Kerimov, Pavlo

Article

Enterprise risk exposure estimation by use of corporate finance tools in Ukraine

Economy and forecasting

Provided in Cooperation with:
ZBW OAS

Reference: Kerimov, Pavlo (2019). Enterprise risk exposure estimation by use of corporate finance tools in Ukraine. In: Economy and forecasting (3), S. 29 - 44. http://econ-forecast.org.ua/?page_id=189&lang=uk&year=2019&issueno=3&begin_page=29&mode=get_art&flang=en. doi:10.15407/econforecast2019.03.029.

This Version is available at:
http://hdl.handle.net/11159/6923

https://doi.org/10.15407/econforecast2019.03.029
JEL: C18, C81, G12

Pavlo Kerimov[1]

ENTERPRISE RISK EXPOSURE ESTIMATION BY USE OF CORPORATE FINANCE TOOLS IN UKRAINE

Weak market infrastructure makes the data provided by Ukrainian stock exchanges obscure and unreliable, which ultimately led to a loss of Ukraine's "frontier market" status since 2015. This, in turn, makes risk exposure estimation of Ukrainian enterprises, especially using CAPM and its modifications, a rather complex and creative process, which is highly dependent on qualifications of the expert making such assessment. The aims of this research are to itemize the main issues with calculating beta-coefficient using Ukrainian data and to offer possible ways of mitigating or avoiding them.

Using a set of Ukrainian engineering enterprises the author demonstrates the main limitations of the current statistics provided by Ukrainian stock exchange (namely, fragmentary data with dubious representativeness), gives a condensed characterization of reasons for such state of affairs, and proposes to use methods of calculation based on open source corporate data instead. The best results were achieved by using a method based on adjusting existing average industry-based beta coefficient to enterprise's individual leverage. The author hypothesizes that in order to receive results more representative for Ukraine's situation one should use industry average beta, calculated based on Ukrainian data instead of worldwide averages, available in the open sources.

The methodical approaches to calculating beta coefficient, examined in this paper, and their modifications in order to fit Ukrainian conditions better, could potentially be used in order to access risk exposure of enterprises, functioning on other frontier or developing markets. Creating an open database of industry-based average betas, calculated on the basis of Ukrainian data, could be a valuable alternative to currently available sources for evaluating assets on non-developed markets.

This publication is a part of scientific research project "Financial risks of doing business in Ukraine: non-financial corporations sector" (state registration №0118U006088).

Key words: *CAPM, beta-coefficient, frontier market; stock price; ROE.*

Risk evaluation for assets situated on frontier markets is a complex task, which demands from an expert both intimate knowledge of calculation methodology and abundant experience of using it. This statement fully applies to Ukrainian market, even though it was comparably recently removed from "frontier market" category by Russell Investments[2]. Most of the assessment methods designed for risk evaluation on the developed markets are inapplicable for the undeveloped ones due to lack of

1 **Kerimov, Pavlo Oleksijovych –** PhD, Junior Researcher**,** Department of Real Sector Finances, State Institution "Institute for Economics and Forecasting, NAS of Ukraine" (26, Panasa Myrnoho St., Kyiv, 01011, Ukraine), pkerimov@zoho.com, https://orcid.org/0000-0002-7793-7788

2 Last time it was mentioned as a "frontier market" was in 2015 Country Guidebook (https://russellinvestments.com/-/media/files/us/insights/corporate/global-guidebook-2015.pdf); in 2017 Ukraine was dropped from the list due to lack of available information

relevant basic information. Such situation calls for numerous amendments and modifications of the methods used, which in turn causes massive variation of possible end results. And while the publications on the assessment methods themselves, both on the developed [1, 2] and emerging markets [3, 4], are plentiful, there are precious few publications dedicated to practical aspects of risk assessment on markets below the "frontier market" threshold, such as Ukraine [5, 6].

Therefore, it seems appropriate to elucidate pragmatics of risks evaluation for asset investments on Ukraine's market using corporate finance methodology (namely, the CAPM and its modifications) and available statistics, highlighting the main problems, which one faces during such a task, and outlining possible solutions to them. This topic is too broad to be covered in a single article (features of risk-free rate estimation process in Ukraine were examined in a separate article [7]), therefore, current research will be focused exclusively on evaluating beta of assets situated on Ukrainian market. Thus, the object of this study is the process of evaluating risks of investing in Ukraine-situated assets (or, more broadly, assessment of expected cost of capital, which includes said process). The subject of this study is the process of calculating beta for Ukraine-situated assets. The aims of this research are to itemize the main issues with calculating beta-coefficient using Ukrainian data and to offer possible ways of mitigating or avoiding them.

Currently MSCI classifies Ukraine as a standalone market[3], which means that our country has some of the characteristic features common for the rest of such countries, especially when it comes to quality of market information. Statistics, which is available from non-insider sources, is of notoriously low quality, which means additional difficulties in evaluating risks of investing in Ukraine-situated assets. The evaluation itself is based on calculating beta of said assets, which is, by the CAPM specifications, the measure of non-diversifiable systematic risk's influence on the enterprise's profitability. In order to calculate it, one needs two main numerical series, which describe the profitability of the enterprise itself and the average profitability of assets on the market where it functions. In the current Ukrainian conditions, neither of them could be used as is.

For one, the lack of historical data. It is a general rule, that the longer are the available numerical series, the more precise results one might expect from calculations. In the current Ukrainian conditions, time horizon of estimation is mainly limited by the available data. For instance, if returns on stocks of Sumy Machine-building Research and Production Company during the period of 2013-2018 are described by a sole transaction on PFTS stock exchange (04.17.2015), it'll be the only figure available for risk evaluation using the method based on stock returns. Some researchers use alternative profitability indices instead, for instance ROE, which can be calculated for any public company, but this "solution" at very least reduces the number of possible observations by 12-365 times, which also decreases the estimation accuracy.

Secondly, available numerical series are of doubtful representativeness. For instance, the stock exchange index, which theoretically shows average market returns, is readily available from the site of stock exchange in question, boasting both regular

3 MSCI ACWI & frontier markets index (https://www.msci.com/o/adaptive-media/image/15038131/Preview-1000x0/Market+Classification+Chart+-+2019.jpg?t=1559107458844).

updates and sufficient number of observations. It also could be replaced by any other stock exchange index, based on the chosen method of estimation. But the question is: do Ukrainian stock exchange indices represent expected average market return?

Let's look into Ukrainian stock exchange indices in detail. According to data provided by the National Commission on Securities and Fund Market (NCSFM) in 2017, 99.69% of overall deals were conducted on three stock exchanges: PFTS (31.26%), "Perspektyva" (61.91%) and Ukrayinska Birzha (6.52%). Furthermore, 92.1% of these deals involved Ukrainian government bonds [[8], c. 17]. The indices of said stock exchanges are calculated based on 7, 10 and 6 constituents respectively, which already calls into question their adequacy not only due to the low number of stocks monitored (for instance, A. Damodaran uses S&P500, which is based on stock data of 500 predominantly big industrial enterprises [1, c. 188(36)]), but also due to the choice of the enterprises to monitor, for most of them are not industrial by nature (Exhibit 1).

"Perspektyva" stock exchange ceased calculating its own index back in 2016 due to low liquidity of equity markets and lack of deals with index-constituent stocks[4]. It appears to be an absolutely logical step if we consider the indices that were left standing. For one, the low liquidity of stock market is reflected by extremely low number of unique enterprises, whose stocks could be used as a basis for a stock exchange index. Apart from obvious problems, it causes such peculiarities like Ukrayinska Birzha stock exchange index including the stocks of "Motor Sich" PJSC, which were pulled out from trade back in 2018 according to a court decision[5]. Secondly, even though these two stock exchange indices share five enterprises as their constituents, they have significantly different (sometimes even opposite) dynamics. The reason behind this is the differences in methodology of calculation of the indices in question. Unlike Ukrayinska Birzha, PFTS does not publish the structure of its index basket, thus necessitating a separate manual calculation. It allows pointing out a significant number of iterations required to adjust the structure of the index basket towards restrictions set by their own method of calculation (no more than 15%[6] per one enterprise on PFTS, no more than 25%[7] – for Ukrayinska Birzha). This serves as yet another argument for unrepresentativeness of Ukrainian stock exchange indices.

In practical terms it means that theoretical predictions of the CAPM will not be backed by such statistics. For instance, according to classic CAPM, the stocks, which are part of stock exchange's index basket, would have beta of 1 if it's to be calculated against the index in question. The logic is clear here: if the index, which shows average market profitability, is calculated based on certain stock returns, any change in the latter will be proportionally reflected in the former. Let us check this prediction using available Ukrainian statistics.

4 Decision of Exchange Board of PJSC "Perspektyva Stock Exchange" from 11.01.2016

5 Court order № 73548378, 20.04.2018, Shevchenko district court of city of Kyiv (https://youcontrol.com.ua/catalog/court-document/73548378/).

6 Rules of calculating PFTS index (http://pfts.ua/images/files/2017/Rozr_index_PFTS.pdf).

7 Method of calculating Ukrayinska Birzha index (http://fs.ux.ua/files/58/622).

Exhibit 1

Constituents of main Ukrainian stock exchange indices as of June 2019

№	PFTS			Ukrayinska Birzha (UX)	
	Enterprise/ticker	%(1)	%(8)	Enterprise/ticker	%
1	Raiffeisen Bank Aval (BAVL)	12.88	15	Raiffeisen Bank Aval (BAVL)	14.94
2	Centrenergo (CEEN)	38.32	15	Centrenergo (CEEN)	25
3	Donbasenergo (DOEN)	3.73	13.15	Donbasenergo (DOEN)	3,53
4	Kriukiv railway car building works (KVBZ)	3.37	11.85	Motor Sich (MSICH)	25
5	Turboatom (TATM)	7.22	15	Turboatom (TATM)	6.53
6	Ukrnafta (UNAF)	27.31	15	Ukrnafta (UNAF)	25
7	Ukrtelekom (UTEL)	7.17			

Source: compiled by author based on data provided by respective stock exchange's websites.

As an example, we will take the returns of Kriukiv railway car building works (KVBZ) on PFTS stock exchange. A. Damodaran, whose method we will be using, estimates beta by regressing weekly returns on stock against the "most popular" local index [9]. Additionally, in each case beta is estimated twice: using two and five years of data. Therefore, the resulting beta for an asset is a weighted (by 2/3 and 1/3 respectively) sum of two-year and five-year beta. Due to low market liquidity (the securities in question are not traded on a weekly basis), we shall use monthly returns instead of weekly ones. The returns are calculated as a difference between average monthly closing prices in adjacent periods. Since the two year period has higher weight and the cost of KVBZ stocks didn't change during 16 out of 24 of observations available for this period (i.e. monthly returns were 0), we could nominate this calculation in US dollars (by multiplying monthly returns by corresponding monthly average exchange rate) in order to account for hypothetical returns an outsider investor could have received from exchange rate volatility. According to the A. Damodaran's method of calculation, beta would be the slope of a simple linear regression of returns of KVBZ stocks against PFTS index, calculated using two and five years of data. In order to save space, we shall provide a line fit plots graph for only one of them – the five year one (Fig.1).

As we can see, only 25% of return distribution of PFTS index could be explained by KVBZ stock return distribution. Despite this, the model is statistically significant (F-statistic is below 5%), as well as its slope, even taking into consideration the latter's substantial (22,3%) standard error. This means that the model is a correct, but substandard one, due to the weak connection between the function and the factor,

which reflects comparatively weak influence of returns of KVBZ stocks on PFTS index, suggested by Exhibit 1 (3.37%). But our interest here is the resulting beta, which equals 2/3*0.01+1/3*0.02 = 0.01. Its value does not equal 1; therefore, an alternative method should be applied.

Could it be that the reason for such deviations was in changing currency of the returns from hryvna to US dollar, which introduced currency risk into beta calculations? Another calculation using unmodified data yielded a beta, calculated as a regression slope, equal to 0.8 and a beta, calculated via covariation and variation of returns, equal to 0.

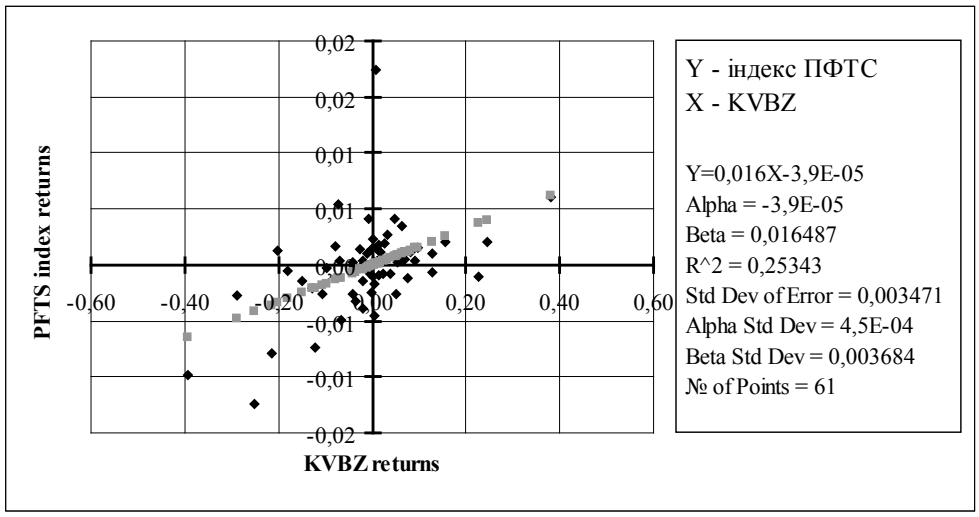

Fig. 1. Regression of KVBZ stock returns against PFTS index returns (monthly, June 2014 – July 2019).

Source: compiled by author based on the PFTS trading results. URL: http://pfts.ua/trade-info/trade-results (accessed: 07.24.2019).

Calculating beta by dividing covariation of stock exchange index returns and returns on the stock in question by the variation of return of stock exchange index, would be the second most widely accepted method of estimating beta [1, c. 27 (119)]. If calculated using Ukrainian data, it provides results which vastly differ from beta estimates using regression's slope. For instance, if we use the same data set we used earlier, two year (2017-2019) beta estimates would reach 1.01 and five year (2014-2019) beta estimates – 10.43, due to massive volatility of exchange rate in 2014-2015; thus, the composite beta would be equal to 4.15. If we were to discard beta value of 10.43 as improbable and replace it with 1 (as A. Damodaran advices to do in case there is not enough data to calculate five year beta), we would arrive at beta value of 1.01, which finally falls in with the theoretical value. Unfortunately, this result can only be obtained by multiple and dubious adjustments.

Thereby, an attempt at evaluating beta using Ukrainian data, depending on chosen method of evaluation and premises (currency, time horizon, etc.) yields beta values varying from 0 to 10, even though the standard value is supposed to be 1 (due to stock in question being one of the constituents of the stock exchange index used), and can only be obtained via trial and error method. This means that the qualification

and experience of the expert who makes the assessment are the only measures of the assessment's usefulness.

Another inference is that the quality of statistics, provided by Ukrainian stock exchanges, is rather low, which, in turn, lowers the overall quality of estimations of risk of investing into Ukraine-situated enterprises, based on such statistics. The reason for this is likely to be connected with peculiarities of Ukrainian stock exchanges, which could be summarized as follows: Ukrainian enterprises are not capable and/or interested in trading their securities on stock markets.

According to Ukrainian laws (specifically, [10, art. 24]), in order to maintain PJSC status an enterprise is to be allowed to trade on at least one Ukrainian stock exchange and maintain this privilege. According to the statistics provided by the State Statistics Service of Ukraine, as of January 1, 2019, only 1 727 out of 14 310 registered enterprises, i.e. 12% had PJSC status[8]. Relatively few of those 1 727 enterprises are listed on any stock exchange whatsoever. For instance, "Perspektyva" stock exchange only has two unique issuers listed as of July 2019 (namely, Ministry of Finance and State Mortgage Organization[9]) and 81 more issuers who are not listed per se, but have the right to trade their securities on the exchange. On Ukrayinska Birzha there are seven enterprises listed and another 58 unlisted participants[10]; on PFTS, respectively, there are 10 and 129 participants[11]. So, on the three biggest stock exchanges there are 19 listed participants and 268 unlisted ones, moreover, some of them belong to all of these stock exchanges simultaneously (for instance, "Ukrtelekom" or "Ukrposhta"). Thereby, the rest of 1 440 enterprises are either listed on stock exchanges, on which less than 0.39% of overall deals take place, or they're not meeting the requirements set by the Law of Ukraine "On joint stock companies". It also worth mentioning that more than half of the overall deals (56.09%) as of 2017 are over-the-counter, moreover the absolute majority of the deals with stocks (96% of the overall deals) are over-the-counter as well [8, c. 30]. This makes the inability or unwillingness of Ukrainian PJSCs to trade their securities on stock exchanges obvious.

Possible reason for such state of affairs could be the fact that from Ukrainian enterprise's perspective the stock market is not an instrument of acquiring additional financial resources (capital), but a mechanism for amending ownership structure. This assumption is supported by relatively low volume of deals with stocks in the overall number of deals (22.68% as of 2016, 27.01% as of 2017) and the fact that 96% of deals with stocks are over-the-counter. The latter could be explained away by lower levels of control, exercised over the OTC deals (which allows to change ownership structure without having to inform many people) and listing demands, which are considered by some experts [11] inadequately high for the majority of Ukrainian issuers.

Low quality of available statistics, however, does not excuse one from a need to evaluate risk of investing in Ukrainian securities. Let us consider alternative methods

8 Number of legal entities by type of business (http://www.ukrstat.gov.ua/edrpoy/ukr/EDRPU_2019/ks_opfg/ks_opfg_0119.htm).

9 "Perspektyva" Stock Exchange stock list (http://fbp.com.ua/Trade/StockListPer.aspx).

10 Ukrayinska Birzha Stock Exchange stock list (http://www.ux.ua/ua/issues.aspx).

11 PFTS Stock Exchange stock list (URL: http://pfts.ua/stock-exchange-pfts/list-pfts).

of evaluations, which would minimize the need for such statistics. So, A. Damoradan recommends to use bottom-up betas [12, c. 18], i.e. to take an average industry beta and adjust it to the enterprise's financial leverage. Values of industry betas for corresponding year and region could be taken directly from the researcher's website [13], but it is worth looking into the methodology used to calculate them beforehand.

A. Damodaran calculates industry beta as an average over a certain sample ("Russia and Eastern Europe"), and the actual share of Ukrainian enterprises in it is as low as 3,4% (19 out of 546). The criteria which justify being referred to mentioned region are somehow unclear, since the same region includes enterprises from Iceland, Balkans and Uganda[12]. Such approach reflects author's rather broad views of comparable enterprises. For instance, by such an approach, Ukrainian enterprises are considered comparable to both Polish ones (which have securities that are commonly traded on local stock exchange, more akin to enterprises from Western Europe) and Belarus ones, which are indeed akin to Ukrainian enterprises in their lack of functioning stock market. A. Damodaran rightly notes that beta should not account for factors, that are already included into the country risk, in order to avoid double count; but this remark works only for situation, when stock prices and stock exchange indices reflect actual economic processes, i.e. for conditions of developing markets, not undeveloped ones. This problem could be circumvented by use of global stock exchange indices instead. Since both of these indicators are percentage of values nominated in the same currency, there is no need to convert primary data into some single currency.

Another approach, which could be used for an undeveloped market, is to calculate industry beta independently based on average industry indicators. It is worth mentioning that usually such a calculation is to be based on forecast data and expected returns, which, in turn, are derived from Gordon Model and/or historical stock returns, but the fact that a decent number of Ukrainian enterprises tend not to pay any official dividends, as well as remarkable rarity of "stable growth" among any of them make such method almost impossible to use. Even in case of availability of complete data in question, there would be still additional issues like evaluating growth and return rates, or calculating discount rate (WACC is usually used for that purpose), which in turn depends on beta, – but this topic is rather broad and requires its own separate research. In our cause, when the only available data can be extracted from enterprises' balance sheets, we have to use it alone, even though the received results will be sub-standard [1, c. 38 (130)].

Using a sample of Ukrainian mechanical engineering enterprises we'll try to show general framework of such a calculation and highlight the main issues one faces when attempting it. Mechanical engineering is chosen for its comparably high returns and low state involvement.

As we concluded before, local stock exchange indices are not representing average returns on Ukrainian market, so an alternative index should be used. Some of CAPM modifications (for instance, global CAPM, Salomon-Smith-Barney Model) recommend calculating beta directly as a slope of regression of local stock returns against a global market index. The majority of CAPM modifications developed for asset evaluation on non-developed markets (Local CAPM, Adjusted Local CAPM,

12 A. Damodaran's sample of enterprises, sorted by industry and country. (http://stern.nyu.edu/~adamodar/pc/datasets/indname.xls).

essard model, Soenen-Johnson model, etc.) require using a local stock exchange index. It would be an acceptable compromise to use Warsaw stock exchange index for beta calculation for big Ukrainian enterprises, as the most successful of them indeed trade there. Here is where we face our first issue: even the most successful of Ukrainian enterprises tend not to have a long history of trading their papers on a stock market (for instance, stocks of "Motor Sich", one of the most successful of Ukrainian mechanical engineering enterprises on stock market, are withdrawn from the biddings for two years already). The less successful Ukrainian enterprises tend not to have any recorded history of trading their securities on a stock exchange whatsoever (Exhibit 2).

Exhibit 2

An example of a representative sample of Ukrainian mechanical engineering enterprises, as of 2017

Enterprise	State Registry Number	Ticker (Exchange)	Share of industry's total assets, %	Share of industry's net profit, %	Share of industry's net loss, %
"Motor Sich» PJSC	14307794	MSICH (UX/ PFTS)	10.34	19.90	0
"AvtoKraz» PHC	05808735	KRAZ (PFTS)	2.57	0	-0.95
"Sumy machine-building research and production company" PJSC	05747991	SMASH (PFTS)	2.56	0	-11.02
"Novokramatorsk machine-building plant" PHC	05763599	NKMZ (PFTS)	2.41	2.53	0
"Turboatom» PJSC	05762269	TATM (UX/ PFTS)	1.94	4.55	0
"ZaporizhTransformator» PHC	00213428	ZATR (UX/ PFTS)	1.80	0	-4.95
"Makarov Pivdenny machine-building plant production company" SO	14308368	N/A	1.77	0	-3.17
"Automotive Company "Bohdan Motors" PHC	05808592	LUAZ (UX)	1.57	0	-6.70
"Kriukiv railway car building works" PJSC	05763814	KVBZ (UX/ PFTS)	1.34	2.13	0
"Ukrainian graphite» PHC	00196204	UGRA (UX)	0.75	1.56	0
Total	N/A	N/A	27.04	30.68	-26.79

Source: compiled by author based on SO "Institute for economics and forecasting of the National Academy of Sciences of Ukraine" corporate finance department's database and sites of respective stock exchanges.

This sample was formed based on total assets of the enterprises and demonstrates the main issues that arise during an attempt to calculate beta using Ukrainian statistics. First of all, most of industries are highly concentrated: in our example, "Motor Sich" PJSC owns more than 10% of total assets of the entire industry and earns around 20% of total industry net profit. Therefore, including this enterprise into any sample automatically turns it representative. Next nine biggest enterprises collectively own 16.7% of industry's assets, and the next 32 biggest enterprises – only 9.61%. Thus, a representative sample without "Motor Sich" PJSC would be four times bigger and its coverage wouldn't exceed 25% of industry's total assets and total net profits. Bigger enterprises are more likely to have their securities traded on a stock exchange, but even when we include only the biggest of them into the sample, we still get enterprises without trading history. Among the aforementioned 37 biggest enterprises only 14 are PJSC's, which are regulation is not always fulfilled (partly due to low market liquidity), therefore any method of calculation based on regressing stock returns against the local index is likely to prove inadequate, even in case of using a proper (foreign) stock exchange index. This puts researcher into a difficult position, since such calculations are to be made using forecast data, and the quality of the forecast is directly related to abundance of available data.

Calculation method, based on dividends paid, which is a usual alternative in such circumstances, cannot be used either, since the majority (up to 85%) of Ukrainian enterprises never pay dividends, at least, officially [5, c. 669]. Thus, the data on return on enterprise's stocks, which are supposed to be regular and long-term, are available only fragmentary and often in batches that are incomparable. A rather high number of stock exchanges in Ukraine does not help. For instance, returns of the same stock on PFTS and Ukrayinska Birzha (for instance, TATM or KVBZ) cannot be used in order to fill gaps in data, since, as it is clearly visible from the periods when there is data available from both sources, such returns differ significantly. Hence, it is necessary to seek out other indices, that characterize enterprise's profitability, in other sources, for instance, in their balance sheets; examples of such indices may include ROE or even RoTA, in the event when enterprise's equity is equal to or below zero (Exhibit 3).

Five year period was chosen according to aforementioned A. Damodaran's beta estimation method, which includes calculation of both five year and two year betas, and then weighting and adding them. Returns on total assets are included in order to highlight the low quality of input data. For instance, negative returns on equity usually mean net loss in the period in question, while positive returns – net profit. However, such a statement is only true for the periods when there are simultaneously negative returns on equity and on total assets. If there are positive returns on equity during the same period as there are negative returns on total assets, like "Sumy machine-building research and production company" PJSC has in 2015-2017, it means that the enterprise in question shows not only negative returns, but negative equity as well. Perhaps the most interesting part is that this enterprise is not under bankruptcy procedure, same as other three enterprises shown in the sample, which have the same problem. If returns on equity are 70% or higher, it means that the enterprise in question has equity that approximately equals to zero, which is usually the result of sustained net losses during a prolonged time period. Aforementioned losses also cause extreme profitability fluctuations between adjacent periods, especially when profitable

and unprofitable periods alternate. Therefore, we can ascertain extreme volatility of returns of Ukrainian enterprises and unusual frequency of negative equity among the less profitable enterprises, which, nonetheless, remain among the biggest asset owners among their industry peers. This results in remarkably high risk estimates.

Exhibit 3

Return on Equity and Return on Total Assets of sample's enterprises, 2013–2017, *%*

Enterprise	2013		2014		2015		2016		2017	
	ROE	RoTA	ROE	RoTA	ROE	RoTA	ROE	RoTA	ROE	RoTA
"Motor Sich» PJSC	16.8	11.3	16.9	11.8	31.6	20.5	13.9	9.5	19.0	12.3
"AvtoKraz» PHC	2.7	0.4	-20.9	-3.4	-52.6	-5.9	-66.8	-3.1	-98.5	-1.4
"Sumy machine-building research and production company" PJSC	-13.5	-3.7	-137	-32.7	720	-35.0	56.3	-19.7	33.4	-16.7
"Novokramatorsk machine-building plant" PHC	6.3	5.2	9.5	8.2	22.7	18.4	9.4	8.4	7.9	6.7
"Turboatom» PJSC	35.4	18.0	29.5	17.1	63.2	40.6	28.2	22.1	21.0	15.0
"Zaporizh Transformator» PHC	33.3	8.3	-618	-64.0	157	-73.7	21.2	-25.1	9.2	-10.7
"Makarov Pivdenny machine-building plant production company" SO	ND	ND	-907	-28.1	130	-33.2	11.1	-6.6	10.7	-6.9
"Automotive Company "Bohdan Motors" PHC	-24.5	-4.4	-185	-25.9	163	-20.5	21.0	-6.6	36.2	-16.6
"Kriukiv railway car building works" PJSC	12.0	8.7	-12.6	-8.0	-17.1	-12.4	-5.5	-3.7	17.1	10.2
"Ukrainian graphite» PHC	-0.6	-0.3	-11.2	-7.1	19.6	9.8	0.8	0.4	32.6	13.3
Arithmetic mean	7.5	4.8	-184	-13.2	124	-9.1	9.0	-2.5	8.9	0.5

Source: compiled by author based on SO "Institute for Economics and Forecasting of the National Academy of Sciences of Ukraine" Corporate Finance Department's database

So, let us calculate beta of the mechanical engineering industry based on the current sample. For indicator of the average market returns we will use MSCI (global) and Warsaw (local) stock exchange indices. Use of ROE calculated based on negative equity is incorrect (if there's no equity, there are no returns on equity), therefore in such cases we will count ROE to be 0. The number of observations is insufficient to build a decent regression, but this is the best source of information available, since half of the sample's enterprises do not have enough information on their stock returns.

As it could be seen from Exhibit 4, those enterprises, which have negative equity, tend to have the least plausible beta values. Calculating beta by use of regression slope is impossible for such enterprises, since their equity is considered to be 0. When calculating average industry values, such enterprises are to be excluded as outliers. Significant difference between two year beta (2y) and five year beta (5y) for same enterprises reflects high volatility of returns of Ukrainian mechanical engineering enterprises. Average industry beta shows extreme levels of risk for three out of four cases, which makes sense, since 40% of the sample's enterprises do not have any equity and have sustained net losses over prolonged time periods; therefore, average risk of Ukrainian mechanical engineering industry is more akin to the average risk of advertising, pharmaceutical or jewelry industries on the developed markets. Although considering how minuscule the number of observations is (ROE is a yearly indicator, while in order to build a decent regression for such a period there would be required at least a monthly one, or even better – a weekly one), credibility of the end results is dubious at best.

Exhibit 4

Mechanical engineering industry beta based on Ukrainian beta, 2017

Enterprise	Stock exchange index	β via the regression slope			β via covariation/ variation		
		5 y	2 y	βl	5 y	2 y	βl
"Motor Sich» PJSC	ΔMSCI, USD	-3.90	4.81	1.90	-3.12	2.40	0.56
	ΔWIG, PLZ	0	-0.28	-0.18	-0.01	-1.81	-1.21
"AvtoKraz» PHC	ΔMSCI, USD	3.96	-29.81	-18.55	3.17	-14.90	-8.88
	ΔWIG, PLZ	-0.01	0.04	0.03	-21.32	11.22	0.37
"Sumy machine-building research and production company" PJSC	ΔMSCI, USD	19.71	0	6.57	15.77	0	5.26
	ΔWIG, PLZ	ND	ND	ND	21.43	0	7.14
"Novokramatorsk machine-building plant" PHC	ΔMSCI, USD	-5.82	-1.42	-2.88	-4.66	-0.71	-2.02
	ΔWIG, PLZ	0.04	0.94	0.64	2.31	0.53	1.13
"Turboatom» PJSC	ΔMSCI, USD	-10.78	-6.77	-8.11	-8.63	-3.38	-5.13
	ΔWIG, PLZ	0	0.20	0.13	1.88	2.55	2.32
"Zaporizh Transformator» PHC	ΔMSCI, USD	122.48	0	40.83	97.99	0	32.66
	ΔWIG, PLZ	ND	ND	ND	69.73	0	23.24
"Makarov Pivdenny machine-building plant production company" SO	ΔMSCI, USD	153.30	0	51.10	81.40	0	27.13
	ΔWIG, PLZ	ND	ND	ND	226.70	0	75.57
"Automotive Company "Bohdan Motors" PHC	ΔMSCI, USD	24.32	0	8.11	19.45	0	6.48
	ΔWIG, PLZ	ND	ND	ND	30.72	0	10.24
"Kriukiv railway car building works" PJSC	ΔMSCI, USD	16.95	21.27	19.83	13.56	10.64	11.61
	ΔWIG, PLZ	-0.02	-0.06	-0.05	-7.47	-8.01	-7.83
"Ukrainian graphite» PHC	ΔMSCI, USD	3.61	29.81	21.08	2.89	14.91	10.90
	ΔWIG, PLZ	0	-0.04	-0.03	0.63	-11.22	-7.27
Arithmetic mean	ΔMSCI, USD	N/A	N/A	11.99	N/A	N/A	7.86
	ΔWIG, PLZ	N/A	N/A	0.05	N/A	N/A	10.37

Source: compiled by author based on SO "Institute for Economics and Forecasting of the National Academy of Sciences of Ukraine" Corporate Finance Department's database

For situations like this A. Damodaran recommends to use average industry beta, calculated by a rating agency or other researchers, and adjusted for each enterprise's leverage. We shall use average industry beta from Exhibit 4 and average industry beta, calculated by A. Damodaran for his sample of enterprises, in order to estimate beta for our own sample (Exhibit 5). In case, when the enterprise in question has negative equity, it presumably has 100% of debt in its capital structure, which makes calculating individual beta impossible, since in that case dividing D/E would generate an infinity due to E being 0.

Exhibit 5

Individual beta via modification of industry average beta

Enterprise	A. Damodaran's β via regression slope	β via regression slope, MSCI	β via covariance/ variation, MSCI	β via regression slope, WIG	β covariation/ variation, WIG
"Motor Sich» PJSC	0.51	2.32	1.52	0.01	2.01
"AvtoKraz» PHC	63.33	288.12	188.85	1.28	249.26
"Sumy machine-building research and production company" PJSC	N/A	N/A	N/A	N/A	N/A
"Novokramatorsk machine-building plant" PHC	0.16	0.72	0.47	0	0.63
"Turboatom» PJSC	0.38	1.71	1.12	0.01	1.48
"Zaporizh Transformator» PHC	N/A	N/A	N/A	N/A	N/A
"Makarov Pivdenny machine-building plant production company" SO	N/A	N/A	N/A	N/A	N/A
"Automotive Company "Bohdan Motors" PHC	N/A	N/A	N/A	N/A	N/A
"Kriukiv railway car building works" PJSC	0.64	2.90	1.90	0.01	2.51
"Ukrainian graphite» PHC	1.34	6.10	4.00	0.03	5.28

Source: compiled by author based on SO "Institute for Economics and Forecasting of the National Academy of Sciences of Ukraine" Corporate Finance Department's database

In order to ensure comparability between A. Damodaran's beta and beta from Exhibit 4, data from Exhibit 4 had to be modified according to A. Damodaran's calculating method, namely adjusted for the industry's average leverage (multiplied by 1+(1-T)*(D/E)) and by the industry's average share of cash in total assets (divided by 1-Cash/Total Assets). Since four enterprises of the sample did not have any equity as of 2017, this method of calculation is not applicable to them. Average values over the sample were used as average industry values (negative equity was considered

to be 0), since the sample includes around one third of Ukrainian mechanical engineering industry and therefore is representative. Extremely high values of beta for "AvtoKraz" PHC could be explained by the fact that it has debt to equity ratio which equals 67.99. Thus, all of the loss-making enterprises either have abnormal beta values or no beta values at all. In order to replace them though, it would be necessary to include 32 more enterprises into the sample, which wouldn't achieve 30% of industry's assets anyway. These are the results of high concentration of the industry in question and low liquidity of stock market. The rest of the enterprises show plausible beta values. Beta calculated using A. Damodaran's industry average beta by regressing profitability indices against WIG stock exchange index look understated, considering Ukrainian enterprises' high return volatility.

Above mentioned examples make it easy to understand why the absolute majority (around 90%) [6, c. 88] of researchers do not calculate their own betas, and use betas, calculated by specialized agencies instead (for instance, Bloomberg, Standard & Poor's, Bara, etc.).

Conclusions

The need for risk estimation of investing in securities based on undeveloped markets, such as Ukraine, poses a wide spectrum of practical questions concerning quality of available statistics and pragmatics of choosing appropriate valuation method. The conducted research allows to conclude that statistics provided by Ukrainian stock exchanges is not a valid representation of average market profitability due to insufficient activities of Ukrainian enterprises on stock exchanges. It makes next to impossible even short- and middle-term valuation of returns on securities of most of the big industrial enterprises (as shows the example of mechanical engineering industry). Together with miniscule number of stock index constituents, it casts doubt on the representativeness of calculations, performed based on Ukrainian stock exchange indices. Possible reason for such situation is the fact that from Ukrainian enterprise's perspective selling its stocks via a stock exchange is not a proper method of accumulating additional financial resources (capital), but rather an additional obligation to disclose their information, and an additional restriction on their business activity.

Possible ways of circumventing this problem are using risk valuation methods based on other statistical sources (such as publicly available data or industry averages), which are examined in the article in detail. At the same time, industry averages taken from foreign sources, for instance, from A. Damodaran's website, should be used with care, taking into account methodology applied to calculate them. It is worth asking oneself, whether a Ukrainian enterprise with a negative equity, could really be characterized by an average industry beta of 0.51, or maybe the average risk of such industry would be higher in Ukraine. Thus, calculating average industry betas based on Ukrainian data might prove to be a valuable alternative source of information, which would take into account local peculiarities, and therefore makes a prospective line of research.

References

1. Damodaran, A. (2014). Applied corporate finance, 4th edition. New York: John Wiley & Sons Inc. 656 p. Retrieved from http://people.stern.nyu.edu/adamodar/pdfiles/acf4E/acf4Ebook.pdf

2. Harvey, C.R. (2005). 12 Ways to Calculate the International Cost of Capital. Retrieved from https://faculty.fuqua.duke.edu/~charvey/Teaching/BA456_2006/Harvey_12_ways_to.pdf

3. Roggi, O., Gianozzi, A., Baglioni, T. (2017). Valuing emerging markets companies: New approaches to determine the effective exposure to country risk. *Research in International Business and Finance,* 39, 553-567. https://doi.org/10.1016/j.ribaf.2016.07.028

4. Pereiro, L.E. (2006). The Practice of Investment Valuation in Emerging Markets: Evidence from Argentina. *Journal of Multinational Financial Management,* 16(2), 160-183. https://doi.org/10.1016/j.mulfin.2005.06.001

5. Tereshchenko, O., Voloshaniuk, N., Savchuk, D. (2019). Rate of Costs on Investment Capital in Emerging Markets. Society. Integration. Education. *Proceedings of the International Scientific Conference,* VI (May 24th -25th), 665-674. https://doi.org/10.17770/sie2019vol6.3957 [in Ukrainian].

6. Tereshchenko, O. (2010). Discounting rate and its role in financial and investment decisions. *Finansy Ukrayiny – Ukraine's Finance*, 9, 77-90 [in Ukrainian].

7. Kerimov, P. (2019). Features of risk-free rate estimation in Ukraine. *Finansy Ukrayiny – Ukraine's Finance*, 8, 61-74. https://doi.org/10.33763/finukr2019.08.061 [in Ukrainian].

8. National Committee's on Securities and Fund Market Annual report, 2017. Retrieved from https://www.nssmc.gov.ua/documents/rtchniy-zvt-nktspfr-za-2017-rk/ [in Ukrainian].

9. Damodaran A. Variables used in dataset. Retrieved from http://people.stern.nyu.edu/adamodar/New_Home_Page/datafile/variable.htm

10. Law of Ukraine "On joint stock companies". Retrieved from https://zakon.rada.gov.ua/laws/show/514-17 [in Ukrainian].

11. Korol, V. (2017, July 25). Listing, Ukrainian-style: fight a friend to fright a foe. *Ekonomichna Pravda – Economic Truth.* retrieved from https://www.epravda.com.ua/columns/2017/07/25/627444/ [in Ukrainian].

12. Damodaran, A. (2009). Volatility Rules: Valuing Emerging Market Companies. *Working paper: Stern School of Business*. New York University. 38 p. https://doi.org/10.2139/ssrn.1609797

13. Damodaran, A. (2019). Useful data sets. URL: http://people.stern.nyu.edu/adamodar/New_Home_Page/data.html

Received 14.08.19
Reviewed 19.10.19
Signed for print 15.11.19

Керімов, Павло Олексійович
канд. екон. наук, молодший науковий співробітник відділу фінансів реального сектора ДУ «Інститут економіки та прогнозування НАН України»
вул. Панаса Мирного, 26, Київ, 01011
pkerimov@zoho.com
https://orcid.org/0000-0002-7793-7788

ОЦІНКА РИЗИКОВОСТІ ПІДПРИЄМСТВ ІЗ ВИКОРИСТАННЯМ ІНСТРУМЕНТАРІЮ КОРПОРАТИВНИХ ФІНАНСІВ В УКРАЇНІ

З 2015 р. Україна втратила навіть статус ринку фронтиру, насамперед через проблеми із доступною і достовірною біржовою статистикою та загальну слабкість ринкової інфраструктури. Це перетворює оцінку ризиковості підприємств, що функціонують на такому ринку, в рамках CAPM та її модифікацій на складний і творчий процес, успіх якого значною мірою залежить від кваліфікації експерта, який здійснює оцінку. Метою статті є виділення основних проблем, які виникають при розрахунку бета-коефіцієнта, базуючись на українських даних, із наведенням можливих шляхів їх вирішення або уникнення.

На прикладі окремих машинобудівних підприємств, а також репрезентативної вибірки по машинобудуванню в Україні було продемонстровано основні обмеження поточної статистики, яка надається українськими біржами (зокрема фрагментарність і сумнівна репрезентативність), коротко охарактеризовано причини такого становища і запропоновано натомість використовувати дані відкритої звітності по підприємствах та методичні підходи, які на них базуються. Найкращі результати дає підхід до оцінки бета-коефіцієнта через поправку середньогалузевого коефіцієнта на індивідуальний фінансовий важіль підприємства. Висунуто гіпотезу, що для більшої репрезентативності результатів доцільно розраховувати середньогалузеві показники ризиковості за українськими даними, а не брати високоагреговані середні дані по світових ринках, доступні у відкритих джерелах.

Розглянуті методичні підходи, а також їх модифікації з метою використання в українських умовах можуть бути використані при оцінці підприємств на інших ринках фронтиру або ринках, що розвиваються. Створення відкритої бази середньогалузевих показників ризиковості на базі українських даних може бути цінною альтернативою наявним у відкритих джерелах даним при оцінці ризиковості активів на нерозвинених ринках.

Публікацію підготовлено за результатами виконання НДР “Фінансові ризики ведення бізнесу в Україні: сектор нефінансових корпорацій” (№ держреєстрації 0118U006088).

Ключові слова: CAPM, бета-коефіцієнт, ринок фронтиру, ціна акцій, рентабельність власного капіталу

Керимов, Павел Алексеевич
канд. экон. наук, младший научный сотрудник отдела финансов реального сектора ГУ «Институт экономики и прогнозирования НАН Украины»
ул. Панаса Мирного, 26, Киев, 01011
pkerimov@zoho.com
https://orcid.org/0000-0002-7793-7788

ОЦЕНКА РИСКОВОСТИ ПРЕДПРИЯТИЙ С ИСПОЛЬЗОВАНИЕМ ИНСТРУМЕНТАРИЯ КОРПОРАТИВНЫХ ФИНАНСОВ В УКРАИНЕ

С 2015 г. Украина утратила даже статус рынка фронтира из-за проблем с доступной и достоверной биржевой статистикой и в связи с общей неразвитостью рыночной инфраструктуры. Это превращает оценку рисковости функционирующих на таком рынке предприятий в рамках CAPM и её модификаций в сложный и творческий процесс, успех которого во многом зависит от квалификации эксперта, который проводит оценку. Целью данной статьи является выделение основных проблем, которые возникают при расчете бета-коэффициента, базируясь на украинских данных, с указанием возможных путей для их решения либо избежания.

На примере отдельных машиностроительных предприятий, а также репрезентативной выборки по машиностроению в Украине были продемонстрированы основные ограничения текущей статистики, предоставляемой украинскими биржами (в частности ее фрагментарность и сомнительная репрезентативность), коротко охарактеризованы причины такого её состояния и предложено использовать вместо неё данные открытой отчетности по предприятиях и методические подходы, которые на них базируются. Наилучший результат дает подход к оценке бета-коэффициента через поправку среднеотраслевого коэффициента на индивидуальный финансовый рычаг предприятия. Предложена гипотеза, что для большей репрезентативности результатов уместно рассчитывать среднеотраслевые показатели рисковости по украинским данным, а не брать высокоагрегированные данные по мировым рынкам, доступные в открытых источниках.

Рассмотренные методические подходы, а также их модификации с целью использования в украинских условиях могут быть использованы при оценке предприятий на других рынках фронтира либо развивающихся рынках. Создание открытой базы среднеотраслевых показателей рисковости на базе украинских данных может послужить хорошей альтернативой существующим в открытых источниках данным при оценке рисковости активов на неразвитых рынках.

Публикация подготовлена по результатам выполнения НИР «Финансовые риски ведения бизнеса в Украине: сектор нефинансовых корпораций» (государственный регистрационный № 0118U006088).

Ключевые слова: CAPM, бета-коэффициент, рынок фронтира, цена акций, рентабельность собственного капитала