Contemporary Economy

MACROECONOMIC DETERMINANTS OF CORPORATE FAILURES IN POLAND

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Abstract

This study aims at identifying macroeconomic factors of corporate bankruptcy.The main objective of this work is to analyse quantity of bankruptcy in Poland in 2000-2017 and attempt to estimate parameters of the regression model where the number of insolvent companies is explained by variance of macroeconomic factors. Essential data has been collected from GUS and Coface resources. Based on selected, macroecomic variables, econometric cause-effect model has been developed. The equation has been estimated by the Ordinary Least Squares method (OLS). A statistical investigation resulted in observing few macroeconomic factors with influence on corporate failure intensity in Poland, among others: expenditures on consumer goods and services, export and exchange rates.

Keywords: bankruptcy, insolvency, corporate failure, regression models, bankruptcy prediction

JEL classification: E3, C4, M2, C2

Introduction

An unpredictable environment causes organizational instability which is a demanding issue for contemporary economic systems. Moreover, permanent instability creates uncertainty and market volatility. One of the main consequence of business volatility is bankruptcy. Obviously, corporate failures pose anintegral part of daily businessand should be considered as a natural piece of an organizational life cycle (OLC)[*]. Accordingly, every single organization has a particular life expectancy, but the exact date of corporate death is usually unknown. It's because of the main obstacle to predicting bankruptcy, which is a wide selection of variables related to a company's financial position. Plenty of these variables are widely known, say macroeconomic indicators such as GDP growth, exchange and interest rates. Furthermore, corporate failures exert some critical influence on both enterprise owners and the whole economy, thus strong

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[*] Organizational life cycle theory is well described andresearched in L.E Greiner's Model, further reading: Larry E. Greiner, Evolution and Revolution as Organizations Grow, Harvard Business Review, Vol. 50(4), 1972.

awareness of potential links between macro economy and bankruptcies is in the interest of policy makers.

1.   Theory of corporate insolvency and bankruptcy

A clear separation of insolvency, bankruptcy, corporate failure and restructuration is a crucial aspect in the enterprise life cycle theory. The word *bankruptcy* comes from Italian. Originally, it was divided into two phrases: *banca* and *rotta*. The first word is connected with *bench* and the second one with a verb *to brake (*Adamska, 2008*)*. Combinedly, *bancarotta* described a procedure which was common among medieval Italian merchants. A seller with an overdue debt was punished with stall defacement (the punishment was executed by creditors who lost their patience or by hired contractors) (B. Prusak, 2007). In ancient Greece, *bankruptcy* was linked to a situation where a particular household lost its liquidity. Then, one of the household members had to work for the creditor to cover the amount of outstanding debt.

Nowadays, bankruptcy should be considered mostly as an economic term. In practice, K.Górka claims that bankruptcy describes a situation where an enterprise lost its liquidity, and settlement of debt is not possible because of insufficient value of the possessed assets (K. Górka, 2011).Therefore, from the economic point of view, bankruptcy usually entails the enterprise death (in its current form), if any external financial support is not provided. Joseph Shumpeter, in his enterprise theory, says that bankruptcy is a tool important to keep the economy clean (J. Grahl, 1986). It means that, the weakest enterprises will be eliminated from market and new business units will replace them. Thus, "clean-up" function of bankruptcy can be considered as a potential advantage for markets, but obviously it brings more economic disadvantages than benefits (e.g. decrease in GDP and job losses).

Insolvency is a second vital term which have to be comprehensively explained. This term should be considered in conjunction with law. The Polish law provides for that insolvency is a state which is ordered by the court towards an insolvent company (Ustawa, 2003). Enterprise under solvency is a unit with low-liquidity performance but possessing assets of a sufficient value for judicial proceedings. The purpose of insolvency legal action is to settle an outstanding debt (usually partially) and/or create a new business pathway for the distressed enterprise. Not every case of bankruptcy ends up with official insolvency approved by court. It is because the state of legal insolvency is achievable as long as the company is able to fulfil a set of mandatory conditions. One of them is to have the assets the value of which is sufficient to cover any future legal fees. Generally speaking, both economist and corporate lawyers agree that insolvency is a legal term, linked with an official, legal state which is useful for enterprise and its creditors to solve the debt problem fairly.

Restructuration is strictly focused on reaching a certain agreement between a debtor and the creditors (Machowska, 2016). The primary goal of this proceeding is to protect further existence of the distressed enterprise. When it comes to the Polish legal system, there are few types of that agreement (Zimmerman, 2018). Generally, they differ in court engagement and the level of formalization. If the process is uncomplicated and both sides are willing to cooperate, the problem is often settled outside of the court. If the case is complicated and it contains disputed receivables, there is a need for court restructuration with support of a specially trained judge. The independence of judge-commissioner provides essential transparency and justice of future agreement between debtors and creditors. In summary, it is important to know that restructuration may end in bankruptcy, but in plenty of cases, the debtors are not interested in reaching the agreement and/or the value of assets is insufficient, so the indebted company finally disappears from the market without being officially insolvent and restructured (Antonowicz, 2015).

The last term is *corporate failure*. There is no homogeneous definition. This term is a combination of bankruptcy, insolvency and the state of financial distress (Piesse et al., 2006). Moreover, the reviewed literature suggests that *corporate failure* means a fragile financial state of enterprise and can be considered as distress and bankruptcy as well (Brealey et al.,2001) (Ross et al.,2002). Additionally, *corporate failure* can be observed if: (Pastena and Ruland, 1986):

- o the value of total liabilities of the enterprise is greater than assets;
- o there is an inability to pay outstanding debt;
- o the enterprise continues operations under court protection.

In summary, the corporate failure has no clear and formal definition. However, in many cases, researchers used to treat it like a joint definition for both bankruptcies and insolvencies. Business intelligence companies in Poland, in industrial reports, are usually not willing to use the term *corporate failure* and they replace it simply with *bankruptcy*. It is important to stress that the mentioned companies usually assume that *bankruptcy* is a sum of insolvencies and restructuration proceedings in a given period[*]. This approach is helpful during statistical analysis, and it is conditioned by the new Polish insolvency law, where insolvency and restructuration proceedings are separated from each other. Hence, measurement of financial distressed companies in Poland is more comprehensive and convenient if it is assumed that the *bankruptcy* variable presents a sum of insolvencies and restructuration proceedings. This approach will be held in the empirical part of this paper.

To conclude, awareness of the differences in the above-mentioned terms is an essential issue to highlight a problem of bankruptcy in a proper way. Industry reports and plenty of published papers usually make a definitional assumptions to render data analyses more convenient, however it is crucial to be aware of the differences which are provided for in the corporate law.

2. Macroeconomic factors of bankruptcies - review of previous studies

Impact of macroeconomic factors on the phenomenon of bankruptcy in Poland was analysed in several papers between 2000 and 2017. In most cases, the authors focused on determining which factors connected with daily economy have the strongest influence on insolvency while adopting the traditional OLS econometric modelling. In the reviewed studies carried out in the past, the most common approach to collecting of data was the time-series. The authors usually created models with quite similar initial set of predictors such as GDP, exchange rates and unemployment. The performed study revealed that the developed models were based on various approaches to creating a dependent variable. The majority of the performed cause-effect equations were formed with an absolute number of corporate failures or rate of bankruptcies (annual %) as an endogenous variable. The table 1 provides an overview of selected, previous studies carried out in relation to the Polish economy.

Table 1: Selected Polish publications where macroeconomic factors were applied to predict corporate failures, published between years 2000-2017

Author (authors)	Type of data set	Dependent variable	Main findings of the study
Jarosław Krajewski, Andrzej Tokarski, Marek Matuszak	Time series, 2002-2015, voivodeship: Kujawsko-Pomorskie, Poland.	Bankruptcies growth (annual %)	Variables with coefficients significantly different from zero were as

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[*] The company mentioned is Coface. It is a business intelligence enterprise which prepares periodic reports about bankruptcies in Poland.

			follows: GDP, EUR/PLN exchange rate, trend line coefficient.
Anna Bieniasz, Zbigniew Gołaś	Time series, 2004-2013, Poland.	Bankruptcies (absolute-number of)	Variables with coefficients significantly different from zero were as follows: GDP growth (%), gross fixed capital formation (5), number of registered companies.
Tomasz Korol	Time series, 1991-2005, Poland.	Bankruptcies (absolute number of) and intensity of insolvencies.	Dataset includes 17 macroeconomic variables(e.g. GDP growth, inflation rate, USD/PLN exchange rate)
Joanna Muszyńska, Ewa Zdunek	Time series, 1990-2005, Poland.	Bankruptciesgrowth (annual %)	In the paper, few econometric models were developed with variouscombinations of predictors (including dynamic forms of model). The variables with coefficients significantly different from zero were as follows: GDP, GDP growth, unemployment growth, import growth. Observed directions of estimated coefficientswere consistent with the theory of macroeconomy.

Source: author's own study.

The developed models generally show a good level of explained variance of the dependent variable (R^2 greater than 70%). In most of the cases, the observed correlations (represented by slopes) between predictors and the endogenous variable are consistent with the theory of insolvency and macroeconomy. It is important to note that results of the OLS estimation are accurate and reliable only if the final formula meets all the stochastic requirements. Assumptions of linear regression include: normal distribution of errors, lack of heteroscedasticity and no autocorrelation – all these are necessary to reach the best linear unbiased estimator (BLUE) in the final model (Maddala, 2002). It is worth highlighting that the reviewed studies are usually based on linear equations. Furthermore, the analysis of previous attempts of insolvency modelling in Poland confirms that creating macroeconomic bankruptcy models with cross-sectional data (e.g. for districtsor provinces) is generally rare. Statistical information provided by time series with a relatively high number of cases is more useful from the economic point of view. It is because of the possibility to observe a variance of the selected macroeconomic factors more comprehensively (the global, time-driven change in macroeconomic indicators is a better source of explanationof corporate failures variance than the static andregionally conditioned differences). The other crucial reason why time-series data is a more valuable approach in the bankruptcy modelling for the whole economy is that fluctuations caused by a business cycle are strictly connected with the passage of time. Likewise, E. Mączyńska confirms the importance of relationship between corporate failures and business cycles (Mączyńska, 2009). A study based on time-series data and performed by D.

Appenzeller revealed high, negative correlation between corporate failures (annual change %) in Poland and its GDP (Appenzeller, 1998).

There are also several attempts to predict bankruptcy with macroeconomic variables in European and global publications. Edward Altman's influence cannot be ignored - his pioneering papers were published in the early 1970s. The majority of early research was performed adopting the time series data collected from the economy of the United States of America. Generally, the majority of previous European bankruptcy studies were taken up in the 2000s. The following table presents selected attempts to explain bankruptcy by macroeconomic factors.

Table 2: Selected world econometric models where macroeconomic factors were applied to predict corporate failures

| Author (authors)	Publicationdate	Country	Time-series
Altman E.I	1971	United States of America	1947-1970
Rose P., Andrews W., Giroux G.	1982	United States of America	1970-1980
Altman E.I	1983	United States of America	1951-1978
Lane S., Schary M.	1989	United States of America	1950 – 1987
Hol S.	2001	Norway	1991 – 1999
Burn P., Redwood V.	2003	United Kingdom	1991 – 2001
Benito A., Delgado F., Pages J.	2004	Spain	1984 – 2001

Source: author's study based on: Hol S., The influence of the business cycle on bankruptcy probability, Discussion Papers No. 466, August 2006, Statistics Norway, Research Department.

Despite the fact that the models presented in Table 2 were built on various type of time-series, almost all of the above-mentioned studies led to similar conclusions. In most cases, significant impact on bankruptcy was observed for the following predictors: change in GDP, interest rates, inflation rate, monetary aggregates and index of sold production of industry (Lane and Schary, 1989).

3. Econometric analysis of the factors of corporate failures in Poland between 2000 and 2017

Multiple quantitative and qualitative changes in contemporary economy are the main reason why plenty of models quickly become outdated.Therefore, in order to keep the forecasts relevant in practice, it is highly recommended to update the estimations with the latest statistical data. The most important task for the estimated formula is to provide an appropriate outcome, which is widely-known as prediction for a new case. The line graph provided below visualizes the corporate failures in Poland between 2000 and 2017[*].

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[*] Corporate failures were computed as a total sum of insolvencies and restructuration proceedings each year, according to the approach presented in papers provided by Cofacei Euler Hermes in their cyclic, industrial reports.
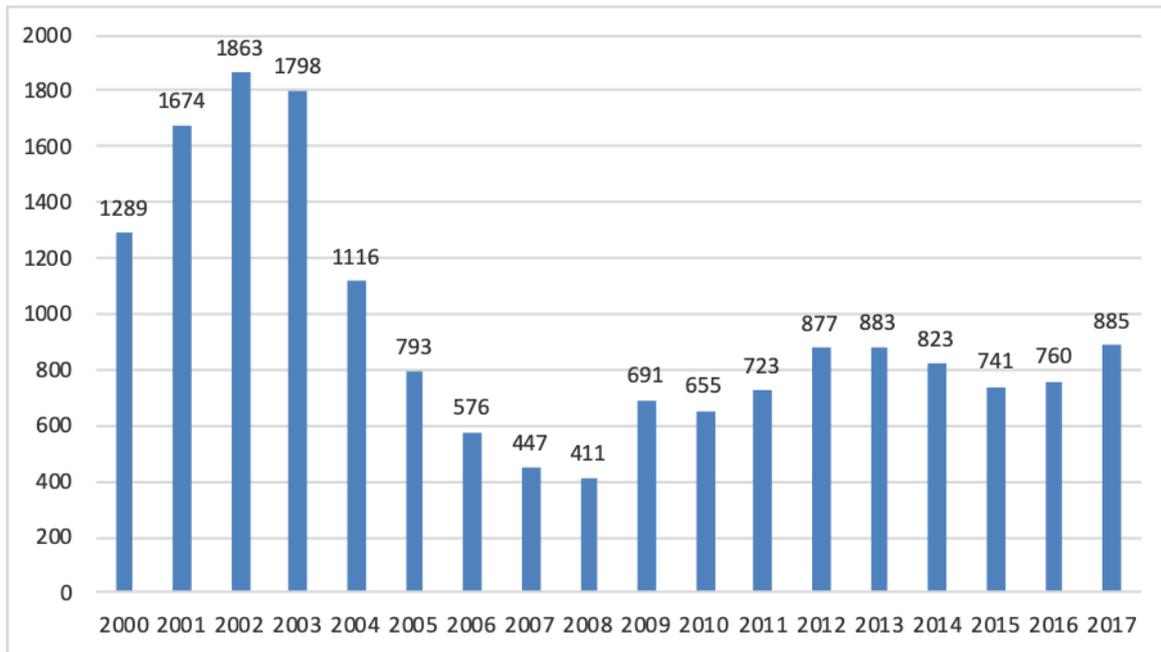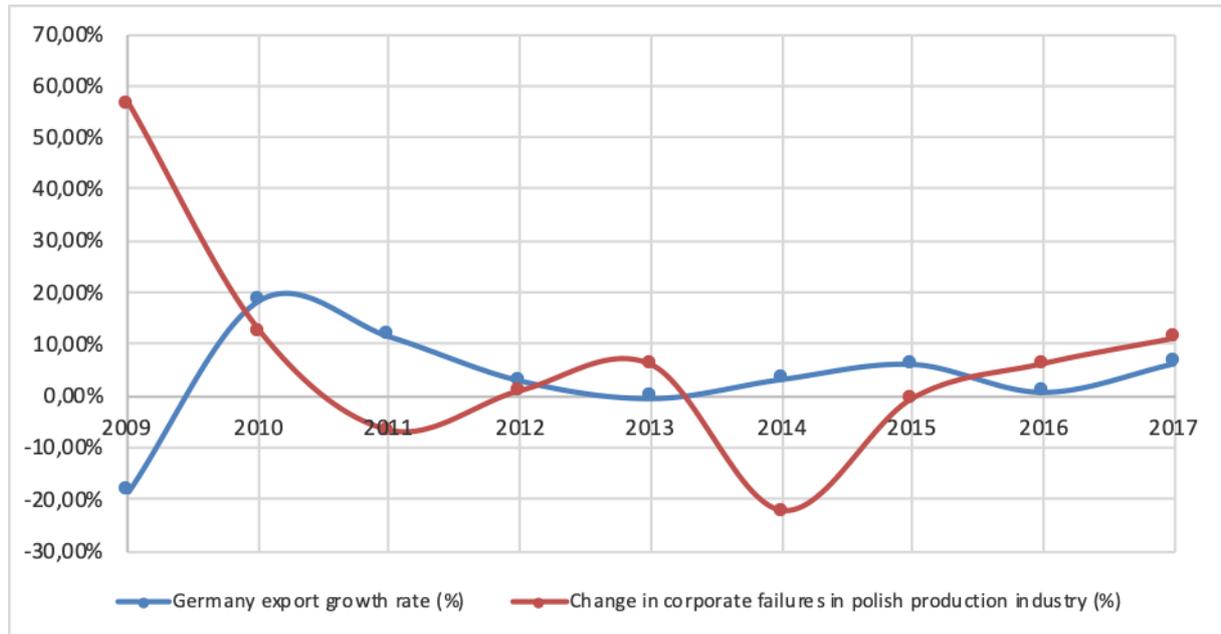
Figure 1: Corporate failures in Poland between years 2000-2017

Source: Own study according to industry reports provided by Coface.pl

Between 2000 and 2004, the quantity of corporate failures in Poland remained greater than one thousand each year. From 2004 to 2008 the phenomenon was on the decrease which was probably due to the accession to the European Union and the upcoming period of economic prosperity. As observed, from 2007 corporate failures in Poland remained stable with 600-800 reported cases per year.

Corporate failures may be sourced both internally and externally. In recently published papers, many researchers highlighted an important link between economic systems of Poland and Germany. For instance, a trade relationship between neighboring countries could be adopted to analyze the nature of change in insolvencies. To perform this task, time-series data of Germany export growth and corporate failures in Poland were presented in a correlation chart (Figure 2). Moreover, conclusions may be enriched by calculating the Pearson's correlation between the mentioned variables (Table 3).

Figure 2: Relationship between export in Germany and corporate failures of production enterprises in Poland

Source: Industry reports provided by Euler Hermes and GUS data.

Table 3: Correlation matrix for study variables

	Germany export growth rate	*Corporate failures (PL)*
Germany export growth rate	**1,00**	**-0,66**
Corporate failures (PL)	**-0,66**	**1,00**

Source: the author's own study

The presented chart confirms a negative relationship between variables. The Pearson's coefficient is less than zero, and equals -0,66, and this informs about a moderately strong (negative) linear relationship between the change in export of Germany and corporate failures in Poland. It is a fact that a great deal of business activities in those countries are operationally connected – Poland is an important supplier of Germany, thus the decrease in its economic performance may impact the financial distress among Polish enterprises. It is a piece of evidence why diversification of trade partners is vital in macroeconomic policy of each state.

The author's attempt to create a macroeconomic bankruptcy model includes some widely known economic indicators such as GDP and inflation rate enriched with few, new variables which were not applied in previous papers. The collected data are listed in Table 4.

Table 4: Initial set of macroeconomic variables, all collected as time-series 2000-2017

Variable	*Type*	*Description*
Corporatefailures (CF_t)	Dependent variable	Total sum of insolvencies and restructuration proceedings each year
GDP_t (%)	Regressor	GDP growth (annual %, constant price)
GDP_{t-1} (%)	Regressor	GDP growth (lagged by one year)
$GFCF_t$	Regressor	Gross fixed capital formation (in millions PLN)

EXP-PL$_t$	Regressor	The value of Poland's export (in millions PLN)
Cg$_t$	Regressor	Consumption growth (annual %)(constant price)
UE	Regressor, dummyvariable.	0:for years before Poland's accession to the EU and 1:after Poland's accession to the EU
SREF$_t$	Regressor	Reference rate of the National Bank of Poland at the end of each year.
EUR	Regressor	EUR/PLN, exchange rate per 100 EUROat the end of each year.
EXP-GER$_t$(%)	Regressor	German export growth (annual %)
CF3$_t$	Regressor	Macroeconomic current ratio (3rd degree liquidity ratio) for non-financial enterprises (%)
NP.$_t$	Regressor	Net turnover profitability rate in Polish economy for non-financial enterprises (%).

Source: author's own study based on GUS and World Bank Open Data, https://data.worldbank.org/indicator

The prepared dataset includes some variables that are typical to measure the macroeconomic performance of a country. Having in mind the clearly visible change of corporate failures after 2004 (Figure 1), the dummy variable was added which represents accession to the EU. This widely-known procedure is usually useful for time series datawith one critical-change caused by a single factor. Adoption of this approach is often a valuable way to obtainmore accurate coefficients in the estimated model. Other variables which were not applied before are as follows: the current ratio (3rd degree liquidity ratio) for non-financial enterprises and net turnover profitability rate for non-financial enterprises in the Polish economy. It seems quite useful to add it to the dataset because both profitability and liquidity ratios are ones of the most popular predictors in bankruptcy-risk modeling of a single company (Platt, 1990).

The estimation procedure was performed with the Ordinary Least Squares method, with a gretl statistical package. The assumed significance level accounts for 5%. The econometric procedure performed in this paper includes the following steps:
- o Firstly, initial estimation was made with all of the listed predictive variables (Table 2) (with the dependent variable - corporate failures)
- o In the second step, the test of normality of residuals was done. The testing procedure was performed with the Doornik-Hansen approach. The normally distributed residuals are strictly mandatory to provide relevant outcomes from further parametric tests.
- o In the third step, in order to eliminate any non-significant predictors,the omit-variable procedure was performed. In this case, the omitting procedure could be considered as relevant because of the presence of the normally distributed errors (step 2),
- o Finally, the stochastic assumptions of the OLS were checked. Moreover, Ramsey's Reset procedure has been used to check the validity (linearity) of specification of estimated formula.

The above-mentioned steps were repeated several times for various functional specifications. The performed attempts includes log-log models, non-linear relationships and few modifcations of the dependent variable (e.g using growth rate of corporate failures and inten-

sity of insolvencies per 1000 registered enterprises). The best estimation result comes from the original form of the depedent variable which is a total of insolvencies and restructuration proceedings each year[1]. Results of the final estimation are presented in Table 5.

Table 5: Reporting regression results, the OLS method

Variable	Coefficient	Standard error (SE)	t-ratio	p-value
Constant (B0)	8940,74	2002,72	4,46	0,001 ***
EU dummy	−409,11	147,93	-2,77	0,02 **
Ct	-56,04	14,71	-3,81	0,003 ***
CRt	-25,71	5,30	-4,85	0,0005 ***
EXPt	0,0004	0,00014	3,50	0,005 ***
EURt	3,29	0,78	4,23	0,0014 ***
R-squared (R^2)	0,98		Adjusted R-squared	0,98
Rho	-0,39		Durbin-Watson	2,64

Source: the author's own study

$$\widehat{CF}_t = 8940,74 - 409,11EU - 54,04C_t - 25,71CR_t + 0,0004EXP_t + 3,29EUR_t$$
(1.)

The regression equation explains 98% of variance of corporate failures in Poland. All of the estimated coefficients are statistically significant (*p<0,05*). Furthermore, the observed slopes represent a logical direction of correlation (marginal effects of each parameter are consistent with theory of economic). The final equation meets all of stochastic requirements thus, according to Gauss–Markov theorem, the OLS estimator is BLUE[2]. Interpretation of results using marginal effects are as follows:

o   After accession to the EU, corporate failures in Poland decreased on average by 409 cases with the standard error of +/- 147 cases, ceteris paribus;

o   Quantity of corporate failures in Poland decreased by 56.04 (on average) for every 1 p.p increase in consumption growth with the standard error of +/- 14.71 (cp);

o   Quantity of corporate failures in Poland decreased by 25,71 (on average) for every 1 p.p increase in 3rd degree liquidity ratio with the standard error of +/- 5.30 (cp);

o   Quantity of corporate failures in Poland increased by 0.0004 (on average) for every 1 million increase in export of Poland with the standard error of +/- 0.00014 (cp);

o   Quantity of corporate failures in Poland increased by 3.29 (on average) for every 1 PLN increase in 100EUR/PLN exchange rate with the standard error of +/- 0.78 (cp);

Upon the initial review, the sign of marginal effect of export seems to be questionable. The positive slope indicates that both variables move in the same direction. This phenomenon can be explained by the fact that Polish small and medium-sized enterprises (SME) sector have a very low export rate. At the same time, the majority of reported corporate failures oc-

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[1] In accordance to industrial reports, this form of dependent variable is highly recommened due to the insolvency law change in Poland in 2016.

[2] Best Linear Unbiased Estimator (BLUE)

cur in the SME sector, thus the positive change in export could empower large, export-driven enterprises. These empowered, export-oriented companies may increase the SME bankruptcy risk and finally displace the small and medium sizeentrepreneurs. This issue needs further investigation.

One of the potential ways to visualize the performance of the estimated equation is creating a plot which compares the observed and predicted values of the dependent variable. Figure 3 shows the time-line chart with actual and fitted (predicted) values of corporate failures over the analyzed period.
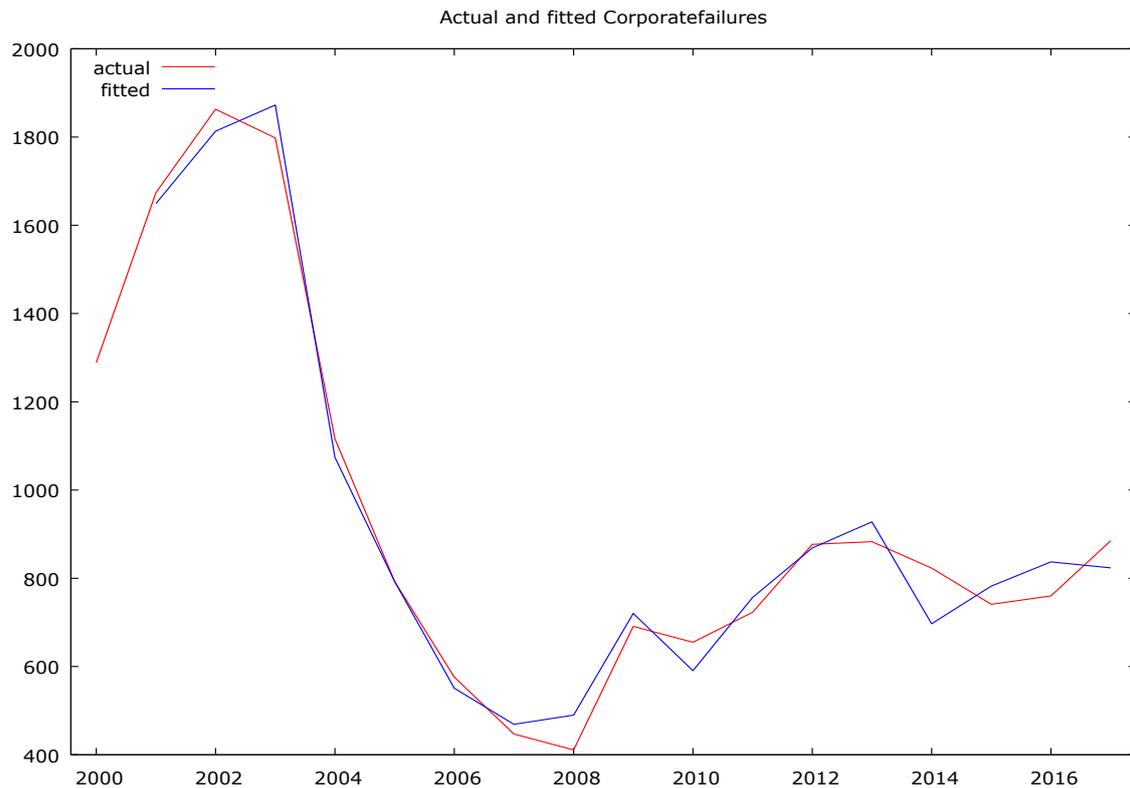
Figure 3: Regression results - fitted versus actual plot against time

Source: the author's own study

According to Figure 3, predictions of corporate failures seem to be well-fitted to actual values of the dependent variable. Both empirical and theoretical lines are visibly similar which means good accuracy of forecasts. Adding an EU dummy variable may have had good influence on performance of the final equation – this procedure probably smoothed the dramatic change in corporate failures after 2004 (EU accession). Obviously, similarity of lines designated in Figure 3 indicates high goodness of fit (R^2=0,98).

Conclusion

The performed study has shown that consumption expenditures, 3rd degree liquidity ratio and exchange rate exert the statistically significant impact on corporate failures. However, it is vital to remember that the linear OLS regression is simplification of economic relationships. The main purpose of this paper was to analyze macroeconomic factors of corporate failures (not creating ex-ante forecast-oriented equation) so accompanying econometric tools and

methods have mainly auxiliary character. Therefore, the estimated OLS equation which was adopted in this paper (despite having satisfying regression results) should be considered as a tool focused mainly on the extraction of macroeconomic factors of corporate failures. The simple linear regression usually has many limitations, so plenty of contemporary macroeconomic problems would tend to be analyzed with more sophisticated technics (e.g. multiple-equation models, Hausman–Taylor estimator). Nevertheless, simple regression can still be considered as a useful and simple tool for describing economic relationships.

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