Machine Learning in Estimating of SMEs Investment Potential in Ukraine

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Abstract. The aim of this research is to develop a model of SMEs investment potential assessment, using some of machine learning approaches. The structure of investment potential for SMEs was defined underlining their main characteristic features. It was revealed that the SME investment potential depends on factors of business environment measured by indicators of Annual Doing Business Reports developed by World Bank Group. The methodology for assessing the impact of business environment factors on the SMEs investment potential was developed. This methodology is based on the algorithm of machine learning, which can be used to design a model for forecasting the investment potential of SMEs. This model allows to determine the degree of influence of parameters on the formation of the SMEs investment potential. It is recommended to use computer language Python for optimization of time and human resources. It provides the opportunity to study the effects of the main drivers (both enhancement and reduction) of SMEs investment potential aimed at its improvement. The authors revealed that estimation results could become the basis for elaboration of recommendations regarding improvement of business environment in Ukraine.

Keywords: Machine learning, SME, Investment Potential, Business factors, Assessment model, Python

1 Introduction

The level of investment attractiveness plays the pivotal role for business development of every country. There are different types of ranking methodologies provided by international institutions covering various aspects of conditions for running business which objective results can help to observe the level of financial sustainability either to invest financial resources into a country`s economy or to abstain from it. Doing Business reports include economic indicators which can be used as information tool for identification of factors negatively or positively influencing investment attractiveness of economy and economic development on the whole.

Business environment factors as the elements of Doing Business methodology influence the investment potential of enterprises, small and medium sized (SMEs) in particular. Investment potential of legal entities defines the level of a separate country economic growth and its sustainability. That is why it is essential to assess the mentioned factors impact for investment potential formation and forecasting it which can be made by using Machine learning approaches.

In the research the effect of business environment factors on investment potential of small enterprises was defined by automatic relevance determination regression model. Besides, for medium ones it is reasonable to use classical linear regression for the mentioned purpose.

So, problems of investment potential growth and negative impact of different business factors need to be solved in order to minimize the business risk level, to increase the level of funding for enterprises, e.g. SMEs and to forecast the prospects of investment potential formation for SMEs.

2 Literature Review

The potential as a scientific category is universal in application. This allows it to be used in various fields of science: in biology, mathematics, physics, medicine and economics (particularly in investment). In economics investment, innovative, personnel, financial, technical potentials have been described in different literature studies. In this research investment potential of SMEs has been considered because it determines the directions of their activity at the investment market. It forms the grounds for further investment. Investment potential defines the axis, strategy, and performance of SMEs. Investment potential at the macro level shows potential volumes of attraction of financial resources to investment processes, revealing the contribution of SMEs to the country's economic growth. Permanent monitoring and measurement of the investment potential of SMEs allows their investment activity and their investment preferences to be tracked, and to determine the problems of feasibility of using resources for further investment.

There is a range of published studies describing the investment potential and approaches to its estimation, but in some scientific papers we can meet the term “investment opportunities”. In this study, we consider investment potential and investment opportunities as related categories. Previous research reflects the approaches which can be divided into several groups related to: (1) the resource, (2) market, (3) probabilistic, (4) resultative, (5) capacitive, (6) structural, (7) cost.

S. Leonov [1], J. Eklund [2], N. Yaremchuk [3] & P. Dieterlen [4] are proponents of the first group related to the resource which means that investment potential is considered as available resources of legal entities. Financial, material, technical and labor resources are the components of investment potential. The majority of supporters of this approach use value assessment of the mentioned types of resources for measuring investment potential. However, such costing method is quite rough, because the main focus is only on financial resources reflecting their cost measurement.

V. Shchelkunow [5] and C. Schulz [6], who are the market approach supporters, associate investment potential with the demand for goods and services. Demand can specify the volumes of investments for production, but it is essential to take into account resources of the enterprise.

K. Pokataeva [7] has considered the investment potential as probabilistic possibility of accumulation of the appropriate volume of resources for further investment by company. Although the researchers consider probability, they do not use the tools of probability theory.

T. Makukh [8] and T. Luehrman [9] in their works suggest the ability to achieve a certain return on the resources used (regardless of their type), or from the standpoint of assessing the economic results of current and future economic activity, the ability to generate investment income. This definition characterizes the resultative approach. Estimation of investment potential is very close to DCF-method (Discounted Cash Flow), but they are not similar and can produce different results. That is why assessment method due to this approach is considered to be understudied.

Complex approach for solving solving different types of information asymmetry problems between SMEs and other market participants aimed at simplifying investment and innovation processes in Ukraine for providing available useful information about the possible ways to attract financial resources was proposed by Yu. Sybirianska [22].

Capacitive approach revealed the ability of the subject of research (territory, enterprise, subsystem, etc.) "to absorb capital", which depends on several objective and subjective factors, and is described in papers such scientists as O. Shelest [10], O. Goralko [11], A. Kostonichenko [12] and J. Daggers & A. Nicholls [13]. Researchers face the problem of gathering data. Their approach has describable character and does not allow to evaluate the investment potential.

Previous studies did not consider all aspects of investment potential estimation. Moreover, these researches are based on old fashioned, weak methods of assessment and they demonstrate poor usage of statistical tools or probability theory. The considered methods are limited in using for assessment of investment potential on macro level, which can show the role and the place of SMEs investment activity. Research has been changing dramatically: the core focus is big data. These days the improved availability of data allows many investors (including SMEs) to make their decisions using instruments of machine learning (ML).

Nowadays, ML has changed the investment landscape, taking into account that ML and artificial intelligence may unleash new insights, like using data analysis before investing significantly in the technology.

In this study, we propose to use ML in SMEs investment potential estimation because it reveals the market structure, the effect of macro factors on SMEs, shows different drivers and losses of the economy due to technology changes and allows to assess business environment. For instance, making million transactions everyday ML can define where spending money is growing or prices are rising, effecting mostly consumers. This analysis can help consumers, policymakers and business representatives and other leaders make smarter decisions.

3 The Main Characteristics of SMEs Investment Potential Tendencies in Ukraine

Criteria for enterprise determination according to its size in Ukraine were changed by adding the new definition for microenterprises due to adoption of the Law on Development and State Support of Small and Medium Entrepreneurship in Ukraine in 2012 which amended the Commercial Code of Ukraine.

The State Statistics Services has started to generate data about the main indicators of business environment using these new criteria for enterprise definition since the mentioned date of law adoption.

Along with legislative changes such current urgent problems existed in Ukraine as conflict in the east of the country and long-term lack of key reforms, the economy stagnation and recession could be observed as the main constraints for creation and implementation of SME support policy.

Besides, the positive moments of business development within 2012-2016 include implementation of the key measures for business registration simplification, extension of e-government services, elimination of trade technical barriers, EU standards adoption and so on. On the other side, a lack of access to finance and real long-term strategy for SME could be considered as the debilitating force for business development.

Though the structure of business in Ukraine should be analyzed regarding such important indicators in dynamics as number of enterprises, their annual turnover and number of employees (fig. 1).

Analyzing fig. 1 it can be specified that in 2016 in total SMEs made up for more than 99 % of the legal entities in Ukraine. Overall, it is clear that while the growth rate of SME number fluctuated, the general trend was downward from 2,2 million entities in 2010 to 1,8 million entities.

In 2016, the private sector constitute in Ukraine was represented by 95,6 % of microenterprises, 2,6 % of small and almost 1 % of medium enterprises.

The chart from fig. 1 provides the dynamics of number of people employed in Ukraine within the period of 2010-2016, which decreased from 8,4 million people in 2010 to 6,5 million people in 2016. Negative growth rate of employed people for SMEs. is observed throughout almost all analyzed period of time

The share of SMEs in employment remained similar at approximately 77 %, herewith the share of medium enterprises for employed individuals was about 32 %. Therefore the significant imbalance can be observed as the share of medium enterprises is lower than 1 % of total legal entities in Ukraine.

Fig. 1 also shows the positive dynamics in turnover increasing in Ukraine within 2010-2016 with the growth rate about 87 % in 2016 compared to 2010. But the highest percentage has been marked for large and medium sized enterprises, equaling at about 30 % each.

Besides, it should be empathized that the share of large enterprises is less than 1 %, but the share of its annual turnover is 3 times higher than share of microenterprise turnover.

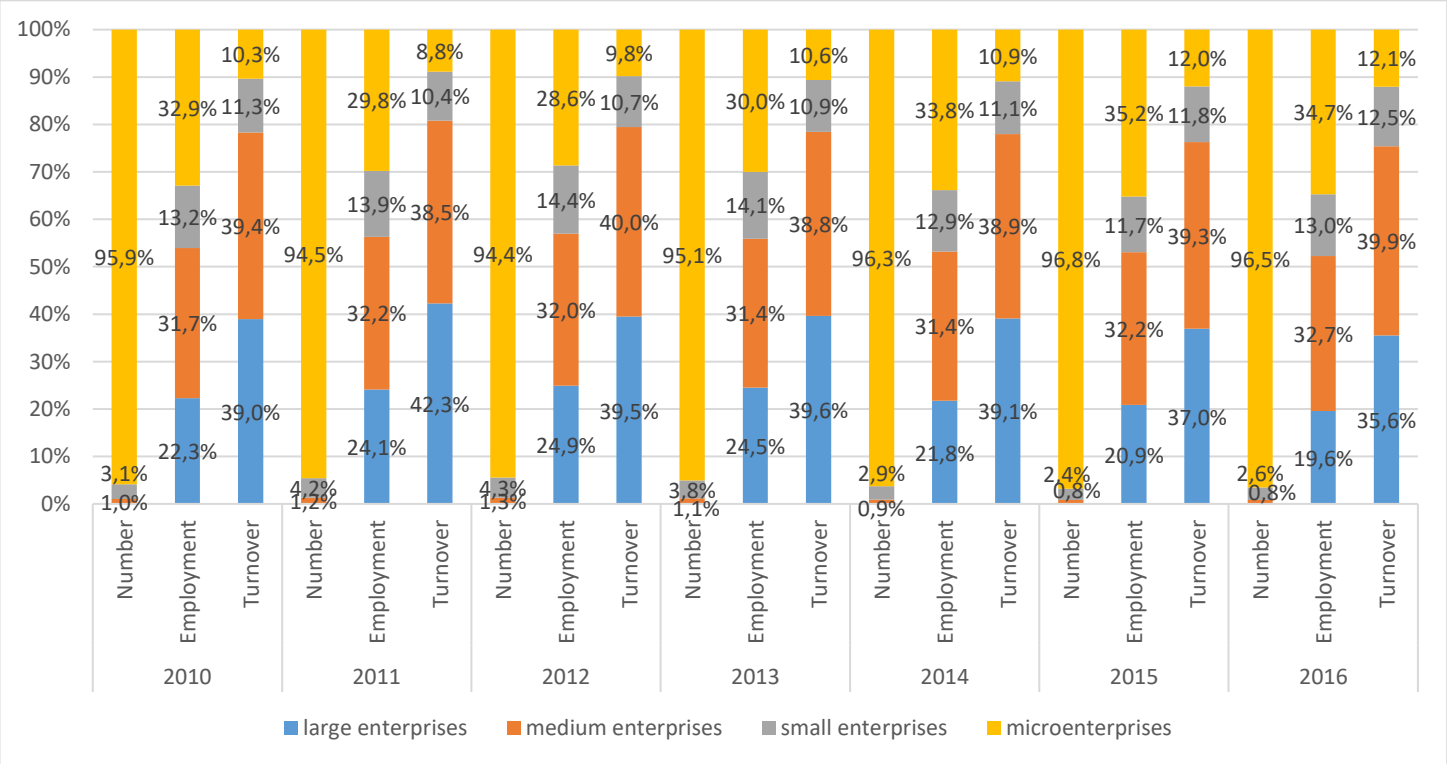

Fig. 1. General trend of business development in Ukraine within 2010-2016, % (Source: compiled by authors on the basis of [14])

To assess business development, it is reasonable to determine the investment potential of enterprises by determination of structure their equity and liabilities (fig. 2).

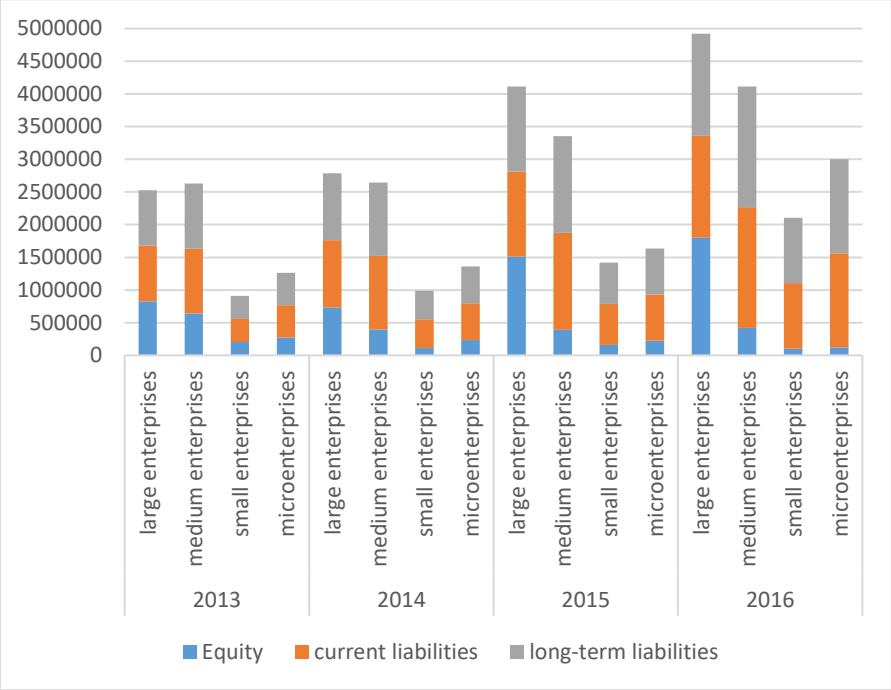

Fig. 2. Investment potential according to size of enterprise, thousands of hryvnas (Source: compiled by authors on the basis of [14])

Significant growth of capital can be observed for large and medium enterprises in 2016 in comparison with 2013 level, the growth rate equals 94,5 % and 54,6 % for each group respectively.

The investment potential of small and microenterprises is much less than for large and medium ones and mainly represented by current and long-term liabilities, the share of equity is too insignificant (about 4-5 %). In comparison with large and medium enterprises the level of equity sufficiency equals about 36,6 % and 10,2 % respectively.

Fig. 2 confirms that investment potential of SMEs is inefficient which proved by the structure of its liabilities which mainly represented by debt and not bank loans. That is why the level of provision by financial resources of SMEs is excessively low.

The next stage of analysis of SMEs investment potential tendencies is to determine the level of investment activity and its directions according to size of enterprises (fig. 3).

Fig. 3 demonstrates that the lowest level of investments is inherent to small and microenterprises, the main areas of which are investment to machinery and equipment.

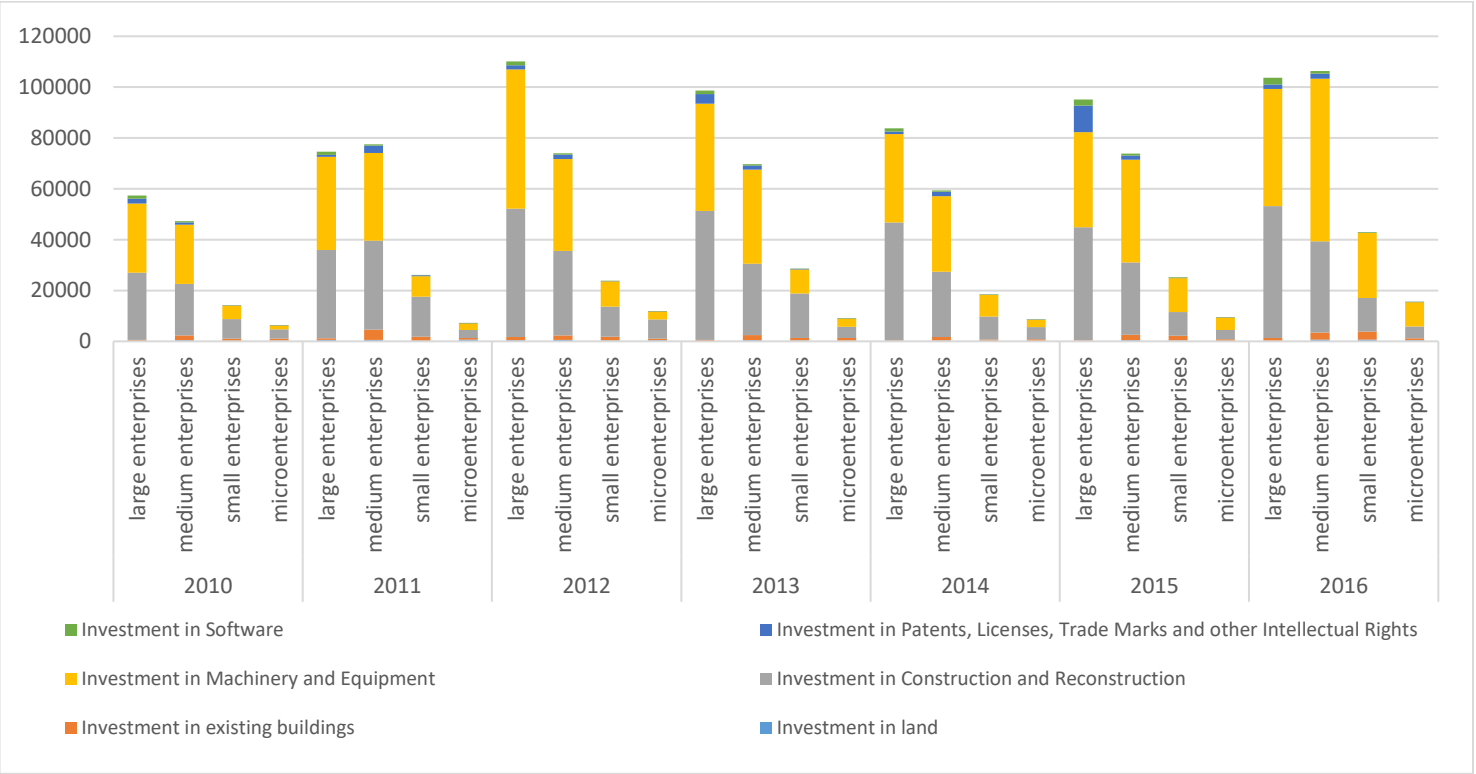

Fig. 3. Areas for investment according to size of enterprise, thousands of hryvnas (Source: compiled by authors on the basis of [14])

The amount of investment for large and medium enterprises is almost 3 times higher than for small ones, herein the main spheres of investment are investment in construction and reconstruction and machinery and equipment, that prove that financial resources are mainly directed to production.

Investment into software, patents, licenses and trademarks is not widespread for enterprises in Ukraine.

4 Doing Business Index as a Tool of Business Environment Assessment

As known, Global competitiveness index (GCI) is global research and the ranking of countries accompanying it in terms of economic competitiveness [21]. But due to the fact that the SME investment potential depends on factors of business environment measured by indicators of Annual Doing Business Reports developed by the World Bank Group it is advisable to consider the methodology of Doing Business rank. The methodology consists of 10 groups of factors with its indicators shown in table 1.

Table 1. The essence and factors of "Doing Business" rank methodology

Factor	The essence	Indicators
Starting a business	Identification of bureaucratic, legal constraints and costs required for entrepreneurs aimed at starting new business.	Procedure (number)
		Time (days)
		Cost (% of income per capita)
		Paid-in min capital (% of income)
Dealing with construction permits	Assessment of procedures, time and financial resources, connected with construction processes, obtaining permits and licenses, mandatory instruction, connection to utilities.	Procedures (number)
		Time (days)
		Cost (% of warehouse value)
		Building quality control index (0-15)
Getting electricity	Assessment of procedures, time and financial resources, connected with getting electricity.	Procedures (number)
		Time (days)
		Cost (% of income per capita)
		Reliability of supply and transparency of tariff index (0-8)
Registering property	Assessment of procedures, time and financial resources, connected with registration of property rights.	Procedures (number)
		Time (days)
		Cost (% of property value)
		Quality of the land administration index (0-30)
Getting credit	Assessment of credit bureau coverage of individual entrepreneurs and legal entities, and their collateral, which presupposes the estimation of factors which can simplify access to loans.	Strength of legal rights index (0-12)
		Depth of credit information index (0-8)
		Credit registry coverage (% of adults)
		Credit bureau (% of adults)

Factor	The essence	Indicators
Protecting minority investors	Assessment of protection level against illegal management of stock companies. Indices equal the sum of points for positive answers to relevant questions, e.g. one consent=one point.	Extent of conflict of interest regulation index (0-10)
		Extent of shareholder governance index (0-10)
Paying taxes	Assessment of taxes and mandatory contributions which should be paid by companies. The quality of tax administration and the level of tax burden are determined.	Payments (number per year)
		Time (hours per year)
		Total tax and contribution rate (% of profit)
		Postfiling index (0-100)
Trading across borders	Assessment of costs, including time, financial, which should be paid due to export or import of goods. 20—foot container is considered as typical situation.	Time to export: border compliance (hours)
		Cost to export: border compliance (USD)
		Time to export: documentary compliance (hours)
		Cost to export: documentary compliance (USD)
		Time to import: border compliance (hours)
		Cost to import: border compliance (USD)
		Time to import: documentary compliance (hours)
		Cost to import: documentary compliance (USD)
Enforcing contracts	Determination of the number of procedures, term and costs of company required to debt collection from unscrupulous buyer-legal entity, which refused to pay for delivered goods, citing its low quality in case when expertise confirms the sufficient level of goods quality.	Time (days)
		Cost (% of claim)
		Quality of juridical processes index (0-18)
Resolving insolvency	Determination of bureaucratic and legal constraints for an entrepreneur to overcome for company liquidation due to its bankruptcy and the main procedure and administrative bottlenecks of bankruptcy procedure. Assessment of set of company actions (terms, cost, the level of loan return) within bankruptcy procedure.	Recovery rate (cents on dollar)
		Time (years)
		Cost (% of estate)
		Outcome (0 as piecemeal sale and 1 as going concern)
		Strength of insolvency framework index (0-16)

Source: [15]

The rate is calculated on the basis of official statistical data and questionnaires of companies, requirements for which are described in table 2. The mentioned rank represents the integrated indicator, which consists of 10 sub-indicators in different categories, which are important for entrepreneur activity. The meaning of rank which is the closest to “top” position (1st rank in the list) shows better conditions for doing business than ranks close to 190 in the list [16].

The typical company for Doing Business assessment is Limited Liability Company located in the largest business center of country and 100 % domestically owned (more detailed analysis is given in table 2).

Table 2. Requirements to companies according to indicator of "Doing Business" rate

Indicator/ Requirements	Starting a business	Dealing with construction permits	Registering property	Getting credit	Paying taxes	Trading across borders	Resolving insolvency
Type of company – Limited Liability Company	+	+	+	+	+	+	+
City – the largest business center of country	+	+	+	+	+	+	+
Company 100 % domestically owned	+	+	+	+	+	+	+
Start-up capital equals	10 times income per capita	–	–	-	102 times income per capita	–	-
Company activity does not include foreign trade	+	–	–	–	– –	–	
Export volume of company	–	–	–	–	–	10 % from annual turnover	–
Company has real estate	+	–	–	–	–	–	–
Company has building	–	–	–	–	–	–	+
Company has land plot	–	+	–	–	+	–	–
Company staff	10–50 employees	60 employees	50 employees	Up to 50 employees	60 employees	-	201 employees & 50 suppliers
Annual turnover of company is not less	100 times income per capita	–	–	–	1,050 times income per capita	-	-

Source: [15]

Table 3. Ukraine in "Doing Business" reports within 2006-2016

Doing Business	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Position in rate	124	128▼	139▼	145▼	142▲	145▼	152▼	137▲	112▲	87▲	83▲
Starting a business	–	101	109▼	128▼	134▼	118▲	112▲	50▲	47▲	70▼	30▲
Dealing with construction permits	–	107	174▼	179▼	181▼	179▲	180▼	183▼	41▲	139▼	140▼
Getting electricity	–	–	–	–	–	–	169	166▲	172▼	138▲	137▲
Hiring	–	107	102▲	100▲	83▲	–	–	–	–	–	–
Registering property	–	133	138▼	140▼	141▼	164▼	166▼	149▲	97 ▲	64 ▲	61 ▲
Getting credit	–	65	68 ▼	28 ▲	30 ▼	32 ▼	24 ▲	23 ▲	13 ▲	17 ▼	19 ▼
Protecting minority investors	–	142	141▲	142▼	109▲	109▬	111▼	117▼	128▼	87▲	88▼
Paying taxes	–	174	177▼	180▼	181▼	181▬	181▬	165▲	164▲	106▲	107▼
Trading across borders	–	106	120▼	131▼	139▼	139▬	140▼	145▼	148▼	109▲	109▬
Enforcing contracts	–	26	46 ▼	49 ▼	43 ▲	43 ▬	44 ▼	42 ▲	45 ▼	98▼	98 ▬
Resolving insolvency	–	139	140▼	143▼	145▼	150▼	156▼	157▼	162▼	141▲	141▬

Source: [17]

The rates for Ukraine in "Doing Business" reports are presented in table 3, from which it can be seen the upward trend for Ukraine from 124 position in 2006 to 83 in 2016 demonstrates the positive dynamic reducing strong discontinuity. The positive changes are mainly connected with such indicators as "Starting a business", "Registering property" and "Paying taxes", but other indicators prove the set of complicated procedures for doing business in Ukraine.

The affirmative modifications relate to simplification of procedures of starting business, registering property and paying taxes exemplified as implementation of e-government services. All factors from table 1 and 3 have great impact for investment climate formation that is why they should be considered for designing the model for forecasting the investment potential of SMEs.

Advantages of Doing Business methodology like available big databases, different categories of parameters, possibility to overview risks and market potential, opportunity to make clear comparisons confirm the necessity to use data from Doing Business rank for designing the mentioned model.

5 Machine Learning Model of SMEs Investment Potential Estimating

The use of investment potential of SMEs is represented by allocating resources (liabilities) to assets [18]. Obviously, investment potential is formed by equity and liabilities, and its use by assets. Therefore, in the future, it is possible to use indicators of total volumes of equity and liabilities for analysis. For determining and analysis of the impact of business environment factors on SMEs it is advised to use such input data as investment potential of SMEs in different European countries (Slovenia, Czech Republic, Estonia, Slovakia, Hungary, Latvia, Poland and Ukraine) and their indicators of Doing business, mentioned above. We propose to use predictive models based on different methods: linear regression model and automatic relevance determination regression model.

The linear regression model is a type of modeling the ratio between the scalar y and the vector variable x. Like other regression analysis methods, linear regression represents the probability distribution of y depending on x rather than the distribution of the common probability y and x, which relates to the field of multivariate analysis.

In general, the linear regression model (one of the algorithms of ML) is defined as follows:

$$y = \beta_0 + \beta_1 x_1 + \ldots + \beta_k x_k + u, \quad (1)$$

where y is a dependent explanatory variable, (x1, x2, ..., xk) is an independent explanatory variable, u is a random error, the distribution of which in the general case depends on independent variables, but whose mathematical expectation is zero [18]. The dependent variable in our case is the value of the investment potential of the SMEs. Independent explanatory variables in this paper are indices of business environment factors: x1 – starting a business, x2 - dealing with construction permits, x3 - registering property, x4 - getting credit, x5 – protecting minority investors, x6 – paying taxes, x7 - trading across borders, x8 - enforcing contracts, x9 - resolving insolvency,

According to this model, the mathematical expectation of a dependent variable is a linear function of independent variables:

$$\mathrm{E}(y) = \beta_0 + \beta_1 x_1 + \ldots + \beta_k x_k + u. \quad (2)$$

The vector of parameters $(\beta_0, \beta_1, \ldots \beta_k)$ is unknown and the problem of linear regression is to evaluate these parameters based on some experimental values yi (x1, x2,…xk). For some n experiments, there are known values $\{y_i, x_{i1}, \ldots, x_{ip}\}\ {}_{i}^{n}= 1$

of independent variables and the corresponding value of the dependent variable. According to the model definition for each experimental case, the dependence between the variables is determined by the formulae:

$$y_i = \beta_0 + \beta_1 x_{1,i} + \ldots + \beta_k x_{k,i} + u_i,$$

or in matrix notation: $y = x\beta + u$,
where

$$X = \begin{pmatrix} x_1' \\ x_2' \\ \vdots \\ x_n' \end{pmatrix} = \begin{pmatrix} 1 & x_{11} & \cdots & x_{1K} \\ 1 & x_{21} & \cdots & x_{2K} \\ \vdots & \ddots & \vdots & \\ 1 & x_{n1} & \cdots & x_{nK} \end{pmatrix}, \quad \beta = \begin{pmatrix} \beta_0 \\ \beta_1 \\ \vdots \\ \beta_K \end{pmatrix}, \quad u = \begin{pmatrix} u_1 \\ u_2 \\ \vdots \\ u_n \end{pmatrix}. \tag{3}$$

On the basis of these data, the value of the parameters $(\beta_0, \beta_1, \ldots, \beta_k)$, is to be estimated as well as the distribution of a random variable [18]. These models are chosen because of their capacity to give the result of the analysis with the slightest error. For a specific group of enterprises (small or medium sized), the experimental way was to determine its model for predicting data.

These models are also implemented in the library of machine learning SCIKIT-learn. In addition, this library contains methods for evaluating the obtained results, which are used in the analysis of the impact of business environment factors on the development of the SMEs. These include: Mean absolute error, Mean squared error, and R^2 (R^2 score, the coefficient of determination).

For accurate analysis, it is necessary to normalize the entire amount of data that include equity and liabilities. Normalization is the process of analyzing ratios in order to identify and eliminate abnormalities of modification. These anomalies can be eliminated by splitting the initial relation into two or more new relations. The elimination of anomalies is carried out according to the following formula:

$$Y_{norm} = \frac{Y - Y_{\min}}{Y_{\max} - Y_{\min}}, \tag{4}$$

where Ynorm is the normalized value, Y is the actual value, Ymin is the minimum value for the total volume of data, Ymax is the maximum value from the total amount of data.

By choosing models to analyze the investment potential of different SMEs, each of them (model) needs to be trained for a variety of data: first by training (to generate coefficients of variables), and then - testing. Whereas, data processing is time-consuming and is to be optimized. The algorithm not only accelerated the process of data processing, but could also make such a methodology suitable for analyzing the impact of business environment factors on SMEs. The methodology was formed by the Python programming language.

Thus, the developed models made it possible to determine the influence of factors of the business environment on the SMEs investment potential. This technique allows to assess the factors which increase their investment potential, and which reduce it. The

evaluation results may form the recommendations basis for improving the business environment that affects the activities of its actors, including SMEs.
In general, this allows to consider the factors which affect the development of SMEs, outlining the main areas of creation, support and improvement of factors of the business environment that determine the activities of SMEs.

This shows the best results of the forecast (the lowest error (app. 0.02) and the highest communication factor (R^2=0.72) between the test and forecast figures). Data, obtained from official sites of the Organization for Economic Development and Cooperation, national regulators of the countries, used, have been normalized by the formula (4). Analysis of the impact of the 9 business environment factors on SME investment potential was made by using the SCIKIT-learn computer library and the Python programming language [19, 20].

Thus, the influence of factors of the business environment on the formation and use of investment potential of small businesses best describes the model of determination of regression with automatic determination of relevancy for small sized enterprises, while classical linear regression - investment potential of medium businesses.

In the learning process the prediction models and the coefficients of the equation were obtained, the absolute value of the module which characterizes the degree of influence on the investment potential, and their sign indicates the nature of the effect ("+" - increases the potential, "-" - reduces the potential).

The results of the modelling (table 4) show that such factors as starting business, protecting minority investors, paying taxes, enforcing contracts (because their coefficients have positive sign) increase investment potential both of small and medium businesses. The value of coefficient demonstrates the impact strength. The most crucial factor in forming the investment potential of small business is starting business (6.09e+05), while for medium businesses investment potential is paying taxes (6.3e+08). Paying taxes also plays a significant role due to the value of its indicator (4.98e+00) for small enterprises, starting business has almost the same value for medium sized enterprises (4.06e+01). Enforcing contracts also positively influences both small and medium businesses and their values are close to each other (2.14e+00 and 2.64e+00). The least positive impact on formation of SMEs investment potential is made by enforcing contracts factor.

Conversely, there is set of factors which reduce the investment potential of SMEs (in the models they have negative sign). Resolving insolvency (-9.94e-07 and -9.70e+00) and getting credit (-8.19e+03 and -8.44 e +04) are among the most destructive factors which sway on formation of SMEs investment potential. This fact proves poor performance with low level of banking SMEs loaning. One more common influence but in different degree (for small businesses - (-1.81e-03) and for medium enterprises - (-5.91e+00)) is trading across the borders. Table 4 shows that for medium sized businesses export opportunities are result forming. In the case of export strategy absence, the activity of medium enterprises remains in the lowest. Inability to export inhibits the competitiveness of medium enterprises of Ukraine in the global business environment.

Although most factors are common for all types of SMEs, at the same time models help to observe some dissimilarities.

Table 4. Specification of models for forecasting the investment potential of small and medium enterprises*

Indicators of business environment factors	**Designation of factors in the formula**	**Designation of factors in the program code**	**The degree of influence of business environment factors on small enterprises investment potential (automatic relevance determination regression model):** Y_{SE}=(6.09e+05)*X1+ (3.05e-01)*X2+(4.0.e+00)*X3+ (-8.19e+03)*X4+ (0.25e-03)*X5+(4.98e+00)*X6 + (-1.81e-03)*X7+ (2.14e+00)*X8+ (-9.94e-07)*X9 **(1)**		**The degree of influence of business environment factors on medium-sized enterprises investment potential (classical linear regression):** Y_{ME}= (4.06e+01) *X1 + (-7.48e+00)*X2 + (-1.39e-+01)*X3+(-8.44 e +04)*X4 + (2.44e-01)*X5+ (6.3e+08)*X6+ (-5.91e+00)*X7+ (2.64e+00)*X8+ (-9.70e+00)*X9 **(2)**	
			Increasing (0;+∞)	*Decreasing (-∞;0)*	*Increasing (0;+∞)*	*Decreasing (-∞;0)*
Starting a business	X_1	S_B	6.09e+05	…	4.06e+01	
Dealing with construction permits	X_2	D_C	3.05e-01	…	…	-7.48e+00
Registering property	X_3	R_P	4.07.e+00	…	…	-1.39e-+01
Getting credit	X_4	G_K	…	-8.19e+03	…	-8.44 e +04
Protecting minority investors	X_5	P_MI	0.25e-03	…	2.44e-01	…
Paying taxes	X_6	P_T	4.98e+00	…	6.3e+08	…
Trading across borders	X_7	T_B	…	-1.81e-03		-5.91e+00
Enforcing contracts	X_8	E_C	2.14e+00	…	2.64e+00	…
Resolving insolvency	X_9	R_I	…	-9.94e-07	…	-9.70e+00

**Designed by authors*

Thus, dealing with construction permits benefits investment potential of small enterprises (3.05e-01), whereas this factor has negative influence on the same indicator of medium businesses (-7.48e+00). The next distinguishing factor is registering property: in the case of small enterprises the result of registering property has positive influence on investment potential (4.07.e+00), while, medium businesses experience the negative impact (-1.39e-+01).

Therefore, the influence of business environment can differ for small and medium enterprises, confirmed by the fact that state and strategy policy for small and medium business should be different.

6 Conclusions

Investment potential of SMEs can be estimated with the help of ML tools, exemplified as developed models for small and medium-sized enterprises assessment in particular. These models allow to determine which factors of business environment have impact on investment potential of SMEs. The decisive feature of these models is not only to forecast investment potential but also to measure the degree of influence of each considered factor.

The results of the assessment can be used by policymakers and public authorities paying attention to policy directions constraining business development of SMEs. Getting credits should be supported by government in different ways (by monetary policy with decreasing interest rate, or its return to the SMEs; by tax policy with incentives for those SMEs which have credit pressure; developing non-banking funding etc.). According to the results resolving insolvency also reduces the investment potential of both small and medium-sized enterprises. The required changes in legislation should protect both creditors as well as bankruptcy enterprises from raiders.

The mentioned models can also help to identify the strengths and weaknesses of SMEs activity. The calculated investment potential should be used in processes of strategy formation, which determines the axis and performance of SMEs. Foreign investors can consider these results in decision making for investment financial resources into some economy or abstaining from it.

Statistical authorities also have to measure the indicators of the SMEs investment potential and its elements and Doing business indicators more often (with 4-time per year frequency). This will allow to make more precise forecasting and smarter decision-making.

These prediction models can be used for evaluation of investment potential of SMEs not only in Ukraine, but also in countries like Slovenia, Czech Republic, Estonia, Slovakia, Hungary, Latvia, Poland, because they have some similar conditions for running business.

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