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Notes, Comments, and Letters to the Editor

Information and Securities: A Note on Pareto Dominance and the Second Best*

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A unified analysis is provided of two related problems: the first concerns the welfare impact of changing the set of tradeable securities in an incomplete market economy. The second concerns the welfare implications of changing the common information structure faced by all agents. Both problems arise from a common second-best framework in which expanding the set of trading opportunities can lead to a Pareto worsening. *Journal of Economic Literature* Classification Number: 026. © 1987 Academic Press, Inc.

In this note we provide a unified analysis of two related problems: The first concerns the welfare impact of changing the set of tradeable securities in an incomplete market economy. The second concerns the welfare implifications of changing the common information structure faced by all agents. We will discuss apparent paradoxial results that arise in both problems, using a single geometric example. The example provides a clear illustration of the source of the apparent paradoxes; both problems arise from a common second-best framework. (By second-best we mean the Lipsey–Lancaster [20] idea of additional constraints on allocations, over and above resource availability constraints.)

Our discussion brings together two related but distinct literatures. The

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first is an extensive series of papers discussing the optimality properties of incomplete market systems. It is well known that with incomplete asset markets a competitive economy may not achieve a Pareto optimal allocation (see Diamond [7]). The second-best nature of the problem arises from an inability to have complete trades across time periods and/or states of the world. In an important paper Hart [14] provided two examples where (a) multiple, incomplete-market equilibria could be Pareto ranked and (b) relaxing some constraints on the set of traded securities can make all households worse off. The first example is straightforward, but the second is more difficult to comprehend and initially paradoxical.

The second literature, beginning with the paper by Hirshleifer [15], discusses the welfare implications of parametric changes in the common information structure of the economy. Examples exist where introducing a more informative structure of information for the economy can make all households worse off (see the exchange between Arrow [1, 2] and Beyer [4]). This type of example appears to be quite paradoxical in that "better" information can render some asset markets worthless and reduce welfare. Other examples exist which show that better information can make all households no worse off. What has emerged from these discussions is the important interaction between the existence of particular asset markets and the change in information structure.

In this note we analyze both problems in a general unified framework, where uncertainty is treated in the manner formulated by Radner [29]. We model information *and* asset constraints as explicit, separate, second-best constraints imposed upon a basic contingent-claims exchange economy. At once this demonstrates the similarity between information systems and asset constraints and suggests that the same second-best forces will operate when any of these constraints are altered. This general model is formulated in Section 1.

In Section 2 we consider a special case of the model: it is a geometric generalization of Hart's [14] paradoxical example. We are able to provide a clear illustration that adding an asset market may make all households worse off, all better off, or some better off and the others worse off. All these cases can be generated by merely altering one parameter in the utility functions of the households. Also we observe that the results do not depend in any way on the existence of uncertainty, but can occur in a suitably interpreted certainly model.

In Section 3, we consider altering the information structure for the economy. By a suitable reinterpretation of the variables of our example in Section 2, we are able to provide an example where finer information can result in *any* pattern of welfare change. Furthermore, the case where all households are made worse off can occur without trade disappearing in any previously active asset market; the elimination of trades in contingent claims is not necessary for the negative welfare result. Clearly, our example suggests that the information and asset constraints have similar impacts on the underlying economy.

1. The Model

Consider an economy which unfolds over a sequence of dates $t=0, 1, \ldots, T$. Let there be H households (indexed by h) who trade contingent claims in commodities. There is a single physical commodity,[1] and S states of nature (indexed by s). For the sake of brevity, we adopt the notation $t \in T$, $s \in S$, $h \in H$ in place of $t \in \{0, 1, \ldots, T\}$, etc. Let the symbol $x_h(t, s)$ be the amount of s-contingent commodity consumed by household h at date t. Assume that $x_h = [x_h(t, s)]$ belongs to a closed, convex consumption set X_h in the nonnegative orthant of Euclidean space. Following Radner [29], an information structure $B = [B_0, \ldots, B_T]$ is a sequence of partitions of S depicting what is known about s at date t. Specifically, date t information consists of the knowledge that there is a particular element $\beta_t \in B_t$ for which $s \in \beta_t$ (with nothing further known about s at t). Therefore, every state $s \in S$ belongs to exactly one member $\beta_t \in B_t$ for each $t \in T$. As usual $B_0 = \{S\}$, the coarsest partition; and at the final date, $B_T = \{\{s\} \mid s \in S\}$ is the finest partition possible. In short, an information structure denotes the process by which the true state is revealed to households.

We will say that B'' is as fine as B' if for all $E \in B''$, there exists an $F \in B'$ such that $E \subset F$. If B'' and B' are distinct, then we say that B'' is *finer* than B'. Notice that the concept of fineness simple says that B'' tells us as much, and possibly more than B' about which state will occur. Assume that B_{t+1} is as fine as $B_{t'}$ for all $t = 0, \ldots, T-1$. (Information is weakly increasing.) Later in the paper we will consider changes in the information structure. Therefore let there be a set of possible information structures $\{B^1, \ldots, B^K\} = I$ which are ordered as follows:

> B^{k+1} is finer than B^k, $k \in \{1, \ldots, K-1\}$ in the sense that B_t^{k+1} is as fine as B_t^k all $t \in T$, and for at least one $\tau \in T$, B_τ^{k+1} is finer than B_τ^k. Thus B^{k+1} is a more informative structure than B^k in the sense that one knows *sooner* when a particular event will occur.

Assume that the set I is constructed such that $B^K = \{\{s\} \mid s \in S\}$, the finest information structure possible. Because we wish to consider comparisons between information structures, we must restrict household preferences and

[1] It is straightforward to extend the framework to include several physical commodities.

contingent endowments to be conformable with the different information structures.

Let household h have an endowment of contingent commodities $\omega_h = [\omega_h(t, s)]$. Given the coarsest information structure B^1, then assume that $\omega_h(t, s') = \omega_h(t, s'')$ for all t, h, and s', $s'' \in \beta^1 \in B^1$. Clearly, for finer information structures, B^k, $k > 1$ household endowments will be consistent with household information.

Similarly let us consider household preferences over X_h, $h \in H$. Assume that household h's preferences can be described by a utility function $U_h\colon X_h \to R$.[2,3] We will require that U_h satisfy certain measurability conditions with respect to the set of information structures I. Assume that household preferences are such that the act of consumption at date t cannot provide information which is finer than B_{t+1} for all k.

We will assume that there is a full set of primitive securities (or contingent futures contracts) available to each household, in order to transfer wealth across time and states. (Later we will impose explicit constraints limiting the use of these securities.) In particular, let $a_h(t, \tau, s)$, $t \in T$, $\tau \in \{t+1, ..., T\}$, $s \in S$ be the number of claims held by $h \in H$, for delivery of one unit of the physical commodity in (τ, s) as negotiated at (t, s). Define $a_h = \langle a_h(t, \tau, s) \rangle$ and $J = T \cdot (T!) S$.

Now households will be constrained in their choices of (x_h, a_h) by the information available to them, the constraints on the use of assets and market prices (i.e., a budget constraint).

Given an information structure B, any household $h \in H$ will have its actions constrained by:

$$\begin{gathered} a_h(t, \tau, s') = a_h(t, \tau, s''), \\ \forall s', s'' \in \beta_\tau,\ \beta_\tau \in B_\tau,\ t \in T,\ \tau \in \{t+1, ..., T\}. \end{gathered} \tag{1}$$

The information constraint will also carry through to consumption since

$$x_h(\tau, s) = \omega_h(\tau, s) + \sum_{t \leq \tau} \sum_{s' \in \beta_t} a_h(t, \tau, s), \tag{2}$$

where $s \in \beta_t$.

Next, we will assume that there are constraints upon the household's choice of contingent securities. There are a number of possible reasons why the market does not provide a full set of unrestricted primitive contingent securities. For example, there may be costs associated with defining and

[2] We have *not* assumed the more restrictive von Neumann–Morgenstern axioms as they are unnecessary for our argument.

[3] We can allow household production in the model by interpreting X_h as the set of net trades and U_h as the induced utility over net trades. See Milne [23].

trading such securities. It is important to understand that the formal introduction of such costs does *not* violate any of the results of this paper. Even in a certainty model[4] with many periods and/or commodities where transaction costs imply a sequence of budget constraints, the standard duality between a competitive equilibrium and Pareto optimality is broken. For our purposes, we will simply assume a set of constraints on the use of securities.

To keep the information and security constraints separate, we will *not* condition the latter upon the information algebras generated by the information structure B. This differs from the usual approach (e.g., Radner [29], Hart [14]), but provides advantages later in our analysis when we wish to vary one type of constraint independently of the other. Formally, consider $C \subset R^J$—the space of asset trades[5]—such that

$$\begin{aligned} &\text{(i)} \quad \text{For each } h \in H,\ a_h \in C; \\ &\text{(ii)} \quad 0 \in C. \end{aligned} \tag{3}$$

Notice that the constraint is common for all households.

This formulation is sufficiently general to include a number of well-known cases. For example, there may be constraints prohibiting the use of certain primitive securities. We can allow restrictions on short-sales or legal restrictions on holding extreme portfolio positions. Also it should be obvious that the constraint set contains as a special case the situation where households are restricted to a set of composite claims with a vector of contingent payoffs. For example, in an economy with $T = 1$ and $S = \{s', s'', s''\}$ let the constraint set can be characterized by

$$a_h(s'') - 2a_h(s') = 0$$

$$a_h(s'') - 3a_h(s') = 0.$$

In this case there is essentially only one type of security being traded, and it has the form:

$$[r_{s'} r_{s''} r_{s''}] = [1, 2, 3].$$

Now let us turn to the market structure. Given any information structure, each housefold faces[6] a competitive asset market. Because of the constraint set C, security markets may not be complete, so that the

[4] See Starrett [30] and Hahn [10].

[5] The set C is not necessarily convex. It can be separable, nonconvex, or a series of points in R^J.

[6] In a many commodity version of this market one would also include a competitive spot market for contingent physical commodities. The model would then be augmented to include a variable $p(t, s) \in R^L$ as the price vector for contingent commodities.

consumer will face a sequence of budget constraints with respect to asset trades. Following Radner [29], we assume that consumers have identical point expectations of future prices; and these expected prices are market-clearing prices. Let $\pi(t, \tau, s)$ be the price of a primitive security. Then household h faces the sequence of budget constraints

$$\sum \pi(t, \tau, s)\, a_h(t, \tau, s) \leqslant 0 \tag{4}$$

for all $t = 1, \ldots, T$; and $\beta_t \in B_t$.

To complete the description of the economy, we require the market clearing conditions:

$$\sum_h a_h(t, \tau, s) \leqslant 0 \qquad \text{for all} \quad t, \tau, s. \tag{5}$$

Finally, we define an equilibrium for the economy.

DEFINITION 1.[7] Given (B, C) an equilibrium for the economy $E(B, C)$ is a set of plans $\langle a_h^* \rangle$ for households, and a price system π^* such that

(a) for each $h \in H$, $U_h(x_h^*)) \geqslant U_h(x_h)$ for all a_h satisfying constraints (1), (2), (3), and (4);

(b) market clearing (constraint (5)) is satisfied.

It is important to observe that the information and asset constraints act as second-best constraints on the allocation. By varying the constraints B and C we are introducing second-best comparisons; and therefore we should not be surprised to discover "paradoxes" associated with the conventional second-best literature.

2. AN EXAMPLE WITH FIXED INFORMATION AND THE OPENING OF AN ASSET MARKET

2.1. In this section, we present a special case of our model that illustrates the second-best nature of changes in the set of asset constraints. The example is a generalization of one presented by Hart [14]. We are able to show that, by simply varying parameters on the consumers' preferences we can generate *any* comparative welfare outcome as a result of the opening of a new asset market.

[7] In this paper, we are concerned with questions of efficiency and welfare comparisons, so we will assume an equilibrium exists. For discussions of existence see Radner [29] and Hart [13].

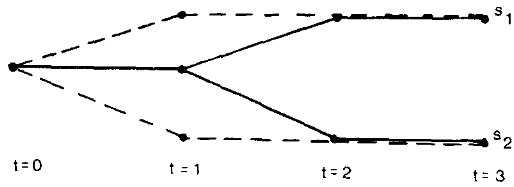

FIGURE 1

We begin by providing an informal sketch of the example, based upon a geometric representation. This is followed by a rigorous formulation showing that there is a formal specification of utility functions and endowments that generates the diagrams. The section closes with some discussion of the robustness of the example and some possible reinterpretations.

Consider a subcase of our model with four dates $t=0, 1, 2, 3$; two states of the world s_1, s_2; and two households $h=H_1, H_2$. The fixed information structure can be illustrated by the solid lines in Fig. 1. That is, at dates 0 and 1 households do not know which state will occur; but at time 2 the true state is revealed, so that no new information appears in moving from dates 2 to 3.

Assume that both households have one unit of the physical commodity at each event node of the information tree. Furthermore, assume that the only asset markets available are those at $(t=2, s=s_1)$ and at $(t=2, s=s_2)$. That is, these are certainty trades for the date $t=3$, given that state s_1 or s_2 has been revealed at $t=2$. The asset market to be opened is the one linking dates $t=0$ and $t=1$ (but more on this later).

The exposition of the example depends crucially upon the structure of household preferences. Assume that households have preferences which are sufficiently separable over events so that we can draw three Edgeworth boxes (see Fig. 2). The first box represents potential trades from dates $t=0$

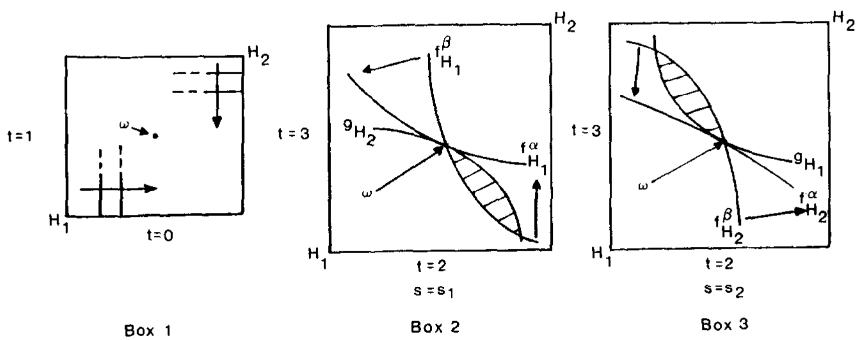

FIGURE 2

to $t=1$. The second and third boxes depict trades between $(t=2; s=s_1)$ and $t=3$; $s=s_1)$ and between $(t=2; s=s_2)$ and $(t=3; s=s_2)$, repectively. If the preferences were, say, additively separable across events for each household, then opening an asset market for trades between $t=0$ and $t=1$ would result in both households being at least as well off as before, and possibly both becoming better off.

But, to generate the example we want, let us introduce a slight variation in the preference structure. Assume that as household H_1 increases its consumption of the commodity at $t=0$, away from its unit endowment, its indifference curve in the second box (i.e., for trades between $(t=2; s=s_1)$ and $(t=3; s=s_1)$) swivels around the endowment point $(1, 1)$. Similarly, assume that as household H_2 increases its consumption of the commodity at $t=1$, away from its unit endowment, its indifference curve in the third box (i.e., for trades between $(t=2; s=s_2)$ and $(t=3; s=s_2)$) swivels around the endowment point $(1, 1)$.

Let us consider the geometrical depiction of the equilibrium (assumed unique) before, and after, the new asset market opens. Assume that, with no asset trading in the first box, there are gains from trade (the hatched lenses in boxes two and three) which are exploited on those markets. Now allowing asset trading in box 1 we can depict the new equilibrium, where there are gains from trade in box 1 but a reduction in trading gains in the other two boxes. In Fig. 2 we have illustrated the extreme case where all the gains from trade in the second and thid boxes have disappeared.[8]

Therefore, each household will be better off or worse off depending upon the relative utility weighting given to the commodity trades in each trading box.[9]

2.2. Given our informal discussion of the example we will proceed now to a treatment with explicit utility functions and endowments. Write $x_h(t)$, $t=0, 1$ for consumption of household h at dates $t=0, 1$, suppressing the state subscript; and write $x_h(t, s)$, $t=2, 3$ and $s=s_1, s_2$ for consumption at the later events. Assume that households $h=H_1, H_2$ have the following utility functions:

$$\begin{aligned} V_{H_1} &= W_{H_1}(x_{H_1}(0)) + f(x_{H_1}(0)); (x_{H_1}(2, s_1), x_{H_1}(3, s_1)) \\ &\quad + \theta^{H_1} g(x_{H_1}(2, s_2), x_{H_1}(3, s_2)). \\ V_{H_2} &= W_{H_2}(x_{H_2}(x_{H_2}(1)) + \theta^{H_2} g(x_{H_2}(2, s_1), x_{H_2}(3, s_1)) \\ &\quad + f(x_{H_2}(0); x_{H_2}(2, s_2), x_{H_2}(3, s_2)). \end{aligned}$$

[8] As the reader can check, this extreme assumption is not necessary for our argument.

[9] For an example of Pareto worsening which arises from the opening of a new market, but does not depend on the features portrayed in this Edgeworth box discussion, see Bhattacharya [3].

Assume

(a) $U_{H_i}: R_+ \to R$; $g: R_+^2 \to R$; $f: R_+^3 \to R$, $i=1, 2$;

(b) U_{H_i}, f and g are neoclassical;

(c) $f(2; x, y) = g(x, y)$, $\forall x, y \geqslant 0$;

(d) given $f(z; 1, 1)$, $g(1, 1)$, and $z \neq 2$ then $(f_2/f_3) \neq (g_1/g_2)$.

Furthermore, we assume that

$$\omega_{H_i}(t, s) = 1; \qquad i = 1, 2; \qquad t = 0, 1, 2, 3; \qquad s = s_1, s_2.$$

Now with no security markets except those linking ($t = 2, 3$; $s = s_1$) and ($t = 2, 3$; $s = s_2$) there is trade only in boxes 2 and 3. If we relax this constraint on trade for the commodities, $t = 0, 1$, then the households will hold $x_{H_1}(0) = 2$, and $x_{H_2}(1) = 2$. Because of the symmetry assumptions there will be no trade in boxes 2 and 3. Household H_1 will lose in the third box because there is a loss of trade. But household H_1 will gain overall from the trades in the first two boxes, even though trade disappears in the second box. The latter assertion can be proved as follows: at the new prices in the second box household H_1 could have chosen $x_{H_1}(0) = 1$ and $x_{H_1} = \{x_{H_1}(2, s), x_{H_1}(3, s)\}$. Given $x_{H_1}(0) = 1$, then because the terms of trade in the second box have swung in H_1's favor, this allocation is preferred to the constrained allocation. But at the new prices $\{x_{H_1}(0) = 2$, $x_{H_1}(2, s_1) = 1$, $x_{H_1}(3, s_1) = 1\}$ is revealed preferred to $\{x_{H_1}(0) = 1, x_{H_1}\}$. Thus

$$\{x_{H_1}(0) = 2;\ x_{H_1}(1) = 0;\ x_{H_1}(2, s_1) = x_{H_1}(3, s_1) = 1\}$$

is revealed preferred to the constrained allocation in boxes 1 and 2. Now by the choice of θ^{H_1} we can make household H_1 either better off, indifferent, or worse off from opening the asset market. A symmetrical argument applies to household H_2. Therefore by relaxing an asset constraint in our example, we can generate any comparative welfare outcome: both households worse off; both better off; one better off and the other worse off; both indifferent.

2.3. Our example includes uncertainty, but this is not necessary for the argument: we can reinterpret the variables so that the economy is a multi-period certainty economy with incomplete asset markets. For example, assume there is one physical commodity and $t = 0, 1, \ldots, 5$; so that the three Edgeworth boxes depict trade for the pairs ($t = 0, 1$), ($t = 2, 3$), ($t = 4, 5$). Clearly the argument follows as above.[10]

[10] The formulation is sufficiently flexible to be open to a number of interpretations. For example, it can be interpreted as a multicommodity (i.e., two commodity) economy with three dates $t = 0, 1, 2$. Each box can be interpreted as a spot trade between the two commodities. There are no asset markets. The absence of spot trades at $t = 0$, and the subsequent opening of that market, can be modeled by our example.

In the next section we will consider an alternative interpretation of the example to provide insights into the welfare implications of improvements in the structure of common information.

3. Examples with a Fixed Set of Asset Markets and Improved Information

3.1. It is well known that introducing finer ("better") information can make all households worse off. A standard example[11] can be constructed as follows. Consider $t = 0, 1, 2$; $s = s_1, s_2$; and $h = H_1, H_2$. The initial structure, where $B_0 = B_1$, can be illustrated by the solid lines in Fig. 3.

We will assume that one and only one household has a unit endowment of the commodity in each of the two events ($t = 2$; $s = s_1$) and ($t = 2$; $s = s_2$); and households have von Neumann–Morgenstern utilities,

$$U_h = \sum_s \ln x_h(2, s)\, p_h(s),$$

where $p_h(s)$ is h's subjective probability that the true state is s.

If there are competitive Arrow–Debreu security markets available at date $t = 1$ (but not at date $t = 0$), there will be a competitive allocation which is Pareto optimal *given* the structure of information. Now consider a change in the information structure so that the revelation of the true state occurs at $t = 1$. The information structure, where $B_1 = B_2$, is illustrated by the broken lines in Fig. 3.

Because there are no Arrow–Debreu securities at $t = 0$, then no trading will take place. Therefore

$$U_{H_i} = -\infty \qquad \text{for} \quad i = 1, 2.$$

This example illustrates how the introduction of finer public information may destroy contingent claims markets and result in both households being made worse off. Notice that if Arrow–Debreu securities were available at $t = 0$ (as well as $t = 1$) then the introduction of finer information would

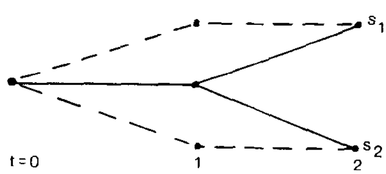

FIGURE 3

[11] See Arrow [1, 2] and Breyer [4], where this example is discussed.

lead to contingent trades at $t=0$ and both households would be indifferent to the introduction of the finer information. Of course the markets at $t=1$ would have no trades, but this would be a matter of indifference as far as households were concerned.

3.2. Examples, such as the one exposited in Section 3.1, generated an extensive literature discussing the welfare implications of introducing finer public information.[12] Recently, Hakansson *et al.* [11] have provided necessary and sufficient conditions for finer information to imply a Pareto improvement. They restricted their analysis to a model with a single commodity, finite states, at most two dates, and von Neumann–Morgenstern utility functions. These strong assumptions were imposed to exclude the kind of perversities that we discussed in Section 2. (see Ohlsen and Buckman [27, 28]). Hakansson *et al.* showed that without strong restrictions on preferences, endowments, and market availability, the introduction of public information could lead to any welfare change.

We are able to generalize this observation by showing that the second-best forces which underlie our example in Section 2, also drive the ambiguous welfare implications associated with the introduction of finer information. This can be seen at two levels. First, by inspecting the general structure of the model in Section 1 it is obvious that the information and asset constraints enter as second-best constraints. Thus it should come as no surprise that ambiguous welfare conclusions follow from the introduction of finer information. Also, this example shows that Pareto inferior allocations can arise even though contingent markets remain active.

The example of Section 2 can be translated as follows. Assume that $t=0, \ldots, 3$, $s=s_1, s_2$. The initial structure of information is illustrated by the solid lines in Fig. 1. Assume that contingent asset markets operate between $t=0, 1$; and between $t=2, 3$. Assume that for both households, endowments are

$$\omega_h(t, s)=\begin{cases}0 & \text{for} \quad t=0;\ s=s_1, s_2\\ 1 & \text{for} \quad t=1, 2, 3;\ s=s_1, s_2.\end{cases}$$

The utility functions can be reinterpreted as

$$\begin{aligned} V_{H_1} &= U_{H_1}(x_{H_1}(1, s_1))+f(x_{H_1}(1, s_1); x_{H_1}(2, s_1), x_{H_1}(3, s_1))\\ &\quad +\theta^{H_1}g(x_{H_1}(2, s_2), x_{H_1}(3, s_2));\\ V_{H_2} &= U_{H_2}(x_{H_2}(1, s_2))+\theta_{H_2}\, g(x_{H_2}(2, s_1), x_{H_2}(3, s_1)).\\ &\quad +f(x_{H_2}(1, s_2); x_{H_2}(2, s_2), x_{H_2}(3, s_2)). \end{aligned}$$

[12] For example, Hirshleifer [15], Marshall [21], Ng [25, 26], and Jaffe [18].

With the same restrictions on the functions, the Edgeworth boxes in Fig. 2 have a new interpretation. The first box represents trades at $t=0$, for contingent claims at $t=1$. Given the structure of information both households cannot discriminate across states at that date, so both households remain at their endowment point. The second and third boxes can be interpreted exactly as in the example in Section 2.

Now assume that finer information is revealed at date $t=1$, so that both households can discriminate between the two states. (The information structure can be illustrated by the broken lines in Fig. 1.) Again the story can be portrayed exactly as in Fig. 2: both households swap their contingent endowments in the first box and the trade lenses contract in boxes 2 and 3. Our example provides an illustration where finer public information improves or worsens welfare, depending upon the choice of the utility parameters (θ^{H_i}).

Notice that unlike the example in Section 3.1 welfare losses are not necessarily accompanied by the elimination of contingent markets. Although our example illustrates this extreme case, it can be modified easily to produce the same welfare conclusions and yet retain some trading in boxes 2 and 3. The loss in welfare is not necessarily associated with the elimination of contingent markets.

The reader may have noticed that our example with changing information can be modified slightly to provide another example of an economy with fixed information but the opening of additional asset markets. The trick is to assume the existence of the finer information structure (the broken lines in Fig. 1) but have trade in the first box be impeded by asset constraints that disallow contingent trades. This variation of the example shows that there are cases where the opening of asset markets is formally equivalent to the introduction of finer information. This might tempt one to argue that choosing finer B's or less restrictive C's are substitute methos for achieving Pareto improvements. However, as we now discuss, this statement does not hold in general.

3.3. The preceding discussion serves to emphasize the structural similarity between the "new securities market" problem and the "finer information structure" problem. This similarity is underscored by the fact that the same example serves both problems. Nevertheless it needs to be understood that the two problems, while close, are distinctly different. The difference can be emphasized by observing that one can exhibit a class of economies possessing the following the two properties:

1. the opening of a new securities market does not require that any household be worse off in the new equilibrium; but

2. the introduction (instead) of a finer information structure leads all households to be worse off in the new equilibrium.

This class is characterized by equilibria which are Pareto optimal relative to the information constraints.[13] It is not difficult to demonstrate that, in these economies, the opening of additional asset markets has no impact on trading and, therefore, on welfare.[14] Yet, as Hirshleifer's example demonstrates, the introduction of finer information can lead to a Pareto worsening.

In terms of the general structure, it is easy to see that the information constraints and asset formulated in Section 1 do not enter symmetrically. First, unlike the information constraints, the set C is not necessarily represented by a set of linear constraints on asset trades. Second, the information constraints act on consumption vectors as well as asset vectors. Third, the information constraints enter jointly into the budget constraints which is not true of the asset constraints.

4. Conclusion

It is by now well understood that a Pareto worsening can result from either the opening of a new securities market and/or the introduction of a finer information structure. However, thus far the degree to which these two problems are related has received scant attention. In an attempt to study this relationship, the present paper has proceeded to construct a general, unified second-best framework which carefully distinguishes asset constraints from information constraints. This framework was then used to communicate the intuition which underlies some of the major Pareto-worsening results. Moreover, our discussion also made clear that the new securities market problem and finer information problem are distinct.

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[13] Examples of such equilibria (in a different context) can be found in Foldes [8] and Milne and Shefrin [24].

[14] The formal proof of this assertion can be obtained by writing to the authors.

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