returns in imperfect markets with their returns in efficient markets and in the equilibrium with favoritism.

Proposition 4 *Perfect markets lead to (weakly) higher financiers' returns than imperfect markets. The latter in turn lead to (weakly) higher financiers' returns than favoritism.*

The intuition of Proposition 4 is straightforward. When information is freely available, financiers can identify all available investment opportunities. Competition for funds among high productivity entrepreneurs drives up the return necessary for attracting funds. In equilibrium, the return to the financiers is A^H per capital invested, the highest attainable return in a capital-abundant economy

When there is asymmetric information and initial saving is relatively high, the expected return of financiers is less than A^H. Even if spending τ and observing the productivity of a distant entrepreneur increases the return to investment in some states of the world, it does not warrant an expected payoff of A^H. In fact, financiers' return does not depend only on the type of entrepreneurs that they happen to evaluate, but also on their other investment opportunities. Financiers thus obtain a return A^H only if they have the opportunity of investing in two high productivity entrepreneurs as competition for funds between the two high-productivity entrepreneurs drives up the return to investment. In all remaining cases, financiers identify entrepreneurs with different productivity. In equilibrium, they are offered only the return of their best alternative investment opportunity, which is lower than A^H, and fund the most productive entrepreneurs.

With favoritism, financiers have even more limited investment opportunities. Financiers' returns are higher with inefficient markers. Information acquisition expands the set of possible investment opportunities available to financiers, increases competition for funds, and drives up equilibrium returns. Nevertheless, financiers actually find it optimal to acquire information only if the increase in expected return is sufficient to compensate the cost τ.

While a reduction in asymmetric information spurs competition for funds and increases the welfare of external financiers, it may increase or decreases the welfare of entrepreneurs.

Proposition 5 *H entrepreneurs are better off with imperfect markets than with perfect markets. H entrepreneurs can be either better off or worse off with imperfect markets in comparison to favoritism. The payoff of L entrepreneurs is always zero.*

Information asymmetry affects entrepreneurs' welfare in two ways. First, an improvement in the quality of information (because financiers evaluate distant entrepreneurs or because information is freely available) allows financiers to identify a larger set of investment opportunities and thus allows capital to flow to more productive entrepreneurs. This clearly benefits higher productivity entrepreneurs because a decrease in the misallocation of capital allows them to run larger scale

projects.

Second, more information increases competition for external funds. An improvement in the quality of information coincides with an expansion of financiers' investment opportunities. Since entrepreneurs compete to attract external funds, they have to offer a higher return to external financiers in equilibrium. This decreases the rent entrepreneurs can enjoy per unit of capital invested. Entrepreneurs thus may prefer a higher level of information asymmetry in order to enjoy a higher rent on a smaller scale project.

The capital allocation and the competition effects influence entrepreneurs according to their type: L entrepreneurs's payoff is not affected by the extent of financiers' information as their rent is always zero. The expected payoff of H entrepreneurs is zero when information is freely available because, with probability 1, they have to compete for funding with other H entrepreneurs. This implies that they enjoy no rents even if they can run larger scale projects.

The rationale behind that H entrepreneurs are better off in the case of information asymmetry is the following: When information is costly, even if only H entrepreneurs are funded (the case in which competition for funding is stronger because financiers have better alternative investment opportunities), with some probability, an H entrepreneur is evaluated with another H entrepreneur and has to offer return A^H to attract capital. With positive probability, however, he is evaluated with a L entrepreneur. In this case, competition for capital is limited because external financiers lack alternative investment opportunities. By offering a return lower than A^H per unit of capital invested, the H entrepreneur can attract funding and enjoy a positive rent. This implies that entrepreneurs are better off when information acquisition is costly compared to when information is freely available.

Entrepreneurs however do *not* always benefit from information acquisition. As noted above, L entrepreneurs' payoff does not depend on financiers' quality of information. More importantly, H entrepreneurs are not necessarily better off with imperfect markets than with favoritism. Since all firms are funded with no information acquisition, H entrepreneurs benefit from financiers' information acquisition by receiving more funding, as some capital originally initially allocated to L entrepreneurs can now be directed to them. However, H entrepreneurs enjoy a higher rent per unit of capital invested when financiers fund only the close entrepreneurs. Depending on the relative importance of the increased ability to invest in comparison to the lower expected rent per unit

invested, H entrepreneurs may be either worse or better off when information is acquired. In some case, they prefer to run smaller scale projects, in order to keep a larger share of the output for each unit invested.

Corollary 3 *Assume that conditions are favorable to the emergence of markets* $\left(\frac{I\tau A^L}{(\alpha^H)^2(A^H-A^L)} < \frac{g^{-1}(A^L)}{(\alpha^L)^2}\right)$. *For intermediate levels of capital* $\left(g^{-1}(A^H) < kI < \frac{g^{-1}(A^L)}{(\alpha^L)^2} + I\tau\right)$, *an* H *entrepreneur always prefers favoritism to imperfect markets if* $\alpha^H > \frac{1}{2}$.

Corollary 4 *When financiers acquire information and fund both* H *and* L *entrepreneurs,* H *entrepreneurs always prefer imperfect markets over favoritism for large enough levels of initial capital* $\left(kI \geqslant \max\left(\frac{2\alpha^L}{2\alpha^L-1}I\tau, \frac{g^{-1}(A^L)}{(\alpha^L)^2} + I\tau, \frac{I\tau A^L}{(\alpha^H)^2(A^H-A^L)} + I\tau\right)\right)$.

IV An Application to Listing Standards

So far, we have analyzed financiers' incentives to acquire information about distant investment opportunities in economies with different levels of initial capital and shown how they depend on the cost of information acquisition and the average quality of entrepreneurs. The most straightforward interpretation of the model is that the mechanisms of capital allocation differ in economies with different levels of initial capital.

Even when markets emerge, agents' payoffs depend on the institutional environment. Entrepreneurs may thus choose to list in markets where they expect to obtain a larger payoff. In this section we show that a crucial parameter affecting entrepreneurs' payoffs is the average quality of entrepreneurs, which may capture the listing standards of an exchange.

If the average quality of the entrepreneurs is high, competition for capital is relatively strong even if investors observe only a subset of entrepreneurs. Under this condition, Proposition 2 implies that an equilibrium in which only H entrepreneurs are funded is more likely to be achieved. More importantly, if this equilibrium exists, while financiers' expected return clearly increases in the average quality of entrepreneurs, in a mature market in which all financiers acquire information, H entrepreneurs's payoff decreases as not only they can enjoy a lower rent per unit of capital invested but they are able to invest less.

Proposition 6 *When all financiers acquire information,* H *entrepreneurs' payoff decreases in* α^H.

When the level of capital is sufficiently large, the return to the general technology falls sufficiently low so that all financiers find it optimal to acquire information. In this case, a larger proportion of L entrepreneurs decreases competition for capital. This increases entrepreneurial rents and decreases financiers' returns. It may nevertheless affect negatively entrepreneurs payoff. This happens if only a subset of financiers acquires information. In this region, a marginal increase in α^H induces a larger set of financiers to produce information. If this set is large enough, an improvement in listing standards may increase the supply of capital to the entrepreneurial sector to the point that the ability to invest a larger amount of capital more than compensate the lower rent per unit of capital invested.[6] However, in a mature market, in which is unlikely that an increase in α^H further stimulate information production and thus brings about a large increase in the supply of capital, H entrepreneurs are negatively affected by an improve in listing standards and are unlikely to be attracted by it.

V Empirical Implications

In this section we discuss our theory's implications and the empirical evidence that appears to be consistent with these implications.

Implication 1 *Allocation of capital based on personal connections is efficient at early stages of development.*

Allocation of capital based on personal connections is widespread at early stages of development. For instance, Lamoreaux (1996) writes that the banks active in New England in the early nineteenth century resembled "investment clubs". Bank directors funneled the bulk of the funds under their control to themselves, their relatives, or others with personal ties to the board. Nevertheless, financiers bought bank stocks as favoritism guaranteed financiers high and steady earnings. Local banks thus fueled the region economic growth and development. As the century progressed, bank performance declined and to attract savers banks started to issue deposits and developed new credit

[6] The increase in the supply of capital brought about by an increase in α^H is captured by the curvuture of the function $g(.)$. Ceteris paribus, the flatter the function $g(.)$ is, the larger the set of financiers that have to start producing information in the relevant interval of kI. If given the other parameters, $g(.)$ is sufficiently large, the amount of capital that each entrepreneur is able to invest may increase in a way that more than compensate the reduced rent.

standards for evaluating the creditworthiness of distant borrowers. These new credit standards fostered an ethic of professionalism that ran counter to the values that originally sustained insider lending. At the same time, they made more difficult for entrepreneurs in the region to obtain funding.

Consistently with our model, during the nineteenth century, New England had transformed from a capital-scarce to a capital-abundant region. We argue that capital accumulation is the main driving force explaining why the performance of credit allocation based on personal ties sharply deteriorated during the century and why it may have become optimal for financiers (banks in this context) to acquire information on distant investment opportunities.

Favoritism in capital allocation is not restricted to New England in the early ninetieth century as there is plenty of evidence that banks in other parts of the United States and in Britain engaged in similar behavior during this period and that this practice is widespread in emerging markets (Lamoreaux, 1996).

Favoritism does not affect only bank lending. Business groups consisting of legally independent firms that are bound together by formal and informal ties are often thought to be drivers of economic growth in the early phase of development of a country and to hamper further development later on (Khanna and Yafeh, 2006). Business groups may be thought as a way to allocate funding to close entrepreneurs without recurring to information acquisition. As our model shows, this leads to an efficient allocation of investment in early phases of development when saving is low; but it decreases investment aggregate productivity below the optimal level as saving increases.

Implication 2 *Financial liberalizations are followed by an improvement in transparency.*

High productivity entrepreneurs have an incentive to voluntarily increase disclosure (τ in our model) only if they anticipate that this brings a sufficiently large increase in investment. This generates the following empirical implication. Firms should disclose more after financial liberalization because of the possibility of attracting large amounts of capital from foreign financiers. We are not aware of any empirical work testing this implication that is particular to our model. It appears however that such an implication would be testable.

There exists indirect empirical evidence in support of the implication of the model. When companies cross-list in a foreign exchange, especially if in the U.S., they voluntarily commit to

disclose more. Pagano, Roell and Zechner (2002) show that this decision is concomitant to raising more capital, as our model suggests.

Implication 3 *Financiers' expected return is higher when competition for external funds is strongest.*

This implication is consistent with the findings of Lowry and Schwert (2002) and Benveniste, Ljungqvist, Wilhelm and Yu (2003) who show that financiers have larger initial returns on IPOs during "hot" markets. In other words, financiers are offered new equity issues at better prices when they have more alternative investment opportunities. This is consistent with the mechanism of our model that suggests that competition for attracting external funds is an important determinant of financiers' returns.[7]

Implication 4 *Transparency and investor protection spur information production and improve capital allocation.*

Our model implies that economic agents are more inclined to produce information when information is cheaper, more precise and reliable. Hence, we should observe that in countries where firms (voluntarily or involuntarily) disclose more, more firm-specific information is available. This is consistent with the findings of Morck, Yeung and Yu (2000) who show that the firm-specific return variation is positively correlated with investor protection (readily available information about entrepreneurs in our model) and propose that investor protection promotes information acquisitions. Durnev, Morck, Yeung and Zarowin (2003) consistently show that firm-specific return variation is associated with future earnings, indicating that more information about future performance is incorporated in current stock returns. Fox, Durnev, Morck and Yeung (2003) further document that improvements in mandatory disclosure effectively increase price accurateness. Finally, Durnev, Morck and Yeung (2004) find that the firm-specific variation in stock returns is positively associated to a measure of economic efficiency of corporate investment, which is again consistent with the mechanism suggested by our model.

[7] In this respect we provide an explanation, alternative to prospect theory (Loughran and Ritter, 2002), for why entrepreneurs are generally content to leave money on the table during hot issues.

VI Conclusions

This paper explains under which conditions favoritism emerges as an equilibrium mechanism for the allocation of capital. It shows that markets in which financiers acquire information and fund distant investment opportunities are unnecessary for reaching an efficient capital allocation at early stages of development when the initial saving is low. As an economy accumulates capital, acquisition of information on distant investment opportunities becomes crucial for achieving an efficient allocation of investment. Nevertheless, entrepreneurs may not have an incentive to join exchanges that require higher disclosure or listing standards because they enjoy higher rents when financiers have information only on a limited sets of investment opportunities.

Our model can explain why favoritism seems to spur growth in developing economies and to hamper the performance of more developed countries. Additionally, it can explain why exchanges tend to lose listed companies and fail to attract new listings if they set listing standards too high.

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A Appendix

A Proof of Proposition 1

In equilibrium, entrepreneurs offer financiers at most the return of general technology due to the lack of competition for capital. If the general technology offers a return higher than the most productive entrepreneur $\left(g(kI) > A^H\right)$, no entrepreneur is funded. All financiers invest in the general technology so their return to capital is $g(kI)$.

If $g(kI) \leqslant A^H$, H entrepreneurs are able to offer the return of the general technology to the financiers. As long as $g\left(kI\alpha^L\right) > A^L$, L entrepreneurs do not receive funding. This is because even if all the capital from financiers who are not close to an H entrepreneur – $kI\alpha^L$ – is invested in the general technology, the return of the general technology is still higher than the maximum return that L entrepreneurs can offer. So for $g^{-1}\left(A^H\right) \leqslant kI < \frac{g^{-1}\left(A^L\right)}{\alpha^L}$, only type H entrepreneurs receive funding.

When only H entrepreneurs are funded, if $g(kI) \leqslant A^H$ and $g\left(kI\alpha^L\right) > A^H$, only *some* financiers fund the H entrepreneurs so that a marginal financier is indifferent between funding the close H entrepreneur or the general technology. There exists $\omega_1 \in \left(0, kI\alpha^H\right)$ such that $kI\alpha^L + \omega_1$ is invested in the general technology, and the rest of capital – $kI\alpha^H - \omega_1$ – is allocated to H entrepreneurs. A financier's equilibrium return is $g\left(kI\alpha^L + \omega_1\right)$.

If $A^L < g\left(kI\alpha^L\right) \leqslant A^H$, $\omega_1 = 0$, and *all* the financiers who are close to H entrepreneurs allocate their capitals to H entrepreneurs instead of the general technology. In this case, a financiers' equilibrium return is $g(kI\left(1-\alpha^H\right)) = g\left(kI\alpha^L\right) \in \left(A^L, A^H\right]$.

When $g\left(kI\alpha^L\right) \leqslant A^L$, even with all the capital from financiers who are close to an L entrepreneur $(kI\alpha^L)$ being invested in the general technology, the return of the general technology is lower than the return that L entrepreneurs can offer. In equilibrium, financiers fund L entrepreneurs and the return to investment is $g\left(\Omega_1\right) = A^L$, where Ω_1 is the total capital invested in the general technology, and $kI - \Omega_1$ is the rest of the capital allocated to the two types of entrepreneurs.

Note that there cannot be an equilibrium with $g\left(\Omega_1\right) < A^L$ for any capital level of Ω_1, as entrepreneur's technology has constant scale of return, and any entrepreneur can compete with other entrepreneurs to attract funding by offering $g\left(\Omega_1\right) + \epsilon$ with $\epsilon \to 0$. So in equilibrium, $g\left(\Omega_1\right) + \epsilon = A^L$.■

B Proof of Proposition 2

Proposition 2 is obtained from the following two lemmas.

Lemma 1 *Suppose* $A^L < g\left(\left(\frac{\alpha^L}{\alpha^H}\right)^2 \frac{I\tau A^L}{A^H - A^L}\right)$. *Then*

1. *If* $kI < g^{-1}\left(A^H\right)$, *financiers do not acquire information and invest only in the general technology;*

2. *If* $g^{-1}\left(A^H\right) \leqslant kI \leqslant \min\left(\frac{g^{-1}\left(\frac{\left(\alpha^H\right)^2(k-\tau)}{\tau+\left(\alpha^H\right)^2(k-\tau)}A^H\right)}{\alpha^L}, \frac{g^{-1}\left(A^L\right)}{\alpha^L}\right)$, *financiers do not acquire information and fund only the close* H *entrepreneurs;*

3. *If* $\frac{I\tau A^L}{(\alpha^H)^2(A^H-A^L)} + I\tau < kI < \frac{g^{-1}\left(A^L\right)}{(\alpha^L)^2} + I\tau$, *some financiers acquire information, and only* H *entrepreneurs are funded;*

4. *If* $\frac{g^{-1}\left(A^L\right)}{\alpha^L} \leqslant kI < \frac{I\tau A^L}{(\alpha^H)^2(A^H-A^L)} + I\tau$, *financiers fund both* H *and* L *entrepreneurs and do not acquire information if* $A^L > g\left(\frac{\alpha^L I\tau A^L}{(\alpha^H)^2(A^H-A^L)} + I\tau\right)$.

5. *If* $kI > \frac{g^{-1}\left(A^L\right)}{(\alpha^L)^2} + I\tau$, *financiers acquire information and fund both* H *and* L *entrepreneurs.*

Proof. We prove each of the five regions for total capital kI in Lemma 1 in order.

Region 1. $kI < g^{-1}\left(A^H\right)$ implies $g(kI)k > A^H k$ – even H entrepreneurs cannot afford to offer the return of the general technology. Since $g(kI)k > A^H k > A^H(k-\tau)$, a marginal financier has no incentive to deviate by acquiring information and funding distant entrepreneurs, as her profit from deviation is capped at $A^H(k-\tau)$. Financiers also have no incentives to fund close entrepreneurs, as doing so yields a profit at most $A^H k$. So $kI < g^{-1}\left(A^H\right)$ ensures that acquiring information and allocating capital to entrepreneurs is not an optimal strategy. In equilibrium, all capitals are invested in the general technology.

Region 2. Financiers have no incentive to acquire information and fund distant H entrepreneurs if the following conditions are satisfied: Given that all financiers do not acquire information and fund only close H entrepreneurs, (a) financiers have incentives to fund at least some close H entrepreneurs, (b) no financier has an incentive to acquire information, and (c) no financier has an incentive to fund a close L entrepreneur.

(a) holds if close H entrepreneurs can offer financiers at least the return of the general technology. That is, $A^H \geqslant g(\Omega_2)$, where $\Omega_2 \leqslant kI$ is the amount of capital invested in the general technology. This implies

$$kI \geqslant g^{-1}\left(A^H\right)$$

Financiers who acquire costly information have expected payoff $\left(\left(\alpha^H\right)^2 A^H + \left(1 - \left(\alpha^H\right)^2\right) g(\Omega_2)\right)(k - \tau)$. This is because a financier who acquires information may receive the following signals and returns:

- With probability of $\left(\alpha^H\right)^2$, both entrepreneurs are type H. To compete to attract capital, both entrepreneurs offer return of $A^H > g$.
- With probability of $2\alpha^H\alpha^L$, one entrepreneur is type H and the other is type L. The H entrepreneur offers $g > A^L$; L entrepreneur cannot offer g.
- With probability of $\left(\alpha^L\right)^2$, both entrepreneurs are type L, the general technology offers higher return.

Financiers who *do not* acquire information invest either in the close entrepreneur or in the general technology and have expected payoff $g(\Omega_2)k$. This is because the close entrepreneur is aware of her alternative investment opportunities and offers at most the return of the general technology. As long as $A^H > g > A^L$, H entrepreneurs receive capital from financiers who do not acquire information. If the close entrepreneur is L type, financiers invest in the general technology.

Then, financiers have no incentive to acquire information (condition (b)) if

$$g(\Omega_2)k \geqslant \left(\left(\alpha^H\right)^2 A^H + \left(1 - \left(\alpha^H\right)^2\right) g(\Omega_2)\right)(k - \tau)$$

which can be rewritten as

$$g(\Omega_2) \geqslant \frac{\left(\alpha^H\right)^2 (k - \tau)}{\tau + \left(\alpha^H\right)^2 (k - \tau)} A^H$$

Financiers have no incentive to fund L entrepreneurs (condition (c)) if $g(\Omega_2) > A^L$.

Hence, an equilibrium in which financiers do not acquire information and fund only close H entrepreneurs exist if

$$\Omega_2 \leqslant \min\left(g^{-1}\left(\frac{\left(\alpha^H\right)^2(k-\tau)}{\tau+\left(\alpha^H\right)^2(k-\tau)}A^H\right), g^{-1}\left(A^L\right)\right) \tag{1}$$

Condition (c) implies that financiers close to L entrepreneurs invest in the general technology. Condition (b) implies that financiers close to H entrepreneurs are weakly better off funding entrepreneurs than investing in the general technology. So the capital invested in the general technology is $\Omega_2 = \alpha^L kI + \omega_2$, where $\omega_2 \geqslant 0$ is the capital invested in the general technology from some financiers whose are close to H entrepreneurs.

Substituting $\Omega_2 = \alpha^L kI + \omega_2$ in (1) and re-arranging, we obtain:

$$kI \leqslant \frac{\min\left(g^{-1}\left(\frac{\left(\alpha^H\right)^2(k-\tau)}{\tau+\left(\alpha^H\right)^2(k-\tau)}A^H\right), g^{-1}\left(A^L\right)\right) - \omega_2}{\alpha^L} \tag{2}$$

The equilibrium condition under which financiers do not acquire information and fund only the close H entrepreneurs then becomes

$$g^{-1}\left(A^H\right) \leqslant kI \leqslant \frac{g^{-1}\left(\max\left(\frac{\left(\alpha^H\right)^2(k-\tau)}{\tau+\left(\alpha^H\right)^2(k-\tau)}A^H, A^L\right)\right)}{\alpha^L} \tag{3}$$

as

$$\frac{\min\left(g^{-1}\left(\frac{\left(\alpha^H\right)^2(k-\tau)}{\tau+\left(\alpha^H\right)^2(k-\tau)}A^H\right), g^{-1}\left(A^L\right)\right) - \omega_2}{\alpha^L} = \frac{g^{-1}\left(\max\left(\frac{\left(\alpha^H\right)^2(k-\tau)}{\tau+\left(\alpha^H\right)^2(k-\tau)}A^H, A^L\right)\right) - \omega_2}{\alpha^L}$$

To establish the upper bound of (3) for kI, first consider $\frac{\left(\alpha^H\right)^2(k-\tau)}{\tau+\left(\alpha^H\right)^2(k-\tau)}A^H < A^L$. Then $\frac{g^{-1}\left(\frac{\left(\alpha^H\right)^2(k-\tau)}{\tau+\left(\alpha^H\right)^2(k-\tau)}A^H\right)}{\alpha^L} > \frac{g^{-1}\left(A^L\right)}{\alpha^L}$. So (3) becomes

$$g^{-1}\left(A^H\right) \leqslant kI \leqslant \frac{g^{-1}\left(A^L\right)}{\alpha^L}$$

But $\frac{\left(\alpha^H\right)^2(k-\tau)}{\tau+\left(\alpha^H\right)^2(k-\tau)}A^H < A^L$ is equivalent to $kI < \frac{I\tau A^L}{\left(\alpha^H\right)^2\left(A^H-A^L\right)} + I\tau$. Putting together, (3) becomes

$$g^{-1}\left(A^H\right) \leqslant kI \leqslant \min\left(\frac{I\tau A^L}{\left(\alpha^H\right)^2\left(A^H-A^L\right)} + I\tau, \frac{g^{-1}\left(A^L\right)}{\alpha^L}\right) \tag{4}$$

Next, consider the opposite: $\frac{\left(\alpha^H\right)^2(k-\tau)}{\tau+\left(\alpha^H\right)^2(k-\tau)}A^H > A^L$. So (3) becomes

$$g^{-1}\left(A^H\right) \leqslant kI \leqslant \frac{g^{-1}\left(\frac{\left(\alpha^H\right)^2(k-\tau)}{\tau+\left(\alpha^H\right)^2(k-\tau)}A^H\right)}{\alpha^L}$$

And $\frac{\left(\alpha^H\right)^2(k-\tau)}{\tau+\left(\alpha^H\right)^2(k-\tau)}A^H > A^L$ is equivalent to $kI > \frac{I\tau A^L}{\left(\alpha^H\right)^2\left(A^H-A^L\right)} + I\tau$. Putting together, (3) becomes

$$\frac{I\tau A^L}{\left(\alpha^H\right)^2\left(A^H-A^L\right)} + I\tau \leqslant kI \leqslant \frac{g^{-1}\left(\frac{\left(\alpha^H\right)^2(k-\tau)}{\tau+\left(\alpha^H\right)^2(k-\tau)}A^H\right)}{\alpha^L} \tag{5}$$

Since $\frac{\left(\alpha^H\right)^2(k-\tau)}{\tau+\left(\alpha^H\right)^2(k-\tau)}A^H > A^L$ implies $\frac{g^{-1}\left(\frac{\left(\alpha^H\right)^2(k-\tau)}{\tau+\left(\alpha^H\right)^2(k-\tau)}A^H\right)}{\alpha^L} < \frac{g^{-1}\left(A^L\right)}{\alpha^L}$, we can rewrite (5) as

$$\frac{I\tau A^L}{\left(\alpha^H\right)^2\left(A^H-A^L\right)} + I\tau \leqslant kI \leqslant \frac{g^{-1}\left(\frac{\left(\alpha^H\right)^2(k-\tau)}{\tau+\left(\alpha^H\right)^2(k-\tau)}A^H\right)}{\alpha^L} < \frac{g^{-1}\left(A^L\right)}{\alpha^L} \tag{6}$$

provided the interval is well-defined: $\frac{I\tau A^L}{\left(\alpha^H\right)^2\left(A^H-A^L\right)}+I\tau < \frac{g^{-1}\left(A^L\right)}{\alpha^L}$ – That is, $A^L < g\left(\frac{\alpha^L I\tau A^L}{\left(\alpha^H\right)^2\left(A^H-A^L\right)} + \alpha^L I\tau\right)$.

To summarize, when $kI < \frac{I\tau A^L}{\left(\alpha^H\right)^2\left(A^H-A^L\right)} + I\tau$ (which is the same as $\frac{\left(\alpha^H\right)^2(k-\tau)}{\tau+\left(\alpha^H\right)^2(k-\tau)}A^H < A^L$), if $\frac{I\tau A^L}{\left(\alpha^H\right)^2\left(A^H-A^L\right)} + I\tau > \frac{g^{-1}\left(A^L\right)}{\alpha^L}$, (4)suggests that financiers have no incentive to acquire information and fund only close H entrepreneurs for

$$g^{-1}\left(A^H\right) \leqslant kI \leqslant \frac{g^{-1}\left(A^L\right)}{\alpha^L} \tag{7}$$

and for $\frac{g^{-1}\left(A^L\right)}{\alpha^L} < kI \leqslant \frac{I\tau A^L}{\left(\alpha^H\right)^2\left(A^H-A^L\right)} + I\tau$, Region 4 of Lemma 1 suggests financiers do not acquire information and fund both close H and L entrepreneurs (see the proof of Region 4 towards the end

of the proof of Lemma 1).

If $\frac{I\tau A^L}{(\alpha^H)^2(A^H-A^L)}+I\tau<\frac{g^{-1}(A^L)}{\alpha^L}$, the equilibrium of no information acquisition and funding only close H entrepreneurs exists for

$$g^{-1}\left(A^H\right)\leqslant kI\leqslant\frac{I\tau A^L}{\left(\alpha^H\right)^2\left(A^H-A^L\right)}+I\tau \tag{8}$$

Then for $kI>\frac{I\tau A^L}{(\alpha^H)^2(A^H-A^L)}+I\tau$ (which is the same as $\frac{\left(\alpha^H\right)^2(k-\tau)}{\tau+(\alpha^H)^2(k-\tau)}A^H>A^L$), financiers have no incentive to acquire information and fund only close H entrepreneurs for

$$\frac{I\tau A^L}{\left(\alpha^H\right)^2\left(A^H-A^L\right)}+I\tau\leqslant kI\leqslant\frac{g^{-1}\left(\frac{\left(\alpha^H\right)^2(k-\tau)}{\tau+(\alpha^H)^2(k-\tau)}A^H\right)}{\alpha^L} \tag{9}$$

Combining (8) and (9): If $\frac{I\tau A^L}{(\alpha^H)^2(A^H-A^L)}+I\tau<\frac{g^{-1}(A^L)}{\alpha^L}$, the equilibrium of no information acquisition and funding only close H entrepreneurs exists for

$$g^{-1}\left(A^H\right)\leqslant kI\leqslant\frac{g^{-1}\left(\frac{\left(\alpha^H\right)^2(k-\tau)}{\tau+(\alpha^H)^2(k-\tau)}A^H\right)}{\alpha^L} \tag{10}$$

as long as $\frac{I\tau A^L}{(\alpha^H)^2(A^H-A^L)}+I\tau<\frac{g^{-1}(A^L)}{\alpha^L}$ holds, or $A^L<g\left(\frac{\alpha^L I\tau A^L}{(\alpha^H)^2(A^H-A^L)}+\alpha^L I\tau\right)$.[8]

Region 3. In the equilibrium of information acquisition and only H entrepreneurs are funded, some financiers may find it optimal to acquire information, and other financiers may find it optimal not to do so. So the capital invested into the general technology is

$$\Omega_3=\alpha^L\omega_3+\left(\alpha^L\right)^2\left(I-\frac{\omega_3}{k}\right)(k-\tau) \tag{11}$$

where $\alpha^L\omega_3$ is the capital invested into the general technology by those financiers who choose not to acquire information and find out that the close entrepreneur is type L.

For such an equilibrium to exist, the following must be satisfied: (a) financiers who acquire information and evaluate one more entrepreneur have no incentive to deviate by not acquiring information; (b) financiers have no incentive to deviate by funding an L entrepreneur; (c) financiers

[8] As will become clear later, the equilibria with information acquisition and no information acquisition coexist in the interval $\frac{I\tau A^L}{(\alpha^H)^2(A^H-A^L)}+I\tau\leqslant kI\leqslant\frac{g^{-1}(A^L)}{\alpha^L}$.

have an incentive to fund H entrepreneurs.

In equilibrium, the expected dollar payoff from acquiring information and funding only H entrepreneurs is $\left(\left(\alpha^H\right)^2 A^H + \left(1-\left(\alpha^H\right)^2\right) g\left(\Omega_3\right)\right)(k-\tau)$. The expected payoff from not acquiring information is $g\left(\Omega_3\right) k$, as even H entrepreneurs, being aware of the alternative investment opportunities of the financiers, offer at most g.

So (a) is met (at least some financiers acquire information and fund only H entrepreneurs) if

$$\left(\left(\alpha^H\right)^2 A^H + \left(1-\left(\alpha^H\right)^2\right) g\left(\Omega_3\right)\right)(k-\tau) \geqslant g\left(\Omega_3\right) k$$

Or

$$g\left(\Omega_3\right) \leqslant \frac{\left(\alpha^H\right)^2 (k-\tau)}{\tau + \left(\alpha^H\right)^2 (k-\tau)} A^H \tag{12}$$

Clearly, if the expected payoff from acquiring information and funding only H entrepreneurs is strictly larger (i.e., if inequality (12) is strictly satisfied), then all financiers prefer costly information acquisition, so $\omega_3 = 0$. If inequality (12) is weakly satisfied, then some but not all financiers acquire information, so $\omega_3 > 0$.

(b) holds and no financier deviates by funding an L entrepreneur if

$$g\left(\Omega_3\right) > A^L \tag{13}$$

Finally, since $\frac{\left(\alpha^H\right)^2 (k-\tau)}{\tau + \left(\alpha^H\right)^2 (k-\tau)} A^H < A^H$ for any $\tau > 0$, (c) is satisfied and H entrepreneurs are able to offer return g as long as (a) holds.

We now characterize the conditions for (12) and (13).

First, consider $\omega_3 > 0$, then $g\left(\Omega_3\right) = \frac{\left(\alpha^H\right)^2 (k-\tau)}{\tau + \left(\alpha^H\right)^2 (k-\tau)} A^H$. (13) can be written as

$$I(k-\tau) > \frac{I \tau A^L}{\left(\alpha^H\right)^2 \left(A^H - A^L\right)} \tag{14}$$

and (11) becomes

$$\Omega_3 = \alpha^L \omega_3 + \left(\alpha^L\right)^2 \left(I - \frac{\omega_3}{k}\right)(k-\tau) = g^{-1}\left(\frac{\left(\alpha^H\right)^2 (k-\tau)}{\tau + \left(\alpha^H\right)^2 (k-\tau)} A^H\right) \tag{15}$$

Since (15) can be re-written as

$$I\left(k-\tau\right)=\frac{g^{-1}\left(\frac{\left(\alpha^{H}\right)^{2}(k-\tau)}{\tau+\left(\alpha^{H}\right)^{2}(k-\tau)}A^{H}\right)-\left(\alpha^{L}-\left(\alpha^{L}\right)^{2}\left(\frac{k-\tau}{k}\right)\right)\omega_{3}}{\left(\alpha^{L}\right)^{2}}<\frac{g^{-1}\left(\frac{\left(\alpha^{H}\right)^{2}(k-\tau)}{\tau+\left(\alpha^{H}\right)^{2}(k-\tau)}A^{H}\right)}{\left(\alpha^{L}\right)^{2}} \tag{16}$$

for any $\omega_3 > 0$, combining (14) and (16) we arrive the equilibrium condition for information acquisition and funding only H entrepreneurs:

$$\frac{I\tau A^{L}}{\left(\alpha^{H}\right)^{2}\left(A^{H}-A^{L}\right)}<I\left(k-\tau\right)<\frac{g^{-1}\left(\frac{\left(\alpha^{H}\right)^{2}(k-\tau)}{\tau+\left(\alpha^{H}\right)^{2}(k-\tau)}A^{H}\right)}{\left(\alpha^{L}\right)^{2}} \tag{17}$$

Next, consider $\omega_3 = 0$. In this case, $g\left(\Omega_3\right) < \frac{\left(\alpha^{H}\right)^{2}(k-\tau)}{\tau+\left(\alpha^{H}\right)^{2}(k-\tau)}A^{H}$, where $\Omega_3 = \left(\alpha^{L}\right)^{2} I\left(k-\tau\right)$. Together with (13), we have

$$g^{-1}\left(\frac{\left(\alpha^{H}\right)^{2}\left(k-\tau\right)}{\tau+\left(\alpha^{H}\right)^{2}\left(k-\tau\right)}A^{H}\right)<\left(\alpha^{L}\right)^{2}I\left(k-\tau\right)<g^{-1}\left(A^{L}\right)$$

That is, if $\omega_3 = 0$, then (a) and (b) require

$$\frac{g^{-1}\left(\frac{\left(\alpha^{H}\right)^{2}(k-\tau)}{\tau+\left(\alpha^{H}\right)^{2}(k-\tau)}A^{H}\right)}{\left(\alpha^{L}\right)^{2}}<I\left(k-\tau\right)<\frac{g^{-1}\left(A^{L}\right)}{\left(\alpha^{L}\right)^{2}} \tag{18}$$

The interval specified in (18) is well-defined for $\frac{\left(\alpha^{H}\right)^{2}(k-\tau)}{\tau+\left(\alpha^{H}\right)^{2}(k-\tau)}A^{H} > A^{L}$, which is equivalent to $I\left(k-\tau\right) > \frac{I\tau A^{L}}{\left(\alpha^{H}\right)^{2}\left(A^{H}-A^{L}\right)}$.

Combining (18) and (17), (12) and (13) hold for

$$\frac{I\tau A^{L}}{\left(\alpha^{H}\right)^{2}\left(A^{H}-A^{L}\right)}<I\left(k-\tau\right)<\frac{g^{-1}\left(A^{L}\right)}{\left(\alpha^{L}\right)^{2}} \tag{19}$$

This equilibrium exists if the interval $\left(\frac{I\tau A^{L}}{\left(\alpha^{H}\right)^{2}\left(A^{H}-A^{L}\right)},\frac{g^{-1}\left(A^{L}\right)}{\left(\alpha^{L}\right)^{2}}\right)$ is well defined: $\frac{I\tau A^{L}}{\left(\alpha^{H}\right)^{2}\left(A^{H}-A^{L}\right)} < \frac{g^{-1}\left(A^{L}\right)}{\left(\alpha^{L}\right)^{2}}$, or $A^{L} < g\left(\left(\frac{\alpha^{L}}{\alpha^{H}}\right)^{2}\frac{I\tau A^{L}}{A^{H}-A^{L}}\right)$. Otherwise, the equilibrium of information acquisition and funding H entrepreneurs does not exist.

Region 4. We first consider an equilibrium in which financiers do not acquire information and fund either close H or close L entrepreneurs. Financiers have an incentive to fund close L entrepreneurs if

$$g\left(\alpha^L kI\right) \leqslant A^L \tag{20}$$

The expected payoff for financiers who acquire information and fund both H or L entrepreneurs is

$$(k-\tau)\left(\left(\alpha^H\right)^2 A^H + \left(2\alpha^H\alpha^L + \left(\alpha^L\right)^2\right) A^L\right)$$

In this case, only when an H entrepreneurs is evaluated with another H entrepreneur, a financier is offered with a return of A^H. When an H entrepreneurs is evaluated with an L entrepreneur, or two L entrepreneurs are evaluated together, a financier is offered only A^L.

So a financier has no incentive to acquire information if and only if

$$\left(\left(\alpha^H\right)^2 A^H + \left(2\alpha^H\alpha^L + \left(\alpha^L\right)^2\right) A^L\right)(k-\tau) \leqslant g(\Omega_4)k \tag{21}$$

where Ω_4 is the equilibrium amount of capital invested in the general technology.

For L entrepreneurs to be funded, they should be able to offer at least the return of the general technology.

$$g(\Omega_4) \leqslant A^L \tag{22}$$

Following the same argument as in the proof of Proposition (1), (21) can be written as

$$g(\Omega_4) = \left(\left(\alpha^H\right)^2 A^H + \left(2\alpha^H\alpha^L + \left(\alpha^L\right)^2\right) A^L\right)\left(\frac{k-\tau}{k}\right) \leqslant A^L$$

which is equivalent to

$$\frac{I\tau A^L}{\left(\alpha^H\right)^2\left(A^H - A^L\right)} \geqslant I\left(k-\tau\right) \tag{23}$$

Combining (20) and (23), this equilibrium exists for

$$\frac{g^{-1}\left(A^L\right)}{\alpha^L} \leqslant kI \leqslant \frac{I\tau A^L}{\left(\alpha^H\right)^2\left(A^H - A^L\right)} + I\tau$$

as long as the interval $\left[\frac{g^{-1}\left(A^L\right)}{\alpha^L}, \frac{I\tau A^L}{\left(\alpha^H\right)^2\left(A^H-A^L\right)} + I\tau\right]$ is well-defined – that is, $\frac{g^{-1}\left(A^L\right)}{\alpha^L} < \frac{I\tau A^L}{\left(\alpha^H\right)^2\left(A^H-A^L\right)} + I\tau$, or $A^L > g\left(\frac{\alpha^L I\tau A^L}{\left(\alpha^H\right)^2\left(A^H-A^L\right)} + I\tau\right)$.

Region 5. Consider an equilibrium in which financiers have incentive to acquire information and to fund both H and L entrepreneurs. Financiers have an incentive to acquire information if

$$\left(\left(\alpha^H\right)^2 A^H + \left(2\alpha^H\alpha^L + \left(\alpha^L\right)^2\right) A^L\right)(k-\tau) \geqslant g(\Omega_4)k.$$

This implies:

$$kI > \frac{I\tau A^L}{\left(\alpha^H\right)^2\left(A^H - A^L\right)} + I\tau$$

Additionally, L entrepreneurs must be able to offer at least the return of the general technology. Hence $A^L \geqslant g(\Omega_4)$. financiers who observe two L entrepreneurs actually invest in the general technology or in the entrepreneurs and earn return A^Lif $kI \geqslant \frac{g^{-1}\left(A^L\right)}{\left(\alpha^L\right)^2} + I\tau$. Then

$$kI > \max\left(\frac{I\tau A^L}{\left(\alpha^H\right)^2\left(A^H - A^L\right)} + I\tau, \frac{g^{-1}\left(A^L\right)}{\left(\alpha^L\right)^2} + I\tau\right)$$

The condition of the lemma, $A^L < g\left(\left(\frac{\alpha^L}{\alpha^H}\right)^2 \frac{I\tau A^L}{A^H-A^L}\right)$, ensures $\frac{I\tau A^L}{\left(\alpha^H\right)^2\left(A^H-A^L\right)} < \frac{g^{-1}\left(A^L\right)}{\left(\alpha^L\right)^2}$. So financiers acquire information and fund both H and L entrepreneurs if

$$kI > \frac{g^{-1}\left(A^L\right)}{\left(\alpha^L\right)^2} + I\tau.$$

■

Lemma 2 *Suppose* $A^L \geqslant g\left(\left(\frac{\alpha^L}{\alpha^H}\right)^2 \frac{I\tau A^L}{A^H-A^L}\right)$. *Then*

1. *If* $kI < g^{-1}\left(A^H\right)$, *financiers do not acquire information and invest only in the general technology;*

2. *If* $g^{-1}\left(A^H\right) \leqslant kI < \frac{g^{-1}\left(A^L\right)}{\alpha^L}$, *financiers do not acquire information and fund only* H *entrepreneurs;*

3. *If* $kI \geqslant \frac{g^{-1}\left(A^L\right)}{\alpha^L}$, *both types of entrepreneurs are funded. In equilibrium, some financiers invest in information acquisition if* $kI \geqslant \frac{I\tau A^L}{(\alpha^H)^2(A^H-A^L)} + I\tau$.

Proof. We prove each of the regions in Lemma 2 in order.

Region 1. See the proof of Region 1 in Lemma 1.

Region 2. Similar to the proof of Region 2 in Lemma 1, we establish that financiers do not acquire information and fund only close H entrepreneurs if (3) is satisfied. Then if $\frac{\left(\alpha^H\right)^2(k-\tau)}{\tau+(\alpha^H)^2(k-\tau)}A^H < A^L$, then $\frac{g^{-1}\left(\max\left(\frac{\left(\alpha^H\right)^2(k-\tau)}{\tau+(\alpha^H)^2(k-\tau)}A^H, A^L\right)\right)}{\alpha^L} = \frac{g^{-1}\left(A^L\right)}{\alpha^L}$. Also, $\frac{\left(\alpha^H\right)^2(k-\tau)}{\tau+(\alpha^H)^2(k-\tau)}A^H < A^L$ is equivalent to $kI < \frac{I\tau A^L}{(\alpha^H)^2(A^H-A^L)} + I\tau$. Thus, (3) becomes

$$g^{-1}\left(A^H\right) \leqslant kI \leqslant \min\left(\frac{I\tau A^L}{\left(\alpha^H\right)^2\left(A^H - A^L\right)} + I\tau, \frac{g^{-1}\left(A^L\right)}{\alpha^L}\right)$$

Condition $A^L \geqslant g\left(\left(\frac{\alpha^L}{\alpha^H}\right)^2 \frac{I\tau A^L}{A^H-A^L}\right)$ implies that $\frac{g^{-1}\left(A^L\right)}{\alpha^L} < \frac{I\tau A^L}{(\alpha^H)^2(A^H-A^L)} + I\tau$.

If $\frac{\left(\alpha^H\right)^2(k-\tau)}{\tau+(\alpha^H)^2(k-\tau)}A^H > A^L$ (which is equivalent to $kI > \frac{I\tau A^L}{(\alpha^H)^2(A^H-A^L)} + I\tau$), then $\frac{g^{-1}\left(\frac{\left(\alpha^H\right)^2(k-\tau)}{\tau+(\alpha^H)^2(k-\tau)}A^H\right)}{\alpha^L} < \frac{g^{-1}\left(A^L\right)}{\alpha^L}$, and (3) becomes

$$\frac{I\tau A^L}{\left(\alpha^H\right)^2\left(A^H - A^L\right)} + I\tau < kI < \frac{g^{-1}\left(\frac{\left(\alpha^H\right)^2(k-\tau)}{\tau+(\alpha^H)^2(k-\tau)}A^H\right)}{\alpha^L}$$

But this implies $\frac{I\tau A^L}{(\alpha^H)^2(A^H-A^L)} + I\tau \leqslant kI \leqslant \frac{g^{-1}\left(A^L\right)}{\alpha^L}$, which contradicts to the condition $A^L \geqslant g\left(\left(\frac{\alpha^L}{\alpha^H}\right)^2 \frac{I\tau A^L}{A^H-A^L}\right)$. Hence the equilibrium that financiers do not acquire information and fund only close H entrepreneurs exists for $g^{-1}\left(A^H\right) \leqslant kI \leqslant \frac{g^{-1}\left(A^L\right)}{\alpha^L}$.

Region 3. From the proof of Lemma 1, an equilibrium with information acquisition and funding of only H entrepreneurs does not exist under condition $A^L \geqslant g\left(\left(\frac{\alpha^L}{\alpha^H}\right)^2 \frac{I\tau A^L}{A^H-A^L}\right)$.

Then for $kI \geqslant \frac{g^{-1}(A^L)}{\alpha^L}$, there are two equilibria. In the first equilibrium, investors do not acquire information and invest in the general technology to the point that $g(\Omega_4) = A^L$, where Ω_4 is defined as in the proof of Lemma 1. All financiers earn return A^L and both types of entrepreneurs are funded. Additionally, it is not optimal to deviate by acquiring information if

$$\left(\left(\alpha^H\right)^2 A^H + \left(2\alpha^H\alpha^L + \left(\alpha^L\right)^2\right) A^L\right)(k-\tau) \leqslant g(\Omega_4)k$$

which implies $\frac{I\tau A^L}{(\alpha^H)^2(A^H-A^L)} \geqslant I(k-\tau)$. Hence, the equilibrium where no information is acquired and all entrepreneurs are funded exists for $\frac{g^{-1}(A^L)}{\alpha^L} \leqslant I(k-\tau) \leqslant \frac{I\tau A^L}{(\alpha^H)^2(A^H-A^L)}$. The condition $A^L \geqslant g\left(\left(\frac{\alpha^L}{\alpha^H}\right)^2 \frac{I\tau A^L}{A^H-A^L}\right)$ ensures the interval is well-defined.

In the second equilibrium, L entrepreneurs are funded in equilibrium if $g(\Omega_5) \leqslant A^L$. Some financiers find it optimal to acquire information and to fund both H and L entrepreneurs if

$$\left(\left(\alpha^H\right)^2 A^H + \left(2\alpha^H\alpha^L + \left(\alpha^L\right)^2\right) A^L\right)(k-\tau) \geqslant g(\Omega_5)k$$

Financiers who do not acquire information earn at most return $g(\Omega_5)$ by investing in either the general technology or the close entrepreneur.

Note also from the proof of Lemma 1, financiers who acquire information have an incentive to fund L entrepreneurs if $kI \geqslant \frac{g^{-1}(A^L)}{(\alpha^L)^2} + I\tau$. Similar to the proof of Region 5 of Lemma 1, we can show

$$I(k-\tau) \geqslant \frac{I\tau A^L}{\left(\alpha^H\right)^2 (A^H - A^L)}$$

Note that condition $A^L \geqslant g\left(\left(\frac{\alpha^L}{\alpha^H}\right)^2 \frac{I\tau A^L}{A^H-A^L}\right)$ implies $\frac{g^{-1}(A^L)}{(\alpha^L)^2} \leqslant \frac{I\tau A^L}{(\alpha^H)^2(A^H-A^L)}$. Therefore this equilibrium exists if $I(k-\tau) \geqslant \frac{I\tau A^L}{(\alpha^H)^2(A^H-A^L)}$. In equilibrium, all financiers acquire information and the return of the traditional technology is $g(\Omega_5) = A^L$. ■

C Proof of Corollary 3

In order to compare the payoffs of H entrepreneurs under favoritism and imperfect markets for intermediate levels of capital, we need to establish the relevant entrepreneurs' payoffs under imperfect

markets and favoritism. These in turn depend on which types of entrepreneurs receive funding.

Case A If $\frac{I\tau A^L}{(\alpha^H)^2(A^H-A^L)} + I\tau < \frac{g^{-1}(A^L)}{\alpha^L} < \frac{g^{-1}(A^L)}{(\alpha^L)^2} + I\tau$, then

A.1 For $\frac{I\tau A^L}{(\alpha^H)^2(A^H-A^L)} + I\tau < kI < \frac{g^{-1}(A^L)}{\alpha^L}$, financiers do not acquire information and fund only H entrepreneurs under favoritism, and at least some of them acquire information and only H entrepreneurs receive funding under imperfect markets;

A.2 For $\frac{g^{-1}(A^L)}{\alpha^L} < kI < \frac{g^{-1}(A^L)}{(\alpha^L)^2} + I\tau$, financiers do not acquire information and fund both H and L entrepreneurs under favoritism, and at least some financiers acquire information and only H entrepreneurs receive funding under imperfect markets.

Case B If $\frac{g^{-1}(A^L)}{\alpha^L} < \frac{I\tau A^L}{(\alpha^H)^2(A^H-A^L)} + I\tau < \frac{g^{-1}(A^L)}{(\alpha^L)^2} + I\tau$, then for $\frac{I\tau A^L}{(\alpha^H)^2(A^H-A^L)} + I\tau < kI < \frac{g^{-1}(A^L)}{(\alpha^L)^2} + I\tau$, financiers do not acquire information and fund H and L under favoritism, and at least some financiers acquire information and only H entrepreneurs receive funding under imperfect markets.

Notice that H entrepreneurs' payoffs under favoritism and imperfect markets in Case B are essentially the same as their payoffs in A.2 of Case A. So we need to consider only two cases.

First, we compare entrepreneurs' payoffs under imperfect markets with payoffs under favoritism when only H entrepreneurs are funded.

Note that in this case the capital invested in the traditional technology is $\Omega_1 = \alpha^L k + \omega_1$. From the proof of Proposition 2, we know that if $\omega_1 > 0$, $g(\Omega_1) = A^H$ implying that entrepreneurs' rent and therefore their payoff is zero. Clearly, when financiers acquire information and fund only H entrepreneurs, $\Omega_3 < \Omega_1$ for any level of kI. This implies that $g(\Omega_3) \geqslant A^H$. Hence, it cannot be individually rational for a financier to acquire information if $\omega_1 > 0$ in the equilibrium in which financiers are assumed not to acquire information. Thus, we only have to consider $\omega_1 = 0$. H entrepreneurs' expected payoff under favoritism that is relevant for our comparison is: $\left(A^H - g\left(kI\alpha^L\right)\right)\frac{kI}{N}$.

When some financiers acquire information and only H are funded under imperfect markets, H entrepreneurs expect to receive a positive rent, $\left(A^H - g\left(\Omega_3\right)\right)$, with probability 1 for attracting capital from financiers who do not acquire information and with probability α^L from financiers that acquire information. They can attract capital $\frac{\omega_3}{N}$ from financiers that do not acquire information

and $\frac{2(k-\tau)\left(I-\frac{\omega_3}{k}\right)}{N}$ from financiers that acquire information if they observe a L entrepreneur. The 2 at the denominator takes into account that when some financiers acquire information the world is segmented in $\frac{N}{2}$ markets.

Thus, favoritism is preferred to imperfect markets if $\left(A^H - g\left(\Omega_3\right)\right)\left(\frac{2(k-\tau)\left(I-\frac{\omega_3}{k}\right)\left(1-\alpha^H\right)}{N} + \frac{\omega_3}{N}\right) \leqslant \left(A^H - g\left(kI\alpha^L\right)\right)\frac{kI}{N}$, which is equivalent to

$$\left(\frac{A^H - g\left(\Omega_3\right)}{A^H - g\left(kI\alpha^L\right)}\right)\left(\frac{2\left(k-\tau\right)\left(I-\frac{\omega_3}{k}\right)\left(1-\alpha^H\right)+\omega_3}{kI}\right) \leqslant 1.$$

Note that $g\left(\Omega_3\right) \geqslant g\left(kI\alpha^L\right)$ as $\Omega_3 = \alpha^L\omega_3 + \left(\alpha^L\right)^2\left(I-\frac{\omega_3}{k}\right)\left(k-\tau\right) \leqslant kI\alpha^L$. Hence the first term is always less than 1. Also, when $\omega_3 = 0$, $2\left(k-\tau\right)\left(I-\frac{\omega_3}{k}\right)\left(1-\alpha^H\right)+\omega_3 < kI$ if $\alpha^H \geqslant \frac{1}{2}$. This implies that if $kI \geqslant g^{-1}(A^H)$ favoritism is always preferred to markets if $\alpha^H \geqslant \frac{1}{2}$.

Hence, the inequality always holds if $\alpha^H \geqslant \frac{1}{2}$. Under this condition, H entrepreneurs prefer favoritism to imperfect markets when only H entrepreneurs are funded.

Next, consider the case in which only H are funded under imperfect markets but both H and L are funded under favoritism. H entrepreneurs' expected payoff under favoritism is $\left(A^H - A^L\right)\frac{kI}{N}$. Thus, favoritism is preferred to imperfect markets if: $\left(A^H - g\left(\Omega_3\right)\right)\left(\frac{2(k-\tau)\left(I-\frac{\omega_3}{k}\right)\left(1-\alpha^H\right)}{N} + \frac{\omega_3}{N}\right) \leqslant \left(A^H - A^L\right)\frac{kI}{N}$, which is equivalent to

$$\left(\frac{A^H - g\left(\Omega_3\right)}{A^H - A^L}\right)\left(\frac{2\left(k-\tau\right)\left(I-\frac{\omega_3}{k}\right)\left(1-\alpha^H\right)+\omega_3}{kI}\right) \leqslant 1$$

Like above, H entrepreneurs always prefer favoritism over imperfect markets as each of the components on the left hand side of the inequality is less than one if $\alpha^H \geqslant \frac{1}{2}$.

D Proof of Corollary 4

Financiers acquire information and fund both H and L entrepreneurs under two different parameters' configurations.

In either case, H and L entrepreneurs are funded under both favoritism and imperfect markets.

First, consider $\frac{I\tau A^L}{\left(\alpha^H\right)^2\left(A^H-A^L\right)} > \frac{g^{-1}\left(A^L\right)}{\left(\alpha^L\right)^2}$. In this case, financiers acquire information and fund both $H$and L entrepreneurs if $kI > \frac{I\tau A^L}{\left(\alpha^H\right)^2\left(A^H-A^L\right)} + I\tau$. An H entrepreneur's rent per unit of capital under favoritism is $A^H - A^L$. His rent per capital under imperfect markets is $\alpha^L\left(A^H - A^L\right)$ because

the H entrepreneur's rent is positive only when he is evaluated with an L entrepreneur; when he is evaluated with another H entrepreneur, competition for capital drives each the rent to zero.

H entrepreneurs can invest $\frac{kI}{N}$ under favoritism and $\frac{2(k-\tau)I}{N}$ under imperfect markets, if they happen to be evaluated with an L entrepreneur. The expected payoff is then $\left(A^H - A^L\right)\frac{kI}{N}$ under favoritism, and is $\alpha^L\left(A^H - A^L\right)\frac{2(k-\tau)I}{N}$ under imperfect markets. So an H entrepreneur's expected payoff under imperfect markets is greater than his payoff under favoritism if and only if $\alpha^L\left(A^H - A^L\right)\frac{2(k-\tau)I}{N} \geqslant \left(A^H - A^L\right)\frac{kI}{N}$. That is, $\alpha^L \geqslant \frac{k}{2(k-\tau)}$.

Note that $\alpha^L \geqslant \frac{k}{2(k-\tau)}$ can be re-written as $kI \geqslant \frac{2\alpha^L}{2\alpha^L-1}I\tau$. Together with the constraint of information acquisition, an H entrepreneur prefers imperfect markets over favoritism if

$$kI \geqslant \max\left(\frac{2\alpha^L}{2\alpha^L-1}I\tau, \frac{I\tau A^L}{\left(\alpha^H\right)^2\left(A^H - A^L\right)} + I\tau\right). \tag{24}$$

Now, consider $\frac{I\tau A^L}{\left(\alpha^H\right)^2\left(A^H-A^L\right)} \leqslant \frac{g^{-1}\left(A^L\right)}{\left(\alpha^L\right)^2}$. As above, H entrepreneurs' expected payoffs are $\left(A^H - A^L\right)\frac{kI}{N}$ under favoritism and is $\alpha^L\left(A^H - A^L\right)\frac{2(k-\tau)I}{N}$ under imperfect markets. Thus, as before, an H entrepreneur prefers imperfect markets over favoritism if and only if $kI \geqslant \frac{2\alpha^L}{2\alpha^L-1}I\tau$. Together with the condition for information acquisition, this implies:

$$kI \geqslant \max\left(\frac{2\alpha^L}{2\alpha^L-1}I\tau, \frac{g^{-1}\left(A^L\right)}{\left(\alpha^L\right)^2} + I\tau\right). \tag{25}$$

Combining inequalities (24) and (25), we obtain Corollary 4.

E Proof of Proposition 6

If all financiers acquire information, H entrepreneurs' expected rent per unit of investment is $\alpha^L\left(A^H - g\left(\Omega_3\right)\right)$ or $\alpha^L\left(A^H - A^L\right)$ depending on the level of capital in the economy.

From the proof of Proposition 2 we know that $g\left(\Omega_3\right) \leqslant \frac{\left(\alpha^H\right)^2(k-\tau)}{\tau+\left(\alpha^H\right)^2(k-\tau)}A^H$. In particular, if $\omega_3 > 0$, $g\left(\Omega_3\right) = \frac{\left(\alpha^H\right)^2(k-\tau)}{\tau+\left(\alpha^H\right)^2(k-\tau)}A^H$, where $\frac{\partial\left(\frac{\left(\alpha^H\right)^2(k-\tau)}{\tau+\left(\alpha^H\right)^2(k-\tau)}\right)}{\partial\alpha^H} = \frac{2\left(\alpha^H\right)(k-\tau)\tau}{\left(\tau+\left(\alpha^H\right)^2(k-\tau)\right)^2} > 0$. Hence, the rent per unit of capital received from financiers that acquire information decreases. Also the rent per unit of

capital received from financiers that do not acquire information decreases.

Hence, the rent per unit of capital invested is weakly decreasing in α^H.

The capital allocated to an H entrepreneur in the states of the world in which the rent is expected to be positive is 0, $\left(\frac{2(k-\tau)\left(I-\frac{\omega_3}{k}\right)\left(1-\alpha^H\right)}{N}+\frac{\omega_3}{N}\right)$, and $\frac{2(k-\tau)I}{N}$, respectively, depending on the level of capital in the economy.

If all financiers acquire information, then $\omega_3 = 0$. The capital an H entrepreneur can employ with a postive rent is thus $\frac{2(k-\tau)I\left(1-\alpha^H\right)}{N}$, which is clearly decreasing in α^H. Capital is not affected by α^H otherwise.

In conclusion, when all financiers acquire information the capital received by an H entrepreneur is either decreasing or unaffected by α^H.

If α^H increases and H entrepreneurs receive less capital and a lower rent per unit of capital invested, their payoff clearly decreases in α^H.