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BUSINESS SURVEY DATA AS THE BASIS OF EMPLOYMENT FORECASTING

1. Theoretical determinants of employment level

Forecasting changes in the number of employees is significant from economic and social perspectives, because it helps to undertake political activities which would restrict the negative effects of changes in demand for labour. Thus, the need arises to search for such economic indicators which would appropriately forecast changes on the labour market. Forecasts of employment should joint two points of view. On one hand, it should be well established in economic theory, which explains interactions between employers and employees decisions on labour market. On another hand, forecasts should have good econometric adjustments.

The aim of this article is to evaluate the possibility of using qualitative indicators obtained by means of business survey method to forecast changes in employment. There are two reasons why business survey indicators are chosen as variables which facilitate evaluation of changes on the labour market. First of all, qualitative indicators are regarded as those which outpace general economic situation by a few months, measured with IPI or GDP [among others Goldrian 1995; Marty 1997]. It allows to suppose that business survey data as also good leading indicators for labour market. Moreover, these indicators contain a subjective element connected with individual evaluations of the state of the economy made by enterprises. Enterprises make their economic decisions not only according to objective aspects of their activities, but also according to their subjective judgement of economy, their expectation and feelings. In this sense business survey data can be very useful tool of employment forecasts.

Contemporary theories of the labour market explain current situation in employment, unemployment or wages by objective aspects of market, such as for example level of production, prices or labour productivity. The main difference among labour market theories concerns the possibility of reducing any disequilibrium of demand or supply surpluses. In these theoretical approaches, where disequilibrium can be reduced by market forces, unemployment is treated as volun-

tary, connected f.e. with searching new job, level of wages or number of employees depend on interaction between demand and supply for labour. In this case, any existing unemployment would influence the wage level.

Regarding unemployment as voluntary can be found both in microeconomic and macroeconomic theories. From microeconomic point of view, this approach is presented for example in a job search theory on the labour market and two models within its framework: search intensity model [e.g. Jensen, Westergard-Nielsen 1987] and reservation wages [analysed e.g. by Burgess 1992; Jones 1989]. In this theories, people are unemployed because they search new job by determining the intensity of this search, connected with costs of searching and possibilities to find better job together with greater search intensity, or reservation wage which they are willing to accept. From macroeconomic point of view, unemployment treated as state of the economy in equilibrium is connected with the natural rate of unemployment (NRU) and non-accelerating inflation rate of unemployment (NAIRU) theory, i.e. the unemployment which does not accelerate inflation [analysed e.g. by Fair 2000, Blanchard, Katz 1997, Stiglitz 1997, Staiger, Stock, Watson 1997].

Second theoretical approach believes that labour market is rigid and any disequilibrium can not be reduce by market mechanism. In this case, unemployment is involuntary, level of wages and number of employees depend on negotiation between enterprises and workers. In this theoretical stream many approaches to wage or employment determination exist. In the model of implicit contracts, enterprises agree to stabilise the wage level, but workers agree to be fired. In consequence, wages are rigid, number of employees changes depending on market situation [Newbery, Stiglitz 1987]. Next group of theories in this approach is connected with the efficiency wages [e.g. the fair-wage – effort model of Akerlof, Yellen 1990, model with worker discipline, Shapiro, Stiglitz 1984]. Workers should receive such wage to be motivate to effort, existing unemployment does not change level of wage, because worker effort with lower wage would decline to zero. Next model in this approach, insider-outsider model [e.g. Gottfries 1992, Lindbeck, Snower 1988], assume that insiders, workers already employed, are much more important to enterprises that outsiders, people who are unemployed, because of their work experience. Once more time, level of unemployment does not influence the level of wages.

The most frequently, demand for labour is derived from the function of enterprises' output where the volume of output (Y) depends on the amount of capital (K) and labour (L) involved, which may be represented by means of Cobb-Douglas's function of production with constant economies of scale in agreement with function ($Y = A K^{\alpha} L^{1-\alpha}$). In one of the newest approaches human capital (H) is included in the factors which shape the function of production. Then the function of production assumes form ($Y = A K^{\alpha} H^{\beta} L^{1-\alpha-\beta}$) [quoted after Romer 2000]. Demand for labour declared by an enterprise results from its decision to maximise

profit, i.e. the difference between the real income from labour and the real cost of labour. Therefore, the first order condition of profit maximisation, indicating zero value of the first derivative is responsible for the fact that labour is remunerated by real wages, thus a real wage is a function of the marginal product of labour understood as increase of output influenced by increase of employment [Kwiatkowski 2002].

The analysis of factors influencing demand for labour can contain a classical approach [Milo, Wesoły, Ciesluk's elaboration on the views of A.Smith, L.Walras and A.Marshall 1999]. According to A. Smith, demand for labour is a function of a statistical measure of a nation's welfare, number of people of productive age, physical capital of an economy, real wages per unit, real interest rate, labour productivity from the previous period understood as the average output per employee, business conditions and expenditures on technological progress. L. Walras assumes that the demand for labour results from price indexes of consumer goods and the prices of the factors of production as well as capitalists' welfare. A. Marshall, in turn, is of the opinion that demand for labour depends on labour productivity, value of dividends, average level of the employees' education, bargaining power of labour and increase in labour productivity.

The Polish research conducted by Prof. W.Welfe's team assumes that effective demand for labour results from potential demand for labour and disequilibrium on the labour market. The potential demand for labour depends on demand for home-made goods which, in turn, results from their real process, labour productivity and potential GDP possible to achieve with full exploitation of machinery and equipment. On the other hand disequilibrium on the labour market results from the ratio between registered jobs and the number of people looking for a job [W. Welfe, A. Welfe, Florczak, Sabanty 2001].

Theoretical work also indicates that labour productivity is the factor which has a strong influence on salary for work through an impact on the bargaining power of employees defined as wage effect of productivity. This concerns mainly dynamic sectors of economy where labour productivity and growth of wages is also determined by the evolution of alternative wages accessible on the labour market [Montuenga-Gómez, Fernández 2001].

Analysing the factors which shape the demand for labour, one can also distinguish the demand for employees of low or high skills. The growth of consumption is regarded as the main source of increased employment of highly qualified workers, mostly in the services sector, whereas technological progress leads to the liquidation of jobs for the poorly qualified and at the same time reduces the level of demand for their labour [Gregory, Zissimos, Greenhalgh 2001].

Such structural economic factors as e.g. real demand in a sector, supply of the factors of production, tax rates or the world's real interest rates exercise a strong influence on the labour market, particularly on unemployment. Some economists

are of the opinion that the structural factors dominate the situation on the labour market [Papell, Murray, Ghiblawi 2000].

Therefore, to recapitulate one can assume that the number of employees depends on the volume of production, labour productivity and wage with a significant role played by the rigidity of the labour market. However, the change of employment level as the answer to any of determinants mentioned above, can be done with some lags. Firing or hiring workers are processes which take some time. In this case, it can be supposed that enterprises make their employment decision not only based on current objective situation, but also based on their expectations about future market condition. These expectations can also determine the level of employment and can be measured by business survey data.

2. Business survey data as the basis of economic diagnosis and prognosis

Business survey data are subjective, qualitative indicators, which representing expectations of enterprises related to certain aspects of their operation. Methodological circumstance of business survey creating is assumption that economic processes are moulded by psychological aspects of decision making by enterprises or consumers [Rekowski 1997].

Qualitative indicators of the business survey are generated on the basis of each month survey responses formulated by enterprises. In questionnaires fulfilled each month, enterprises evaluate change of their current and future economic situation in different aspects. In the studies carried out by means of business survey in Poland, enterprises have three variants of responses. They can say that a given category, e.g. new domestic and foreign orders, increased, remained unchanged or decreased. The value of indicators is a difference between the percentage of positive (increase) and negative (decrease) answers to a given question. Therefore, neutral answers (remain unchanged) are not taken into account.

Questions concerning different aspects of the functioning of enterprises are divided into two groups. In the first part the enterprises assess how their current situation in a given field of activity changed in comparison with the previous month. Responses to these questions are the basis to construct diagnostic indicators which reflect the current situation. In the second part the enterprises assess their future situation,indicating how a given element of their functioning will change within the nearest three months. This group of responses is a basis to create prognostic indicators. Third group of indicators is created as composite indicators and it is called as *climates*. This kind of indicators is built as average value of diagnostic and prognostic indicators.

The way of creation business survey data determines some of their features. First of all, business survey data show economic dynamics because enterprises should evaluate the change of their current and future economic situation in comparison to previous period. Next, these indicators have strongly subjective nature. Respondents can be influenced by surges of optimism or pessimism. In these cases, their evaluations can be overestimated or underestimated in comparison to objective economic situation. Depending on individual perception, different respondents can give different estimations of much similar economic situations of their enterprises. The same respondent can evaluate the similar situations in different ways depending on time, f.e. during phases of business cycle.

Qualitative indicators of business survey data carry another information value then traditional used quantitative indicators. They are treated as source of information, which allows to quick evaluation of current economic situation and short-term forecasts [f.e. Jerczyńska, Zagoździńska 1996], because they describe economic activity correctly [Adamowicz, Dudek, Walczyk 2002]. Business survey data can be the basis to forecasting quantitative indexes as for example IPI (industrial production index), which was estimated both in Polish researches [Drozdowicz-Bieć, Stanek 1994] and in foreign ones [Kangasniemi, Tsupari 1997].

Out of the business survey indicators generated in Poland the following ones were chosen for this study, which refer to the situation in the manufacturing industry:

- General economic situation (GES),
- Domestic and foreign demand (DFD),
- Foreign demand (FD),
- Level of production sold (PS),
- Stocks of finished products (SFP),
- Settlement of liabilities (L),
- Level of dues (LD),
- Forecast of economic situation (FES),
- Forecast of domestic and foreign demand (FDFD),
- Forecast of foreign demand (FFD),
- Forecast of the level of production sold (FP),
- Forecast of selling prices (FPRICE),
- Forecast of employment (FE),
- Forecast of the settlement of liabilities (FL),
- Climate of economic situation (CES),
- Climate of domestic and foreign demand (CDFD),
- Climate of foreign demand (CFD),
- Climate of production (CP),
- Climate of liabilities (CL).

The first seven indicators, general economic situation, domestic and foreign demand, foreign demand, level of production sold, stocks of finished products, settlement of liabilities, amounts due belong to the group of diagnostic indicators. The next six indexes, forecast of the economic situation, forecast of domestic and foreign demand, forecast of foreign demand, forecast of the level of production sold, forecast of selling prices, forecast of employment, forecast of the settlement of liabilities, are the prognostic indicators. The last five indicators, climate of economic situation, climate of domestic and foreign demand, climate of foreign demand, climate of production and climate of liabilities, are composite indicators and they are calculated as average value of diagnostic and prognostic indicators. For example, climate of economic situation, in each month is average of two indicators, general economic situation as diagnostic index and forecast of economic situation as prognostic one.

All three types of indicators, diagnostic, prognostic indicators and climates, were considered separately as determinants of employment.

3. Research method of employment forecasts on the basis of business survey indicators

In order to verify the hypothesis of usefulness of business survey data to forecast employment, the analysis of the manufacturing industry in Poland was made. This analysis covers the period from January 1993 to March 2004 on a monthly basis. Two variables connected with employment, the average number of employees and first difference of number of employees (changes in employment), were explained and forecasted variables, while the qualitative indicators of the business survey were the explaining variables.

Raw statistical data on employment were taken from the *Biuletyn Statystyczny* and the data presenting qualitative indicators of the business survey from the *Badania Koniunktury*, published by the Central Statistical Office in Warsaw. Empirical verification of business survey data forecasting possibilities was made in several steps.

First step of research procedure was seasonal decomposition. All the raw statistical data were subject to decomposition by CENSUS X-11 method and cleared of the influence of seasonal and random fluctuations. Thanks to this the series with a joint influence of a development tendency and business fluctuations were obtained.

Granger causality was second step of research procedure. It was used in order to identify the possible time leads in the qualitative indicators in relation to the number of employees and its first differences. This analysis is based on the con-

struction of auto-regression function of the dependent variable (y) and introduction of the independent variable (x) into the auto-regression function, taking into account time shifts according to equation (1).

$$y_t = \alpha_0 + \alpha_1 y_{t-1} + \ldots + \alpha_n y_{t-n} + \beta_1 x_{t-1} + \ldots + \beta_n x_{t-n}. \quad (1)$$

In equation (1) the current value of dependent variable (y) is explained by its previous values and by the previous values of independent variable (x) with time lags of n periods. Granger causality checks whether introduction of independent variable (x) to auto-regression improves adjustment of the function. Null hypothesis says that in Granger sense the variable (x) is not the cause of the variable (y), i.e. parameters $\beta_1, \ldots, \beta_n$ are statistically insignificant and assume zero value. Then introducing them into regression function (1) does not improve the explanation of variable (y). If the results of the analysis make it possible to reject the null hypothesis, then variable (x) is according to Granger the cause of variable (y) and including it in equation (1) improves the possibilities of estimating the value of variable (y) and parameters $\beta_1, \ldots, \beta_n$ are statistically significant and different from zero [Chow 1995].

In the presented research dependent variables (y) were the average number of employees in the manufacturing sector and first differences in average employment, while independent variables (x) were successively introduced indicators of the business survey. The application of the causality analysis made it possible to reject, on the one hand, those indicators which are not significant for the explanation of changes in employment and, on the other hand, to identify the possible time leads between the qualitative indicators and employment.

Time leads between business survey data and the number of employees or first differences in average employment were used to construct the regression functions as the basis for the forecasts, according to general equations (2) and (3).

$$AE_t = \alpha + \beta_1 BSI_t + \ldots + \beta_n BSI_{t-n} \quad (2)$$

$$FDAE_t = \alpha + \beta_1 BSI_t + \ldots + \beta_n BSI_{t-n} \quad (3)$$

where:

AE_t – average employment in manufacturing in period t,
$FDAE_t$ – first differences in average employment in period t,
$BSI_t - BSI_{t-n}$ – business survey indexes with time leads from n to 0 periods, numbers of leading periods n depend to results of Granger causality,
α, β_1, β_n – parameters of regression functions.

The next step of research procedure, leaded to obtain regression function as the basis to forecast. The whole period of time series (01.1993 – 03.2004) was di-

vided into two parts. First period of time series, from 01.1993 to 03.2003, was used to construct regression function. Second period of time series, form 04.2003 – – 03.2004, was used to build ex post forecasts of dependent variables. The quality of these forecasts is the basis to verify the usefulness of business survey data as the tool of employment forecast.

Because of using three different types of business survey data, diagnostic indicators, prognostic indicators and climates, for each of dependent variables, average number of employees and first differences in numbers of employees, three regression functions were constructed. First regression function was built with diagnostic business survey data as independent variables, in second regression function prognostic indicators were treated as independent variables, and in third regression function climates of business survey data were the basis to explain dependent variable. It allowed to constructed six regression functions.

Step regression method was used to construct all the functions of regression. According to this method independent variables are successively introduced into and removed from the equation until the best adjusted function is obtained.

After construction of regression function, forecasts of average employment and first differences in average employment for second period of time were made. Two parameters were used to evaluate the possibilities of forecasting employment on the basis of business survey data. First of all, the adjustment of regression function was assessed on the basis of determination co-efficient. Moreover, the quality of ex post prognoses were evaluated by average deviations of the ex post prognosis from the real value of the variable. Average deviations of the forecasts, made on the basis of models, from the real value of the variable were determined according to formula (4).

$$SD = \frac{\sum \sqrt{\left(y_t - y_t^*\right)^2}}{n} \tag{4}$$

where:

y_t – observed value of dependent variable in period t,

y_t^* – theoretical value of modelled dependent variable in period t,

n – numbers of observations.

Average deviations of the forecasts from the actual size of employment were determined in three time intervals:

- ex post forecasts deviations for first 3 months of prognosis (04.2003--06.2003),
- ex post forecasts deviations for the first 6 months of prognosis (04.2003--09.2003),
- ex post forecasts deviations in the whole 12-month period (04.2003--03.2004).

4. The results of employment forecasts on the basis of qualitative business survey data

At first step of research, two causality analyses were carried out, first with average employment in manufactory industry as dependent variable and second with first difference in average employment as dependent variable. Its results are presented in table 1 and in table 2 in the statistical annex. Zero hypothesis assumed that particular indicators of the business survey indicators were not the cause of employment or changes in employment in Granger's sense, with the longest leads considered in causality lasting 12 months.

Table 1

The longest statistically important leads of independent variables average number of employees according to Granger causality

Null hypothesis	Lags in months	F-statistic	Probability
GES does not Granger Cause AE	9	2.04978	0.04058
DFD does not Granger Cause AE	12	1.97901	0.03411
FD does not Granger Cause AE	10	1.96751	0.04429
P does not Granger Cause AE	11	1.90797	0.04678
SFP does not Granger Cause AE	4	3.49083	0.00978
L does not Granger Cause AE	12	3.22274	0.00063
LD does not Granger Cause AE		can not be rejected	
FES does not Granger Cause AE	4	3.05995	0.01924
FDFD does not Granger Cause AE	1	8.42362	0.00435
FFD does not Granger Cause AE	4	3.13533	0.01710
FP does not Granger Cause AE	1	10.34790	0.00163
FPRICE does not Granger Cause AE	11	2.07170	0.02909
FE does not Granger Cause AE	12	1.96950	0.03511
FL does not Granger Cause AE	12	1.93972	0.03844
CES does not Granger Cause AE	5	2.29306	0.04977
CDFD does not Granger Cause AE	12	1.95762	0.03640
CFD does not Granger Cause AE	9	2.31224	0.02038
CP does not Granger Cause AE	12	1.90476	0.04272
CL does not Granger Cause AE	12	2.50561	0.00651

In case of one indicators, level of dues, the results of causality did not allow to reject the null hypothesis with any leads, both for average employment and for

Table 2

The longest statistically important leads of independent variables first differences in average number of employees according to Granger causality

null hypothesis	Lags in months	F-statistic	Probability
GES does not Granger Cause FDAE	11	1.95239	0.04118
DFD does not Granger Cause FDAE	11	2.12813	0.02464
FD does not Granger Cause FDAE	6	2.23634	0.04444
P does not Granger Cause FDAE	11	1.96427	0.03979
SFP does not Granger Cause FDAE	3	4.44005	0.00531
L does not Granger Cause FDAE	12	3.50365	0.00025
LD does not Granger Cause FDAE		can not be rejected	
FES does not Granger Cause FDAE		can not be rejected	
FDFD does not Granger Cause FDAE		can not be rejected	
FFD does not Granger Cause FDAE	3	3.30848	0.02240
FP does not Granger Cause FDAE		can not be rejected	
FPRICE does not Granger Cause FDAE		can not be rejected	
FE does not Granger Cause FDAE	12	2.71358	0.00332
FL does not Granger Cause FDAE	12	2.20198	0.01710
CES does not Granger Cause FDAE	4	3.34549	0.01229
CDFD does not Granger Cause FDAE	12	2.28385	0.01321
CFD does not Granger Cause FDAE	6	2.33502	0.03641
CP does not Granger Cause FDAE	12	2.18872	0.01782
CL does not Granger Cause FDAE	12	2.66548	0.00388

first difference of average employment. So, this variable was reject from next steps of research.

For average employment, the rest of business survey indicators are causes of according to Granger causality. Seven of indicators, domestic and foreign demand (DFD), liabilities (L), forecast of employment (FE), forecast of liabilities (FL), climate of domestic and foreign demand (CDFD), climate of production (CP) and climate of liabilities (CL), are cause of employment with the longest 12-month leads.

For changes in average employment, except of level of dues, next four indicators, forecast of economic situation, forecast of domestic and foreign demand, forecast of the level of production sold and forecast of price, are not the cause with any leads of these variables. Therefore, it was possible to reject those variables in the further part of the research and they were not taken into account when constructing the functions of regression.

As regards the remaining indicators of the business survey, results of the causality analysis made it possible to reject the null hypothesis and to state that they

can be the cause for changes in employment. The longest 12-month leads were obtained in the case of five indicators, forecast of employment (FE), forecast of liabilities (FL), climate of domestic and foreign demand (CDFD), climate of production (CP) and climate of liabilities (CL).

Results of the causality analysis were a basis for the construction of the regression functions. In initial form of regressions all important leads of independent variables were taken into account. In case of average employment as dependent variable, initial form of regression function with diagnostic business survey indicators as independent variable assumed a form of equation (5), with prognostic business survey indicators – equation (6), with climates – equation (7). The initial forms of regression functions of first differences in average employment were equation (8) for diagnostic indicators as independent variables, equation (9) for prognostic indicators as independent variables and equation (10) for climates as independent variables.

$$AE_t = a_1 + a_2GES_{t-9} + \ldots + a_{11}GES_t + a_{12}DFD_{t-12} + \ldots + a_{24}DFD_t + \\ + a_{25}FD_{t-10} + \ldots + a_{35}FD_t + a_{36}P_{t-11} + \ldots + a_{47}P_t + a_{48}SFP_{t-4} + \ldots + \\ + a_{52}SFP_t + a_{53}L_{t-12} + \ldots + a_{65}L_t \quad (5)$$

$$AE_t = b_1 + b_2FES_{t-4} + \ldots + b_6FES_t + b_7FDFD_{t-1} + b_8FDFD_t + b_9FFD_{t-4} + \\ + \ldots + b_{13}FFD_t + b_{14}FP_{t-1} + b_{15}FP_t + b_{16}FPRICE_{t-11} + \ldots + b_{27}FPRICE_t + \\ + b_{28}FE_{t-12} + \ldots + b_{40}FE_t + b_{41}FL_{t-12} + \ldots + b_{53}FL_t \quad (6)$$

$$AE_t = c_1 + c_2CES_{t-5} + \ldots + c_7CES_t + c_8CDFD_{t-12} + \ldots + c_{20}CDFD_t + \\ + c_{21}CFD_{t-9} + \ldots + c_{30}CFD_t + c_{31}CP_{t-12} + \ldots + c_{43}CP_t + c_{44}CL_{t-12} + \\ + \ldots + c_{56}CL_t \quad (7)$$

$$FDAE_t = d_1 + d_2GES_{t-11} + \ldots + d_{13}GES_t + d_{14}DFD_{t-11} + \ldots + d_{25}DFD_t + \\ + d_{26}FD_{t-6} + \ldots + d_{32}FD_t + d_{33}P_{t-11} + \ldots + d_{44}P_t + d_{45}SFP_{t-3} + \\ + \ldots + d_{48}SFP_t + d_{49}L_{t-12} + + \ldots + d_{61}L_t \quad (8)$$

$$FDAE_t = e_1 + e_2FFD_{t-3} + \ldots + e_5FFD_t + e_6FE_{t-12} + \ldots + e_{18}FE_t + e_{19}FL_{t-12} + \\ + \ldots + e_{30}FL_t \quad (9)$$

$$FDAE_t = f_1 + f_2CES_{t-4} + \ldots + f_6CES_t + f_7CDFD_{t-12} + \ldots + f_{19}CDFD_t + \\ + f_{20}CFD_{t-6} + \ldots + f_{26}CFD_t + f_{27}CP_{t-12} + \ldots + f_{39}CP_t + f_{40}CL_{t-12} + \\ + \ldots + f_{52}CL_t \quad (10)$$

The step regression method made it possible to eliminate from equations (5)-(10) those independent variables which are insignificant for the explanation of average employment and changes in average employment and to estimate the best regression functions. The initial forms of regression functions (5)-(10) assumed the forms of equations (11)-(16), where average employment is the dependent variable in equations (11)-(13), first differences in average employment is the dependent variable in equations (14)-(16). Diagnostic business survey indicators are the independent variables in regression functions (11) and (14), prognostic indicators are the explaining variables in functions (12) and (15), climates of business survey are the independent variables in equations (13) and (16). Assessment of regression functions (11)-(16) are presented in table 3.

$$AE_t = 2652.3 + 23.8P_{t-11} + 15.8\ L_{t-1} \tag{11}$$

$$AE_t = 2314.3 + 13.4\ FP_{t-1} + 9.3\ FPRICE_{t-2} + 10.8\ FE_{t-12} \tag{12}$$

$$AE_t = 2113 + 20.36\ CDFD_{t-12} + 25.2\ CFD_t \tag{13}$$

$$FDAE_t = 4.4 + 0.63\ SFP_{t-3} + 0.63\ L_{t-3} \tag{14}$$

$$FDAE_t = 5.5 + 0.36\ FFD_{t-3} + 0.57\ FE_{t-1} \tag{15}$$

$$FDAE_t = -\ 10 + 0.97\ CFD_{t-4} \tag{16}$$

Results of the analysis of regression of employment in the manufacturing industry and changes in average employment made it possible to identify nine qualitative indicators of the business survey which outpace changes in employment and explain how they are developed. Three of them, liabilities, forecast of employment and climate of foreign demand, are independent variables both for average employment and for changes of average employment. Among all indicators, important for regression functions, these include three diagnostic indicators, level of production sold, liabilities and stocks of finished products. The next four indicators which describe the regression functions of average employment and changes of employment belong to the group of prognostic indicators: forecast of the level of production sold, forecast of foreign demand, forecast of prices and forecast of employment. Next two business survey indicators explaining average employment or changes in employment belong to composite indicators, climate of domestic and foreign demand and climate of foreign demand.

Judging by a positive value of parameters of the functions (11) – (16), all of the differentiated leading indicators exercise a directly proportional influence on em-

Table 3

Results of regression function (11-16)

Evaluation of regression function	Name of the parameter of function	Value of parameter	Standard error of parameter	t	p level
Function (11)					
- R^2= 0.5931 - adjusted R^2= 0.5856 - F(2, 108)=78.712 - Standard error of estimation: 139.58	Intercept	2652.2780	36.1028	73.4646	0
	P_{t-11}	23.7775	2.4415	9.7389	0
	L_{t-1}	15.7386	2.8485	5.5252	0
Function (12)					
- R^2= 0.8339 - adjusted R^2= 0.8293 - F(3, 107)=179.09 - Standard error of estimation: 89.592	Intercept	2314.2560	56.7322	40.7926	0
	FP_{t-1}	13.4463	2.2273	6.0371	0
	$FPRICE_{t-2}$	9.2883	1.0527	8.8231	0
	FE_{t-12}	10.7713	0.9317	11.5609	0
Function (13)					
- R^2= 0.7555 - adjusted R^2= 0.7510 - F(2, 108)=166.85 - Standard error of estimation: 108.20	Intercept	2113.0530	20.0335	105.4758	0
	$CDFD_{t-12}$	20.3611	1.5419	13.2052	0
	CFD_t	25.1940	2.1817	11.5481	0
Function (14)					
- R^2= 0.4699 - adjusted R^2= 0.4601 - F(2, 108)=47.876 - Standard error of estimation: 5.9	Intercept	4.4471	1.5151	2.9353	0.004072
	SFP_{t-3}	0.6314	0.1119	5.6407	0
	L_{t-3}	0.6362	0.1229	5.1778	0
Function (15)					
- R^2= 0.6502 - adjusted R^2= 0.6437 - F(2, 108)=100.36 - Standard error of estimation: 4.7931	Intercept	5.5313	2.7568	2.0064	0.047311
	FFD_{t-3}	0.3683	0.1193	3.0869	0.002571
	FE_{t-1}	0.5746	0.0519	11.0799	0
Function (16)					
- R^2= 0.3302 - adjusted R^2= 0.3240 - F(1, 109)=53.734 - Standard error of estimation: 6.6018	Intercept	- 9.9975	0.8998	-11.1110	0
	CFD_{t-4}	0.9710	0.1325	7.3303	0

ployment. Improvement (worsening) of the values illustrating the condition of enterprises influences the growth (decline) of employment.

When comparing the adjustment of employment regression functions (11)-(16) it should be noticed that generally regression functions of average employment are better fitted than regression functions of changes in employment, because its adjusted R^2 are on average higher. The highest values of R^2 are connected with regression functions where prognostic indicators were used as independent variables. Function (12), constructed on the basis of prognostic indicators, describes average employment in manufacturing industry most accurately. Its adjusted R^2 is fairly high and amounts to (0,83) which means that the function explains the dependent variable in 83%.

In the next part of the study ex post prognoses were made for the surveyed period on the basis of regression functions (11)-(16) and deviations of those prognoses from the real observations were determined in the approach of standard deviations rate according to formula (4). Deviations of ex post forecasts were determined in three periods, for the first three months of the surveyed period (04.2003-06.2003), for first 6 months of the surveyed period (04.2003-09.2003), and within 12 months of the surveyed period (04.2003-03.2004). Table 4 in the statistical annex presents

Table 4

Standard deviation of ex post prognoses from their realisation

Regression	Standard deviation of a 3-month forecast for the period 04.2003-06.2003	Standard deviation of a 6-month forecast for the period 04.2003-09.2003	Standard deviation of a 12-month forecast for the period 04.2003-03.2004
Function (11)	404.7589	438.8743	493.5875
Function (12)	361.3248	381.9018	418.9153
Function (13)	236.6630	314.8389	473.4668
Function (14)	1.0604	1.1438	3.1735
Function (15)	1.6767	1.6489	3.0590
Function (16)	0.8423	1.6158	4.4537

the results of measurement of deviations from the forecasts. Average employment and particular functions of regression along with the forecasts are presented by the figure 1, while changes of employment with theirs models and ex post forecasts are presented by the figure 2.

Analysis of ex post prognoses of average employment or changes in employment made on the basis of regression functions with business survey data as explaining indicators shows very important differences in the quality of forecasts,

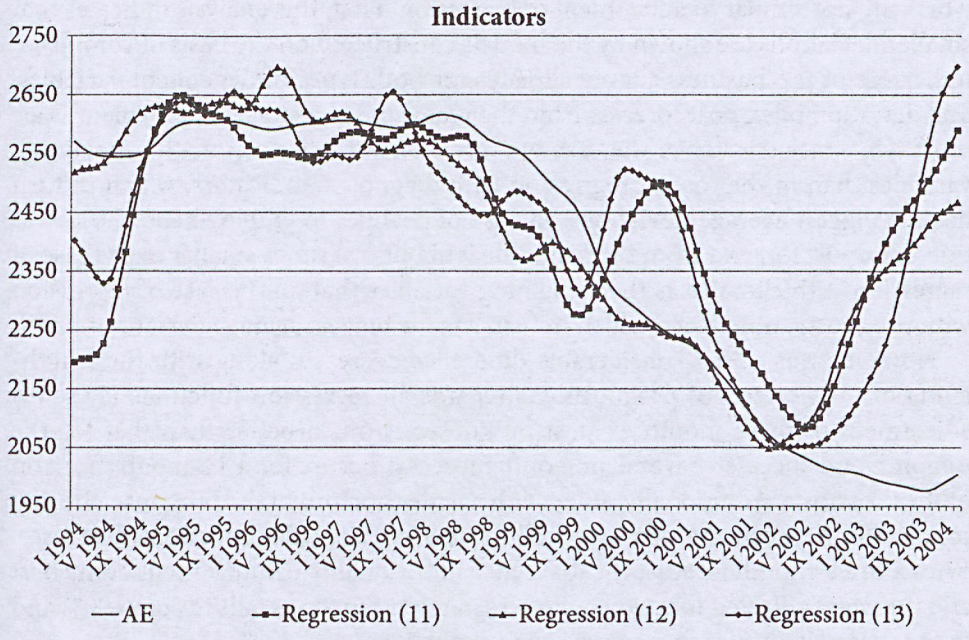


Figure 1. Average employment in the manufacturing industry and its models constructed on the basis of business survey qualitative

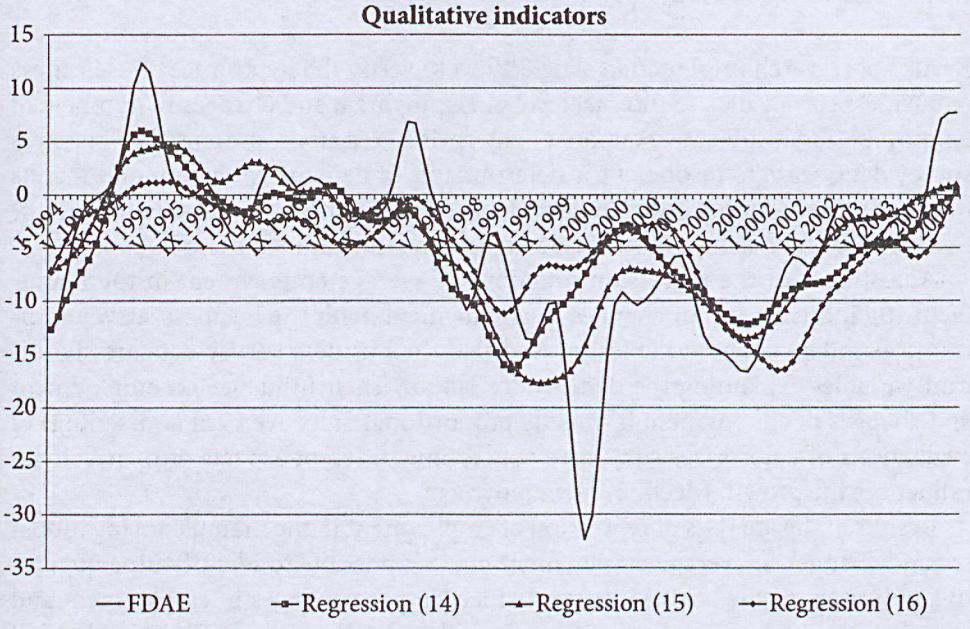


Figure 2. Changes in average employment in the manufacturing industry and its models constructed on the basis of business survey

which are not similar to adjustment of regression. First, this analysis indicates that smaller deviations are shown by the models constructed on the basis of composite indicators of the business survey climates for both types of dependent variables. The deviation of ex post forecast from the real value of average employment is almost two times smaller in the case of regression with climates as the explaining variables than in the case of regression with diagnostic indicators, which in turn has the biggest average deviations. In case of changes in employment, the deviation of ex post forecast from the real value is about two times smaller in the case of regression with climates as the explaining variables than in the case of regression with prognostic indicators, which in turn has the biggest average deviations.

However, this initial considerable difference decreases along with the lengthening of the horizon of prognosis. As regards all regression functions (11)-(16) adjustment of three-month ex post prognoses is much better than that for the 6 month and successive worsening of the forecast occurs for a 12-month horizon of the prognosis. Additionally, along with a wider horizon of the prognosis the disproportion between the quality of adjustment of particular functions decreases. With a three-month forecast the difference in the quality of adjustment of the best and the worst adjusted function of both regression functions falls to about 90% and in the case of a 12-month prognosis – to about 20%.

4. Final remarks

Results of research presented in article allow to verify the hypothesis of usefulness of business survey data to forecast level of employment and changes in numbers of employees. First, subjective factors of enterprises decisions, presented in business survey data, seam to be one of the determinants of demand for labour and thanks to this, business survey indicators can be used to describe the situation on labour market. Second, business survey data are leading indicators for employment.

Adjustment of the regression functions of average employment in the manufacturing industry and of changes in employment, with the business survey indicators as independent variables, proved that the business survey data are significant variables explaining the demand for labour. Their influence on employment and changes of employment is directly proportional, improvement (worsening) of evaluations of enterprises subjective concerning different aspects of their activity influences the growth (decline) of employment.

Results of the analysis of regression of employment in the manufacturing industry and changes in average employment made it possible to identify nine qualitative indicators of the business survey which outpace changes in employment and explain how they are developed. These include three diagnostic indicators, level of production sold, liabilities and stocks of finished products. The next four indica-

tors which describe the regression functions of average employment and changes of employment belong to the group of prognostic indicators: forecast of the level of production sold, forecast of foreign demand, forecast of prices and forecast of employment. Next two business survey indicators explaining average employment or changes in employment belong to composite indicators, climate of domestic and foreign demand and climate of foreign demand.

The possibilities to forecast employment on the basis of business survey data result from the fact that they are leading indicators with several months of lead for the changes in employment.

The best quality of these ex post forecasts are for quite short forecasting period, and these quality decreases along with the lengthening of the prognosis period. The best adjustment of the forecasts to the actual level of employment was obtained for a three-month prognoses, whereas the forecasts of a longer, one-year horizon yielded a decisively worse adjustment to the actual results.

It seems worthwhile to include business survey indicators in a wider set of variables applied to prognosis short-term changes in employment and to combine the use of subjective and objective indicators. Formulating employment forecasts exclusively on the basis of qualitative business survey data can be burdened with a risk of error.

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