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Courts

Drawing from Anderlini et al (2007), we model the operation of courts by defining different sets within Γ: (i) a set of verifiable events, so that binding legal contracts can be written conditional on them; (ii) a set of unforeseen events in which contracts are nevertheless upheld, so that agents are obliged to fulfill some contractual obligations (despite the fact that the realized state of nature was not contemplated in the contract); and (iii) a set of unforeseen events in which courts void the contract.

As before, assume that $\gamma \sim U(0,1)$, but, in addition, suppose that there are values $\underline{\theta} \leq \overline{\theta}$ between 0 and 1 defining the sets described in the previous paragraph. So $\gamma \in [0, \underline{\theta}]$ stand for the states of nature that can be contracted upon ex-ante, $\gamma \in (\underline{\theta}, \overline{\theta}]$ denotes states of nature under which there are unforeseen contingencies – not described in the contract – but nevertheless the contract is upheld by courts, while $\gamma \in (\overline{\theta}, 1]$ denotes states of nature with such extreme unforeseen contingencies that courts void the contractual obligations. We call $\underline{\theta}$ the degree of contractibility and $(\overline{\theta} - \underline{\theta})$ the degree of contract enforcement.

Also following Anderlini et al (2007), we go one step further in describing the structure of uncertainty in this economy. Assume that

$$v(\gamma) = \begin{cases} v_H(\gamma) = v_N + f(\gamma), \text{ with probability}\, q, \text{ and} \\ v_L(\gamma) = v_N - g(\gamma), \text{ with probability } 1-q, \end{cases}$$

where $\frac{\partial f(\cdot)}{\partial \gamma} > 0$ and $\frac{\partial g(\cdot)}{\partial \gamma} > 0$, and $qf(\gamma) - (1-q)g(\gamma) = 0$, so that the expected value of $v(\gamma)$ is v_N for any value of γ. Given that $v(\gamma) - c(\gamma) = \Delta$, this implies that $c(\gamma) = c_H(\gamma) = v_N + f(\gamma) - \Delta$ with probability q, and $c(\gamma) = c_L(\gamma) = v_N - g(\gamma) - \Delta$ with probability $1-q$.[1]

Finally, we assume that although γ is verifiable by courts, $v(\gamma)$ and $c(\gamma)$ are not, although observed privately.

[1]We could introduce assumptions related to the values of $f(\cdot)$ and $g(\cdot)$ when γ is close to 0 or 1, in order to limit the potential gains and losses of the agents. But this is not essential in the discussion that follows.

The motivation for this structure is that, even though the expected values of the gains and losses are constant, uncertainty increases with higher values of γ. One can therefore think of realizations of γ within the $[0, 1]$ interval as indexing increasingly high levels of uncertainty. The higher the γ, the higher the probability of extreme outcomes for either agent.

The description of the operation of courts in this setting tries to capture the following features. First, there are normal circumstances, under which all relevant contingencies are described in the contract so that contract terms are always valid and enforced ($\gamma \in [0, \underline{\theta}]$). But as the level of uncertainty increases in the economy, it becomes increasingly difficult for all contingencies to be described explicitly in the contract and for the court to recognize all relevant states of nature. So there are certain states of nature that courts do not understand entirely, but that they recognize as being "not too far" from normal conditions ($\gamma \in (\underline{\theta}, \overline{\theta}]$). In these situations, courts enforce the obligations established in the contract for the scenario "closest" to the realized one. Finally, there are states of nature that courts do not understand entirely, but that they know may imply such high levels of uncertainty and such extreme outcomes that they excuse both parties from further obligations associated with the contract ($\gamma \in (\underline{\theta}, 1]$).[2]

Specifically, we assume that for $\gamma \leq \underline{\theta}$ courts observe the realization of γ and whether the outcome was $v_L(\gamma)$ or $v_H(\gamma)$, so that a contract with the relevant contingencies can be written. For $\gamma > \underline{\theta}$, courts only observe whether γ was in the $(\underline{\theta}, \overline{\theta}]$ or in the $(\underline{\theta}, 1]$ interval. If γ was in the $(\underline{\theta}, \overline{\theta}]$ interval, courts oblige agents to stick to the average contractual obligations associated with $\underline{\theta}$. If γ was in the $(\underline{\theta}, 1]$ interval, courts excuse agents from further contractual obligations.

Since verifiable contingencies are perfectly contractible and gains from trade are always constant, we assume that $f(\gamma) = g(\gamma) = 0, \forall \gamma \in [0, \underline{\theta}]$. This is equivalent to the hypothesis that, under normal circumstances, there is no underlying uncertainty in the economy. From this perspective, uncertainty related to costs and values would only appear for exceptional states indicated by $\gamma > \underline{\theta}$, and the variance of the outcome would increase with the distance between a given non-verifiable state and $\underline{\theta}$ (that is, states of nature further away from contractible ones would be riskier). A motivation for this structure is related to parties' inability to ex-ante settle about realizations that substan-

[2]Anderlini et al (2007) are mainly concerned with the optimal design of courts. In our model, the problem they address would be equivalent to the optimal choice of $\overline{\theta}$. We do not deal with the optimal design of courts here. We take the behavior of courts as given, as an institutional attribute of this economy, and analyze their impact on occupational choices and investment.

tially depart from the "normal" ones. In order to greatly simplify the problem, we maintain this assumption throughout the paper.

In our theory $\underline{\theta}$ and $\overline{\theta}$ are known and constant. Motivation for this comes from common knowledge built upon jurisprudence, although our results do not rely on that particular assumption.[3] Clearly, complete contracts correspond to $\underline{\theta} = \overline{\theta} = 1$ and absence of contractibility corresponds to $\underline{\theta} = \overline{\theta} = 0$. Any intermediate case with $\underline{\theta} = \overline{\theta}$ displays unidimensional courts, that is, courts that only recognize contracts under the particular state of nature for which they were written. The bidimensional case ($\underline{\theta} < \overline{\theta}$) illustrates courts that, in addition, arbitrate trade gains under some contingencies that were not specified in the contract.[4]

In contrast to the complete contracts framework, the entrepreneur can no longer perfectly insure the risk-averse supplier under this setting, once the latter is bound to experience payoff fluctuations in any exceptional state of nature. We now describe the occupational equilibrium under different distributions of ex-post bargaining power.

3.1 Entrepreneur with Ex-post Bargaining Power

Under this setting, the supplier's expected utility is defined as[5]

$$U_S(t, p(\gamma)) = \int_0^{\underline{\theta}} V\left(t + p(\gamma) - c(\gamma)\right) \, d\gamma + \int_{\underline{\theta}}^{\overline{\theta}} V\left(t + p_{ruled} - c(\gamma)\right) \, d\gamma + \int_{\overline{\theta}}^{1} V(t - c(\gamma)) \, d\gamma, \tag{3.1}$$

where the first term refers to the verifiable and contractible states of nature, the second term refers to non-verifiable contingencies for which the contract is upheld, and the last term refers to states of nature for which the contract is voided. We assume that, once the contract is voided, previous transfers cannot be reclaimed.

When the entrepreneur holds the bargaining power, if there is renegotiation, the supplier can only appropriate the ex-ante transfer, so his payoff is $V(t - c(\gamma))$ whenever $\gamma > \overline{\theta}$. With the assumption introduced before that

[3] Obviously, in reality, the specific points $\underline{\theta}$ and $\overline{\theta}$ are not clearly defined. But we do think that the model captures the essence of the problem: that there are some exceptional states of nature that courts tend to consider not to be too exceptional, so that contractual obligations are maintained, and that there are some states of nature that courts do consider truly exceptional, so that contracts are voided.

[4] We model courts with no room for breach compensation, that is, neither party can enjoy excused performance by paying a fine. Alternatively, it is equivalent to setting this fine equal to infinity.

[5] In order to save space, we abuse the notation and do not write explicitly the uncertaity associated with states L and H for each γ. So, for example, when we should write $\int_{\overline{\theta}}^{1} [qV(t - c_H(\gamma)) + (1-q)V(t - c_L(\gamma))] \, d\gamma$, instead we simply write $\int_{\overline{\theta}}^{1} V(t - c(\gamma)) \, d\gamma$.

$f(\gamma) = g(\gamma) = 0 \quad , \quad \forall \gamma \in [0, \underline{\theta}]$, and taking p_{ruled}, the price imposed by courts under unforeseen contingencies for which the contract is upheld, to be equal to the average price under contractible states of nature ($p_{ruled} = E[p]$) [6], we can rewrite the supplier's objective function as:

$$U_S(t,p) = \int_0^{\underline{\theta}} V\left(t + p - c_N\right) d\gamma + \int_{\underline{\theta}}^{\overline{\theta}} V\left(t + p - c(\gamma)\right) d\gamma + \int_{\overline{\theta}}^{1} V\left(t - c(\gamma)\right) d\gamma, \tag{3.2}$$

where only the second and third terms depend on γ.

Analogously, the expected utility of an entrepreneur can be written as

$$\begin{aligned} U_E(t,p) \quad = \quad & \int_0^{\underline{\theta}} (v_N + R(e) - p - w)\, d\gamma + \int_{\underline{\theta}}^{\overline{\theta}} (v(\gamma) + R(e) - p - w)\, d\gamma + \\ & \int_{\overline{\theta}}^{1} (v(\gamma) + R(e) - w)\, d\gamma - t - e. \end{aligned}$$

Using the fact that $\int_A v(\gamma)\, d\gamma = v_N$, $\forall A \subseteq \Gamma$, it follows that

$$U_E(t,p) = v_N - \overline{\theta} p - t - w + R(e) - e. \tag{3.3}$$

The optimal contract in this context is the pair (t, p) that maximizes entrepreneur's expected gain, conditional on supplier's participation, on entrepreneur's participation, and on the optimal investment level e^*. Formally,

$$\begin{aligned} & \max_{\{t,p\}} U_E(t,p) \\ \text{s.t. } U_S(t,p) \quad & \geq \quad V(r), \\ U_E(t,p) \quad & \geq \quad w, \text{ and} \\ e^* \quad & = \quad \min\{a_i - t, R'^{-1}(1)\}, \end{aligned}$$

where the outside options are given by the payoffs agents enjoy outside the relationship.

Unconstrained Entrepreneur

Appendix 6.3.1 solves the problem above for the unconstrained individual, who invests the optimal amount $R'^{-1}(1)$ in the project. It is intuitive to see that, for this individual, very little can be generally said about t and p. Since the absence of perfect contractibility stops the entrepreneur from providing full insurance to the supplier, t and p are used to play part of this role, even

[6] This can also be interpreted as $p_{ruled} = E[p(\underline{\theta})]$, the average price for the closest verifiable contingency, which is also the average price p. Without the simplifying assumption, setting $p(\underline{\theta})$ would be a separate strategic problem, in addition to the choice of the other values of $p(\gamma)$ and t.

though imperfectly because of the presence of $\underline{\theta}$ and $\overline{\theta}$. So, for example, if $\overline{\theta}$ is small, so that the supplier is subject to substantial uncertainty in relation to the probability of receiving p, he will demand an increased t ex-ante to compensate for this higher probability. In reality, given supplier's lower payoff on account of p not being paid associated with the states of nature with measure $(1 - \overline{\theta})$, if $\overline{\theta}$ is sufficiently small and $\underline{\theta}$ is close enough to $\overline{\theta}$, the optimal contract may establish $t > 0$ and $p < 0$, as a way for the supplier to transfer resources from states of nature with probability $\overline{\theta}$ to states of nature with probability $(1 - \overline{\theta})$, so as to mimic an insurance mechanism. This claim is proved in the appendix, together with the claim that, if $\overline{\theta}$ is large enough, p might be positive and t tends to be smaller. The general characterization of the solution for unconstrained individuals can be summarized by the following condition:

$$U_S(t^*, p^*) = V(r). \tag{3.4}$$

The expression above simply states that the participation constraint of the supplier must be binding in equilibrium. The intuition for this result is simple, since the supplier's payoff is increasing on t and p, while the entrepreneur's is decreasing. It is hard to provide a general assessment of the choice of p for the unconstrained entrepreneur. It might be either positive or negative, contingent on the specific parameters of courts' operation (see Appendix 6.3.1 for details). This follows from the condition of partial insurance, since the risk-neutral entrepreneur will try to minimize the variance of the payoff of the risk-averse supplier. As perfect insurance is no longer possible – suppliers cannot avoid payoff fluctuations under non-verifiable states of nature – and the supplier has decreasing absolute risk aversion, the conditions stated above must hold.

Constrained Entrepreneur

Though interesting on its own, the previous discussion does not shed much light on the impact of verifiability and contract enforcement on entrepreneurship and investment. This is so because the discussion refers to an inframarginal individual. The key to understand how the operation of courts affects the occupational structure of the economy is the marginal individual. This is an individual who does not have enough wealth to invest optimally in the project and is indifferent between being an entrepreneur and a salaried worker. Appendix 6.3.2 derives the results for this case. Here, we just discuss the main implications of these results.

The key difference between the optimal contract design when comparing an unconstrained and a constrained entrepreneur is that, in the case of the constrained entrepreneur, a higher ex-ante transfer is associated with a lower ex-ante investment. So the constrained entrepreneur is willing, to some extent, to reduce t and increase p in order to increase expected gains. But this is not free: reducing t and increasing p in relation to the unconstrained individual implies moving the supplier further away from an ideal insurance position. So, in order to compensate the supplier, the expected value of the increase in p has to be larger than the expected value of the reduction in t. This implies that constrained entrepreneurs are generally willing to explore some of this trade-off, but that this is not enough to guarantee that optimal investment is achieved.

Typically, less than half of the population become entrepreneurs and the wage rate is given by $\underline{w}$.[7] The marginal entrepreneur is then determined by the wealth level $\widetilde{a}_i$ for which $v_N - \overline{\theta}p^* + R(\widetilde{a}_i - t^*) - \widetilde{a}_i = 2\underline{w}$, where t^* and p^* solve the optimal contract problem. Given that it is costly for constrained individuals to reduce t^* in order to finance ex-ante investments, if the individual with initial wealth $\widetilde{a}_i$ is the marginal entrepreneur, all individuals with wealth $a_i > \widetilde{a}_i$ are also entrepreneurs.

3.2 Supplier with Ex-post Bargaining Power

When suppliers hold ex-post bargaining power, a supplier's expected utility is given by

$$U_S(t,p) = \int_0^{\underline{\theta}} V\left(t + p - c_N\right) d\gamma + \int_{\underline{\theta}}^{\overline{\theta}} V\left(t + p - c(\gamma)\right) d\gamma + \int_{\overline{\theta}}^{1} V\left(t + \Delta + R(e) - w - \underline{w}\right) d\gamma. \tag{3.5}$$

, where we have already substituted for $p_{ruled} = E[p]$ in the second integral. The last integral denotes states of nature where contracts are not enforced and, since the supplier holds the bargaining power, he extracts all the surplus from the entrepreneur, leaving the latter with his ex-post outside option ($\underline{w}$).

Analogously, the expected return to entrepreneurship can be written as:

$$U_E(t,p) = \int_0^{\underline{\theta}} (v_N + R(e) - p - w)\, d\gamma + \int_{\underline{\theta}}^{\overline{\theta}} (v(\gamma) + R(e) - p - w)\, d\gamma + \int_{\overline{\theta}}^{1} \underline{w}\, d\gamma - t - e$$

Or, in simpler form:

$$U_E(t,p) = \overline{\theta}(v_N + R(e) - p - w) + (1 - \overline{\theta})\underline{w} - t - e. \tag{3.6}$$

[7] If wealth is large enough for a sufficiently large fraction of the population, then there are no constrained individuals and half the population become entrepreneurs. See the appendix 6.3.2 for a brief description of this equilibrium.

The maximization problem determining the optimal contract is then given by[8]

$$\begin{aligned} &\max_{\{t,p\}} U_E(t,p) \\ \text{s.t.: } & U_S(t,p) \geq V(r), \\ & U_E(t,p) \geq w, \text{ and} \\ e^*(\overline{\theta}) = & \min\left\{a_i - t, R'^{-1}\left(\frac{1}{\overline{\theta}}\right)\right\}. \end{aligned} \tag{3.7}$$

Unconstrained Entrepreneur

Appendix 6.4.1 presents the solution for this problem when entrepreneurs are unconstrained, so that investment is set to its optimal level ($e^* = R'^{-1}\left(\frac{1}{\overline{\theta}}\right)$). Here we only discuss the main features and intuition of the solution, as well as its implications. As before, if one is willing to characterize the optimum structure of ex-post payments in further detail by assuming decreasing absolute risk-aversion, two conditions characterize the optimal contract:

$$p^* \geq v_N + R(e^*) - w - \underline{w} \text{ and } t^* \leq 0.$$

The result for p^* is somewhat counterintuitive. It means that the ex-post payment from entrepreneurs makes the expected value of gains to suppliers larger in states of nature where the contract is upheld, as compared to states of nature where the supplier appropriates all the ex-post surplus. This seemingly contradictory result comes, once more, from the role that t and p play in trying to insure suppliers from marginal utility variations (together with the restrictions imposed by the participation constraints).

Ex-ante, suppliers want to transfer resources from the states of nature where surplus is appropriated (probability $(1 - \overline{\theta})$) to other states. The way to do it is to set a high p and a negative t. Since there is residual uncertainty regarding $c(\gamma)$ in the intermediary states where contingencies are non-verifiable but contracts are upheld (probability $(\overline{\theta} - \underline{\theta})$), the force towards equalizing expected marginal utilities across states leads to $p^* \geq v_N + R(e^*) - w - \underline{w}$.

This is clearly illustrated in the case where $\overline{\theta} = \underline{\theta}$. Under this circumstances, first order conditions for the optimal contract problem imply that $p^* = v_N + R(e^*) - w - \underline{w}$. Supplier's participation constraint, in turn, implies $t^* = r - \Delta - R(e^*) - w - \underline{w} < 0$, where the inequality comes from the fact that,

[8]From the objective function of the entrepreneur, it is immediate to see that the interior solution for optimal investment in this case is characterized by $\overline{\theta}R'(e) = 1$, so that $e^* = R'^{-1}(\frac{1}{\overline{\theta}})$.

by assumption, the project increases social surplus. In this case, the supplier is able to fully insure against marginal utility variations. In the general case, as shown in the appendix, the entrepreneur's participation constraint guarantees that t^* cannot be positive, but full insurance is not possible.

Constrained Entrepreneur

In order to fully understand the impact of contractibility and contract enforcement on entrepreneurship and investment, we once more turn to the marginal individual, who is indifferent between becoming an entrepreneur and a salaried worker. In this scenario, in addition to helping the supplier transfer resources across states of nature, $t < 0$ can also help the entrepreneur reach the optimal ex-ante level of investment ($e^* = R'^{-1}(1/\overline{\theta})$, so that $t^* = a_i - R'^{-1}(1/\overline{\theta}) < 0$). In fact, appendix 6.4.2 proves that, under these circumstances, it is always the case that suppliers are willing to set $t < 0$ so as to finance entrepreneurs ex-ante investment up to the optimal point. But this anticipation of funds is not costless to entrepreneurs: in order for suppliers to accept a lower t, they have to be compensated with a higher p. Since the use of t to finance entrepreneurs' investments deviates suppliers from the ideal insurance scheme, the increase in p needed to compensate for the utility loss has to be larger than the initial change in t. So, in reality there is some efficiency loss when entrepreneurs make use of t as a way to finance ex-ante investments.

Still, as there are no upfront costs to entrepreneurship, the equilibrium is such that half the individuals are entrepreneurs and half the individuals are salaried workers. Since using t to finance ex-ante investments is costly, wealthier individuals experience higher gains from entrepreneurship, so the final occupational structure is such that all individuals with wealth above $G^{-1}(1/2)$ are entrepreneurs and all individuals with wealth below that level supply labor. The endogenous adjustment of the wage w guarantees that, as long as the surplus generated by entrepreneurship is large enough, this occupational structure will hold.

Thus, under this distribution of bargaining power, indivisibilities are not present, irrespective of the degree of contractibility or contract enforcement in the economy ($\underline{\theta}$ and $\overline{\theta}$). On the other hand, ex-ante investments are now directly affected by contract enforcement, since $e^* = R'^{-1}(\frac{1}{\overline{\theta}})$: the larger the set of states of natures under which contract is enforced by courts, the larger are ex-ante investments. Changes in $\underline{\theta}$ and $\overline{\theta}$ here also affect p, t and w, and, therefore, aggregate welfare in the economy. We summarize our findings over the last sections in the following result:

RESULT 1: Positive startup costs to entrepreneurship are only economically justified when the supplier can be expropriated ex-post from her ex-ante outside option.