Preliminary and incomplete

SPINOUT ENTREPRENEURSHIP, CRONY CAPITALISM, AND DEVELOPMENT

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Recently collected data show that, within any manufacturing industry, vertically integrated firms tend to have larger, higher productivity plants, account for the bulk of sales, and also sell externally most of the inputs they produce. In a weak contracting environment characteristic of less developed countries (LDCs), vertically integrated firms are vulnerable to "spinouts" by employees who make specialized inputs formerly provided internally subject to hold-up and capture the profits formerly made from external sales of generic inputs. This vulnerability is shown to lead to inefficiently low entry and to help explain the "missing middle" in the size distribution of LDC firms and the low local content of LDC exports. Vertically integrated firms can fight back by hiring "cronies" to manage their input divisions: members of networks that informally sanction hold-ups, or children who keep profits "in the family" even if they spin out. This is shown to predict the association of co-ethnic networks with high rates of entrepreneurship and the prominence of family-owned business groups in LDC manufacturing. The government can achieve a higher level of entry at minimum cost by directing subsidies to vertically integrated family firms, but only if families with competent children can be identified ex ante.

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1. Introduction

Data recently collected by Hortaçsu and Syverson (2007) show that, within narrowly-defined manufacturing industries, vertically integrated firms are larger (and have larger plants) and have higher productivity. These data, collected for the United States for the period 1977-97, also show that vertically integrated firms account for about 70% of the value of manufacturing output. Comparably detailed studies are not available for less developed countries (LDCs), but we can expect the need for larger, more productive firms to produce their own inputs to be even stronger in these countries. Tybout (2000, p. 14) reports, "The menu of domestically produced intermediate inputs and capital equipment is also often limited in developing countries. Thus producers who might easily have acquired specialized inputs if they were operating in an OECD country must either make do with imperfect substitutes or import the needed inputs at extra expense."

An employee supplying a material or service input inside a vertically integrated firm may become an independent producer of that input, typically then entering a subcontracting relationship with his former employer. Shieh (1992) devotes an entire chapter of his study of subcontracting in Taiwanese manufacturing to "Spinning Off 'Bosses'." We call the firms founded by these employees "spinouts" (rather than spinoffs) to emphasize the "externalization" of formerly internally supplied inputs.[1]

[1] Spinoffs have been found to be an important source of entrepreneurship in widely varying contexts. Bhide (2000, p. 94) reports that 71 percent of the firms in the Inc 500 (a list of young, fast-growing firms) were founded by entrepreneurs who "replicated or modified an idea encountered through previous employment." Also for the United States, Cooper (1985, p. 77) reports that 60-70 percent of new full-time businesses and about 85 percent of technically oriented firms serve similar markets or utilize similar technologies as the organizations which the entrepreneurs had left. Rona-Tas (1997, Table 2) finds that in 1993-4, most of the CEOs of the top privately founded (not privatized) firms in Hungary and the Czech Republic had been high or middle managers in state-owned firms in 1988. Finally, Elkan (1988, p. 174)

Entrepreneurs who found spinouts may work harder than they did for their former employers. Yet spinouts are a double-edged sword in a weak contracting environment. Well-known inefficiencies may arise in the now arm's-length customer-supplier relationship. A potentially more important problem is that a spinout deprives a vertically integrated firm of a significant revenue stream. As described in more detail in section 2, Hortasçu and Syverson (2007) find that vertically integrated firms sell the bulk of their internally produced inputs externally. Former employers cannot force spinouts to compensate them for the profits lost from these external sales of inputs without effective non-compete enforcement and/or patent protection. In the LDC context the knowledge possessed by spinouts is probably not patentable, and enforcement of non-compete contracts is likely to be too slow, if it happens at all. Gilson (1999) states that in the United States the most often used way for a firm to use a non-compete clause in its contract with an employee is through a preliminary injunction.[2] Otherwise the non-compete clause is ineffective because by the time it is enforced the damage to the employer's business has already been done.

I shall argue that, by discouraging entry of vertically integrated firms, these contractual difficulties contribute to the "missing middle" in the size distribution of LDC firms (Tybout 2000): only the highest productivity, largest firms founded by the best entrepreneurs are profitable despite these difficulties, and less able entrepreneurs simply

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states, "A survey of the hundred or so largest Nigerian industrial businesses in 1975 reported that 68 percent had been founded by former employees of expatriate firms."

[2] In personal communication (2008), Lawrence Carnevale, a prominent New York attorney specializing in employment law, states, "Those prosecuting or defending non-compete actions may be called upon to argue the merits of such clauses in court within hours of the employee's notice." Even within the United States, however, enforcement of non-compete contracts is uneven (Malsberger 2006). Other means of intellectual property protection may also fail developed country employers. Nevertheless, loss of profits due to spinouts in developed countries will not have the negative multiplier effect on entry of vertically integrated firms described in section 2 because these countries tend to have a comparative advantage in intermediate goods and are therefore less dependent on the market provided by domestic firms.

found small, non-integrated firms.[3] Moreover, since vertically integrated firms sell most of their intermediate output externally, fewer of them (and their spinouts) means fewer locally supplied inputs, leading to a low local content of LDC exports and contributing to precisely the state of affairs regarding intermediates that Tybout described above.

Employers can mitigate the impact of these contractual problems by hiring different types of "cronies" to manage their input divisions: members of networks that support efficient subcontracting relationships through informal punishment of opportunistic behavior, or children who keep profits "in the family" even if they spin out. Regarding the latter, Shieh (1992, p. 184) writes

> it is the middle-level or above managerial staffs who are more likely to open their own workshops. Hence a gap in promotion channel prevents line workers from setting up their own businesses, yet guarantees more opportunities for the managerial staffs of the inner circle of the boss....Only the family members of the boss can be promoted to the key positions....the family-based enterprises, which are the majority of Taiwanese enterprises, reserve training opportunities for the family members of the boss, for they fear that non-family-member employees may quit someday and the investment in training would be in vain, not to mention the threat from the potential competitors cultivated by their own hands. Familism here is a condition for the relatives or in-circle members of the boss to spin-off, which may in turn reinforce familism.

The most readily identifiable networks are based on ethnicity. Studies of ethnic minority entrepreneurship consistently emphasize that these groups collectively sanction deviant behavior in business dealings (see Alesina and La Ferrara 2005 for references).

The advantages of hiring cronies help to explain the prominence of ethnic minorities and family business groups in LDC economies.[4] Our model is also consistent

[3] The advantage of being small enough to avoid costly regulation also contributes to the missing middle, as shown in Rauch (1991).
[4] For a discussion and numerous examples of "market-dominant" ethnic minorities, see Chua (1998). In their survey article, Khanna and Yafeh (2007, p. 332) state, "in virtually all emerging markets, group-

with more subtle findings regarding family firms. Bertrand et al. (2008, Table 8) find that the number of sons of the founder of a family business group in Thailand does not affect the number of firms in the group until after the founder has died. This could be because sons exert higher effort than non-family managers when monitored by the parent-founder, making spinouts less advantageous until after his death. At the same time, founding entrepreneurs may be willing to hire children who are not the best available employees in order to keep profits from any subsequent spinouts in the family. These offsetting influences on family firm profitability are consistent with the contradictory results in the literature.[5]

The analysis of this paper has clear first- and second-best policy implications. The key market failure can be addressed directly by enforcing non-compete clauses in employment contracts and making loans to workers to buy out their contracts when spinouts are the efficient option. Second-best policies would encourage entry by high quality, vertically integrated producers. If these producers are exporters, export subsidies can be used. If lump-sum taxation is available, export subsidies to inframarginal entrants are socially harmless transfer payments. If lump-sum taxation is not available, however, subsidies need to be targeted as narrowly as possible. Family firms with competent children require the least subsidy. Crony capitalism in the more widely used, political economy sense of the term may partially reflect government attempts to direct subsidies to such firms, more likely in an effort to achieve a target level of entry at minimum cost than to achieve a well-defined welfare objective.

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affiliated firms tend to be relatively large and economically important." They also write (p. 352), "the vast majority of business groups began as family dominated corporations".

[5] Claessens et al. (2002) and Cronqvist and Nilsson (2003) find that family firms are associated with lower stock market valuations and lower rates of return, whereas Anderson and Reeb (2003) and Khanna and Palepu (2000) find the opposite.

In the next section of this paper I construct an industry model in which larger firms producing higher quality goods are vertically integrated, yet sell most of their produced inputs externally. In section 3 I extend the model to allow the manager of the input division of a vertically integrated firm to spin out, and in section 4 I analyze the cases where that manager is a social network or family "crony". Still in progress are section 5 on implications for policy, and a concluding section.

2. The basic model

An industry in a less developed country can produce both low and high quality final goods using imported intermediates and unskilled domestic labor. Low quality final goods are homogeneous and are sold domestically in competition with imports. High quality final goods are differentiated and are sold abroad.

The economy of which this industry is part is populated by risk neutral old and young agents. A measure N of old agents is available to found and manage firms in this particular industry; each has the alternative to retire and enjoy leisure valued at R. We will follow Lucas (1978) and assume that a fixed distribution of managerial talent G: $\mathbb{R}^+ \rightarrow [0,1]$ exists in the population but is only relevant when actually managing firms that produce final goods, and hence is irrelevant for young agents. Young agents can, however, be divided into skilled and unskilled. Unskilled young agents supply labor to the industry at wage rate w_U. Among the skilled are a subset of measure greater than N who have achieved the highest measurable technical preparation for work in this industry; for example they have completed the requisite specialized education with the highest possible grades. These highly skilled young workers will be demanded by entrepreneur-managers who want to produce high quality final goods in this industry; the remaining skilled young workers will supply labor to the rest of the economy at wage rate w_S. However, we will later want to consider the possibility that entrepreneurs who produce high quality final goods hire their children even if they are less technically proficient.

Before management is applied, the "raw" technologies for producing final goods display constant returns to scale in unskilled labor and a CES aggregate of intermediates. The technology for the low quality final good is associated with the following unit cost function:

$$c_L\left(\left(\int_0^{n_L}\left(p_L(i)\right)^{1-\sigma_L}di\right)^{\frac{1}{1-\sigma_L}}, w_U\right), \tag{1}$$

where n_L is the measure of the fixed number of low quality intermediates, $p_L(i)$ is the price of the ith low quality intermediate, and σ_L is the elasticity of substitution for the CES aggregate of low quality intermediates. An entrepreneur with talent z who enters low quality final goods production uses this production technology with a diminishing returns managerial technology as in Lucas (1978), yielding a total cost function $(c_L/z)(q)^{\varphi}$, $\varphi > 1$, where q is output. The transportation- and tariff-inclusive price of the imported low quality final good is p_M. The entrepreneur therefore chooses q to maximize p_Mq - $(c_L/z)(q)^{\varphi}$, yielding the profit function

$$\pi_L(z) = A(p_M)^{\alpha+1}(c_L)^{-\alpha}z^{\alpha}, \tag{2}$$

where $\alpha \equiv 1/(\varphi-1)$, $A \equiv (\varphi^{-\alpha} - \varphi^{-\alpha-1})$, and c_L is defined by equation (1).

An entrepreneur with talent z who enters high quality final goods production has a more challenging task. He must develop an in-house design capability and specialize one of the imported high quality inputs in order to differentiate his product for foreign buyers and attract market share. This is an expensive process that requires hiring and training a technically prepared worker who will embody the in-house design capability and oversee production of the input. The entrepreneurs taking this route are matched randomly with the subset of skilled workers described above; unmatched workers earn w_S in the rest of the economy. In this basic model the matched workers also earn w_S; we will consider the determination of their earnings in more detail in section 3.

Unlike all other inputs, the specialized input enters the production function with a coefficient $\beta > 1$. The total cost function for differentiated product j is then:

$$\left(c_H\left(\left((\mu/\beta)^{1-\sigma_H} + \int_0^{n_H} \left(p_H(i)\right)^{1-\sigma_H} di \right)^{\frac{1}{1-\sigma_H}}, w_U \right) \Big/ z \right) q_j + F, \tag{3}$$

where μ is the (constant) marginal cost to the firm of producing the specialized input, n_H is the measure of the fixed number of high quality intermediates, $p_H(i)$ is the price of the ith high quality intermediate, σ_H is the elasticity of substitution for the CES aggregate of high quality intermediates, q_j is output of the differentiated product, and F is the fixed cost of establishing production of the specialized input.[6]

The managerial technology for the high quality final good is not subject to diminishing returns, but this differentiated product faces a downward-sloping foreign demand curve $q_j = E^*(p_{Xj})^{-\varepsilon}/(P^*)^{1-\varepsilon}$, where E^* is foreign expenditure on high quality final goods in this industry, P^* is the foreign CES price index for this industry, and p_{xj} is the price foreigners pay for differentiated product j when it is exported to them. An entrepreneur with talent z who enters high quality final goods production will follow the

[6] We allow ourselves the following abuse of notation: in this section the earnings of the skilled worker, w_S, are absorbed into the fixed cost F, but F is net of w_S in the remaining sections of the paper.

standard markup pricing rule, yielding $p_X(z) = \tau c_H/z\eta$, where $\tau > 1$ is the number of units of any high quality final good that need to be shipped if one unit is to arrive, $\eta = (\varepsilon - 1)/\varepsilon$, and we have dropped the subscript j because the price of any differentiated product will be the same for a given level of entrepreneurial talent. Standard computations then yield the profit function

$$\pi_H(z) = (\eta P^* z/\tau c_H)^{\varepsilon-1}(E^*/\varepsilon) - F, \tag{4}$$

where c_H is defined by equation (3).

Producers of final goods generate constant elasticity demands for intermediates, to which foreign suppliers respond with constant markups over their marginal costs. The transportation-inclusive price of any imported intermediate is therefore $p_K(i) = p_K = \tau_K \mu_K^*/\rho_K$, $K = H, L$, where $\tau_K > 1$ is the number of units of quality K intermediate that need to be shipped if one unit is to arrive, μ_K^* is the foreign marginal cost of production for quality K intermediates, and $\rho_K = (\sigma_K - 1)/\sigma_K$. For simplicity we have treated all intermediates of a given quality symmetrically.

Recall that each domestic producer of a high quality final good supplies itself with a version of an imported high quality input that is specialized to its own needs. It can also supply a generic version of the same input in competition with imports at marginal cost μ_H. I assume that $\mu_H^*/\tau_H < \mu_H < \tau_H \mu_H^* < \mu_H/\rho_H$. The final goods producer then practices limit pricing as in Grossman and Helpman (1991), selling the input to other domestic final goods producers at the foreign (transportation inclusive) marginal cost.[7] This allows it to recoup some of its expenses incurred in developing its production capability for the input. Unlike in Grossman and Helpman (1991), however,

[7] Specifically, this corresponds to the "narrow gap" case in Grossman and Helpman (1991), where wages in the less developed country are not so much lower than wages in the more developed country that the former can charge the full markup over marginal cost and still undercut the marginal cost of the latter.

transportation costs allow the foreign producer to keep the domestic producer of the input out of its home market.

I assume that profits from domestic sales of a high quality input are not great enough to cover the fixed costs of entry into its production, which include the cost of imitating the foreign technology. It follows that independent domestic production of high quality inputs does not take place: all domestic producers of high quality inputs are owned by final goods producers (in the next section of the paper they will be joined by spinouts from final goods producers). The symmetry of all inputs in our model ensures that if independent entry were profitable for one, it would be profitable for all. If inputs were not all symmetrical we could allow for independent domestic production of a subset of high quality inputs without changing any of our results.

If profits from domestic sales of a high quality input are not great enough to cover the fixed costs of entry into its production, it is reasonable to assume they are also too small to cover F, which also includes the cost of developing a specialized version of the input for use in production of a differentiated final good. In this case, a comparison of equations (2) and (4) shows that as managerial talent goes to zero, entry into low quality final goods production must dominate entry into high quality final goods production. If there is to be positive high quality production, it must therefore be true that $\pi_H(z)$ increases more rapidly with z than does $\pi_L(z)$. Positive low quality production then requires low enough R that low quality production is preferred to retirement before managerial talent is great enough that high quality production is preferred to low quality production.

Figure 1 embodies these assumptions and shows the breakdown of old agents available to found and manage firms in this industry into retirement, low quality entrepreneurship, and high quality entrepreneurship. In the figure we define $\underline{z}$ as the cutoff level of managerial talent for choosing low quality final goods production over retirement and $\bar{z}$ as the cutoff level of managerial talent for choosing high over low quality final goods production. We also define profits from input sales, $\pi_S(\bar{z})$:

$$\pi_S(\bar{z}) = (\tau_H \mu_H^* - \mu_H) N \int_{\bar{z}}^{\infty} \left(-\partial \pi_H(z, \bar{z}) / \partial p_H\right) dG(z), \tag{5}$$

where S denotes subsidiary. Finally, in an abuse of notation, we now write profits of a domestic producer of high quality final goods as a function not only of the entrepreneur's managerial talent z but also of the cutoff level of managerial talent $\bar{z}$. This dependence of π_H on $\bar{z}$ comes through the unit cost function c_H, and more specifically through its first argument, the CES price index for high quality inputs P_H faced by any domestic producer of high quality final goods:[8]

$$P_H = \left((\mu/\beta)^{1-\sigma_H} + \left(1 - G(\bar{z})\right) N (\tau_H \mu_H^*)^{1-\sigma_H} + \left(n_H - \left(1 - G(\bar{z})\right) N\right) (\tau_H \mu_H^* / \rho_H)^{1-\sigma_H} \right)^{\frac{1}{1-\sigma_H}}. \tag{6}$$

An increase in $\bar{z}$ means that fewer high quality inputs will be produced domestically, hence there are more high quality inputs for which domestic producers of high quality

[8] π_H could also depend on $\bar{z}$ through P^*, the foreign CES price index for this industry: fewer domestic varieties available to foreigners (higher $\bar{z}$) raises P^* and therefore raises profits by equation (4). I have made a "small country" assumption that the domestic industry is too small to affect P^*, but if I relaxed this assumption it would not qualitatively change any results in the paper provided the positive effect of $\bar{z}$ on π_H through P^* does not *more* than offset the negative effect of $\bar{z}$ on π_H through P_H.

final goods have to pay the markup over foreign marginal cost, raising P_H and lowering profits.[9]

With this notation in place, we can see from Figure 1 that $\underline{z}$ and $\bar{z}$ are determined as follows:

$$\pi_L(\underline{z}) = R \tag{7}$$

$$\pi_H(\bar{z}, \bar{z}) + \pi_S(\bar{z}) = \pi_L(\bar{z}). \tag{8}$$

We can then prove

Proposition 1: A $\underline{z}$ that solves equation (7) exists and is unique, and a $\bar{z}$ that solves equation (8) exists and is unique under the following sufficient conditions: [in process].

The technical conditions for $\bar{z}$ to be unique will be stated in Proposition 1 in a future draft of this paper, but a more intuitive explanation will build understanding of how the model works. Consider the comparative static impact of a change in the fixed cost of entry on the cutoff level of managerial talent for high quality final goods production:

$$d\bar{z}/dF = 1/[\partial\pi_H(\bar{z}, \bar{z})/\partial z - \partial\pi_L(\bar{z})/\partial z + \partial\pi_S(\bar{z})/\partial\bar{z} + \partial\pi_H(\bar{z}, \bar{z})/\partial\bar{z}].$$

We expect this expression to be positive: a fall in the fixed cost should lead to more entry into high quality final goods production, implying a lower $\bar{z}$. Without taking account of the impact of $\bar{z}$ on subsidiary or final good profits, we see that a sufficient condition for $d\bar{z}/dF > 0$ is for profits from high quality production to be increasing faster with managerial talent than profits from low quality production, as in Figure 1. However, the impact of $\bar{z}$ on subsidiary profits is negative: the smaller the number of high quality final goods firms, the lower are the profits from selling them an input. We

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[9] I assume $n_H > (1 - G(\underline{z}))N$, so that some high quality inputs are imported even in an equilibrium with maximum entry into high quality final goods production.

also saw from equation (6) that the smaller the number of high quality final goods firms, hence the smaller the number of domestically produced high quality inputs, the lower are profits from domestic production of the final good. This implies that a change in fixed cost has a multiplier effect: entry in response to lower fixed cost increases both subsidiary profits and final good profits, stimulating further entry. The terms $\partial\pi_S(\bar{z})/\partial\bar{z}$ and $\partial\pi_H(\bar{z},\bar{z})/\partial\bar{z}$ must be sufficiently small in absolute value for $d\bar{z}/dF > 0$ or, equivalently, for the multiplier effect not to explode.[10]

This multiplier effect has important implications for our analysis in subsequent sections. It implies that small changes in the profitability of entry into high quality final goods production can have large effects on the volume of high quality domestic production of both final goods and inputs, and on welfare.

It is straightforward to compute the internal sales ratio (*ISR*) for any subsidiary:

$$ISR(z,\bar{z}) = \mu\,\partial\pi_H(z,\bar{z})/\partial\mu \Big/ \left(\mu\partial\pi_H(z,\bar{z})/\partial\mu + \tau\mu_H^* N\int_{\bar{z}}^{\infty}\left(\partial\pi_H(z,\bar{z})/\partial p_H\right)dG(z)\right).$$

This will be small unless the firm is very large (managerial talent z is very high) or the measure of high quality final goods producers is very small ($\bar{z}$ is very high). The small value of *ISR* is consistent with the median value of 2.6 percent in the data of Hortaçsu and Syverson (2007). However, *ISR* cannot be zero, its modal value according to Hortaçsu and Syverson. I conjecture that the zeros in their data occur because some firms produce the specialized version of the input they developed in the same plant in which they produce the final good that uses it, while dedicating their separate plant to the generic version of the input, so that no internal shipments of the input are recorded. This

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[10] Allowing for π_H to depend on $\bar{z}$ through P^* would dampen the multiplier effect.

is consistent with the idea that production of the specialized version of the input requires closer supervision, an assumption we will make in the next section.

Since generic input sales are the same for all vertically integrated firms, but internal "sales" increase with firm size, we can state:

Proposition 2: The degree of vertical integration, as measured by the share of the value of produced inputs used internally rather than sold externally, increases with firm size.

I conclude this section by noting two features of the basic model that will be important in the subsequent analysis. First, since all prices of goods consumed domestically and all wages are determined outside the industry under study, the contribution of this industry to domestic welfare will exactly equal the domestic profits it generates. Second, we can use the model to define the local content of exports (*LCE*) for the industry:

$$LCE = \frac{\left(1-G(\bar{z})\right)N(\tau_H\mu_H^*)\left.\dfrac{\partial\pi_H}{\partial p_H}\right|_{\tau_H\mu_H^*}}{\left(1-G(\bar{z})\right)N(\tau_H\mu_H^*)\left.\dfrac{\partial\pi_H}{\partial p_H}\right|_{\tau_H\mu_H^*} + \left(n_H-\left(1-G(\bar{z})\right)N\right)(\tau_H\mu_H^*/\rho_H)\left.\dfrac{\partial\pi_H}{\partial p_H}\right|_{\tau_H\mu_H^*/\rho_H}}. \qquad (9)$$

Equation (9) gives the percentage of the value of purchased inputs to high quality final goods production that is of domestic origin. It is easily shown to be independent of managerial talent and therefore the same for all firms in the industry. It is decreasing in $\bar{z}$, the cutoff managerial talent for entry into high quality final goods production.

3. Spinouts without cronies

We now extend the model of the previous section in three ways. First, the skilled worker can choose the effort he exerts in management of the production of the generic input. I assume that no effort choice is possible in production of the specialized input because it is too closely coordinated with production of the final good and therefore too closely supervised by the entrepreneur. Second, this worker can, at some cost, establish his own firm to produce the specialized and generic versions of the input.[11] Third, this worker's pay is determined through bargaining with the entrepreneur; previously this worker's pay was simply absorbed into the fixed cost *F*.

The timing of the interaction between the entrepreneur and the skilled worker is as follows:

(i) The entrepreneur and the worker are matched randomly, and the entrepreneur hires and trains the worker. The worker is liquidity-constrained, and therefore cannot make a transfer to the entrepreneur to cover any future losses the latter might suffer if the worker spins out. Inability to borrow against one's human capital is realistic for young agents in the LDC context and can be thought of as part of the weak contracting environment.[12] We maintain the assumption that the worker is liquidity-constrained throughout the analysis.

[11] The worker's spinout implies the vertical disintegration of the original firm. In our model, then, firms vertically integrate because of the difficulties of contracting out the creation of a distinctive final good and specialized input; they may vertically disintegrate due to problems with worker incentives described below. Purchasing creative or problem-solving tasks intrafirm is consistent with the findings of Costinot, Oldenski, and Rauch (2008) for U.S. multinationals.

[12] Since the entrepreneur incurs the fixed cost *F*, he must not be liquidity constrained. This could be because lenders make loans to businesses but not pure human capital loans, or because having wealth adequate to finance the fixed cost of starting high quality final goods production is a condition for being considered part of the pool of older agents who are potential entrepreneurs for this industry.

(ii) The worker discovers his fixed cost, measured in terms of his own time, to establish his own business. Specifically, the worker draws the cost x from a fixed distribution Y with support $[0, \bar{x}]$. The entrepreneur as well as the worker observes x.

(iii) The entrepreneur and the worker decide whether to separate. If they stay together, the entrepreneur makes a transfer to the worker. I label the continuation (a) if they stay together and (b) if they separate.

(iv.a) As in section II, the worker produces the specialized input at marginal cost μ and the entrepreneur produces the final good, obtaining profit $\pi_H(z, \bar{z})$ as defined by equations (4), (3), and (6). The marginal cost μ_H for the generic input, however, is now a function of worker effort e: we write $\mu_H(e)$, where we assume that $\mu_H'' > 0$, $\lim_{e\to 0} \mu_H'(e) = -\infty$, and $\lim_{e\to\infty} \mu_H'(e) = 0$. Neither the amount of effort supplied by the worker nor the marginal cost is verifiable outside the firm. Moreover, the marginal cost cannot be inferred from the price the firm charges for the generic input since this is still optimally chosen to equal $\tau_H \mu_H^*$. Finally, due to vertical integration the profit earned from selling the generic input is mixed together with the profit earned from selling the final good, so that no accountant can verify the profit earned from input production, therefore the marginal cost. In short, effort is non-verifiable, hence non-contractible. The best the entrepreneur and worker can do is work without a contract and, following the worker's effort decision, rely on their bargaining powers to obtain shares of the profit from generic input production.[13] The worker and the entrepreneur have bargaining

[13] Here we are assuming that, after the worker's effort decision, the entrepreneur and worker can make a verifiable spot contract for actual delivery of output to the entrepreneur and payment to the worker. Signing such a contract in advance of the worker's effort decision, however, simply removes his incentive to exert effort.

weights λ and 1-λ, respectively. The worker chooses his level of effort *e* (which is in monetary units) to maximize $\lambda\pi_S(\bar{z}) - e$.

(iv.b) After they separate, the entrepreneur and worker first negotiate over whether the worker will continue to produce and supply the specialized input. If they agree, the worker supplies the specialized input to the entrepreneur at marginal cost μ and receives a transfer. If they disagree, the worker does not produce the specialized input and the entrepreneur must produce it himself at marginal cost $\hat{\mu} > \mu$.[14] The entrepreneur then produces the final good and the worker produces the generic input, choosing effort to maximize $\pi_S(\bar{z}) - e$.

Let us label the values of the variables associated with the separation or spinout branch and associated with the together or internal branch *OUT* and *IN*, respectively. It is easy to show that, as long as $\lambda < 1$, the worker will choose greater effort when he separates from the entrepreneur, yielding greater profit net of effort from sales of the generic input:

$$e^{OUT} > e^{IN} \text{ and } \pi_S^{OUT}(\bar{z}) - e^{OUT} > \pi_S^{IN}(\bar{z}) - e^{IN}.$$

Here we compute $\pi_S(\bar{z})$ using equation (5), and therefore implicitly assume that $\mu_H(e^{OUT}) < \mu_H(e^{IN})$ both satisfy $\mu_H^*/\tau_H < \mu_H < \tau_H\mu_H^* < \mu_H/\rho_H$.

At the end of the separation branch the entrepreneur earns $\pi_H(z, \bar{z}) - t(z,\bar{z})$ and the worker earns $\pi_S^{OUT}(\bar{z}) - e^{OUT} - x + t(z,\bar{z})$. Denoting by $\hat{\pi}_H(z,\bar{z})$ the profit earned by the entrepreneur from the final good when $\hat{\mu}$ is substituted for μ in equation (3), it is

[14] We continue to assume that the worker has no effort choice when he supplies the specialized input, i.e., there is only one effort choice that permits coordination with production of the final good, so any other effort choice is equivalent to failure to produce the specialized input (disagreement with the entrepreneur). When the entrepreneur takes over management of production of the specialized input from the worker we assume he is less efficient because his time is less specialized to this task.

easily shown that $t(z,\bar{z}) = \lambda\big(\pi_H(z,\bar{z}) - \hat{\pi}_H(z,\bar{z})\big)$. In contrast, at the end of the together branch the entrepreneur earns $\pi_H(z, \bar{z}) + (1-\lambda)\pi_S^{IN}(\bar{z})$ and the worker earns $\lambda\pi_S^{IN}(\bar{z}) - e^{IN}$. With efficient bargaining, therefore, separation will occur if and only if x satisfies:[15]

$$x < (\pi_S^{OUT}(\bar{z}) - e^{OUT}) - (\pi_S^{IN}(\bar{z}) - e^{IN}).$$

At the point where the entrepreneur and worker decide whether to separate, if they agree each must receive his threat point (his earning at the end of the separation branch) plus his share of the surplus from agreement. It follows that the entrepreneur receives

$$\pi_H(z,\bar{z}) - t(z,\bar{z}) + (1-\lambda)(x + (\pi_S^{IN}(\bar{z}) - e^{IN}) - (\pi_S^{OUT}(\bar{z}) - e^{OUT}))$$

and the worker receives

$$\pi_S^{OUT}(\bar{z}) - e^{OUT} - x + t(z,\bar{z}) + \lambda(x + (\pi_S^{IN}(\bar{z}) - e^{IN}) - (\pi_S^{OUT}(\bar{z}) - e^{OUT})).$$

Comparing these earnings to the earnings at the end of the together (a) branch, we see that the entrepreneur must make a transfer $t^{(a)}(x,z,\bar{z})$ to the worker given by

$$t^{(a)}(x,z,\bar{z}) = t(x) + t(z,\bar{z}), \quad t(x) \equiv (1-\lambda)((\pi_S^{OUT}(\bar{z}) - e^{OUT}) + e^{IN} - x).$$

This transfer must be nonnegative in order to satisfy the liquidity constraint of the worker.[16] For this constraint to always be satisfied, it is sufficient that $t(\bar{x}) \geq 0$, or

$$\bar{x} \leq (1-\lambda)((\pi_S^{OUT}(\bar{z}) - e^{OUT}) + e^{IN}).$$

[15] Since the separation decision is efficient, we do not expect a high quality producer to be more or less likely to remain vertically integrated in a more versus less developed country, conditional on entry. Greater availability of specialized product design firms, however, may lead more high quality producers in developed countries to enter without ever being vertically integrated.

[16] If the worker is forced to buy out the entrepreneur along the separation branch, the transfer will be negative. This means that it is not straightforward to solve for the impact of a policy that assigns property rights in the spinout to the entrepreneur, and indeed we expect such a policy to lead to inefficient bargaining outcomes given the liquidity constraint (though these outcomes could be more efficient from the point of view of society).

We are free to choose $\bar{x}$ small enough to ensure that this condition holds.

We can now compute the expected profits for an entrepreneur with talent *z* who decides to enter production of high quality final goods:

$$\Pi_H(z,\bar{z}) = \pi_H(z,\bar{z}) - t(z,\bar{z}) + \int_{\hat{x}}^{\bar{x}} ((1-\lambda)\pi_S^{IN}(\bar{z}) - t(x))dY(x)$$

where

$$\hat{x} = (\pi_S^{OUT}(\bar{z}) - e^{OUT}) - (\pi_S^{IN}(\bar{z}) - e^{IN})$$

is the cost to the worker of starting his own business that makes the entrepreneur and worker exactly indifferent between separating and staying together. $\Pi_H(z,\bar{z})$ can be compared to the social benefit from entry of an entrepreneur with talent *z* into production of high quality final goods:

$$\tilde{\Pi}_H(z,\bar{z}) = \pi_H(z,\bar{z}) + \int_0^{\hat{x}} (\pi_S^{OUT}(\bar{z}) - e^{OUT} - x)dY(x) + \int_{\hat{x}}^{\bar{x}} (\pi_S^{IN}(\bar{z}) - e^{IN})dY(x).$$

The key difference between $\tilde{\Pi}_H(z,\bar{z})$ and $\Pi_H(z,\bar{z})$ is the second term of these expressions. The second term of $\tilde{\Pi}_H(z,\bar{z})$ gives the expected net profit from the spinout, which is completely lost to the entrepreneur, whereas the second term of $\Pi_H(z,\bar{z})$ gives the transfer the spinout is able to extract from the entrepreneur, which is a wash from the point of view of society. In contrast, the difference between the third terms of $\tilde{\Pi}_H(z,\bar{z})$ and $\Pi_H(z,\bar{z})$ reflects the need for the entrepreneur to motivate the worker to stay with his firm and exert effort. This is not a special vulnerability of vertically integrated firms and we would not want to build a case for suboptimal entry into high quality final goods production around it.

We can now prove the main welfare result of the paper, followed by a series of corollary results.

Proposition 3: $\bar{z} > \tilde{z}$: equilibrium entry into high quality final goods production is below the social optimum, and the difference is amplified by the multiplier effect described after Proposition 1. This proposition can be proven by substituting $\Pi_H(\bar{z}, \bar{z})$ for $\pi_H(\bar{z}, \bar{z}) + \pi_S(\bar{z})$ in equation (8), solving for $\bar{z}$, and repeating the exercise substituting $\tilde{\Pi}_H(\tilde{z}, \tilde{z})$ instead and solving for $\tilde{z}$.

Corollary 1: The equilibrium local content of exports (*LCE*) is below the socially optimal level. This can be proved by substituting the result from Proposition 3 into equation (9).

Corollary 2: The equilibrium "missing middle" in the distribution of firm sizes is larger than the socially optimal level. This follows immediately from Proposition 3, provided that the difference in profits earned from sales of high versus low quality final goods, evaluated at a given level of managerial talent and gross of fixed costs, translates into a difference in firm "size." This is more clear if firm size is measured by output or revenue than if it is measured by employment, because high quality final goods producers could be more capital intensive. The LDC data surveyed by Tybout (2000, p. 16) measure firm size by employment, with medium-sized plants (10-49 workers) accounting for as little as one percent of total employment. On the other hand, if input subsidiaries operate in separate plants, they may themselves contribute to the ranks of medium-sized plants, which strengthens the connection between our results and the data.

Corollary 3: The equilibrium (measure of the) number of entrepreneurs is lower than the socially optimal number. This does not follow immediately from Proposition 3, because the number of entrepreneurs in final goods production is actually determined by $\underline{z}$, the cutoff level of managerial talent for entry into low quality final goods production. However, more entry into low rather than high quality final goods production implies fewer subsidiaries producing intermediates, hence fewer spinouts and a lower total number of entrepreneurs.

4. Spinouts with cronies

In this section, we will analyze what happens when the skilled worker is a member of the entrepreneur's social network and when he is a member of the entrepreneur's family. Since we will consider the entrepreneur's family to be a strict subset of his social network, we will analyze the family worker case second.

Collective sanctioning of deviant business behavior is typically analyzed in a repeated games framework (e.g., Greif 1993). To work within our static model, we instead emphasize immediate punishments such as social ostracism (e.g., exclusion from industry association banquets). In our model, the deviant action taken by the worker is refusing to supply the entrepreneur with the specialized input after he has spun out (in contrast to the spinout decision itself, which is efficient and mutual). Let us denote the collective punishment imposed on the worker, measured in monetary units, by $\zeta < \lambda\left(\pi_H(\underline{z},\bar{z}) - \hat{\pi}_H(\underline{z},\bar{z})\right)/(1-\lambda)$. It is easily shown that the transfer from the entrepreneur to the worker then falls to $\lambda\left(\pi_H(z,\bar{z}) - \hat{\pi}_H(z,\bar{z})\right) - (1-\lambda)\zeta$, where our restriction on ζ ensures that the transfer is positive for any entrepreneur engaged in high quality production.

The results summarized in Proposition 4 follow immediately:

Proposition 4: When all entrepreneurs and workers are part of the same social network, then compared to its absence (i) entry into high quality final goods production is higher, and the difference is amplified by the multiplier effect described after Proposition 1; (ii) the local content of exports (*LCE*) is higher; (iii) the "missing middle" in the distribution of firm sizes is smaller; and (iv) the (measure of the) number of entrepreneurs is higher.

Note that the social network produces a higher volume of entrepreneurship not because of a higher propensity to spin out (that remains the same) but because there are more high quality firms from which to spin out.[17]

We now consider the case in which the skilled worker is not merely a member of the entrepreneur's social network but a member of his family. We define a family firm as a firm in which the entrepreneur is characterized by one-sided altruism towards the worker. We measure the strength of that altruism by θ and denote family firm variables

[17] This conclusion must be qualified if the social network also reduces the costs to the workers of starting their own businesses, which is the impact of networks emphasized by Gompers et al. (2005) in the U.S. context. This implies a first-order stochastically dominated distribution of *x*, generating a higher propensity to spin out but a lower rate of entry into high quality final goods production, with an ambiguous net effect on the volume of entrepreneurship.

by a subscript *f*. Since agents are risk-neutral, we can write the entrepreneur and worker utilities as

$$U_E = I_E + \theta U_W\ ,\ U_W = I_W\ ,$$

where *E* denotes entrepreneur, *W* denotes worker, *U* is utility, and *I* is income. We assume $0 < \theta < 1\text{-}\lambda$, $U_W = U_{Wf}$; $\theta = 0$ otherwise. It is as though the entrepreneur has an equity contract with the family worker that gives him a share θ of the worker's profits, yet this contract costs the worker nothing and is self-enforcing.

We next use the generalized Nash bargaining solution to find the division between the entrepreneur and the worker of the profit $\pi_S(\bar{z})$ from generic input production at the end of the together branch. We solve:

$$\text{Max}\{I_E\ ,I_{Wf}\}\ \ (I_E + \theta I_{Wf})^{1\text{-}\lambda}(I_{Wf})^{\lambda}\ \ \text{s.t.}\ I_E + I_{Wf}\ = \pi_S(\bar{z}),$$

where the disagreement points at the end of the together branch are zero. This yields $I_{Wf} = [\lambda/(1\text{-}\theta)]\pi_S(\bar{z})$ and $I_E = [1 - \lambda/(1\text{-}\theta)]\pi_S(\bar{z})$. We see that the family worker receives a larger share of the profit than the non-family worker, and will therefore supply more effort along the together branch. The entrepreneur and family worker divide the total profit from staying together by solving the same problem, except that now their threat points are given by their utilities evaluated at the incomes earned when they separate. It can be shown that the solution for the together incomes is the same as for non-family firms, substituting $\lambda/(1\text{-}\theta)$ for λ. It follows that family firms stay together or separate based on the same comparison of total incomes that non-family firms make. However, total income along the together branch is greater because the family worker supplies more effort, and total income along the separation branch is the same, so the family worker is less likely to spin out:

Proposition 5: The entrepreneur and family worker will stay together for a lower draw of *x* than would the entrepreneur and non-family worker.

We can now compute the total expected utility for an entrepreneur with talent *z* who enters high quality final goods production and hires a family worker of ability equal to that of the best available workers:[18]

$$\Pi_{Hf}(z,\bar{z}) = \pi_H(z,\bar{z}) - t(z,\bar{z}) + (1-\lambda)\zeta + \int_0^{\hat{x}_f} \theta(\pi_S^{OUT}(\bar{z}) - e^{OUT} - x)dY(x)$$
$$+\int_{\hat{x}_f}^{\bar{x}} (\theta(\pi_S^{OUT}(\bar{z}) - e^{OUT} - x) + (1-\lambda)(\pi_{Sf}^{IN}(\bar{z}) - e_f^{IN} - (\pi_S^{OUT}(\bar{z}) - e^{OUT} - x)))dY(x)$$

The difference between this expected utility and the expected utility (profit) of the same entrepreneur when he hires a non-family worker within his social network can be shown to equal

$$\Pi_{Hf}(z,\bar{z}) - \Pi_H(z,\bar{z}) = \int_0^{\bar{x}} \theta(\pi_S^{OUT}(\bar{z}) - e^{OUT} - x)dY(x)$$
$$+\int_{\hat{x}_f}^{\hat{x}} (1-\lambda)(\pi_{Sf}^{IN}(\bar{z}) - e_f^{IN} - (\pi_S^{OUT}(\bar{z}) - e^{OUT} - x))dY(x) + \int_{\hat{x}}^{\bar{x}} (1-\lambda)(\pi_{Sf}^{IN}(\bar{z}) - e_f^{IN} - (\pi_S^{IN}(\bar{z}) - e^{IN}))dY(x).$$

The first term is the extra utility the entrepreneur gets from having an altruistic "equity stake" in the spinout of the family worker. The second and third terms reflect the additional profit earned by the entrepreneur because the family worker supplies more effort.

However, the total expected utility for an entrepreneur with talent *z* who hires a family worker of ability equal to that of the best available workers still falls short of even

[18] The upper bound $\bar{x}$ still ensures a non-negative transfer from the entrepreneur to the family worker because the family worker has, in effect, a greater bargaining weight than the non-family worker.

the observed total expected profit generated by his entry into high quality final goods production. The latter is given by

$$\tilde{\Pi}_{Hf}(z,\bar{z}) = \pi_H(z,\bar{z}) + \int_0^{\hat{x}_f} (\pi_S^{OUT}(\bar{z}) - e^{OUT} - x)dY(x) + \int_{\hat{x}_f}^{\bar{x}} (\pi_{Sf}^{IN}(\bar{z}) - e_f^{IN})dY(x).$$

The difference between this expected profit and the expected utility obtained by this entrepreneur is given by

$$\begin{aligned}\tilde{\Pi}_{Hf}(z,\bar{z}) - \Pi_{Hf}(z,\bar{z}) &= t(z,\bar{z}) - (1-\lambda)\zeta + \int_0^{\hat{x}_f} (1-\theta)(\pi_S^{OUT}(\bar{z}) - e^{OUT} - x)dY(x) \\ &+ \int_{\hat{x}_f}^{\bar{x}} (\lambda(\pi_{Sf}^{IN}(\bar{z}) - e_f^{IN}) + (1-\lambda-\theta)(\pi_S^{OUT}(\bar{z}) - e^{OUT} - x))dY(x)\end{aligned}.$$

The first two terms equal the net transfer from the entrepreneur to the worker in response to the latter's threat to withhold the specialized input when he spins out. The third term reflects the fact that the entrepreneur does not value profits received by the family worker as highly as profits received by himself, and the fourth term reflects the need for the entrepreneur to share the profits from the input division with the worker even when the entrepreneur and worker stay together.

We can now state

Proposition 6: The cutoff level of talent for an entrepreneur to enter high quality final goods production is lower when he can hire a family worker of ability equal to that of the best available workers, but not as low as it would be if he could capture all of the observable profits generated by his entry.

We next consider the possibility that the best family worker available to the entrepreneur has ability lower than that of the best available non-family workers. It is then easy to show that the profitability of observed family firms can be lower as well as higher than the profitability of non-family firms. Assume that lower worker ability raises the marginal costs of production for both the specialized and generic inputs, thereby lowering profits from both the final and intermediate goods divisions of the firm. Might the entrepreneur hire a family worker even if this effect more than offsets the positive effect on profits from greater worker effort? The answer is yes, because the entrepreneur still gets the term

$$\int_0^{\bar{x}} \theta(\pi_S^{OUT}(\bar{z}) - e^{OUT} - x)dY(x)$$

which he does not obtain when he hires a non-family worker. Ironically, it is the unobserved ability of the family firm to capture the profits from spinouts that can cause the observed profitability of a family firm to be lower than that of an otherwise comparable non-family firm.[19]

Finally, it is easy to show that entry into high quality final goods production by family firms will be more common in industries where input subsidiaries are more profitable (because, for example, import competition is weak). This result follows from the fact that the "extra" term in the entrepreneur's utility when he hires a family rather than non-family worker is increasing in subsidiary profitability. Therefore, when subsidiary profitability rises, the entrepreneur's utility when he hires within the family increases more than his utility when he hires outside the family:

Proposition 7: An increase in the price for which domestically produced generic inputs are sold will increase the difference in ability between a family and non-family worker that an entrepreneur is willing to accept when entering high quality final goods production.

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[19] Clearly profits of the family firm can be lower along the together branch, which is the branch along which the econometrician typically observes the firm. If the econometrician observes the profits of business groups into which spinouts have been incorporated, the same argument demonstrates that the profits of family business groups may be higher or lower than those of non-family business groups until the death of the original entrepreneur, after which profits of family business groups must be (weakly) lower because the (weakly) lower ability of family workers will no longer be offset by their higher effort.

5. Implications for Policy [in process]

Rodrik (1995) recognized the value of vertical business groups in overcoming the problem of "coordination failure" between buyers and suppliers that in his view prevented countries with potential comparative advantage from moving into production and export of higher quality, higher technology manufactured goods. He describes preferential treatment given to these groups by the governments of Korea and Taiwan. Our model helps to understand the market failures that motivated such policies, at least for the founding firms, and also the concentration on certain families.

6. Conclusions [in process]

We have at several points in this paper implied that spinouts lead to the formation of business groups, particularly family business groups. However, a key feature of business groups is internal capital markets and especially equity holdings of the lead firm in the subordinate firms (Khanna and Yafeh 2007). Given the intimate knowledge the parent firm has of the spinout in our model, it would be natural for the spinout to turn to the parent rather than an external bank to meet its financing needs. From there it seems a small step to equity holdings by the parent in the spinout, which in family business groups could replace the ties of affect that vanish with the death of the founder.[20] Future research should include formal modeling of this process and empirical investigation of its frequency.

[20] When restrictive employment covenants such as non-competes are enforced (or the spinout violates patent laws that are enforced), the parent firm may accept equity in the spinout as compensation. This mode of formation of business groups is therefore not restricted to a less developed country context. For evidence on the importance of internal capital markets for European business groups, see Belenzon and Berkovitz (2008).

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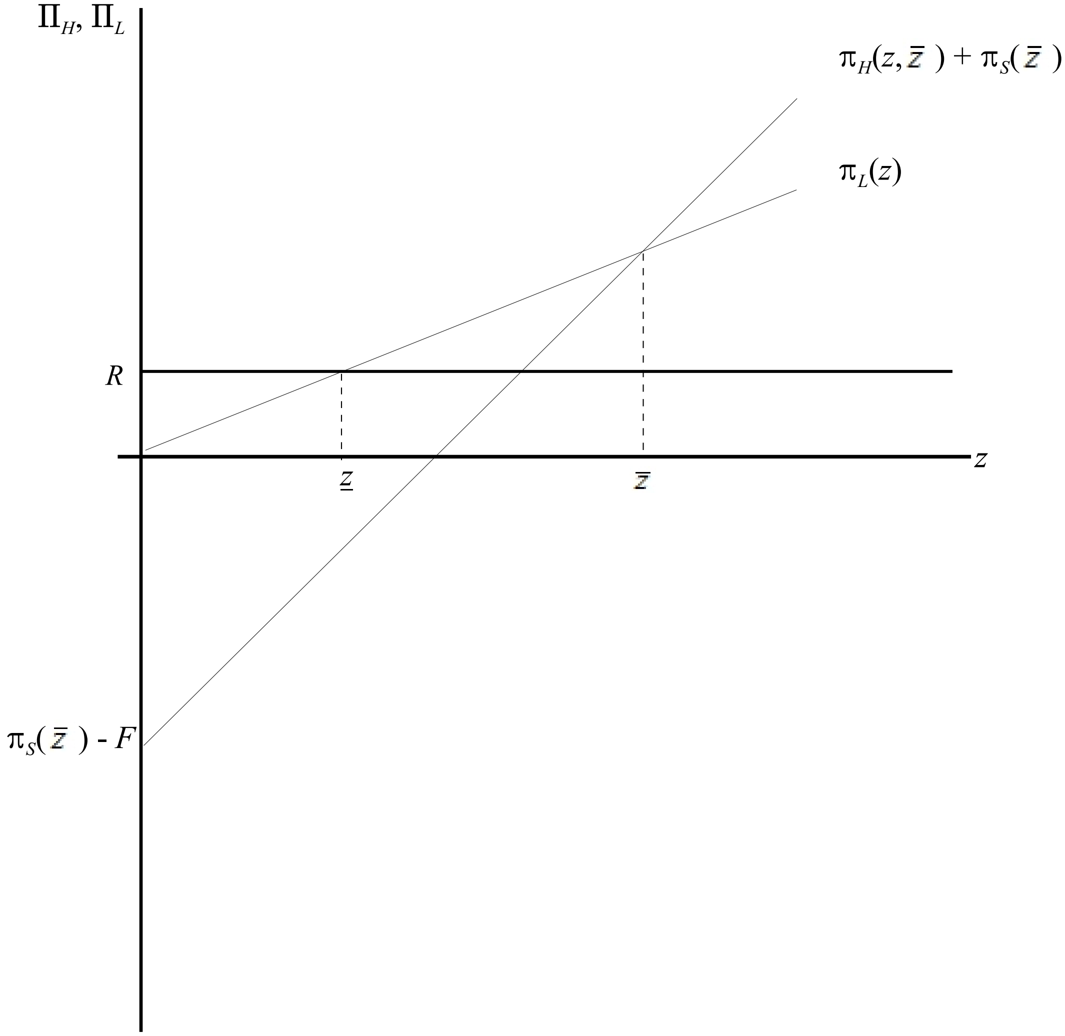

Figure 1: Determination of cutoff levels of entrepreneurial talent