Intrafirm planning and mathematical modeling of owner's equity in industrial enterprises

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Abstract. The article aims to review the different approaches to intrafirm planning of owner's equity in industrial enterprises. Since charter capital, additional capital and reserve capital do not change in the process of enterprise activity, the main interest lies on the field of share repurchases from shareholders and retained earnings within the owner's equity of the enterprise. In order to study the effect of share repurchases on the activities of the enterprise, let us use such mathematical methods as event study and econometric modeling. This article describes the step-by-step algorithm of carrying out event study and justifies the choice of Logit model in econometric analysis. The article represents basic results of conducted regression analysis on the effect of share repurchases on the key financial indicators in industrial enterprises.

1. Introduction.
One of the economic development areas is rational planning in economic activity, development of production strategies in accordance with the mission, which ensures the growth of efficiency at industrial enterprise. In the planning process, every industrial enterprise needs to ensure the full volume of production and employment, the available material, labor and financial resources, which implies rational use of production assets, inventories, working time, money and currency, information opportunities and many other internal and external factors.

Previous studies indicate that the process of intrafirm planning presents complex interrelated actions, which take into account the peculiarities of specific industries, enterprise hierarchy, an organisational structure and a management level in the enterprise [1]. The main elements of intrafirm planning are plans, programs, budgets, assignments and projects.

The main purpose of intrafirm planning is to ensure effective functioning and development of the enterprise. Realisation of this purposes involves the following tasks: prediction of probable market trends and production program adjustment according to them; investigation of consumers' demands and formation of a program focused on their needs; ensuring better product quality; continuous improvement of production efficiency through further specialization and cooperation; identification and mobilization of internal resources; the most efficient technologies and equipment; coordination with suppliers, consumers and intermediaries of the enterprise and orientation of these actions on mutually beneficial results [2].

The equity capital in industrial enterprises represents the assets value of the enterprise completely in its possession, and includes charter, additional and reserve capital, own shares repurchased from shareholders, and retained earnings.

Planning own capital within the framework of intrafirm planning in industrial enterprises is a selection process of optimal financing sources in order to maximise owners wealth at an enterprise and to increase retained earnings, which directly depend on the results of enterprise operations. However, it should be noted that unlimited increase of own capital does not always lead to its effective use. Own
capital invested by shareholders must create revenue, which ensures competitive strength and stable activity of an enterprise in the market.

Practically charter, additional and reserve capital does not change very often; therefore, scientific interest lies in the field of shares repurchases and retained earnings.

2. Results and Discussion.
In order to study the effect of share repurchases on the activities of the enterprise, let us use such mathematical methods as event study and econometric modeling.

Event study is one of the popular methods in testing financial decisions. The method is based on market reaction, tracking of certain events caused by management decisions or external factors.

MacKinlay (1997) used event study concerning the signaling effects of financial performance (announcements on net profit dynamics, operating or net cash flow) [3], Wruck (1989) – concerning financial solutions to attract the public debt or equity capital, solutions for raising private capital [4].

The empirical research history on the basis of event study starts with the work of J. Dolley (1933), who describes the impact of decisions on the stock split on the market value of companies [5]. In subsequent years, the most interesting research was presented by J. H. Myers & Bakay, A. (1948), C. A. Barker (1956, 1957, 1958), J. Ashley (1962).

Nowadays most of the research is based on an algorithm that was developed in the late 1960s in the works of R. Ball & Ph. Brown (1968) and E. Fama (1969). Ball and Brown (1968) analysed the impact of announcements on financial results (profits) of their market value [6]. Eugene Fama (Fama &.., 1969) studied the effect of stock split on the market value of the company [7].

In recent years, several modifications of event study in the framework of the algorithm have been proposed developed by Ball & Brown (1968), Fama (1969). The need for algorithms adjustments is justified by the attempt of applying the method to the imperfect markets (with weak information efficiency and low liquidity). Significant works on the systematization of the algorithm and generalization of modifications were presented by Stephen Brown & J. Warner (1980, 1985) [8] and MacKinlay (1997).

The event study algorithm consists of ten steps. The first step is to determine the event. In the article "Strategic capital planning of Russian companies based on the dynamics analysis of buyback abnormal returns" [9], the following was used as events: a) the announcement of share repurchase, b) the beginning of share repurchase, c) completion of share repurchase. Data for the study were taken from Bloomberg’s information base.

The second step is to formulate a hypothesis and to define the criterion for "good" and "bad" news. The hypothesis is that if the announcement in the media about the share repurchase is an information signal that the industrial enterprises are undervalued by the market, then such event increases enterprise value and owners welfare. In the study, the "good" news was the increase in the market value of industrial enterprises in the period of event completion, while the "bad" news showed a decrease in the market value of industrial enterprises in the period of event completion.

The third step is to choose the period of time during which there would be changes in the market value of an industrial enterprise. This time period is called the event window. Selected intervals are often 61 days or longer. Consideration of long periods makes sense only if the point is about important events for industrial enterprises such as mergers or acquisitions. The effects of such events can start to occur long before the formal announcement of the transaction; its effects are much more long-term than the declaration of financial results.

The other extreme situation in conducting an empirical research on the method of event study is a much shorter window of one or two days before and after the event date. On the one hand, a too wide window, which includes many days before and after the date of transaction announcement, leads to the fact that it considers too much noise not related to the reaction to the event. On the other hand, a short window does not take into account possible errors of incorrect reflection in a database of the event dates. In the article "Strategic capital planning of Russian companies based on the dynamics analysis
of buyback abnormal returns”, the event window is 21 days: 10 days before the event, an event day and 10 days after the event.

Since share repurchase announcement is one of the many events taking place in industrial enterprises, with greater probability it is possible to exclude the influence of domestic macroeconomic and other events [10]. Furthermore, the effects of share repurchase announcement have short-term nature, thus the chosen interval would be sufficient to assess the market response to the analysed event.

The fourth step calculates the actual stock returns of industrial enterprises. The fifth step calculates the normal returns for all event window dates according to the capital asset pricing model (CAPM). In this study, MICEX index represents Russian market profitability in order to exclude the impact of currency fluctuations on shares’ value in industrial companies.

The sixth step calculates daily abnormal returns from the event window for each of the considered event. Abnormal return equals the difference between the actual return obtained in the fourth step and the normal return obtained in the fifth step. It represents the deviation of the actual (observed) stock returns from normal (expected) returns.

The seventh step involves the calculation of cumulative abnormal returns. For each day, it represented the sum of the excess returns in all previous days within the event window. In academic literature, event study is often called as a cumulative abnormal returns model [10]. If the cumulative abnormal return is positive, then the event leads to value creation, and therefore, company decision shall be considered as a positive phenomenon.

The eighth step is the aggregation of cumulative excess returns values over all events in the sample. Returns should be summarised by all dates in the event window for all the sampled enterprises and events for one company, for example, if within analysed time horizon, the enterprise announced share repurchase several times. As the result, the authors calculated the average value of cumulative abnormal returns over all events for each day of the event window.

The ninth step is checked for correctness of using an "event study" method. In this step, statistical significance analysis of abnormal returns takes place. If the average market reaction is positive and statistically significant, an event leads to increased efficiency of industrial enterprises (its value); otherwise – no.

The tenth step examines the effect of various factors on the market reaction. Within this step, total cumulative abnormal returns are calculated for each enterprise, and regression analysis is conducted.

Results of the study according to the considered algorithm can be found in the article "Strategic capital planning of Russian companies based on the analysis dynamics of buyback abnormal returns" [9].

In addition to event study, the second method, which investigates the influence share repurchase and retained earnings on company’s activities, is econometric modeling. Econometrics was formed as a separate science that combines economic theory, financial indicators (data) and statistical methods. Norwegian economist Ragnar Frisch, a Nobel prize laureate in Economics in 1969, is considered to be the founder of the Econometric Society, established in 1930. [11]

In 2007, the journal "Questions of Economics" highlights a debate between John Keynes and Jan Tinbergen regarding if any given economical event that occurs can be described using mathematical formulas. Keynes [12] adhered to the analytical approach in the study of the events, while Tinbergen [13] used the multiple regression analysis. According to the results of the dispute, strengths and weaknesses were revealed in both approaches and it was concluded that both approaches complement each other, which reduces the probability of error.

Nowadays econometrics plays a significant role in economic sciences. In the world community, several scientific journals devoted to econometrics, such as the Journal of Econometrics (Sweden), Econometric Reviews (USA) Econometrica (USA), Sankhya, Indian Journal of Statistics, Ser.D. Quantitative Economics (India), Publications Econometriques (France), were produced [14].
In the framework of intrafirm planning of equity capital at industrial enterprises, an econometric analysis that showed the impact of share repurchase on the financial performance of industrial enterprises was conducted.

Panel data represent quarterly growth accounting balance of an enterprise and the report on financial results for the three production enterprises, following the program of share repurchase: PJSC "Novatek", PJSC "Norilsk Nickel", PJSC "Uralkali" from 2012 to the first half of 2017. Thus, the sample consists of 66 observations, 35 independent variables in balance sheet and 18 independent variables in the statement of financial performance.

Among the variety of econometric models, the authors selected Logit model with the dependent variable of share repurchase, taking 1 if share repurchase was completed during the reporting quarter, and 0 if share repurchase was not completed. For the period, the authors recorded 22 share repurchases, which is one-third of the whole sample.

Investigating regression models, the greatest interest lies in growth of independent variables and the nature of the relationship (direct/reverse) of the analysed indicators with completion of share repurchase. The absolute amounts of all investigated parameters increase over time, which could not make the basis for analysis of the impact of share repurchase on them.

In general balance, currency was increased in the periods of share repurchase. Consequently, share repurchase leads to the increase of production capacity, contributes to value growth at industrial enterprises and welfare of the shareholders.

In the period of share repurchase, the growth rate of short-term and long-term borrowings decreased. According to the increase in growth rates of short-term and long-term financial investments and cash, it can be concluded that statistically the share repurchase is financed by companies' own funds, thus enterprises do not seek growth of credit risks.

Regarding non-current assets, the analysis of the Logit-model showed that in the period of share repurchase, industrial enterprises tend to invest less in intangible assets. They are patents implemented in the production invention; the exclusive rights to computer software; licenses for subsoil use; geological information search, evaluation and exploration of oilfields; trademark; the company's business reputation, etc.); research and development (scientific-research work, development work, process work); plant and equipment and income-bearing investments in tangible assets (income from rental of buildings, equipment, etc.). Periods of share repurchase are accompanied by a lack of investment opportunities in these types of assets.

3. Conclusion.
Analysis of the report on financial results showed that in the period of share repurchase, there was an increase in a growth rate of revenues, cost of sales, gross profit, but the net profit growth rate was reduced in that period. Most likely, this was due to the difference in changes of deferred tax assets and liabilities from previous periods.

In addition to absolute indicators, econometric analysis was applied to relative indicators such as financial leverage, the proportion of cash in assets, the proportion of retained earnings in liabilities, inventory turnover ratio.

Analysis of financial leverage (D/E) showed that share repurchases were financed by company's own funds.

The proportion of cash in assets of the company increased in absolute and relative terms. This ratio emphasizes that during share repurchase industrial enterprises gather a significant proportion of cash in their accounts. This conclusion is supported by the study of H. Yang, where it is mentioned that the share repurchase procedure is accompanied by an increase of free cash flow [15].

In general, industrial enterprises activity during share repurchase is characterised by stable situation, the possession of available funds, possible stagnation in the current activity, decreased growth of investment in research and development, intangible assets, lack of investment alternatives. In this case, the best allocation of the available funds at an enterprise is investment in itself in order to
draw attention to itself in the market among investors and suppliers to reach a new development level and to find new investment opportunities.

Thus, owing to mathematical tools, the enterprise activity can be assessed most objectively. The construction of mathematical models based on historical data with a certain probability allows predicting any event. In this study, event analysis and construction of multiple regressions contributes most effectively to intrafirm planning of equity capital at industrial enterprises.

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