Information Revelation and the Marketing of New Financial Assets[¤]

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Abstract

In this paper I present a model where an informed financial issuer of a new security decides whether to reveal payoff-relevant information to investors. The main result is that, if information is not revealed, and consumers have biased expectations about payoffs then they might not buy the new securities. I also characterize the value of information revelation for the financial intermediary I show that when the intermediary is risk averse the value is always positive if revealing is costless. Otherwise the incentives to publish it (and to issue the new securities) depend upon the cost of disclosing information.

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1. Introduction

This paper presents a simple model of financial innovation with asymmetric information. In this economy the innovator or intermediary is a monopolist that offers forward contracts to households. The main purpose of these contracts is to improve risk sharing among the investors. The intermediary has some private information about the payoffs of such contracts that could be credibly revealed. A priori, the innovator could profit from this private information, but there are situations in which it is more profitable to reveal that information rather than keeping it private. The intuition is that if the information is not revealed to the potential buyers of the contracts, the ex-ante value they assign to the contract may be so low that they will not buy the contract at any relevant price. Therefore markets might close due to a null demand. In other words, keeping information private might lead to no-trade in asset markets (when in fact it is more efficient to trade in them due to risk sharing). This paper provides sufficient conditions under which such phenomenon arises in equilibrium.

This model has several interpretations. Consider for example the case of a bank offering contracts to customers in order to improve their risk sharing. Those contracts specify payoffs in the future contingent on several future events. Although these contingencies could be common knowledge across all agents, the bank may not be very precise about the terms of payments in each contingency. An alternative story is the fact that the investors are not "sophisticated" enough to understand the small print of the contracts. The intermediary faces then the problem of how precise to make this payoff specification, that is, whether to give to the investor the extra information needed to understand the small print. This paper provides an answer to this question in the sense that it states conditions under which the optimal policy is to provide information that is as precise as possible.

A second interpretation of the model is the decision of whether to publish a pricing formula for newly issued securities. Before the Black and Scholes formula [4] was published, there were few option contracts which could be traded in the over-the-counter market. After the publication of the formula, the Chicago Options Exchange was opened and trading volume in options exploded. Similar features were experienced in the derivative markets on fixed income assets[1]. The

[1] In the early eighties there was very little trading volume in these securities. After the menu

application of the model to this interpretation is clear. If the intermediary possesses the formula, then the decision is whether to reveal it to the investors or not. In this case the relevant information is the asset pricing formula.

A third interpretation is the decision of disclosing information about productive assets owned by a corporation. Suppose an oil company issues new shares on a new oil production complex. The dividends of such assets are linked directly to the productivity of the new holes. The firm might have private information on those new investments, but the consumers might ignore such information. The question here is whether to make the information on those new productive assets public.

A fourth interpretation can be found in the field of Accounting. There is a growing literature on the value-relevance of financial disclosures in the banking industry. Some studies focus on the importance of such disclosures to explain the cross-sectional differences in the stock market value of banks. Particularly interesting has been the discussion about the effect of derivatives disclosures under the Statement of Financial Accounting Standards (SFAS) 105, 107 and their amendment 119. These require the disclosure of information about the fair value as well as the purpose of all derivative holdings by banks, including those off-the-balance. Recent evidence (see [19] for example) shows that these disclosures have a positive market value effect, in the sense that revelation of this information is positive correlated with the market value of bank equity[2]. The model presented in this paper is consistent with this interpretation. The market value of stocks of financial institutions depend on the value of assets, which clearly include derivatives. Hence if the bank does not reveal the information about those derivatives it could be that its market capitalization is lower relative to the value when such data is disclosed. The main conclusion of the model under this interpretation is that it may be more profitable for the managers of the bank to reveal that information.

In this paper I use a two-period, incomplete markets, general equilibrium model and add an imperfect information assumption for the consumers. I employ the idea developed by Allen and Gale [3] of obscure states. The consumers face two sources of uncertainty. One is the usual aggregate state, which is common

of term-structure models, such as Cox, Ingersoll and Ross[7], Heath, Jarrow and Morton[12] and others, these markets had a substantial increase in terms of volume trading.

[2] Still these empirical results should be qualified as preliminary. See [18] for a criticism of the methodology used to show the cross-sectional correlation between disclosure and market value.

to all agents in the economy and is the standard way of generating risk. The second is a set of obscure contingencies. This captures the fact that each consumer may not be sure about the payo¤ of an asset even when the aggregate state is realized due to some type of bounded rationality. The investor is not sophisticated enough to exactly know the payo¤s of the securities in each contingency. I also introduce an intermediary or innovator who is the only agent with legal permission to issue new securities. The innovator has the extra information that the consumer needs to know precisely the payo¤s. The objective is to determine the conditions under which it is preferable for the innovator to reveal the information (so that the obscure uncertainty is eliminated) rather than to keep it private. This is because if information is not revealed, then it is impossible for the innovator to sell the new security.

1.1. Summary of Results

The main result shows that, whenever the expected payo¤ of the asset according to risk averse consumer's beliefs is low enough (in the absence of information), then there is an equilibrium with no trade. This depends also on the assumption that consumers ignore completely the intermediary's side. That is, they have no knowledge about the innovator's budget constraint and preference. When information is not revealed the same belief condition is enough not to have an equilibrium with trade. The type of argument used here is based on a biased expectation argument. If the uninformed consumers do not trust the issuer (because they think that the "quality" of the asset is low, in the sense of facing a very poor payo¤ scheme) at any price then there cannot be trade in this asset in equilibrium. I also show that, when the biased expectations condition is not satis…ed, there is an equilibrium with trade when information is not revealed, showing that the biased beliefs e¤ect is also necessary to have an equilibrium with trade.

Second I provide a characterization of the value of the information revelation for the innovator. I characterize this value in terms of the dispersion of initial endowments of the consumers when there is no trade with no revelation. The greater the dispersion, the larger is the value due to larger risk sharing opportunities. I also consider the case of a costly provision of the information. I show the existence of a threshold level of the cost above which no revelation takes place when the intermediary is strictly risk averse. Hence an autarchic solution arises and markets become endogenously incomplete. I characterize the value of information when there is trade with no revelation. In this case such a threshold still exists (provided that the innovator is risk averse). However, above that threshold markets are still complete since in this case there is trade even when no revelation takes place.

1.2. Related Literature

Several papers are related to mine. Perhaps the closest is Gale [11]. His focus is on the e¤ect of product uncertainty on the …nancial innovation process and its e¢ciency properties. He shows that there can be di¤erent Pareto - ranked equilibria in an economy where consumers face uncertainty on the quality of securities. This is essentially a coordination failure result due to costly information acquisition on behalf of investors. My model di¤ers from his in several aspects. A …rst important di¤erence is the uncertainty modelling procedure. Gale assumes that consumers face uncertainty on their own types, which can be known ex-ante at some cost. When cost is positive, prices do not necessarily convey precise signals to the issuers, and so ine¢cient equilibria can arise. In my model uncertainty is on payo¤s of securities through the so-called obscure states. What matters here are the beliefs that consumers have on these states when they remain uninformed. For certain class of beliefs consumers assign a very low expected payo¤, leading to the no trade equilibrium result.

A second major di¤erence is who may resolve the uncertainty. In Gale's model consumers themselves could know their types at some cost. In my model it is either an outsider or the issuer of the securities who could reveal the extra-dimension of uncertainty. I believe that this is a more suitable way to capture facts included in the examples mentioned above, since the decision is taken either by a third party (in the case of publishing a pricing formula) or by the issuer himself (in the case of the accounting problem).

De Marzo and Du¢e [9] present a model of …nancial innovation by a corporation that issues a security backed by a …xed set of assets and may have private information on those assets. It is essentially a securitization problem based on the liquidity of the new asset. The issuer faces a trade-o¤ between retained cash - ‡ows not included in the designed security and the liquidity cost of including the cash ‡ows and making this more sensitive to private information. They show conditions under which standard debt is optimal as opposed to pure equity. They also use asymmetric information that causes a "lemons" problem. They prove that the asymmetric information induces a downward sloping demand curve for the security, while in my case its e¤ect is no-trade. Another important di¤erence is that the market participants are involved in a signalling game, where the portion of cash ‡ows retained by the corporation acts as a signal. In my paper no signalling takes place[3].

Demange and Laroque [8] have also a security-design model in which entrepreneurs face a trade-o¤ between private information (speculative gains) and demand for the asset (insurance motive). Section 6 of my paper could be interpreted as an extreme case of Demange and Laroque's paper, although it answers a di¤erent question. In the former the choice is either not to reveal the information and keep it as a private information, or to reveal the information, sell the securities with totally public information. My paper focuses on the case in which, apart from costs, it is always bene…cial to reveal information since otherwise there is no gain in keeping it (if beliefs are biased towards low values of the payo¤s).

The uncertainty structure that I use is taken from Allen and Gale [3]. They use this in order to address the question of whether the individual investors decide to participate in the asset markets directly or through an intermediary. They present an economy where unsophisticated consumers face the two types of uncertainty mentioned before, but where they could solve the obscure uncertainty by purchasing information at some cost (as in Gale[11]). They show that, if this cost is high enough, the consumer will prefer to purchase an individualized security (not depending on the obscure states) o¤ered by the intermediary, instead of investing in the asset market directly. In this way the intermediary o¤ers the customer implicit insurance. There is a di¤erence in motivation between their paper and mine. They focus more on the rationalization of the increase in …nancial intermediation observed in the last two decades. I use their uncertainty device for a di¤erent purpose. I focus on the revealing mechanism of the "payo¤ uncertainty" faced by "non-sophisticated" investors. A more primitive version of this uncertainty space is also used in Milgrom and Stokey [16] to show su¢ cient conditions under which no-trade takes place if the endowment is Pareto optimal.

[3] This is mainly due to the knowledge assumption that only the consumer's fundamentals are common knowledge. The intermediary side is not known to the investors. This makes impossible any possible inference from the price announced by the intermediary.

In the literature on financial innovation with incomplete markets, there are few recent contributions to the issue of the marketing new securities. In particular Pesendorfer [17] considers a general equilibrium model with incomplete markets. He includes a set of intermediaries who issue "non-standard" assets collateralized by standard securities. This issuing process is assumed to be costly. In particular marketing costs are necessary to sell these claims to consumers. He assumes that these costs are exogenously given and have a fixed component. He shows the existence of an equilibrium in which the price of new securities is an affine function of trade volume. In my paper I include costs of providing information in section 6. Although in my model the pricing of securities is also non-linear, the nature is essentially different. While in Pessendorfer's model the non-linearity comes directly from fixed marketing costs, in my paper non-linearity is the result of a monopolistic asset market. On the other hand, if revelation is costly, (as assumed in section 6) this cost would affect the pricing, but I do not analyze the precise way in which the price is affected by that cost. In any case this paper provides a partial foundation of the fixed portion of the marketing costs used by Pesendorfer.

There is a well known literature on incomplete contracts. Although this paper does not attempt to make a contribution in this regard, it is worth noting its relationship with some of the recent work on the foundations of contract incompleteness. In particular, my model could be used to justify incompleteness of contracts due to writing costs. One of the results in section 5 is that when the cost of revelation is high enough, then there is no incentive to reveal the information. This could be reinterpreted as follows. If costs of making contracts more accurate are high enough, then it is better for the issuer of the contract not to make it very precise.

1.3. Plan of the paper.

In section 2 I describe the economy. In section 3 I characterize the benchmark case when information is provided. In this case the asymmetry in information vanishes. I characterize the equilibrium where the innovator has an incentive to introduce two Arrow securities (with no-short sales constraints). In section 4 I assume that the information is kept private by the intermediary. I analyze an economy with strictly risk averse consumers. In section 5 I characterize the value of the information revelation for the innovator. In section 6 I provide concluding remarks as well as several possible extensions and related issues for future research.

2. A Two Period Economy.

2.1. Consumers and commodities.

The economy lasts for two periods, $t = 1; 2:$ There is a unique physical commodity. In period 1 there is no uncertainty, while for $t = 2$ there is uncertainty. The information structure will be described later. There are two consumers, indexed by $h = 1; 2:$ Let x_2^h be agent h 's consumption at date 2. Preferences are given by strictly concave utility functions.

$$E\left[V\left(x_2^h\right)\right]$$

for $h = 1; 2:$ The Bernoulli utility function V is strictly increasing, strictly concave, C^2 and satisfies all the usual Inada conditions. In period 1 the endowment is certain and equal to $a^h:$ I describe endowments in period 2 after presenting the uncertainty device.

These agents trade securities denominated in the numeraire good. They cannot sell short any of the existing assets. Instead they must buy them from an intermediary. I describe the asset structure in the next section.

2.2. Financial intermediaries

I introduce an intermediary (also called financial innovator) who has a utility function:

$$E\left[u\left(x_2^m\right)\right]$$

The Bernoulli utility function u is bounded, strictly increasing, concave, and $C^2:$ The innovator does not have any endowment: He is the only agent in the economy who can issue securities. The investors trade in these securities with the impossibility of short sell each asset. In the next section I explain the information structure and the asset market in detail.

2.3. Information Structure and Asset Markets

Each consumer - investor faces two aggregate states of the world. The state space is $S = \{\alpha, \beta\}$ with typical element $s \in S$. Let $q = \Pr[s = \alpha]$. Assume that $0 < q < 1$. In each aggregate state consumer h receives an endowment $\omega^h(s)$, $s \in S$. I assume that $\omega^h(s) > 0$ for every h and every s.

The asset market is monopolistic in the sense that the only supplier of new securities is the financial intermediary[4]. The consumers constitute the demand side of the market. The innovator knows the demand functions of each consumer. In this regard I depart from standard general equilibrium models with incomplete markets[5], which assume perfect competition in asset markets[6]. Imperfect competition is a reasonable assumption for markets such as the over-the-counter market, particularly those taking place in big financial institutions such as banks and mutual funds. In a sense the monopolist assumption captures the relationships between the intermediary and the customers, where usually the financial institution is the one with more market power. The other reason is a matter of convenience: it is an easy way to make the innovator profit from marketing new assets[7].

The market works as follows. In period 1 the intermediary issues two Arrow securities, the "α" and the "β" asset. These are contingent claims whose main purpose is to improve consumers's risk sharing. The α asset objectively pays off 1 unit of the good if $s = \alpha$ and 0 otherwise. Equivalently the β asset objectively pays

[4] Alternatively I could have assumed a continuum of two types of consumers, and a continuum of identical intermediaries. Having this I could have "matched" two different consumers with one intermediary and make the latter act as a monopolist. The results are of course the same as in the original case.

[5] For a survey about the GEI literature, see [13] and [14].

[6] The other main difference is the fact that in my model consumers only care about period 2 consumption. This is not usual is most of the standard GEI models. They have consumers whose utility depend upon consumption of both dates 1 and 2. This assumption allows us to skip date 1 budget constraint as explained in the next paragraph.

[7] Since the intermediary does not charge any type of commission over the price, then a perfectly competitive market for these assets may drive profits down to zero either with or without the formula. This constitutes a problem since all the analysis done below depends upon the fact that the innovator will be interested in providing the formula (if it is costless) for the newly issued assets as long as it gives him strictly higher utility. Hence I decided to make the intermediary monopolistic in order for him to be able to profit from the formula.

off one if $s = \beta$ and 0 otherwise. The intermediary knows this perfectly. However the consumer is not able to interpret this correctly. The investor believes that the α asset will pay some positive amount r_α in state α and 0 in state β, but he is uncertain about r_α.

I model this extra uncertainty by adding an additional state space, called obscure states, that reflect the investor's ignorance about the precise payoff of the s asset in state s. Given that α is realized the consumer still faces an uncertainty space called $T(\alpha)$, defined by a finite set $T(\alpha) \equiv \{\tau_1^\alpha, ..., \tau_A^\alpha\}$. The consumers share the same priors on $T(\alpha)$. Let $\pi(\tau^\alpha|\alpha)$ be the prior conditional probability that $\tau^\alpha \in T(\alpha)$ is the true state, given that α is observed. Each consumer thinks that, if α is realized, the payoff of the α asset is given by a strictly positive, measurable function $r(\tau^\alpha;\alpha)$, where τ^α is an element of $T(\alpha)$. In a similar way, each investor is not sure about what is the payoff of the security if β is realized. Instead he faces another source of uncertainty given β, given by the finite set $T(\beta) = \{\tau_1^\beta, ..., \tau_B^\beta\}$. Each consumer shares the same prior on $T(\beta)$ given by $\pi(\tau^\beta|\beta)$. The consumer thinks that if β is realized the payoff of the β asset is given by $r(\tau^\beta;\beta)$. I assume that both return functions are strictly increasing in τ^s and also $r(\tau_A^\alpha;\alpha) = r(\tau_B^\beta;\beta) = 1$. So for every s and τ^s, $0 < r(\tau^s;s) \leq 1$.

In sections 4 and 5 I assume that the information might be provided by some outsider. In section 6 I assume that the innovator has the possibility of making the information public. If the information is announced, it is known before consumers take decisions whether buying the securities or not. What matters is that, if the information is publicly known, then the consumers know perfectly that $\tau^\alpha = \tau_A^\alpha$ and $\tau^\beta = \tau_B^\beta$. Hence, in this case the original asymmetric information economy collapses to a more standard symmetric information economy.

The timing of decisions is as follows. At the beginning of period 1 the outsider decides whether to reveal the information. Then the intermediary issues the two securities to the investors, as well as offers a price $p_1(s)$ for each of the securities. After knowing this, consumer h decides the amount to purchase of each security taking the prices $p_1(s)$ as given. By purchasing $z_1^h(s)$ contracts of the s security at price $p_1(s)$ I mean that consumer h signs a contract by which she (perfectly) commits herself to give to the intermediary $p_1(s)\, z_1^h(s)$ units of the good in period 2 regardless of the state. Hence, there is no transfer of goods in period 1. In this sense the assets can be interpreted as forward contracts[8]. The transfers correspondent to purchases take place in period 2:

At the beginning of date 2 the aggregate state s is realized. The innovator delivers 1 unit of the good for each s security contract issued at date 1 if s occurs: If information was not made public this last transaction becomes common knowledge just before the delivery takes place. Therefore the true ¿^{s} is known by consumers only after s is realized if they do not know the information. At the end of period 2 all payments are balanced and the amount of good left for each agent is consumed.

Some remarks are in order before I analyze equilibria. This market does not satisfy all the conditions commonly seen in standard GEI models. The first key element is the fact that the assets are issued by another agent, and so the asset structure is determined endogenously. The second point is that this asset market is monopolistic. The third key element is the fact that no transfers occur in period 1: The purchasing of securities by the consumers represent in the first date only a commitment to transfer goods to the issuer of the assets. The reason for this is the nature of the utility function. Both consumers are effectively solving a risk sharing problem. None of these agents have any incentive to smooth consumption between periods, since they do not derive utility from period 1 consumption. This is essentially a risk sharing model, ignoring completely any savings problem. For the motivation described above this is realistic enough: the "real-life" securities I have in mind are usually designed mainly to hedge risk, having a very secondary role as savings instruments. On the modelling side, this last assumption is very convenient since it makes all proofs much easier [9].

I finally introduce the following knowledge assumption:

Assumption 0 Consumers's fundamentals (preferences and endowment patterns) are common knowledge. The fact that the intermediary has a priori an extra information about the payoffs is also common knowledge. Consumers know

[8] I thank Robert Jarrow for this observation.

[9] For the sake of completeness, I have worked out the case with a date 1 budget constraint, stating that the value of asset purchases by consumer h must not exceed her date 1 endowment. Despite this extra assumption, the results are qualitatively the same, although clearly the value of the formula might be quantitatively lower with this constraint than in the original framework. The proofs are available upon request.

nothing else about the intermediary. In particular they do not know either the monopolist's budget constraint or his utility function.

This is the crucial assumption that prevents the consumers from inferring information through the price announcement.

3. The Benchmark case: information published.

In this section I assume that the innovator provides all information about the security. Let $p_1(s)$ be the price of the "s" asset ($s \in S$). Let $z_1^h(s)$ be the amount of the "s" security bought by h at date 1. Let $z_1(s) = \sum_{s \in S} z_1^h(s)$ be the aggregate demand for the s security. Everybody knows that $\tau^{\alpha} = \tau_A^{\alpha}; \tau^{\beta} = \tau_B$. The issuer reveals the true obscure states, which means that the α asset pays off 1 unit of the good if α occurs and 0 otherwise, while the β asset pays off 1 unit of the good if β occurs and 0 otherwise.

Hence in period 2 the only two relevant states of the world are the aggregate ones: Define $I^h(s) \equiv \omega^h(s) + a^h$. I also define the marginal rate of substitution of agent h as:

$$MRS^h \equiv \frac{qV'\left(x_2^h(\alpha)\right)}{(1-q)V'\left(x_2^h(\beta)\right)}$$

I make the following assumption for the pattern of endowments:

Assumption 1 The following conditions hold

$$\omega^1(\alpha) < \omega^1(\beta)$$
$$\omega^2(\alpha) > \omega^2(\beta)$$

thus the marginal rate of substitution (as defined before) for agent 2 is lower than for agent 1 at the endowment point.

Since there are no short sales, this assumption implies that agent 1 buys the α contract only, and agent 2 buys the β contract only. This is to avoid a situation where both agents would like to buy the same contract. Suppose that both consumers have a higher endowment in α than in β: In this situation they would buy only the β contract. However, if β occurs the monopolist incurs in losses since he must pay to the β contract holders more than the revenues he receives. In this case no contract is issued even with symmetric information. Since this makes the problem uninteresting, I assume that each consumer is interested in buying exactly one security to insure trade with symmetric information.

In the absence of obscure uncertainty the $h-$ consumer solves in equilibrium:

$$\max qV\left(x_2^h(\alpha)\right) + (1-q)V\left(x_2^h(\beta)\right)$$
$$s.t$$

$$\begin{aligned} x_2^h(\alpha) &= \omega^h(\alpha) + a^h + (1-p_1(\alpha))z_1^h(\alpha) - p_1(\beta)z_1^h(\beta) \geq 0 \\ x_2^h(\beta) &= \omega^h(\beta) + a^h + (1-p_1(\beta))z_1^h(\beta) - p_1(\alpha)z_1^h(\alpha) \geq 0 \end{aligned}$$

$$z_1^h(s) \geq 0$$

Remark 1. I am not imposing any restriction at date 1 in terms of budget constraints. This is due to the nature of contracts described in section 3: The idea is that the payments that consumer h must make to the intermediaries will be covered by total endowments $I^h(s)$ plus the promised delivery of goods coming from the assets payoffs, as stated in the last section.

The problem for the intermediary is:

$$\max \quad qu(x^m(\alpha)) + (1-q)u(x^m(\beta))$$

subject to

$$
\begin{aligned}
x^m(\alpha) &= (p_1(\alpha) - 1) z_1(\alpha) + p_1(\beta) z_1(\beta) \\
x^m(\beta) &= p_1(\alpha) z_1(\alpha) + (p_1(\beta) - 1) z_1(\beta)
\end{aligned}
$$

The innovator will issue the securities only if $x^m(s) \geq 0$ for every s: For the proofs let us rewrite this constraint as:

$$(p_1(\alpha) - 1) z_1(\alpha) + p_1(\beta) z_1(\beta) \geq 0 \qquad (3.1)$$

and

$$p_1(\alpha) z_1(\alpha) + (p_1(\beta) - 1) z_1(\beta) \geq 0 \qquad (3.2)$$

The innovator computes $z_1(s)$ by calculating and aggregating the demand functions. The innovator can do this since he knows the utility functions of each investor as well as the endowment patterns and the probabilities.

Formally an equilibrium with information revelation for this economy is:

Definition 1. An equilibrium with information revelation for this economy is given by consumption allocations $\left[\left(x_2^{*h}(s)\right)_{s=\alpha}^{\beta}\right]_{h=1}^{2}$; $\left[(x^m(s))_{s=\alpha}^{\beta}\right]$ asset portfolios $\left(z_1^{*h}(\alpha); z_1^{*h}(\beta)\right)_{h=1}^{2}$; and prices $(p_1^*(\alpha); p_1^*(\beta))$ such that

1.- For each h the allocations $\left(x^{*h}(s)\right)_{s=\alpha}^{\beta}$; $\left(z_1^{*h}(\alpha); z_1^{*h}(\beta)\right)$ solve the consumer's problem taken $(p_1^*(\alpha); p_1^*(\beta))$ as given.

2.- The innovator, using the aggregate inverse demand functions solve his problem and gets $(p_1^*(\alpha); p_1^*(\beta))$:

Because of assumption 1; it is possible to define an equilibrium where consumer 1 buys the α asset and consumer 2 buys the β asset.

Definition 2. A $(1;\alpha);(2;\beta)$ **equilibrium** is an equilibrium with information revelation where agent 1 buys the α asset only, while agent 2 buys the β contract only.

This the only possible equilibrium given assumption 1. The intuition is as follows. By assumption 1; agent 1 is interested in buying asset the ® asset since this is the state in which she is relatively "poorer". Similarly agent 2 is interested mostly in buying asset ¯ since this is the state in which 2 is relatively poorer. On the other hand, if at least one agent buys both assets it is shown that p_1 (®) + p_1 (¯) = 1: In this case it can be shown that the innovator gets x^m (s) = 0 for both states (otherwise one of the non-negativity constraints is violated). But then p_1 (s) is not an optimal pricing policy: it can be shown that there is a pair of prices ($\hat{p}_1$ (®) ; $\hat{p}_1$ (¯)) such that the innovator enjoys a consumption pro…le strictly higher than his endowment for both states. I leave the details for the proof of lemma 4:6:

The …rst lemma comes from the asset demand choices.

Lemma 1. In the (1; ®) ; (2; ¯)equilibrium asset prices must be strictly less than one (for 0 < q < 1.)

Proof. (sketch) This is a necessary condition to have z_1^1 (®) > 0 and z_1^2 (¯) > 0:[10] ■

From the last lemma and the condition above it is clear that:

Lemma 2. The innovator will never issue only one asset. That is, if the innovator issues new securities, he will market both assets.

Proof. See Appendix. ■

A characterization of the prices in an equilibrium is provided by the following lemma.

Lemma 3. Let z_1^1 (®) > 0 and z_1^2 (¯) > 0 be the demand for assets when prices are p_1 (®) and p_1 (¯) respectively. Under the assumption that p_1 (®) + p_1 (¯) · 1; the intermediary faces a violation of the non-negativity constraint for at least one state. Moreover, a necessary condition to have an equilibrium with trade is that p_1 (®) + p_1 (¯) > 1:

[10] The formal proof is available upon request.

Proof. See appendix. ■

This result states that when the sum of prices is less than one the intermediary violates at least one non-negativity constraint. The interpretation of this is as follows. The sum $p_1(\alpha) + p_1(\beta)$ is basically the increase in the intermediary's revenue state-by-state by selling the first infinitesimal extra amount of both assets. However, the marginal cost of providing that extra amount of assets is, state-by-state, equal to 1. Therefore, if $p_1(\alpha) + p_1(\beta) \leq 1$; the intermediary lacks any incentive to create and to expand the market since, on the margin, his consumption falls by selling more assets. Therefore, in order to induce the monopolist to market a positive amount of each asset, the sum must be greater than one[11].

This last lemma immediately implies the following result.

Lemma 4. At the optimal solution, prices are such that at least one price is $p_1(s) \geq 0.5$.

Proof. Obvious ■.

There is still another characterization of the optimal pricing policy for the innovator in the presence of disclosed information.

Lemma 5. Prices at the optimum are bounded below by some amount δ.

Proof. Suppose not. Without loss of generality suppose that at the optimum $p_1(\alpha) \to 0$. Then by looking at the consumption of the innovator at state α I get $\lim_{p_1(\alpha) \to 0} (p_1(\alpha) - 1) z_1(\alpha) + p_1(\beta) z_1(\beta)$. In this equilibrium $z_1(\beta)$ is independent of $p_1(\alpha)$. It is a matter of routine to check that $z_1^h(\alpha) \to \infty$ when $p_1(\alpha) \to 0$; and so $z_1(\alpha)$ grows without bounds as $p_1(\alpha)$ decreases to zero. Then the limit above is clearly $-\infty$, which clearly violates the participation constraint. ■

[11] Since the intermediary is a monopolist, the "marginal revenue" for any amount of assets is not equal to the price. Notice however that the marginal revenue is lower than the price (given the monotonicity of the security demand functions). Thus the condition $p_1(\alpha) + p_1(\beta) \leq 1$ implies that the marginal revenue of selling an extra infinitesimal unit of each asset is also less than the marginal cost.

This shows that prices can be without loss of generality be bounded such that $\delta \leq p_1(s) \leq 1$.

The following result can be shown using the lemmas above.

Theorem 3.1. Given the assumptions above, the solution of the innovator's problem is well defined and there is an equilibrium with trading in both assets.

The proof is presented in the appendix. It essentially uses assumption 1 and continuity of the marginal utilities, as well as the fact that prices that can be chosen by the innovator are on a compact set.

4. The Economy with Uninformed Investors: Inefficient No Trade Results.

In this economy the innovator may not be able to provide the information that he has. Hence the investors face the original two types of uncertainty: the aggregate states and the obscure states. I make the following assumption:

Assumption 2 - Information for only one of the assets (assuming a "technological constraint"), namely, the β asset is already released.

Hence only the payoff of the $\alpha -$ security is given for the h consumer by a function $r(\alpha; \tau^{\alpha})$; where τ^{α} belongs to the set $T(\alpha)$: Consumers understand that the β asset gives 1 unit of the good if β occurs and 0 otherwise. The β asset is related directly to public information about the issuer. In the accounting interpretation the payoff of the β asset may refer to those securities that depend heavily on the value of on-the- balance assets minus liabilities. Instead the α asset might be related to derivatives held by the intermediary but whose information might kept private. Although this looks special, I show in appendix B that this assumption could be easily relaxed to get the same no-trade results if no information is revealed about either security.

I de…ne an equilibrium with private information in a similar fashion as in section 4. In this case the consumption allocations for the investors depend upon both types of uncertainty in state ®:

De…nition 3. An equilibrium with private information for this economy is given by consumption allocations $\left[\left(\left(x_2^{¤h}(s;¿^s)\right)_{¿^s}\right)_{s=®}\right]_{h=1}^{2};\ \left(x^{¤m}(s)\right)_{s=®}$; asset portfolios $\left(z_1^{¤h}(®);z_1^{¤h}(¯)\right)_{h=1}^{2}$; and prices $(p_1^{¤}(®);p_1^{¤}(¯))$ such that

1.- For each h the allocations $\left(x^{¤h}(s)\right)_{s=®}$; $\left(z_1^{¤h}(®);z_1^{¤h}(¯)\right)$ solve the consumer's problem taken; $p_1^{¤}(®)$; $p_1^{¤}(¯)$ and $((r(®;¿^®))_{¿^®})$ as given.

2.- The innovator calculates the aggregate demand function for assets (as explained before) given that consumers do not know $¿^®$. He uses them two solve his problem and gets $(p_1^{¤}(®);p_1^{¤}(¯))$:

Note that lemmas 3 and 4 still apply here since they do not involve the demand side of assets. Although lemma 5 is still true (provided that $\min_{¿^®}\{r(¿^®;®)\}>0$) the lower bound is now function of $(¼;r)$; where $¼ ´ (¼(¿^®;®))_{¿^®}$ and $r ´ (r(¿^®;®))_{¿^®}$ (for the rest of the parameters …xed). Denote $\hat{±}(¼;r)$ as the lower bound. I assume:

Assumption 3 The following condition holds

$$\sum_{¿^®} r(®;¿^®)\,¼(¿^®|®) < \min\left\{\frac{\frac{1}{1+\frac{1}{MRS_0^1}}}{\frac{1}{1+\frac{1}{MRS_0^2}}};\hat{±}(¼;r)\right\}$$

where MRS_0^h is the marginal rate of substitution of h at the endowment point. I also assume that there is no $z_1^1(®)>0$ such that the correspondent inverse demand function price value $p_1(®)$ (given by the …rst order conditions) is equal to the price of the …rst in…nitesimal unit of the ® asset.

This is a crucial assumption for the propositions in this section. The …rst part of the assumption is that the subjective expected payo¤ is lower than the minimum

$p_1(\alpha)$ that the intermediary is willing to offer to sell a positive amount of the α asset. This together with the second assumption implies that the summation $p_1(\alpha) + p_1(\beta) < 1$ for any positive amount of assets. By lemma 5 this implies that an equilibrium with trade in an economy without trade cannot happen.

The intuition behind assumption 3 is that the subjective payoffs are biased towards low values such that the investors will only buy the assets at very low prices. However, these are low enough so that the innovator would loose money (negative consumption) by offering those prices. In fact the intermediary would consume a negative amount in some state by just offering the first infinitesimal unit of each asset at the correspondent reservation price. This is the main force that drives the no-trade theorem.

A preliminary result to be used is:

Lemma 6. Under assumption 3; the lower bound $\hat{\delta}$ for $p_1(\alpha)$ is given by

$$\frac{1}{1+\frac{1}{MRS_0^2}}$$

whenever the intermediary has an incentive to issue a positive amount of both assets.

Proof. By the monotonicity assumption, it is clear that $p_1(\beta) \leq \frac{1}{1+MRS_0^2}$ to have $z_1^2(\beta) \geq 0$. Hence $1 - p_1(\beta) \geq \frac{1}{1+\frac{1}{MRS_0^2}}$. On the other hand, $p_1(\alpha) + p_1(\beta) \geq 1$ in order for the intermediary not to violate the non-negativity constraints. Hence $p_1(\alpha) \geq 1 - p_1(\beta) \geq \frac{1}{1+\frac{1}{MRS_0^2}}$; showing the result. ■

Under assumption 2 the expected utility for investor h can be written in the following way:

$$q\left[\sum_{\theta^\alpha} V\left(x^h(\alpha;\theta^\alpha)\right)\pi(\theta^\alpha|\alpha)\right] + (1-q)V\left(x^h(\beta)\right)$$

The problem for h is to maximize this objective subject to the budget constraints

$$\begin{aligned} x_2^h(®; ¿^®) &= !^h(®) + a^h + (r(®; ¿^®) ¡ p_1(®))\, z_1^h(®) ¡ p_1(¯)\, z_1^h(¯) ¸ 0 \\ x_2^h(¯) &= !^h(¯) + a^h + (1 ¡ p_1(¯))\, z_1^h(¯) ¡ p_1(®)\, z_1^h(®) ¸ 0 \end{aligned}$$

$$z_1^h(s) ¸ 0$$

The following result follows immediately from the …rst order conditions.

Proposition 1. Suppose that assumptions 1 - 3 hold. Then for any price $p_1(®) ¸ \hat{±}$ the optimal demand for the ® asset is 0.

Proof. See Appendix. ■

This is the biased expectation e¤ect mentioned before. The investors believe that, if information is kept private, payo¤s of the asset are low enough such that for any feasible price it is not optimal for the investor to buy the ® asset. The last step is to show the following:

Theorem 4.1. There is an equilibrium with¡no trade in both assets such that the price of the ® asset is any number in $\hat{±}; 1$ and $p_1(¯) > 1=(1 + MRS_0^2)$.[12]

Proof. By lemma 7, if $p_1(®) ¸ \hat{±}$ it is true that $z_1^1(®) = 0$; then the payo¤ for the innovator in state ¯ is

$$x^m(¯) = (p_1(¯) ¡ 1)\, z_1^2(¯)$$

[12] It is important to remark that this result could have been obtained without assuming obscure uncertainty. Instead, if the consumers make mistakes when evaluating the assets's payo¤s such that they believe (with probability one) that those are small enough, then it is possible to show the same result. However, the obscure uncertainty structure captures as a special case this "mistaken consumers" case, while also allows for modelling ‡exibility for extensions.

If $p_1(\beta) \leq \frac{1}{1+MRS_0^2}$ then $z_1^2(\beta) > 0$; but this violates the non-negativity constraints.. Hence $p_1(\beta) \geq \frac{1}{1+MRS_0^2}$: Hence $z_1^2(\beta) = 0$:

From the first order conditions of the investors, it is routine to check that these pair of prices leading to the no - trade situation is optimal also for the consumers, concluding the proof. ■

The value for the innovator in this equilibrium is:

$$V^b = u(0)$$

This will be important for calculating the value for the innovator of providing information.

4.1. The special case of investors with CRRA utility functions

Suppose that investors's preferences are consistent with constant relative risk aversion utility functions:

$$V\left(x_2^h(s)\right) = \frac{\left(x_2^h(s)\right)^{1-\sigma}}{1-\sigma}$$

From lemma 6 the condition under which there is an equilibrium with no trade (given that there is only disclosed information on the β asset) is

$$\sum_{\tau^\alpha} r(\alpha;\tau^\alpha)\,\pi(\tau^\alpha|\alpha) < \frac{1+\frac{1-q}{q}\left(\frac{l^1(\alpha)}{l^1(\beta)}\right)^{\sigma}}{1+\frac{1-q}{q}\left(\frac{l^2(\alpha)}{l^2(\beta)}\right)^{\sigma}}$$

together with the second condition in assumption 3: This condition assures that the summation of the "reservation prices" of the first infinitesimal unit is less than one. But then the summation of prices for positive asset holdings is also less than one. Hence the monopolist does not offer such a low price to induce trade.

Note that as σ gets larger, this condition forces $\sum_{\tau^\alpha} r(\alpha;\tau^\alpha)\,\pi(\tau^\alpha|\alpha)$ to be very small. In the limit, that is, when $\sigma = \infty$, the condition reduces to $\sum_{\tau^\alpha} r(\alpha;\tau^\alpha)\,\pi(\tau^\alpha|\alpha) = 0$. On the other hand, it can be shown that when $\sigma \to \infty$ the price corresponding to the α asset if $z_1^1(\alpha) > 0$ is less than or equal to the lowest payoff $\min_{\tau^\alpha}\{r(\alpha;\tau^\alpha)\}$. If this value is "low enough" then there may not be an equilibrium with trade in the α asset. Specifically, if the price of the α asset must be at least some positive number $\hat{\delta}$, and if $\min_{\tau^\alpha}\{r(\alpha;\tau^\alpha)\} < \hat{\delta}$, then there is no equilibrium with trade in the α asset since the revenues are not sufficient to guarantee that $x^m(s) \geq 0$ for all s. This is summarized by the following proposition:

Proposition 2. If the utility functions of the consumers are of the CRRA type, and if $z_1^1(\alpha) > 0$ then the price must be at most $\min_{\tau^\alpha}\{r(\alpha;\tau^\alpha)\}$. Moreover, if $p_1(\alpha) \geq \hat{\delta}$ in order for the innovator to offer $z_1^1(\alpha) > 0$ then there cannot be an equilibrium with trade in the α asset whenever $\min_{\tau^\alpha}\{r(\alpha;\tau^\alpha)\} < \hat{\delta}$.

Proof. (Sketch) Let $\tau_1^\alpha \equiv \arg\min_{\tau^\alpha}\{r(\alpha;\tau^\alpha)\}$ without loss of generality. From the first order conditions of agent 1 when trade is positive divide both sides of the equality by $x_1^1(\alpha;\tau_1^\alpha)$. Taking limits on both sides gives the result that $p_1(\alpha) = r(\alpha;\tau_1^\alpha)$. The second statement follows automatically. ■

4.2. Violation of assumption 3: Existence of trade with no-revelation.

It is not difficult to show that assumption 3 is not only sufficient, but at least partially necessary to have a no-trade equilibrium. Suppose now that the following holds.

Assumption 3' Suppose that

$$\sum_{\tau^\alpha} r(\tau^\alpha;\alpha)\,\pi(\tau^\alpha|\alpha) > \left(\frac{\frac{1}{1+\frac{1}{MRS_0^1}}}{\frac{1}{1+\frac{1}{MRS_0^2}}}\right)$$

It is possible to show now that there is an equilibrium with trade even if information is not revealed.

Theorem 4.2. Under assumption $3'$ there is an equilibrium with positive trade in both assets and the intermediary has a positive amount of consumption in at least one aggregate state.

Proof. (sketch). It follows the same arguments as theorem 3.1. The idea is that the sum $p_1(\alpha) + p_1(\beta)$ (where the prices satisfy the first order conditions with equality) is greater than one for $z_1^1(\alpha) = z_1^2(\beta) = 0$. Hence by offering a very small amount $\delta > 0$ of both assets at the correspondent price gives to the intermediary a strictly positive consumption in both states. Hence there is a set of prices that gives to the intermediary a strictly positive consumption in each state. This assures that the problem of the monopolist has a solution since prices are defined on a compact set. It is routine to check that the prices obtained in the monopolist's solution satisfy the optimality conditions for each consumer (since the sum of prices is still greater than one). ■

The intuition for this result is clear. In the absence of a very biased expectation of payoffs the intermediary could still sell a positive amount of both assets. This is because the intermediary can always market a very small amount of assets at prices that exceed the marginal cost of the assets on a state-by-state basis. Although the consumer does not know exactly the true payoff value in state α, its expected value is high enough to induce him to buy the asset at a reasonable price. This shows that assumption 3 is at least partially necessary to obtain no-trade in equilibrium, since the violation of one of the conditions stated there leads to the opposite result.

4.3. Comments on the main results.

This section has shown that it is possible to rationalize the absence of trade observed in several asset markets through a biased expectation effect, in the sense that beliefs could be biased towards low values of the payoff function $r(\tau^s; s)$. This effect allows us to have an equilibrium without trade for risk averse consumers who search for risk sharing opportunities.

An important point is that the result does not depend on the variance of r: This is surprising, since due to our assumptions the no-trade result should be just a consequence of the risk aversion of the investors and the riskiness of the payoffs of the α asset (given that α occurs). However a closer look at the consumer's problem shows that this is not necessarily the case. Notice that by not participating in the α market at all, the variance of agent 1's consumption in state α is zero, since $x_1^1(\alpha;\tau^\alpha) = I^1(\alpha)$ in that case. Since she is able to invest any amount of the α asset, the conditional variance of $x_1^1(\alpha;\tau^\alpha)$ can be made as small as desired by investing a "negligible" amount $z_1^1(\alpha) = \varepsilon$ in the α asset, given that the variance of r is finite. This is a consequence of the budget constraint of agent 1 in state $(\alpha;\tau^\alpha)$: Roughly speaking, if by not participating at all in the α market the variance of r is not a problem for agent 1; then by "almost" not participating in it (that is, by investing a very tiny amount) it is not a problem either. In a sense, given the variance of r and the price $p_1(\alpha)$, the conditional variance of $x_1^1(\alpha;\tau^\alpha)$ can be "controlled" by the consumer.

Confirming this, notice that in subsection 4:2 the main result is that, independently of the variance of r; if the expected payoffs under π are not biased towards zero, then there is an equilibrium with trade. This, however, relies heavily on the assumption that the investor can invest any positive amount of the assets. More precisely, the investor can buy as small amount of the asset as he wants. If there is a minimum asset holdings restriction (agent 1 could enter only with a minimum of $z_1^1(\alpha)$ units of the asset, where $z_1^1(\alpha)$ is not small) then this argument would break down and then the riskiness of r could be part of the no-trade result.

5. The Value of Information Revelation.

Suppose now that at the beginning of the first period it is the intermediary who owns the information and decides whether to reveal it. I characterize the value in terms of utility of revealing the information for the innovator in order to study the incentives to disclose information.

Define

$z_1^F(s) \equiv$ optimum quantity of the s asset issued when information is revealed $(s = \alpha;\beta)$,

$p_1^F(s) \equiv$ equilibrium price of the s asset when information is revealed.
$x^{mF}(\alpha) \equiv \left(p_1^F(\alpha) - 1\right) z_1^F(\alpha) + p_1^F(\beta)\, z_1^F(\beta)$
$x^{mF}(\beta) \equiv p_1^F(\alpha)\, z_1^F(\alpha) + \left(p_1^F(\beta) - 1\right) z_1^F(\beta)$

We can define then an equilibrium for this economy.

Definition 4. An overall equilibrium for this economy is given by consumption allocations $\left(\left(\left(x^{*h}(s,\tau^s)\right)_{\tau^s}\right)_{s=\alpha,\beta}\right)_{h=1}^2$; $\left(\left(\hat{x}^h(s)\right)_{s=\alpha,\beta}\right)_{h=1}^2$; $\left(x^{mF}(s)\right)_{s=\alpha,\beta}$; $\left(x^{*m}(s)\right)_{s=\alpha,\beta}$; asset portfolios $\left(z_1^{*h}(\alpha), z_1^{*h}(\beta)\right)_{h=1}^2$; $\left(\left(\hat{z}_1^h(s)\right)_{s=\alpha,\beta}\right)_{h=1}^2$; and prices $\left(p_1^*(\alpha), p_1^*(\beta)\right)$; $\left(p_1^F(\alpha), p_1^F(\beta)\right)$ such that

1.- For each h the allocations $\left(\hat{x}^h(s^s)\right)_{s=\alpha,\beta}$; $\left(\hat{z}_1^h(\alpha), \hat{z}_1^h(\beta)\right)$ solve the consumer's problem "with information disclosed" of section 4 taking $p_1^F(\alpha), p_1^F(\beta)$ as given.

2.- For each h the allocations $\left(\left(\left(x^{*h}(s,\tau^s)\right)_{\tau^s}\right)_{s=\alpha,\beta}\right)_{h=1}^2$; $\left(z_1^{*h}(\alpha), z_1^{*h}(\beta)\right)_{h=1}^2$ solves the consumer's problem "with private information" taking $\left(p_1^*(\alpha), p_1^*(\beta)\right)$ as given.

3.- If the innovator publishes information, he uses the aggregate inverse demand functions to solve his problem and gets $\left(p_1^F(\alpha), p_1^F(\beta)\right)$.

4.- If the innovator does not publish the information, he still uses the inverse demand functions to get $p_1^*(s)$, for $s = \alpha, \beta$.

5.- The innovator discloses information as long as its value is strictly positive. The value is given by

$$W = q\left[u\left(x^{mF}(\alpha)\right) - u\left(x^{*m}(\alpha)\right)\right] + (1-q)\left[u\left(x^{mF}(\beta)\right) - u\left(x^{*m}(\beta)\right)\right]$$

where $x^{*m}(s)$ is similarly defined as $x^{Fm}(s)$ but using the "without the information disclosure" prices and allocations.

This equilibrium definition "pools" the other two definitions together when the information is provided by the innovator. This means that disclosure is now an endogenous decision of the intermediary. This depends on the utility gains that reporting information gives to the monopolist, whether is positive (then disclosure takes place) or non-positive (then revelation does not take place).

5.1. Characterization of the information value when there is no trade without revelation. The costless and the costly cases.

Since in the equilibrium considered in this model $x^{*m}(s) = 0$; for every s; the value of the information for the innovator, if there is no cost of providing it, is given by the expression

$$W = q\left[u\left(x^{mF}(\alpha)\right) - u(0)\right] + (1 - q)\left[u\left(x^{mF}(\beta)\right) - u(0)\right]$$

Clearly W must be strictly positive. This means that, if providing information is feasible for the innovator and is costless, then he will always provide it. This conclusion, although obvious, gives some interesting insights about when the innovator will have incentives to produce information if is costly.

We can characterize W in terms of the "differences" of endowments across states for any of the consumers.

Proposition 3. Suppose that we have two economies, one with endowments $\left\{\left\{\omega^h(s)\right\}_{s=\alpha}^{\beta}\right\}_{h=1}^{2}$ and another with endowments $\left\{\left\{\hat{\omega}^h(s)\right\}_{s=\alpha}^{\beta}\right\}_{h=1}^{2}$. Suppose that both economies satisfy assumption 1: Moreoverassume that both endowment patterns have the same mean but the second economy has a strictly higher variance. Then the value of the information for the second economy is strictly higher than for the first economy.

The proof is in the appendix. The intuition is straightforward: the more disperse the endowments are, the greater risk sharing opportunities must be and then the higher must be either the price or the quantities traded (or both).

So far I assumed that information revelation does not involve any cost. Suppose instead that revelation is costly. To make things simple, assume a fixed cost $\bar{c}$. In this economy the non-negativity constraints are given by:

$$
\begin{aligned}
\pi^m(\alpha) &= (p_1(\alpha) - 1) z_1(\alpha) + p_1(\beta) z_1(\beta) - c \geq 0 \\
\pi^m(\beta) &= p_1(\alpha) z_1(\alpha) + (p_1(\beta) - 1) z_1(\beta) - c \geq 0
\end{aligned}
$$

Costs will affect the value of the information . For an economy with costly provision the value is

$$
\Delta W = q \left[u\left(\pi^{mF}(\alpha)\right) - u(0) \right] + (1 - q) \left[u\left(\pi^{mF}(\beta)\right) - u(0) \right]
$$

where

$$
\begin{aligned}
\pi^{mF}(\alpha) &= \left(p_1^F(\alpha) - 1\right) z_1^F(\alpha) + p_1^F(\beta) z_1^F(\beta) - c \\
\pi^m(\beta) &= p_1^F(\alpha) z_1(\alpha) + \left(p_1^F(\beta) - 1\right) z_1^F(\beta) - c
\end{aligned}
$$

Notice that existence of equilibrium with symmetric information is not guaranteed. The problem is that the non-negativity constraints might not be satisfied for any price. However we can still say the following.

Proposition 4. If the costs c are positive but "small enough", the value of information W is well defined and positive.

Proof. (Sketch): If c is zero, it is shown that assumption 1 implies that for a very small amount of assets $z_1^1(\alpha) = z_1^2(\beta) = \varepsilon$ the intermediary 's consumption in every state is strictly positive. Therefore there is a c such that substracted from the consumption by the intermediary is still positive. The rest of the proof is as in theorem 3.1. ■

This result implies that economies with intermediaries facing low costs may still have incentives to publish the information. Clearly, if we increase c then W may not be well defined, since the non-negativity restrictions with disclosure might be violated. In this case I assume that the innovator will have no incentives to reveal the information. Therefore no Arrow - security will be issued since no trade will take place in this economy.

Another characterization of this value is possible when u is strictly concave and satisfies the Inada conditions. Proposition 5 provides a threshold level for the information revelation fixed cost $\bar{c}^*$.

Proposition 5. Suppose that u is strictly concave satisfying Inada conditions. Then there is a value $\bar{c}^* > 0$ such that for any $\bar{c} \leq \bar{c}^*$ the value of information is well defined and non negative. For any $\bar{c} > \bar{c}^*$ the intermediary violates at least one non-negativity constraint by revealing the information and no disclosure takes place.

Proof. Suppose first that $\bar{c} = 0$: By the assumptions on u it must be that $x^{Fm}(s) > 0$ for $s = \alpha, \beta$. (If this is not true, the marginal utility at the state where $x^{Fm}(s) = 0$ is infinite, which cannot happen in equilibrium). Hence, take $\bar{c}^* \equiv \min_{s \in \{\alpha,\beta\}} \left\{ x^{Fm}(s) \right\}$: Therefore we must have that $x^{mF}(s) - \bar{c}^* \geq 0$: Notice that since $\bar{c}$ is fixed, the optimal consumption allocations for the intermediary $x^{Fm}(s)$ are independent of $\bar{c}$ provided that $\bar{c} \leq \bar{c}^*$: Therefore for any $\bar{c} \leq \bar{c}^*$ the optimal consumption allocation in each state s is $x^{mF}(s) - \bar{c}$; which is non-negative (if $\bar{c} < \bar{c}^*$; it must be positive). However, if $\bar{c} > \bar{c}^*$ then for at least one s is true that $x^{mF}(s) - \bar{c} < 0$: Since this violates the constraint for the intermediary it turns out that he will not reveal the information under this condition on $\bar{c}$: ■

Remark 2. It is important to note that the expressions for the different information values in this case do not depend on the uncertainty device described in this model. Although I have assumed that the investor faces one extra uncertainty dimension for the security payoff, the model would have given the same equilibrium value of information for a more general uncertainty space, provided that there is no trade with no revelation and there is no extra uncertainty except for the aggregate states when information is disclosed. This shows that the result is applicable to more general models with more general uncertainty spaces. In a sense the results given in this section are quite general and independent of the uncertainty device. However, they do depend on the fact that with no revelation there is no trade. The statements might not be true for the case in which there is trade even without disclosure.

Remark 3. The presence of very high costs of disclosure implies that markets become incomplete. In this model expensive information implies the impossibility of issuing the Arrow contingent claims and then the autarchic solution arises naturally. This shows some similarity with the traditional financial innovation literature, which considers the optimal design of securities when issuing costs are positive. In that case the issuing costs determine the spanning of the asset structure endogenously. In my case it is the cost of publishing information what determines whether markets are "complete" or "incomplete"[13].

5.2. The value of information with positive trades in the absence of revelation.

The arguments presented above do not hold when there is a positive consumption for the innovator when he does not reveal information. Suppose that assumption $3'$ is true. Then there is trade in equilibrium without disclosure and positive consumption for the intermediary for at least one aggregate state.

Characterizing the value of information when there is trade without revelation is a bit more complicated. The following proposition provides a sufficient condition to have the positivity of the value of information when its provision is costless.

Proposition 6. If the demand function for asset α with information revealed does not cross the demand function for the same asset with information not revealed, then the value of reveling information is strictly positive if there is no cost of revelation.

Proof. Since $0 \le r(\alpha;\tau^{\alpha}) < 1$ the price paid for the first infinitesimal unit of the α asset is lower under no-revelation than with disclosure. That is, denote $\hat{p}_1^0(\alpha)$ the price that satisfies with equality the first order conditions for consumer 1 when $z_1^1(\alpha)$ and no revelation is provided, and denote $\tilde{p}_1^0(\alpha)$ the same price

[13] Notice that I am distinguishing between "completeness" and the "perfection" of markets (in the sense of short sales constraints). In all this paper markets are clearly "imperfect" since consumers face short sales constraints. However if the value of information is positive the asset market becomes complete in the sense that the equilibrium asset structure spans the relevant uncertainty space.

when revelation is provided. Then $\hat{p}^0_1(\alpha) > \tilde{p}^0_1(\alpha)$. It can be easily checked that the slope of the demand function for the α asset is downward sloping when $z^1_1(\alpha) = 0$ under both regimes. By the non-crossing assumption then the value $\tilde{p}_1(\alpha)$ (without disclosure) when $z^1_1(\alpha) > 0$ is always below $\hat{p}_1(\alpha)$ for the same $z^1_1(\alpha) > 0$ (when disclosure takes place). In words, the demand function for the α asset with revelation is always above the demand without revelation. Then the optimal consumption for the intermediary is always lower without revelation than with revelation, giving the result. ■

This is intuitive. Even if the intermediary is able to trade a positive amount of both assets without revealing the information, he will have a lower consumption state-by-state relative to the consumption with disclosure, because agent 1 is willing to pay a lower price if information is not revealed. This is because the payoffs that consumer 1 thinks as possible are at most equal to 1 in state α. When information is revealed she knows for sure that the payoff is 1 when α is observed. Therefore she will not invest without revelation as much resources as when the intermediary reveals the information. Hence, under this situation the intermediary also always reveal the information.

For the costly case, we know that if $\hat{c}$ is small enough proposition 4 states that the value of information is well defined, since with revelation the non-negativity constraints are still satisfied for the intermediary's consumption. However the value might be positive or negative depending the value of $\hat{c}$: If the monopolist has a strictly concave utility function u satisfying Inada conditions, then I can adapt the arguments in proposition 5 to get the following.

Proposition 7. Suppose u is strictly concave and satisfies Inada conditions. Then there is a value $\bar{c} > 0$ such that for any $\hat{c} < \bar{c}$ the value of information revelation is positive and for any $\hat{c} > \bar{c}$ the value is negative. The value of information at $\bar{c}$ is exactly zero.

Proof. Let $x^{mF}(s)$ be the optimal consumption for the intermediary in state s when information is revealed. By the stated assumptions on u I have $x^{mF}(s) > 0$ for $s = \alpha, \beta$: Let $x^{m*}(s)$ be the optimal consumption for the monopolist in state s if no information is revealed. The assumption on u also implies $x^{mF}(s) > x^{m*}(s)$ for every s. Let $\hat{c}^{**}(s)$ be defined as the value $\hat{c}^{**}(s) \equiv x^{mF}(s) - x^{m*}(s)$. By the condition $x^{mF}(s) > x^{m*}(s)$ then $c^{**}(s) > 0$: Let $c^{**} \equiv \min_s \{c^{**}(s)\}$: Therefore for any $\hat{c} \leq \hat{c}^{**}$ we have that $u\left(x^{mF}(s) - c^{**}(s)\right) \geq u(x^{m*}(s))$ with at least one strict inequality. Hence the value of revelation is positive in this case. Let $\hat{c}_{**} \equiv \max_s \{c^{**}(s)\}$. Hence for any $\hat{c} > \hat{c}_{**}$ the value of information is negative (if well defined, which is true for values close to $\hat{c}_{**}$). Since W is strictly decreasing and continuous in $\hat{c}$ (at least for values of the cost on $[c^{**}; \hat{c}_{**}]$ there is a unique threshold $\tilde{c} \in (c^{**}; \hat{c}_{**})$ such that the value of information at that cost value is 0 and then for any cost above $\tilde{c}$ the value of revelation is positive and for any cost below $\tilde{c}$ the value is negative. ■

Remark 4. Notice that in this case the value of information does depend on the obscure states, since $x^{m*}(s)$ is function of the asset trades and prices, which depend upon the obscure states. Notice also that in this case markets are always complete, since even without revelation there is trade. This reemphasizes the importance of how biased are expectations on payoffs when no information is revealed. If they are "biased enough" we get the no-trade equilibrium and then markets are incomplete. If they are not biased markets are complete (in this setup) independently of the willingness to reveal by the intermediary.

6. Concluding Remarks and Future Research

This paper provided a framework to analyze the role of information revelation in the marketing of financial securities. When relevant information about payoffs of securities is not revealed, this absence of information may prevent trade. Due to this extra uncertainty the investor may not be willing to buy the asset if priors are pessimistic (biased towards low value of payoffs). I have shown the existence of a no-trade equilibrium for a risk averse consumer given that the beliefs of the investor about payoffs are such that the expected value is low enough. If the investor thinks that the payoffs of the new financial security are low in expected value then it is optimal not to participate in such a market at any price offered by the innovator. I also show that this leads to a situation where there is no trade in any asset. The intuition is the fact that the innovator hedges the risk of one asset with the revenues of the other asset. If this hedging is not possible because of the lack of market of one asset, then there is no incentive to offer the other one. Hence no disclosure of information could lead to autarchic equilibria.

I also show that the bias in expectations is almost a necessary condition. If the expected payo¤s are not low, there may be trade in equilibrium even without revelation. The reason is that the if the expected value of the payo¤s are not low, consumers are willing to pay prices for the assets that exceed the "marginal cost" for the intermediary. Hence the intermediary will market these new securities even without revealing information.

I also characterize the value of providing information and how this is related to the cost of providing it. I have shown the existence of threshold levels of costs under which no revelation takes place and above which there is information disclosure. It is interesting that, given that there is no trade in the absence of disclosure, the information value does not necessarily depend on the uncertainty device. As long as the extra uncertainty is totally removed when private information is revealed, and whenever, in the absence of such disclosure there is no trade in that particular asset, then for a two - aggregate state economy the equilibria will be exactly the same and so will be the value of the information. This insight is essential to understanding the level of generality of the analysis in this paper. However, this breaks down when there is trade in equilibrium without revelation.

This analysis has several implications for the interpretations mentioned in the introduction. For example, one message is that, whenever an intermediary issues a new type of security the institution must provide the formula to price it. Otherwise the price that the potential investors are willing to pay might be so low so that it is not pro…table to open the new market. This is consistent with evidence in certain derivative markets. A second message has to do with derivative disclosures in accounting. If a bank decides to issue a new …nancial instrument, and if the payo¤s of that security are closely related to the value of the assets by the bank, then the bank ought to reveal the true value of those assets. Otherwise the potential buyers might …nd it not worthwhile to enter into the new contract since they could "distrust" the bank in terms of its solvency[14]. Finally, a …rm which has a new type of productive asset might want to disclose fully the information on that asset in order to market successfully equity shares whose payo¤ is linked to that investment.

The …rst extension of this model has to do with the crucial assumption of

[14] Of course, I am not a¢rming that the last two cases will always be true. However empirical evidence mentioned also in the introduction suggests that revelation of information (either in terms of formula or in disclosure of …nancial information) has some positive value.

the intermediary being a monopolist. This is never threatened by any potential entrant, so in absence of costs, revealing information has a positive value for him. However many real-life institutions are subject to strong competition, either actual or at least potential. Hence, in certain cases revealing information might be harmful for the institution possessing it. For example, if an institution knows how to price a new asset, making the pricing formula public could reduce the demand faced by them since competitors would enter the market once the formula is published to pro…t from the risk sharing needs of the consumers. Hence potential competition may give the counterpart of the results in this paper, namely, that could prevent information revelation by the institutions[15]. Extensions of the model incorporating competition in the …nancial market should be studied to address these issues.

Another extension has already been mentioned. The prevalent e¤ect that leads to the no-trade result is the "biased expectation" result. The main results with no revelation do not depend on the riskiness of the payo¤s. The main assumption is the consumer can "control" the conditional variance of the consumption stream (with respect to the obscure states) by just buying a very small amount of the asset. Therefore, if the biased expectation e¤ect is absent (if the expected value of r under the priors ¼ is not "low") then it is possible to get an equilibrium with very little (but positive) trade. However, the assumption of trading any positive amount does not seem to match real world …nancial markets. In most of them there is "minimum" amount to be invested if the investor desires to enter in the market. In my model that could be captured by an indivisibility of $z_1^h(s)$: This extension might be important to reconcile the "riskiness" e¤ect of the subjective payo¤s r with the generation of a no-trade equilibrium.

It would also be interesting to add institutional features for the model to specialize the argument to one of the interpretations in the introduction. Speci…cally, the issue of release of the asset pricing formula could be studied using this framework and adding several speci…c features of this problem. This could be used to study the relationship between the revelation of the asset pricing formula and the

[15] Notice that this interpretation is more di¢cult to reconcile with intermediaries o¤ering "personal" assets. It is also hard to make it consistent with the accounting problem mentioned before. The disclosure of information by a particular company should a¤ect only the equity and bonds issued by that …rm, and the e¤ects on other …rms associated with the revelation should not be important. However there are many situations where the institutions do not seem to have the proper incentives to disclose information.

incentives to set up a more institutional exchange for the security. This is actually more in the line of what happened in the options market. Although this paper does not work out this idea, it certainly suggests that the release of a pricing formula for an asset that dissipates the uncertainty (at least up to some degree) may provide adequate incentives for an exchange to be set up by the Government. One can adapt the framework in [1] to this problem in order to study this issue.

Finally, I assumed here that the intermediary has the accurate extra information at the beginning of the economy. This implies that no indirect revelation through publicly observable actions by the monopolist can be made on behalf of the consumers. Consider instead the case in which there is a period 0 where "nature" chooses whether to give an "accurate" or an "inaccurate" piece of extra information to the innovator. Suppose that this structure is common knowledge. Hence the price announced in period 1 could be used to infer the "type" of information received by the intermediary. This extension is interesting to study how adverse selection might a¤ect the no-trade results by adding a "signal" to the economy. Since in this paper the "source of ine¢ciency" is not an adverse selection e¤ect due to the impossibility of getting a signal, it would be interesting to explore the possibility of adding "a …rst move by nature" to see if this model is able to recover an adverse selection ine¢ciency result.

A. Proofs.

A.1. Proof of Lemma 2

If $z_1^1(\alpha) = 0$: Then in state β; $x^m(\beta) = (p_1(\beta) - 1)\, z_1^2(\beta)$: Suppose $z_1^2(\beta) \geq 0$; by last lemma $(p_1(\beta) - 1)\, z_1^2(\beta) < 0$: Hence $x^m(\beta) < 0$ contradicting the condition. The proof for state α is identical.

A.2. Proof of Lemma 3.

Suppose $p_1(\alpha) + p_1(\beta) < 1$: Therefore after some algebra I get

$$\frac{(1 - p_1(\alpha))\, z_1^1(\alpha)}{p_1(\beta)\, z_1^2(\beta)} > \frac{p_1(\alpha)\, z_1^1(\alpha)}{(1 - p_1(\beta))\, z_1^2(\beta)}$$

Hence, suppose that $\frac{(1 - p_1(\alpha)) z_1^1(\alpha)}{p_1(\beta) z_1^2(\beta)} \leq 1$: From the inequality above we get $p_1(\alpha)\, z_1^1(\alpha) < (1 - p_1(\beta))\, z_1^2(\beta)$: On the other hand suppose that $\frac{p_1(\alpha) z_1^1(\alpha)}{(1 - p_1(\beta)) z_1^2(\beta)} \geq 1$: By similar arguments $p_1(\beta) z_1^2(\beta) < (1 - p_1(\alpha)) z_1^1(\alpha)$. Finally if none of the two cases above is true, it can be shown that

$$p_1(\beta) z_1^2(\beta) \leq (1 - p_1(\alpha)) z_1^1(\alpha)$$

$$p_1(\alpha) z_1^1(\alpha) \leq (1 - p_1(\beta)) z_1^2(\beta)$$

with at least one inequality being strong. This finishes the proof.

A.3. Proof of Theorem 3.1

In the symmetric information economy, the $h-$ investor faces the maximization problem

$$\max \quad qV\left(I^h(\alpha) + (1 - p_1(\alpha)) z_1^h(\alpha) - p_1(\beta) z_1^h(\beta)\right)$$
$$+ (1 - q) V\left(I^h(\beta) - p_1(\alpha) z_1^h(\alpha) + (1 - p_1(\beta)) z_1^h(\beta)\right)$$

subject to the non-negativity of the arguments and

$$z_1^h(s) \geq 0$$

for every s.

We guess a solution such that $z_1^1(\alpha) > 0; z_1^1(\beta) = 0; z_1^2(\alpha) = 0; z_1^2(\beta) > 0$. This basically makes $p_1(\alpha)$ being dependent on the MRS. of agent 1 and $p_1(\beta)$ dependent on MRS of agent 2.

Recall the problem for the innovator

$$\max \quad qu\left((p_1(\alpha) - 1) z_1^1(\alpha) + p_1(\beta) z_1^2(\beta)\right)$$
$$+ (1 - q) u\left(p_1(\alpha) z_1^1(\alpha) + (p_1(\beta) - 1) z_1^2(\beta)\right)$$

subject to

$$(p_1(\alpha) - 1) z_1^1(\alpha) + p_1(\beta) z_1^2(\beta) \geq 0$$
$$p_1(\alpha) z_1^1(\alpha) + (p_1(\beta) - 1) z_1^2(\beta) \geq 0$$

It can be shown that the prices $p_1(\alpha)$ and $p_1(\beta)$ derived from the investor's first order conditions are such that, if $z_1^1(\alpha) = z_1^2(\beta) = \varepsilon;\ \varepsilon$ small enough, then the consumption for the innovator in this case is positive for any state. Therefore the problem for the innovator is well defined and has a solution, since $\delta \le p_1(s) \le 1$. Hence the solution for the innovator problem exists and chooses a pair $(p_1(s), z_1(s))$ that gives him a consumption profile which strictly dominates the endowment allocation for at least one state. After a tedious algebra, it is shown that at the optimum the initial guess $z_1^1(\alpha) > 0;\ z_1^2(\beta) > 0;\ z_1^1(\beta) = z_1^2(\alpha) = 0$ is confirmed. Then there is an equilibrium with trade.

A.4. Proof of Proposition 1.

The problem for consumer h is now

$$\max \quad q \sum_{\tau^\alpha} \left[V\left(x_2^h(\alpha;\tau^\alpha) \right) \pi(\tau^\alpha|\alpha) \right] + (1-q)\, V\left(x_2^h(\beta) \right)$$

subject to

$$\begin{aligned} x_2^h(\alpha;\tau^\alpha) &= I^h(\alpha) + (r(\tau^\alpha;\alpha) - p_1(\alpha))\, z_1^h(\alpha) - p_1(\beta)\, z_1^h(\beta) \ \ge 0 \\ x_2^h(\beta) &= I^h(\beta) - p_1(\alpha)\, z_1^h(\alpha) + (1 - p_1(\beta))\, z_1^h(\beta) \ \ge 0 \end{aligned}$$

and

$$z_1^h(s) \ge 0$$

The first order condition with respect to $z_1^h(\alpha)$ is

$$q \sum_{\tau^\alpha} \left[V'\left(x_2^h(\alpha;\tau^\alpha) \right) [r(\tau^\alpha;\alpha) - p_1(\alpha)]\, \pi(\tau^\alpha|\alpha) \right] \le (1-q)\, V'\left(x_2^h(\beta) \right) p_1(\alpha)$$

with equality if $z_1^h(\alpha) > 0$.

Given that $r(\tau^\alpha;\alpha) \le 1$; under the assumptions stated before agent 2 will not demand any of the α asset. For agent 1 we also know that the demand for the β asset is 0. Therefore we know that if $z_1^1(\alpha) > 0$; then

$q \sum_{\tau^\alpha} [V'(x_2^1(\alpha;\tau^\alpha))\, [r(\tau^\alpha;\alpha) - p_1(\alpha)]\, \pi(\tau^\alpha|\alpha)] < 0$. However this implies that $p_1(\alpha) < 0$; impossible in equilibrium. Hence it must be the case that for any price $p_1(\alpha) \ge \hat{\delta}$ the optimal demand for the α asset by agent 1 is 0.

A.5. Proof of Proposition 3.

Under the assumptions presented in the statement of the proposition it is true that $\hat{I}^1(\alpha) < I^1(\alpha) < I^1(\beta) < \hat{I}^1(\beta)$ and $\hat{I}^2(\beta) < I^2(\beta) < I^2(\alpha) < \hat{I}^2(\alpha)$; where $\hat{I}^h(s) \equiv \hat{\omega}^h(s) + a^h$.

Let $x_2^h(s)$ the consumption of agent h in state s in the equilibrium "hats". Let

$$\hat{x}_2^h(s) \equiv x_2^h(s) + \left(\hat{I}^h(s) - I^h(s)\right)$$

This, together with the assumptions, implies:

$$\begin{aligned} & \frac{(1-q)V'(\hat{x}_2^2(\beta))\, z_1^2(\beta)}{(1-q)V'(\hat{x}_2^2(\beta)) + qV'(\hat{x}_2^2(\alpha))} - \frac{z_1^1(\alpha)\,(1-q)V'(\hat{x}_2^1(\beta))}{(1-q)V'(\hat{x}_2^1(\beta)) + qV'(\hat{x}_2^1(\alpha))} \\ > \; & \frac{(1-q)V'(x_2^2(\beta))\, z_1^2(\beta)}{(1-q)V'(x_2^2(\beta)) + qV'(x_2^2(\alpha))} - \frac{z_1^1(\alpha)\,(1-q)V'(x_2^1(\beta))}{(1-q)V'(x_2^1(\beta)) + qV'(x_2^1(\alpha))} \end{aligned}$$

which means that, if the innovator chooses the solution of the $\left\{\omega^h(s)\right\}$ - economy to the one with endowments $\left\{\hat{\omega}^h(s)\right\}$; then he gets a strictly higher consumption in period 2 , state α. Identical is the proof to show that the innovator's consumption with the same policy for state β is strictly higher under $\left\{\hat{\omega}^h(s)\right\}$ than the original $x^m(\beta)$. Therefore the value in the $\left\{\hat{\omega}^h(s)\right\}$ economy must be strictly higher than in the $\left\{\omega^h(s)\right\}$ - economy.

B. Generalization: no-revelation for both assets

This section presents a version where assumption 3 is eliminated. We show that the condition

$$\sum_{\tau^s} r(s;\tau^s)\,\pi(\tau^s|s) < \frac{1}{2}$$

for $s = \alpha, \beta$ is sufficient to have no trade in any of the assets.

Recall that for at least one asset its price must be at least $1/2$. Therefore, using the argument as in proposition 3.1 we can show a contradiction if $z_1^1(\alpha) > 0$; $z_1^2(\beta) > 0$.

Suppose that these are true. Therefore the following holds

$$q\sum_{\tau^{\alpha}}\pi(\tau^{\alpha}|\alpha)\left(r(\tau^{\alpha};\alpha)-p_1(\alpha)\right)V'\left(x_2^1(\alpha;\tau^{\alpha})\right) = (1-q)\,p_1(\alpha)\,V'\left(x_1^2(\beta)\right)$$

$$(1-q)\sum_{\tau^{\alpha}}\pi\left(\tau^{\beta}|\beta\right)\left(r(\tau^{\alpha};\beta)-p_1(\beta)\right)V'\left(x_2^2\left(\beta;\tau^{\beta}\right)\right) = q\,p_1(\beta)\,V'\left(x_1^2(\alpha)\right)$$

By the same argument as before it is true that

$$\begin{aligned} & q\sum_{\tau^{\alpha}}\pi(\tau^{\alpha}|\alpha)\left(r(\tau^{\alpha};\alpha)-p_1(\alpha)\right)V'\left(x_2^1(\alpha;\tau^{\alpha})\right) \\ < \ & qV'\left(I^1(\alpha)\right)\left(\sum_{\tau^{\alpha}}\pi(\tau^{\alpha}|\alpha)\,r(\tau^{\alpha};\alpha)-p_1(\alpha)\right)\end{aligned}$$

and

$$\begin{aligned} & (1-q)\sum_{\tau^{\alpha}}\pi\left(\tau^{\beta}|\beta\right)\left(r(\tau^{\alpha};\beta)-p_1(\beta)\right)V'\left(x_2^2\left(\beta;\tau^{\beta}\right)\right) \\ < \ & (1-q)V'\left(I^2(\beta)\right)\left(\sum_{\tau^{\alpha}}\pi\left(\tau^{\beta}|\beta\right)r(\tau^{\alpha};\beta)-p_1(\beta)\right)\end{aligned}$$

Since at least one of the $p_1(s)$ must be at least $1/2$ by lemma 4; then either

$$qV'\left(I^1(\alpha)\right)\left(\sum_{\tau^{\alpha}}\pi(\tau^{\alpha}|\alpha)\,r(\tau^{\alpha};\alpha)-p_1(\alpha)\right)$$

or

$$(1-q)V'\left(I^2(\beta)\right)\left(\sum_{\tau^{\alpha}}\pi\left(\tau^{\beta}|\beta\right)r(\tau^{\alpha};\beta)-p_1(\beta)\right)$$

is negative, implying that at least one price must be negative, a contradiction. Therefore at least one of the two quantities must be zero.

It remains to show that there is an equilibrium with zero trade. Suppose first that $z_1^1(\alpha)=0$. Then apply the argument in theorem 4.1 to get that the monopolist sets $p_1(\beta)$ such that $z_1^2(\beta)=0$. Note that there is no incentive to deviate for the monopolist since otherwise he gets a negative consumption in some state. The argument starting from $z_1^2(\beta)=0$ is symmetric and omitted..

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