

Financial Intermediation without Exclusivity

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Futures exchanges and other financial intermediaries assume counterparty risks and, in return, demand guarantees that these counterparties will deliver on their promises. It is often argued that, to attract volume, financial intermediaries would settle for excessively low contractual guarantees. In Santos and Scheinkman (2001), we model financial intermediation in an environment where traders may choose to default, and we examine the characteristics of the equilibrium. In particular, we investigate whether competition implies excessively low standards. We show that, in fact, when society punishes default and intermediaries can impose collateral requirements effectively to limit the size of positions, competition leads to a (constrained) optimal amount of contractual guarantees.

In Santos and Scheinkman (2001) we assume that exchanges cannot control the size of the positions taken by individuals, but we preclude investors from participating in more than one exchange. This ignores the effect that trading with one financial intermediary may have on the risks faced by other intermediaries. Financial intermediaries typically cannot control the amount of risk that counterparties will take with other intermediaries. In this paper we examine the effect of dropping the exclusivity assumption. We show that the constrained optimum can no longer be implemented as a standard Nash equilibrium with free entry. Nonetheless this allocation is the only one that can be sustained as an *anticipatory* equilibrium (Charles Wilson, 1977). To break a candidate anticipatory equilibrium it must be possible to add a contract that is profitable and that does not become unprof-

itable when the now unprofitable contracts from the original menu are withdrawn. If one views this requirement as reasonable, nonexclusivity reproduces the outcome that obtains when intermediaries enjoy exclusivity but cannot control the size of positions taken against them by traders.

A superficially similar result holds in the insurance model of Richard Arnott and Joseph E. Stiglitz (1993). In that model, the price of insurance is simply the ratio of what the client pays in the favorable state versus what he receives in the adverse state. As a consequence, if insurers cannot control the size of policies, it makes no difference whether a client buys from one or many insurance companies: clients will buy as much as desired at the lowest price. As we will show below, in our model of financial intermediation, agents may want to combine several contracts, and this is precisely the reason why the original equilibrium does not survive as a Nash equilibrium once exclusivity is dropped.

I. A Model of Competition among Financial Intermediaries

There are two periods. In the first period only asset trading occurs. In the second period, there are two equally probable observable states of the world, s_1 and s_2 . The model has a large number of agents. In each state, half the agents receive an endowment of x units of the consumption good. The other half "typically" receives a larger endowment y . However, each agent has a small probability $1 - \pi$ of receiving $z < x$ instead of y . The occurrence of this bad draw is private information and is independent across agents.¹ Agents maximize $E[u(\cdot)]$ with $u'' < 0$. Assume that $u'(x) > (1 - \pi)u'(z) + \pi u'(y)$, so that agents want to transfer con-

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¹ In Santos and Scheinkman (2001) we consider the case where an agent's π is private information.

sumption to the state where they obtain the certain endowment.

Because first-period endowments are zero, exchanges compete for customers by issuing forwards. To focus on the ability of the marketed contracts to spread risks among investors, assume that exchanges must break even in each state of the world. Contracts treat groups symmetrically. The forward is normalized so that the party that is long must deliver one unit of the good in state s_2 . To finance defaults, the exchange delivers $K < 1$ units for each unit of the contract that is in-the-money.

Exchanges also impose margin requirements. When a trader deposits collateral C , this amount is taken from his endowment and delivered to the exchange to satisfy claims the exchange has on the agent. Hence, C cannot exceed the minimum endowment that the trader will have in a state where he is required to deliver to the exchange. Consistent with the search for a symmetric outcome, and to make the model robust to splitting and pooling orders, each exchange chooses a $\Phi \geq 0$ and demands that each unit (long or short) of the contract be secured by Φ units of the good as collateral. Investors can take any long or short position in the marketed asset. However, if an agent defaults, his positions are netted. Since $K < 1$, agents would never simultaneously take a long and a short position. The fact that exchanges cannot price-discriminate as a function of the size of trades creates a moral-hazard aspect to our problem.

As in Martin Shubik and Wilson (1977), we introduce a penalty on utility that is proportional to the amount that the individual fails to deliver. If an agent is committed to deliver w and delivers D , he suffers a utility loss of $\lambda \max(w - D, 0)$. The parameter λ is economy-wide, and exchanges cannot alter it. Assume that $u'(x) < u'(z) - \lambda$ so that it does not pay to transfer consumption from the state where endowment is z to the state where it is x , even after accounting for reduced penalties. To eliminate one multiplier, assume that z is sufficiently small relative to y , so that agents that receive y will always deliver more than the collateral.

A trader in an exchange that offers a contract $\gamma = (\Phi, K)$ must choose a position and how many units to deliver when out-of-the-money. A simple calculation shows that each agent's problem has a unique solution: that group-1

agents take a long position, and by symmetry, agents in group 2 take the negative of the position taken by agents in group 1. Since $u'(z) > \lambda$, an agent that receives z makes no deliveries in excess of collateral. When endowed with y , the investor equates the marginal utility of consumption to the marginal penalty λ . If $u'(y - \theta^*) = \lambda$, an agent that is long θ^* contracts and receives endowment y delivers fully if $\theta \leq \theta^*$. Otherwise, given our assumptions, he delivers $D = \max(\theta^*, \theta\Phi) = \theta^*$.

We use a standard Nash equilibrium where firms compete in contracts. Since we have constant returns, we may assume that, in equilibrium, all agents trade in the same exchange. In Santos and Scheinkman (2001) we show that the equilibrium contract $\gamma^* = (\Phi^*, K^*)$ yields maximum utility among those that at least break even (see Fig. 1).² In equilibrium, agents of group 1 buy θ^* contracts, and hence agents that receive y do not default. Since the contract yields zero profits, $K^* = \pi + (1 - \pi)\Phi^*$.

In Santos and Scheinkman (2001), we argue that a central planner facing the same restrictions as our exchanges can do no better than the allocation supported by γ^* . In this sense, the equilibrium is a constrained optimum.

II. Nonexclusivity

If agents can simultaneously trade in several exchanges, we must choose a sharing rule in case of default. We assume that exchanges keep any collateral they have received. Additional deliveries are shared in proportion to the amount owed to each exchange.

The ratio Φ/K does not summarize the price that agents face. Contracts involve three parameters, one of which, the amount owed when out-of-the-money, is normalized to unity. An agent can combine contracts with the same Φ/K to increase utility. Even when an exchange cannot control the exact positions of counterparties, there is a crucial difference between assuming that agents can trade with a single exchange or several. In fact, if contracts are nonexclusive, γ^* is no longer an equilibrium contract. Let

² Here and in what follows we assume that $\Phi^* > 0$. This holds if penalties are not too high (see Santos and Scheinkman, 2001).

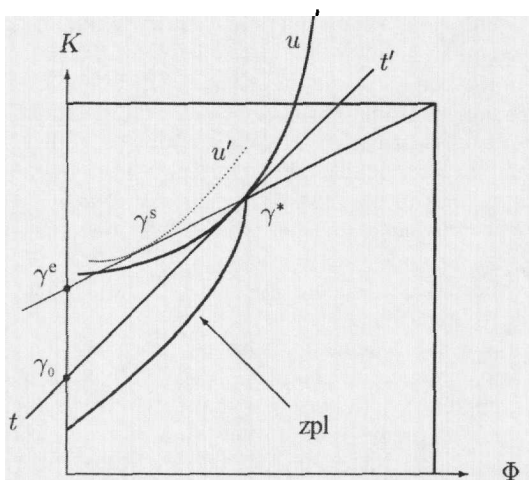


FIGURE 1. EQUILIBRIUM CONTRACT

$\gamma_0 = (0, K_0)$ be the contract that lies in the line tt' , the tangent to the indifference curve at γ^* , and involves zero collateral (see Fig. 1). If γ_0 and γ^* are simultaneously available, agents buy zero units of γ_0 and θ^* units of γ^* . In the following section, we show that an entrant can offer a contract $\gamma^e = (0, K_0 + \varepsilon)$ that yields positive profits in the presence of γ^* . Traders will combine contracts γ^e and γ^* to form a synthetic contract γ^s , that is preferred to γ^* . From our characterization of γ^* , we know that any contract that is preferred to γ^* produces losses. Since the entrant is making a profit, the incumbent must now be making losses. These losses result from an increase in the rate of default on the incumbent's contracts.

It is now natural to suppose that the incumbent withdraws the contract γ^* leaving γ^e as the only available contract. If any contract that makes a profit in the presence of γ^* makes losses after γ^* is withdrawn, then the original allocation is an anticipatory equilibrium. In fact, as we show in the following section, the zero-profit line (line zpl in Fig. 1) lies below the line tt' . Any contract that can attract trades in the presence of γ^* must produce losses when it is the only contract available; that is, there exists an anticipatory equilibrium where all active intermediaries offer γ^* . Also, in any candidate anticipatory equilibrium, the portfolio chosen by traders does not bring losses. If this portfolio

is not equivalent to γ^* , an entrant can introduce a contract that generates profits whether or not the original contracts are withdrawn. Hence, any anticipatory equilibrium must be equivalent to one where active intermediaries offer γ^* .

We have assumed until now that each intermediary offers a single contract. Intermediaries may want to offer contracts that are not necessary to implement the equilibrium, but which deter entrants, as in the insurance model of Alberto Bisin and Danilo Guaitoli (1999). These contracts are present principally as threats to a potential entrant. However, in equilibrium, if there are costs of maintaining each contract, those contracts that are not needed to implement the equilibrium allocation would not be offered, and the analysis in this paper can accommodate intermediaries that issue multiple contracts.

III. Proofs

Suppose a single contract is available. If group-1 agents choose a position $\theta \leq \theta^*$ from the first-order conditions,

$$(1) \quad u'(x + \theta K)K = \pi u'(y - \theta) + (1 - \pi)\lambda + (1 - \pi)\Phi[u'(z - \theta\Phi) - \lambda]$$

where $u'(y - \theta) \leq \lambda$. On the other hand, if $\theta \geq \theta^*$,

$$(2) \quad u'(x + \theta K)K = \lambda + (1 - \pi)\Phi[u'(z - \theta\Phi) - \lambda].$$

To show that the equilibrium under exclusivity is no longer an equilibrium without exclusivity, consider again the line tt' . From the envelope theorem, the slope of this line is

$$(1 - \pi) \frac{u'(z - \theta^*\Phi^*) - \lambda}{u'(x + \theta^*K^*)} > (1 - \pi)$$

since $u'(x) < u'(z) - \lambda$. Differentiating the slopes shows that indifference curves are convex. If γ^* is available, γ_0 is not demanded. Take a sequence $\gamma_n = (0, K_0 + 1/n)$. When both γ_n

and γ^* are available, group-1 traders purchase θ_n units of γ_n and θ_n^* of γ^* . Since indifference curves are convex, $\theta_n > 0$. Standard arguments show that $(\theta_n, \theta_n^*) \rightarrow (0, \theta^*)$. Consequently, the profit per unit of trade of the contract γ_n will converge to $\pi - K_0 > 0$, since the slope of tt' exceeds $1 - \pi$. Hence, an entrant using contract γ_n , for n sufficiently large, will make a positive profit.

We now show that our original equilibrium is still an anticipatory equilibrium. Since the slope of tt' exceeds $1 - \pi$, there is no contract with $\Phi \geq \Phi^*$ that produces profits in the presence of γ^* . Since indifference curves are convex, any contract with $\Phi < \Phi^*$ that agents want to combine with γ^* must lie above the segment $[\gamma_0, \gamma^*]$. It thus suffices to show that any contract $\gamma_\alpha = (\Phi_\alpha, K_\alpha) = \alpha\gamma^* + (1 - \alpha)\gamma_0$ loses money when it is the only contract available. If only γ_α is available, equations (1) and (2) imply

$$(3) \quad u'(x + \theta_\alpha K_\alpha) K_\alpha \\ \leq \lambda + (1 - \pi) \Phi_\alpha [u'(z - \theta_\alpha \Phi_\alpha) - \lambda].$$

Since γ_α lies on tt' and θ^* is chosen when only γ^* is available,

$$(4) \quad u'(x + \theta^* K^*) K_\alpha \\ = \lambda + (1 - \pi) \Phi_\alpha [u'(z - \theta^* \Phi^*) - \lambda].$$

We will use the following lemma.

LEMMA 1: For all $\alpha \in [0, 1)$, $\theta_\alpha K_\alpha \geq \theta^* K^*$. Consequently, $\theta_\alpha > \theta^*$.

PROOF:

If $\theta_\alpha K_\alpha < \theta^* K^*$, then $u'(x + \theta_\alpha K_\alpha) > u'(x + \theta^* K^*)$. From equations (3) and (4) we obtain, $\theta^* \Phi^* < \theta_\alpha K_\alpha$. Hence, $\alpha \theta_\alpha > \theta^*$. Since $K_\alpha > \alpha K^*$, it follows that $\alpha \theta_\alpha K_\alpha > \alpha \theta^* K^*$, a contradiction.

Lemma 1 implies that equation (3) holds with equality. Again using the lemma, we obtain, comparing equations (2) and (3) that $\theta_\alpha \Phi_\alpha < \theta^* \Phi^*$. Hence, when γ_α is the only available contract, since it collects less collateral and delivers at least as much as γ^* , it produces losses.

REFERENCES

- Arnott, Richard and Stiglitz, Joseph E.** "Price Equilibrium, and Decentralizability in Insurance Markets with Moral Hazard." DELTA-CREST (Paris, France) Document No. 05, 1993.
- Bisin, Alberto and Guaitoli, Danilo.** "Moral Hazard and Non-Exclusive Contracts." Mimeo, New York University, 1999.
- Santos, Tano and Scheinkman, José A.** "Competition Among Exchanges." *Quarterly Journal of Economics*, 2001 (forthcoming).
- Shubik, Martin and Wilson, Charles.** "The Optimal Bankruptcy Rule in a Trading Economy with Fiat Money." *Zeitschrift für Nationalökonomie*, 1977, 37(3), pp. 337-54.
- Wilson, Charles.** "A Model of Insurance with Incomplete Information." *Journal of Economic Theory*, December 1977, 16(2), pp. 167-207.