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What Drives Firm Productivity Growth?

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Abstract

This paper presents new evidence on the causal links between changes in the business environment and firm productivity growth. It contributes to the literature in three important aspects. First, it constructs a unique database merging information from two large firm-level databases. The samples of both databases are merged on four criteria—country, sub-national location, firm size, and year—producing a panel of 22,004 firms in eight economies of Eastern Europe and the former Soviet Union: Bulgaria, Croatia, Czech Republic, Estonia,, Poland, Romania, Serbia, and Ukraine. Second, the paper addresses shortcomings of earlier studies, namely reverse causation, multicollinearity, and unreliable productivity estimates. Firm productivity growth is estimated drawing on corporate financial data from manufacturing firms included in the AMADEUS database. Changes in the business environment are estimated from the World Bank Enterprise Surveys conducted in 2002 and 2005. Multicollinearity problems in the full model regression are mitigated by constructing a set of six aggregate indicators of the business environment (using principal component analysis). The paper finds that, over the period 2001 to 2004, an increase of one standard deviation in infrastructure quality, financial development, governance, labor market flexibility, labor quality, and market competition raises the total factor productivity of the average firm by 9.8, 7.8, 3.2, 3.4, 5.8, and 3 percent, respectively. Lastly, the paper decomposes firm productivity growth and ranks the relative impact of changes in these six aspects of the business environment by country, by firm size, and by industry.

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1. Introduction

This paper addresses a central question in the recent literature on the microeconomics of growth: What is the impact of changes in the business environment on firm productivity? Institutions and policies determine the business environment within which individuals accumulate skills and firms accumulate capital and produce output. Regulations and laws exist to protect against diversion, but are often instruments of predation in an economy. A good business environment reduces rent seeking activities, supports productive activities, and encourages skill acquisition, capital accumulation, and innovation.

This paper builds upon the recent research by Dollar, Hallward-Driemeier, and Mengistae (2003), Bastos and Nasir (2004), and Escribano and Guasch (2005) in using data from recent World Bank Enterprise Surveys to link indicators of the business environment to firm-level productivity. These studies have done much to overcome the many shortcomings of the macroeconomic literature on this topic (Knack and Keefer, 1995; Hall and Jones, 1999; Acemoglu, Johnson, and Robinson, 2001).[1] However, these earlier papers that were the first to use data from the World Bank Enterprise Surveys suffer from two major estimation problems. First, the countries covered were surveyed just once and only a single year of business environment indicators is available. Given the cross-sectional nature of the data, regressions potentially suffer from a problem of reverse causality—some business environment indicators whose effect on firm productivity is estimated may themselves be affected by firm productivity. For example, financing from foreign banks may have a positive effect on firm productivity, but concurrently, financing from foreign banks may be influenced by firm productivity (i.e., foreign banks are more willing to lend to only the most productive domestic firms). Second, while multiple years of data are collected for production function variables in some of these countries, measurement error and non-response plague the recall data collected by these surveys.

The paper contributes to the literature in two important respects. First, a unique dataset is constructed by merging information from two large databases of European firms—the Business

[1] As Dollar, Hallward-Driemeier, and Mengistae (2003) note, the literature that examines the links between the business environment and productivity at the macroeconomic level suffers from three major shortcomings: (i) few countries have good data on the business environment that are necessary to derive robust statistical results (Levine and Renelt, 1992; Rodriguez and Rodrik, 2000); (ii) the proxies used as explanatory variables provide minimal guidance about what governments need to do to improve their business environment; and (iii) using national-level data assumes that the business environment is the same across locations within a country, but interesting variation may exist based on heterogeneous local governments and institutions.

Environment and Enterprise Performance Survey (BEEPS) and AMADEUS—in order to address the aforementioned shortcomings of the earlier studies. For the measurement of the business environment, the analysis draws on firm-level data from the BEEPS, which was conducted by the World Bank in conjunction with the European Bank for Reconstruction and Development (EBRD) and covers all countries of Central and Eastern Europe, the former Soviet Union, and Turkey. In an effort to track changes of evolving business environments and benchmark the effects of reforms, BEEPS was conducted in 2002 and again in 2005, asking an identical core set of questions (covering 367 variables) in both rounds to ensure comparability across countries and years. For the estimation of firm productivity, the analysis uses data from the May 2006 edition of the AMADEUS database, a comprehensive, pan-European commercial database compiled by Bureau van Dijk. For each firm, the database includes up to ten years of accounting data. The manufacturing sector of these two large databases are merged on four criteria—country, sub-national location, firm size, and year—producing a large 4-year panel of 22,004 manufacturing firms in 8 countries, Bulgaria, Croatia, the Czech Republic, Estonia, Poland, Romania, Serbia, and Ukraine. This unique dataset enables us to measure the effect of changes in the business environment on firm-level productivity growth over the period 2001 to 2004.

Second, in order to mitigate the problems of multicollinearity in the full model regression, a new set of robust indicators is constructed, using principal component analysis on quantitative variables from the BEEPS manufacturing dataset, that summarizes the following five distinct aspects of the business environment: (a) infrastructure quality, (b) financial development, (c) governance, (d) labor market flexibility, and (e) labor quality. Variable selection for PCA is guided by the preference for quantitative over qualitative indicators for two reasons. First, quantitative responses link directly to objective, actionable policy actions, as opposed to firm perceptions. Second, there are numerous statistical and measurement problems associated with the use of perception-based data, such as Likert-scale survey responses.[2] The construction of each indicator meets the three variables per component minimum threshold recommended for exploratory factor analysis (Thurstone, 1935; Kim and Mueller, 1978b). Furthermore, all synthetic indicators are given by the first principal component of their

[2] For example, based on data from Enterprise Surveys in 33 African and Latin American countries that used instruments similar to those in the BEEPS, González, López-Córdova, and Valladares (2007) show that perceptions adjust slowly to firms' experience with corrupt officials and hence are an imperfect proxy for the true incidence of graft.

respective set of underlying BEEPS variables, and three separate tests—the Guttman-Kaiser criterion, Cattell's scree test, and Humphrey-Ilgen parallel analysis—confirm the decision to retain only the first principal component.

The estimation strategy follows a two-step approach and exploits cross-cell (defined by country, sub-national location, and firm size) variation in the changes across time of the five synthetic business environment indicators, as well as a sixth measuring the level of competition (based on the four-firm concentration ratio for each 4-digit NACE industry), to determine their effect on firm-level productivity.[3] First, a production function equation whose residuals measure total factor productivity (TFP) is estimated using the methodology of Levinsohn and Petrin (2003), which corrects for the crucial simultaneity bias arising from the fact that firms make input choices with knowledge of their productivity. Second, a first-differenced equation in firm characteristics, whose dependent variable is the two-year change in log TFP and whose main regressors of interest are the lagged two-year changes in six different business environment indicators, is estimated using ordinary least squares with White correction for heteroskedasticity. The availability of four years of production function data from the AMADEUS database allows the model specification to control for lagged productivity in this second step. This feature is particularly important for consistency given the assumption in Levinsohn and Petrin (2003) of a Markov process for productivity (Fernandes, 2007).

The results of the regression analysis confirm that firm-level productivity growth is directly linked to important factors in the business environment and strongly support the presence of large TFP gains from successful efforts to improve these microeconomic foundations of economic development, even after controlling for unobserved firm, industry, sub-national location, and country heterogeneity. The main findings of the paper are as follows. Over the period 2001 to 2004, (i) a one standard deviation increase in the *infrastructure* indicator raises TFP of the average firm by 9.8 percent; (ii) a one standard deviation increase in the *financial development* indicator raises TFP of the average firm by 7.8 percent; (iii) a one standard deviation increase in the *governance* indicator raises TFP of the average firm by 3.2 percent; (iv) a one standard deviation increase in the *labor market flexibility* indicator raises TFP of the

[3] NACE Rev.1 (*Nomenclature générale des activités économiques dans les Communautés européennes*), the standard industrial classification of economic activities within the European Communities, is identical to the United Nations Statistical Division's International Standard Industrial Classification of All Economic Activities (ISIC Rev. 3) at the one- and two-digit levels.

average firm by 3.4 percent; (v) a one standard deviation increase in the *labor quality* indicator raises TFP of the average firm by 5.8 percent; and (vi) a one standard deviation increase in the *competition* indicator raises TFP of the average firm by 3 percent.

Lastly, to complement the productivity analysis that is based on regression analysis, productivity growth over the period 2002 to 2004 is decomposed following Olley and Pakes (1996) as a way to measure and rank the relative impact of these six aspects of the business environment on a country-by-country basis. In Bulgaria, relative to the total impact of changes in all six business environment indicators, improvements in infrastructure quality contributed 15 percent to log TFP growth over the period 2002 to 2004, whereas a decrease in the level of competition accounted for a 33 percent negative impact. In Croatia, the increases in the infrastructure quality and governance indicators led to relative contributions of 36 and 28 percent, respectively, while the decrease in the labor quality indicator accounted for a −12 percent impact. In the Czech Republic, the increases in the infrastructure quality and financial development indicators led to relative contributions of 25 and 17 percent, and conversely, the decline in the labor market flexibility indicator resulted in a −23 percent relative contribution. In Estonia, the increases in the labor quality and infrastructure quality indicators led to relative contributions of 30 and 27 percent, while the decrease in the labor market flexibility indicator resulted in a relative contribution of −27 percent. In Poland, the increase in the labor market flexibility indicator led to a relative contribution of 34 percent to log TFP growth, whereas the decline in the financial development indicator resulted in a relative contribution of −39 percent. In Romania, all aspects of the business environment improved over the period 2001 to 2003, with the change in the governance indicator accounting for 42 percent of the total positive impact on log TFP. In Serbia, the increase in the infrastructure quality indicator led to a relative contribution of 53 percent to log TFP growth, and conversely, the decline in the financial development indicator resulted in a relative contribution of −17 percent. In Ukraine, the increase in the infrastructure quality indicator led to a relative contribution of 85 percent to log TFP growth and dominated the relative contributions of the other five aspects of the business environment.

The paper proceeds as follows. Section 2 describes the data. Section 3 presents the empirical methodology. Section 4 discusses results. Section 5 concludes. The annex presents descriptive statistics and main results.

2. Data

The empirical analysis in the paper merges information from two large databases of European firms: the Business Environment and Enterprise Performance Survey (BEEPS) and AMADEUS databases.

2.1 Business Environment and Enterprise Productivity Survey (BEEPS)

For the measurement of the business environment, the analysis draws on firm-level data from the BEEPS, which was conducted by the World Bank in conjunction with the European Bank for Reconstruction and Development (EBRD). BEEPS covers establishments of all sizes in many industries and provides a wide array of qualitative and quantitative information regarding the business environment in all countries of Central and Eastern Europe, the former Soviet Union, and Turkey. Topics covered in the BEEPS include the obstacles to doing business, infrastructure, finance, corruption and red tape, legal and judicial issues, labor market regulations, and the skills and education of available workers. Taken together, the qualitative and quantitative data capture all aspects of the business environment within countries that affect firm productivity and performance.

In an effort to track changes of evolving business environments and benchmark the effects of reforms, the survey was conducted in 2002 and again in 2005. An identical core set of questions (covering 367 variables) was asked in all countries in both rounds to ensure comparability across countries and years, and all questionnaires in every country in both rounds of the BEEPS were implemented through face-to-face interviews with managers and owners. In each country, the sectoral composition of the sample in terms of industry (ISIC codes 10-14, 15-37, 45) versus services (ISIC codes 50-52, 55, 60-64, 70-74) was determined by their relative contribution to GDP. Furthermore, the sampling design in both rounds included quotas for a set of firm characteristics to ensure sufficient numbers for statistical analysis, specifically, city/town (i.e., large, medium, small), firm size (i.e., small=2-49, medium=50-249, large=250-9,999), ownership (i.e., domestic, foreign, state), and exporters/non-exporters. The sampling approach was the same in both rounds of the BEEPS and was implemented nationwide.[4]

[4] The BEEPS 2002 and 2005 datasets in Stata and CSV format as well as documentation on sampling and implementation are available for download from the following World Bank website:

2.2. AMADEUS Database

For the estimation of firm productivity, the analysis uses data from the May 2006 edition of the AMADEUS database, a comprehensive, pan-European commercial database compiled by Bureau van Dijk. For each firm, AMADEUS provides accounting data in standardized financial format for 24 balance sheet items, 25 profit and loss account items, 26 financial ratios, and additional information including trade description and activity codes. The database includes up to ten years of information per firm through 2004, although coverage varies by country. AMADEUS is created by collecting standardized data received from 50 vendors across Europe, where the local source for these data is generally the office of the Registrar of Companies.[5]

The accounts for each firm are transformed into a universal format to allow for comparison across countries. All accounting data is converted into U.S. dollars using period average exchange rates, based on monthly series from the International Monetary Fund, nearest to the end date of each respective financial account. Nominal values are deflated using country-level GDP deflators to express values in 2001 US dollars. In addition, all firms are categorized by industry according to NACE Rev.1., and for the analysis, industry dummy variables are coded based on the 4-digit activity code following NACE Rev.1 that AMADEUS assigns to each firm.

2.3. Sample Selection

The econometric analysis of firm-level TFP growth and changes in the business environment uses a first-differenced equation in firm characteristics with two-year changes and requires a panel of manufacturing firms from the AMADEUS database with complete information on production function variables for the years 2001 through 2004, the period that correspond to the 2002 and 2005 rounds of the BEEPS. Specifically, output, labor, material inputs, and capital are given by the operating revenues, number of employees, material costs, and tangible fixed assets of firms in the AMADEUS database. Consequently, observations that are missing values in just one of these four production function variables must be dropped from the sample. Given these data requirements, sufficient information exists in the AMADEUS database

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http://web.worldbank.org/WBSITE/EXTERNAL/COUNTRIES/ECAEXT/EXTECAREGTOPANTCOR/0,,contentMDK:21303980~pagePK:34004173~piPK:34003707~theSitePK:704666,00.html.

[5] Further details about the AMADEUS database can be found on the product page of Bureau van Dijk's website: http://www.bvdep.com/en/AMADEUS.html.

to estimate TFP for manufacturing firms in eight countries: Bulgaria, Croatia, the Czech Republic, Estonia, Poland, Romania, Serbia, and Ukraine.

A number of additional restrictions are imposed to reduce sample bias in the panel of AMADEUS firms with complete data on production function variables. First, observations that are "inactive", "dissolved", "in bankruptcy", or "in liquidation" are dropped from the panel. Bureau van Dijk removes firms from the AMADEUS database only when there is no reporting for at least five years; specifically a "not available/missing" is reported for four years following the last included filing. Second, observations with data sourced from consolidated statements are dropped from the panel in order to avoid the double-counting of firms and subsidiaries or operations abroad. For most firms in the AMADEUS database, unconsolidated statements are reported and consolidated statements are provided when available. Third, observations with a positive number of subsidiaries are also dropped from the panel to reduce double-counting. Fourth, observations with less than two employees are dropped from the sample. This criterion helps to exclude any dummy (phantom) firms established for tax or other purposes.

Fifth, certain manufacturing industries are excluded when the activity is country-specific. Observations in the manufacture of tobacco products (NACE code 16) are dropped from panel because there are no such observations from Croatia, the Czech Republic, Estonia, Serbia, and Ukraine in the AMADEUS database. Similarly, observations in the manufacture of coke, refined petroleum products and nuclear fuel (NACE code 23) are dropped from panel because there are no such observations from Bulgaria, Croatia, the Czech Republic, Estonia, Poland, Serbia, and Ukraine in the AMADEUS database. Lastly, observations in recycling (NACE code 37) are dropped from the panel because there are no such observations from Bulgaria with complete information on production function variables in the AMADEUS database.

A number of additional criteria are imposed on the set of four production function variables to reduce measurement error. First, observations with negative tangible fixed assets and material costs are dropped from the sample. Second, observations with material costs-operating revenues and cost of employees-operating revenues ratios greater than one are dropped from the sample. Lastly, observations with operating revenues-number of employees, tangible fixed assets-number of employees, material costs-number of employees, material costs-operating revenues, and cost of employees-operating revenues ratios that are greater (less) than three times the standard deviation from the upper (lower) quartile in the corresponding two-digit NACE industry, country, and year are considered outliers and dropped from the sample.

Given that respondents to the BEEPS were asked to answer questions with respect to business operations occurring in the previous year, BEEPS 2002 and 2005 data are assumed to capture the characteristics of the business environment in 2001 and 2003, respectively, in order to fit the first-difference model with two-year changes in firm productivity regressed on lagged two-year changes in the business environment. BEEPS 2002 and 2005, therefore, is match merged with Amadeus 2002 and 2004 observations, respectively, on country, sector, sub-national location, and firm size. Specifically, averages of variables from the BEEPS manufacturing dataset are first calculated for groups defined by country, sub-national location, and firm size in each respective year using only the responses of manufacturing firms (NACE codes 15-36). There are three sub-national location categories: capital city, large city (defined as a non-capital city having a population of 250,000 or greater), and small city (defined as a non-capital city having a population less than 250,000); and two firm size categories: small (defined as employing 2 to 49 full-time workers) and large (defined as employing 50 or more full-time workers). These country-location-size-year averages of BEEPS variables for the manufacturing sector are then match merged to each AMADEUS observation on this identical set of variables. To illustrate, the average number of days in 2001 that large-sized manufacturing firms located in small cities in Bulgaria experienced power outages or surges from the public grid is first calculated from the BEEPS 2002 database, and then this value is assigned to all observations in the 2002 AMADEUS sample that operate in the manufacturing sector, employ 50 or more full-time workers, and are located in cities with populations less than 250,000 in Bulgaria.

The final sample that will be used for the econometric analysis of the effect of changes in the business environment on firm-level TFP growth over the period 2001 to 2004 consists of 22,004 manufacturing firms in 8 countries: Bulgaria, Croatia, the Czech Republic, Estonia, Poland, Romania, Serbia, and Ukraine. The distribution of the merged AMADEUS-BEEPS balanced panel dataset by countries is as follows: Bulgaria 221; Croatia 1,780; Czech Republic 964; Estonia 1,253; Poland 1,133; Romania 12,576; Serbia 2,237; and Ukraine 1,840. The above inclusion criteria create the most comparable sample of firms across countries. Note, however, that strong conclusions at the international level cannot be derived from direct cross-country comparisons because data requirements for the estimation of log TFP result in varying sample attrition across countries, leading to non-representative country samples.

3. Estimation Methodology

To estimate the impact of the business environment on firm performance, the two-year change in log TFP of manufacturing firms is regressed on lagged two-year changes in several aspects of the business environment as measured by a wide array of BEEPS variables.

3.1. Estimation of TFP in the Presence of Simultaneity

Total factor productivity is measured as the residual from the estimation of a log-linear three factor Cobb-Douglas production function. For the analysis, the production function of firm *i* in NACE 2-digit manufacturing industry (15-36) *j* at time *t* is assumed to have the following form:

$$Y_{ijt} = A_{ijt} L_{ijt}^{\lambda} M_{ijt}^{\mu} K_{ijt}^{\kappa}, \tag{1}$$

where *Y* is a measure of output, and *L*, *M*, and *K* are the usage of labor, material inputs, and capital with output shares λ, μ, and κ, respectively. Drawing on the AMADEUS database, *Y* is measured by operating revenues (thousands of 2001 U.S. dollars), *L* is measured by the number of employees, *M* is measured by material cost (thousands of 2001 U.S. dollars), and *K* is measured by the value of tangible fixed assets (thousands of 2001 U.S. dollars). A_{ijt} represents TFP and increases the marginal product of all factors simultaneously. Transforming equation (1) into logarithms allows for linear estimation of TFP with the equation for the general form written as:

$$\ln A_{ijt} = \ln Y_{ijt} - \lambda_j \ln L_{ijt} - \mu_j \ln M_{ijt} - \kappa_j \ln K_{ijt}, \tag{2}$$

where industry-specific coefficients—λ_j, μ_j, and κ_j— are given by the estimation of the production function.

A simultaneity problem, however, arises when there is contemporaneous correlation between the factors of production and the errors, often thought as Hicks neutral productivity shocks. The firm, for example, may observe productivity shocks early enough to allow for a change in factor input decisions. In the context of the Cobb-Douglas production function, the error term is therefore assumed to be additively separable in two distinct components:

$$y_{ijt} = a_j + \lambda_j l_{ijt} + \mu_j m_{ijt} + \kappa_j k_{ijt} + \omega_{ijt} + \eta_{ijt}, \tag{3}$$

where y is the logarithm of output; l and m are the logarithm of the freely variable inputs of labor and materials; k is the logarithm of the state variable capital; ω is the part of the error term that is observed by the firm when decisions on optimal factor input choices are being made, and thus, are correlated with the inputs, l, m, and k; and η is a true error term uncorrelated with factor input choices that may contain both unobserved shocks (i.e., unpredictable zero-mean shocks realized after inputs are chosen) and measurement errors. As pointed out by Griliches and Mareisse (1998), profit-maximizing firms immediately adjust their inputs each time a productivity shock is observed, resulting in input levels correlated with ω in the regression. This simultaneity violates the OLS conditions for unbiased and consistent estimation.

Olley and Pakes (1996) and Levinsohn and Petrin (2003) have developed two similar semi-parametric estimation procedures to overcome the simultaneity problem when estimating production functions. Olley and Pakes include the investment decision of the firm in the estimation equation to proxy for unobserved productivity shocks. Derived from a structural model of the optimizing firm, the proxy controls for the part of the error correlated with inputs, ω, by "annihilating" any variation that is possibly related to the productivity term. The method suggested by Olley and Pakes, however, generates consistent and unbiased estimates if and only if there is a strictly monotonous relationship between the proxy and output. Consequently, firms that make only intermittent investments will have their zero-investment observations truncated from the estimation routine because the monotonicity condition does not hold for these observations. For AMADEUS, this is a large portion of the data.[6]

Given the considerable attrition in the AMADEUS sample when using the Olley and Pakes approach, the paper adopts the method developed by Levinsohn and Petrin (2003) to estimate production functions. Levinsohn and Petrin offer an estimation technique that is very close in spirit to the Olley and Pakes approach but uses intermediate inputs in lieu of investment as a proxy for unobserved productivity shocks. Nearly all firms in the AMADEUS database almost always report positive material costs. Therefore, the Levinsohn-Petrin intermediate input proxy estimator is the optimal choice for the AMADEUS sample.

[6] Calculating investment as the year-to-year change in the real value of tangible fixed assets, only 1,947 (8.5 percent) of the 22,004 manufacturing firms in the final sample used for the econometric analysis in this paper have strictly positive investment in years 2001 through 2004.

Given differences in production technologies across industries, the analysis estimates heterogeneous, industry-specific (2-digit NACE) production functions using the Levinsohn and Petrin technique to obtain consistent and unbiased estimates of λ_j, μ_j, and κ_j for the derivation of log TFP estimates according to equation (3), which takes two step.[7] In the first step, the coefficient on labor is obtained using semi-parametric techniques. Assuming that the firm's demand for material inputs increases monotonically with its productivity conditional on its capital, the inverse demand function for material inputs then depends only on observable materials usage and capital and its nonparametric estimate can be used to control for unobservable productivity, thus removing the simultaneity bias.[8] In the second step, the coefficients for material inputs and capital are obtained using generalized method of moments techniques. The identification assumption is that capital adjusts with a lag to productivity, specifically productivity is assumed to follow a Markov process, $\omega_{ijt} = E[\omega_{ijt} \mid \omega_{ijt-1}] + \xi_{ijt}$, where ξ_{ijt} is the unexpected part of current productivity to which capital does not adjust. The estimates of firm log TFP are given by the residuals from equation (3), $TFP_{ijt} \equiv \omega_{ijt} + \varepsilon_{ijt}$, and capture the efficiency in transforming inputs into outputs and may include changes in factor utilization.[9]

Table 1 presents descriptive statistics of log TFP estimates, calculated according to the technique of Levinsohn and Petrin (2003), for firms in the manufacturing sector (NACE 1500 to 3663) of Bulgaria, Croatia, the Czech Republic, Estonia, Poland, Romania, Serbia, and Ukraine. For years 2001 through 2004, means are provided for the whole sample, by country, and also by groups defined by country, sub-national location, and firm size upon which the BEEPS manufacturing dataset is merged. On average, firms experienced an overall increase in log TFP

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[7] Alternatively, a fixed effects model can be used to address the simultaneity problem if the part of the error that influences input factor decision, ω_i, is assumed to be a firm-specific attribute and time invariant (e.g., managerial skills, organizational efficiency, etc.). In this case, unobserved firm heterogeneity that remains constant over time can be removed (for example, by subtracting the means from each variable for each observation) before estimating the production function so that *l*, *m*, and *k* are no longer correlated with the error term.

However, evidence from BEEPS suggests that managerial skills and organizational structure have changed significantly over time, and therefore, preclude the adoption of fixed effect methods for the analysis in the paper. Among the 1,416 firms from Bulgaria, Croatia, Czech Republic, Estonia, Poland, Romania, Serbia, and Ukraine that comprise the BEEPS 2005 sample, 22 percent had "some reallocation of responsibility and resources between departments", 11 percent had "major reallocations of responsibility and resources between departments", and 5 percent had a "completely new organisational structure" over the last three years.

[8] Making mild assumptions about the firm's production technology, Levinsohn and Petrin (2003) show that the demand function is monotonically increasing in ω_{ijt}.

[9] The estimated $\hat{\lambda}_j$, $\hat{\mu}_j$, and $\hat{\kappa}_j$ show the importance of the simultaneity bias when compared to OLS. The production function parameters are available from the authors upon request.

of 0.062 log points from 2002 to 2004, but performance varied greatly among firms—the standard deviation of sample is 0.386. Log TFP of the average firm in Serbia grew the fastest, increasing by 0.219 log points, whereas log TFP of the average firm in Romania grew the slowest, increasing by only 0.019 log points.

Figure 1 through 3 present kernel density estimations of log TFP for several different cuts of the sample using estimates in all years 2001 through 2004 for the panel of 22,004 firms, resulting in a total of 88,016 observations. An adaptive kernel density estimation method using a varying, rather than fixed, bandwidth is used to draw the distributions. The fixed bandwidth tends to oversmooth the middle of the log TFP distribution. On the contrary, the adaptive kernel estimate is smoother in the tails (especially in the higher tail).[10] All estimations use the Epanechnikov kernel function, start with an oversmoothed global bandwidth of 0.3, and specify 3,000 equally spaced grid points.

Figure 1 presents the kernel density estimation for the sample as a whole. Figure 2a shows the kernel density estimation of log TFP by firm size. Not surprisingly, the distribution for large firms (250 or more employees) is higher than that for small firms (less than 250 employees). Figure 2b presents the kernel density estimation of log TFP by sub-national location. The order of the distributions from highest to lower are also as expected: firms located in capital cities, firms located in large cities (population greater or equal to 250,000), and lastly, firms located in small cities (populations less than 250,000). Figure 2c shows the kernel density estimation of log TFP by the average industry factor intensity. The distribution for firms in capital-intensity industries (i.e., 4-digit NACE industries with average tangible fixed assets per employee in the top two quintiles, specifically greater than or equal to $8,837.43) is higher than that for firms in labor-intensive industries (i.e., 4-digit NACE industries with average tangible fixed assets per employee in the bottom two quintiles, specifically less than or equal to $6,785.85). Figure 3 shows the kernel density estimation of log TFP by the country.

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[10] The advantages of varying or local bandwidths is widely acknowledged in the estimation of long-tailed density functions with kernel methods, when a fixed or global bandwidth approach may result in undersmoothing in areas with sparse observations, while oversmoothing in areas with abundant observations. Varying the bandwidth along the support of the sample data gives flexibility to reduce the variance of the estimates in areas with few observations and can reduce the bias of the estimates in areas with many observations.

An adaptive kernel approach adapts to the sparseness of the data by varying the bandwidth inversely with the density using an iterative procedure. An initial (fixed bandwidth) density estimate is computed to get an approximation of the density at each of the specified grid points. Subsequently, this pilot estimate is used to adapt the size of the bandwidth over the data points when computing a new kernel density estimate. For a discussion, see Silverman (1986), Bowman and Azzalini (1997), and Van Kerm (2003).

The separations observed in the kernel density estimates presented in Figures 2 and 3 confirm the necessity to match merge the BEEPS data with the Amadeus observations on country, sector, sub-national location, and firm size. However, it is important to reiterate here that strong conclusions at the international level cannot be derived from direct cross-country comparisons because of data requirements and varying sample attrition across countries. For example, given the limited data sources available for Serbia, firms that have the prerequisite data on production function variables in all four years of the panel exhibit very high log TFP levels, resulting in a distribution much higher than those of the other countries. Nonetheless, even though sample biases may exist between countries, the basic test in this paper examines within-industry differences across countries and will not be affected unless there are systematic biases in sub-national location-size-year groups within industries in each country.

3.2. Identification Strategy

The analysis exploits cross-cell (defined by country, sub-national location, and firm size) variation in the changes of the business environment variables across time to determine their effect on firm-level productivity. Estimated using ordinary least squares (OLS) with White correction for heteroskedasticity, the full regression model is a first-differenced equation in firm characteristics with two-year changes whose main regressors of interest are lagged two-year changes in business environment indicators and is formally specified as follows:

$$\begin{aligned}\Delta \ln TFP_{it} &= \alpha + \beta_1 \Delta INFRASTRUCTURE_{t-1}^{s,l,c} + \beta_2 \Delta FINANCE_{t-1}^{s,l,c} + \beta_3 \Delta GOVERNANCE_{t-1}^{s,l,c} \\ &+ \beta_4 \Delta LABOR\_MARKET_{t-1}^{s,l,c} + \beta_5 \Delta LABOR\_QUALITY_{t-1}^{s,l,c} + \beta_6 \Delta COMPETITION_{t-1}^{m,c} \\ &+ \partial \Delta \ln TFP_{i,t-1} + \sum_n \phi_n \Delta Z_{i,t}^n + \sum_m \xi INDUSTRY_m + \sum_l \lambda LOCATION_l + \sum_c \gamma COUNTRY_c + \varepsilon_{i,t} \quad (4)\end{aligned}$$

where $\Delta \ln TFP_{i,t}$ is the change in the logarithm of TFP of manufacturing establishment *i* from 2002 to 2004, estimated by the semiparametric estimation technique developed by Levinsohn and Petrin (2003); $\Delta INFRASTRUCTURE_{t-1}^{s,l,c}$, $\Delta FINANCE_{t-1}^{s,l,c}$, $\Delta GOVERNANCE_{t-1}^{s,l,c}$, $\Delta LABOR\_MARKET_{t-1}^{s,l,c}$, and $\Delta LABOR\_QUALITY_{t-1}^{s,l,c}$ are the changes from 2001 to 2003 in respective business environment indicators for groups of firm size *s*, location *l*, and country *c*; $\Delta \ln TFP_{i,t-1}$ is the change in the logarithm of TFP from 2001 to 2003; ΔZ_i^n is a vector of logarithmic changes in firm characteristics from 2002 to 2004 that include the number of employees, the value of tangible fixed assets (thousands of 2001 U.S. dollars), and cost of materials (thousands of 2001 U.S. dollars); $INDUSTRY_s$ is a vector of industry dummy variables defined at the 4-digit NACE level (1510 to 3663); $LOCATION_s$ is a vector of location dummy variables including a capital city dummy variable (equal to 1 if the firm is located in a capital city—that is, Belgrade, Bucharest, Kyiv, Prague, Sofia, Tallinn, Warsaw, or Zagreb—and 0 otherwise) and a large city dummy variable (equal to 1 if the firm is located in a city with a population of 250,000 or greater, and 0 otherwise); and $COUNTRY_c$ is a vector of country dummy variables for Bulgaria, Croatia, the Czech Republic, Estonia, Poland, Romania, Serbia, and Ukraine.

Lastly, $\Delta COMPETITION_{t-1}^{m,c}$ is the change in the level of competition in each industry *m* of country *c* from 2001 to 2003 and is equal to 1 minus the change in the four-firm concentration ratio for industries defined at the 4-digit NACE level (so that positive changes indicate higher levels of competition). The four-firm concentration of an industry is equal to the market share as measured by operating revenues of the four largest firms in each 4-digit NACE level industry and is country-specific.[11] Given the lower data requirements, a much larger AMADEUS sample is used to calculate the competition indicator: 69,116 firms in 1,935 4-digit NACE industries from the 2001 sample and 77,265 firms in 1,970 4-digit NACE industries from the 2003 sample. Table 2 presents descriptive statistics of the competition indicator.

The above specification of the model addresses a number of econometric concerns. Given that the objective of the paper is to capture the effect of changes in the business environment on productivity growth of the average firm, the regression analysis opts for a balanced panel design, pooling observations across 296 NACE industries at the 4-digit level in eight countries with data in the years 2001 through 2004. Second, first-differencing firm characteristics and lagging business environment indicators by one year mitigates further endogeneity between unobservable firm heterogeneity and factor input choices. Third, the inclusion of lagged changes in log TFP addresses serial correlation that is not eliminated by first differencing. Given the necessary assumption made in the TFP estimation technique of Levinsohn and Petrin (2003) of a Markov process for productivity—that is, the conditional probability distribution of future states of the productivity, given the present state and all past

[11] Market forms are often classified by their four-firm concentration ratio. Perfect competition is associated with a very low ratio, monopolistic competition with ratios below 0.4, oligopoly with ratios above 0.4, and monopoly with a near-1 four-firm measurement.

states, depends only upon the present state and not on any past states—lagged productivity must be included in the regression model for consistency (Fernandes, 2007). Fourth, the inclusion of industry, sub-national location, and country fixed effects controls for time trends and unobserved sub-national location-, industry-, and country-specific characteristics that might affect the correlation between productivity growth and changes in the business environment.

Fifth, as described in the previous section, merging the AMADEUS and BEEPS manufacturing datasets on country, sub-national location, firm size, and year mitigates the endogeneity between firm productivity and business environment indicators. The econometric analysis in this paper treats BEEPS variables as exogenous determinants of firm productivity; however, firms can be proactive in reducing the constraints they face in the business environment, producing a simultaneity bias in the estimation exercise. For example, a well-managed firm with high productivity growth may have worked with authorities to secure a more reliable power supply or to relax hiring and firing restrictions. Statistically, a balance must be struck so that the set of variables, on which the AMADEUS and BEEPS manufacturing datasets are merged, is large enough so that resulting average values not only mitigates the endogeneity problem but also retain sufficient variation for regression analysis. To the extent that sub-sample groupings as defined are sufficiently aggregated so that individual firms are less likely to influence averages but varied enough so that heterogeneous "pockets" of business environments are reflected, using year-specific averages of BEEPS indicators taken across firms in the same country, sector, sub-national location, and size groups is a valid way to instrument out the simultaneity problem (Bastos and Nasir, 2004).

Sixth, in order to mitigate the problems of multicollinearity in the full model regression, principal component analysis (PCA) is used to reduce the dimensionality of the BEEPS data and construct indicators that summarize various dimensions of the business environment. In the BEEPS database, there are typically several variables that address a particular issue that affect the productivity and growth of firms. Several questions, for example, collect information on the quality of infrastructure, namely the number of days of power outages or surges from the public grid, the number of days of insufficient water supply, and the number of days of unavailable mainline telephone service. Inclusion of two or more highly correlated explanatory variables in a regression model generally leads to difficulties in ascertaining the effects of individual factors on the dependent variable. The follow section explains the construction of the five business environment indicators that are used in the paper.

3.3. Business Environment Indicators: Principal Component Analysis (PCA)

Synthetic indicators are constructed using PCA on the BEEPS manufacturing dataset for the following five distinct aspects of the business environment: (a) infrastructure quality, (b) financial development, (c) governance, (d) labor market flexibility, and (e) labor quality. Intuitively, the method of principal components is used to describe a set of variables with a set of variables of lower dimensionality; for this paper, the objective of PCA is to construct one series that summarizes the behavior of a group of three or more underlying BEEPS variables that describe a particular aspect of the business environment. Statistically, PCA reduces the number of variables in the analysis by specifying linear combinations ("principal components") of the underlying BEEPS variables such that the resulting series contains most of the information, i.e. has maximum variance.[12] Specifically, BEEPS variables are first mapped into one of five distinct aspects of the business environment, and then the main variation commanded by each aspect is extracted through the use of their respective principal components. Before applying PCA, the underlying variables are rescaled so that higher values indicate improvements in the business environment and then standardized to having mean zero and standard deviation one in order to abstract from units of measurements.

Variable selection for PCA is guided by the preference for quantitative over qualitative indicators. First, quantitative responses link directly to objective, actionable policy actions, as opposed to firm perceptions. Second, there are numerous statistical problems associated with the use of perception-based data, such as Likert-scale survey responses. The most fundamental is whether responses along a semantic continuum can be treated as if they were interval data. Additionally, there are several potential sources of measurement error with perception-based data. For example, individual respondents may differ in their use of the Likert scale owning to

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[12] Algebraically, this method locates n linear combinations of the n columns of the $X'X$ matrix, all orthogonal to each other, with the following property: the first principal component p_1 minimizes $tr(X - p_1 a_1')'(X - p_1 a_1')$, where a_1 is the eigenvector of the $X'X$ matrix associated with the largest eigenvalue. Intuitively, p_1 summarizes the n variables in X by giving the best linear description of the columns of X in a least squares sense. The second principal component of p_2 also describes what is not "captured" by the first component p_1 by minimizing the sum of squared residuals after subtracting p_1, i.e. p_1 minimizes $tr(X - p_1 a_1' - p_2 a_2')'(X - p_1 a_1' - p_2 a_2')$ where a_2 is now the eigenvector associated with the second largest eigenvalue, and so on. See Alesina and Perotti (1996).

his or her subjective frame of reference. An issue perceived as a major obstacle to doing business in one country may actually impose a lower cost in actuality than it does in a country where the problem is rated as merely a minor problem. For example, based on data from Enterprise Surveys in 33 African and Latin American countries that used instruments similar to those used for the BEEPS, González, López-Córdova, and Valladares (2007) show that perceptions adjust slowly to firms' experience with corrupt officials and hence are an imperfect proxy for the true incidence of graft.

Consequently, quantitative measures of an issue in the business environment are always selected over perception-based indicators whenever available. For example, the number of power outages or surges from the public grid is used rather than the perceptions of the manager on how problematic electricity is for the operation and growth of the business. Similarly, the level of bribes paid as a percentage of total annual sales number is used rather than the perceptions of the manager on how problematic corruption is for the operation and growth of the business. However, because of the inadequate number of quantitative measures available in the areas of governance (legal system), labor market flexibility, and labor quality, one perceptions-based question is used in the construction of these indicators in order to meet the three variables per component minimum threshold recommended for exploratory factor analysis (Thurstone, 1935; Kim and Mueller, 1978b).

All synthetic indicators are given by the first principal component of their respective set of underlying BEEPS variables, and three separate tests confirm the decision to retain only the first principal component. The first test is the most frequently used Guttman-Kaiser criterion, which states all components with eigenvalues greater than 1 should be extracted as variables. The rationale behind this criterion is that the interpretation of proportions of variance smaller than the variance contribution of a single variable is of dubious value (Guttman, 1954; Kaiser, 1961). The second test is the Cattell's scree test, which plots the components along the X-axis and the corresponding eigenvalues along the Y-axis and is also a widely used criterion. Cattell (1996) suggests visual inspection to identify an inflection point of the resulting curve (scree), where components to the left are retained and those to the right are dropped.[13]

[13] "Scree" is the geological term referring to the debris that collects on the lower part of a rocky slope (Cattell, 1966).

The final test is Humphrey-Ilgen parallel analysis, which is now often recommended as the best method to assess the true number of factors (Velicer, Eaton, and Fava, 2000; Lance, Butts, and Michels, 2006). Parallel analysis compares obtained eigenvalues to those one would expect to obtain from random data. To use this procedure, a matrix of random numbers representing the same number of observations and variables is factor analyzed. If the first *n* eigenvalues given by the actual data are those which have values greater than those generated from random data, then *n* components are retained. Graphically, eigenvalues from the actual and random data are represented on the same scree plot; the intersection of the two lines determines the number of components to be retained. All three tests determined that for each set of BEEPS variables only one component should be retained.

A detailed explanation for each of the underlying BEEPS variables used in the construction of the synthetic indicators for infrastructure quality, financial development, governance, labor market flexibility, and labor quality follows below. Given that principal components are used to summarize a group of variables that describe a particular aspect of the business environment, the resulting indices are expected to be correlated with their underlying BEEPS variables. Tables 3 through 7 show that all five indices are indeed strongly associated with their corresponding BEEPS variables. Figures 4 through 8 graphically show that the Guttman-Kaiser criterion, Cattell's scree test, and Humphrey-Ilgen parallel analysis all confirm the retention of only the first principal component for each set of BEEPS variables.

Infrastructure Quality

The *infrastructure quality indicator* measures the quality in the provision of infrastructure services. Underlying variables are rescaled as explained below so that higher values of the indicator signify higher levels of infrastructure quality. The indicator is based on a PCA of the following three BEEPS variables:

- *Power outages*. The number of days over the last 12 months that each establishment experienced power outages or surges from the public grid (multiplied by -1) (Question 23).
- *Insufficient water supply*. The number of days over the last 12 months that each establishment experienced insufficient water supply (multiplied by -1) (Question 23).

- *Unavailable mainline telephone service*. The number of days over the last 12 months that each establishment experienced unavailable mainline telephone service (multiplied by -1) (Question 23).

Financial Development

The *financial development indicator* measures the reliance of firms on various sources of finance for new fixed investments (i.e., new machinery, equipment, buildings, and land). Underlying variables are rescaled as explained below so that higher values of the indicator signify higher levels of financial development. The indicator is based on a PCA of the following three BEEPS variables:

- *Local private commercial banks*. The percentage of new fixed investment financed by borrowing from "local private commercial banks" (Question 45a).
- *Foreign banks.* The percentage of new fixed investment financed by borrowing from "foreign banks" (Question 45a).
- *Informal (family/friends/money lenders*). The percentage of new fixed investment financed by borrowing from loans from family or friends, money lenders, or other informal sources (subtracted from 100 percent) (Question 45a).

Governance

The *governance indicator* measures the control of corruption, bureaucratic efficiency, and judicial effectiveness in resolving business disputes. Underlying variables are rescaled as explained below so that higher values of the indicator signify higher levels of good governance. The indicator is based on a PCA of the following three BEEPS variables:

- *Bribe level*. The estimated percentage of total annual sales firms typically pay in unofficial payments or gifts to public officials (subtracted from 100 percent) (Question 40).
- *Tax compliance*. The response of the firm to the question, "Recognizing the difficulties that many firms face in fully complying with taxes and regulations, what percentage of total annual sales would you estimate the typical firm in your area of business reports for tax purposes" (Question 43a).

- *Confidence in the legal system*. The response of the firm on a six-point scale (1="strongly disagree" to 6="strongly agree") when asked the question, "To what degree do you agree with this statement. 'I am confident that the legal system will uphold my contract and property rights in business disputes. (Question 27).

Labor Market Flexibility

The *labor market flexibility indicator* measures the efficiency of employment protection legislation and the degree to which labor markets can adapt to fluctuations and changes in the economy or the demands of production. Underlying variables are rescaled as explained below so that higher values of the indicator signify higher levels of labor market flexibility. The indicator is based on a PCA of the following three BEEPS variables:

- *Underemployment and overemployment*. The percentage of firms that either report underemployment because of labor restrictions regarding the hiring of workers (i.e., seeking and obtaining permission, etc.) or report overemployment because of labor restrictions regarding the firing of workers (i.e., making severance payments, etc.). Specifically, this dummy variable is equal to 1 if the optimal level of employment estimated by the firm is equal to or greater than 120 percent (underemployment) or equal to or less than 80 percent (overemployment) of their existing workforce, and is equal to 0 otherwise (subtracted from 100) (Question 73).
- *Change in the use of temporary workers*. The change in the number of part-time/temporary workers (as a percentage of permanent, full-time workers) over the last 36 months (Questions 66 and 67). Atkinson (1984) and Atkinson and Meager (1986) study the labor management strategies companies use and identify four types of labor market flexibility. One category is called "external numerical flexibility," which refers to the adjustment of labor intake, or the number of workers from the external market. External numerical flexibility can be achieved by employing workers on temporary or fixed-term contracts or through relaxed hiring and firing regulations, where employers can hire and fire permanent workers according to the needs of the firm.

- *Labor regulations as a constraint*. The responses of firms on a four-point scale (1="major obstacle" to 4="no obstacle") to the question: How problematic are "labor regulations" to the operation and growth of your business? (Question 63).

Labor Quality

The *labor quality indicator* measures the skill level and educational attainment of workers. Underlying variables are rescaled as explained below so that higher values of the indicator signify higher levels of labor quality. The indicator is based on a PCA of the following three BEEPS variables:

- *Skilled workers/Total employees*. The percentage of the firm's current permanent, full-time workers that are managers, professionals, or skilled production workers (Question 68).
- *Time to fill vacancy*. The average number of weeks it took to fill the most recent vacancy for a manager, professional, or skilled production worker (multiplied by −1) (Question 70).
- *Labor quality as a constraint*. The responses of firms on a four-point scale (1="major obstacle" to 4="no obstacle") to the question: How problematic are the "skills and education of available workers'" to the operation and growth of your business? (Question 63).

Table 8 presents descriptive statistics of the five synthetic indicators, constructed using PCA on the BEEPS manufacturing dataset for the following five distinct aspects of the business environment: (a) infrastructure quality, (b) financial development, (c) governance, (d) labor market flexibility, and (e) labor quality. For years 2001 and 2003, means are provided for the whole sample, by country, and also by groups defined by country, sub-national location, and firm size upon which the AMADEUS data is merged. On average, countries from 2001 to 2003 improved in the areas of infrastructure quality, governance, and labor quality, but faced worsening financial development and decreasing labor market flexibility. All countries improved infrastructure quality over this period, but results were mixed across countries in the other four areas. Labor market flexibility worsened in the largest number of countries, only improving in Poland and Romania.

3.4. The Olley and Pakes Decomposition: Relative Percentage Contribution of Changes in Business Environment Indicators to Log TFP Growth, 2001-2004

To complement the productivity analysis that is based on the OLS estimation of equation (4), the paper follows Escribano and Guasch (2005) and measures the partial direct effect of the change in each business environment indicator on average productivity for each country by calculating the average productivity term of the Olley and Pakes (1996) decomposition of productivity.

The Olley and Pakes decomposition of productivity has two components: average productivity and the efficiency or covariance term. Formally, let $TFP_t^c = \sum_{i=1}^{N^c} s_{it}^{Y^c} TFP_{it}^c$ be the productivity of country *j* at year *t* obtained as the weighted average productivity of firm *i* in country *c* at year *t*, where N^c is the number of firms in country *c*. The weights $s_{it}^{Y^c}$ indicate the share of firm *i* in aggregate operating revenue of country *c* in year *t*, and is equal to the operating revenue of firm *i* divided by the total operating revenue of country *c* at year *t*: $s_{it}^{Y^c} = \frac{Y_{it}}{\sum_{i=1}^{N^c} Y_{it}}$. Let $\overline{TFP}_t^c = \frac{1}{N^c}\sum_{i=1}^{N^c} TFP_{it}^c$ be the average productivity of the firms in country *c* at year *t*. Let $\tilde{s}_{it}^{Y^c} = s_{it}^{Y^c} - \overline{s}_t^{Y^c}$ and $\widetilde{TFP}_t^c = TFP_{it}^c - \overline{TFP}_t^c$ be deviations to the mean. Since $\tilde{s}_{it}^{Y^c} = \frac{1}{N^c}$, the annual aggregate productivity of country *c* can then be decomposed as:

$$TFP_t^c = \overline{TFP}_t^c + \sum_{i=1}^{N^c} \tilde{s}_{it}^{Y^c} \widetilde{TFP}_{it}^c, \tag{5}$$

The first term $\overline{TFP}_t^c$ is the average productivity of country *c* at year *t* and the second term $\sum_{i=1}^{N^c} \tilde{s}_{it}^{Y^c} \widetilde{TFP}_{it}^c = N^c \operatorname{cov}\left(s_{c,it}^Y, TFP_{it}^c\right)$ measures the allocative efficiency or covariance between the share of operating revenue and productivity, $\operatorname{cov}\left(s_{c,it}^Y, TFP_{it}^c\right)$, multiplied by the number of firms, N^c, that operate in country *c*. A covariance that is negative indicates that there are allocation inefficiencies. That is, as the share of output for less productive firms increases, the covariance becomes more negative and the productivity of country *c* decreases.

For the calculation of the relative percentage contribution of changes in business environment indicators to log TFP growth over the period 2001 to 2004, the Olley and Pakes decomposition of productivity is also similarly computed for aggregate productivity in logs. Let $\ln TFP_t^c = \sum_{i=1}^{N^c} s_{it}^{\ln Y^c} \ln TFP_{it}^c$ be the log productivity of country *j* at year *t* obtained as the weighted average log productivity of firm *i* in country *c* at year *t*. The weights $s_{it}^{\ln Y^c}$ indicate the share of firm *i* in aggregate log operating revenue of country *c* in year *t*, and is equal to the log operating revenue of firm *i* divided by the total log operating revenue of country *c* at year *t*: $s_{it}^{\ln Y^c} = \frac{\ln Y_{it}}{\sum_{i=1}^{N^c} \ln Y_{it}}$. Let $\overline{\ln TFP}_t^c = \frac{1}{N^c}\sum_{i=1}^{N^c} \ln TFP_{it}^c$ be the average log productivity of the firms in country *c* at year *t*. Let $\tilde{s}_{it}^{\ln Y^c} = s_{it}^{\ln Y^c} - \overline{s}_t^{\ln Y^c}$ and $\widetilde{\ln} TFP_t^c = \ln TFP_{it}^c - \overline{\ln TFP}_t^c$ be deviations to the mean. Since $\tilde{s}_{it}^{\ln Y^c} = \frac{1}{N^c}$, the annual aggregate log productivity of country *c* can then be decomposed as:

$$\ln TFP_t^c = \overline{\ln TFP}_t^c + \sum_{i=1}^{N^c} \tilde{s}_{it}^{\ln Y^c} \widetilde{\ln} TFP_{it}^c, \tag{6}$$

The first term $\overline{\ln TFP_t^c}$ is the average log productivity of country *c* at year *t* and the second term $\sum_{i=1}^{N^c} \tilde{s}_{it}^{\ln Y^c} \widetilde{\ln} TFP_{it}^c = N^c \operatorname{cov}\left(s_{c,it}^{\ln Y}, \ln TFP_{it}^c\right)$ measures the allocative efficiency or covariance between the share of log operating revenue and log productivity.

Equation (5) estimated by OLS with a constant term implies that the mean of the residuals is zero, and therefore, the estimation results of equation (5) can be evaluated at their sample mean values without including an error term (Escribano and Guasch, 2005). The corresponding expression for the first term of Olley and Pakes decomposition in changes then becomes:

$$\begin{aligned}
\overline{\Delta \ln TFP}_t^c = {} & \hat{\alpha} + \hat{\beta}_1 \overline{\Delta INFRASTRUCTURE}_{t-1}^c + \hat{\beta}_2 \overline{\Delta FINANCE}_{t-1}^c + \hat{\beta}_3 \overline{\Delta GOVERNANCE}_{t-1}^c \\
& + \hat{\beta}_4 \overline{\Delta LABOR_MARKET}_{t-1}^{s,l,c} + \hat{\beta}_5 \overline{\Delta LABOR_QUALITY}_{t-1}^{s,l,c} + \hat{\beta}_6 \overline{\Delta COMPETITION}_{t-1}^{m,c} \\
& + \hat{\partial} \overline{\Delta \ln TFP}_{i,t-1} + \sum_n \hat{\phi}_n \overline{\Delta Z}_{i,t}^n + \sum_m \hat{\xi} \overline{INDUSTRY}_m + \sum_l \hat{\lambda} \overline{LOCATION}_l + \sum_c \hat{\gamma} \overline{COUNTRY}_c
\end{aligned} \tag{7}$$

where the variables with bars on top indicate the country averages of each covariate. Following Escribano and Guasch (2005), the relative contribution of each business indicator is derived by dividing the change in each business environment indicators by the dependent variable $\overline{\Delta \ln TFP_t^c}$ and multiplying by 100:

$$100 = \frac{\hat{\beta}_1 \overline{\Delta INFRASTRUCTURE_{t-1}^{c}}}{\overline{\Delta \ln TFP_t^c}} \cdot 100 + \frac{\hat{\beta}_2 \overline{\Delta FINANCE_{t-1}^{c}}}{\overline{\Delta \ln TFP_t^c}} \cdot 100 + \frac{\hat{\beta}_3 \overline{\Delta GOVERNANCE_{t-1}^{s,l,c}}}{\overline{\Delta \ln TFP_t^c}} \cdot 100 +$$
$$\frac{\hat{\beta}_4 \overline{\Delta LABOR\_MARKET_{t-1}^{s,l,c}}}{\overline{\Delta \ln TFP_t^c}} \cdot 100 + \frac{\hat{\beta}_5 \overline{\Delta LABOR\_QUALITY_{t-1}^{s,l,c}}}{\overline{\Delta \ln TFP_t^c}} \cdot 100$$
$$+ \frac{\hat{\beta}_6 \overline{\Delta COMPETITION_{t-1}^{m,c}}}{\overline{\Delta \ln TFP_t^c}} \cdot 100 \tag{8}$$

Equation (8) represents the sum of the percentage productivity gains and losses from the change in each business environment indicators relative to the average log TFP growth of country *c* over the period 2002 to 2004. In this way, the relative impact of the average change in each business environment indicator over the period 2001 to 2003 on average log TFP growth over the period 2002 to 2004 can be estimated.

4. Results

4.1. OLS Regression Estimation

As presented in Table 9, the results obtained from the estimation of equation (4) by OLS with robust standard errors (White correction for heteroskedasticity) show a positive and statistically significant impact of improvements in each of the six aspects of the business environment on firm TFP over the period 2001 to 2004. Entering changes in the PCA indicators into the model one by one, the effects are statistically significant at the 1 percent level for infrastructure quality (column 1), financial development (column 2), governance (column 3), labor market flexibility (column 4), and labor quality (column 5), and at the 5 percent level for competition (column 6). Entering changes in all six aspects of the business environment into the model jointly (column 7), the effects remain strong. Changes in all BEEPS-based indicators are again statistically significant at the 1 percent level, with changes in the competition indicator significant at the 5 percent level.

From the point estimates of the full regression model presented in column 7 of Table 9, and given the joint significance of the coefficients on the changes in all six business environment indicators, the following causal relationships can be inferred[14]:

- A one standard deviation increase in the *infrastructure* indicator over the period 2001 to 2004 (1.532) raises TFP of the average firm by 9.8 percent.
- A one standard deviation increase in the *financial development* indicator over period 2001 to 2004 (1.177) raises TFP of the average firm by 7.8 percent.
- A one standard deviation increase in the *governance* indicator over period 2001 to 2004 (1.392) raises TFP of the average firm by 3.2 percent.
- A one standard deviation increase in the *labor market flexibility* indicator over period 2001 to 2004 (1.198) raises TFP of the average firm by 3.4 percent.
- A one standard deviation increase in the *labor quality* indicator over period 2001 to 2004 (1.175) raises TFP of the average firm by 5.8 percent.
- A one standard deviation increase in the *competition* indicator over period 2001 to 2004 (0.234) raises TFP of the average firm by 3 percent.

The results of the regression analysis confirm that firm-level productivity growth is directly linked to each of these factors in the business environment and strongly support the presence of large TFP gains from successful efforts to improve the business environment. On the whole, while evidence shows that each of the six dimensions of the business environment is important and significant, one caveat is that the results do not provide clear implications for reform priorities in specific countries.

4.2. Olley and Pakes Decomposition

Figure 9 presents the results of the Olley and Pakes decomposition in levels by country for 2001, 2002, 2003, and 2004. There are no significant differences across years. Poland has the largest aggregate productivity followed by Serbia and the Czech Republic.[15] The efficiency terms are likewise high for these three countries, whereas their role in the other five countries is

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[14] With the dependent variable in logarithmic form, the exact percentage change in the predicted TFP associated with a change in the regressor is calculated as $[\exp(\hat{\beta}_i \Delta x_i) - 1] \times 100$ where $\hat{\beta}_i$ is the estimated coefficient.

[15] Again, given the limited data sources available for Serbia, firms that have the prerequisite data on production function variables in all four years of the panel exhibit very high log TFP levels, resulting in a distribution much higher than those of the other countries at similar levels of economic development.

marginal. Nonetheless, the efficiency term is positive in all countries, indicating no allocative inefficiencies in any of the eight countries over the period 2001 to 2004.

Figure 10 graphically presents the relative percentage contribution of changes in each business environment indicator to log TFP growth over the period 2001 to 2004 calculated according to equation (8) by country. That is, each bar in Figure 10 shows the relative weight of the average change in each business environment indicator with respect to the total impact of the changes in all six business environment indicators for the respective country sample. Because all coefficient estimates from the OLS regression of equation (4) are positive (see column 7 of Table 9), a positive (negative) relative percentage indicates an improvement (worsening), on average, in the respective business environment indicator. For example, infrastructure quality improved, on average, in all countries over the period 2001 to 2003, while labor quality, on average, increased in the Czech Republic, Estonia, Poland, Romania, and Ukraine, but decreased in Bulgaria, Croatia, and Serbia.

For the sample as a whole (first column in Figure 10), all aspects of the business environment, on average, improve over the period 2001 to 2003. Improvements in the infrastructure quality and governance indicators have relative contributions of 27.8 and 22.7 percent. Changes in the labor quality (7.5 percent), financial development (5.6 percent), labor market flexibility (2.6 percent), and competition (2.2 percent) indicators account for the remaining positive business environment impacts on log TFP growth. These results from the Olley Pakes decomposition of log TFP growth by country are consistent with the OLS regression results for the full sample presented in Table 9.

In Bulgaria, only two aspects of the business environment improve over the period 2001 to 2003. Relative to the total change in all six business environment indicators, increases in the infrastructure quality and financial development indicators contribute 14.7 and 6.0 percent, respectively, to log TFP growth over the period 2002 to 2004. Conversely, negative changes in the governance, labor market flexibility, labor quality, and competition indicators dominate the positive contributions of increases in infrastructure quality and financial development. A worsening in the competition indicator accounts for a third (33.3 percent) of the total impact of business environment changes on log TFP growth over the period. Negative changes in labor quality (−24.8 percent), labor market flexibility (−14.7 percent), and governance (−6.5 percent) account for the remaining impacts on log TFP growth.

In Croatia, several aspects of the business environment improve over the period 2001 to 2003 and have large relative contributions, while indicators with negative changes have relatively little impact, in sharp contrast to Bulgaria. Improvements in the infrastructure quality and governance indicators have relative contributions of 35.8 and 27.9 percent. Changes in the financial development (16.2 percent) and labor market flexibility (7.5 percent) indicators account for the remaining positive business environment impacts on log TFP growth. A worsening in labor quality (−11.7 percent) and competition (−0.9 percent) have limited negative impact on log TFP growth relative to the positive changes in other aspects of the business environment.

In the Czech Republic, several aspects of the business environment also improve over the period 2001 to 2003, but have more moderate relative contributions, in comparison to Croatia, while indicators with negative changes have larger relative impacts on log TFP growth. Improvements in the infrastructure quality and financial development indicators have relative contributions of 25.1 and 16.5 percent. Changes in the competition (13.3 percent) and labor market quality (10 percent) indicators account for the remaining positive business environment impacts on log TFP growth. Worsening labor market flexibility (−22.9 percent) and governance (−12.2 percent) over the period have significant negative impacts on log TFP growth relative to the positive changes in other aspects of the business environment.

In Estonia, the positive impacts in several aspects of the business environment are also somewhat diminished by the large negative relative contribution of worsening labor market flexibility, similar to the Czech Republic. Improvements in the labor quality and infrastructure quality indicators have relative contributions of 29.5 and 26.7 percent. Changes in the financial development (13.8 percent) and competition (1.4 percent) indicators account for the remaining positive business environment impacts on log TFP growth. A worsening in labor market flexibility has a significant relative contribution of −27.3 percent on log TFP growth relative to the positive changes in other aspects of the business environment. The relative contribution of the change in the governance indicator is −1.3 percent.

In Poland, the positive impacts in several aspects of the business environment are diminished by the large negative relative contribution of worsening financial development. Improvements in the labor market flexibility and labor quality indicators have relative contributions of 34.3 and 14.3 percent. Changes in the infrastructure quality (8.3 percent) and competition (0.5 percent) indicators account for the remaining positive business environment impacts on log TFP growth. A worsening in financial development had a significant contribution of −38.6 percent on log TFP growth relative to the positive changes in other aspects of the business environment. The relative contribution of the change in the governance indicator is −4 percent.

In Romania, all aspects of the business environment improve over the period 2001 to 2003. The relative contribution of improvements in the governance indicator lead the way with 42 percent of the total positive impact on log TFP growth over the period 2002 to 2004. Labor quality (17.7 percent), infrastructure quality (13 percent), and financial development (12.8 percent) have double digit relative contributions. Changes in the labor market flexibility (9.4 percent) and competition (5.1 percent) indicators account for the remaining positive business environment impacts on log TFP growth.

In Serbia, several aspects of the business environment improve over the period 2001 to 2003 and have large relative contributions, while indicators with negative changes have relatively little impact, similar to Croatia. Improvements in the infrastructure quality and governance indicators have relative contributions of 52.5 and 20.2 percent. Changes in the competition (2.5 percent) and labor market flexibility (1.4 percent) indicators account for the remaining positive business environment impacts on log TFP growth. A worsening in financial development (−17.4 percent) and labor quality (−6 percent) have limited negative impact on log TFP growth relative to the positive changes in other aspects of the business environment.

In Ukraine, improvements in infrastructure dominate the relative contributions of the changes in all other aspects of the business environment. The increase in the infrastructure quality indicator has a relative contribution 85.4 percent. Changes in the financial development (1.1 percent), labor quality (1.1 percent), and labor market flexibility (0.6 percent) indicators account for the remaining positive business environment impacts on log TFP growth. A worsening in competition (−9.4 percent) and governance (−2.4 percent) have limited negative impact on log TFP growth relative to the positive change in infrastructure quality.

Figure 11 graphically presents the relative percentage contribution of changes in each business environment indicator to log TFP growth by firm size. That is, each bar in Figure 11 shows the relative weight of the average change in each business environment indicator with respect to the total impact of the changes in all six business environment indicators for the respective samples of small-sized firms (less that 50 employees) and large-sized firms (50 or more employees). Small-size firms in the sample experienced on average an increase in all the business environment indicators over this period, with improvements in governance (40.1 percent) and infrastructure quality (30.3 percent) accounting for the largest relative contributions to log TFP growth. Conversely, large-sized firms experienced a worsening in labor market flexibility that accounted for a −9.3 percent relative contribution. For large-sized firms, the largest relative contributions to log TFP growth are attributed to increases in the indicators for infrastructure quality (39.3 percent), labor quality (25.4 percent), and financial development (15.7 percent).

Figure 12 graphically presents the relative percentage contribution of changes in each business environment indicator to log TFP growth by NACE industries defined at the 2-digit level. That is, each bar in Figure 12 shows the relative weight of the average change in each business environment indicator with respect to the total impact of the changes in all six business environment indicators for the respective sample of firms operating in the indicated industry. Improvements in infrastructure and governance account for the two largest relative contributions, to log TFP growth in all industries (41.6 and 29.9 percent on average, respectively), with the exception of garments (NACE 18) and leather (NACE 19). While the increase in the governance indicator has the largest relative contribution for firms in both the garments (26.6 percent) and leather (23.5 percent) industries, improvements in labor quality (23.4 and 15.7 percent, respectively, for garments and leather) and financial development (19.8 and 16.1 percent) have higher relative contributions than that in infrastructure quality (18.3 and 14.5 percent) for garment- and leather-producing firms. Improvement in labor quality also contributes significantly to productivity growth in many of the industries (11.1 percent, on average) and is ranked third in terms of relative contribution in food processing (NACE 15), textiles (NACE 17), other non-metallic products (NACE 26), basic metals (NACE 27), motor vehicles (NACE 34), and other transport equipment (NACE 35), and furniture (NACE 36). Increases in competition relative to other changes in the business environment contributes at least 5 percent to productivity growth in textiles (NACE 17), leather (NACE 19), chemicals (NACE 24), rubber and plastic (NACE 25), other non-metallic products (NACE 26), basic metals (NACE 27), machinery and equipment (NACE 29), electric machinery (NACE 31), radio, television, and communication equipment (NACE 32), medical, precision, and optical instruments (NACE 33), other transport equipment (NACE 35), and furniture (NACE 36).

Worsening of certain aspects of the business environment over the period 2001 to 2004 for firms in leather (NACE 19), paper (NACE 21), office, accounting, and computing machinery (NACE 30), radio, television, and communication equipment (NACE 32), and, motor vehicles (NACE 34) led to significant negative impacts on productivity growth. Decreases in the indicator for labor quality negatively impacted log TFP growth in office, accounting, and computing machinery (−13.8 percent), radio, television, and communication equipment (−7.3 percent), and paper (−2.0 percent). Decreases in the indicator for labor market flexibility negatively impacted log TFP growth in office, accounting, and computing machinery (−7.1 percent), motor vehicles (−4.0 percent), and radio, television, and communication equipment (−3.5 percent). Decreases in the indicator for competition negatively impacted log TFP growth in leather (−6.1 percent), radio, television, and communication equipment (−5.8 percent), and paper (−3.1 percent). Lastly, the decrease in the indicator for financial development negatively impacted log TFP growth in motor vehicles (−8.3 percent).

5. Conclusions

This paper provides new evidence on the impact that changes in the business environment have on firm productivity, and contributes to the literature in two important respects. First, a unique dataset is constructed by merging information from two large databases in order to address shortcomings of earlier studies, namely reverse causation and unreliable TFP estimates. Second, in order to mitigate the problems of multicollinearity in the full model regression, a new set of robust indicators is constructed using principal component analysis on quantitative variables from the BEEPS manufacturing dataset to summarize the following five distinct aspects of the business environment: (a) infrastructure quality, (b) financial development, (c) governance, (d) labor market flexibility, and (e) labor quality. Regression analysis is based on production function estimates that correct the bias arising from the simultaneity between inputs and productivity. Furthermore, the paper exploits cross-cell (defined by country, sub-national location, and firm size) variation in the changes of the business environment indicators across years to determine their effect on firm-level productivity, thereby circumventing the shortfalls of previous studies that focus only on a single year of business environment variables.

Results indicate that successful efforts to improve the business environment has a strong positive impact on firm productivity, even after controlling for unobserved firm, industry, sub-national location, and country heterogeneity. Evidence from the BEEPS-AMADEUS dataset confirms that a good business environment encourages firms to operate efficiently and promote productivity growth by lowering risks, costs, and barriers to entry. In a global economy where technology diffuses rapidly, the persistence of productivity differences across countries may be largely explained by differences in the business environment in which firms operate. These microeconomic foundations of economic development—infrastructure quality, financial development, governance, labor market flexibility, labor quality, and competition—are critically linked to the success and growth of firms.

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Figure 1. Kernel Density Estimation (a) for the Sample of all Firms, 2001-2004.

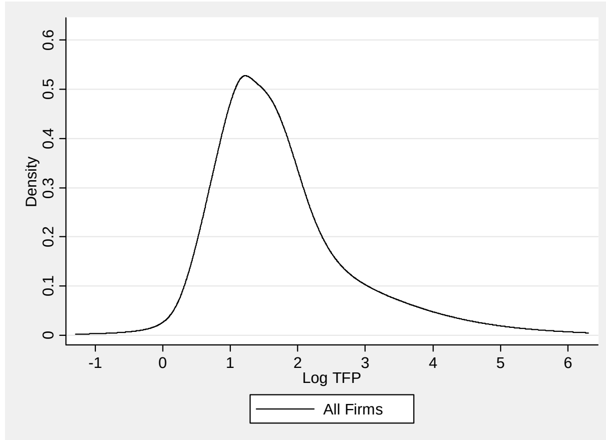
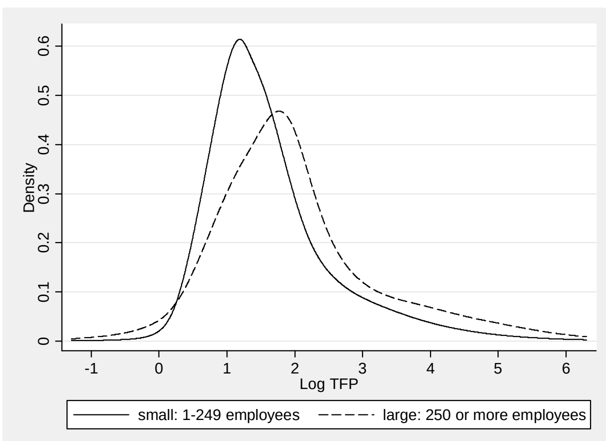
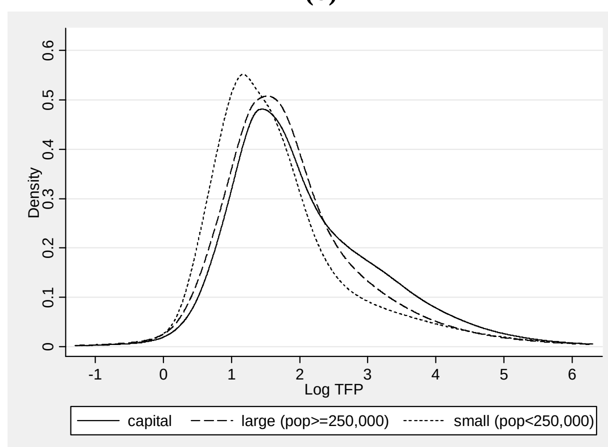


Figure 2. Kernel Density Estimation by (a) Firm Size, (b) Sub-national Location, and (c) Average Industry Factor Intensity, 2001-2004.

(a)



(b)



(c)

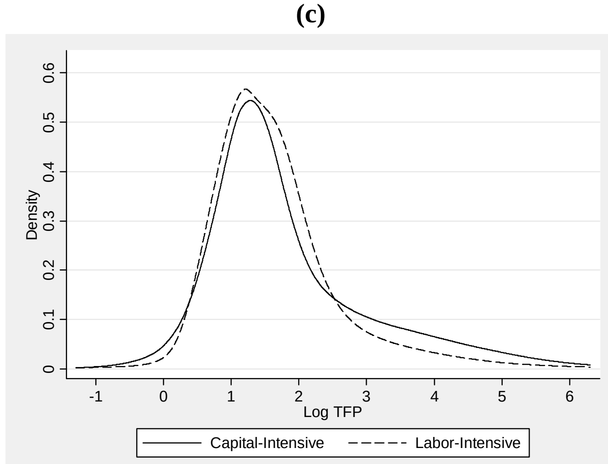


Figure 3. Kernel Density Estimation by Country, 2001-2004.

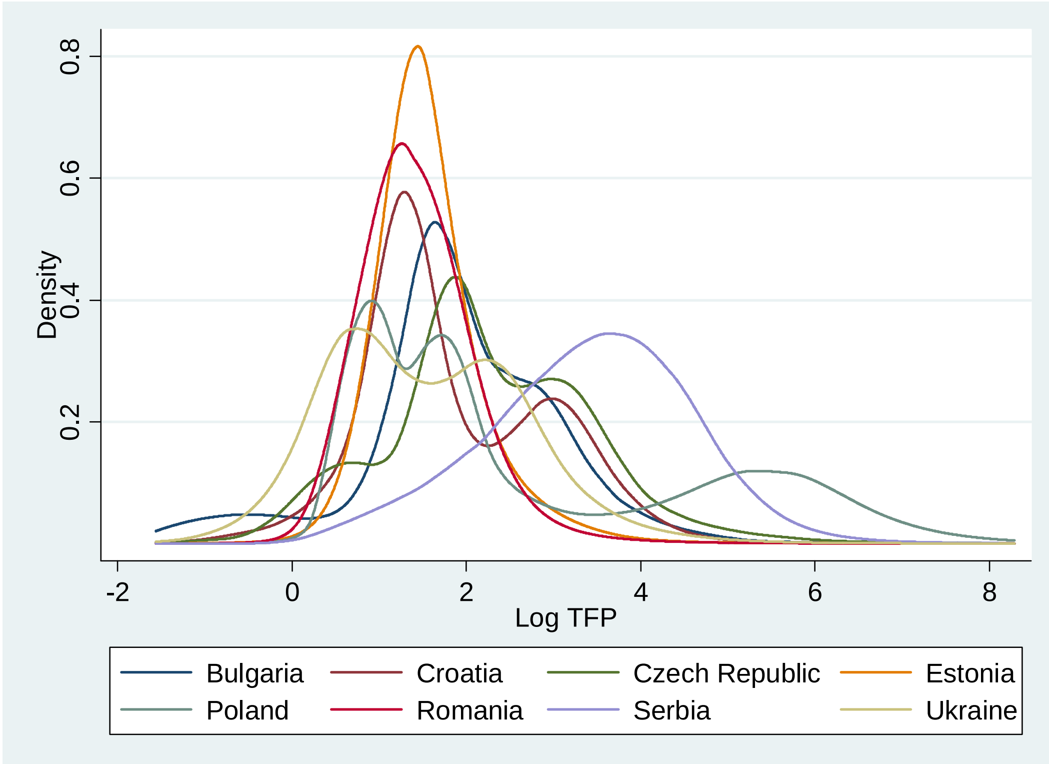


Figure 4. Infrastructure Quality Indicator: Guttman-Kaiser Criterion, Cattell's Scree Test, and Humphrey-Ilgen Parallel Analysis.

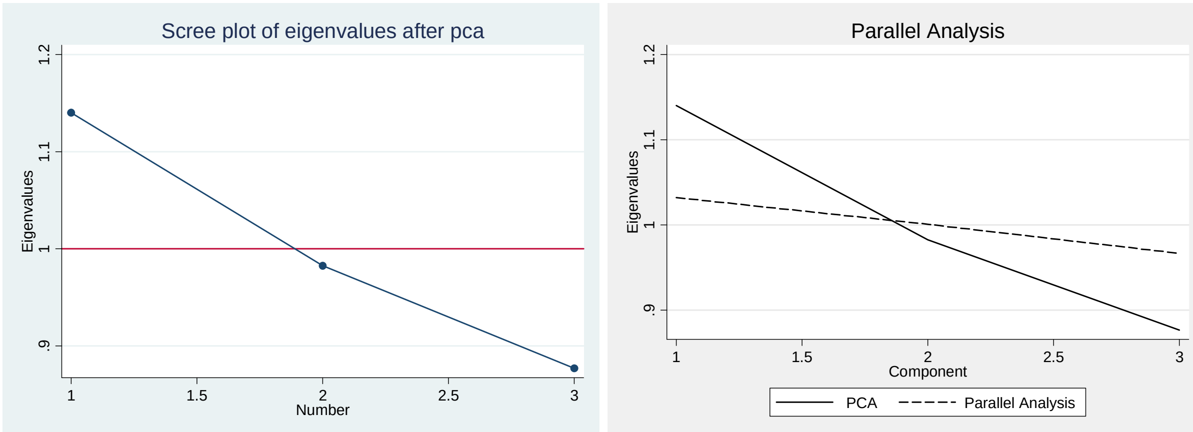


Figure 5. Financial Development Indicator: Guttman-Kaiser Criterion, Cattell's Scree Test, and Humphrey-Ilgen Parallel Analysis.

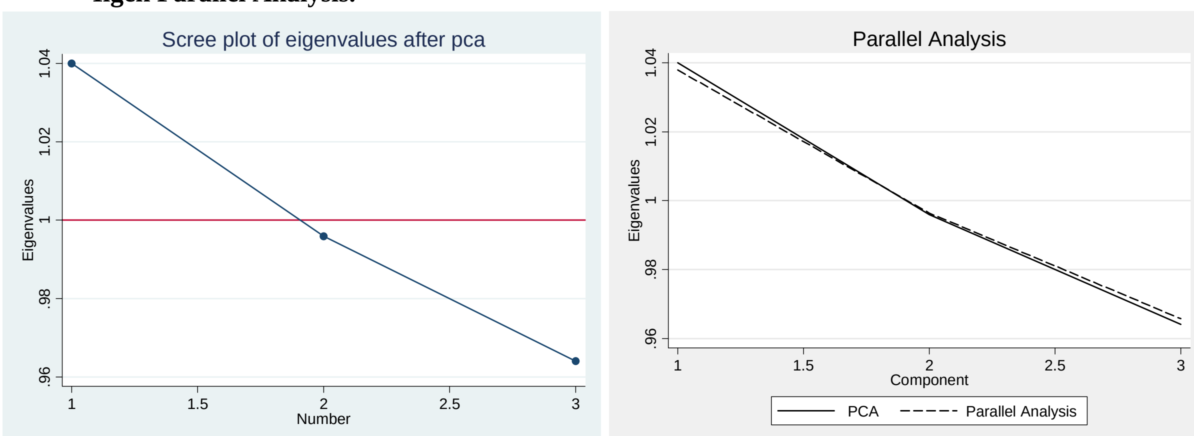


Figure 6. Governance Indicator: Guttman-Kaiser Criterion, Cattell's Scree Test, and Humphrey-Ilgen Parallel Analysis.

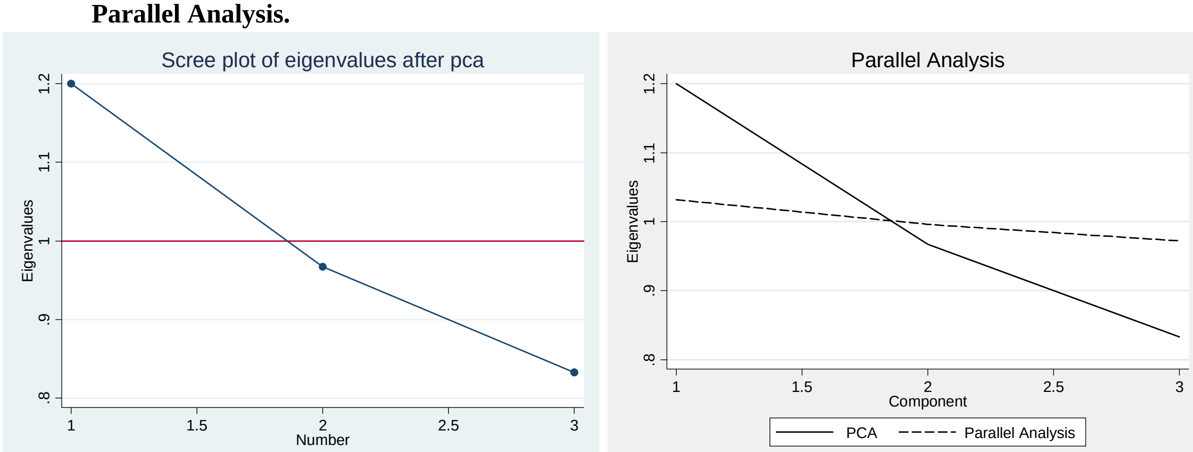


Figure 7. Labor Market Flexibility Indicator Guttman-Kaiser Criterion, Cattell's Scree Test, and Humphrey-Ilgen Parallel Analysis.

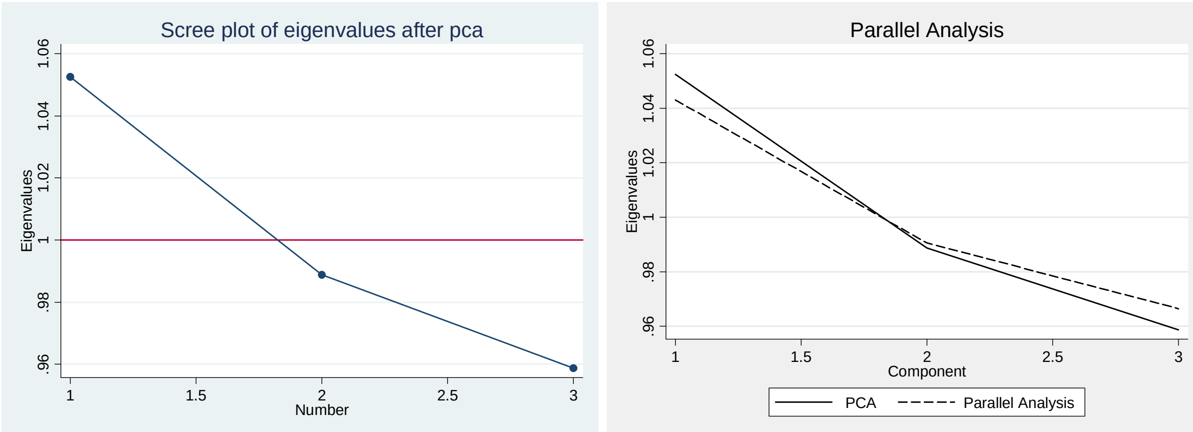


Figure 8. Labor Quality Indicator: Guttman-Kaiser Criterion, Cattell's Scree Test, and Humphrey-Ilgen Parallel Analysis.

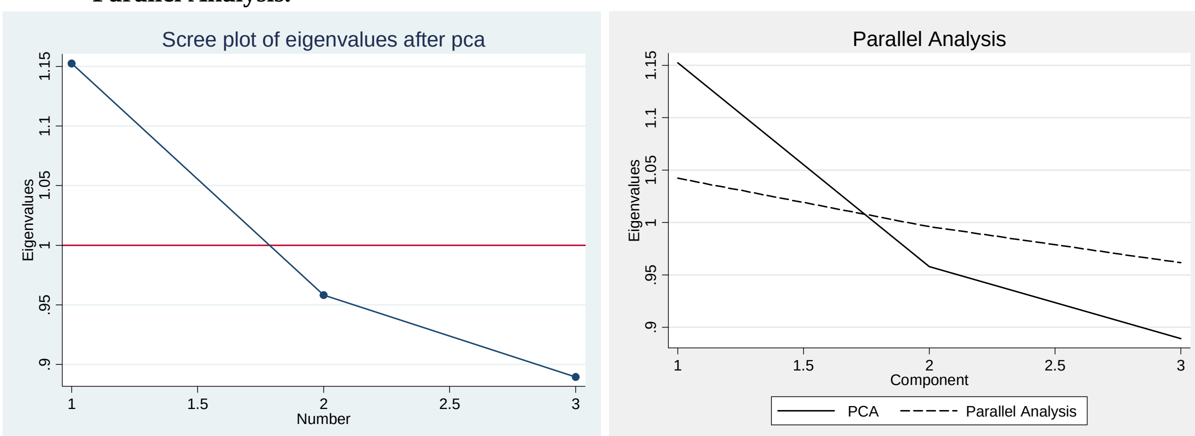


Figure 9. Olley and Pakes Decomposition of Aggregate Productivity (TFP à la Levinsohn and Petrin) in Levels by Country, 2001-2004

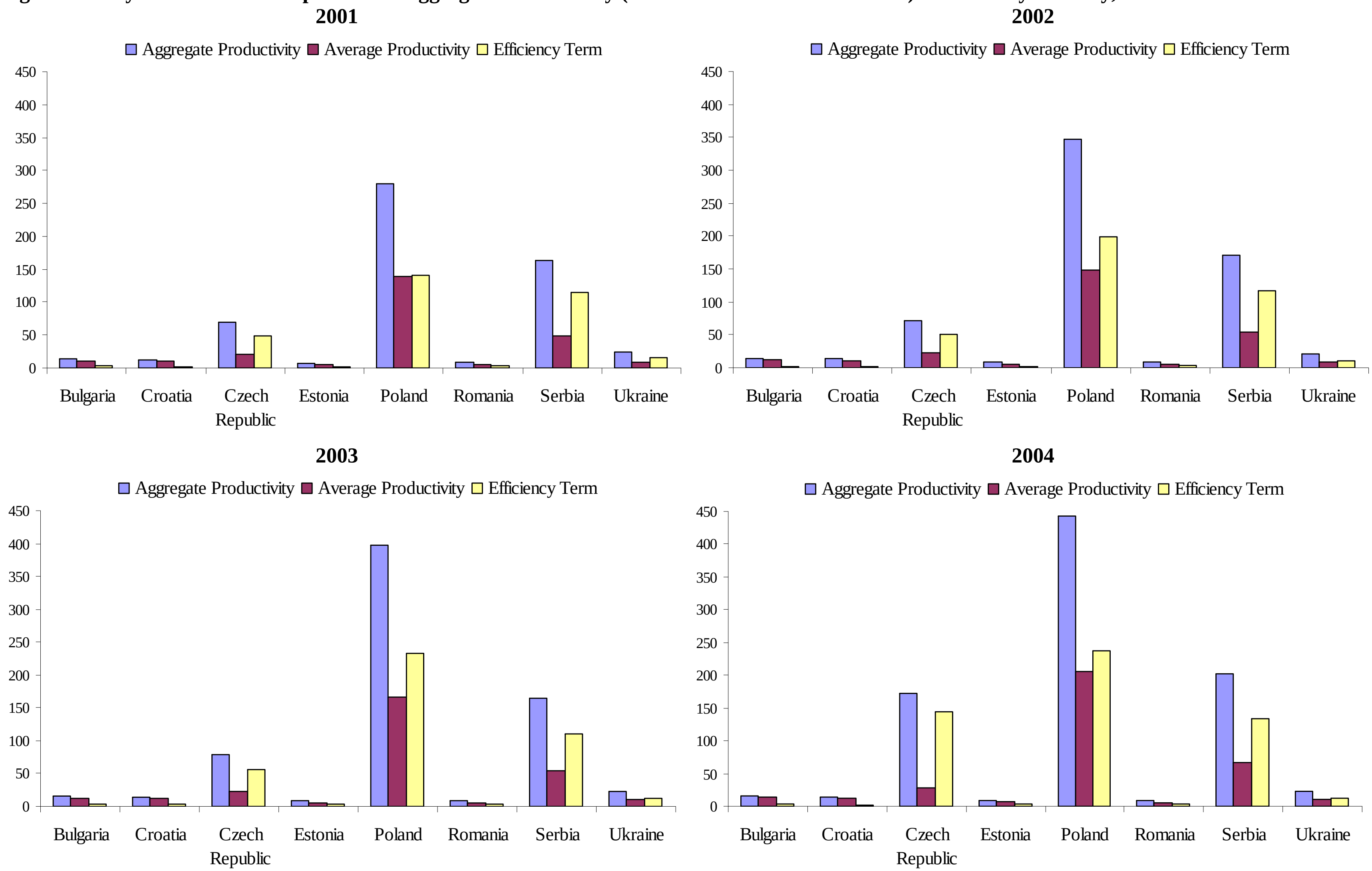


Figure 10. Relative Percentage Contribution of Changes in Business Environment Indicators to Log TFP Growth over the Period 2001-2004 by Country.

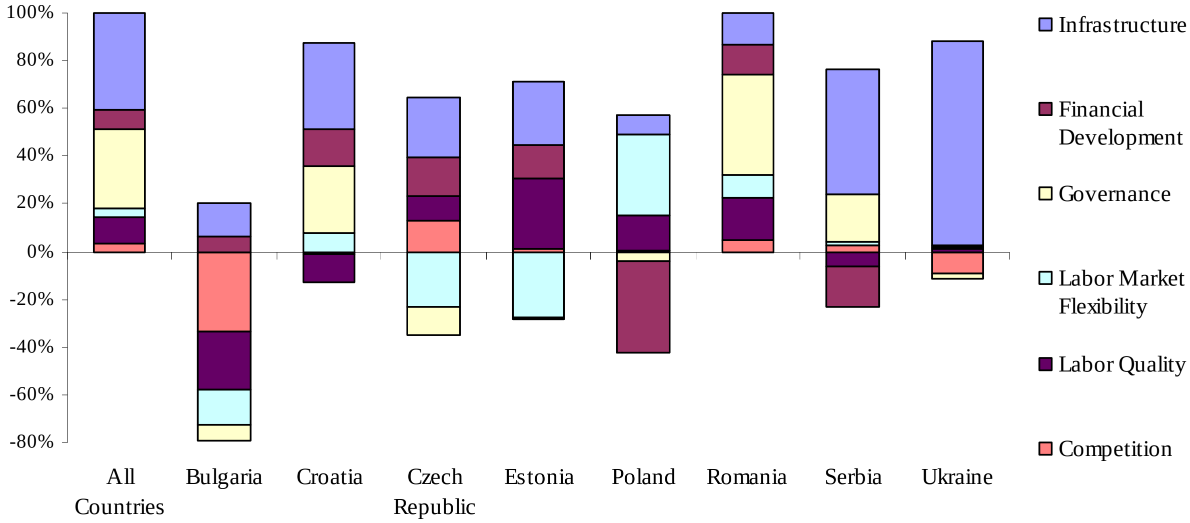


Figure 11. Relative Percentage Contribution of Changes in Business Environment Indicators to Log TFP Growth over the Period 2001-2004 by Size.

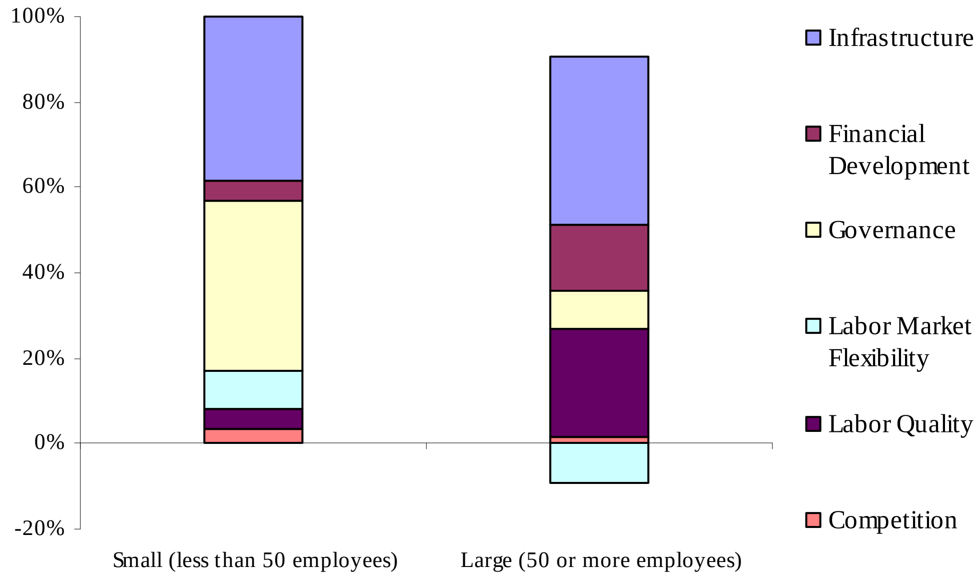
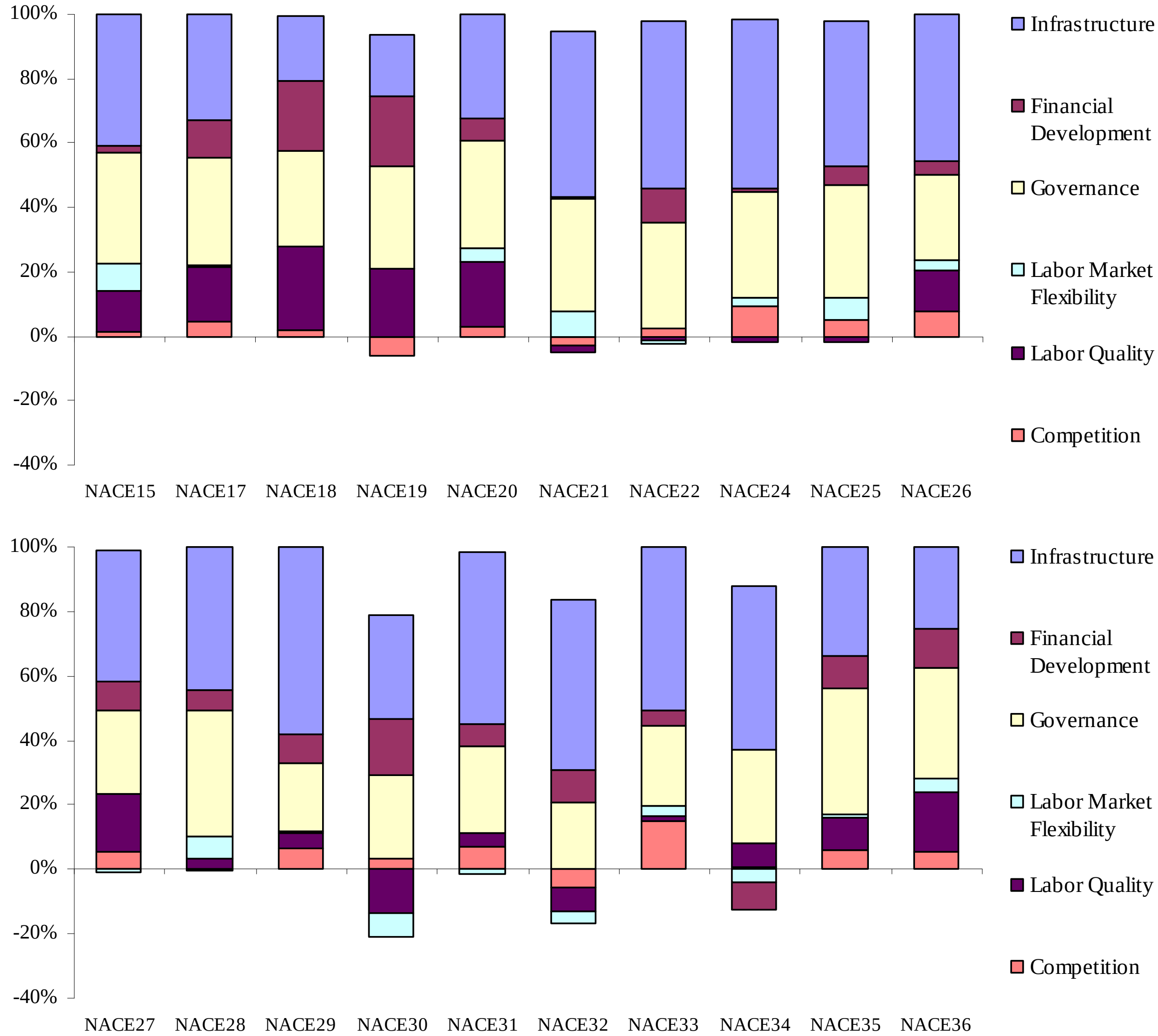


Figure 12. Relative Percentage Contribution of Changes in Business Environment Indicators to Log TFP Growth over the Period 2001-2004 by Industry.



NACE Industry Descriptions

(15) food products and beverages; (17) textiles; (18) garments; (19) tanning and dressing of leather; luggage, handbags, saddlery, harness, and footwear; (20) wood and products of wood and cork, except furniture; articles of straw and plaiting materials; (21) paper and paper products; (22) Publishing, printing and reproduction of recorded media; (24) chemicals and chemical products; (25) rubber and plastics products; (26) other non-metallic mineral products; (27) basic metals; (28) fabricated metal products, except machinery and equipment; (29)machinery and equipment not elsewhere classified t elsewhere classified (n.e.c.); (30) office, accounting, and computing machinery; (31) electrical machinery and apparatus n.e.c.; (32) radio, television, and communication equipment and apparatus; (33) medical, precision, and optical instruments, watches, and clocks; (34) motor vehicles, trailers, and semi-trailers; (35) other transport equipment; and (36) furniture; manufacturing n.e.c.

Table 1. Descriptive Statistics of Total Factor Productivity (TFP) Estimates [calculated according to the method described in Levinsohn and Petrin (2003)].

Country	Location	Firm Size	Obs	ΔlnTFP $_t$	ΔlnTFP $_{t-1}$	lnTFP			
						2001	2002	2003	2004
All Countries[1]	**Total**		22,004	0.062	0.030	1.770	1.782	1.800	1.844
				(0.386)	(0.384)	(1.095)	(1.103)	(1.105)	(1.157)
Bulgaria	**Sofia**	**large**	102	0.100	0.128	1.931	1.968	2.059	2.068
	small city	**small**	32	0.325	0.256	1.921	1.979	2.177	2.305
	small city	**large**	77	0.183	0.184	1.672	1.729	1.856	1.912
	large city	**large**	10	0.077	0.172	1.152	1.183	1.325	1.260
	Total		221	0.160	0.168	1.804	1.851	1.972	2.012
Croatia	**Zagreb**	**small**	433	0.062	0.121	2.100	2.152	2.221	2.214
	Zagreb	**large**	65	0.043	0.096	1.667	1.696	1.763	1.739
	small city	**small**	987	0.045	0.086	1.657	1.699	1.743	1.744
	small city	**large**	295	0.058	0.089	1.941	1.988	2.030	2.046
	Total		1,780	0.051	0.095	1.812	1.857	1.908	1.908
Czech Republic	**small city**	**small**	134	0.031	0.030	2.215	2.226	2.245	2.257
	small city	**large**	769	0.070	0.079	2.187	2.234	2.266	2.304
	large city	**small**	11	0.216	0.097	2.535	2.609	2.632	2.825
	large city	**large**	50	0.036	0.059	2.222	2.301	2.281	2.337
	Total		964	0.064	0.072	2.197	2.241	2.268	2.306
Estonia	**Tallinn**	**small**	369	0.113	0.117	1.637	1.694	1.754	1.806
	Tallinn	**large**	40	0.113	0.103	1.769	1.813	1.873	1.926
	small city	**small**	728	0.074	0.101	1.413	1.460	1.514	1.534
	small city	**large**	116	0.067	0.119	1.469	1.531	1.588	1.598
	Total		1,253	0.086	0.108	1.495	1.547	1.603	1.633
Poland	**Warsaw**	**small**	14	0.108	-0.010	3.625	3.604	3.615	3.712
	Warsaw	**large**	48	0.159	0.092	4.084	4.120	4.176	4.279
	small city	**small**	117	0.088	0.037	2.515	2.554	2.552	2.642
	small city	**large**	754	0.129	-0.031	2.655	2.577	2.624	2.706
	large city	**small**	46	0.108	-0.014	3.028	3.004	3.014	3.112
	large city	**large**	154	0.166	0.019	2.954	2.918	2.973	3.084
	Total		1,133	0.130	-0.011	2.769	2.716	2.758	2.846
Romania	**Bucharest**	**small**	1,157	0.003	-0.025	1.691	1.681	1.666	1.684
	Bucharest	**large**	273	0.055	-0.033	1.956	1.917	1.923	1.972
	small city	**small**	7,067	0.015	0.005	1.262	1.265	1.267	1.280
	small city	**large**	2,173	0.030	0.005	1.658	1.650	1.662	1.680
	large city	**small**	1,505	0.022	-0.024	1.541	1.517	1.517	1.539
	large city	**large**	401	0.036	0.010	1.852	1.839	1.862	1.876
	Total		12,576	0.019	-0.002	1.437	1.433	1.435	1.451
Serbia	**Belgrade**	**small**	430	0.387	0.139	2.971	3.104	3.110	3.490
	Belgrade	**large**	103	0.214	0.153	3.978	4.128	4.131	4.342
	small city	**small**	1,120	0.249	0.108	3.047	3.151	3.155	3.400
	small city	**large**	584	0.039	-0.033	3.859	3.871	3.826	3.909
	Total		2,237	0.219	0.079	3.287	3.375	3.367	3.594
Ukraine	**Kiev**	**small**	10	-0.093	0.194	2.129	2.244	2.323	2.151
	Kiev	**large**	98	0.151	0.095	1.591	1.607	1.687	1.758
	small city	**small**	124	0.066	-0.119	1.111	1.024	0.991	1.090
	small city	**large**	1,022	0.122	0.071	1.486	1.490	1.558	1.612
	large city	**small**	60	0.064	0.093	1.501	1.415	1.594	1.479
	large city	**large**	526	0.091	0.056	1.623	1.610	1.679	1.700
	Total		1,840	0.108	0.057	1.510	1.501	1.567	1.608

Source : Authors' calculations based on AMADEUS database (May 2006 edition).

Notes : [1] Standard deviation in parentheses. Appendix Table A1 presents descriptive statistics of labor, materials, and capital in levels for the years 2001 through 2004. A *small city* is defined as having a population less than 250,000, and a *large city* is defined as having a population equal to or greater than 250,000. A small-sized firm is defined as employing 2 to 49 full-time workers, and a large-sized firm is defined as employing 50 or more full-time workers.

Table 2. Descriptive Statistics of the Competition Indicator.

	Number of Industries	2001	Number of Industries	2003	Change
All Countries	1,935	0.190	1,970	0.185	-0.005
		(0.234)		(0.231)	
Bulgaria	280	0.215	254	0.106	-0.108
		(0.233)		(0.165)	
Croatia	230	0.135	233	0.131	-0.005
		(0.198)		(0.195)	
Czech Republic	265	0.163	284	0.220	0.057
		(0.206)		(0.230)	
Estonia	204	0.132	214	0.129	-0.003
		(0.196)		(0.193)	
Poland	276	0.217	288	0.226	0.009
		(0.246)		(0.239)	
Romania	247	0.313	248	0.340	0.027
		(0.267)		(0.268)	
Serbia	208	0.167	220	0.175	0.008
		(0.238)		(0.242)	
Ukraine	225	0.152	229	0.131	-0.021
		(0.218)		(0.201)	

Note : The competition indicator is equal to 1 minus the four-firm concentration ratio for industries defined at the 4-digit NACE level (1500-3663) and calculated using the full AMADEUS sample.

Table 3. Correlation between Infrastructure Quality Indicator and Underlying BEEPS Variables

	Overall			2001			2003		
	Corr.	Mean	S.D.	Corr.	Mean	S.D.	Corr.	Mean	S.D.
Power outages	0.720	3.7	11.5	0.739	6.2	15.3	0.686	2.7	9.4
Insufficient water supply	0.362	4.6	32.9	0.466	11.9	56.3	0.184	1.7	14.9
Unavailable mainline telephone service	0.701	1.5	10.1	0.665	3.2	17.7	0.746	0.8	3.9

Table 4. Correlation between Financial Development Indicator and Underlying BEEPS Variables

	Overall			2001			2003		
	Corr.	Mean	S.D.	Corr.	Mean	S.D.	Corr.	Mean	S.D.
Local private commercial banks	0.574	10.5	25.1	0.462	6.3	19.3	0.635	12.1	26.7
Foreign banks	0.468	2.8	14.2	0.617	4.8	18.4	0.344	2.0	12.1
Informal (family/friends/money lenders)	0.701	3.6	15.4	0.654	4.1	17.2	0.730	3.5	14.7

Table 5. Correlation between Governance Indicator and Underlying BEEPS Variables

	Overall			2001			2003		
	Corr.	Mean	S.D.	Corr.	Mean	S.D.	Corr.	Mean	S.D.
Bribe level (officials)	0.735	0.9	2.3	0.825	1.5	3.1	0.656	0.7	1.9
Tax compliance	0.669	90.4	17.4	0.630	89.4	19.7	0.697	90.8	16.5
Confidence in legal system	0.461	3.5	1.4	0.355	3.5	1.4	0.532	3.5	1.4

Table 6. Correlation between Labor Market Flexibility Indicator and Underlying BEEPS Variables

	Overall			2001			2003		
	Corr.	Mean	S.D.	Corr.	Mean	S.D.	Corr.	Mean	S.D.
Underemployment and overemployment	0.680	30.2	45.9	0.616	27.0	44.4	0.718	31.4	46.4
ΔTemporary workers to permanent workers	0.509	0.3	41.5	0.690	2.1	58.7	0.356	-0.5	32.4
Labor regulations as a constraint	0.576	2.8	1.1	0.503	2.9	1.0	0.613	2.7	1.1

Table 7. Correlation between Labor Quality Indicator and Underlying BEEPS Variables

	Overall			2001			2003		
	Corr.	Mean	S.D.	Corr.	Mean	S.D.	Corr.	Mean	S.D.
Skilled workers to total employees	0.640	83.0	21.5	0.568	82.5	20.4	0.674	83.3	21.9
Time to fill vacancy for skilled worker	0.689	4.0	5.4	0.765	5.1	7.6	0.646	3.6	4.2
Labor quality as a constraint	0.517	2.8	1.1	0.482	2.9	1.0	0.536	2.8	1.1

Table 8. Descriptive Statistics of Business Environment PCA Indicators, 2001 and 2003.

Country	Location	Firm Size	Infrastructure Quality					Financial Development					Governance					Labor Market Flexibility					Labor Quality				
			Obs	**2001**	**Obs**	**2003**	**Change**	**Obs**	**2001**	**Obs**	**2003**	**Change**	**Obs**	**2001**	**Obs**	**2003**	**Change**	**Obs**	**2001**	**Obs**	**2003**	**Change**	**Obs**	**2001**	**Obs**	**2003**	**Change**
All Countries	**Total**		376	-0.273	1,082	0.106	0.379	370	0.027	927	-0.012	-0.039	340	-0.202	1,029	0.082	0.284	356	0.109	914	-0.043	-0.152	348	-0.110	889	0.034	0.144
				(1.532)		(0.823)			(1.177)		(0.951)			(1.392)		(0.951)			(1.198)		(0.947)			(1.175)		(1.029)	
Bulgaria	**Sofia**	**large**	5	0.042	7	0.135	0.093	8	0.284	4	-0.018	-0.302	8	-0.618	6	-1.189	-0.570	7	-0.306	4	-0.782	-0.476	6	-0.088	6	-0.288	-0.200
	small city	**small**	7	-0.306	14	-0.026	0.281	8	0.161	12	0.439	0.278	10	-0.886	15	-0.330	0.556	9	0.560	16	-0.120	-0.680	7	0.553	12	0.322	-0.231
	small city	**large**	15	-0.114	16	0.047	0.161	16	0.464	12	0.934	0.470	12	0.018	15	0.016	-0.003	15	0.404	15	0.491	0.087	15	0.239	16	-0.191	-0.430
	large city	**large**	2	-0.323	6	-0.336	-0.014	2	-0.018	4	-0.055	-0.036	3	0.684	5	0.432	-0.252	2	1.019	4	0.492	-0.527	3	0.162	6	-0.196	-0.359
	Total		29	-0.148	43	-0.016	0.132	34	0.322	32	0.506	0.184	33	-0.350	41	-0.236	0.113	33	0.333	39	0.110	-0.223	31	0.239	40	-0.053	-0.291
Croatia	**Zagreb**	**small**	7	-0.208	11	0.303	0.511	4	-0.018	6	0.470	0.488	7	0.225	13	0.633	0.408	5	1.727	14	-0.030	-1.758	6	-0.153	6	0.207	0.360
	Zagreb	**large**	4	0.264	12	0.209	-0.055	3	-0.018	7	0.301	0.319	4	0.331	10	0.303	-0.028	2	0.139	11	0.141	0.002	2	-0.823	9	-0.139	0.684
	small city	**small**	11	-0.406	18	0.323	0.729	9	0.252	17	0.409	0.157	5	-1.690	16	0.288	1.978	5	-0.719	15	0.479	1.197	6	0.452	13	-0.300	-0.752
	small city	**large**	9	0.033	16	0.290	0.257	8	1.491	11	1.668	0.176	6	0.423	16	0.445	0.021	9	0.241	14	0.388	0.147	11	-0.940	16	-0.523	0.416
	Total		31	-0.148	57	0.286	0.433	24	0.586	41	0.737	0.151	22	-0.137	55	0.418	0.555	21	0.357	54	0.254	-0.102	25	-0.408	44	-0.279	0.128
Czech Republic	**small city**	**small**	23	-0.050	37	0.170	0.220	23	-0.329	30	0.144	0.473	12	0.284	34	-0.394	-0.679	18	0.469	28	-0.191	-0.659	14	0.374	15	0.289	-0.085
	small city	**large**	14	-0.046	22	0.308	0.355	12	0.130	20	0.261	0.131	11	0.424	14	0.039	-0.385	10	0.643	16	-0.018	-0.661	11	-0.674	15	-0.398	0.276
	large city	**small**	3	0.007	5	-0.824	-0.831	4	-1.111	6	-0.643	0.468	2	0.842	6	0.039	-0.802	3	0.601	6	0.155	-0.446	3	-0.894	5	0.656	1.550
	large city	**large**	3	0.336	3	0.336	0.000	4	-0.018	2	-0.018	0.000	2	0.166	3	0.367	0.200	3	0.274	3	0.508	0.234	4	0.088	3	-0.931	-1.020
	Total		43	-0.018	67	0.149	0.167	43	-0.245	58	0.097	0.342	27	0.374	57	-0.202	-0.576	34	0.515	53	-0.060	-0.574	32	-0.141	38	-0.030	0.111
Estonia	**Tallinn**	**small**	10	-0.107	13	0.161	0.268	6	-0.018	7	0.168	0.186	4	0.442	10	0.317	-0.125	7	0.972	12	0.043	-0.929	10	-0.187	5	0.511	0.698
	Tallinn	**large**	4	-0.470	7	-0.174	0.296	4	0.075	5	0.800	0.725	2	-0.022	5	0.520	0.542	4	0.471	7	0.103	-0.368	4	-0.672	6	-0.920	-0.248
	small city	**small**	6	-0.286	10	0.131	0.418	5	-0.018	8	0.051	0.070	5	0.541	5	0.569	0.029	3	0.843	8	0.269	-0.574	4	-1.081	7	-0.818	0.263
	small city	**large**	5	-0.056	8	-0.059	-0.003	6	0.695	6	1.141	0.447	4	0.654	2	0.212	-0.441	3	0.961	6	-0.296	-1.257	6	-1.211	7	0.017	1.228
	Total		25	-0.198	38	0.045	0.243	21	0.203	26	0.478	0.275	15	0.469	22	0.411	-0.059	17	0.830	33	0.049	-0.781	24	-0.673	25	-0.343	0.330
Poland	**Warsaw**	**small**	6	0.274	39	0.296	0.022	9	-0.018	36	-0.238	-0.220	3	-0.709	36	0.179	0.888	5	-0.439	32	-0.430	0.009	2	-0.872	31	0.521	1.393
	Warsaw	**large**	6	0.336	8	0.321	-0.016	4	-0.018	7	0.061	0.080	2	0.016	9	0.205	0.188	7	-0.045	8	-0.095	-0.050	5	0.416	10	0.022	-0.394
	small city	**small**	19	0.145	129	0.244	0.100	16	0.571	113	-0.166	-0.737	20	-0.103	130	0.066	0.170	18	-0.111	115	-0.188	-0.077	13	0.139	75	0.275	0.136
	small city	**large**	23	0.207	44	0.243	0.036	20	0.163	36	-0.002	-0.165	18	0.511	46	0.418	-0.093	24	-0.315	34	0.051	0.366	22	-0.092	36	-0.070	0.022
	large city	**small**	10	0.229	153	0.293	0.064	14	-0.613	135	-0.248	0.365	9	0.667	155	-0.010	-0.677	11	-0.778	116	-0.182	0.596	9	0.167	113	0.161	-0.006
	large city	**large**	11	0.303	29	0.306	0.004	8	-0.018	22	-0.018	0.000	5	0.606	29	0.565	-0.041	10	-0.695	26	-0.035	0.660	7	-0.496	29	-0.073	0.423
	Total		75	0.224	402	0.274	0.050	71	0.048	349	-0.174	-0.223	57	0.247	405	0.126	-0.121	75	-0.368	331	-0.170	0.197	58	-0.032	294	0.172	0.204
Romania	**Bucharest**	**small**	5	-0.011	20	0.103	0.114	7	-0.379	22	-0.247	0.132	4	0.024	19	-0.052	-0.075	4	-0.164	17	0.277	0.441	6	1.132	23	0.078	-1.054
	Bucharest	**large**	4	0.181	16	0.195	0.014	3	-0.018	18	0.083	0.101	3	-0.239	16	0.405	0.644	2	1.019	15	0.187	-0.832	4	0.042	20	-0.046	-0.088
	small city	**small**	15	-0.336	74	-0.115	0.221	26	-0.031	67	-0.037	-0.006	23	-0.826	72	0.176	1.002	22	-0.258	65	-0.015	0.242	20	-0.095	61	0.208	0.302
	small city	**large**	12	-0.153	45	-0.192	-0.038	16	-0.317	38	0.162	0.479	14	-0.097	43	0.413	0.511	12	0.289	36	0.136	-0.154	10	-0.602	39	0.158	0.760
	large city	**small**	8	0.336	111	0.072	-0.265	7	-0.050	91	-0.096	-0.046	8	-1.067	97	0.168	1.235	5	-0.276	83	-0.123	0.153	5	0.552	93	0.347	-0.205
	large city	**large**	4	0.243	44	0.128	-0.116	5	0.056	34	0.109	0.053	7	-0.003	44	0.346	0.349	5	0.140	39	-0.062	-0.201	6	0.501	43	0.120	-0.381
	Total		48	-0.053	310	0.005	0.058	64	-0.135	270	-0.020	0.116	59	-0.500	291	0.232	0.732	50	-0.030	255	-0.005	0.025	51	0.094	279	0.205	0.110
Serbia	**Belgrade**	**small**	8	-2.148	12	-0.765	1.383	12	-0.018	11	-0.018	0.000	3	-0.222	10	-0.315	-0.093	10	0.409	10	0.418	0.009	2	-0.809	5	0.183	0.991
	Belgrade	**large**	10	0.187	13	0.240	0.053	10	-0.018	10	-0.018	0.000	6	-0.591	12	-0.132	0.460	5	0.618	10	-0.001	-0.619	7	0.495	9	-0.600	-1.095
	small city	**small**	7	-1.059	8	-0.083	0.976	10	-0.040	3	-0.018	0.022	5	-1.783	9	0.177	1.959	7	-1.045	5	-0.632	0.413	6	0.173	6	-0.238	-0.411
	small city	**large**	10	-1.386	20	-1.165	0.221	8	1.346	11	0.311	-1.035	8	0.344	13	-0.144	-0.488	11	0.016	18	-0.485	-0.500	5	-0.271	13	-0.494	-0.223
	Total		35	-1.045	53	-0.567	0.479	40	0.249	35	0.085	-0.164	22	-0.472	44	-0.114	0.358	33	0.001	43	-0.179	-0.180	20	0.077	33	-0.374	-0.450
Ukraine	**Kiev**	**small**	7	-1.773	8	0.122	1.895	3	-0.018	10	-0.293	-0.275	6	-0.841	10	-0.608	0.233	4	0.923	10	-0.159	-1.081	6	0.098	11	-0.541	-0.639
	Kiev	**large**	8	0.088	10	0.187	0.099	4	-0.018	12	-0.365	-0.347	6	-0.491	7	-0.215	0.277	4	0.820	10	0.491	-0.329	8	-0.702	14	-0.247	0.455
	small city	**small**	20	-1.644	30	0.118	1.762	16	-0.448	28	-0.020	0.428	23	-0.378	33	-0.185	0.194	25	0.028	28	-0.204	-0.233	21	-0.324	28	-0.112	0.212
	small city	**large**	10	-0.916	12	0.112	1.028	9	-0.018	15	0.131	0.149	13	0.069	14	-0.039	-0.108	13	0.399	11	0.524	0.125	14	-0.423	15	-0.235	0.188
	large city	**small**	23	-0.355	32	-0.164	0.192	25	-0.235	32	-0.069	0.166	32	-0.527	34	-0.515	0.012	24	0.014	27	0.072	0.058	33	0.077	41	-0.192	-0.269
	large city	**large**	22	-0.181	20	0.146	0.326	16	-0.018	19	-0.238	-0.220	25	-0.514	16	-0.533	-0.020	23	0.195	20	0.197	0.002	25	-0.167	27	-0.617	-0.450
	Total		90	-0.732	112	0.048	0.780	73	-0.187	116	-0.109	0.078	105	-0.433	114	-0.353	0.080	93	0.190	106	0.087	-0.103	107	-0.181	136	-0.299	-0.118

Source : Authors' calculations based on BEEPS 2002 and 2005 databases.

Note : [1]Standard deviation in parentheses. Appendix Tables A2 through A6 present descriptive statistics of underlying BEEPS variables in levels for years 2001 and 2003. A *small city* is defined as having a population less than 250,000, and a *large city* is defined as having a population equal to or greater than 250,000. A small-sized firm is defined as employing 2 to 49 full-time workers, and a large-sized firm is defined as employing 50 or more full-time workers.

Table 9. Firm-Level Productivity Growth and Changes in the Business Environment, 2001-2004.

[dependent variable: Δln(TFP) $_t$ (Levinsohn-Petrin)]

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
ΔInfrastructure Quality $_{t-1}$	0.112***	-	-	-	-	-	0.061***
	(0.018)						(0.020)
ΔFinancial Development $_{t-1}$	-	0.100***	-	-	-	-	0.064***
		(0.011)					(0.012)
ΔGovernance $_{t-1}$	-	-	0.037***	-	-	-	0.023***
			(0.006)				(0.0080)
ΔLabor Market Flexibility $_{t-1}$	-	-	-	0.019***	-	-	0.028***
				(0.005)			(0.010)
ΔLabor Quality $_{t-1}$	-	-	-	-	0.033***	-	0.048***
					(0.007)		(0.010)
ΔCompetition $_{t-1}$	-	-	-	-	-	0.117**	0.127**
						(0.057)	(0.057)
Δln(TFP) $_{t-1}$	0.253***	0.252***	0.253***	0.255***	0.254***	0.255***	0.249***
	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)
Firm characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Location dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	22,004	22,004	22,004	22,004	22,004	22,004	22,004
Adjusted R^2	0.187	0.187	0.185	0.184	0.185	0.184	0.191

Note : ** significant at 5%; *** significant at 1%. Robust standard errors are denoted in parentheses.

Firm characteristics include logarithmic changes in the number of employees, the value of tangible fixed assets (thousands of 2001 U.S. dollars), and cost of materials (thousands of 2001 U.S. dollars).

Industry dummies are defined at the 4-digit NACE level (1500 to 3663).

Location dummies include capital city dummy variable ((equal to 1 if the firm is located in a capital city—that is, Belgrade, Bucharest, Kyiv, Prague, Sofia, Tallinn, Warsaw, or Zagreb—and 0 otherwise) and large city dummy variable (equal to 1 if the firm is located in a city with a population of 250,000 and over, and 0 otherwise).

Countries (8 total) include: Bulgaria, Croatia, Czech Republic, Estonia, Poland, Romania, Serbia, and Ukraine.

Table A1. Descriptive Statistics of Labor, Materials, and Capital, 2001-2004.

Country	Location	Firm Size	Obs	Labor (number of employees)				Materials (material costs 2001 US$000)				Capital (tangible fixed assets 2001 US$000)			
				2001	2002	2003	2004	2001	2002	2003	2004	2001	2002	2003	2004
All Countries	**Total**		22,004	98	97	95	94	1,063	1,285	1,588	2,136	699	853	1,032	1,278
				(258)	(241)	(231)	(227)	(5,562)	(6,937)	(8,896)	(12,962)	(3,401)	(4,165)	(5,045)	(6,072)
Bulgaria	**Sofia**	**large**	102	171	173	171	187	738	983	1,383	1,747	865	1,117	1,578	1,819
	small city	**small**	32	41	38	30	24	121	149	171	217	195	223	272	272
	small city	**large**	77	245	256	256	268	1,270	1,766	2,493	3,129	1,183	1,693	2,424	2,854
	large city	**large**	10	203	205	201	206	1,011	1,158	1,734	2,083	745	996	1,696	2,429
	Total		221	179	184	182	192	846	1,143	1,610	2,022	873	1,183	1,689	1,983
Croatia	**Zagreb**	**small**	433	10	11	11	12	388	496	689	750	97	134	178	209
	Zagreb	**large**	65	224	232	236	235	4,905	6,306	8,462	9,936	4,311	5,536	6,506	7,189
	small city	**small**	987	12	13	14	13	395	499	652	747	187	237	312	360
	small city	**large**	295	173	183	185	187	3,686	4,579	5,658	6,573	2,655	3,273	3,986	4,597
	Total		1,780	46	49	50	50	1,103	1,387	1,776	2,048	725	909	1,114	1,275
Czech Republic	**small city**	**small**	134	31	30	30	29	844	981	1,239	1,573	394	499	642	815
	small city	**large**	769	279	281	285	304	7,018	8,887	11,288	15,021	4,264	5,318	6,454	7,527
	large city	**small**	11	27	27	27	27	701	649	818	963	381	507	576	647
	large city	**large**	50	298	288	285	267	6,582	7,383	7,792	10,655	5,450	6,798	7,824	9,080
	Total		964	242	243	246	261	6,065	7,616	9,590	12,765	3,743	4,670	5,650	6,596
Estonia	**Tallinn**	**small**	369	12	13	13	13	149	189	233	291	40	55	83	97
	Tallinn	**large**	40	94	97	100	96	1,720	2,177	2,936	3,321	629	829	910	1,003
	small city	**small**	728	15	15	16	15	169	223	286	348	64	91	125	159
	small city	**large**	116	105	108	113	118	1,557	1,955	2,723	3,490	672	863	1,131	1,404
	Total		1,253	25	26	26	27	341	435	581	717	131	176	231	283
Poland	**Warsaw**	**small**	14	30	27	26	26	1,773	1,946	2,055	3,410	138	134	151	329
	Warsaw	**large**	48	293	281	278	273	12,948	13,726	15,551	24,139	8,057	9,943	10,021	12,554
	small city	**small**	117	28	27	27	27	1,164	1,498	1,669	2,369	418	473	493	615
	small city	**large**	754	243	247	255	264	7,162	8,144	9,726	15,260	3,253	3,720	4,100	5,681
	large city	**small**	46	26	25	25	26	949	1,065	1,243	1,690	262	329	394	531
	large city	**large**	154	198	216	217	219	4,132	5,180	6,463	9,917	2,550	2,899	2,987	4,225
	Total		1,133	205	210	215	221	6,057	6,927	8,258	12,881	2,908	3,355	3,628	4,976
Romania	**Bucharest**	**small**	1,157	14	14	14	14	111	134	172	226	34	44	61	86
	Bucharest	**large**	273	227	226	224	216	1,351	1,580	2,200	3,103	1,050	1,237	1,655	2,168
	small city	**small**	7,067	17	16	16	15	100	122	160	210	36	46	63	91
	small city	**large**	2,173	225	229	230	229	1,050	1,299	1,700	2,349	648	841	1,191	1,602
	large city	**small**	1,505	16	16	16	15	102	120	162	213	34	43	59	84
	large city	**large**	401	233	226	219	214	1,029	1,163	1,577	2,240	850	1,085	1,415	1,854
	Total		12,576	64	64	64	63	322	391	517	709	189	242	335	452
Serbia	**Belgrade**	**small**	430	11	11	12	11	171	272	336	214	58	89	116	141
	Belgrade	**large**	103	326	309	296	291	3,601	5,260	5,941	5,803	3,416	4,434	5,973	7,200
	small city	**small**	1,120	12	13	13	12	198	280	336	228	101	138	172	209
	small city	**large**	584	443	409	370	338	3,285	4,249	4,543	5,000	4,013	5,228	6,441	7,818
	Total		2,237	139	130	119	110	1,155	1,544	1,692	1,728	1,267	1,655	2,065	2,504
Ukraine	**Kiev**	**small**	10	67	59	37	29	131	161	200	262	57	55	75	86
	Kiev	**large**	98	230	226	220	221	1,137	1,006	1,296	1,929	1,002	1,060	1,167	1,346
	small city	**small**	124	139	94	56	29	249	172	143	133	514	480	427	382
	small city	**large**	1,022	238	231	220	221	873	856	1,103	1,408	863	885	924	986
	large city	**small**	60	137	92	50	28	162	141	113	108	431	356	262	259
	large city	**large**	526	249	235	225	226	815	823	987	1,268	1,016	1,010	1,046	1,086
	Total		1,840	230	218	204	202	801	781	978	1,261	872	881	912	965

Source : Authors' calculations based on AMADEUS database (May 2006 edition).

Note : [1]Standard deviation in parentheses. A *small city* is defined as having a population less than 250,000, and a *large city* is defined as having a population equal to or greater than 250,000. A small-sized firm is defined as employing 2 to 49 full-time workers, and a large-sized firm is defined as employing 50 or more full-time workers.

Table A2. Descriptive Statistics of Underlying BEEPS Variables for Infrastructure Quality PCA Indicator, 2001 and 2003.

Country	Location	Firm Size	Power outages (days)				Insufficient water supply (days)				Unavailable mainline telephone service (days)			
			Obs	2001	Obs	2003	Obs	2001	Obs	2003	Obs	2001	Obs	2003
	Sofia	**large**	9	2.4	8	2.4	9	4.3	8	1.3	9	4.8	8	0.6
	small city	**small**	13	20.1	18	2.7	12	10.8	17	11.8	13	7.3	17	0.9
Bulgaria	**small city**	**large**	18	3.3	19	1.6	18	1.3	19	4.9	17	0.4	19	3.7
	large city	**large**	3	3.3	6	3.0	3	13.3	6	5.8	3	1.7	6	0.3
	Total		43	8.2	51	2.3	42	5.5	50	6.8	42	3.6	50	1.9
	Zagreb	**small**	8	1.9	14	1.9	7	0.0	14	0.2	7	1.1	14	0.3
	Zagreb	**large**	5	1.6	13	1.0	5	3.0	13	0.0	5	0.2	13	0.3
Croatia	**small city**	**small**	13	3.0	24	0.6	13	2.7	22	0.0	13	1.6	24	1.6
	small city	**large**	11	2.5	17	0.5	11	0.5	17	0.1	11	0.9	17	0.1
	Total		37	2.4	68	0.9	36	1.5	66	0.1	36	1.1	68	0.7
	small city	**small**	28	3.7	40	1.3	27	0.4	39	0.3	27	0.5	39	0.2
	small city	**large**	16	3.1	22	0.2	16	1.6	22	0.0	16	0.7	22	0.0
Czech Republic	**large city**	**small**	4	1.3	6	0.0	4	0.5	6	0.0	4	1.5	6	5.0
	large city	**large**	4	2.5	3	0.0	4	0.5	3	0.0	4	0.5	3	0.0
	Total		52	3.2	71	0.8	51	0.8	70	0.2	51	0.6	70	0.5
	Tallinn	**small**	11	2.7	14	0.7	11	0.5	14	0.7	11	1.5	14	0.3
	Tallinn	**large**	5	3.2	7	1.6	5	1.4	7	0.7	5	2.4	7	1.0
Estonia	**small city**	**small**	7	2.0	11	2.4	6	0.8	11	0.3	6	1.3	11	0.2
	small city	**large**	7	3.3	8	2.8	7	1.3	8	0.5	7	1.7	8	0.1
	Total		30	2.8	40	1.7	29	0.9	40	0.6	29	1.7	40	0.4
	Warsaw	**small**	10	0.5	46	0.4	10	0.4	46	0.1	10	1.9	46	0.9
	Warsaw	**large**	7	0.4	12	2.3	7	0.4	12	0.4	7	0.1	12	0.4
Poland	**small city**	**small**	28	4.0	173	1.5	28	0.1	173	0.3	28	1.5	173	0.6
	small city	**large**	35	3.6	55	0.9	35	0.5	55	0.1	35	1.1	55	0.6
	large city	**small**	18	4.4	205	1.1	18	0.9	205	0.2	18	0.6	205	1.0
	large city	**large**	15	3.5	36	0.8	15	0.8	36	0.1	15	1.0	36	0.3
	Total		113	3.3	527	1.1	113	0.5	527	0.2	113	1.1	527	0.7
Romania	**Bucharest**	**small**	9	3.8	30	10.9	9	1.8	30	2.7	9	1.2	30	1.1
	Bucharest	**large**	4	1.3	22	2.9	4	0.0	22	1.5	4	0.0	22	2.2
	small city	**small**	30	16.0	93	5.0	30	26.7	93	1.6	30	1.8	93	0.9
	small city	**large**	20	9.9	53	4.6	20	23.6	53	1.2	20	2.7	52	0.0
	large city	**small**	9	0.0	131	4.3	9	1.1	131	1.7	9	0.2	130	0.4
	large city	**large**	8	4.5	55	4.4	8	2.1	55	6.9	8	0.9	55	0.2
	Total		80	9.4	384	4.9	80	16.5	384	2.4	80	1.6	382	0.6
	Belgrade	**small**	12	14.6	14	3.0	12	2.1	14	0.6	12	17.1	14	2.2
	Belgrade	**large**	10	1.2	14	0.9	10	0.0	14	0.9	10	0.0	14	0.0
Serbia	**small city**	**small**	13	10.8	9	2.2	13	0.9	9	2.2	13	10.2	9	0.3
	small city	**large**	12	13.7	22	5.3	12	0.0	22	0.0	12	33.5	22	4.4
	Total		47	10.4	59	3.2	47	0.8	59	0.7	47	15.7	59	2.2
Ukraine	**Kiev**	**small**	8	6.4	13	9.5	8	0.4	13	2.5	8	4.0	13	1.9
	Kiev	**large**	9	2.0	13	1.2	9	0.6	12	0.0	9	0.3	12	0.3
	small city	**small**	31	12.8	42	3.5	30	42.8	37	1.7	31	3.5	36	0.6
	small city	**large**	16	10.3	15	1.5	16	30.3	13	0.4	16	3.8	13	0.4
	large city	**small**	44	6.4	44	5.5	43	54.1	43	14.4	43	4.4	43	1.1
	large city	**large**	31	4.0	26	2.5	31	16.7	26	2.7	31	1.7	27	0.6
	Total		139	7.4	153	4.0	137	33.7	144	5.5	138	3.2	144	0.8
All Countries	**Total**		541	6.2	1,353	2.7	535	11.9	1,340	1.7	536	3.2	1,340	0.8

Source: Authors' calculations based on BEEPS 2002 and 2005 databases.
Note: A *small city* is defined as having a population less than 250,000, and a *large city* is defined as having a population equal to or greater than 250,000. A small-sized firm is defined as employing 2 to 49 full-time workers, and a large-sized firm is defined as employing 50 or more full-time workers.

Table A3. Descriptive Statistics of Underlying BEEPS Variables for Financial Development PCA Indicator, 2001 and 2003.

Country	Location	Firm Size	Sources of Finance (percentage of new fixed investment)											
			Local private commercial banks				Foreign banks				Informal (family/friends/ money lenders)			
			Obs	2001	Obs	2003	Obs	2001	Obs	2003	Obs	2001	Obs	2003
	Sofia	**large**	8	8.1	8	15.0	8	0.0	8	7.5	8	0.0	8	1.9
	small city	**small**	9	11.1	12	14.2	9	22.2	12	0.0	9	22.2	12	1.7
Bulgaria	**small city**	**large**	17	6.5	15	14.7	17	7.1	15	9.3	17	0.0	15	0.0
	large city	**large**	2	0.0	5	36.0	2	0.0	5	0.0	2	0.0	5	15.0
	Total		36	7.6	40	17.3	36	8.9	40	5.0	36	5.6	40	2.8
	Zagreb	**small**	7	0.0	7	5.7	7	25.7	7	4.3	7	0.0	7	1.4
	Zagreb	**large**	5	18.0	10	16.0	5	5.0	10	20.0	5	0.0	10	0.0
Croatia	**small city**	**small**	9	10.0	20	24.5	9	4.4	20	0.0	9	8.9	20	2.0
	small city	**large**	8	0.0	12	22.1	8	25.0	12	12.5	8	0.0	12	0.0
	Total		29	6.2	49	19.5	29	15.3	49	7.8	29	2.8	49	1.0
	small city	**small**	25	7.6	35	14.3	25	0.4	35	0.9	25	10.8	35	3.7
	small city	**large**	14	7.8	22	12.3	14	0.0	22	0.0	14	0.7	22	0.0
Czech Republic	**large city**	**small**	4	0.0	6	0.0	4	0.0	6	0.0	4	26.3	6	15.0
	large city	**large**	4	0.0	3	20.0	4	0.0	3	6.7	4	0.0	3	0.0
	Total		47	6.4	66	12.6	47	0.2	66	0.8	47	8.2	66	3.3
	Tallinn	**small**	6	0.0	8	16.9	6	0.0	8	0.0	6	0.0	8	0.0
	Tallinn	**large**	4	2.5	5	22.0	4	0.0	5	0.0	4	0.0	5	0.0
Estonia	**small city**	**small**	5	0.0	8	1.9	5	0.0	8	0.0	5	0.0	8	0.0
	small city	**large**	7	17.0	6	35.8	7	0.0	6	0.0	7	0.0	6	4.2
	Total		22	5.9	27	17.6	22	0.0	27	0.0	22	0.0	27	0.9
	Warsaw	**small**	9	0.0	42	11.2	9	0.0	42	0.0	9	0.0	42	4.5
	Warsaw	**large**	5	0.0	10	8.0	5	10.0	10	5.0	5	0.0	10	0.0
	small city	**small**	21	12.9	143	9.7	21	9.5	143	1.6	21	0.0	143	3.7
Poland	**small city**	**large**	27	16.3	51	12.2	27	2.4	51	0.2	27	0.7	51	0.0
	large city	**small**	15	0.0	163	7.8	15	4.0	163	1.6	15	13.3	163	5.2
	large city	**large**	12	14.2	32	15.3	12	4.2	32	0.9	12	0.0	32	0.0
	Total		89	9.9	441	9.8	89	4.8	441	1.3	89	2.5	441	3.6
Romania	**Bucharest**	**small**	8	12.5	24	7.3	8	12.5	24	1.3	8	18.8	24	8.3
	Bucharest	**large**	4	0.0	20	5.5	4	10.0	20	1.3	4	0.0	20	0.5
	small city	**small**	29	8.6	77	12.2	29	3.4	77	2.6	29	4.0	77	4.7
	small city	**large**	18	1.7	47	14.6	18	5.6	47	4.3	18	6.4	47	0.2
	large city	**small**	9	12.2	113	13.5	9	0.0	113	3.7	9	6.7	113	3.8
	large city	**large**	6	11.7	49	19.5	6	0.0	49	1.6	6	0.0	49	0.0
	Total		74	7.6	330	13.3	74	4.6	330	2.9	74	5.9	330	3.0
	Belgrade	**small**	12	0.0	11	0.0	12	0.0	11	0.0	12	0.0	11	0.0
Serbia	**Belgrade**	**large**	10	0.0	10	0.0	10	0.0	10	0.0	10	0.0	10	0.0
	small city	**small**	10	5.0	7	18.6	10	0.0	7	0.0	10	5.0	7	0.0
	small city	**large**	10	13.0	12	7.9	10	18.0	12	1.7	10	0.0	12	0.0
	Total		42	4.3	40	5.6	42	4.3	40	0.5	42	1.2	40	0.0
Ukraine	**Kiev**	**small**	3	0.0	11	13.6	3	0.0	11	4.5	3	0.0	11	18.2
	Kiev	**large**	4	0.0	13	3.8	4	0.0	13	0.0	4	0.0	13	7.7
	small city	**small**	17	0.0	34	14.7	17	5.9	34	0.0	17	9.7	34	4.7
	small city	**large**	10	1.0	16	4.0	10	0.0	16	0.0	10	0.0	16	0.0
	large city	**small**	27	1.9	38	15.4	27	4.4	38	1.3	27	6.5	38	6.6
	large city	**large**	20	5.0	26	17.5	20	4.5	26	0.0	20	1.0	26	8.8
	Total		81	2.0	138	13.1	81	3.8	138	0.7	81	4.4	138	6.8
All Countries	**Total**		420	6.3	1131	12.1	420	4.8	1131	2.0	420	4.1	1131	3.5

Source: Authors' calculations based on BEEPS 2002 and 2005 databases.
Note: A *small city* is defined as having a population less than 250,000, and a *large city* is defined as having a population equal to or greater than 250,000. A small-sized firm is defined as employing 2 to 49 full-time workers, and a large-sized firm is defined as employing 50 or more full-time workers.

Table A4. Descriptive Statistics of Underlying BEEPS Variables for Governance PCA Indicator, 2001 and 2003.

Country	Location	Firm Size	Bribe level (percentage of total annual sales)				Tax compliance (percentage of total annual sales reported)				Confidence in legal system (1="strongly disagree" to 6="strongly agree")			
			Obs	2001	Obs	2003	Obs	2001	Obs	2003	Obs	2001	Obs	2003
Bulgaria	**Sofia**	**large**	9	1.3	6	1.2	9	86.7	8	75.6	9	3.1	8	2.9
	small city	**small**	12	2.5	16	1.1	12	90.4	18	89.4	13	3.2	18	2.9
	small city	**large**	15	0.5	18	1.2	15	96.0	18	94.2	18	3.2	19	3.0
	large city	**large**	3	0.0	6	1.7	3	100.0	6	100.0	3	4.0	6	3.0
	Total		39	1.3	46	1.2	39	92.4	50	90.2	43	3.2	51	3.0
Croatia	**Zagreb**	**small**	8	0.1	14	0.1	8	93.1	14	97.9	8	3.6	14	4.1
	Zagreb	**large**	5	0.0	13	0.2	4	95.0	11	88.6	5	3.0	13	4.2
	small city	**small**	13	2.7	25	0.6	10	77.5	22	93.2	12	3.1	24	3.9
	small city	**large**	12	0.1	18	0.1	8	93.8	17	93.2	12	3.9	18	4.1
	Total		38	1.0	70	0.3	30	88.3	64	93.4	37	3.5	69	4.1
Czech Republic	**small city**	**small**	26	0.9	38	0.4	23	93.0	39	83.6	19	3.4	39	3.0
	small city	**large**	16	0.1	21	0.2	14	90.6	22	87.7	13	4.1	20	3.3
	large city	**small**	4	1.0	6	0.2	4	77.5	6	90.8	4	4.0	6	3.3
	large city	**large**	3	3.4	3	0.1	3	83.3	3	92.7	4	3.5	3	4.0
	Total		49	0.8	68	0.3	44	90.2	70	85.9	40	3.7	68	3.1
Estonia	**Tallinn**	**small**	11	1.1	14	0.1	10	89.4	12	95.8	9	3.2	11	3.7
	Tallinn	**large**	3	0.3	7	0.0	4	92.5	5	95.8	5	3.6	7	4.0
	small city	**small**	7	0.0	9	0.1	5	96.8	8	96.8	7	3.9	9	4.0
	small city	**large**	5	0.0	3	0.0	4	97.5	6	100.0	6	4.2	6	3.8
	Total		26	0.5	33	0.1	23	93.0	31	96.9	27	3.7	33	3.9
Poland	**Warsaw**	**small**	7	1.1	46	0.7	9	92.2	46	89.3	9	3.7	41	3.5
	Warsaw	**large**	3	0.0	11	0.4	6	98.3	12	89.2	5	3.2	11	3.2
	small city	**small**	27	1.6	172	0.8	26	91.9	173	90.5	27	3.4	164	3.4
	small city	**large**	33	0.7	55	0.4	30	95.7	55	94.9	33	4.1	53	3.8
	large city	**small**	16	0.7	203	0.5	17	85.9	204	88.6	16	3.8	191	3.1
	large city	**large**	13	1.7	36	0.3	12	94.6	36	96.8	14	3.7	36	3.8
	Total		99	1.1	523	0.6	100	92.8	526	90.5	104	3.7	496	3.3
Romania	**Bucharest**	**small**	9	4.7	25	1.5	9	88.3	30	89.5	9	3.7	29	3.7
	Bucharest	**large**	4	1.8	16	0.6	3	98.3	22	98.2	4	4.0	22	4.1
	small city	**small**	30	2.7	83	0.6	29	88.6	87	93.9	28	3.8	85	3.2
	small city	**large**	20	2.0	51	0.4	16	94.4	51	94.1	20	3.9	51	3.8
	large city	**small**	9	3.4	116	0.8	9	94.4	126	91.9	9	2.9	129	3.6
	large city	**large**	8	1.8	48	0.5	8	90.0	55	93.7	8	3.6	54	3.9
	Total		80	2.7	339	0.7	74	91.1	371	93.1	78	3.7	370	3.6
Serbia	**Belgrade**	**small**	8	2.5	10	0.4	10	80.0	14	90.0	10	3.2	14	3.1
	Belgrade	**large**	7	0.5	13	0.3	8	81.3	14	83.2	8	4.0	14	3.8
	small city	**small**	8	1.3	9	0.1	10	63.5	9	88.3	11	4.1	9	4.0
	small city	**large**	11	0.2	14	0.5	9	90.0	21	86.6	12	4.6	22	3.8
	Total		34	1.0	46	0.3	37	78.2	58	86.9	41	4.0	59	3.7
Ukraine	**Kiev**	**small**	8	4.9	14	1.8	7	92.9	14	74.3	8	2.5	14	3.0
	Kiev	**large**	9	3.0	11	1.5	8	81.3	12	92.5	9	4.0	14	3.5
	small city	**small**	30	0.9	40	1.2	27	86.6	48	88.0	28	3.2	48	3.6
	small city	**large**	16	0.8	14	0.9	14	96.4	16	89.4	16	3.5	17	3.9
	large city	**small**	41	2.5	44	1.5	41	85.6	50	86.0	44	3.2	50	3.4
	large city	**large**	30	1.4	26	2.2	30	86.6	28	93.7	30	3.1	28	3.2
	Total		134	1.9	149	1.5	127	87.4	168	87.7	135	3.2	171	3.5
All Countries	**Total**		499	1.5	1,274	0.7	474	89.4	1,338	90.8	505	3.5	1,317	3.5

Source: Authors' calculations based on BEEPS 2002 and 2005 databases.

Note: A *small city* is defined as having a population less than 250,000, and a *large city* is defined as having a population equal to or greater than 250,000. A small-sized firm is defined as employing 2 to 49 full-time workers, and a large-sized firm is defined as employing 50 or more full-time workers.

Table A5. Descriptive Statistics of Underlying BEEPS Variables for Labor Market Flexibility PCA Indicator, 2001 and 2003.

Country	Location	Firm Size	Underemployment/overemployment (percentage of firms)				Change in temporary workers/permanent workers over last 3 years				Labor regulations as a constraint (1="major obstacle" to 4="no obstacle")			
			Obs	2001	Obs	2003	Obs	2001	Obs	2003	Obs	2001	Obs	2003
	Sofia	large	9	33.3	8	50.0	9	-1.9	8	-1.5	9	2.4	8	2.3
	small city	small	13	30.8	18	33.3	13	15.6	18	-1.9	13	3.1	18	2.9
Bulgaria	small city	large	18	16.7	19	5.3	18	-0.5	17	-1.5	18	3.4	19	3.1
	large city	large	3	0.0	6	0.0	3	-4.3	6	0.5	3	4.0	6	3.3
	Total		43	23.3	51	21.6	43	3.8	49	-1.4	43	3.1	51	2.9
	Zagreb	small	8	50.0	14	57.1	8	12.3	14	0.8	8	3.6	14	3.5
	Zagreb	large	4	25.0	13	30.8	3	5.1	13	-1.4	5	2.8	13	3.5
Croatia	small city	small	10	50.0	22	27.3	11	84.5	22	-1.2	13	3.6	25	3.8
	small city	large	11	36.4	17	29.4	10	2.2	18	-5.4	12	3.2	18	3.2
	Total		33	42.4	66	34.8	32	33.3	67	-2.0	38	3.4	70	3.5
	small city	small	25	12.0	39	41.0	27	0.9	37	0.4	24	3.1	40	2.5
	small city	large	13	0.0	22	13.6	15	-0.8	22	2.6	16	2.9	22	2.0
Czech Republic	large city	small	4	0.0	6	16.7	4	5.3	6	0.0	4	3.0	6	2.8
	large city	large	4	25.0	3	0.0	4	2.5	3	0.2	3	3.0	3	3.0
	Total		46	8.7	70	28.6	50	0.9	68	1.1	47	3.0	71	2.4
	Tallinn	small	10	30.0	14	14.3	10	6.2	14	-0.7	11	3.2	14	2.4
	Tallinn	large	4	0.0	7	0.0	5	-1.3	7	0.7	5	3.0	7	2.1
Estonia	small city	small	6	16.7	10	20.0	5	2.5	11	0.4	7	3.4	10	2.3
	small city	large	5	20.0	8	12.5	3	5.5	8	0.6	7	3.1	8	1.9
	Total		25	20.0	39	12.8	23	3.7	40	0.1	30	3.2	39	2.2
	Warsaw	small	8	25.0	46	52.2	10	19.5	46	-11.5	10	2.5	44	2.8
	Warsaw	large	7	14.3	12	8.3	7	-0.3	10	-2.8	7	2.4	12	2.6
	small city	small	27	18.5	173	39.3	28	-0.2	173	-0.4	28	2.4	172	2.6
Poland	small city	large	31	19.4	55	14.5	35	1.2	54	0.6	35	2.3	55	2.6
	large city	small	16	25.0	205	35.6	18	22.0	204	3.4	18	2.3	202	2.5
	large city	large	15	40.0	36	11.1	14	-3.6	35	-0.3	15	2.0	36	2.2
	Total		104	23.1	527	33.8	112	5.1	522	0.2	113	2.3	521	2.5
Romania	Bucharest	small	9	55.6	30	33.3	9	-2.0	30	1.0	9	3.1	30	2.9
	Bucharest	large	3	33.3	22	13.6	4	-8.2	22	-1.9	4	3.5	22	2.7
	small city	small	30	43.3	93	29.0	30	-2.0	90	2.4	29	2.9	90	2.9
	small city	large	19	31.6	53	24.5	19	-2.8	53	-1.2	19	3.6	52	2.7
	large city	small	9	22.2	131	38.2	9	-11.6	128	-1.4	9	3.0	128	2.5
	large city	large	8	25.0	55	21.8	8	-0.9	52	-3.1	8	3.0	54	2.5
	Total		78	37.2	384	29.9	79	-3.5	375	-0.5	78	3.1	376	2.7
	Belgrade	small	12	16.7	13	38.5	12	11.3	14	-14.4	12	3.1	13	2.8
	Belgrade	large	8	12.5	14	28.6	9	-1.0	12	-0.2	9	2.7	14	3.0
Serbia	small city	small	13	61.5	8	37.5	10	-86.6	9	0.4	11	3.1	8	2.5
	small city	large	12	16.7	23	34.8	11	-1.3	20	-1.0	12	2.8	23	2.3
	Total		45	28.9	58	34.5	42	-17.9	55	-4.0	44	2.9	58	2.6
Ukraine	Kiev	small	8	12.5	14	71.4	8	9.7	13	-0.5	7	3.4	13	3.6
	Kiev	large	9	11.1	15	33.3	9	2.1	14	0.8	9	3.6	15	3.5
	small city	small	31	32.3	48	41.7	31	-13.6	41	10.7	29	3.1	48	3.1
	small city	large	16	12.5	17	23.5	15	4.5	16	-31.6	16	3.1	17	3.2
	large city	small	44	50.0	52	28.8	44	12.7	46	-2.9	43	3.0	51	3.5
	large city	large	30	10.0	31	16.1	31	-3.0	27	0.5	31	3.1	31	2.9
	Total		138	28.3	177	33.3	138	1.5	157	-1.2	135	3.1	175	3.2
All Countries	Total		512	27.0	1,372	31.4	519	2.1	1,333	-0.5	528	2.9	1,361	2.7

Source : Authors' calculations based on BEEPS 2002 and 2005 databases.
Note : A *small city* is defined as having a population less than 250,000, and a *large city* is defined as having a population equal to or greater than 250,000. A small-sized firm is defined as employing 2 to 49 full-time workers, and a large-sized firm is defined as employing 50 or more full-time workers.

Table A6. Descriptive Statistics of Underlying BEEPS Variables for Labor Quality PCA Indicator, 2001 and 2003.

Table A6. Descriptive Statistics of Underlying BEEPS Variables for Labor Quality PCA Indicator, 2001 and 2003.

Country	Location	Firm Size	Skilled workers/total employees (percentage)				Time to fill vacancy for skilled worker (weeks)				Labor quality\ as a constraint (1=“major obstacle” to 4=“no obstacle”)			
			Obs	2001	Obs	2003	Obs	2001	Obs	2003	Obs	2001	Obs	2003
	Sofia	large	9	83.3	8	81.0	6	4.2	7	5.8	9	3.0	8	3.0
	small city	small	13	76.3	18	83.2	8	2.0	12	2.1	13	3.1	18	2.8
Bulgaria	small city	large	18	73.6	19	71.6	15	2.7	16	2.6	18	3.4	19	2.7
	large city	large	3	62.7	6	75.0	3	2.3	6	3.4	3	4.0	6	2.8
	Total		43	75.7	51	77.5	32	2.8	41	3.1	43	3.3	51	2.8
	Zagreb	small	8	81.9	14	78.5	6	4.9	6	4.4	8	3.0	14	3.5
	Zagreb	large	5	74.4	13	63.6	2	4.2	9	4.2	5	2.8	13	3.2
Croatia	small city	small	13	93.5	25	88.4	6	3.1	14	9.9	12	3.3	25	3.1
	small city	large	12	74.8	18	71.0	11	6.9	16	4.9	12	2.8	18	2.9
	Total		38	82.6	70	77.3	25	5.3	45	6.3	37	3.0	70	3.2
	small city	small	28	86.1	26	81.5	15	5.1	15	3.6	26	3.1	38	2.7
	small city	large	14	74.9	17	74.8	11	5.3	15	4.5	16	2.4	21	2.6
Czech Republic	large city	small	4	80.0	6	75.8	3	9.3	5	1.8	4	3.3	6	3.5
	large city	large	4	81.5	3	57.7	4	5.8	3	3.4	4	3.0	3	2.3
	Total		50	82.1	52	77.3	33	5.7	38	3.7	50	2.9	68	2.7
	Tallinn	small	11	90.3	14	81.2	10	5.7	5	2.8	11	2.5	14	3.4
	Tallinn	large	5	72.0	7	64.1	5	6.1	6	5.9	4	2.5	7	3.3
Estonia	small city	small	7	72.4	11	75.9	4	5.0	8	7.8	7	2.1	11	3.0
	small city	large	7	68.3	7	81.1	6	4.4	7	3.8	7	1.6	8	2.9
	Total		30	77.9	39	76.6	25	5.4	26	5.3	29	2.2	40	3.2
	Warsaw	small	10	84.9	46	92.2	2	3.5	31	3.2	10	3.0	46	2.9
	Warsaw	large	7	86.4	12	78.6	5	6.1	10	2.8	7	3.3	12	2.9
Poland	small city	small	27	86.7	173	90.2	14	2.4	75	3.2	28	2.5	172	2.8
	small city	large	35	85.2	54	77.6	23	5.6	36	3.2	35	2.7	55	2.9
	large city	small	18	92.1	205	90.9	9	3.1	118	3.5	18	2.6	204	2.6
	large city	large	15	81.0	36	85.6	7	3.0	29	3.6	15	2.7	36	2.6
	Total		112	86.2	526	88.8	60	4.1	299	3.4	113	2.7	525	2.7
Romania	Bucharest	small	9	86.0	30	81.6	7	3.7	24	3.1	9	3.6	30	2.6
	Bucharest	large	4	84.5	22	78.7	4	4.8	20	3.2	4	3.3	22	2.6
	small city	small	29	74.1	92	76.4	21	3.0	62	2.1	30	3.0	93	3.0
	small city	large	20	79.9	53	77.4	12	9.8	41	2.5	19	3.1	51	2.9
	large city	small	9	91.2	131	85.9	6	5.2	97	2.4	9	3.0	128	2.6
	large city	large	8	87.9	55	81.8	6	3.0	44	2.6	8	3.1	54	2.5
	Total		79	80.8	383	81.1	56	4.9	288	2.5	79	3.1	378	2.7
	Belgrade	small	12	85.3	14	90.1	2	4.0	6	5.0	12	3.3	13	3.6
Serbia	Belgrade	large	10	80.9	13	73.6	7	2.5	9	5.3	10	3.6	14	3.2
	small city	small	13	82.5	9	63.9	6	2.3	6	4.3	11	2.7	9	3.0
	small city	large	12	59.2	22	75.3	5	2.4	13	4.7	11	2.9	23	2.8
	Total		47	76.9	58	76.7	20	2.6	34	4.8	44	3.1	59	3.1
Ukraine	Kiev	small	8	88.0	14	71.3	6	6.6	12	3.6	8	3.4	13	2.2
	Kiev	large	9	71.6	15	82.1	8	5.3	15	8.6	9	2.8	15	3.1
	small city	small	31	88.5	48	81.5	21	5.6	28	3.9	31	2.8	48	2.8
	small city	large	16	75.0	17	82.8	15	9.1	15	4.4	16	2.8	17	2.5
	large city	small	42	90.4	53	83.6	34	4.8	42	5.9	44	2.7	53	2.7
	large city	large	30	85.7	31	76.6	26	8.3	27	5.3	31	2.5	31	2.5
	Total		136	85.7	178	80.7	110	6.5	139	5.3	139	2.7	177	2.7
All Countries	Total		535	82.5	1,357	83.3	361	5.1	910	3.6	534	2.9	1,368	2.8

Source: Authors' calculations based on BEEPS 2002 and 2005 databases.
Note: A *small city* is defined as having a population less than 250,000, and a *large city* is defined as having a population equal to or greater than 250,000. A small-sized firm is defined as employing 2 to 49 full-time workers, and a large-sized firm is defined as employing 50 or more full-time workers.