Portfolio Theory: An Application to the Market of Selected Fruit in Caerá State, Brazil

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Abstract. The modern portfolio theory uses a scientific approach to analyze the market of selected tropical fruit in Ceara State. The key idea is to model the relation between risk and return to construct an optimal portfolio. This work presentes a short review of Markowitz's Portfolio Theory. This paper applies portfolio theory to agricultural products, and arrives at some interesting conclusions. As a major conclusion, it suggests that portfolios consisting only of few low-risk assets have a high rather than a low-risk profile. Decision makers who want to reduce portfolio risk must invest in many different assets, even if the individual assets are risky.

Resumo. A moderna teoria do portfolio foi utilizada com o propósito cientifico de analisar o mercado de frutas tropicais selecionadas no Estado do Ceará. A idéia básica é para modelar a relação entre risco e retorno visando construir um portfolio ótimo. Este documento, aplica a teoria do portfolio pela primeira vez a produtos agrícolas no Estado do Ceara   e apresenta interessantes conclusões. Como principal conclusão, ele sugere que portfolios que consistem somente de uns poucos ativos de baixo risco tem resultado em ativos de alto risco. Desta forma, tomadores de decisão que desejam reduzir o risco dos portfolios devem investir nos mais deferentes ativos mesmo que os ativos, individualmente, apresentam alto risco.

The evaluation in terms of income and risk of the main agricultural activities developed in an area is shown as one of the basic requirements to reduce risks in the agriculture (Menezes) 1981. Besides the risk and the profitability, it is another important factor that influences in making decisions. In this context, fruit production is one of the segments of agriculture that has been growing substantially in Ceará State and has stimulated the exports and consequently investments in modern technologies to increase the production of fruits (Pimentel,1998) . However, there are few studies, to determine and compare the returns and the risks of the commodities or which combination of these provide a larger return associated to a certain risk level or vice-versa. It is believed that the results of this research are quite important to guide those that intend to invest in this activity, as well as to serve as base for the incentive to the production of fruit that guarantee a smaller risk level and higher returns.

Materials and Methods

The data used in this study, were collected at CEASA-CE (Agrifood Distribuition Center of the Ceará State) and correspond to the weekly prices in the period of June of 1997 to February of 2001 of some fruits marketed in Ceará State. In the selection of these data we used the fruit that were marketed the most in the period of analysis. The fruit used were banana, orange, passion fruit, papaya and avocado. According to PINDYCK (1994) the terms risk and uncertainty are discussed thoroughly in the economic theory.

The idea of the theory of the portfolio is to foresee a distribution of funds for a given group of stocks or assets that will minimize the risk for a certain level of expected return based on the historical data of a given group of assets. The curve

in Figure 1, represents the best fit between return and risk for selected portfolios of a given number of assets and the compositions that result in minimum risk indicating the different investors' preference resulting in a denominated hyperbolic area of " Efficient " Frontier of investments. The mathematical model of Markowitz was used to select a portfolio formed by assets that allow a larger expected rate of return given a risk level. The development of this methodology is based on the studies of Markovitz(1952), Securato (1986) Pizzol et al (1997), Silva et al (1997). This way the knowledge of the efficient frontier is important because it allows the visualization of the appropriate combinations of risk and return of the investments in potential.
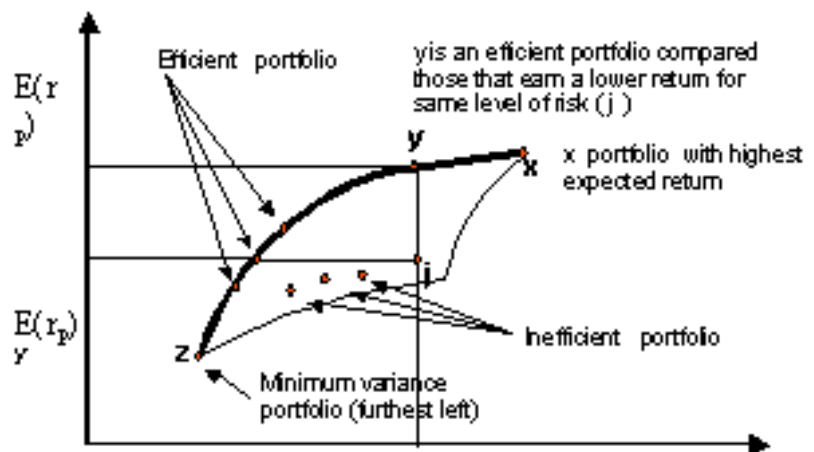
Results and Discussion

In general, in all the cases in analysis there was reduction of the risk and in some cases elevation of the average return of the portfolios because some of the positive assets compensated the damage of the ones that were negative, the theory of the portfolio that says that the risk is reduced with the diversification of the portfolios. The relative statistics to the rate of weekly returns, risks (standard deviation), expected returns and the total invested in each asset are expressed in the Table 1.

Table 1. Rates of expected returns, risks and the percentile invested in each assets.

Assets	Average Return (%)	Risk / Standart Deviation (%)	Total Investment (%)
Avocato	-0,0669	13,8722	100
Banana	-0,0271	14,7434	100
Orange	1,1912	15,4153	100
Papaya	0,0237	15,5874	100
Passion fruit	0,1180	11,5998	100

Seeking to diversify and to know, the behavior of the returns and of the risks of the portfolio,we simulated portfolios with four assets. The points that form the efficient frontier of these portfolios are expressed in the Table 2.

Table 2 . Rates of expected returns and risk of the portfolios formed by four assets.

Four Assets Combination	Expected Return (%)	Risk (deviation) (%)
Banana/avocato/orange/papaya	0,2604	7,93
Banana/avocato/orange/passion fruit	0,2514	7,24
Banana/avocato/papaya/passion fruit	0,0260	7,34
Banana/orange/papaya/passion fruit	0,2990	7,23

All the combinations presented positive average returns in spite of the presence of the negative returns of the banana and of the avocato. The combination composed by banana, orange, papaya and passion fruit had the best result, that is, average return of 0,2990% and risk of 7,23%. This result is due the elevated participation of the orange, with 21,47% and of the passion fruit with 37,45% in the invested amount. Remembering that these fruit when isolated present the largest expected returns. All the portfolios with four assets showed lower risk to the portfolios then three assets. Table 3 presents the referring participations to the great points of each portfolios composed by four assets. As expected the sum of these percentiles form the total of 100% of the investments made in each portfolio.

Table 3 . Compositions of the portfolios formed by four assets that minimize the risk of the investment.

Combinations	Banana	Avocado	Orange	Papaya	Passion Fruit
Banana/Avocato/Orange/Papaya	26,57	26,78	23,51	26,14	-
Banana/Avocato/Orange/Passion fruit	21,09	22,71	19,20	-	37,00
Banana/Avocato/Papaya/Pasion fruit	22,65	22,91	-	17,80	36,64
Banana/Orange/Papaya/Passion fruit	20,91	-	21,47	20,17	37,45

The portfolio with five assets presented the largest return (0,394%) in all the combinations formed by two, three four assets, except for the portfolio composed by only banana and orange and for one formed by three assets banana, papaya and passion fruit that can be explained by the high participation of the orange.

Conclusions

The results of the portfolio with four assets confirm the theory of the diversification, that is, the portfolios formed by a larger number of assets reduce the risk. The best alternative, is the portfolio formed by banana/orange/papaya/passion fruit (smaller risk and larger return).

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