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FINANCE – CHANGE
OF PARADIGM IN TEACHING
AND RESEARCH

1. NEW MODEL FOR TEACHING
AND RESEARCH IN FINANCE

The transformation of the economic system which has been taking place in the last few years in Poland implies changes in science and education. Of course this refers mainly to economics and business. As far as education is concerned, this means substantial changes in the content of many subjects taught in economic and business schools. Undoubtedly, the same is true for the topics of research.

One of the subjects where significant changes have to be introduced is finance, especially corporate finance. It is probably fair to say that we are in the process of changing the paradigm in finance. In a general sense 'paradigm' means 'pattern' or 'model'. The paradigm in finance is understood as a general model to analyze scientific problems in finance and to teach courses in finance.

A common model for teaching and research in finance has been used for years in developed countries. This is an analytical model, based on quantitative methods which is strongly oriented towards managerial goals. This model, as we will show later, was developed in the United States but now is used for research and teaching in many Western countries.

It seems that Poland is forced to adopt this model. Our economic system will resemble the system of Western countries, this also applies to the financial system. The possible merging of our economy with the European Union is another argument. Upon graduation our students will act in an economic system which is very similar to the system of Western countries. Therefore in education

it is necessary to put more emphasis on skills and general knowledge useful for a developed financial system rather than to concentrate on problems specific solely for the transition period. It is very likely that the money and capital markets will grow in the nearest future (e.g. the number of traded stocks will increase, institutional investors will participate significantly in the market), not to mention the new financial instruments that will be introduced.

It is worth mentioning as an additional argument that a person applying for a license as an investment advisor is required to pass the exam based mainly on the same problems as the person applying to be Chartered Financial Analyst in the United States (see Sharpe, Alexander 1990).

This paper presents the general outline of the basic topics in corporate finance, including money and capital markets. To get a better understanding of this scheme, it is worth sketching a brief history of modern finance.

2. FINANCE AS A SCIENCE
– A COLLECTION OF THE MOST IMPORTANT FACTS

The history of finance as a science is over 100 years old. At the beginning, the emphasis of researchers was put on the legal aspects of the financial system, particularly on the establishing and merging of companies and on the issuing of stocks. In the thirties a lot of research was done in the area of solvency, bankruptcy and the reorganization of companies. Studies were also done on the regulation of capital markets by governments.

Until the beginning of the fifties, finance has a purely a descriptive subject, where the company was analyzed from the external point of view. There was a complete lack of precise methods that could lead to the effective financial management of the firm.

In the last 40 years this old-fashioned point of view has been completely changed in developed countries. The analytical point of view has replaced the descriptive one. On one hand, modern finance is heavily based on mathematical methods, on the other hand the emphasis is put on financial management, where both the finance of the firm and the finance of the investors on the financial markets are taken into account.

Let us have a short trip through the history of finance in the last 40 years. It is worth looking at the main breakthroughs of finance.

Without doubt, the most important changes in finance took place more than forty years **ago**. In the first half of the fifties, theoretical bases were founded to use **time-discounted methods** in investment decisions. Today, the concept of time value of money is a fundamental one in finance. Such methods as **Net Present Value** and **Internal Rate of Return** show their advantage over non--discounted methods, like **Payback Period**.

However, the cornerstone of modern finance was laid by Harry Markowitz, a young researcher who wrote his doctoral thesis and published his first paper on **portfolio selection**. This paper (see Markowitz 1952, 77–91) was published in the most respectable finance journal, 'Journal of Finance', and started the discussion on the fundamental concepts of finance.

In his paper, Markowitz considered the following problem: find such a portfolio of stocks so that the **rate of return** on this portfolio is as **high** as possible and the **risk** is as **low** as possible. Markowitz coped with this problem using statistical methods. He showed the possible way of measuring the risk of securities by standard deviation (or variance).

At this time the approach proposed by Markowitz was entirely different from the traditional approach used in finance, therefore it caused a lot of discussion and even resistance. However, after a few years this approach was accepted by scientists in finance. The extended portfolio theory was presented by Markowitz in his book (see Markowitz 1959).

Portfolio theory is now widely used in theory as well as in practice. It is not an exaggeration to say that Markowitz changed the paradigm in finance. Now everyone understands that return and risk have to be measured, securities have to be valuated and the investment decision process for the individual and for the firm has to based on quantitative methods. For his great contribution to finance Harry Markowitz got the Nobel Prize in 1990.

One of the main conclusions drawn by Markowitz is that the rational investor seeking a 'good' portfolio of stocks should consider only so-called **efficient portfolios**. The efficient portfolio is defined as such a portfolio for which, on one hand, there is no portfolio with lower risk for given level of return, while on the other hand, there is no portfolio with higher return for given level of risk.

The next important result of **portfolio theory** was obtained by James Tobin. He considered the portfolio of securities consisting of risky stocks and riskless bonds (see Tobin 1958, 65–86). He extended the results obtained by Markowitz by showing that including riskless bonds in a portfolio can reduce risk by keeping the return on the same or a higher level. So his efficient portfolio dominates an efficient portfolio of stocks. This portfolio lies on the line known as the **Capital Market Line** (CML).

The development of time-discounted methods gives the base to **stock valuation methods**. One of the very first methods which remain widely used nowadays is the Gordon–Shapiro model (see Gordon, Shapiro 1956, 102–110). This model assumes that the stockholder does not sell the stock, and the dividend grows at a constant rate. In this case the value of the stock is the function of: dividend, the growth rate of dividend and the required rate of return of the investor (this rate is simply the cost of equity of the firm).

Another significant contribution to finance was the research by Franco Modigliani and Merton Miller. Their research was in corporate finance rather

than in portfolio theory. However, they used the quantitative approach, which at that time started to become predominant in finance. In 1958, Modigliani and Miller published a paper (see Modigliani, Miller 1958, 261–297) where they considered the capital structure of an unlevered firm (a firm which does not use a debt to finance part of its investments) and of a levered firm (a firm which uses debt to finance part of its investments) and they assumed that there were no corporate taxes and personal income taxes. They stated two propositions.

According to the first one, the value of the firm (levered and unlevered) can be determined by capitalizing its expected net operating income at a rate appropriate to the risk of the firm. This means that when there are no taxes, the value of the firm is independent of its leverage. According to the second proposition, the cost of equity of the levered firm is equal to the cost of equity of the unlevered firm with the same risk plus risk premium depending on the amount of leverage. This means that the cost of equity increases when the use of debt increases.

To conclude the description of the development of finance in the fifties, it is also worth mentioning that some models for **working capital management** were proposed.

The sixties were characterized as the development of research in portfolio theory. The most important results were the single-index model and CAPM.

Single-index model was proposed by William Sharpe (see Sharpe 1963, 277–293). The model gives a linear relationship between return on security and return on the market. This relationship is called **characteristic line** and usually is considered as regression line and determined by statistical methods. The most important notion in this model is **beta coefficient,** which is well known in finance. Beta coefficient shows the change of return on security when the return on market (measured for example via return on stock index) increases by 1%. Therefore beta coefficient can be considered as a measure of market (systematic) risk.

The second important contribution made in the mid sixties was **Capital Asset Pricing Model,** proposed mainly by William Sharpe, John Lintner and Jan Mossin (see Sharpe 1964, 425–442; Lintner 1965, 587–615; Mossin 1966, 768–783). This model gives an answer to the following problem: if the investors act on the capital market in a rational way (for example, if they try to maximize return and minimize risk), what will drive the prices on this market?

One of the possible answers gives CAPM, strictly speaking **Security Market Line (SML).** The main conclusion which can be drawn from SML is: if the capital market is in equilibrium, then given stock beta one may determine the expected return on this stock. This expected return depends on so called risk-free rate (for example the rate of return on riskless bond) and risk premium being the average price of risk (reward obtained by investors bearing risk by buying risky stocks). Security Market Line indicates which stocks are overvalued or undervalued, therefore it may help in making investment decisions.

It is worth to mention that CAPM is the most commonly used model of security pricing and capital market. Empirical tests show that most capital markets generally fall into the CAPM scheme.

Portfolio theory and capital markets were not the only areas where significant contributions were made in the sixties. Modigliani and Miller continued their studies on the capital structure of the firm. In 1963 they published their second paper, where they removed the assumption of zero taxes. Similarly as before, they stated two propositions.

According to the first one, the value of a levered firm is higher than the value of an unlevered firm by the amount equal to the amount of debt times tax rate. So in the case of taxes, the value of the firm depends on the leverage. According to the second proposition, the cost of equity of a levered firm is equal to the cost of equity of an unlevered firm with the same risk plus risk premium depending on the amount of leverage and tax rate. This means that the cost of equity increases when the use of debt increases, but less than in the case of zero taxes.

Later on, Robert Hamada combined the results of Modigliani and Miller with CAPM. He showed (see Hamada 1969, 13–31) that the cost of equity of a levered firm can be expressed as a sum of three components: risk-free rate, business risk premium and financial risk premium. To measure both business and financial risk he used the concept of beta coefficient.

The seventies brought rapid development of research in finance, particularly related to financial instruments. The main reason was the increasing volatility of interest rates as well as exchange rates. The latter was caused by the end of the Bretton Woods system. This volatility meant an increasing investment risk. To cope with this problem, the organized trading of **financial futures** (in 1972) and **options** (in 1973) were started. Options and financial futures were invented and used mainly to hedge against risk. These two instruments were the first types of so called **derivatives** (derivative instruments). Derivative is an instrument whose value depends on the value of the underlying instrument (like stock, bond, exchange rate, market index and the others).

Without doubt, the most important theoretical result in the area of derivative securities is the model of option valuation, widely known as **Black–Scholes model** (see Black, Scholes 1973, 637–654). The model was derived from the differential equation of stock price. In the Black–Scholes model the value of an option is the function of price of underlying instrument (for example stock), exercise price, risk-free rate, volatility of underlying instrument and time to expire. Currently this model is used to value other derivative instruments as well.

Another significant result obtained in the seventies was the **Arbitrage Pricing Theory** (APT), developed by Stephen Ross (see Ross 1976, 341–360). This is a capital market model, which tries to solve the same problem as CAPM. In fact, this model is considered as a competitor to CAPM. However APT is more general than CAPM and is based on fewer assumptions. The most important

assumption – law of one price – implies that two securities of the same risk should have the same return. This means no arbitrage on capital markets. It can be proved that under some conditions, CAPM can be considered as a particular case of APT. Despite its theoretical advantage, Arbitrage Pricing Theory is still used much less than CAPM.

The eighties brought on one hand further development of mathematical methods to analyze investments and financial instruments, and on the other hand the growth of new financial instruments, as a rule, derivatives. In 1981 the organized trading of **swaps** was introduced (five years after the first large swap between IBM and the World Bank took place). Later other instruments were introduced (e.g. caps, collars, floors, swap-options, synthetic calls and puts and so on). It is worth mentioning that all these new instruments are not standardized, therefore they are traded on OTC (over-the-counter) market. This situation gave the signal to develop the methods for the valuation of these instruments.

It is probably too early to make conclusions as to the development of finance in the nineties. However, it seems to me that two new important areas are of great importance.

The first one is the research on new methods to analyze prices of financial instruments. As they become more volatile, there is a need for more sophisticated methods of analysis. Researchers very often develop econometric models of financial instruments.

A relatively new tool is **neural networks**. The fast development of computer technology made it possible to use computers as so-called learning tools. Here the algorithm is used so that a quite complicated nonlinear function can be estimated which approximates the past prices of financial instruments. Then this function is used for the prediction of future prices. Speaking less formally, 'the computer is learning the pattern' of past data.

The second new and important area of research is **financial engineering**. The main goal of this area is to propose and analyze new financial instruments. As I mentioned, modern derivative instruments are non-standardized, they are 'tailor-made' according to the needs of the investor. Sometimes financial engineering is compared to a **LEGO system**, in which there are basic building blocks used to construct any desired item. In financial engineering these building blocks are: stocks, riskless bonds, call options and put options. They can be used to construct the instrument with a return profile sought by the investor and they can hedge him against almost any type of risk. This, as a rule, involves mathematical methods.

To conclude this brief history of research in finance I would like to list the Nobel Prize winners who made the great contributions to finance (the year of award is given in parenthesis): Harry Markowitz (1990), William Sharpe (1990), Merton Miller (1990), Franco Modigliani (1985), James Tobin (1981).

Similarly in other disciplines, as with finance, the results of research caused changes in the content of teaching at university level. In the next chapter I will review this problem.

3. A REVIEW OF TOPICS TAUGHT
IN THE AREA OF CORPORATE FINANCE

In most Western countries there is developed a standard as to the content of courses in finance. Although there are differences as to the title of the course (usually either 'Corporate finance' or 'Financial management' are used), it is easy to extract the contents that may be included in this standard.

There are a lot of textbooks used for these courses, however some of them are recognized as the best textbooks and they are worth recommendation. They are written by Brealey, Myers (1988), Brigham, Gapenski (1991), Levy, Sarnat (1988), Ross, Westerfield, Jaffe (1988), Copeland, Weston (1988), Shapiro (1991).

The analysis of the contents of the textbooks leads to the conclusion that the basic areas of corporate finance are as follows:
1. The legal and financial environment of the firm.
2. The analysis of financial statements of the firm.
3. Capital budgeting.
4. Security analysis.
5. Portfolio theory and portfolio management.
6. Derivative instruments.
7. Long-term financial decisions.
8. Short-term financial decisions.

The presented classification is the result of three obvious facts.

Firstly, there are two main participants on the financial markets:
– investors (both individual and institutional) buying and selling financial instruments, including securities;
– issuers of these instruments.

Secondly, there are two main types of investments:
– physical investments (point 3);
– financial investments (point 4 and 5).

Thirdly, each firm faces two main types of decisions:
– investment decisions (point 3), that is how to invest;
– financial decisions (point 7 and 8), that is how to finance the chosen investment.

Here is a brief description of the mentioned areas of corporate finance.

1. The legal and financial environment of the firm.

Here two main problems are discussed. The first one is the legal environment of the firm, like the tax system and banking regulations. The second one refers to the financial markets, including different exchanges and OTC market as well as the presentation of financial instruments, including basic types of securities and derivative instruments.

2. The analysis of financial statements of the firm.

The main goal of this area is to process the financial information of the firm, particularly financial statements, like the balance sheet and income statement. This area is strictly connected to accounting. The most important problems discussed here are:

– ratio analysis, to draw conclusions as to the financial performance of the firm the following groups of ratios are usually considered: liquidity ratios, debt ratios, activity ratios, profitability ratios and market value ratios;

– planning and forecasting of basic elements of financial statements, for example sales.

3. Capital budgeting.

The most fundamental task of capital budgeting is to choose the best investment project from the available projects. Here time-discounted methods are used, Net Present Value and Internal Rate of Return being the most common. A very important task is to extend the capital budgeting methods to take into account the uncertainty existing in the economy. Here such methods as sensitivity analysis, scenario analysis or simulation analysis are used.

4. Security analysis.

There are three main approaches in security analysis:

– fundamental analysis; this contains ratio analysis (already mentioned) and security valuation;

– technical analysis;

– statistical analysis of return and risk of financial instruments.

Security valuation, including stock valuation, determines the so called 'intrinsic value' of a security, so that this value is compared to the market value and helps to make the decision to purchase or sell the security; the stock valuation can be done for example by the Gordon–Shapiro model.

Technical analysis is based on the previous prices of financial instruments and uses graphs and simple indices to determine whether the price of instrument will increase, decrease or stay at the same level; it is worth mentioning that technical analysis is not taught at university level in Western countries.

5. Portfolio theory and portfolio management.

Portfolio theory is the general strategy of investment decision-making under uncertainty. Although it refers to financial investments, its general ideas can be

applied to physical investments in a rather straightforward way. As mentioned earlier, the classic problem in portfolio theory is to find a portfolio of securities so that the return is as high as possible while the risk is as low as possible. Currently many more methods of portfolio selection are proposed (see Elton, Gruber 1991).

This area also contains portfolio management methods. Apart from formal methods of portfolio theory, it is very important to make judgements as to the profile of the investor, particularly his attitude towards risk, which can be done by introducing psychological analysis.

6. Derivative instruments.

As derivative instruments are recently getting a lot of attention, they are introduced in most finance courses and textbooks. Here the analysis and valuation of options, financial futures, financial forwards, swaps and others are discussed. They are considered not only from the point of view of the investor, but also as sources of financing for the firm. This refers mainly to such instruments as warrants and convertibles.

7. Long-term financial decisions.

This area considers the problems and methods to finance the investment project after making the investment decision. The most important problems studied here are the following:
  – issuing shares by company;
  – using debt as a method of financing;
  – determining the proper capital structure of the company (relation of debt to equity);
  – determining the cost of capital of the company;
  – dividend policy.

8. Short-term financial decisions.

This area is not connected so strictly to the chosen investment project as are long-term financial decisions. Here the main task is working capital management, e.g. the management of cash, credit, inventory, receivables, as well as short-term financial planning.

REFERENCES

Black F., Scholes M. (1973): *The pricing of options and corporate liabilities*. 'Journal of Political Economy' No 81.
Brealey R. A., Myers S. C. (1988): *Principles of corporate finance*. McGraw-Hill, New York.

Brigham E. F., Gapenski L. C. (1991): *Financial management, theory and practice.* Dryden Press, Chicago.

Copeland T. E., Weston J. F. (1988): *Financial theory and corporate policy.* Addison-Wesley, Reading.

Elton E. J., Gruber M. J. (1991): *Modern portfolio theory and investment analysis.* Wiley, New York.

Gordon M. J., Shapiro E. (1956): *Capital equipment analysis: the required rate of profit.* 'Management Science' No 3.

Hamada R. S. (1969): *Portfolio analysis, market equilibrium and corporation finance.* 'Journal of Finance' No 24.

Levy H., Sarnat M. (1988): *Principles of financial management.* Prentice Hall, New York.

Lintner J. (1965): *Security prices, risk and maximal gains from diversification.* 'Journal of Finance' No 20.

Markowitz H. M. (1952): *Portfolio selection.* 'Journal of Finance' No 7.

Markowitz H. M. (1959): *Portfolio selection – efficient diversification of investments.* Yale University Press, New Haven.

Modigliani F., Miller M. (1958): *The cost of capital, corporation finance and the theory of investment.* 'American Economic Review' No 48.

Modigliani F., Miller M. (1963): *Corporate income taxes and the cost of capital: a correction.* 'American Economic Review' No 53.

Mossin J. (1966): *Equilibrium in a capital asset market.* 'Econometrica' No 34.

Ross S. A. (1976): *The arbitrage theory of capital asset pricing.* 'Journal of Economic Theory' No 13.

Ross S. A., Westerfield R. W., Jaffe J. F. (1988): *Corporate Finance.* Irwin, Homewood.

Shapiro A. C. (1991): *Modern corporate finance.* Macmillan, New York.

Sharpe W. F. (1963): *A simplified model for portfolio analysis.* 'Management Science' No 19.

Sharpe W. F. (1964): *Capital asset prices: a theory of market equilibrium under conditions of risk.* 'Journal of Finance' No 19.

Sharpe W. F., Alexander G. J. (1990): *Investments.* Prentice Hall, Englewood Cliffs.

Tobin J. (1958): *Liquidity preference as behavior towards risk.* 'Review of Economic Studies' No 25.