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Knowledge Based Restructuring in Transition Economies

- The Role of Business Environment, Competition and ICT -

I Introduction

Over the last decade thousands of enterprises in transition countries have faced radical changes in their political and economic environment. At the same time, information and communications technology become all-pervasive, making it an essential infrastructure of the economy. On a firm level, advances in information and communication technologies have made environment dynamic and vibrant more than ever, changing the way organizations carry out day-to-day operations, making inevitable the use of internet to interact with clients and suppliers and information systems for decision support and strategic planning.

Some of the former state enterprises have responded to challenges, implementing both large and small innovations in work processes, business organization, supply chain management or introducing software applications, while in the same time a number of new enterprises have entered markets. These improvements and new entries, together with new ownership structure yielded considerable productivity increase and improved competitiveness at the world markets. On the other hand many companies remained dependent on subsidies, protected from competition or stayed under hostile business environment, delaying decision to change. This has brought considerable variation in the degree to which economies and

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enterprises have reallocated their resources, restructured their business and successfully applied available technological improvements.

With restructuring more successful in some countries than in others, the issue that comes up is to what extent such divergence relates to policies, incentives and conditions. Does success with reforms sought to increase competition, to harden firms' budget constraints or to improve business environment alleviates the need for developed ICT infrastructure, or ICT represents *sine qua non* for the second stage of restructuring in transition economies?

The structure of the paper is as follows. In section 2 we introduce the concept of knowledge based restructuring. In section 3 we use the results of the BEEPS II survey to pursue the question of the determinants of knowledge based restructuring. In section 4 we discuss the modeling strategy and empirical specifications. Section 5 presents our results and section 6 summarizes conclusions.

II Determinants of a Knowledge Based Restructuring – An Old Concept With a New Relevance

As noted by Roland (2000) the notion of enterprise restructuring is a rather vague concept. Aghion and Schankerman (1999) define the very nature of restructuring as the process undertaken by enterprises in order to adapt behaviour to that necessary for survival and success in a market economy. Grosfeld and Roland (1997) have introduced useful distinction between defensive and strategic restructuring. While defensive restructuring means taking measures to reduce costs and scale down unprofitable activities, strategic restructuring refers to the objective of innovation and investment necessary to enhance enterprise performance.

Djankov and Murrell (2002) surveyed the empirical literature and identified two groups of measures of restructuring: *a) measures based on enterprise decisions* - changes in the structure of corporate governance and management; renovations of factories; investment rates; introduction of new products, computerization of the accounting function; *b) measures based on enterprise performance* - productivity (total factor productivity levels or growth rate), labour productivity level or growth; profits; sales or revenue. Consequently, any of these measures can be used as a left-hand side variable. However, we can have a measure based on enterprise decisions as an explanatory variable and a measure based on enterprise performance as a dependent variable.

A number of studies¹ analyzed various determinants of restructuring: ownership, product market competition, role of managers, soft-budgets and broader institutional changes (business environment or institutional infrastructure).

In our paper because of endogeneity issues related to privatization we will try not to differentiate state-owned and privatized firms (privatization improves the performance, but better firms are more likely to be selected for privatisation). Thus, using only the distinction between old firms and new entrants (no state-owned predecessor) is useful because it is unambiguously exogenous. Generally, papers in the transition literature on restructuring generate different results on the effect of change in *ownership* on sales growth or strategic restructuring (see Djankov and Murell, (2002)). One possible way how ownership affects sales or productivity growth is through strategic restructuring as shown in Carlin, Fries, Schaffer and Seabright (2001).

As noted by Carlin, Fries, Schaffer and Seabright (2003), in the theoretical literature, there are models that suggest that more *competition* is good for innovation and others that highlight a hump-shaped relationship, in which a moderate degree of competition is better than either monopoly or intense competition.² Using new data set we will re-examine the role of the competitive pressure, coming both from domestic and international competition. We would expect this to be the best incentive to improving enterprise and corporate management, encouraging innovation and spurring economic growth. However, some competition related explanatory variables raise the issue of endogeneity, e.g. the number of competitors or firm's market share may be endogenous to the performance (the causality can go from performance to structure i.e. the successful performance of a firm will shape the market structure). However, in our paper we assume that in the second phase of transition the endogeneity is still a less of a problem than in established market economies and that

Recently, the attention has been drawn to the importance of the well-established regulatory and institutional framework. There is a growing literature that the business environment has a considerable impact on economic performance.³ Institutional infrastructure or *business environment* comprises a range of factors associated with the functioning of the state– from the corruption and organized crime, macroeconomic instability and non-transparent tax systems, to the uncertain enforcement of business contracts and property rights

¹ Djankov and Murrell (2000) surveyed over one hundred studies using the statistical technique of meta-analysis to synthesize the empirical results; Using the BEEPS 1 data, Carlin, Fries, Schaffer and Seabright (2001) and (2003) analyzed the impact on performance of ownership, soft budget constraints, the general business environment and a range of measures of the intensity of competition as perceived by a firm; Aghion, Carlin and Schaffer (2002) following the same approach analyzed the complementarities between hard budget constraint and competition.

² For a review of the theoretical and empirical literature on the link between competition and performance see Carlin, Fries, Schaffer and Seabright (2001) and (2003) and Aghion, Carlin and Schaffer (2002).

³ see Hellman and Schankerman (2000), Brunetti et al. (1997)

due to inefficient judiciary system. Again, we are facing the problem of endogeneity - we may think that business environment influence through restructuring on performance, (but performance can also influence restructuring)

In addition to these “standard” determinants, we investigate the role of the *ICT infrastructure*.⁴ The motivation comes from the impressive changes in the past decade and the widespread reach of information and communications networks that create great opportunities for transition countries. Although the rapid progress in ICTs completely changes information structure and economic activities, as well as the acquisition and dissemination of knowledge, it takes time to develop new IT strategies and infrastructure within enterprise – starting from the identification of the need, through the phase of learning-by-doing and improving the efficiency to the phase of complete adoption of the new ideas. On the one hand, former state-owned enterprises might undertake very small restructuring, continuing to serve a limited regional market or they might become completely integrated into the global economy. On the other hand, new entrants, predominantly SMEs, due to improved access to information networks and relatively cheap hardware and easy-to-use software, might implement computerization much faster. In this broader context after the inclusion of new entrants, ICT based changes are not solely related to the concept of the strategic restructuring or innovation. That is why we make conceptual distinction and use the term knowledge based restructuring.

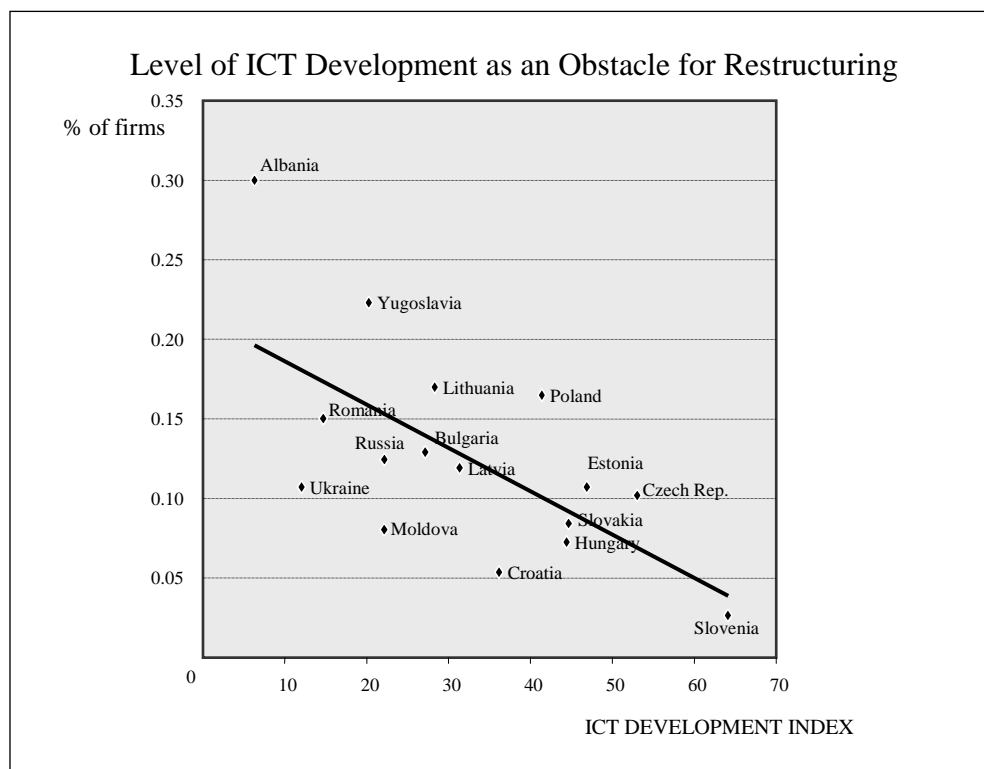
Given the vital role of ICTs, and access to information networks, we would like to address the question of whether the poor state of ICT access and use, represent a major impediment to knowledge based restructuring. We do not expect from each and every transition country to develop a substantial indigenous ICT industry, in hardware (computers, networking equipment, telecommunications equipment, etc.) or in software. In that sense, knowledge based restructuring is an all-inclusive approach rather than only about development of the new hi-tech industries or communication-technology services.

For the enterprises under restructuring it is far more important to have regular contact with ICT service providers than to have proximity to ICT producers.

To see whether the level of ICT development really creates an obstacle for successful restructuring we make use of the available data. As we will use the measure of perceived ICT impediment, we compare the results from survey with macro data using the ITU data base. From ITU data for the main phone lines, number of telephone subscribers, number of cell phones, number of PC's and internet subscribers per 100, we construct ICT development

⁴ The role of ICT was rarely used in this context. In a study of Georgian firms Djankov and Kreacic (1998) examined the influence of competition on defensive (employment cuts) and strategic restructuring (renovations and computerization).

index from the principal component analysis.⁵ The first principal component explains almost 80 per cent of the variance, and represents good summary measure. To proxy the level of problem, we are using BEEPS II data i.e. the percentage of the firms stated that the telecommunications are crating major or moderate impediment for normal functioning of an enterprise. There is a clear negative relationship between the level of ICT development and the percentage of firms that state that ICT development creates problem for the operation and growth of the business. In what follows, we will be using a measure of the quality of ICT infrastructure perceived by each firm as an explanatory variable, rather than attempting to infer this from macro data as measured by ITU or statistical agencies. As we will see later, the measure of the ICT infrastructure is actually part of the broader measure of the business environment.



Source: BEEPS II and ITU

Interestingly enough, ICT i.e. problems with telecommunications are not high on the agenda of the surveyed companies. From 21 offered impediments, the percentage of the companies that claimed that telecommunications compared to the other obstacles, represent a major problem, was lowest in Romania (15%), while in Poland and Bulgaria it is only on the 19th place (13% and 16.5% respectively), and 18th in Hungary. On the average the rank of the “problems with telecommunications” is about 19th place, far behind the other business environment problems, such as economic uncertainty, costs and access to finance, corruption,

⁵ We obtain ICT development index as a weighted average of the raw measures (the weights are the eigenvectors of the first components).

etc. Such low importance that countries attach to this problem may draw us to a conclusion that the availability of ICT services does not represent a major obstacle for restructuring. However this causality is not that simple as it seems. In the case of Albania one third of the companies and in the case of Lithuania and Poland more than 15% of the companies are having problems due to relatively low level of ICT development.

Innovation in this sense is not defined as the invention or the world's first application of new knowledge but rather as the first use of knowledge in a new context. For developed countries, possible indicator of the acceleration in the creation of knowledge is the number of new patents granted each year. However, as noted by Aghion et. al. (2002), patenting will be of much less relevance to firms in a transition economy. As we have argued, for the enterprise in transition economy, it is much more relevant to see whether that company introduced new product, adopted ISO standard, or opened a new production line.

One of the difficulties is to make a clear distinction between ICT as a tool and ICT as a result of restructuring itself e.g. computerization of accounting function can be viewed as the measure of restructuring based on enterprise decisions, but also as a variable that influence on the enterprise performance. Until now, none of the empirical studies had measured specific ICT investments and analyses its influence on restructuring. BEEPS 2 has improved the range of data, yet this data source is not particularly suited to study ICT based changes within enterprises.

Finally, a number of papers emphasized the importance of the difference between managerial incentives for restructuring (innovation). Although the skilled and adaptive people will play a crucial role for long-run restructuring, the restructuring literature is focusing more on the role of managers. Manager's human capital and incentives are one of preconditions for successful restructuring.

We can examine this using the decision to introduce ICT based change in the enterprise. Managers might be unable to respond to new incentives, no matter how well designed – e.g. manager may not understand the role of ICT change that can create competitive advantage in the market place, no matter how good incentive scheme is. On the other hand manager will choose not to introduce such change, when the incentive scheme is bad. Thus, good managers might not work well under badly structured incentives, and vice versa. Thus, to a certain extent, ICT applications in many enterprises in transition are government pulled i.e. they are related to implementation of necessary regulations (getting product to the market, certification), new accountancy rules, new reporting forms or custom procedures rather than being business pushed ICT applications.

However, instead using only data on manager, we proxy *human capital* using the percent of the workforce with the university education level. We assume that a higher level of human

capital makes “innovation” more probable. Next we turn to data description and to empirical analysis.

III The Preliminary Data Description

In this paper we use the results of the BEEPS II – the second large cross-country survey of firms from 27 transition countries. The BEEPS is a large dataset not only in terms of the sample size but also in terms of the measures it provides about the business environment and the performance of enterprises. BEEPS II is covering 6667 firms in 27 countries of the region. Detailed overview of the second round results was presented in Fries and Polanec (2003).⁶ We should note that like any other survey BEEPS is based upon self-reported information on the change in real sales as well as on the kinds of restructuring activities carried out by the firms.

The BEEPS is based on the random sampling from the population of firms in each country, except that minimum quotas were imposed for state-owned firms and large firms. The sectoral composition of the sample was 38 per cent industry and 62 per cent services, reflecting the relative contribution of these two sectors to the region’s GDP. Two-thirds of the firms surveyed were small (2 to 49 employees), 19 per cent were medium-sized (50 to 249 employees) and 14 per cent were large. Of the firms in the sample, 69.5 per cent are newly established private firms, 16.5 per cent are privatized and 14 per cent are state-owned. The survey included approximately 170 or 250 firms from each of the 27 countries, with larger samples in Poland, Ukraine and Russia (445 firms). From the total sample, we omit firms missing the most basic indicators (industry, size classification, ownership classification, sales growth and employment growth etc.) leaving us with a sample of 3,341 firms.

The BEEPS shows the relative influence of competition, ownership and features of firms’ external business and infrastructural environment on their restructuring actions. The advantage of the BEEPS database is the richness in a comprehensive range of information on firm performance, involvement in exporting, product innovation, business practices, business restructuring reorganisation etc. This allows us to approach to the issue of innovation or knowledge based restructuring from the enterprise sector perspective.

⁶ The Business Environment and Enterprise Performance Survey II (BEEPS II), was developed jointly by the World Bank and the European Bank for Reconstruction and Development, and examines a wide range of interactions between firms and the state. The first round of the survey BEEPS I was implemented in 1999 and covered 4104 firms in 25 countries. The survey is based on face-to-face interviews with firm managers and owners, BEEPS is designed to generate comparative measurements in such areas as corruption, state capture, lobbying, and the quality of the business environment, which can then be related to specific firm characteristics and firm performance. See: <http://info.worldbank.org/governance/beeps/front.htm>

We consider the way to measure the country-level factors that determine the overall environment for business activity, and which may be important determinants of performance. The first such indicator is the business environment index.

We are constructing the measure that represents the business environment based on perception of the quality of the general business environment. Responds are obviously subjective and as such are subject to bias due to the blaming culture whenever the company is performing poorly. We are using question which asked about the extent to which aspects of the macroeconomic conditions, taxation, functioning of judiciary, corruption, etc., create obstacles for normal functioning of an enterprise.⁷ Again, we utilize the principal component analysis and the raw measures of business environment are the ratings by firms on scale of 1 (major obstacle) to 4 (no obstacle).

Table 2 – Business Environment Index Construction

Component	Eigenvalue	Difference	Proportion	Cumulative
1	3.98	2.78	0.44	0.44
2	1.19	0.39	0.13	0.57
3	0.81	0.13	0.09	0.66
4	0.67	0.06	0.07	0.74
5	0.62	0.02	0.07	0.81
6	0.60	0.11	0.07	0.87
7	0.49	0.13	0.05	0.93
8	0.35	0.07	0.04	0.97
9	0.29		0.03	1.00
Eigenvectors				
Variable			1	
tax administration			0.30	
customs			0.32	
business licensing			0.32	
labour regulation			0.29	
judiciary			0.36	
corruption			0.39	
Street crime			0.35	
organised crime			0.37	
contract violations			0.28	

We obtain the index from the first principal component, as a weighted average of the raw measures (the weights are the eigenvectors of the first components). The results of the principal component analysis are presented in Table 3. The first principal component explains 44 per cent of the variance. That is significantly higher than the other eight components. The heaviest weight is given to the corruption, followed by the crime, judiciary, etc. As noted by Carlin, Fries, Schaffer and Seabright (2001) this answer is a subject to a bias due to manager's tendency to complain, and to put blame to unfavorable business environment, as an excuse for

⁷ We deliberately leave out the question about the telecommunications, as we will construct additional variable that will describe ICT level of development.

the firm's bad performance. The next step is to normalize the BE index to lie in the interval [0,1]. Each component is multiplied with the raw data, and then divided with the sum of the component scores.

Next table shows the ranking of countries according to the quality of the business environment constructed from the BEEPS 1 and BEEPS 2 data.⁸ Countries are ranked from "best" to "worst" on each measure so that those with the hardest budget constraints and the highest quality business environments are ranked first.

Table 3 Country rankings for business environment variables

	BE Index 1999	RANK 1999	BE Index 2002	Rank 2002
Estonia	0.68	1	0.69	7
Hungary	0.66	2	0.74	4
Slovenia	0.64	3	0.76	2
Armenia	0.64	4	0.71	6
Uzbekistan	0.57	5	0.75	3
Slovakia	0.54	6	0.57	16
Poland	0.54	7	0.47	25
Latvia	0.53	8	0.62	13
Czech Republic	0.52	9	0.65	8
Bosnia	0.50	10	0.50	23
Bulgaria	0.49	11	0.58	15
Belarus	0.48	12	0.54	20
Azerbaijan	0.47	13	0.82	1
Croatia	0.45	14	0.64	10
Macedonia	0.43	15	0.55	19
Russia	0.40	16	0.65	9
Ukraine	0.40	17	0.55	18
Kazakhstan	0.39	18	0.72	5
Lithuania	0.39	19	0.63	11
Georgia	0.39	20	0.53	21
Romania	0.35	21	0.53	22
Albania	0.35	22	0.40	26
Kyrgyzstan	0.33	23	0.63	12
Moldova	0.31	24	0.48	24
Tajikistan	-	-	0.62	14
Yugoslavia	-	-	0.56	17

To our surprise several CIS countries (Armenia, Azerbaijan, etc) are highly ranked. Nevertheless, we have to remember that we should expect positive sign for the business environment variable.

Next, using the same procedure, we derive the index of the perceived ICT Infrastructure quality. We have obtained this index from questions on how hard is to get connected, and on perception of the quality of the telecommunications and electricity (as a proxy for ICT infrastructure). Again, answers are obviously subjective and as such are subject to bias.

⁸ Reduced BEEPS I data base has 1952 observations.

Table 4 – Infrastructure Impedimenta Index Construction

Component	Eigenvalue	Difference	Proportion	Cumulative
1	1.63	0.69	0.54	0.54
2	0.94	0.51	0.31	0.86
3	0.43		0.14	1.00
Eigenvectors				
Variable			1	
Get connected			0.31	
telecommunications			0.66	
electricity			0.68	

An alternative to this approach would be to study whether the companies that invested in R&D activities improved their performance. BEEPS II questionnaire allows us to do this and this important issue remains to be examined.

Finally, we obtain the variable for innovation — in the sense of strategic restructuring — was constructed from the first principal component of responses to four questions on whether, in the previous period, firms had developed a new product line or upgraded an existing one, opened a new plant or obtained new technology.⁹

Table 4 Knowledge based Restructuring Index Construction

Component	Eigenvalue	Difference	Proportion	Cumulative
1	1.91	1.02	0.48	0.48
2	0.89	0.24	0.22	0.70
3	0.66	0.12	0.16	0.87
4	0.54		0.13	1.00
Eigenvectors				
Variable			1	
new product			0.56	
upgrade			0.55	
new technology			0.52	
new plant			0.33	

The resulting index was scaled from zero (firm did none of these) to four (firm engaged in all four activities). The results of the principal component analysis are presented in Table 3.¹⁰ The first principal component explains 48 per cent of the variance. The heaviest weight is given to the development of a new product line, followed by the upgrading of the existing product, new technology and opening of a new plant.

⁹ More details about the indices of the various dimensions of business environment can be found in Carlin, Fries, Schaffer and Seabright (2001). Useful overview of Principal Component Analyses was given in Johnston (1984). All calculations were done using the Stata statistical package. Main reference for the methodology is Baum, Schaffer and Stillman (2003).

¹⁰ ISO accreditation was deliberately dropped due to unreliability of the data compared to the official ISO figures.

IV Estimation

We are now analysing the impact on restructuring of ownership, soft budget constraints, business environment, ICT infrastructure impediments and a number of measures related to the level of competition as perceived by a firm. Like in the previous part we are using the large cross-sectional data set (BEEPS II). The empirical strategy is to pool the observations from the sample and to estimate performance and strategic restructuring equations. This part makes use of methodology presented in the several papers written by Carlin, Fries, Schaffer and Seabright.¹¹ The basic idea is to use cross-country variation in the BEEPS data in order to provide instruments for the business environment variable. The business environment faced by firms varies across countries. The interaction between country dummies and competition variables is used to provide instruments for the business environment, soft budget constraints, etc. faced by the enterprises.

Following the Carlin, Fries, Schaffer and Seabright (CFSS) approach, the strategy is to estimate equations for performance, with the dependent variable measured in two ways: first, by the real growth of sales over the preceding three years, and second by the growth of real labour productivity over the same period. We assume that firm's performance depend on several types of variable, some of which are evidently endogenous: ownership, competition variables, the extent of restructuring activity, the state of the business environment and the ICT indicators.

$$\text{PERFORMANCE} = \beta_0 + \beta_1 \text{COMPETITION} + \beta_2 \text{DE_NOVO} + X\beta_3 + \beta_4 \text{BE} + \beta_5 \text{HC} + \beta_6 \text{ICT} + u$$

We not only look at the overall impact of ICT development or competition on performance, but also investigate the channels through which such an impact may work. In particular, we look at the way in which business environment, competition and other variables influence aspects of firms' restructuring activities, and in the next step, how these restructuring activities affect performance.

We take strategic restructuring to depend on several variables:

$$\text{STRREST} = \beta_0 + \beta_1 \text{COMPETITION} + \beta_2 \text{PRESSURE} + \beta_3 \text{DE_NOVO} + X\beta_4 + \beta_5 \text{BE} + \beta_6 \text{EDU} + \beta_7 \text{ICT} + \beta_8 \text{SBC} + u$$

¹¹ For more details see Carlin, Fries, Schaffer and Seabright (2002) and (2003). As argued in CFSS papers and in Aghion, Carlin and Schaffer (2002) the soft budget constraint environment faced by firms varies across countries. Poor performance by a firm in one country may be less likely to generate tax arrears than if it operated in another country. The interaction of country dummies and competition variables is used to provide instruments for the soft budget constraint faced by the firm.

STRREST is the strategic restructuring (or innovation) variable; MARKET COMPETITION is measured by two components NUMBER OF COMPETITORS and PRICE ELASTICITY (i.e. the effects of 10% price increase); DE_NOVO is a dummy variable for a private firms without a state-owned predecessor; PRESSURE, and BE are variables for market pressure and business environment, respectively. ICT represents a variable for impediments related to the communication and other infrastructure (higher value of the index is associated with a lower level of impediments), SBC represents the percentage of subsidies and arrears to total sales and u is an error term. Finally, X represents a set of controls (size of firm measured by the log of employment (SIZE), export firms (EXPORT), location as measured by a dummy for whether the firm is located in a large city (BIGCITY) and sector as measured by a dummy for the service sector (SERVICES), etc.

The variables *STRREST*, *BE*, and *ICT* are constructed using principal components from responses to various relevant questions as presented in the previous section.

V Results

We begin by reporting the results of reduced form estimations of the restructuring and performance indicators on the exogenous variables.

- Competition effects are important - Own-price elasticity shows up as very important in the restructuring regressions. The indication that competition effects are important comes from the positive sign on the variable for firms reporting inelastic or weakly elastic own price elasticity. We find support for impact of increased competitive pressure from foreign and domestic firms on strategic restructuring.
- New private firms show higher levels of restructuring and have significantly higher sales growth. Newly established firms show lower productivity growth than established firms due to the fact that they started from the relatively higher level of productivity and due to employing labour faster than their sales have been growing. As noted by CFSS (2003) there is a “*survivor bias*” – part of the positive relationship between new private firms and sales growth is related to the fact that only successful new companies were observed i.e. survivors.
- Exporters represent the winners of the transition. Firms that are exporting lead in strategic restructuring, and they reported growth both in productivity and in sales. These firms saw sales growth 17% and productivity growth 13% higher than others. Alternatively, the pressure coming from foreign competitors is important determinant of restructuring. Thus, foreign trade liberalization represents very important determinant of the strategic restructuring.

- Reduced form equations BEEPS II reveals that developed ICT sector doesn't represent sine qua non for strategic restructuring. The sign is negative and highly significant, bringing us to the preliminary conclusion that during this period even countries or more precisely firms that identified availability of ICT as an obstacle to its growth were in position to develop their technology. This is also in accordance to our previous conclusion that availability of ICT services does not represent a major obstacle for restructuring at this stage of development in most of the transition countries. The share of those with the university degree doesn't represent significant determinant of any of the variables under investigation.
- Size (log employment) is positively related both to the restructuring and to the performance measured by sales growth. Service sector is lagging in all areas. The effect of the initial over-manning of manufacturing firms still hasn't dried up. One difference compared to the results from the BEEPS I is that smaller cities and rural areas are catching up. Finally, country fixed effects are highly significant i.e. the F-test of fixed effects confirms the joint significance of country effects.

REDUCED FORM ESTIMATES OF DETERMINANTS OF RESTRUCTURING AND PERFORMANCE

	STRATEGIC RESTRUCTURING	SALES GROWTH	LABOUR PRODUCTIVITY GROWTH
* significant at 10% level ; ** at 5% level; *** at 1% level	coeff. (s.e.)	coeff. (s.e.)	coeff. (s.e.)
NUMBER OF COMPETITORS (0 IS OMMITED)			
1TO3	-0.005 (0.193)	0.026 (0.048)	-0.022 0.083
MORETHAN3	-0.222 (0.190)	-0.017 (0.047)	-0.035 0.082
ELASTICITY (OMMITED COMPLETELY ELASTIC)			
VERY ELASTIC	0.130 ** (0.061)	0.027 * (0.015)	0.017 0.026
SLIGHTLY ELASTIC	0.277 *** (0.054)	0.047 *** (0.013)	0.013 0.023
INELASTIC	0.320 *** (0.062)	0.068 *** (0.015)	0.033 0.027
PRESSURE - DOMESTIC COMPETITION	0.072 *** (0.025)	-0.012 ** (0.006)	-0.009 0.011
PRESSURE - FOREIGN COMPETITION	0.103 *** (0.021)	0.009 * (0.005)	-0.001 0.009
PRESSURE - CUSTOMERS	0.092 *** (0.025)	0.009 (0.006)	-0.006 0.0107
ORIGIN (OMMITED STATE AND PRIVATIZED)			
DE_NOVO	0.282 *** (0.052)	0.051 *** (0.013)	-0.209 *** 0.020
LOGEMP (SIZE)	0.140 *** (0.015)	0.015 *** 0.004	(OMMITED)
ICT INFRASTRUCTURE AVAILABILITY	-0.145 *** (0.036)	0.016 * 0.009	-0.007 0.016
EXPORT	0.311 *** (0.052)	0.168 *** 0.013	0.133 *** 0.022
SERVICES	-0.420 *** (0.046)	-0.017 0.011	-0.035 * 0.019
BIGCITY	0.022 (0.050)	-0.010 0.012	0.000 0.021
CONSTANT	0.648 *** (0.240)	-0.243 *** 0.059	0.027 0.100
SHARE OF UNIVERSITY EDUCATED WORKERS	0.001 (0.001)	0.000 0.000	0.000 0.000
R²			
WITHIN	0.150	0.106	0.057
BETWEEN	0.012	0.472	0.012
OVERALL	0.141	0.115	0.054
TEST OF SIGNIFICANCE OF FIXED EFFECTS			
F(25, 3400)	7.24	4.66	3.63
p-value	0.000	0.000	0.000
Number of observations = 3441 Source: BEEPS 2			

Next we turn to the determinants of knowledge based restructuring and performance after including the effects of the endogenous variables.

SALES GROWTH		GMM		2SLS	
* = significant at 10% level ; ** = significant at 5% level; *** = significant at 1% level		coeff. (s.e.)		coeff. (s.e.)	
NUMBER OF COMPETITORS (0 IS OMITTED)					
1TO3		0.000		0.030	
		(0.042)		0.045	
MORETHAN3		-0.031		-0.028	
		(0.041)		0.044	
ELASTICITY (OMMITTED VERY ELASTIC)					
ELASTIC		0.005		0.006	
		(0.006)		0.006	
SLIGHTLY ELASTIC		0.048	***	0.058	***
		(0.013)		0.015	
INELASTIC		0.062	***	0.056	***
		(0.012)		0.015	
ORIGIN (OMMITTED STATE AND PRIVATIZED)					
DE_NOVO		0.059	***	0.083	***
		(0.016)		0.019	
LOGEMP (SIZE)		0.025	***	0.030	***
		(0.004)		0.005	
ICT INFRASTRUCTURE AVAILABILITY					
		0.038	***	0.033	*
		(0.014)		0.018	
SERVICES		-0.008		-0.033	**
		(0.013)		0.016	
BIGCITY		-0.013		-0.007	
		(0.012)		0.013	
STRATEGIC RESTRUCTURING		0.039	**	0.004	
		(0.016)		0.023	
BE		-0.009		0.003	
		(0.018)		0.026	
TOTAL SUBSIDIES		0.001		0.003	
		0.002		0.003	
CONSTANT		-0.297	***	-0.288	***
		0.070			
Robust standard errors Number of observations = 3441		Hansen J statistic (overidentification test of all instruments): 53.052 $\chi^2 (47) p = 0.2526$			
Tests of instrument relevance in first-stage regressions: Shea					
VARIABLE	Partial R ²	Partial R ²	F(50,3380)	p-value	
STRATEGIC RESTRUCTURING	0.0211	0.0279	1.94	0.0001	
BE	0.0313	0.0384	2.7	0	
TOTAL SUBSIDIES	0.0276	0.0303	2.11	0	

STRATEGIC RESTRUCTURING		2SLS	GMM
*= significant at 10% level ; **= significant at 5% level ; ***= significant at 1% level		coeff. (s.e.)	coeff. (s.e.)
NUMBER OF COMPETITORS (0 IS OMMITED)			
ITO3		0.210	0.197
		0.258	0.251
MORETHAN3		-0.014	-0.027
		0.257	0.251
ELASTICITY (OMMITED VERY ELASTIC)			
ELASTIC		0.015 *	0.015
		0.019	0.018
SLIGHTLY ELASTIC		0.244 ***	0.262 ***
		0.053	0.052
INELASTIC		0.286 ***	0.257 ***
		0.066	0.064
PRESSURE			
PRESSURE DOMESTIC COMPETITION		0.039	0.038
		0.028	0.027
PRESSURE FOREIGN COMPETITION		0.057 *	0.063 **
		0.030	0.027
PRESSURE CUSTOMERS		0.042	0.047 *
		0.027	0.026
ORIGIN (OMMITED STATE AND PRIVATIZED)			
DE_NOVO		0.293 ***	0.293 ***
		0.077	0.074
LOGEMP (SIZE)		0.120 ***	0.125 ***
		0.019	0.018
ICT INFRASTRUCTURE AVAILABILITY		0.124	0.114 **
		0.081	0.057
EXPORT		0.304 ***	0.297 ***
		0.058	0.057
SERVICES		-0.399 ***	-0.392 ***
		0.051	0.051
BIGCITY		-0.062	-0.073
		0.054	0.053
SHARE OF UNIVERSITY EDUCATED		0.001 *	0.001 *
		0.001	0.001
MANAGERS EDUCATION		0.012	0.015
		0.021	0.020
TOTAL SUBSIDIES		0.035 **	0.032 **
		0.015	0.014
BE		0.390 ***	0.372 ***
		0.114	0.082
CONSTANT		-0.521	-0.495
		0.399	0.344
Robust standard errors	Hansen J statistic (overidentification test of all instruments): 54.341		
Number of observations = 3441	χ^2 (48) p= 0.24569		
Variable	Partial R ²	F(50,3374)	p-value
BE	0.0416	2.93	0
TOTAL SUBSIDIES	0.0306	2.13	0

- Larger firms and exporters are much more likely and those in the service sector much less likely to have engaged in restructuring.
- Favourable business environment is an important positive determinant of the decision to innovate. Business environment indirectly, through strategic restructuring affects sales growth as strategic restructuring represents positive and significant determinant of the performance equation.
- In our restructuring GMM equation, ICT environment represents significant positive determinant of the restructuring. What is probably the crucial finding is the fact that ICT both directly and indirectly affects performance equation;
- The number of competitors is not a significant determinant while demand elasticity is an important positive determinant of restructuring, as well as pressure from foreign competitors and customers (pressure from domestic competitors is positive but insignificant).
- Subsidies are weakly positively related to knowledge based restructuring. We can see this as a governmental support to specific sectors and firms which does not necessary poorly-perform. However in order to give a definite answer we need to examine how subsidies are related to defensive restructuring. The subsidies appear to have no independent influence on sales growth except very mild indirect effect, through restructuring.

The validity of the instruments was tested using the Hansen J-test of orthogonality restrictions. The diagnostic tests for the knowledge based restructuring equation are broadly reassuring.¹² In particular, the J-test is passed, which means that the instruments are valid, exogenous and do not belong in the set of regressors. However, although the statistics of the instruments in the first stage regressions are significant, they are rather low and point to the possibility of a problem of weak instruments. The specification of the sales growth equation is similar to the second equation, as indicated by the diagnostic tests. The J-test is passed, but there are again signs of weakness of the instruments.

¹² We present several tests. The first-stage results include Shea's (1997) "partial R-squared" measure of instrument relevance that takes inter-correlations among instruments into account, and the F-test of the excluded instruments that corresponds to the latter R-squared measure. The Hansen test is a test of overidentifying restrictions. The joint null hypothesis is that the excluded instruments are valid instruments, i.e. uncorrelated with the error term, and that they are correctly excluded from the estimated equation. We have calculated diagnostic tests using Stata commands *ivreg2*, *ivendog*, *ivhettest*. A full discussion of these computations and related tests can be found in Baum, Schaffer, and Stillman (2002). Due to the limitation of Stata Intercooled version we were not able to obtain Pagan-Hall test.

VI Conclusions

The main finding of this paper is the role of ICT infrastructure in influencing restructuring and performance. We find that new firms are driving the innovation process in the transition economies and that both the availability of ICT and the existence of competitive pressure raise innovation. The question of subsidies needs to be more analysed. It is unclear whether subsidies are now becoming more related to the strategic restructuring through a governmental support to certain industrial sectors, or subsidies are still linked to defensive restructuring, as a support to deal with redundancies.

It is obvious, that better communication and information technologies, are going to be more and more important, as the other variables, such as market pressure, hard budget constraint, dominance of private ownership become a standard. ICT provides unique opportunity to the whole real sector to restructure faster and more efficiently as it decreases transaction costs. We believe that with the enterprises entering into the second phase of restructuring, the importance of ICT infrastructure is becoming more apparent. The paper shows that availability of the ICT influences the performance (sales growth) both directly and indirectly via restructuring.

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