Regional Development of Small Firms in Poland

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Abstract

Employing a probit and Logit model, this paper demonstrates that small firm development, conceived of in terms of structural, behavior and performance features, is correlated with regional location in Poland. Regional GDP is also shown to be polarizing. The paper uses original data that samples the small firm stratum in two contrasting regions, Gdansk and Lublin. The following variables were shown to be significantly correlated with regional location: legal structure, subcontracting, technological level of the products of the firm, average wage and intention to expand turnover. Policy implications are discussed including the desirability of a regionally differentiated small firm policy that reflects the level of small firm development in a particular region.

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1. Introduction

The specific objective of this paper is to formulate and test a novel hypothesis in a transitional economy, Poland. This country is characterized by the spatial and economic differentiation of what has been called Poland A and Poland B - the former more developed, industrialized and closer to the EU, the latter less developed, more agrarian and closer to Russia. We have chosen two regions representative of Poland A and B[1] - Gdansk and Lublin - and sample small firm development in both. We test our hypothesis by using a probit analysis discovering the correlation between Structure-Conduct-Performance (S-C-P)[2] features of small firms and their regional location. Faster growing regions (in terms of GDP per capita) within such an economy are expected to produce firms that have a more developed range of S-C-P features from firms in less developed regions. To the best of our knowledge, such an analysis has not been attempted before.

The context for this paper is the impressive growth of Polish GDP post 1989 that was driven by the growth in small firms and accompanied by the growing regional disparities within Poland during the 1990s. By 1999 8.8 million people were working in the sector of which 46.5% were in small and medium enterprises. Regional development displayed uneven growth as more favoured regions with natural, market, geographic or historical advantages grew faster and growth was cumulatively generated (Kaldor 1970, Dixon and Thirlwall 1975). Fig 1 shows a 30% difference in 1995 between the GDP per capita of the Gdansk and Lublin regions which widened to 46% by the year 2000. Fig 2 shows comparable figures for the differences between Poland A and B: a 30% difference between the averaged GDP per capita of their regions in 1995 widening to 40% by 2000. Dramatic regional polarisation has been occurring in Poland in the lead up to EU accession. The motivation of the paper is to test if S-C-P differences in small firm development are related to the regions they inhabit.

The structure of this paper is as follows. Section 2 gives the empirical analysis. Section 3 discusses the variables found to be significant in the empirical analysis. Section 4 discusses policy implications. Section 5 concludes.

[1] Both regions are part of sample suggested by Piasecki et alia (2000) as representative of Poland A and B. Berger et al (1998) also note these structural differences in the Polish space.

[2] The term S-C-P is loosely based on the S-C-P model of micro economics. Here we refer to a range of structural factors (including legal structure), conduct factors (e.g. networking, research, human capital policy) and performance features (productivity, profits, turnover for example).

2. Empirical Analysis

In this section we outline the empirical modelling of regional differences in Poland. First we discuss the econometric method to be employed for inference followed by a discussion of the data and then we present and interpret the estimation results.

2.1 Econometric methodology

The dependent variable (denoted Y_i) that we model is dichotomous, taking the value of zero for firms in the Polish region of Lublin ($Y_i = 0$) and unity for those in Gdansk ($Y_i = 1$). Application of the ordinary least squares (OLS) estimator is inappropriate because it would induce heteroscedasticity in the residuals of the model. Further, the predicted values of the dependant variable would not necessarily be constrained to fall within the range of zero and one giving rise to nonsense probability values and negative variances (Greene, 2000, p. 813). The appropriate specification to employ in these circumstances is a binary choice model including the standard probit and logit models. Since there is no theoretical reason for favouring the probit over the logit form (or *vice versa*) and there is typically little difference in the results obtained from the two forms (Greene, 2000, p. 815) we focus on the probit model.

We hypothesise that a range of factors (denoted by the matrix **X**), including economic characteristics, can be used to ascertain regional location. The probit model specifies the probability that Y_i takes on any particular value, Y, (denoted as $\Pr[Y_i = Y]$) as:

$$\Pr[Y_i = 1] = \Phi(\mathbf{X}\boldsymbol{\beta}) = \int_{-\infty}^{\mathbf{X}\boldsymbol{\beta}} \phi(s)\, ds \qquad \textbf{(2.1a)}$$

$$\Pr[Y_i = 0] = 1 - \Phi(\mathbf{X}\boldsymbol{\beta}) = 1 - \int_{-\infty}^{\mathbf{X}\boldsymbol{\beta}} \phi(s)\, ds \qquad \textbf{(2.1b)}$$

where $\boldsymbol{\beta}$ is the vector of parameters corresponding to **X**, $\phi(\bullet)$ denotes the (non-cumulated normal) distribution and $\Phi(\bullet)$ is the cumulative normal distribution.[3] Using the normal distribution the probit model transforms the values of $\mathbf{X}\boldsymbol{\beta}$, that are defined over the infinite interval ($-\infty < \mathbf{X}\boldsymbol{\beta} < \infty$), into probabilities that are weakly bounded by zero and one ($0 \leq \Pr[Y_i = Y] \leq 1$). Thus, all probabilities take on sensible values and variances cannot be negative.

The probability model for the probit specification, given equation **(2.1a)** and **(2.1b)**, is (where **y** is the vector representation of the observations on the dependent variable Y_i):

[3] For the probit model one employs the normal distribution thus: $\int \phi(s)\, ds = [1 / \sqrt{(2\pi)}] \int \exp\{-\tfrac{1}{2}s^2\}\, ds$. A different distribution is used for the logit form [and, indeed, the gompit (extreme value) form].

$$E(\mathbf{y} \mid \mathbf{X}) = \sum_{Yi=0}^{1} \{Y_i \times Pr[Y_i]\} = \{0 \times [1 - \Phi(\mathbf{X\beta})]\} + \{1 \times \Phi(\mathbf{X\beta})\} = \Phi(\mathbf{X\beta}) \qquad \textbf{(2.2)}$$

The parameters of this model, as with any non-linear specification, do not necessarily yield the marginal effects [Greene (2000) p. 815]. For the probit model the marginal effects are obtained from the following expression:[4]

$$\partial E(\mathbf{y} \mid \mathbf{X}) / \partial \mathbf{X} = \partial \Phi(\mathbf{X\beta}) / \partial \mathbf{X} = \phi(\mathbf{X\beta})\boldsymbol{\beta} \qquad \textbf{(2.3)}$$

Strictly this expression is only correct when the explanatory variable of interest is continuous. However, "taking the derivative with respect to the binary variable as if it were continuous provides an approximation that is often surprisingly accurate" (Greene (2000) p. 817).[5]

2.2 Data and Variables

Our analysis is based on primary survey data obtained by direct interviews via a detailed questionnaire in the small firm stratum of Gdansk and Lublin in 1999. They were part of a research programme "An Empirical Study of Small and Medium Size Enterprises in Poland: Phase 11".[6] Small firms were defined as employing between 10 and 49 employees[7] and most of the NACE sector categories (industry, trade, construction, transport and services) were included in the population. The questionnaires consisted of 58 general questions many of which had sub-sections. Considerable data was collected. Professional enumerators were employed to ensure maximum quality and minimum non-sampling error. The sampling technique used a proportionate stratification sampling method across the chosen sectors. Micro enterprises with less than 10 employees were not included since such data was not regarded as reliable. For the purpose of the model twenty-nine variables were chosen on both practical and theoretical grounds. These are presented in Table 1 in the appendix. Not all variables from the original 58 questions were suitable for measurement and inclusion in our model. There were some variables for which accurate data was inherently difficult to obtain in small firm interviews (e.g. profit levels). We use 163 data points (74 firms from Gdansk and 89 from Lublin). The choice of our twenty-nine variables was based upon economic reasoning concerning their likely influences upon small firm's differential regional development.

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[4] Let $u = \mathbf{X\beta} \Rightarrow \Phi(\mathbf{X\beta}) = \Phi(u)$, by the chain rule it follows that, $\partial \Phi(\mathbf{X\beta}) / \partial \mathbf{X} = \{\partial u / \partial \mathbf{X}\} \times \{\partial \Phi(\mathbf{X\beta}) / \partial u\}$. Then, $\partial u / \partial \mathbf{X} = \partial (\mathbf{X\beta}) / \partial \mathbf{X} = \boldsymbol{\beta}$ and $\partial \Phi(\mathbf{X\beta}) / \partial u = \partial \Phi(\mathbf{X\beta}) / \partial(\mathbf{X\beta}) = \phi(\mathbf{X\beta})$ – the latter arises because $\Phi(\mathbf{X\beta}) = \int \phi(s)\, ds$. Therefore, $\partial \Phi(\mathbf{X\beta}) / \partial \mathbf{X} = \phi(\mathbf{X\beta})\boldsymbol{\beta}$.

[5] The marginal effect of a particular variable is typically calculated in one of two ways. First, one can evaluate $\phi(\mathbf{X\beta})$ in **(3.3)** using the sample means of the explanatory variables and multiply the result by $\boldsymbol{\beta}$. Second, $\phi(\mathbf{X\beta})$ in **(3.3)** can be calculated at every observation of the sample, the average series is then generated and the result multiplied by $\boldsymbol{\beta}$. Greene (2000) p. 816 suggests that current practice favours the latter method, hence this is the method that we use to calculate marginal effects (slopes).

[6] These surveys were financed by the European commissions PHARE ACE PROGRAMME 1997, Contract Number p97-8123-R.

[7] The small firm definition (10-49 employees) is in accord with the EU and also with recent Polish legislation (1999): "Law on Economic Activity".

2.3 Potential Determinants of Regional Differences

The full name of each of the 29 variables is given in Table 4. Economic reasoning indicted the choice and significance of these variables. It was expected that they would all be positively correlated with the regional location of Gdansk since this is the more dynamic and growing region. Thus firms were expected to have more advanced legal status, greater networking experience (e.g. subcontracting), higher levels of technology, organization change of the firm and its products, greater levels of revenue, profits and wages indicating productivity differences between the regions[8]. Gdansk firms were expected to be more oriented to foreign trade, investment and collaboration and to have higher levels of preparation for and expectation of gain from Europe. They were expected to use greater levels of franchising, credit, to have higher levels of training provision and the like. In general we expected a more dynamic small firm stratum in the Gdansk region. However, some of these variables are not significant in the final results due to a loss of information in our choice of final model and multicollinearity. However what we expected from the results was that a group of significant variables would emerge indicating that the Structure-Conduct-Performance features of small firms was regionally differentiated.

2.4 Empirical results

Table 1 reports the probit model estimation results. The general specification (Model 1) regresses the dependant variable on 29 explanatory variables (in addition to the intercept) taken from the original Polish firm survey. 163 observations are used to estimate the model with 74 from the Gdansk region and 89 from Lublin. There is no evidence of heteroscedasticity, autocorrelation or non-normally distributed residuals at the 5% level of significance for any of the three models reported in Table 1, except for Model 1 where non-normality is evident.[9] However, non-normality is not evident at the 1% level for Model 1 suggesting that the departure from normality is not excessively severe and that the critical values employed for hypothesis testing will provide useful guidance. Further,

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[8] Gdansk has a 40% industrial productivity advantage over Lublin - author's calculations from GUS data, Warsaw.

[9] The test for heteroscedasticity is outlined in, for example, the E-Views User Guide pp. 421. It tests the null of homoscedasticity against the alternative that heteroscedasticity takes the form, $\sigma_i^2 = \exp(2\mathbf{z}_i'\boldsymbol{\gamma})$, where $\mathbf{z}_i$ is a vector of variables that the variance of the binary choice model, σ_i^2, varies with and $\boldsymbol{\gamma}$ is the corresponding coefficient vector. The auxiliary test equation is:

$$\{(Y_i - \hat{P}_i) / \sqrt{[\hat{P}_i(1 - \hat{P}_i)]}\} = \{\phi(\mathbf{X}\boldsymbol{\beta}) / \sqrt{[\hat{P}_i(1 - \hat{P}_i)]}\}\mathbf{X}\boldsymbol{\delta} + \{\phi(\mathbf{X}\boldsymbol{\beta})(\mathbf{X}\boldsymbol{\beta}) / \sqrt{[\hat{P}_i(1 - \hat{P}_i)]}\}\mathbf{Z}\boldsymbol{\lambda} + v_i$$

where $\hat{P}_i$ denotes the fitted probability value and $\boldsymbol{\delta}$ and $\boldsymbol{\lambda}$ are coefficient vectors. The test statistic is the explained sum of squares of the above auxiliary regression which is distributed with degrees of freedom equal to the number of variables in the **Z** matrix (the matrix counterpart of $\mathbf{z}_i$). In our application we use all of the variables in the **X** matrix, less the intercept, in the **Z** matrix. Thus the degrees of freedom are k' = k – 1, where k denotes the number of variables in the **X** matrix.

because non-normality is not evident in the other models, inferences from these models will be valid.

In Model 1 five of the variables are statistically significant (not including the intercept which is also significant) and feature the expected sign. However, because the other twenty-four variables are insignificantly different from zero, we pursue model reduction to clarify the results and enhance efficiency of estimation. We employ the standard general-to-specific methodology by sequentially deleting the least significant variables (being reticent to exclude those that are regarded as most theoretically important) until we achieve a parsimonious specification. We obtain two different parsimonious models: Model 2 and Model 3.

The removal of 24 variables from Model 1 to yield Model 2 is valid according to an F-test [$F(1\rightarrow)$] at the 5% level (the probability value is 0.803). Model 2 incorporates 5 explanatory variables in addition to the intercept. They are the firm's legal status (Lstatus), the percentage of the firm's output that is subcontracted (Subcon) and whether the enterprise has introduced technologically improved goods (Newgoods). Also included are whether the firm intends to expand turnover (Turnover) and average gross wages (Avewage). All variables are statistically significant at the 5% level with z-statistics greater than 1.96 in magnitude, except Lstatus which has a z-statistic of 1.921 (which is virtually significant). All five variables feature the expected positive correlation with the dependent variable. Model 2 explains 30.5% of the variation in the dependent variable and this explanatory power is statistically significant, according to the LR statistic, at the 5% level.[10] The regression standard error is 0.412 which is approximately the average error of the model.

The removal of 25 variables from Model 1 to yield Model 3 is valid according to an F-test [$F(1\rightarrow)$] at the 5% level (the probability value is 0.616). Model 3 incorporates 4 explanatory variables in addition to the intercept, they are Subcon, Newgoods, Turnover and Avewage. All four variables feature the expected positive sign and are statistically significant at the 5% level. Model 3 explains 28.8% of the variation in the dependent variable and this explanatory power is statistically significant, according to the LR statistic, at the 5% level. The regression standard error is 0.416.

In both Model 2 and Model 3 all of the retained variables' coefficients exhibit the expected positive sign, the exclusion restrictions are valid and there is no evident misspecification. Although all of the retained variables in Model 3 are individually significant, Model 2 has a better fit, a lower AIC (=1.031) and includes the additional variable Lstatus, which is almost significant. Hence we favour Model 2 for inference and argue that Lstatus may be considered an important explanatory factor of regional differences in Poland. We therefore conclude that the variables that explain regional

[10] The pseudo R^2 (or likelihood ratio index) is defined as: pseudo $R^2 = 1 - (\ln L / \ln L_0)$, where $\ln L$ and $\ln L_0$ are the maximised values of the model's likelihood function including all variables and only incorporating an intercept, respectively – see Greene (2000, p 831). Clearly, if all the slope coefficients are zero then $\ln L$ equals $\ln L_0$ and the pseudo R^2 is zero. Perfect fit can only be obtained if $\ln L$ is zero (the log of the likelihood function attaining the maximum value of one).

differences in Polish firms are as follows. The firm's legal status (Lstatus), the percentage of the firm's output that is subcontracted (Subcon), whether the enterprise has introduced technologically improved goods (Newgoods), whether the firm intends to expand turnover (Turnover) and average gross wages (Avewage).

To determine whether these inferences are robust to the different forms of binary choice model used we report the estimation results of Model 1 to 3 using the logit and gompit (extreme value) forms in tables 2 and 3, respectively. The inferences are qualitatively similar to those obtained for the probit formulation, reported in table 1. Although the coefficients are different for each model across the three forms of binary choice model, this is expected because the coefficients do not measure the marginal effects (slopes) of the variables.[11] However, the slopes for each model across all three binary choice forms are virtually the same – except for the variable Qexport in the general specification, Model 1, which has a poorly determined coefficient. Hence, the results are robust across the three different types of binary choice model, which enhances our confidence in the inferences obtained.

3. Explanation of significant variables

Our significant variables indicate that the S-C-P features of small firms in Poland are regionally differentiated.

That the legal status of Gdansk's small firms tends to be significantly different from that of Lublin's , with more firms at the higher end of the free market development spectrum, indicates *structural* differences between firms in the two regions.[12] Firms that are legally structured as limited companies, for example, are more likely to survive, to raise finance, to be larger in size, more specialised, technologically more advanced than sole traders. The legal structure of a company is therefore indicative of a raft of structural differences between small firms. Very importantly, more advanced legal structures of small firms imply higher levels of corporate governance which are positively related to productivity levels of the small firm (Cowling 2003).

Subcontracting proved a significant difference between small firms in the two regions indicating differing regional *behaviour* of firms in response to competitive dynamics. In fact in the survey Gdansk engaged in seven times more subcontracting than Lublin. Once again this variable is indicative of a range of behavioral features. The firm that is subcontracting is clearly more networked and connected than a firm that is not. Such a firm is knowledgeable about the "rules of engagement" with larger firms, some of them probably foreign. This firm is probably more advanced in information technology and has access to more contracts than other less "connected" firms. It is possibly part of a cluster

[11] For example, Greene (2000) p. 817 suggests that one needs to multiply the coefficients on the probit model by the factor 1.6 to obtain values comparable to the logit form.

[12] The spectrum of legal ownership in our questionnaire was as follows: state owned enterprise, communal enterprise, co-operative, individual's business (sole enterprise), partnership, trade law partnership, joint stock Ltd, other. The legal structure of a firm reflects other developmental levels of the firm.

arrangement and its associated benefits (Schmitz 1992). It is likely to be more flexible and responsive to change than other firms. It is also likely to have more credit accessible to it since the more a firm is part of cluster of interrelated firms that "know" one another the more likely such a firm is to receive trade credit, or access references for bank credit. Such connectivity and transparency is not available to the more isolated firm who will only have far more limited and expensive forms of credit available. Since credit is a general constraint on small firm development in Poland (as well as many other countries) then sub-contracting is indicative ways of overcoming this (Ghatak, Mulhern and Stewart, 2003; Petersen and Rajan 1997).

The *performance* features of small firms in the two regions show a number of telling differences. The significant variables emerging from the study - the technological level of the products of the firm, the average wage, and intention to expand turnover - point to a range of clear differences between firms in the two regions. Gdansk's small firms are more likely to have a higher technological level of their products indicating greater productivity advances in this region.[13] The higher average wage of the Gdansk small firms should be correlated with the expected higher marginal productivity of labour, while the intention to expand turnover indicates the existence of higher profit levels[14] of the Gdansk firms and points once again the productivity differential between the two regions. [15]

4. Policy implications

This paper develops a link between small firm development and regional analysis in transitional economies. It has been shown to have evidence supporting it in two Polish diverging regions that are representative of wider regional divisions in the country. Conceptually it leans towards a view of the firm that emphasises the *qualitative* nature of its organisation and behaviour (Penrose 1956).

With respect to regional policy, programmes that apply across the national space have probably limited impact since the needs of small firms in very underdeveloped regions are very different from those in developed areas. Indeed there has been growing criticism of both the failure Business Support Centres in Eastern Europe (Bateman 2000) and the international, imported nature of so called *local* regional small firm programmes in Poland (Piasecka and Rainnie 2000). Specifically with regard to Poland it is also clear that the rate of regional polarization is increasing rapidly. This paper emphasizes the qualitative level of small firm's development in different regions of a transitional

[13] See Acs and Audretsch (1990) and Carlsson (1991) for the capacity of small firms to capture market share through productivity and innovation advances.
[14] "Intentionality" is linked to past and future performance (Pistrui et alia 2002)
[15] In economic theory the real wage is equal to the marginal product of labour in order for profit to be maximised. In the Cobb-Douglas framework also wage growth and profits are linked to productivity growth (McCann 2001 p241-2).

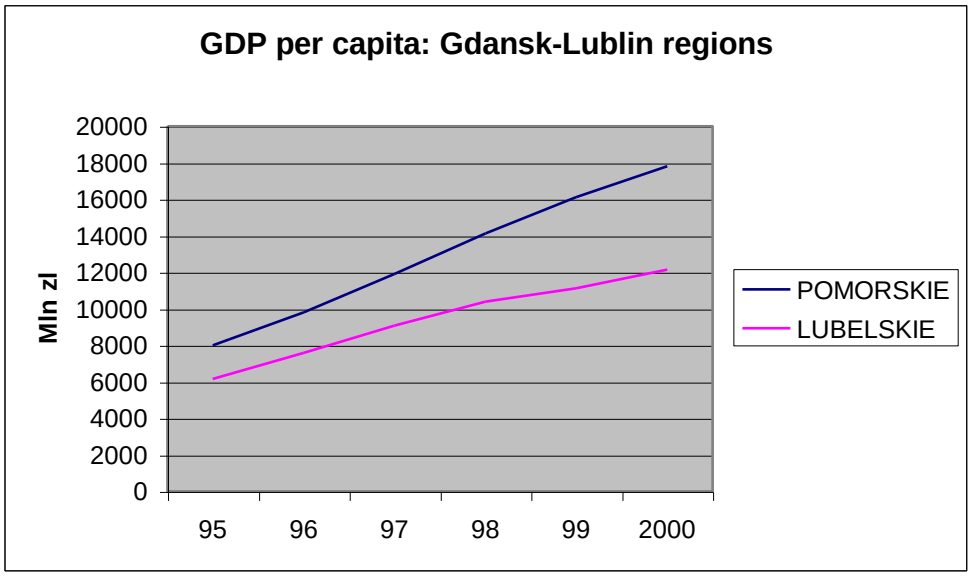
economy like Poland. Regional policy that addresses the specific deficiencies in S-C-P level of small firms will be more promising than generic strategies.[16]

5. Conclusion

This paper has investigated the determinants of differences in Polish firms in the regions of Gdansk and Lublin using a probit model. Of the twenty-nine potential determinants we found that five could explain significant differences between the two regions. These are the firm's legal status, the percentage of the firm's output that is subcontracted, whether the enterprise has introduced technologically improved goods, whether the firm intends to expand turnover and average gross wages. It demonstrates the existence of a correlation between small firm development, conceived of in terms of Structure-Conduct-Performance, and regional location in Poland. Further research is needed to explore its relevance to other transitional economies. Policy implications are suggested that especially point to the desirability of a regionally differentiated small firm policy.

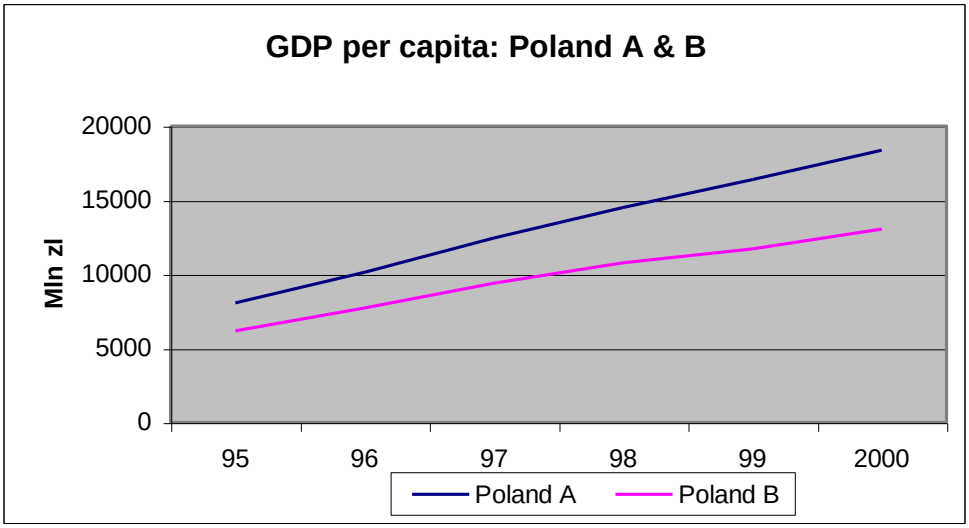
[16] See Mulhern (2003) for example of how such qualitative measures might be used to target faster growing firms.

Fig 1



Source Authors' calculations from GUS data base.

Fig 2



Source Authors' calculations from GUS data base

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Table 1: Probit Regional Differences Regressions

	Model 1			Model 2			Model 3		
Variable	**Coef**	**z-stat**	**Slope**	**Coef**	**z-stat**	**Slope**	**Coef**	**z-stat**	**Slope**
Intercept	–6.834	–2.871	—	–6.211	–5.658	—	–4.931	–6.039	—
Lstatus	0.343	2.107	0.081	0.249	1.921	0.067			
Sector	–0.079	–0.097	–0.019						
Fcapital	0.007	0.545	0.002						
Subcon	0.021	2.974	0.005	0.015	3.360	0.004	0.015	3.348	0.004
Qothereg	–0.005	–0.901	–0.001						
Qexport	0.001	0.0767	0.0001						
Franchis	0.210	0.224	0.050						
Demand	–0.220	–0.503	–0.052						
Comp	–0.372	–0.510	–0.088						
Techprod	0.398	1.010	0.094						
Internet	–0.182	–0.456	–0.043						
Newgoods	1.477	3.349	0.350	0.683	2.896	0.183	0.648	2.785	0.178
Newmethd	1.062	2.309	0.251						
Neworg	0.676	1.531	0.160						
Newprop	1.713	1.242	0.405						
Exsupprt	–1.131	–1.005	–0.268						
Farise	–0.195	–0.648	–0.046						
Turnover	0.122	1.090	0.029	0.183	2.816	0.049	0.205	3.049	0.056
Employed	0.009	0.473	0.002						
Empgrow	0.002	0.374	0.0004						
Humcap	–0.269	–0.678	–0.064						
Avewage	0.003	3.943	0.001	0.003	5.255	0.001	0.003	5.253	0.001
Trdunion	0.369	0.333	0.087						
Euaffect	0.071	0.258	0.017						
Eupreprn	0.216	0.509	0.051						
Loan2yrs	–0.496	–1.727	–0.117						
Revenuef	0.077	0.509	0.018						
Prgrow98	0.004	0.862	0.001						
Profityr	–0.304	–1.179	–0.072						
Summary									
Avg[$\phi(\mathbf{X\beta})$]			0.236			0.268			0.275
Fit	**Stat**	**Prob**		**Stat**	**Prob**		**Stat**	**Prob**	
R^2	0.386			0.305			0.288		
S	0.420			0.412			0.416		
AIC	1.215			1.031			1.042		
LR Statistic	86.600	0.000		68.569	0.000		64.688	0.000	
F(1→)				0.739	0.803		0.891	0.616	
Misspec	**Stat**	**Prob**		**Stat**	**Prob**		**Stat**	**Prob**	
χ^2(H,k')	16.805	0.965		3.679	0.596		4.184	0.382	
χ^2(A,1)	0.207	0.649		0.002	0.967		0.069	0.793	
χ^2(N,2)	8.790	0.012		1.371	0.504		1.003	0.606	

Avg[$\phi(\mathbf{X\beta})$] is the average value of the $\phi(\mathbf{X\beta})$ series – the latter is calculated at the estimated value of $\boldsymbol{\beta}$ for each observation – which is employed in the calculation of the slope {slope = $\boldsymbol{\beta} \times$ Avg[$\phi(\mathbf{X\beta})$]}. R^2 is the McFadden R^2 and F(1→) denotes the F-test for the exclusion of variables from model 1 to obtain the specified restricted form. χ^2(H,k') is a test for heteroscedasticity (discussed in the E-Views 4 User's Guide pp. 421–422) which is distributed with k' degrees of freedom, where k' is the number of variables in the estimated binary choice model excluding the intercept (model 1: k' = 29; model 2: k' = 5; model 3: k' = 4). χ^2(A,1) is the Ljung-Box test for first-order autocorrelation and χ^2(N,2) denotes the Jarque-Bera test for non-normally distributed residuals. All coefficients are expected to be positive except Trdunion, which can take either sign. All regressions use 163 observations with the dependent variable taking the unit value for 74 observations (representing Gdansk) and 89 being zero (Lublin). All estimations were carried out using Eviews 4.1.

Table 2: Logit Regional Differences Regressions

	Model 1			Model 2			Model 3		
Variable	**Coef**	**z-stat**	**Slope**	**Coef**	**z-stat**	**Slope**	**Coef**	**z-stat**	**Slope**
Intercept	–11.857	–2.805	—	–10.474	–5.296	—	–8.272	–5.548	—
Lstatus	0.591	2.053	0.083	0.440	1.939	0.070			
Sector	–0.173	–0.119	–0.024						
Fcapital	0.013	0.561	0.002						
Subcon	0.036	2.930	0.005	0.025	3.236	0.004	0.025	3.233	0.004
Qothereg	–0.009	–0.903	–0.001						
Qexport	–0.0001	–0.007	–1.172						
Franchis	0.367	0.232	0.052						
Demand	–0.292	–0.379	–0.041						
Comp	–0.525	–0.422	–0.074						
Techprod	0.706	1.059	0.099						
Internet	–0.279	–0.412	–0.039						
Newgoods	2.503	3.231	0.352	1.164	2.870	0.186	1.062	2.691	0.175
Newmethd	1.847	2.303	0.260						
Neworg	1.167	1.510	0.164						
Newprop	2.962	1.295	0.417						
Exsupprt	–1.907	–1.017	–0.268						
Farise	–0.350	–0.665	–0.049						
Turnover	0.206	1.100	0.029	0.306	2.836	0.049	0.335	3.047	0.055
Employed	0.014	0.436	0.002						
Empgrow	0.003	0.415	0.0004						
Humcap	–0.496	–0.731	–0.070						
Avewage	0.006	3.781	0.001	0.005	4.946	0.001	0.005	4.871	0.001
Trdunion	0.679	0.359	0.013						
Euaffect	0.092	0.195	0.013						
Eupreprn	0.315	0.421	0.044						
Loan2yrs	–0.842	–1.723	–0.118						
Revenuef	0.149	0.584	0.021						
Prgrow98	0.007	0.842	0.001						
Profityr	–0.507	–1.147	–0.071						
Summary									
Avg[$\phi(\mathbf{X\beta})$]			0.141			0.160			0.165
Fit	**Stat**	**Prob**		**Stat**	**Prob**		**Stat**	**Prob**	
R^2	0.382			0.302			0.284		
s	0.420			0.416			0.417		
AIC	1.220			1.036			1.047		
LR Statistic	85.758	0.000		67.756	0.000		63.861	0.000	
F(1→)				0.746	0.796		0.741	0.595	
Misspec	**Stat**	**Prob**		**Stat**	**Prob**		**Stat**	**Prob**	
χ^2(H,k')	18.160	0.941		3.742	0.587		4.021	0.403	
χ^2(A,1)	0.188	0.665		0.001	0.977		0.084	0.772	
χ^2(N,2)	12.607	0.002		1.637	0.441		0.600	0.741	

All statistics are the same as in Table 1 except Avg[$\phi(\mathbf{X\beta})$] employs the logistic distribution rather than the normal distribution.

Table 3: Gompit (Extreme Value) Regional Differences Regressions

	Model 1			Model 2			Model 3		
Variable	**Coef**	**z-stat**	**Slope**	**Coef**	**z-stat**	**Slope**	**Coef**	**z-stat**	**Slope**
Intercept	–6.935	–2.628	—	–6.182	–5.179	—	–4.993	–5.772	—
Lstatus	0.417	2.026	0.086	0.246	1.621	0.058			
Sector	–0.027	–0.033	–0.006						
Fcapital	0.006	0.419	0.001						
Subcon	0.022	2.628	0.005	0.017	3.070	0.004	0.017	3.131	0.004
Qothereg	–0.003	–0.471	–0.001						
Qexport	–0.001	–0.107	–0.0002						
Franchis	0.251	0.270	0.052						
Demand	–0.396	–0.846	–0.082						
Comp	–0.491	–0.624	–0.102						
Techprod	0.517	1.142	0.107						
Internet	–0.275	–0.560	–0.057						
Newgoods	1.505	2.988	0.312	0.750	2.839	0.177	0.703	2.686	0.168
Newmethd	0.960	1.829	0.199						
Neworg	0.676	1.399	0.140						
Newprop	1.652	1.048	0.342						
Exsupprt	–1.274	–1.038	–0.264						
Farise	–0.227	–0.669	–0.047						
Turnover	0.131	0.983	0.027	0.187	2.673	0.044	0.209	2.854	0.050
Employed	0.016	0.631	0.003						
Empgrow	0.001	0.161	0.0002						
Humcap	–0.270	–0.570	–0.056						
Avewage	0.004	3.676	0.001	0.003	5.290	0.001	0.003	5.316	0.001
Trdunion	0.091	0.068	0.014						
Euaffect	0.069	0.216	0.014						
Euprepm	0.316	0.686	0.065						
Loan2yrs	–0.518	–1.588	–0.107						
Revenuef	0.073	0.411	0.015						
Prgrow98	0.006	0.925	0.001						
Profityr	–0.417	–1.206	–0.086						
Summary									
Avg[$\phi(\mathbf{X\beta})$]			0.207			0.236			0.239
Fit	**Stat**	**Prob**		**Stat**	**Prob**		**Stat**	**Prob**	
R^2	0.381			0.304			0.292		
s	0.422			0.413			0.417		
AIC	1.221			1.032			1.037		
LR Statistic	85.556	0.000		68.302	0.000		65.489	0.000	
F(1→)				0.731	0.812		0.851	0.671	
Misspec	**Stat**	**Prob**		**Stat**	**Prob**		**Stat**	**Prob**	
χ^2(H,k')	31.712	0.333		4.253	0.514		2.508	0.643	
χ^2(A,1)	0.147	0.701		0.053	0.818		0.225	0.635	
χ^2(N,2)	2.346	0.309		0.896	0.639		0.110	0.946	

All statistics are the same as in Table 1 except Avg[$\phi(\mathbf{X\beta})$] employs the Type-I extreme value distribution rather than the normal distribution. The test for heteroscedasticity for Model 1 uses 159, rather than 163, observations. This is because four of the fitted probabilities from this model equal zero which means that the denominator of the scaling factor used in the auxiliary test regression was also zero. Thus, for these four observations the variables in the auxiliary regression could not be calculated and so were excluded.

Table 4. Full Name of variables

Legal status of firm	Lstatus
public or private sector of economy	Sector
ownership of other foreign firms	Fcapital
subcontracting activity	Subcon
export to other Polish regions	Qothereg
export abroad	Qexport
franchising activity	Franchis
adequacy of level of demand	Demand
foreign firms as the major competitors	Comp
technological level of firm's products	Techprod
internet use	Internet
new goods produced in last two years	Newgoods
new methods of production in the last two years	Newmethd
new organizational forms in last two years	Neworg
new business premises in last two years	Newprop
external financial support	Exsupprt
increase in fixed assets 1998-99	Farise
intention to increase turnover	Turnover
Numbers employed in the firm in 1999	Employed
percentage increase in employment 1998-99.	Empgrow
policy on human capital development	Humcap
Level of average wage in the firm	Avewage
absence of trade unions in the firm	Trdunion
optimism of EU accession upon the firm	Euaffect
preparation for the EU	Eupreprn
existence of a bank loan in 1988-99	Loan2yrs
revenue level in 1999	Revenuef
proportionate change in profits from 1997 to 1998	Prgrow98
number of years of positive profits	Profityr