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Asymmetric Abundance and the Pattern of Futures Projects

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The demand for the future commodity (cotton) has been attributed to information asymmetry (contracting literature). Backwardation, and the presence of short order to be expected, is a hedge to avoid future price risks. More recent evidence of the quantity traded at a producer's expense is the possibility of an absence of long order to the market. A backwardation, and an arbitrage (1987), it argues to the present of a commodity. However, if we are dealing with a true futures market, under the above assumption, there is no effect on the formation of futures (or cash) prices.

ABSTRACT

Categorize Institute of Technology

Asymmetric Arbitrage and the Pattern of Futures Prices

1 Introduction

(September 5, 1984)
In a world with an equal number of short and long hedge, with no competition of the market, and assumption that all market participants are rational, the net present value of the futures contract is zero, indicating that it is an attractive, on-net present value.

This result is consistent with the assumption that the futures contract is a perfect hedge, and that the market is efficient, in the sense that all information and market participants have access to the same information.

However, in a world with an unequal number of short and long hedge, with competition of the market, the futures contract may not be a perfect hedge, and the net present value of the futures contract may be different from zero, depending on the degree of market competition.

In conclusion, the futures contract provides a way for market participants to hedge against price risk, and to participate in the market for derivatives.

References:

As interest, warehousing, franchise, and the like, associated with cash commodities, introduce commodity yields as well as a specially designed function representing the "carry" costs, i.e., I^2 - 3, where the effective period 't' is at the end of the period 'T', and the long and short hedges are assumed to be perfect.

Hedgers take these profits when the price of the commodity options deteriorates under the future. The replication of this world is a futures market as well.

We consider a world in which there is a futures market as well.

2. The Model

At least, highly correlated when applied to a true futures market.

The option is at this time, despite the ultimate appeal.

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Similarly, the futures market exhibits a converage at time \( t \),

\[
I_t - 1 = \frac{\text{Futures market price}}{\text{Cash market price}} - 1
\]

The futures market is said to exhibit a converage at time \( t \). If

\[
I_t - 1 = \frac{\text{Futures market price}}{\text{Cash market price}} - 1 > 0
\]

If

\[
I_t - 1 = \frac{\text{Futures market price}}{\text{Cash market price}} - 1 < 0
\]

It is assumed that the commodities at \( t = 1 \) to \( t = \infty \) are represented by the cash commodities.

\( t = 0 \). Similarly, it is assumed that all of the commodities for the cash commodities (except for the futures price) are represented by the cash commodities available for use at time \( t = 0 \) to \( t = \infty \). It is assumed that the futures market is open at time \( t = 0 \). Hence, it is assumed that the cash price per unit of the futures market equals the cash price per unit of the cash market.

If

\[
I_t - 1 = \frac{\text{Futures market price}}{\text{Cash market price}} - 1 > 0
\]

and futures market prices are increasing.

The process continues for \( t = 1, 2, \ldots, \infty \). Finally, at time \( t = \infty \)

and \( \hat{A}_t, \hat{B}_t \) are known at the time that \( W_t, \hat{W}_t, \hat{A}_t, \hat{B}_t \) are undertaken.

where \( \hat{a} \) is a discount factor.

\[
(\frac{1}{\sigma})^2 \frac{I_{\hat{a}}}{I_{\hat{B}}} = \frac{1}{I_{\hat{G}}}
\]

The objective functions for the hedgers are then given by

\[
(\frac{1}{\sigma})^2 \frac{I_{\hat{a}}}{I_{\hat{B}}} = \frac{1}{I_{\hat{G}}}
\]

The same for both short and long hedgers.

\[
(\frac{1}{\sigma})^2 \frac{I_{\hat{a}}}{I_{\hat{B}}} = \frac{1}{I_{\hat{G}}}
\]

The cash market is assumed to be the same for both short and long hedgers.

\[
(\frac{1}{\sigma})^2 \frac{I_{\hat{a}}}{I_{\hat{B}}} = \frac{1}{I_{\hat{G}}}
\]
\[ 0 = \frac{1}{2} d \left( \frac{\partial^2}{\partial x^2} \right) \left[ 1 - \frac{L_d}{1 - d} \right] \frac{\partial}{\partial x} \left( \frac{\partial}{\partial x} \right) \phi \]  

(6)

\[ 0 = \frac{1}{2} d \left( \frac{\partial^2}{\partial x^2} \right) \left[ 1 - \frac{L_d}{1 - d} \right] \frac{\partial}{\partial x} \left( \frac{\partial}{\partial x} \right) \phi \]  

(7)

Moreover, at any time \( t \), the forward price is deterministic.

For a short position appear as

\[ 0 = \frac{1}{2} d \left( \frac{\partial^2}{\partial x^2} \right) \left[ 1 - \frac{L_d}{1 - d} \right] \frac{\partial}{\partial x} \left( \frac{\partial}{\partial x} \right) \phi \]  

(8)

For a short position appear as

\[ 0 = \frac{1}{2} d \left( \frac{\partial^2}{\partial x^2} \right) \left[ 1 - \frac{L_d}{1 - d} \right] \frac{\partial}{\partial x} \left( \frac{\partial}{\partial x} \right) \phi \]  

(9)

For a long position appear as

\[ 0 = \frac{1}{2} d \left( \frac{\partial^2}{\partial x^2} \right) \left[ 1 - \frac{L_d}{1 - d} \right] \frac{\partial}{\partial x} \left( \frac{\partial}{\partial x} \right) \phi \]  

(10)

For a long position appear as

\[ 0 = \frac{1}{2} d \left( \frac{\partial^2}{\partial x^2} \right) \left[ 1 - \frac{L_d}{1 - d} \right] \frac{\partial}{\partial x} \left( \frac{\partial}{\partial x} \right) \phi \]  

(11)

For a long position appear as

\[ 0 = \frac{1}{2} d \left( \frac{\partial^2}{\partial x^2} \right) \left[ 1 - \frac{L_d}{1 - d} \right] \frac{\partial}{\partial x} \left( \frac{\partial}{\partial x} \right) \phi \]  

(12)

For a long position appear as

\[ 0 = \frac{1}{2} d \left( \frac{\partial^2}{\partial x^2} \right) \left[ 1 - \frac{L_d}{1 - d} \right] \frac{\partial}{\partial x} \left( \frac{\partial}{\partial x} \right) \phi \]  

(13)

For a long position appear as

\[ 0 = \frac{1}{2} d \left( \frac{\partial^2}{\partial x^2} \right) \left[ 1 - \frac{L_d}{1 - d} \right] \frac{\partial}{\partial x} \left( \frac{\partial}{\partial x} \right) \phi \]  

(14)

For a long position appear as

\[ 0 = \frac{1}{2} d \left( \frac{\partial^2}{\partial x^2} \right) \left[ 1 - \frac{L_d}{1 - d} \right] \frac{\partial}{\partial x} \left( \frac{\partial}{\partial x} \right) \phi \]  

(15)

For a long position appear as

\[ 0 = \frac{1}{2} d \left( \frac{\partial^2}{\partial x^2} \right) \left[ 1 - \frac{L_d}{1 - d} \right] \frac{\partial}{\partial x} \left( \frac{\partial}{\partial x} \right) \phi \]  

(16)

For a long position appear as

\[ 0 = \frac{1}{2} d \left( \frac{\partial^2}{\partial x^2} \right) \left[ 1 - \frac{L_d}{1 - d} \right] \frac{\partial}{\partial x} \left( \frac{\partial}{\partial x} \right) \phi \]  

(17)

For a long position appear as

\[ 0 = \frac{1}{2} d \left( \frac{\partial^2}{\partial x^2} \right) \left[ 1 - \frac{L_d}{1 - d} \right] \frac{\partial}{\partial x} \left( \frac{\partial}{\partial x} \right) \phi \]  

(18)

For a long position appear as

\[ 0 = \frac{1}{2} d \left( \frac{\partial^2}{\partial x^2} \right) \left[ 1 - \frac{L_d}{1 - d} \right] \frac{\partial}{\partial x} \left( \frac{\partial}{\partial x} \right) \phi \]  

(19)

For a long position appear as

\[ 0 = \frac{1}{2} d \left( \frac{\partial^2}{\partial x^2} \right) \left[ 1 - \frac{L_d}{1 - d} \right] \frac{\partial}{\partial x} \left( \frac{\partial}{\partial x} \right) \phi \]  

(20)

For a long position appear as

\[ 0 = \frac{1}{2} d \left( \frac{\partial^2}{\partial x^2} \right) \left[ 1 - \frac{L_d}{1 - d} \right] \frac{\partial}{\partial x} \left( \frac{\partial}{\partial x} \right) \phi \]  

(21)

For a long position appear as

\[ 0 = \frac{1}{2} d \left( \frac{\partial^2}{\partial x^2} \right) \left[ 1 - \frac{L_d}{1 - d} \right] \frac{\partial}{\partial x} \left( \frac{\partial}{\partial x} \right) \phi \]  

(22)

For a long position appear as

\[ 0 = \frac{1}{2} d \left( \frac{\partial^2}{\partial x^2} \right) \left[ 1 - \frac{L_d}{1 - d} \right] \frac{\partial}{\partial x} \left( \frac{\partial}{\partial x} \right) \phi \]  

(23)
Using the factor approach, the immediate condition is:

\[ 0 = I - \delta p(I - L_d)g(I - L_d) \left\{ 1 - \frac{I - L_M}{I} \right\} + I - L_d \left\{ I - L_d \right\} n^0 \]

The total order condition in the market clearing condition is:

\[ 0 = I - \delta p(I - L_d)g(I - L_d) \left\{ 1 - \frac{I - L_M}{I} \right\} - I - L_d \left\{ I - L_d \right\} n^0 \]

The limit order condition is:

\[ 0 = I - \delta p(I - L_d)g(I - L_d) \left\{ 1 - \frac{I - L_M}{I} \right\} + I - L_d \left\{ I - L_d \right\} n^0 \]

where we satisfy the market clearing condition. Further, integrate the total order condition in (8) by parts to implement that the market satisfies the condition of:

\[ 0 = \int \delta p(x) \left\{ I - \frac{I - L_M}{I} \right\} - I - L_d \left\{ I - L_d \right\} n^0 \]

This will be done in (9) and (10) to get the common knowledge properties.

Further, integrate the total order condition in (9) by parts to implement that the market satisfies the condition of:

\[ 0 = \int \delta p(x) \left\{ I - \frac{I - L_M}{I} \right\} - I - L_d \left\{ I - L_d \right\} n^0 \]

Note that considering the two factor order conditions in (8) and (9) with all invertibility from time 1 to 1 by 0, we have:

\[ 0 = I - \frac{I - L_M}{I} \]

and

\[ 0 = I - \frac{I - L_M}{I} \]

with a total order condition at time 1 and time 2 are both the same and futures prices. Then we obtain the common knowledge properties and preferences.

Suppose that the common knowledge at time 1 is the same as futures prices. Then all traders have the same expected utility functions and therefore, the market clears.

Consider next the market for a possible candidate for a market in the future.
a martingale criterion. In particular, assume that the dynamic of a set of states are maximal among the martingale (without arbitrage). It is convenient to begin with

because we want to explore the effects of asymmetric arbitrage.

with the martingale under arbitrage.

and then to consider the resulting action of market clearing process.

at time $t$. Our approach is to first construct an

tree, and then to project the resulting action at time $t$. In such a situation, hold by all

perpetual to occur. Then, let $(\frac{1}{2}, \frac{3}{2})$ denote the joint density over the

consider the non-perfect market in which arbitrage is not

exceed the number at any point in time.

where the martingale criterion is satisfied. The amount by which the cash price

never exceed the number at any point in time.

Futures markets.

effect on the pattern of the market clearing process in the cash and

consider the cash and futures components, which in turn has an

process, and hence can have an impact on the decision of hedgers,

improve a trading constraint on the joint pdf over the cash and futures

conditioned on the joint futures market, asymmetric arbitrage can

the two futures markets, with two more detailed option strategies under the

the situation is quite different once we move to a true

Futures market.
\[ (A' \cdot x)_{I_A} = x_{I_A} = x_{I_A} - x_{I_A} = (x_{I_A})_{I_A} \]

Note that we do not require symmetry of the demand over time. Then

\[ (I_{-A})_{I_A} = x_{I_A} \]

and

\[ x_{I_A} \]

)satisfy

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When an asset is permitted, the third order condition holds.

Proposition 2. The propagation of an asset in the presence of a third or higher order condition is given by

\[
(\text{expected utility of asset} = \text{expected utility of non-asset})
\]

Hence, we have the following:

for all \( 3d \) and \( d \) if \( u(3d) > u(d) \), then \( u(3d) > u(d) \), which is a property of the distribution of the asset.

For all \( 3d \) and \( d \) if \( u(3d) > u(d) \), then \( u(3d) > u(d) \), which is a property of the distribution of the asset.

Since, for any \( d \), we have

\[
\text{expected utility of asset} = \text{expected utility of non-asset}
\]

Thus, the effect of asset propagation is to concentrate at

\[
\frac{3d^2}{d - 3d} + \frac{3d}{d - 3d}
\]

where \( d = 3d \) for \( d \) and \( 3d \) for \( 3d \).

Proposition 2. Given an equal number of short and long headers, each

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where \( d = 3d \) for \( d \) and \( 3d \) for \( 3d \).
In order to show that the艺关 agendas appear, the aggregation function. In
\[ L-s_A = L-s_B, L-s_M = L-s_W, \quad \text{where} \quad L-d = \int \phi_j d\theta \quad \text{and} \quad L-s = \frac{x}{s} \]

\[ \frac{\int \phi_j d\theta}{s} \frac{L-d}{s} \frac{L-s}{s} \]

(6)
The graphs and equations in the document illustrate the relationship between the density and the economic variables. The curves represent different scenarios involving supply, demand, and price levels. The diagrams show how changes in these variables affect the equilibrium price and quantity.

In Figure 1, the solid line represents the equilibrium density, and the dashed line represents the density at different price levels. The slope of the curves indicates the responsiveness of supply to changes in price. The equations provided in the text correspond to the graphical representations, with variables representing the density, supply, and demand functions.

The text elaborates on the implications of these relationships, discussing how changes in supply and demand affect the equilibrium point. It also highlights the importance of understanding these dynamics for economic analysis.

The document concludes by noting the importance of considering both short- and long-term effects when analyzing market conditions. The diagrams and equations serve as tools for visualizing these effects and for making informed decisions in economic policy.
at \( t = T - 1 \). To clear markets, the futures price \( p_{T-1}^f \) falls and the cash price \( p_{T-1}^c \) rises.

Proposition 4. Given an equal number of short and long hedges, all with identical utility functions and densities over cash and futures prices, assume (1) when arbitrage is prohibited, the density \( h(p_{T-1}^c, p_{T-1}^f) \) is uniform; (2) cash and futures commitments are technical complements for one another; (3) the utility function is characterized by constant or decreasing absolute risk aversion. Then the effect of introducing arbitrage is to lower the futures price at \( t = T - 1 \) and to raise the cash price at \( t = T - 1 \), both relative to the equilibrium prices when arbitrage is prohibited.

Proposition 4 provides some highly restrictive sufficient conditions for the effect that Houthakker argued was due to arbitrage, with arbitrage encouraging short hedging and discouraging long hedging. Note, however, that even under the highly restrictive conditions of Proposition 4, there is no guarantee that the equilibrium when arbitrage is present is a backwardation equilibrium. The reason is that the introduction of arbitrage makes short hedging more attractive in part because it lowers the expected value of the futures price at time T, since the upper tail of the density \( h \) is lopped off by arbitrage. What is required for arbitrage to lead to backwardation is not simply that short hedging be encouraged and long hedging be discouraged; net short hedging must be encouraged enough so that the fall in the futures price at \( t = T - 1 \) more than compensates for the fall in the expected value of the futures price at \( t = T \). This requires restrictive quantitative conditions on the utility function and on the density, beyond the conditions specified in Proposition 4. It is clear that the presence of asymmetric arbitrage is at best a tenuous argument for a backwardation equilibrium.

One other point should be made about the pattern of futures prices under asymmetric arbitrage, given the rational expectations framework. The common knowledge assumption that underlies rational expectations equilibria guarantees that the only effect that asymmetric arbitrage will have so far as backwardation (or a contango) is concerned is in the \( t = T - 1 \) market. The reason for this is that whatever is the relationship between the market clearing cash and futures prices on the \( t = T - 1 \) markets, this relationship will be inferred by all traders at a rational expectations equilibrium at \( t = T - 2 \). Similar arguments apply to \( t = T - 3, T - 4, ..., 0 \).

Backwardation (or a contango) can only occur in the \( t = T - 1 \) markets. This means that at a rational expectations equilibrium, the upper limit on the futures price imposed by arbitrage does not constrain the equilibrium in any period prior to \( T - 1 \), and the futures market is reduced to a simple forward market in all such prior periods. The futures price in such periods simply equals the cash price plus carrying costs to maturity of the futures contract, and there is no role for speculation to play, since the futures market attains a martingale equilibrium. This might be viewed as a rationalization of sorts for the widespread use of two period models in the literature on
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5. Conclusion.

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