LINK BETWEEN STOCK RETURNS AND ECONOMIC FLUCTUATIONS: DOES IT MATTER IN UKRAINE?

by

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Abstract

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The paper investigates the existence of a relationship between stock market behaviour and macroeconomic indicators. The theoretical framework of the Arbitrage Pricing Theory is used to test whether there are state variables that might have a significant impact on Ukrainian stock market path. Kalman filter methodology is chosen to generate unanticipated components of the observed macro indicators. The iterative non-linear seemingly unrelated regression estimation technique is utilized in order to examine the exposures of the cross-section of returns to macroeconomic and financial risks. The estimation results show that the Ukrainian stock market is heavily influenced by systematic risk forces, though they can not be captured appropriately by the constructed model, and conclude that the nature of the systematic risk is mostly exogenous. However, the uncaptured variation in stock returns diminishes over time partly due to the followed macroeconomic stabilization and national economy expansion.

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GLOSSARY

American Depositary Receipts (ADRs). Multiple shares of foreign (non-US) company stock as it is traded in its native country and currency but represented in US dollars and traded on the American stock market.

Ask. Minimum price a seller wants to get for a stock.

Beta. Risk (volatility) measure computed as the covariance between a return on a particular stock and a return on a market portfolio.

Bid. Maximum price a buyer wants to pay for a stock.

Errors-in-variable problem. Problem that could arise in econometric estimation originated from the use of incorrectly measured variables.

Float. Number of shares in circulation excluding owned by insiders and by those who hold more than 5 per cent of shares outstanding.

Leverage effect. Tendency for volatility to rise more following a large price drop than following a price increase of the same magnitude.

Price to Earnings (P/E) ratio. Valuation tool measured as a share price divided by earnings (profit) per share.

Shorting. Speculative practice of borrowing shares to sell them immediately hoping to buy it back later at a lower price.

Spread. Difference between the ask and the bid.

Chapter 1

INTRODUCTION

The recent financial crisis in Russia and subsequent declines in production, consumption and trade turnover have raised the issue of the link between financial and macro variables, notably, between stock market behaviour and economic activity. The empirical relationship between stock returns and economic variables has been actively analyzed and discussed in the United States and other developed countries. However, this field of research remains surprisingly unexplored regarding countries with so called transition economies. The study of such relationship in these countries may proceed unconstrained by a few of the difficulties which characterize other markets. One of them is the endogeneity of the stock market relative to other markets. Apparently, due to relative underdevelopment of the equity market in transition economy countries it may be more suitable as it avoids the restriction that could have questioned the relevance of the obtained empirical findings.

Financial theory suggests that unanticipated changes in macroeconomic variables are systematic risks that are rewarded in the stock market. The idea that equities returns could be influenced by the set of macroeconomic and monetary variables was firstly proposed by Ross (1976). Subsequent empirical investigations prove that the Arbitrage Pricing Theory (APT) performs better than the Capital Asset Pricing Model (CAPM), which dominated research in the 1960s in the terms of numerous attempts to explain the expected returns of equities.

Asset prices are commonly believed to react sensitively to upcoming economic news. Daily experience at the most developed equity markets seems to support the view that unanticipated changes in systematic risk factors influence stock prices and that the changes in some of those factors have

more pervasive effects than do others. The subsequently generated idea that comes into mind is to extrapolate such influences to the long run.

In general, the growth path of the economy influences stock market behaviour in the long run in two ways: directly through the difference between expected and announced or revised magnitudes of major macroeconomic indicators and financial benchmarks and indirectly through the differences between anticipated and actual financial results of the companies and their forecasts for future cash flows and earnings.

But determining the macroeconomic and non-equity returns factors that appear to be priced in stock returns is not enough simply to evaluate the empirical content of the APT. What is necessary to perform is to check the validity of the assumptions or to impose some restrictions in order to be sure that the investigating model does apply to the real world.

In my work I want to test whether Ukrainian stock market behaviour in relation to observed financial and macroeconomic factors is consistent with the APT postulates, and to determine what state variables, if any, produce the greatest impact on the stock market path.

Analyzing the link between stock returns and economic growth is especially interesting for emerging markets. Though the empirical relationship between stock returns and economic activity has been widely analyzed in the US and, less extensively, in other developed countries, this relationship still remains largely unexplored in the emerging market economies. This could be explained by the fact that necessary indicators are relatively scarce in emerging markets and such markets are characterized by low liquidity. Combined with the high volatility inherent in emerging markets it is alleged to cause greater "noise". The major challenge in such investigations is, therefore, to capture somehow this noise in order to construct a relevant model and to produce coherent inferences.

The paper is organized as follows. The second chapter sketches a literature survey and briefly presents main points of the APT. The third chapter introduces the theoretical framework and the methodology for

further empirical research. The fourth chapter discusses the peculiarities of the Ukrainian corporate stock market development and its current position. The fifth chapter presents data description, while the sixth one contains the empirical results and the economic analysis relating to the findings. The final section concludes.

Chapter 2

LITERATURE REVIEW

How should the risk of an asset be measured? What economic forces are likely to determine the price of risk, the additional return an investor gets for bearing additional risk? According to Campbell (1996), these are the questions among the most fundamental in finance.

The first complete model of asset pricing is the Capital Assets Pricing Model (CAPM) developed by Sharpe (1964) and Lintner (1965). The model measures the risk by the covariance between a particular stock return and the return on all invested wealth which is known as a "market return". In empirical studies the market return used to be proxied by the return on a diversified portfolio of stocks which serve as a basis for calculating stock market indices, e. g. Standard & Poors 500 in the US.

Although the CAPM remains quite popular, it has been under attack from different directions for some time. Merton (1973) argues that marginal utility of investors should be incorporated in determining asset risks, since there is an intertemporal connection between innovations in marginal utility and expectations of future returns which have dynamic nature.

In separate studies, Fama and French (1992) and Jegadeesh (1992) show that the market beta which is the core element of the CAPM model and its affiliates has little power in explaining the cross-sectional variation in returns on assets. Their discoveries combined with earlier evidence against the CAPM cast doubt on the validity of the model, and raise the question concerning the power of prediction modeling in modern finance theory. Mei (1993) maintains that the failure of the market beta to explain the cross-section of stock returns could be derived from the fact that stock prices reflect multi-dimensional risk factors rather than a one-dimensional factor as assumed in the CAPM. This switches attention to whether appropriate multi-

factor asset pricing model can be constructed that would be able to explain cross-section returns more comprehensively. That is, can the multiple betas from that model better absorb information about variation in stock prices so that asset returns can better be explained by a wider notion of systematic risk rather than by firm specific variables?

The Arbitrage Pricing Theory (APT) first proposed by Ross (1976) has built a foundation for such multi-factor models and its ideas have been widely used among practitioners, since it provides good empirical fit under very weak theoretical assumptions. Following his study plenty of empirical work has confirmed the result that stock returns are closely related to observed macroeconomic and financial factors and that such factors are significant in pricing the risk. Even today, the APT continues to arouse considerable theoretical interest and is widely applied in empirical analysis.

The major idea of the Theory is to link macroeconomic and financial indicators to stock returns where the former are the determinants of the latter. It is considered that the APT is rather intuitive in this sense. The model that provides direct economic insight on the stock market behaviour is relatively straightforward, as it is always possible to find some macroeconomic variables that can be ascribed as explicit determinants of pervasive risk factors in stock returns. Such models, however, are silent in determining forces that influence risk and provide little guidance in choosing factors a priori. One should rely on economic intuition to determine innovations in macroeconomic and financial factors which might influence a particular stock market. The weak assumptions of the model that make it so attractive are, therefore, also the major source of its vulnerability as well. The model could be bated with the accusation that it generates valid results but its use for predictions in future periods can be irrelevant. As Fama (1991, p. 1595) argues,

> …since multi-factor models offer at best vague predictions about the variables that are important in returns and expected returns, there is the danger that measured relations between returns and economic factors may be spurious, the result of special features of a particular sample

(factor dredging). Thus the Chen, Roll and Ross tests, and future extensions, warrant extended robustness checks. For example, although the returns and economic factors used by Chen, Roll and Ross are available for earlier and later periods, to my knowledge we have no evidence on how the factors perform outside their sample.

The Arbitrage Pricing Theory yields an asset pricing model that attempts to explain the cross-sectional variation in asset returns. Unlike the CAPM, the APT relates linearly each asset return to several common multi-factors plus its own idiosyncratic disturbance. The key condition of the APT to be satisfied for the model to be well-specified was perfectly formulated by Chen (1983). It is necessary that in well-diversified and perfectly competitive economy the expected returns vector must lie asymptotically in the $k+1$ dimensional space spanned by a vector of all ones and k vectors of asset response amplitudes to those k common multi-factors. This is precisely the requirement of no arbitrage in stock returns.

Beginning with empirical investigations of Roll and Ross (1980), the view that macroeconomic factors systematically affect asset returns has attracted widespread attention and has given rise to a large body of empirical work.

Chen (1983) estimates the parameters of the APT using daily return data on 180 US securities during the 1963-78 period. He finds out that the APT performs better compared to the CAPM and shows that the asset variance (the core factor in the CAPM) has no additional significant explanatory power to that of the common factors. He concludes that the APT cannot be rejected in favor of any alternative hypothesis though it requires more research to get appropriate economic interpretation of the common factors. Burmeister and McElroy (1988) also reject the CAPM in favor of APT, while they are unable to reject the APT restrictions on the linear factor model (LFM) which shows that the former model is more powerful than both CAPM and LFM in explaining cross-section of stock returns in their sample.

Using data for US individual equities during the 1962-72 period, Roll and Ross (1980) found at least three factors that are significantly priced in the generating process of asset returns. They also check that the estimated expected returns depend on the estimated factor loadings and determine that the "own" standard deviation, though highly correlated with the expected returns, has no additional explaining power to that of the common factors loadings.

Chen et al. (1986) test whether innovations in macroeconomic variables are significantly priced in the stock market, relying on the discount model of future expected cash flows to choose appropriate state variables for determining the relation between stock returns and fundamentals. They created a five-factor model in which the maturity premium, expected and unexpected inflation, industrial production growth and default premium are significantly priced in expected returns.

According to Roll and Ross (1980), there are two major differences between the APT and the original CAPM single factor generating model. First, the APT simply allows more than only one explaining factor. Second, the APT expresses the condition that any market equilibrium must be consistent with the absence of arbitrage profits as a linear relationship between expected returns and returns' response loadings to common factors. Assuming that the unavailability of riskless arbitrage profits is as common a condition as market competitiveness, we turn immediately to the APT. Its modest assumptions and easy implications are what has made the theory become the object of numerous empirical tests.

The fundamental issue of the APT is that "news" concerning macroeconomic and financial variables contain unanticipated elements that might explain asset returns. Such "news" are either unexpected themselves, or deal with parameters that could not be known exactly in advance but rather have some probability distribution. Hence, it is necessary to determine the expectations formation process in order to generate unanticipated components that enter into the original model.

Priestley (1996) underlines the importance of the choice of the relevant technique to be used for the construction of the unexpected components of the variables and argues that the traditional methodologies employed in this area in the 1980s might have led to false inferences. He proposes an alternative technique to generate unanticipated components which treats expectations formation as a learning process. That method is theoretically more robust and the innovations generated by it provide a better description of actual results. Antoniou et al. (1998) extend the results of Priestley's study and investigate the performance of the APT postulates for securities traded on the London Stock Exchange covering the 1980-1993 period. The uniqueness of the paper is in its attempt to analyze the performance of a multi-factor model using two different samples of securities: one for deriving the relationship between stock returns and macroeconomic variables and one for the purpose of checking the validity of this relationship in the spirit of Fama's suggestion.

Li and Hu (1998) follow Chen, Ross and Roll in their study of the relationship between the daily percentage changes of leading US stock indices and an expanded set of macroeconomic announcements related to the equity discount rate and cash flows. They add to the study the option of allowing stock prices to respond differently depending on the stage of business cycle, and consider the issue of whether the same macroeconomic factors have a different level of influence on the stocks with large and small capitalization.

Gjerde and Saettem (1999) investigate the validity of the relations among stock returns and macroeconomic factors in a small, open economy by implementing vector autoregressive (VAR) approach on Norwegian data set over 1974-1994 period. They find out that real interest rate changes are significantly negatively priced in stock returns, while the stock market is positively affected by lagged changes in industrial production. The phenomenon of the stock returns delayed response to changes in the domestic real activity may be explained by the hypothesis that interest rates themselves rather than stock returns are associated with the changes in real

activity which could lead to the investors overreaction to interest rate news. It occurs due to the widely believed positive association between high interest rates and the expansion phase of the business cycle signalling the improved cash flows and, thus, more buying pressure for companies shares.

Leaning against the case of the same small, open economy of Norway and utilizing multivariate VAR model over the period 1952-1995 Gjerde et al. (2001) show that current stock returns correlate negatively with lagged growth in investment and positively with current growth in production but the relationship in reverse direction is meaningless since the stock market lack the ability to predict future investment or production.

Sokalska (1996) tries to identify macroeconomic factors that could explain the behaviour of stock market returns in Poland by applying the APT framework to the group of eight Polish quoted companies in the period between December 1992 and August 1995. The set of macroeconomic factors includes changes in consumer prices, industrial production and real sales, with the latter factor being viewed as the closest proxy for consumption. Term structure and risk premium represent financial factors. However, the empirical findings show that all of those factors do not appear to be priced in the Polish stock market, since risk prices which are restricted to be the same for each company according to the original model do not prove to be statistically significant.

The reverse direction in the relationship between stock returns and macro variables was also investigated. Mauro (2000) studies the correlation between output growth and lagged stock returns where the former is the dependent variable. He finds that the correlation between those variables is as strong in emerging markets as in the countries with advanced economies and concludes that asset prices contain valuable information in forecasting output in emerging market economies as well. His results can be also interpreted in a different way, that emerging markets tend to show the same level of relationship between stock returns and fundamentals than developed countries are seen to observe.

Based on a theoretical postulate that fluctuations in stock prices have an impact on private consumption through a wealth effect, Funke (2002) investigates the relationship between stock returns and private consumption in a sample of 16 emerging markets. He finds small, but statistically significant, nature of such relationship. Besides, the author argues that private consumption has become more sensitive to stock market fluctuations in the 1990s.

The investigation of the existence of a reverse relationship between stock market behaviour and economic development becomes a controversial issue when we turn to the assumption of the endogeneity of a stock market. The reason that lagged values of returns on stock portfolios would affect production levels could originate from the circular nature of the investigated relationship. The lagged values of the returns might be explained by macro variables themselves and, thus, implicitly play a role of instrumental variable in such reverse oriented investigations. Such kind of investigations would present interim results of a wide field of research concerning the link between economic activity and financial markets. It appears that the first logical step is to implement the APT model in emerging markets regarding the level of their development in order to find whether the mechanism of shocks transmission between the economy and the securities market is consistent with the major theoretical postulates.

Chapter 3

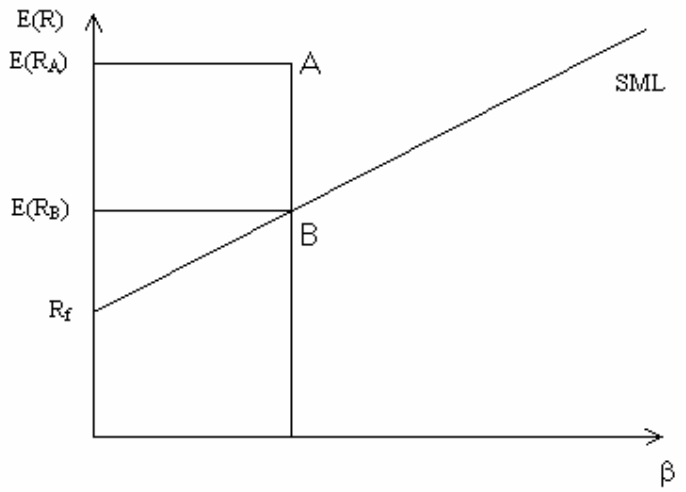
METHODOLOGY

The Arbitrage Pricing Theory was developed as an alternative to Capital Asset Pricing Model (CAPM) that dominated the 1960s. The APT is less restrictive in the sense that it relaxes two controversial assumptions of the CAPM: it neither requires homogeneous believes among investors, nor deals with the total wealth (market) portfolio, which is the only risky asset in the CAPM that every investor should hold. Everybody can hold different portfolios, thus, paying less attention to the market portfolio itself. Moreover, there is no need to look for the ideal proxy for the total wealth portfolio, it is just one source of risk among a group of them. The portfolio diversification problem becomes more complicated if being solved in multi-dimensional space.

The validity of the major premise of the APT – absence of arbitrage opportunities – can be demonstrated diagrammatically with the help of the Security Market Line (SML). Suppose, equity A is located above the SML (Figure 1). The CAPM argues that it cannot, but the empirical evidence does not support this argument. Suppose further, that there exists equity B which is plotted strictly on the SML (or very close to it) and has the same β as A has. Is this juncture sustainable? No. Smart traders feel that there is opportunity to get riskless profits. They *expect* to make easy money by shorting B and buying A simultaneously. The riskless nature of such strategy is explained by the fact that returns on both equities are determined by the same systematic risk. The avalanche of such transactions would lead to the increase in price of A which would cause its expected return to drop and force the stock to the neighborhood of the SML. At the same time, price of B is supposed to decrease due to the heavy short selling and it would cause B to move up from the SML. New arbitrage opportunities emerge and they would also be

liquidated either by playing in the same manner using other equities with similar systematic risk measure (beta) or by rearranging positions in A/B portfolio. The final point is that by using arbitrage opportunities all equities with the same betas will be forced to concentrate closely near the SML (point B). Pretty the same logic works if point A lies below the SML.

Figure 1. Security Market Line: illustration of arbitrage opportunity



Are such strategies really riskless? As Goetzmann (1996) notes this investment still involves some risk because the investor is remaining with a positive *expected* payoff, not a positive *guaranteed* payoff. Thus, the core element of the APT is not arbitrage itself, but rather *arbitrage in expectations*.

Both the CAPM and the APT imply a positive relation between expected return on equity and risk. The core distinction between two theories lies in the interpretation of interrelationship among returns on different securities. The APT argues that stock returns are affected by a range of specific industrywide and marketwide "risk" factors. It then explains the nature of correlation between the returns of a pair of securities by the simultaneous influence of the same factors on both equities. By contrast, the CAPM does not specify underlying factors causing the correlation between stock returns.

The ex post return on any stock is basically considered to be composed of two parts. The first part is the expected return that analysts and

shareholders predict or expect. It depends on the information about the particular company available today that seems to influence stock behaviour in the future, plus expectations of the common factors.

The second part is the unexpected return on the stock. This portion fully comes from the impact of the unanticipated information that will be revealed in the coming future. Therefore, return on stock *i* in period *t* can be expressed as

$$R_{it} = E(R_{it}/t\text{-}1) + U_{it}, \qquad (1)$$

where $E(R_{it}/t\text{-}1)$ is an expected stock return in period *t* provided information in period *t*-1, and U_{it} is an unexpected part of the return on stock *i* in period *t*.

While the stock return expectations could depend on the news/factors that have anticipated nature, the unexpected part of return is generated by the impact of the unanticipated news[1]. And such news are originated from different sources. Some of the stories concern just some specific company while others are more general and they are to be priced in various equities simultaneously. It is common to divide risk into two parts which are called systematic and unsystematic risk. The unsystematic risk affects a single asset or a small group of assets that are relatively close to each other by having some common characteristics. On the other hand, the systematic risk is any risk that affects a large number of assets to a greater or lesser degree. Forces that influence all companies are the essence of the systematic risk. Uncertainties about GDP, inflation or interest rates are the examples.

To permit to break down the risk into two different components we rewrite the previous equation as

$$R_{it} = E(R_{it}/t\text{-}1) + F_t + \varepsilon_{it}, \qquad (2)$$

where F_t is the systematic risk factor and ε_{it} is unsystematic, or idiosyncratic risk.

[1] Generally speaking, stock market most likely deals with a stream of separate news where each news is anticipated to some extent, thus, being composed of expected and unanticipated elements. Those unanticipated elements are classified as unanticipated news themselves.

The important point here is that since unsystematic risk is specific to a particular company, it is unrelated to most of other companies and, therefore, it has no influence on their stock returns in any period. It means that unsystematic risk of *ith* company stock is unrelated to the respective risk of *jth* company stock. In terms of statistics,

$$\text{Corr}(\varepsilon_i, \varepsilon_j) = 0. \quad (3)$$

Expected and unexpected risks differ not only in their nature but in the time of occurrence as well. While unexpected risk could come any time, the time of occurrence for expected risk is mostly limited and known in advance. It commonly comes from announcements that are preliminary scheduled. Moreover, the parts of risk have different forms: if it is possible to measure expected risk, it is done in levels, while unexpected risk is often measured in differences. Combining this with what was said above, we can say that stock market participants have already discounted the announcement. Here, the word "discount" has a different meaning than what is assumed in computing present value, but the notion is similar. In this problem, discounting has an additive nature rather than the multiplicative one. When we discount a dollar in the future, its value today is less because time has its own value. When we discount an announcement or news in the future, it means that it is known today to some extent but not precisely. Therefore, not the announcement itself but the difference between the actual result and the forecast is of value. The difference is sometimes called the innovation or surprise.

Any announcement can be broken into two parts:

$$\text{Announcement} = \text{Expected part} + \text{Surprise}. \quad (4)$$

Here the *Surprise* is nothing else but F_{jt}, where *j* counts for the number of respective announcement during the period *t*. Therefore, when we speak about unanticipated news, we refer to the surprise part of any announcement but not to what market has expected or to the announcement itself.

Finally, after all possible factors or components of the systematic risk are determined we create the *k*-factor model where each stock return is generated by the following:

$$R_{it} = E(R_{it}/t\text{-}1) + \beta_{i1}F_{1t} + \beta_{i2}F_{2t} + \ldots + \beta_{ik}F_{kt} + \varepsilon_{it}. \qquad (5)$$

Unfortunately, the APT does not specify how economic agents form their expectations of macroeconomic and financial factors. But any expectations generating process has to satisfy a series of necessary conditions. The required conditions for the generated unanticipated components are that they must be mean-zero, serially uncorrelated white-noise processes.

Chen et al. (1986) uses the so called "rate of change" model to generate unanticipated components. This technique simply used first differences as unanticipated parts of the factors and was based on the assumptions of static expectations of the agents and random walk nature of the factors. Clare and Thomas (1994) generate their unanticipated components through the use of autoregressive models. Their technique is more general and rather than assuming the factors follow random walks, they treat this possibility as a special case. Priestley (1996) argues that these models are rather weak and fail to satisfy all the necessary conditions for the generated series indicated above. The two major assumptions of the "rate of change" model counteract each other, since if it is assumed that agents do not value past information when it could be relevant, then in the case of the random walk model the unanticipated components will not be white noise. However, unanticipated components generated from time-series models allowing for the use of past information assume that parameters of the model are stable and do not change over time. Thus, autoregressive methodology fails to avoid the possibility of agents making repeated forecast errors.

The recent methodology of expectations generating process proposed by Priestley (1996) is based upon expectations formation as a learning process. This alternative technique is based on the use of a Kalman filter and it meets all the necessary requirements levied on unanticipated components and it avoids the drawbacks of previously described methods. Priestley argues

that this methodology not only meets the basic requirements highlighted above, but also avoids the possibility that agents make systematic forecast errors, while using autoregressive methodology, heavily implemented earlier, fails to get rid of this drawback. Furthermore, these findings are important while testing the APT, since estimated risk premiums are sensitive to the way the unexpected components are generated.

This model completely differs from its predecessors. The Kalman filter technique is considered a useful device to unravel dependencies in any time series. For a sample of trial values the Kalman filter is applied recursively to successive values of a time series to produce a sequence of one step predictions.

Its more complex nature originates from the premise that rather than knowing the true model and its unchanged parameters, agents deal with a linear model whose parameters are time-varying. In this case agents learn and update their expectations recursively with time, as more information becomes available. This is a kind of learning process where the extraction of the innovations can be achieved through the use of the Kalman filter. The Kalman filter framework has been already applied by Rockinger and Urga (1999) in testing efficiency paths of stock markets in transition economies (including Russia) and showed its usefulness in dealing with markets characterized by low liquidity.

Assuming X_t is the variable of interest, the most popular way to generate expectation series through the Kalman filter is to express expectations $E(X_t)$ as a random walk:

$$X_t = E(X_t) + u_t, \tag{6}$$

$$E(X_t) = E(X_{t-1}) + \zeta_t, \tag{7}$$

where u_t and ζ_t are white-noise processes.

Eq. (6) is called the measurement equation, while Eq. (7) which determines the evolution of the expectation $E(x_t)$ is called the transition equation. This type of model defines information as a random process and suggests that agents have been involved in the stochastic environment. The

residuals u_is, if they are serially uncorrelated, enter equation (5) as respective "surprises" *F*. If they are serially correlated, then lags of the variable of interest are included and a more general structure (time-varying AR model) is estimated:

$$X_t = \Sigma\delta_{it}X_{t-i} + \varepsilon_t, \tag{8}$$

$$\delta_{it} = \delta_{it-1} + \omega_t, \tag{9}$$

where the transitional equation (9) specifies time-varying parameter as a random walk[2].

The unexpected components generated by the Kalman filter technique are not suppressed by the restrictive nature of the autoregressive models due to the possibility of altering parameters with time. The fact that agents are allowed to set up expectations through a learning process helps in the belief that those expectations are more likely to reflect agents' actual expectations than any other model could provide[3]. Plus the model also meets the basic requirement that the unanticipated components are innovations. It appear that the factors generated from the Kalman filter approach are the main candidates to be used in the APT specification. Recent empirical investigations are consistent with this assertion.

Eq. (5) represents an unrestricted linear factor model. The APT superimposes the pricing restriction that there are no opportunities for arbitrage. This condition is reflected by the following equation:

$$E(R_{it}/t\text{-}1) = \lambda_0 + \beta_{i1}\lambda_1 + \beta_{i2}\lambda_2 + \ldots + \beta_{ik}\lambda_{k,} \tag{10}$$

where λ_0 is the return on the risk-free asset, and λ_j ($j = \overline{1,k}$) is the price of risk associated with the *jth* factor.

Substituting Eq. (10) into Eq. (5) and subtracting λ_0 from both sides gives

$$R_{it} - \lambda_0 = \sum_{j=1}^{k} b_{ij}\lambda_j + \sum_{j=1}^{k} b_{ij} f_{jt} + \varepsilon_{it}. \tag{11}$$

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[2] In this case $E(X_t) = \Sigma\delta_{it}X_{t-1}$.

[3] Under the assumption that agents do not make systematic forecast errors.

The joint estimation of risk premiums and factors sensitivities can be done either by iterated non-linear seemingly unrelated regressions (ITNLSUR) or by iterated non-linear three-stage least squares (ITNL3SLS). Both methodologies are robust to the errors-in-variable problem (EIV) which appears when applying the seemingly appropriate two-step cross sectional regression. The latter technique is invalid in the presence of the EIV, as the estimation of the factors "betas" in one period affects the resulting estimates of the risk premiums in subsequent periods. Failure to correct for the EIV may lead to wrong inferences regarding the statistical significance of the respective factors. By contrast, both ITNLSUR and ITNL3SLS provide results that are not sensitive to the method and criteria of portfolio formation[4].

The cross-equation non-linear restrictions to be satisfied for the validity of the APT model arise from the comparison of (11) with the general unrestricted linear factor model given by

$$R_{it} - \lambda_0 = \alpha_i + \sum_{j=1}^{k} b_{ij} f_{jt} + \varepsilon_{it}, \qquad (12)$$

where α_i is constant.

It follows that the APT restriction states that the price of risk for asset *i* must be equal to α_i for all assets[5]:

$$\alpha_i = \sum_{j=1}^{k} b_{ij} \lambda_j. \qquad (13)$$

This restriction is tested with the help of the likelihood ratio test.

The comovements of asset prices suggest that there are some exogenous factors that influence the stock market. However, theory remains silent about which events, or factors exert such comovements. There are still no precise answer on the question which economic variables determine the

[4] ITNL3SLS is a more reliable technique to use when at least one factor is treated as endogenous in the system. In our case all factors are treated as exogenous variables making implementation of ITNLSUR justifiable.

[5] For more rigorous aspects of technical derivations of the model check Burmeister and McElroy (1988).

path of stock market behaviour. In fact, the proper selection of the appropriate risk factors has become and still remains one of the most challenging tasks in modern finance.

It could be the case that stock prices being influenced by a set of macroeconomic variables have a feedback on other variables with those variables affecting the original set of factors. This may lead to cyclical movements in underlying variables and asset prices where length of lag and its effect are weakening with time.

It is apparent that all economic variables are endogenous to some extent. Our present goal is to model equity returns as dependent variables on macro and non-equity return variables. Therefore, we take the stock market as endogenous relative to other markets. Though it could be a rather controversial issue if working with developed stock market such as in the US, the stock market of a country with transition economy is a suitable case.

To choose appropriate economic variables Chen et al. (1986) use as a theoretical background the model where stock prices p can be expressed as expected discounted dividends:

$$p = \sum_{i=1}^{\infty} \frac{E(d_i)}{(1+r)^i}, \tag{14}$$

where $E(d)$ is the yearly expected dividend stream and r is the discount rate.

It follows that the systematic forces that influence asset prices are those that affect either expected cash flows or discount rate.

Expected cash flows change because of both real and nominal forces. Unexpected inflation is supposed to hurt cash flows decreasing their real value, while change in expected inflation influences nominal expected cash flows as well as nominal rate of interest and this change is partly due to the unexpected part of inflation promoting a kind of inertia when unanticipated inflation in period t has influence on inflation expectations in subsequent periods of time. It could be said that unexpected inflation in period $t+m$ equals actual inflation in period $t+m$ minus expected inflation in period $t+m$

having information in period *t*, minus the sum of changes in expected inflation in period *t+m* given information in periods *t+1, t+2, …, t+m-1*.

Innovations in the level of real production would also affect the real value of cash flows unless the risk premium measure captures industrial production uncertainty.

The discount rate varies over time and, therefore, it changes with term-structure spreads of different maturities. Unanticipated changes in the interest rate on a riskless asset will influence discount rates for future periods and this will lead to the changes in returns. It should be noted here that interest rates could be affected by changes in equity returns themselves which are supposed to signal the current state of the economy. However, we notified earlier that we take the stock market as endogenous with all other markets being exogenous.

Chapter 4

CORPORATE STOCK MARKET PECULIARITIES IN UKRAINE

One of the reasons for the subsequent declines of the industrial output in Ukraine during the 1990s was the low competitiveness of Ukrainian manufacturers as a result of the investment hunger originated by lack of domestic sources of capital combined with a reluctance of foreign investors, which had begun simultaneously with economic reforms. The theory says that restructuring of the economy requires additional investment resources and the Ukrainian experience has just proved it. Investment resources, including foreign, were mainly spent on consumption of fixed capital since the initial investments in the form of the replacement of highly depreciated technologies required huge resources which would lead to low returns inconsistent with the high level of risk inherent to such kind of investment. This adverse phenomenon cannot be overcome unless market mechanisms are put into practice. For this to be achieved there should be as large a competition for investment resources as possible, on the one hand, and wide-scale possibilities for mobilization and concentration of these resources, on the other. Both these tasks can be effectively implemented with the use of the corporate stock market. Drawing household savings and the temporarily available resources of business institutions, the stock market helps to direct a portion of national expenditure to capital accumulation. The main task of the market is to establish efficient mechanisms of accumulation of temporarily spare funds of investors and provide enterprises with access to investment resources.

Still underdeveloped and inadequately regulated, the securities market has been considered anything but a source of capital in Ukraine.

Its history started following the adoption of Law of Ukraine "About Securities and Stock Exchange" in 1991. Together with the introduction of the Ukrainian Stock Exchange it was the first attempt of the creation of a

centralized stock market. However, in the early 1990s the legislation basis remained undeveloped and there was no clear determination of the relations between the stock market and other segments of the financial system of the country. The customer awareness of the market's functioning was limited making fertile ground for the creation and fast propagation of the Ponzi game schemes.

The peak of the financial pyramids satiation was reached in 1994, leading to their massive collapses. The second attempt to organize an effective and clear stock market functioning was undertaken when the government established the State Commission for Securities and the Stock Market (SCSSM) to oversee securities issues and their circulation. The market was dominated by small- and middle-sized public ventures that relied heavily on the stock issues as the major and even the only method of financial inflows. Not surprisingly, the effectiveness of such investments was low and virtually all shareholders of such ventures lost their money. As a consequence, during the period of 1991-1996 middle-class private investors lost their confidence and left the market.

The major impulse for the creation of the stock market in Ukraine was caused by the privatization of state-owned enterprises. This is usually considered as support for the hypothesis that the first steps of the Ukrainian stock market development was mainly of a revolutionary nature rather than one of evolutionary behaviour. With the lack of significant domestic funds, the immediate necessity of additional resources for the government and a high level of corruption, the first years of privatization process were characterized by the redistribution of ownership rights from the state to powerful insider groups with insignificant prices paid for equities. All in all, during the first 5 years of independence the Ukrainian stock market was characterized by chaotic, highly speculative and distrustful behaviour of its participants striving to get short-time profits rather than to take care of investment prospects in the long run.

In 1997 the regulators tightened regulatory control over market participants. The number of stock exchanges grew to four, but their trading activities were mainly limited to selling state-held blocks of shares in privatized companies offered by the State Property Fund. Nevertheless, the year of 1997 may be considered the year of the rise of the Ukrainian corporate stock market. The leading position in the market infrastructure was occupied by the PFTS[6] over-the-counter stock trading system which was established in early 1996 and now meets high international standards. The volume of the PFTS trade of all securities in 1997 totaled $250 million, of which $180 million (70%) consisted of corporate shares.

In 1997 the first Ukrainian stock indexes appeared. They were calculated by securities traders themselves. The PFTS introduced its own index in October. The same month, a global financial crisis occurred which negatively influenced Ukrainian shares mainly due to the subsequent reduction of foreign portfolio investment.

As Ignatov (2000) noted, according to the State Securities and Stock Exchange Commission there were several factors that contributed to the low functionality of the market in 1997:

1. The "flawed investment climate" and the high risk of investing;

2. Unfinished privatization in many joint stock companies, that confused potential investors;

3. Unwillingness of new owners to disclose and sell to the public because of fear of losing "control" over the company;

4. "Lack of domestic investment funds"; that is, the absence of cash for investment among most citizens.

The Ukrainian stock market has been under the significant influence of its Eastern neighbour. First, it is heavily correlated with its Russian counterpart which was demonstrated most brightly in late 1998 following the

[6] Ukrainian version of the abbreviation is the First Stock Trading System. Some sources mention it as the OTCTS (Over-the-Counter-Trading-System).

Russian financial crisis.[7] Second, the Russian corporate stock market is more attractive to foreign investors due to its higher liquidity, larger market capitalization and easier access to the financial and macro information from first hand sources.[8] This leads to the prevalence of a negative substitution effect vis-à-vis holding Ukrainian stocks in the shadow of the Russian "blue chips". Third, Russian investors themselves have a great interest in the Ukrainian economy "pie" hunting for controlling blocks in the most attractive industrial enterprises.[9]

The initial strategy of foreign investors to buy minority stakes in various businesses was not particularly successful due to the poor corporate governance laws and murky business environment which was followed by the financial crisis. These troubles convinced the investors to change their views, and shift financial capital into buying controlling stakes in the joint stock companies representing young, fast growing industries.

Frail corporate governance has been one of the major problems faced by the Ukrainian stock market and remains a serious obstacle in attracting foreign investment. Asset stripping and profit skimming are the most rampant examples of shareholders rights violations that are still common in modern Ukraine.

One of the widely quoted significant impediments for corporate stock market growth has been the absence of comprehensive legislation to protect minority shareholders' rights. With the adoption of the relevant law it would be much more attractive for the public to invest into equities and thus it would act to boost market liquidity.

A positive step toward the defense of the shareholders rights was taken in 2000 when the SCSSM adopted the regulation act that protected

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[7] In 1998 coefficient of correlation for daily closing values of PFTS and RTS indices was 0.95. In 2001 it was -0.77 and its negative sign could be mainly explained by geopolitical factors. For the period of 1998-2002 the coefficient is 0.75.

[8] The latter factor can be interpreted as the lower variability in investors expectations.

[9] However, it will be said later that such activities have only indirect influence on the market with the principal transactions taking place out of it.

stockholders against share dilution, a common problem that took place when companies emitted new series of shares in order to increase their statutory funds with no regard to the initial shareholders rights.

Another problem to be solved is that the acquisitions of state-owned enterprises are often undertaken behind the stock market. The year 2001 was characterized by a spate of lawsuits brought by creditors against heavily indebted state-owned companies. The issue is that it is easier and less expensive to get control of the company through asset-stripping forced bankruptcies or privatization auctions. Using such privatization techniques it was quite possible to buy a controlling stake for just a fraction of the real price, making rent-seeking highly profitable for everybody involved in it. Instead of buying shares, it became possible to buy the whole plant at once. This led to a decrease in the overall liquidity of the stock market.

Specifically, the most vulnerable to asset stripping schemes were companies representing the energy sector, so called oblenergos. One of the major peculiarities of the Ukrainian stock market originates from its low liquidity level. Energy companies have been considered "blue chips" and historically accounted for 40-50 per cent of the PFTS index weight. As a consequence of growing insurrection and specialists' interference, at the end of 2001 the parliament imposed a moratorium on bankruptcy related asset stripping deals at indebted state enterprises and President Kuchma signed a bill banning the forced asset sales of the companies in which state owned 25 per cent or more. It has led to a speculative increase in the demand for energy sector equities with some of them jumping fourfold in value.

A high level of taxes levied on portfolio income is also considered a serious impediment to market activity. Though the taxation rates are not far from the respective averages accepted in the world, they make portfolio investment in Ukrainian companies less attractive due to lower return to risk ratios and force potential institutional investors either to search for other financial instruments or switch to countries with a better investment climate.

High taxes and a lack of transparency do nothing to lure small investors. Unlike other Eastern European countries, where the population more actively takes part in investing in equities from year to year, Ukraine has not seen growing investment interest among the general public. Though it can be explained by low disposable income, Ukrainians still do not take equities as an alternative way to save preferring bank deposits (CDs) and US dollars accumulation.

Comparing the Ukrainian stock market with its counterparts of other transition countries, it should be mentioned that since 2000 Standard & Poor's agency has determined Ukraine as a "frontier market" together with Bulgaria, Croatia, Estonia, Romania, Slovenia and others. The capitalization of the national stock market was $1679.9 million,[10] a value less than in Slovenia, Romania, Croatia and Estonia. Excluding state-owned shares in partly privatized companies Ukraine's total stock market capitalization is estimated at less than $600 million.[11] The average monthly trade volume in 2002 was $8.71 million, the lowest among eight Eastern and Central European countries whose companies were represented in the S&P IFCG Frontier Comp index.

Though even the trade volume to capitalization ratio for Ukraine was the second lowest among those countries, the industrial potential of the country remains much higher and it can be concluded that the Ukrainian stock market, while characterized by low level of attractiveness for foreign portfolio investors, is still undercapitalized. Another argument in favor of the market's future growth is that the Ukrainian leading industrial enterprises whose shares are among the most liquid on the stock market have low P/E ratios, combined with significant returns on assets.

[10] As for 01.01.2003

[11] As for October, 2002

Chapter 5

DATA DESCRIPTION

The original data set for the fundamentals is extracted from the database published in *Ukrainian Economic Trends* by UEPLAC. The estimation deals with monthly series for the period from 10.1997 through 04.2002 included[12]. The variables and their designation are represented in Table 1.

Table 1. Description of the variables

Name	*Symbol*
Monthly per cent change of CPI	CPI
Official exchange rate of hryvna against US dollar set by the NBU (average for period)	EXR
Index of real industrial production, seasonally adjusted (official, 1990=100)	PRO
Real interest rate on credits (lending rate), weighted average, per cent	IRC

Information about the equity prices was derived from the site of the *Kinto Securities* brokerage company *www.kinto.com*. The list of ten most liquid companies ("blue chips") whose shares are represented in the sample is showed at Table 2.

The problem of choosing right sample for the creation and testing of various models is especially acute in the field of finance. Some models can perform better at one period but fail to provide any insight at other time. Same situation occurs while dealing with different cross-section samples of returns. A particular model could provide meaningful results and be tested

[12] Data for the last three months of 1997 serve as trial values for the generation of the expectations series. Cross-section of stock returns is constructed for the 01.1998-04.2002 sample period.

appropriately using the original sample of stocks but become out of order if we would try just to *extend* the sample.

In my case the extension of the chosen sample would make the model less appropriate to use for the original purposes of the conducted research. In the conditions of low liquidity and high volatility, inclusion of non-frequently traded shares would lead to the downward bias in the significance of the results of the search for the link between equity returns and macroeconomic indicators. Shares of the companies with a low float and/or which are characterized by a low demand could observe just a couple of unaltered bid and ask orders or do not have them at all for months. Having plenty of such white spots in the cross-section sample of returns would make the estimation results meaningless.

Table 2. List of companies whose shares are represented at the cross-section sample of stock returns

Ticker	*Company*
UNAF	Ukrnafta, gas-extraction and petroleum company
KIEN	Kyivenergo, regional power generation and distribution company
CEEN	Centrenergo, regional power generation company
ZAEN	Zahidenergo, regional power generation company
STIR	Stirol, chemical and pharmaceutical plant
DNEN	Dniproenergo, regional power generation company
DOEN	Donbasenergo, regional power generation company
NITR	Nyzhnodniprovsk tube-rolling mill
FLOT	Ukrrichflot, navigation company
DNON	Dniprooblenergo, regional power distribution company

The limited size of the sample and the problem of selection of the appropriate candidates for it is the major restriction for the extensive research of financial markets in countries with transition economies. With the major Ukrainian benchmark PFTS stock index being nothing but a portfolio of

exactly 10 stocks and with shares of just 8 companies traded at the highest (first) level at the PFTS, our sample of companies chosen for the estimation could be considered the most justifiable one.

The share prices are taken for the PFTS last working day of each month at the sample period. As a matter of fact, since the equity trades do not take place very often and the spread is quite substantial and varies from share to share, the day closing price of the stock is of little value for the analysis. The major Ukrainian stock market indices used to be calculated using one of two methods, depending on the stock prices used: either calculate the stock price as the average of the maximum bid and minimum ask, or to consider as the price of the share so called *quoted price*, which is the weighted average of all bids and asks submitted during the trading session. Not surprisingly, the quoted prices of the stocks in the sample had on average less variability than their counterparts and were chosen for our analysis in order to avoid the possible influence of daily ticks.

Since those prices were expressed in US dollars, the original stock returns were adjusted by the change in the official exchange rates established by the National Bank of Ukraine for the respective days. The daily official exchange rates were extracted from the financial web-portal *finance.com.ua*. As a proxy for return on risk-free asset nominal money market rate series was taken from *Ukrainian Economic Trends*.

The proposed model deals with logarithmic returns on stocks. Therefore, some of the dependent variables were also transformed into log returns in order to have compatible data series:

$$exr_t = (\ln EXR_t - \ln EXR_{t-1}) \cdot 100, \qquad (15)$$

$$pro_t = (\ln PRO_t - \ln PRO_{t-12}) \cdot 100. \qquad (16)$$

The real interest rate on credits *IRC* and consumer price index *CPI* are used in the model in the original form.

Note that the variable pro_t measures the monthly growth rate of industrial production with respect to the respective month of the previous year. It is generally considered that the equity market is related to the changes

in industrial production in the long run. This measure means that it is the yearly growth rate rather than the monthly one that is related to the contemporaneous monthly changes in stock returns. As the latter is the subject to seasonal shocks it may not reveal correctly the current path of industrial growth even in the medium term. However, it might be the case that pro_t is highly correlated due to the overlapping data series.

Chapter 6

ESTIMATION RESULTS

So far, the main purpose of the proposed analysis is to determine whether the information about economic activities reflected by macro and non-return financial indicators is incorporated into the equities prices.

The macroeconomic factors that are used for the estimation of the model are unanticipated inflation and changes in the inflation expectations, unexpected shocks to the industrial production, unanticipated shocks to UAH/USD exchange rate and unanticipated shocks to the lending interest rate. The unanticipated shocks are generated as residuals from autoregressive models with unobserved components (expectations) with time varying parameters. Such specification allows agents to update their expectations recursively each period based on the information available during the previous period of time, i. e. at the time when their expectations are actually formed.

Unanticipated components of CPI and its expectations series proved to be stationary while implementing the unobserved components model (6)-(7). For the unanticipated exchange rate, industrial production and real interest rate time-varying parameter AR(1) models (8)-(9) were estimated. The exchange rate series observed a huge spike in November of 1998 (45.02 per cent) which was the consequence of the financial crisis in Russia. In order to isolate its influence on the subsequent expectations a dummy variable was introduced. The final model for exr_t series is

$$exr_t = \delta_t exr_{t-1} + \gamma_t dummy + \varepsilon_t, \quad (17)$$

$$\delta_t = \delta_{t-1} + \omega_t. \quad (18)$$

The results indicated in Table 3 show that the series of unanticipated components of the macroeconomic variables can be considered stationary.

Table 3. Augmented Dickey-Fuller (ADF) test results for the model components

Factor	*Model used*	*ADF test statistic*[a]
Unanticipated inflation	unobserved components	-3.528*
Change in expected inflation	unobserved components	-3.798**
Unanticipated change in production	time-varying parameter	-3.711**
Unanticipated change in real interest rate	time-varying parameter	-3.673**
Unanticipated change in exchange rate	time-varying parameter	-3.521*

[a] The test was done for the "trend and intercept" option. For the first three components the number of lagged differences chosen for the test was 12, while for the final two, which are considered less sensitive to seasonal patterns, the number of lags was 3.

* Unit root hypothesis is rejected at 10 per cent level of significance.

** Unit root hypothesis is rejected at 5 per cent level of significance.

For the time-varying parameter models plots of the generated time-varying coefficients are presented in Appendix A. The graphs show that the parameters vary substantially over time. This can be explained by the significant variation in the original data series due to short-term seasonality and the fact that the data covers a period that included a trough in the Ukrainian economy business cycle development (U-shaped pattern).

Table 4. Autocorrelation of the unanticipated components

Symbol	ρ_1	ρ_2	ρ_3	ρ_4	ρ_5	ρ_6	ρ_7	ρ_8	ρ_9	ρ_{10}	ρ_{11}	ρ_{12}	P-val
CPI_F	0.119	-0.351	-0.115	0.001	-0.133	-0.027	0.061	0.018	-0.126	-0.131	-0.050	0.174	0.253
EXR_F	0.111	-0.183	0.179	0.049	0.198	-0.070	0.068	0.206	0.020	-0.060	-0.148	0.010	0.450
IRC_F	-0.112	-0.177	0.061	0.003	-0.055	0.033	0.026	-0.098	-0.041	-0.007	-0.145	-0.014	0.950
PRO_F	-0.043	0.058	0.024	-0.024	0.134	0.089	-0.065	0.163	-0.146	0.039	-0.121	-0.297	0.389

P-val = *P*-value for hypothesis that all autocorrelation coefficients through this point are zero.

Table 4 displays the autocorrelations for the unanticipated components of the generated state variables. The variables mostly show moderate autocorrelations. The only noticeable ones are for unexpected inflation at the second-month lag and unanticipated production changes for the 12-month lag. Thus, we can conclude that there are no visible seasonal subordinations in the state variables. As was noted in the model description section, the existence of autocorrelation in state variables implies the errors-in-variable problem which would lead to the biased estimates of the factor

loadings for those variables and to a downward bias in the estimates indicating statistical significance.

Yet, we cannot be sure that our unanticipated components are true "surprises". The ADF test just checks whether we use an appropriate model to generate unexpected parts of the factors and a correlogram showing that a particular series has no statistically significant correlation is not sufficient to claim that the observations of the series are independent. Table 5 shows the results of the BDS test which is a portmanteau test for time based dependence in a series.

Table 5. BDS Test results for unanticipated components

BDS Test for CPI_F		
Dimension	BDS-statistic	P-value
2	0.007058	0.5068
3	0.029090	0.0877
4	0.014346	0.4832
5	0.020354	0.3439
6	0.014647	0.4839
BDS Test for EXR_F		
Dimension	BDS-statistic	P-value
2	-0.003872	0.5264
3	-0.011661	0.3670
4	0.002956	0.8852
5	0.016723	0.5555
6	0.033750	0.3534
BDS Test for IRC_F		
Dimension	BDS-statistic	P-value
2	-0.006079	0.6676
3	-0.008306	0.7158
4	-0.024467	0.3748
5	-0.053479	0.0667
6	-0.049342	0.0840
BDS Test for PRO_F		
Dimension	BDS-statistic	P-value
2	-0.017705	0.2855
3	-0.009569	0.7220
4	0.005429	0.8682
5	0.007382	0.8323
6	0.005038	0.8835

The BDS test is usually applied to check whether the series of the estimated residuals are independent and identically distributed. Under the assumption of independence, we would expect the BDS-statistic to be close to zero. As we can see, the hypothesis of independence could not be rejected for either of the series, so that we may claim that Kalman filter technique looks to be convincing in doing an adequate job at generating expectations and deriving innovations.

If the market participants process information efficiently, then only contemporaneous information could influence returns. However, it could be the case when there is a natural delay in announcement or publication and then it is more relevant to use lagged innovations in macro variables in the analysis. In our case this aspect mostly concerns announcements about inflation and level of production. Thus, instead of the current innovations one period lagged values of unanticipated components of CPI_t and pro_t are used in the general model.

The results from estimating model (11) by ITNLSUR are reported in Table 6. From the table it is clear that the APT pricing restriction for nonlinear cross-equations is easily accepted.

Table 6. Estimates for the prices of risk (risk premiums) carried by the factors

Factor	*Price of risk*	*t-statistic*	*P-val.*
λ_1 (expected inflation)	-1.064098	-0.980776	0.3272
λ_2 (unexpected inflation)	0.272623	1.021789	0.3074
λ_3 (exchange rate)	-1.134466	-1.439292	0.1507
λ_4 (interest rate)	0.219935	0.607644	0.5437
λ_5 (industrial production)	-0.744446	-0.623458	0.5333
APT pricing restriction			
H_0: $A = B\lambda_k$	$\chi^2(10) = 0.035494$		

P-val. = *P*-value for hypothesis that the coefficient is zero. The statistic testing H_0 is a Wald test distributed $\chi^2(.)$ under the null. 5% critical value for $\chi^2(10)$ is 18.31.

Due to the fact that the central hypothesis of the entire theory is accepted, one could erroneously assert that the APT appears to be a reasonable description of the observed equity returns. However, the obtained results are rather more frustrating than optimistic for the APT partisan. The methodology applied is an application of a step-by-step technique: where the second step becomes necessary and even has more value than the first, conditional on the first step being successful. In our case neither of the coefficients is significant which puts under doubt the whole hypothesis about the existence of the link between stock returns and economic development path in Ukraine. The signs of several coefficients (λ_4 and λ_5) are opposite to the expected. The stock market reacts more sensitively to the change in inflation expectations and unanticipated changes in the exchange rate. This reaction is negative showing that rather than adjusting stock prices to those changes agents do not favor potential rise in inflation and hryvna depreciation, becoming more bearish. Interestingly, market tends to discount in stock prices unanticipated inflation of the previous month but if higher past inflation figures increase future inflation expectations, the combined effect on stock prices tends to be negative. It seems that systematic forces affecting discount rate are more powerful in their influence on stock market if compared with those that affect expected cash flows.

Nevertheless, the results signal that the systematic risk could not be captured appropriately by the chosen factors. However, the problem may not be in factors themselves, but in the nature of the risk. It is hardly possible to find any other variables to serve as the proxies for the dispersed systematic risk: they would be meaningless in the sense that no relevant economic nexus could be assumed to take place between them and the stock market.

The inference is that systematic risk forces that influence the Ukrainian stock market are exogenous, i. e. their origins are outside of the national economic system. Appendix B shows the correlation matrix of the residual series of the equity returns from the original ITNLSUR. The matrix says that there still is a huge amount of systematic risk uncovered by the

model that exerts correlation coefficients to be "unreasonably" high. Only the variation of stock returns on Dniprooblenergo shares tends to be fully absorbed by the variations in the factors. However, Appendix C shows that since the year 2000, variation in the stock return residuals series has mostly declined which can be partly explained by longly awaited expansion in the national economy and followed macro stabilization. With stocks tending to rise when economy is growing, and tending to fall when macroeconomic indicators are deteriorating, this is precisely the leverage effect in work.

Chapter 7

CONCLUSIONS

The purpose of this work is to check whether the Ukrainian stock market behaviour is related somehow to the unanticipated changes in the observed major financial and macroeconomic indicators regarding the availability of data. The theoretical framework of the analysis was derived from the Arbitrage Pricing Theory postulates in order to determine which state variables if any influence the stock market path.

In summary, the assertion that the Ukrainian stock market is heavily influenced by the systematic risk forces seems to be correct. However, the nature of the factors that exert stock market movement is found to be exogenous, since the constructed model showed that neither of the proposed factors was significant enough to capture variation in the equity returns. Being heavily influenced by external forces that could not be proxied by relevant quantitative variables indicates that due to its low liquidity stock market is very vulnerable to speculation and/or insider trading. Since the conducted research does not deal with lagged values of stock prices as independent variables, there is no sufficient background to talk about the efficiency of the stock market. However, based on the results of the analysis which support hypothesis of highly speculative nature of stock market transactions and its participants, one could argue that the current state of Ukrainian stock market is far from being considered efficient.

The reason why the Ukrainian corporate stock market lacks serious investors lies mainly in its internal substance, i. e. undeveloped legislation and high dependence on state regulation bodies. The lack of potential prospective companies to invest in drags the market, too. There is still no Ukrainian company that has introduced American Depositary Receipts (ADRs) in order to enter the world stock market. Some of them prefer rather to issue

corporate bonds which, although are more expensive for issuers, are more attractive for investors if compared to the "would be" corporate stocks issues. The only company whose shares can be considered "blue chips" at the local financial market is Ukrnafta, while the fringe of less attractive ones whose shares are listed at the PFTS consists mainly of energy sector companies, which are historically most vulnerable to various external shocks serving as major laggards in unpopular asset stripping schemes.

With positive steps in the direction of improving the legislation base conducted in late 2001 – early 2002 we can expect more consistency in stock market behaviour. More companies could be represented in the sample pool with improving liquidity. However, the time horizon for such targets is a matter of years rather than of months unless further reforms in the financial sector are on the schedule.

Though chosen macroeconomic indicators failed to serve as reasonable proxies for the factors that determine stock market behaviour, it is apparent that macro stabilization and continuous growth of national economy are necessary conditions for further stock market development. It would help the market and its participants to join growing number of European emerging stock markets in competitive struggle for foreign capital influx which might cause excessive volatility to dampen.

BIBLIOGRAPHY

Antoniou, A., Garrett, I., and Priestley, R. 1998. Macroeconomic Variables as Common Pervasive Risk Factors and the Empirical Content of the Arbitrage Pricing Theory. *Journal of Empirical Finance* 5:221-240.

Braychenko, V. With Market Quiet, Traders Watch for Deals. *Kyiv Post*, October 17th, 2002.

Burmeister, E., and McElroy, M. 1988. Joint Estimation of Factor Sensitivities and Risk Premia for the Arbitrage Pricing Theory. *Journal of Finance* 43:721-733.

Campbell, J. 1996. Understanding Risk and Return. *The Journal of Political Economy* 104:298-345.

Chen, N. 1983. Some Empirical Tests of the Theory of Arbitrage Pricing. *Journal of Finance* 38:1393-1414.

Chen, N., Roll R., and Ross S. 1986. Economic Forces and the Stock Market. *Journal of Business* 59 (July):383-403.

Chervachidze, S. Stock market slump continues. *Kyiv Post*, November 8th, 2001.

Clare, A., and Thomas, S. 1994. Macroeconomic Factors, the APT and the UK Stock Market. *Journal of Business Finance & Accounting* 21:309-330.

Fama, E. 1991. Efficient Capital Markets: II. *Journal of Finance* 46:1575-1617.

Fama, E., and French K. 1992. The Cross-Section of Expected Stock Returns. *Journal of Finance* 47:427-466.

Gjerde, O., Knivsfla, K., and Saettem, F. 2001. The Stock Market and Investment in the Small and Open Norwegian Economy. *Empirical Economics* 26:565-580.

Gjerde, O., and Saettem, F. 1999. Causal Relation Among Stock Returns and Macroeconomic Variables in a Small, Open Economy. *Journal of International Financial Markets, Institutions and Money* 9:61-74.

Goetzmann, W. An Introduction to Investment Theory. Available from http://viking.som.yale.edu/will/finman540/welcome.html. Accessed 17 March 2003.

Ignatov, A. 2000. International Market Insight: Overview of Capital Markets in Ukraine. Available from http://bisnis.doc.gov/bisnis/country/000724ukrcapmkts.htm. Accessed 27 August 2002.

Jegadeesh, N. 1992. Does Market Risk Really Explain the Size Effect? *Journal of Finance* 27:337-351.

Li, L., and Zuliu, F. 1998. Responses of the Stock Market to Macroeconomic Announcements Across Economic States. IMF Working Paper WP/98/79.

Lintner, J. 1965. The Valuation of Risk Assets and the Selection of Risky Investment in Stock Portfolios and Capital Budgets. *Review of Economics and Statistics* 47:13-37.

Mauro, P. 2000. Stock Returns and Output Growth in Emerging and Advanced Economies. IMF Working Paper WP/00/89.

Mei, J. 1993. Explaining The Cross-Section of Returns via a Multi-Factor APT Model. *The Journal of Financial and Quantitative Analysis* 28:331-345.

Merton, R. 1973. An Intertemporal Capital Asset Pricing Model. *Econometrica* 41:867-887.

Olearchuk, R. Stock Power. *Kyiv Post*, November 15th, 2001.

Olearchuk, R. The Blue Chips are Up. *Kyiv Post*, May 17th, 2002.

Priestley, R. 1996. The Arbitrage Pricing Theory, Macroeconomic and Financial Factors, and Expectations

Generating Processes. *Journal of Banking & Finance* 20:869-890.

Robotti, C. 2002. Asset Returns and Economic Risk. Federal Reserve Bank of Atlanta Economic Review. Second Quarter: 13-25.

Rockinger, M., and Urga, G. 1999. A Time Varying Parameter Model to Test for Predictability and Integration in Stock Markets of Transition Economies. Centre for Economic Forecasting, London Business School.

Roll, R., and Ross, S. 1980. An Empirical Investigation of the Arbitrage Pricing Theory. *Journal of Finance* 35:1073-1103.

Ross, S. 1976. The Arbitrage Theory of Capital Asset Pricing. *Journal of Economic Theory* 13:341-360.

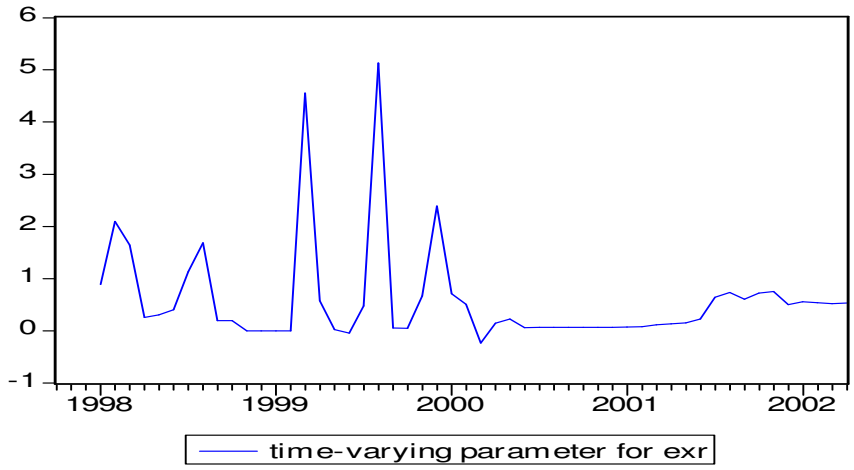
Sharpe, W. 1964. Capital Asset Prices: A Theory of Market Equilibrium Under Conditions of Risk. *Journal of Finance* 19:425-442.

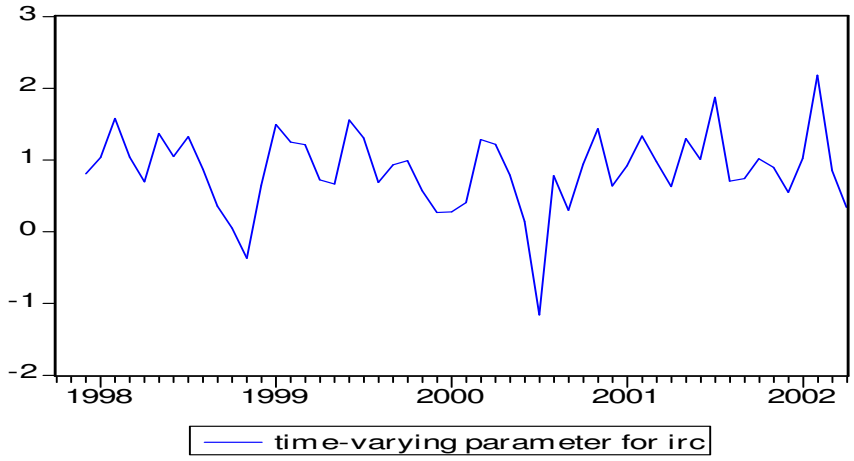
Snyder, R., and Forbes, S. 1999. Understanding the Kalman Filter: An Object Oriented Programming Perspective. Monash University Working Paper 14/99.

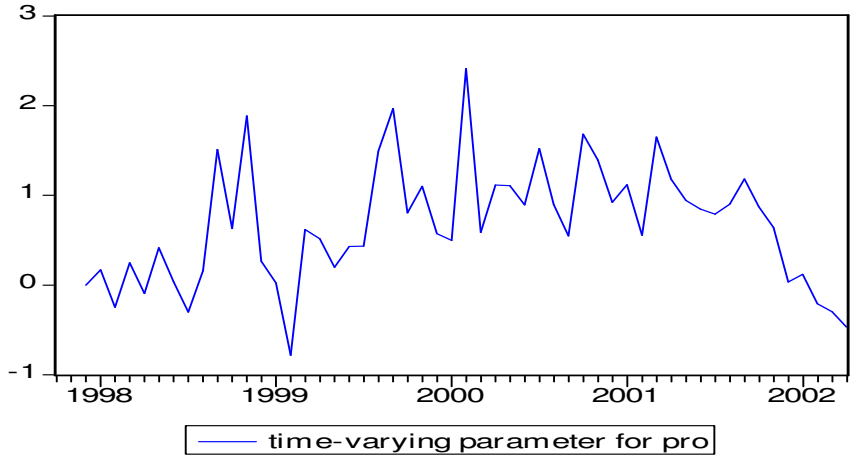
Sokalska, M. 1996. The Influence of Macroeconomic Factors on Behaviour and Predictability of Stock Market Returns In East European Countries: The Case of Poland. Robinson College. MIMEO.

APPENDIX A

Plots of generated time-varying coefficients for the respective models







APPENDIX B

Correlation matrix of the residual series of equity returns

	CEEN	DNEN	DNON	DOEN	KIEN	FLOT	NITR	STIR	UNAF	ZAEN
CEEN	1.000000									
DNEN	0.406482	1.000000								
DNON	0.150360	0.042005	1.000000							
DOEN	0.577785	0.538361	0.075137	1.000000						
KIEN	0.410377	0.326124	0.140377	0.474406	1.000000					
FLOT	-0.083423	0.212855	0.020066	0.178015	0.116539	1.000000				
NITR	0.279509	0.213922	-0.023143	0.231098	0.371663	-0.254378	1.000000			
STIR	0.312943	0.398584	-0.004533	0.285393	0.258935	-0.090092	0.183319	1.000000		
UNAF	0.416121	0.513432	0.057735	0.428366	0.552629	0.132018	0.398512	0.465968	1.000000	
ZAEN	0.691533	0.607279	0.075209	0.575014	0.389664	0.078281	0.300855	0.363817	0.558229	1.000000

APPENDIX C

Variation over time in the stock return residuals series