



**AgEcon** SEARCH  
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

*The World's Largest Open Access Agricultural & Applied Economics Digital Library*

**This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.**

**Help ensure our sustainability.**

Give to AgEcon Search

AgEcon Search  
<http://ageconsearch.umn.edu>  
[aesearch@umn.edu](mailto:aesearch@umn.edu)

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*



## **INTERNATIONAL DIVERSIFICATION OF THE ASSET PORTFOLIO BY INVESTING IN AGRICULTURAL COMMODITIES. WHY NOT USE THE CAPM FUTURES MARKETS?**

**Gheorghe Hurduzeu**

*The Research Institute for Agriculture Economy and Rural Development*  
[geohurduzeu@gmail.com](mailto:geohurduzeu@gmail.com)

**Raluca Hurduzeu**

*Bucharest University of Economic Studies*  
[rehurduzeu@gmail.com](mailto:rehurduzeu@gmail.com)

**Abstract:** The international diversification of assets by investing in agricultural commodities has manifested increasingly in recent years, as demonstrated by the growth in investment in commodities which have augmented rapidly in recent years, the prospect is that they will increase further. The common perception is that international trade markets investments popularity comes from the fact that the goods constitute an alternative asset class with returns that present, at least in theory, low or negative correlation with the returns on assets belonging to traditional asset classes: stocks and bonds. *Harry Markowitz* (1959) and *James Tobin* (1958) developed *the theory of optimal selection of securities portfolios in an uncertain environment*. This was developed by *William Sharpe* (1964) and *John Lintner* (1965) in a general equilibrium model prices. This model completes and improves *Markowitz's* theory, because even its author *William Sharpe*, leaves in its development, inters alia, on the premise that the investor will use an investment approach as described by his predecessor. Basically the model enables us to facilitate the work in evaluating the expected earnings of the various securities and portfolios, which relates to a risk measure called  $\beta$ . What is particularly important about this model is that it is currently applied in the industry of the investments, maybe not in its original form, but in newer versions adapted of it. However, the researchers concluded that the overall balance given by the CAPM is quite inconsistent in practice. Other authors have attempted to explain the application of CAPM on futures markets. The conclusion was that the CAPM is not consistent in explaining the results of the futures markets, but also the qualitative and quantitative empirical phenomena are unable to explain the results from the futures markets.

**Keywords:** portofolio, diversification, prices, volatility, risk

## 1. THE CAPM MODEL – BRIEF CONSIDERATIONS

The general model of equilibrium is generally based on the assumptions (A<sub>1</sub>) to (A<sub>7</sub>).

(A<sub>1</sub>) Investors evaluate the portfolios in terms of the expected earnings profile - standard deviation determined for a well-established period of time.

(A<sub>2</sub>) Faced with a choice between two portfolios, otherwise identical, investors will choose the portfolio with the lowest standard deviation.

(A<sub>3</sub>) The quantities of all shares are predetermined.

(A<sub>4</sub>) All investors have the same perceptions about expected earnings, standard deviations and covariances of the titles.

(A<sub>5</sub>) There is a risk-free rate at which an investor may be granted or borrow money

(A<sub>6</sub>) The fees and transaction costs are irrelevant..

(A<sub>7</sub>) The individual assets are perfectly divisible, an investor may purchase, if so desired, a fraction of a share.

The basic implications of CAPM are:

(CAPM - 1) All investors hold in portfolios all the assets in the same proportions regardless of preferences. Defining the expected gains as the earnings of an asset  $E(R_i)$  in excess of the risk-free gains,  $r$ , the following implication is:

(CAPM - 2) The expected return of the market and risk-free gain  $(E(R_i) - r)$  is proportional to the expected market gain  $(E(R_m) - r)$ .

(CAPM - 3) If  $\beta_i$  is the covariance of the returns of the title  $i$  with the market portfolio, divided by the variation of the returns of the market portfolio.

This can be defined as:

$$E(R_i) = r + \beta_i [E(R_m) - r] \quad (1)$$

and

$$\beta_i = \text{cov}(R_i, R_m) / \text{var } R_m \quad (2)$$

Combining the two implications, the fourth implication is:

(CAPM - 4) the appropriate risk measure for an asset is not its own variance, but the covariance of its rate of profit and the market portfolio.

So the expected rate of gain is equal to the sum of two terms: the risk-free rate of return and an increase compensating for the acceptance of a risky asset. This compensation for beta risk is expressed as a result of the additional asset multiplied by the supplementary result of the market,  $E(R_m) - r$ . This additional result is called *risk premium*.

The factor  $\beta_i$  is the percentage of the increase in portfolio risk resulting from the marginal increase in the share of the asset  $i$  has on the market portfolio.

$$\beta_i = \frac{1}{\sigma_m} \frac{\partial \sigma_m}{\partial w_i} \quad (3)$$

where  $\sigma_m$  is the standard deviation of portfolio gains and  $w_i$  is the percentage the  $i$  asset has on the portfolio.

The empirical evidence on the CAPM model testing are inconsistent with the theory (see *Lintner*, 1965), *Miller, Scholes* (1972), *Black, Jensen et Scholes* (1972), *Levy* (1978), etc.). The research used data sets to estimate the coefficient  $\beta_i$  in the equation (1).

Using  $\beta_i$  derived from the data series we reach:

$$\overline{R}_i = \gamma_0 + \gamma_1 \widehat{\beta}_i + e_i \quad (4)$$

$$\overline{R}_i = \gamma_0 + \gamma_1 \widehat{\beta}_i + \gamma_2 \sigma_i^2 + e_i \quad (5)$$

Where  $\overline{R}_i$  is the average of the earnings for the title  $i$  throughout the period,  $\sigma_i^2$  is the variance of the earnings for the title  $i$ ,  $\widehat{\beta}_i$  is the systemic risk and  $e_i$  is the random error associated with the earnings brought by title  $i$ .

If the CAPM is valid then the equation (4) must correspond to the equation (1). Thus, the following hypotheses have to be true.

(I<sub>1</sub>) The coefficient  $\gamma_0$  corresponds to the risk-free rate  $\overline{r}$

(I<sub>2</sub>) The coefficient  $\gamma_1$  corresponds to the average market earnings minus the risk free rate  $(\overline{R}_m - \overline{r})$

(I<sub>3</sub>) The coefficient  $\gamma_2$  in equation (5) should be zero because (CAPM – 4): the only relevant risk is  $\beta_i$  and not the own variation of the title.

The conclusions drawn from the empirical research showed that the CAPM model described in equation (1) are not adequate to the descriptions of the structure of the earnings of the financial assets.

## 2. USING THE CAPM MODEL ON FUTURES MARKETS

Can the CAPM model be extended to the study of the futures markets, namely the agricultural markets?

The starting point is the risk premium which should be identified on the commodity futures markets. The research is numerous, using various methodologies, data related to different commodities, markets, and time series.

*Keynes* considered the futures markets the ones on which the traders have commodities and sell futures contracts to transfer the risk of price fluctuations<sup>1</sup>. He believed that futures prices are lower than expected spot prices and therefore the futures prices that should grow to equal the future spot prices when the contract expires. In other words, forward prices, the price is above the spot price, must fall below anticipated spot to at least the sum given by the normal backwardation. *Keynes's* rationale is simple: excluding the speculative opportunities in a risk-neutral economy, futures prices should equalize on the spot and those traders will be rewarded at maturity. Therefore, the futures price deviation from the expected spot price is given by the *risk premium*, which can increase if traders have long or short risk aversion higher than the counterparty. For example, the farmers should sell futures to stabilize the prices of the next crop. If farmers have a strong aversion to risk, they will be willing to sell futures at a price below the expected spot price for the commodity. If this situation

---

<sup>1</sup>. In his *Treaty on Money*, he shows that on the commodities market, there are at the same time two prices - spot and forward prices. For the producer wishing to sell in the future, the main role is played by the forward price. Thus, he/she can eliminate the price risk by selling forward freight before harvesting. If the forward price indicates profit compared to production costs, it can start producing, selling at time and eliminate any risk of price. If the forward price does not cover production costs then there is no incentive to produce in general. This fact, according to John M. Keynes, the forward price plays the role of an indicator for next status of the spot market.

The spot and forward prices can be different depending on the existence of correlations in time, on the spot market, excess or lack of products. If the supply is less, the spot price will be higher than at term. This difference John M. Keynes called it backwardation. In other words, the state of market equilibrium, the spot price exceeds the forward price to the size of the prize, which they hope to receive speculators. If the offer is insufficient on the spot market, the backwardation can grow. He/ she will be limited to buyer reluctance to pay a price higher than spot to postpone the period of purchase.

The situation in which the price is higher than the spot, Keynes named contango (premium). The size of the premium must be equal to the cost of delivery. The existence of contango does not say that the manufacturer may be subject to a hedging position without paying a premium for the risk. Because of the existence of surplus of products, the market is not in equilibrium, hence the price increase is observed. And because the hedger must pay the risk premium, the forward price must be lower than the expected spot price; otherwise it means that the manufacturer pays a negative price to safety or lack of risk.

persists futures prices fall below the expected spot prices. *Keynes* also believed that hedgers have normal positions as sellers and speculators with positions of buyers.

So, the speculators are on the other side and buy these futures contracts with a discount under the estimated price<sup>2</sup>. *The magnitude of this discount is the risk premium required by the speculators.*

*Keynes's* theory about the 'normal backwardation' was and is the subject of numerous controversies. *Brennan* (1958), *Cootner* (1967) and *Telser* (1958) tried to find out whether the 'normal backwardation' exists. The debate was continued by *Dusak* (1973), *Carter, Rausser and Schmitz* (1983), *Kolb* (1992) and others. *Dusak* (1973) applied the CAPM in an attempt to determine the risk premium that speculators should receive in order to balance other market opportunities.

The purpose of the research was the implication (CAPM - 4) described above. The proper measure of the risk of an asset is not its own variation but the covariation of its rate of earnings with the market portfolio.

As a measure of the risk premium, which is the expected rate of earnings of a futures contract over the risk free rate, we used the discount of futures price  $P_f(0)$  below the expected subsequent price  $EP_i(1)$  as a percentage of the current cash price  $P_i(0)$ . This term is given by the left side of equation (6). According to (CAPM - 2) and (CAPM - 3) it must be proportional to the rate  $\beta_i$ , the term of the right side of equation (6).

$$\frac{EP_i(1) - P_f(0)}{P_i(0)} = \beta_i [E(R_m) - r] \quad (6)$$

The demanded risk premium is depended on  $\beta_i$ , which measures the systemic risk. Is it positive, as stipulated by *Keynes*?

The *Dusak* model estimates the regression of the equation (7) for futures contracts on wheats, corn and soybeans at CBOT.

$$R_i = \alpha_i + \beta_i R_m + \varepsilon \quad (7)$$

where  $R_m$  is the earning brought by index S&P 500 and  $R_i$  is the earning brought by the futures contracts, the term on the left side of the equation (6).

---

<sup>2</sup> Hurduzeu, Gh. et al. (2002), *Speculatia si acoperirea pepietele la termen de marfuri agricole*, editura RAO, Bucuresti, pp/59-91.

The findings of the research show that both earnings and  $\beta_i$  showed values closed to zero. Consequently there is no systematic risk brought by the futures contracts of the market portfolio. As a result, futures prices should not be trade with a discount and 'normal backwardation' should not exist.

Subsequently, the research of *Carter, Rausser și Schmitz* (1983) have come to opposite conclusions.

Thus:

1. The data is inconsistent with the CAPM model in the sense that  $\gamma_1$  from (4) has negative values (theoretically,  $\gamma_1$  should be positive  $(\overline{R_m} - \overline{r}) > 0$ ).
2. This is supported by the *Keynes's* theory
3. The earnings on futures and equity are the same
4. An investor can reduce the risk without lowering the rate of returns by portfolio diversification, combining the stock with the futures. If we change the portfolio with all stock with one in which we have 60% stock and 40% futures on commodities, an investor can reduce the standard deviation of earnings to one-third without sacrificing the earnings.

*Bodie și Rosansky* (1980) find positive earnings related to futures positions. Similarly, *Fama și French* (1987) found positive gains which confirmed *Keynes's* theory.

*Carter, Rausser și Schmitz* (1983) explored the systemic risk for futures and found evidence supporting the *normal backwardation*. They chose the contracts on wheat, corn and soybeans as *Dusak*.

Also, *Marcus* (1984) and *Baxter, Connie and Tamarkin* (1985) did not find any evidence related to *normal backwardation* and *Ehrhardt, Jordan and Walking* (1987) have extended the research using the Arbitrage Price Theory for futures contracts on wheat, corn and soybeans and found no evidence about the risk premium.

*Chang* (1985) uses nonparametric methods to test the existence of the risk premium for the same products. He argues that speculators make profits for these products although the method used did not prove to measure the size of the risk premium.

*Kolb* (1992) shows that *Keynes's* theory of normal backwardation is 'normal' but not for all commodities.

## CONCLUSIONS

From the studies mentioned above, there are several strong arguments for the inapplicability CAPM on futures markets:

1. An important implication is the model of the general equilibrium (CAPM – 1): the investors take the risk in its portfolio as far as titles are available on the market. This implication does not make sense on futures markets because here we have the number of open positions equally divided between long and short. This makes the net positions to be zero because the number of long positions equals the number of short positions. How can then both holders of both long and short portfolios have the same proportions?
2. The presumption (A3) of the CAPM, such that all titles are predetermined quantities is unenforceable on futures markets. The open positions are determined by the economic conditions of endogenous variables and vary considerably over a month.
3. Almost all open positions are on the closest maturities typically futures contracts with maturities of three months. The futures contracts are ‘securities’ on the short term, while the shares are long-term transactions.
4. Then the majority of futures market positions are covered to maturity both through purchases and through sales (through offsetting) whereas the transactions are effective shares.
5. More, as many research has shown<sup>3</sup>, an investor can reduce risk without reducing their rate gains through portfolio diversification, combining action with futures, by changing a portfolio of all the action with one in which we have 60% equity and 40% commodity futures. Either this is logically impossible. The earnings rate  $R_i$  for a long position is minus gains rate for a short position. How can then both long and short holders carry the same risk reduction without sacrificing their expected gains?

## REFERENCES

- Baxter, J.; Conine, T.E.; Tamarkin, M. (1985), On Commodity Market Risk Premiums: Aditonal Evidence, *The Journal of Futures Markets*, 5: 121-125.
- Black, F.; Jensen, M.C.; Scholes, M. (1972), The Capital Asset Pricing Model: Some Empirical Tests. In M.C. Jensen (ed.), *Studies in Theory of Financial Markets*, New York: Praeger Publishers.
- Bodie, Z.; Rosansky, V.I. (1980), Risk and Return in Commodity Futures, *Financial Analysts Journal*, May/June: 27-39.
- Brennan, M.J. (1958), The Supply of Storage, *American Economic Review*, 48, 50-72.

---

<sup>3</sup> *Bodie and Rosansky (1980).*



- Carter, C.A.; Rausser, G.C.; Schmitz, A. (1983), Efficient Asset Portofolios and the Theory of Nornal Backwardation, *Journal of Political Economy*, 91: 319-331.
- Chang, E.C. (1985), Return to Speculators and the Theory of Nornal Backwardation, *Journal of Finance*, 40: 193-208.
- Cootner, P.H. (1967), Speculation and Hedging, *Food Research Institute Studies*, VII Supplement, 65-106.
- Dusak, K. (1973), Futures Trading and Investor Returns: An Investigation of Commodity Market Risk Premiums, *Journal of Political Economy*, 81: 1387-1406.
- Ehrhardt, M.C.; Jordan, J.V.; Walking, R.A. (1987), An Application of Arbitrage Pricing Theory to Futures Markets: Tests of Nornal Backwardation, *The Journal of Futures Markets*, 7: 21-34.
- Fama, E.F.; French, K.R. (1987), Commodity Futures Prices: Some Evidende on Forecast Power, Premiums, and the Theory of Storage, *Journal of Business*, 60: 55-73.
- Hartzmark, M.L. (1987), Returns to Individual Traders of Futures: Aggregate Resuts, *Journal of Political Economy*, 95: 1292-1306.
- Hurduzeu, Gh. et al. (2002), *Speculatia si acoperirea pepietele la termen de marfuri agricole*, editura RAO, Bucuresti
- Keynes, J.M. (1930), *A Treatise on Money*, (vol. 2), London: Macmillan.
- Kolb, R.W. (1992), Is Normal Backwardation Normal?, *The Journal of Futures Markets*, vol. 12, No. 1.
- Levy, H. (1978), Equilibrium in an Imperfect Market: A Constraint on the Number of Securities in the Portfolio, *American Economic Review*, 68, 643-58.
- Lintner, J. (1965), The Valuation of Risk Assets and the Selection of Risky Investments in Stock Portfolio and Capital Budgets, *Review of Economics and Statistics*, 47, 13-37.
- Marcus, A.J. (1984), Efficient Asset Portfolios and the Theory of Nornal Backwardation: A Comment, *Journal of Political Economy*, 92: 162-164.
- Markowitz, H. (1959), *Portfolio Selection: Efficient Diversification of Investment*, New York: John Wiley and Sons.
- Sharpe, W.F. (1964), Capital Asset Prices: A Theory of Market Equilibrium Under Conditions of Risk, *Journal of Finance*, 19, 425-42.
- Tobin, J. (1958), Liquidity preference as Behavior Toward Risk, *Review of Economic Studies*, 27, 65-85.