

## Transitional Progress and Business Challenges

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**Abstract** Eight Central European and Baltic countries have joined the European Union in May 2004. Transitioning economies need to develop a business environment with a healthy financial sector to realize economic growth. This paper uses two classification methods, the discriminant analysis and taxonomic measure, to investigate the possibility of the South Eastern European and Commonwealth of Independent transitional countries to develop an enterprise and business environment that is compatible with the newest European Union (EU8) members. This paper found that the EU8 countries are correctly classified as having transitioned successfully in their business development. Bulgaria and Croatia have transitioned closely to the EU8. However, Romania, Ukraine, and the Commonwealth of Independent countries are not close to the EU8 in achieving a compatible business environment.

**Keywords** Transition countries · Enterprise reforms · Business structures · Taxonomic methods · Discriminant analysis

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### Introduction

Transitional economies have been striving to transform to a market economy for nearly two decades. Countries like Poland, Czech Republic and Hungary have made

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more progress and been more successful. By May 2004, eight of the Central European and Baltic countries (EU8) had transitioned sufficiently to become members of the European Union (EU): Poland, Czech Republic, Hungary, Estonia, Lithuania, Latvia, Slovakia and Slovenia. Candidate countries like Croatia are currently making determined efforts to become an EU member, and January 2007 saw Romania and Bulgaria achieve membership status. Other countries of the Commonwealth of Independent States like Ukraine and Moldova, although not currently pursuing EU memberships, nevertheless, are looking west. The transition countries are restructuring their economy to a capitalistic business environment that will be attractive to foreign direct investment and integration into the global business community. The pursuit of a market-based business structure has resulted in remarkable real GDP growth for some of the countries, attracted increased inflow of foreign direct investment and integrated the transition countries into the world markets.

Because the EU8 had been so successful in transforming their business environment, their transition effort is a success story that other aspiring transition countries can emulate. The convergence of the EU8 with the old EU indicates that their economy has transitioned to accommodate market business practices in the enterprise, legal and financial environment sectors.

### **Restructuring and Business Environment Characteristics**

Enterprise restructuring is an important process in enhancing productivity and profit margins. Numerous studies have investigated the theories and benefits of enterprise restructuring (Grosfeld and Roland 1997; Aghion and Schankerman 1999; Bornstein 2000; Djankov and Murrell 2002). Previous studies have also looked at the different methods of privatization in the transition countries (Claessens and Djankov 1997; Barberis et al 1996; Bornstein 2000).

Regardless of the method of privatization, the heavy debt burden inherited from the former socialist era made it difficult for most of the newly privatized state-owned enterprises (SOEs) to operate efficiently and profitably. Management and employee owners alike have little incentives or management skills for long-term value maximization goals. Asset-stripping was a greater incentive after obtaining ownership of the privatized firm when the long-term benefits are more uncertain for the managers–employee owners in an evolving uncertain market economy (Foo and Michelson 2003).

The emerging markets offer strategic opportunities for multinational corporations and the restructuring of the enterprise sector has attracted foreign direct investment. The benefits to the transitional countries from inviting foreign investors are the needed capital infusion, managerial and technical skills, corporate governance and the internationalization of the emerging countries. In particular, the central, eastern and southeastern countries bordering the EU would experience increased linkages of trade and investment across borders with the EU countries.

Transitional countries are unique in that the transition from a socialist planned economy to a market economy is unprecedented. The business environment immediately after the dismantling of the socialist economy is one of uncertainty and with institutions and organizations in flux. The lack of a developed financial and

legal sector to bind business transactions and a price mechanism to allocate resources efficiently increased transaction costs (Choi et al. 1999). Transitional economies lack human capital skills and expertise in managing a privatized firm. Government directed policies, budget subsidization and protection were an integral part of early business transactions. Although legal reforms and regulations, such as entry and exit of firms, have been enacted, consistent enforcement of commercial laws is still inadequate and inefficient. The ability to settle legal claims smoothly and on a timely basis is still a concern for doing business. The lack of long-term incentives for managers and an adequate corporate governance system engenders a lack of commitment to sound business practices and long-term business goals. Studies find that entrenched management and too much government involvement have a negative impact on the business sector (Djankov and Pohl 1997; Youssef 2003). Radulovic (2004), using pooled observations, finds that (1) local businesses face greater domestic and foreign competition, (2) the entry of new innovative firms, and large and export firms are the leaders in the new transitional economy.

Businesses and individuals still have inadequate legal protection of private property rights and compensation on claims. The enforcement of enacted laws is slow and erratic and businesses are uncertain as to legal recourse and contract enforcement. The adoption of EU common laws and EU business standards and practices has allayed the fears of doing business in the EU8.

The heavy reliance on trade by many of the transitional countries, like Georgia and Ukraine, with the former Soviet bloc countries, has limited the growth and expansion of the local businesses due to the closed nature of the trading bloc. On the other hand, the integration of the EU8 into the EU has expanded their economic growth. Russia, a major supplier of oil and gas to the region, is a threat to EU members because they use oil and gas to coerce trade transactions.

In many of the transitional countries, social discontent and income inequality are growing. The large government fiscal imbalances due to the collapse of the SOEs, the drying source of revenue base, together with increasing soft budget constraints to keep the SOEs afloat and the difficulty in weaning state supported subsidies from the labor and enterprise sector mean that the government is not taking a leading role in infrastructure investment and development. Much of the initiative and capital infusion for business and economic development in the EU8 are coming from multinational foreign participation in the enterprise and financial sectors, particularly from the old EU countries. The EU8 government aided this endeavor by liberalizing trade and investment and encouraging foreign transfer of technology and skills. Local businesses have to restructure and reinvest to be competitive and viable.

Numerous studies have shown that low country risk and political stability are strong attractions for foreign direct investment inflows (Bevan and Estrin 2000; Howell 2003). Most studies agree that the candidacy of EU accession countries and their openness to foreign trade and participation, have contributed to attracting foreign direct investment to countries like Poland and Hungary, spurred on by the stringent EU membership requirements to meet them. The willingness of leading transitional countries to implement tough reforms in enterprise restructuring, that may be socially unpopular, and to overhaul the legal and financial sectors, thereby, contributing to rapid economic growth and a stable business environment, are strong inducements for foreign direct investment.

## Methodology Description

In the empirical analysis, we are interested in how we can compare and classify the EU8 countries relative to other transition countries in restructuring their business sector to a market economy. We use data from 2000 to 2004 that is from the European Bank for Reconstruction and Development (EBRD) Transition Report 2005.

Based on previous studies, we use similar factors that may stimulate business environment and development. We looked at the liberalization of trade (share of trade in GDP— $x_1$ ), private sector share in GDP ( $x_2$ ), enterprise reform (the EBRD index— $x_3$ ), banking sector reform (the EBRD index— $x_4$ ), real GDP growth ( $x_5$ ), and general government balance ( $x_6$ ). The aim is to classify the countries into several groups according to some given assumptions. We want to determine whether the transition countries, particularly the non-EU transition countries, have made inroads to developing a business environment consistent with the EU8 countries.

Classification problems occur in a wide range of human activity. The term may cover any context in which some decisions or forecasts are made based on current available information, and the classification procedure is then a formal method for making repeated judgements in new situations. We shall assume that the problem concerns the construction of a procedure that assigns each case to a pre-defined class based on observed attributes or features. The construction of a classification procedure from a set of data for which the true classes are known is called: pattern recognition, discrimination, or supervised learning in order to distinguish it from unsupervised learning or clustering in which the classes are deduced from the data (Schurmann 1996). In our investigation we apply: synthetic taxonomic measure (TMAI) that is a clustering method and linear discriminant function that is a pattern recognition method.

Applying both methods, we want to find if the analyzed objects are similar in terms of distinguished features that are described by the variables  $x_1$ – $x_6$ . Taxonomic measures allow us to rank countries by employing all data or only part of them while discriminant analysis requires the estimation of parameters. Thus, the whole set of data must be divided into estimation (training, learning) sample and test (verification) sample.

The taxonomic measure (Tarczynski 1994) can be defined as follows:

$$TMAI_i = 1 - \frac{d_i}{d_0} \quad (1)$$

$$d_i = \sqrt{\sum_{k=1}^K v_i(z_{ik} - z_{0k})^2} \quad (2)$$

$$d_0 = \bar{d} + a \cdot S_d \quad (3)$$

where for every  $i$ -th ( $i=1, 2, \dots, n$ ) object and the  $k$ -th ( $k=1, 2, \dots, K$ ) descriptive variable,  $z_{ik}$ —the  $k$ -th standardized diagnostic variable observed for  $i$ -th object:  $z_{ik} = \frac{x_{ik} - \bar{x}_k}{S_k}$ ;  $z_{0k}$ —the  $k$ -th standardized diagnostic variable observed for the benchmarks,  $x_{ik}$ —the  $k$ -th diagnostic variable observed for  $i$ -th object;  $\bar{x}_k$ —the mean

calculated for the  $k$ -th diagnostic variable;  $S_k$ —the standard deviation;  $d_i$ —the distance between the  $i$ -th object and the benchmark defined with the formula 2,  $TMAI_i$ —the synthetic development measure for the  $i$ -th case,  $d_0$ —the norm assuring that  $TMAI_i$  reaches values ranging from 0 to 1,  $\bar{d}$ —is the mean of  $d_i$ ;  $S_d$ —is the standard deviation of  $d_i$ ;  $\nu_i$ —weights that describe the range of each variable taken into account, if all variables are assumed to be of the same range (Tarczynski 2002)  $\nu_i=1$  or  $\nu_i = \frac{1}{K}$ ;  $a$ —is the parameter:  $a = \frac{\max_i\{d_i\}-\bar{d}}{S_d}$ .

Although TMAI is the clustering method as defined above, to apply this measure we must specify the benchmarks that may be a real or hypothetical object. In our investigation, we use the hypothetical object that is characterized by features  $z_{0k}$  ( $k=1, 2, \dots, K$ ). The benchmark is constructed by using the averages of the standardized variables:  $x_1, x_2, \dots, x_6$  evaluated for the EU8 countries. We assume that the successful EU8 countries are the benchmark patterns for other non-EU transition countries to follow in their efforts to restructure their business environment to be compatible with EU norms. Thus, the taxonomic measure  $TMAI_i$  will indicate how far from the desired object (described by averages calculated for EU8 countries) is the  $i$ -th country. From the results of the country ranking, we classify the countries into groups based on the  $TMAI_i$  values (where  $TMAI_i$  is the value calculated for the  $i$ -th country;  $i=1, 2, \dots, n$ ). In Table 1, we specify four categories according to the country's degree of business development. Note that  $TMAI$  is the average and  $S_{TMAI}$  is the standard deviation of measure  $TMAI_i$ .

In the linear discriminant analysis (Altman 1968; Schurmann 1996), we derive the linear combination of variables that discriminates the best between two or more defined groups. The discriminant function is given as:

$$g_l(x_i) = d_0 + d_1x_{i1} + d_2x_{i2} + \dots + d_Kx_{iK} = d_0 + d^T x_i, \tag{4}$$

where,  $d = [d_k]$   $k=0, 1, \dots, [K \times 1]$  vector of discriminant function parameters (weights),  $x_i = [x_{ik}] - [n \times 1]$  vector of discriminant variables and,  $n$  is the number of cases (objects that are to be classified),  $l$  —number of classes ( $l=1, 2, \dots, L$ ).

Since the discriminant analysis is a method of pattern recognition, discriminant weights are estimated based on the training sample. Then, critical values for each of the groups are evaluated and, depending on the value of the discriminant function  $g_l(x_i)$ , which is calculated for each country, all objects are placed into certain classes. In the training sample, every object must be defined as belonging to a certain group. For instance, in a dichotomous classification each country is assumed to belong to one of two pre-defined classes (for example, EU members and nonmembers). In our experiments, we classify the countries into three ( $L=3$ ) or two ( $L=2$ ) groups, consisting of the following country classification (Table 2 below).

**Table 1** The rules for country classification

| Category | Ranking of Countries                      | Value of $TMAI_i$                 |
|----------|---|-----------------------------------|
| 1        | Highly transitioned (very good) countries | $TMAI_i > TMAI + S_{TMAI}$        |
| 2        | Relatively transitioned (good) countries  | $TMAI + S_{TMAI} > TMAI_i > TMAI$ |
| 3        | Average countries                         | $TMAI > TMAI_i > TMAI - S_{TMAI}$ |
| 4        | Weak (less transitioned) countries        | $TMAI_i < TMAI - S_{TMAI}$        |

**Table 2** List of countries that belong to classification groups for Classification 1 and 2

| Number of Groups  | Type of Classification  |
|-------------------|---|
| $L=3$             | Classification 1  |
| Group 1           | EU8: Czech Republic, Poland, Hungary, Estonia, Lithuania, Latvia, Slovakia and Slovenia |
| Group 2           | Bulgaria, Romania, Croatia, Ukraine and Russia  |
| Group 3           | Other countries   |
| $L=2$             | Classification 2  |
| Group 1*=Group 1+ | Czech Republic, Poland, Hungary, Estonia, Lithuania, Latvia, Slovakia and               |
| Group 2           | Slovenia, Bulgaria, Romania, Croatia, Ukraine and Russia                                |
| Group 2*=Group 3  | Other countries   |

The first variant of classification with groups  $L=3$  is labeled as Classification 1. The second variant of classification with groups  $L=2$ , labeled as Classification 2, is obtained by aggregating the first two groups of countries from Classification 1.

## Results from the Experiments

Analyzing the Country Classification 1 (Appendix Table 7), we observe that the average for variable  $x_1$  (share of trade in GDP) is the biggest for the Group 1. It is also clear that the averages of variables  $x_2$ – $x_4$  are the smallest for the Group 3, and the biggest for the Group 2 for the years 2000–2002. The mean of  $x_5$  (real GDP growth) is the biggest for the Group 3 and the smallest for the Group 2 except the years 2003–2004. The average of  $x_6$ , describing the government deficit, is the biggest for the Group 1 and its variability is the biggest among all variables.

Considering averages from the EU8 countries as “a benchmark pattern,” we can see that Slovenia and Lithuania always belong to Category 1 of the highly transitioned countries for all years (Table 3). Latvia also achieved the status of Category 1 for the years 2002–2004, and the Czech Republic in years 2000, 2002 and 2004. For all years (except 2000 for Slovakia and 2003 for the Czech Republic) the EU8 countries did not drop lower than the tenth place among the 27 countries under study.

Bulgaria and Croatia have relatively high rankings, as well as Romania (between the 10th and the 12th place depending on the year). This means that these countries are more similar to the EU8 countries than others are in business development. Russia and Ukraine are further away but Ukraine consistently ranks above Russia, while Belarus consistently ranks below Russia. It is clear that the weakest countries (in Category 4) are Belarus, and Turkmenistan (for all years) and also Tajikistan, Serbia Montenegro, and Uzbekistan.

In the investigations employing discriminant function, we assume that the training set contains data from 2000–2003 and the testing sample contains data from 2004. We also use data from 2000–2002 for the parameter estimation and data from 2003–2004 for verification. The testing set is used to verify the robustness of a classification since during the testing procedure each object is recognized as belonging to the certain class employing the discriminant function only. In our investigation, we use four variants of discriminant functions that are different in (1) training and testing samples

**Table 3** Country rankings obtained for TMAI

|                                   | Year 2000   | Year 2001   | Year 2002   | Year 2003  | Year 2004  |
|-----------------------------------|---|---|---|--|--|
| TMAI                              | 0.65  | 0.62  | 0.56  | 0.60   | 0.61   |
| $S_{TMAI}$                        | 0.19  | 0.18  | 0.18  | 0.18   | 0.17   |
| Highly transitioned countries     | Slovenia<br>Lithuania<br>Czech Rep  | Slovenia<br>Lithuania<br>Bulgaria<br>Hungary  | Slovenia<br>Lithuania<br>Slovakia<br>Latvia<br>Czech Rep  | Bulgaria<br>Slovenia<br>Latvia<br>Lithuania  | Lithuania<br>Slovenia<br>Czech Rep<br>Latvia   |
| Relatively transitioned countries | Latvia<br>Bulgaria<br>Poland<br>Croatia<br>Hungary<br>Estonia<br>Romania<br>Macedonia<br>Ukraine<br>Moldova<br>Armenia<br>Georgia<br>Kazakhstan | Latvia<br>Estonia<br>Czech Rep<br>Slovakia<br>Croatia<br>Poland<br>Romania<br>Moldova<br>Azerbaijan<br>Ukraine<br>Georgia | Croatia<br>Bulgaria<br>Poland<br>Hungary<br>Estonia<br>Macedonia<br>Romania<br>Ukraine  | Slovakia<br>Poland<br>Hungary<br>Estonia<br>Croatia<br>Macedonia<br>Romania<br>Ukraine   | Poland<br>Bulgaria<br>Hungary<br>Slovakia<br>Estonia<br>Croatia<br>Romania<br>Boz and Her<br>Kyrgyz Rep                                |
| Average countries                 | Slovakia<br>Azerbaijan<br>Albania<br>Kyrgyz Rep<br>Uzbekistan<br>Russia<br>Boz and Her  | Kyrgyz Rep<br>Macedonia<br>Boz and Her<br>Russia<br>Uzbekistan<br>Kazakhstan<br>Albania<br>Armenia                        | Moldova<br>Georgia<br>Azerbaijan<br>Kyrgyz Rep<br>Russia<br>Albania<br>Sebia and Mont<br>Boz and Her<br>Kazakhstan<br>Armenia | Kyrgyz Rep<br>Kazakhstan<br>Czech Rep<br>Boz and Her<br>Azerbaijan<br>Russia<br>Moldova<br>Albania<br>Georgia<br>Sebia and Mont<br>Armenia<br>Tajikistan | Moldova<br>Macedonia<br>Georgia<br>Kazakhstan<br>Azerbaijan<br>Armenia<br>Sebia and Mont<br>Albania<br>Ukraine<br>Tajikistan<br>Russia |
| Weak countries                    | Sebia and Mont<br>Tajikistan<br>Belarus<br>Turkmenistan   | Tajikistan<br>Sebia and Mont<br>Belarus<br>Turkmenistan   | Tajikistan<br>Uzbekistan<br>Belarus<br>Turkmenistan   | Uzbekistan<br>Belarus<br>Turkmenistan  | Uzbekistan<br>Belarus<br>Turkmenistan  |

Source: Authors' calculation

(two variants: estimation period contains either years 2000–2003 or 2000–2002 and the testing set contains data from years either 2004 or 2003–2004 respectively), and (2) the number of pre-defined classes ( $L=2$  or  $L=3$  classes).

The results of the classifications are presented in Tables 4 and 5. The direction of arrows  $\uparrow$  denotes misclassification to the better (higher) position from the actual, i.e. from that assumed (for instance, in Group 1\* rather than to Group 2\* as assumed in Classification 2), and  $\downarrow$  the opposite direction when a country is misclassified to less business development than assumed (for instance, in Group 2\* rather than to Group 1\* in Classification 2).

**Table 4** Misclassified countries in dichotomous Classification 2  $L=2$ 

| Country    | Discriminant Function 5 |      |      |      |      | Discriminant Function 6 |      |      |             |      |
|------------|-------------------------|------|------|------|------|-------------------------|------|------|-------------|------|
|            | Training Set            |      |      |      | Test | Training Set            |      |      | Testing Set |      |
|            | 2000                    | 2001 | 2002 | 2003 | 2004 | 2000                    | 2001 | 2002 | 2003        | 2004 |
| Romania    | ↓                       | ↓    | ↓    | ↓    | ↓    | ↓                       | ↓    | ↓    | ↓           | ↓    |
| Ukraine    | ↓                       | ↓    | ↓    | ↓    | ↓    | ↓                       | ↓    |      | ↓           | ↓    |
| Macedonia  | ↑                       | ↑    |      | ↑    | ↑    | ↑                       | ↑    |      | ↑           | ↑    |
| Kazakhstan |                         |      |      | ↑    | ↑    |                         |      |      |             | ↑    |
| Russia     | ↓                       |      | ↓    | ↓    |      |                         |      |      |             |      |
| Armenia    |                         |      |      |      |      |                         |      |      |             | ↑    |
| Azerbaijan |                         |      |      |      |      |                         |      |      |             | ↑    |
| Georgia    |                         |      |      |      |      |                         |      |      |             | ↑    |

Source: Authors' calculations.

The first variant of discriminant function is constructed for Classification 2;  $L=2$  (Table 1) and estimated using data for the period 2000–2003:

$$\begin{aligned}
 g_1(x) &= -36.7853 + 1.6794x_3 + 0.3482x_6 + 0.1843x_1 + 0.5514x_2 + 0.3113x_5 + 3.5962x_4 \\
 g_2(x) &= -22.2536 - 1.3138x_3 + 0.1220x_6 + 0.1571x_1 + 0.4810x_2 + 0.4640x_5 + 2.6489x_4
 \end{aligned}
 \tag{5}$$

All six variables,  $x_1$ – $x_6$ , are statistically significant in this variant of discriminant function. The most important variable is  $x_3$ , the EBRD index of enterprise reform, while the least important is variable  $x_4$ , i.e. the EBRD index of banking sector reform.

Misclassification by the discriminant model occurs when the model predicts the object as belonging to a different class than what is actual or assumed in Table 2. From the results in Table 4, the discriminant functions for Classification 2 indicate that five countries are misclassified from what is actually specified in Table 2. For example, Romania and Ukraine are misclassified by the discriminant function as belonging in Group 2\*, and not in Group 1\* with the EU8 countries, in all years 2000–2004. Russia is also misclassified as belonging to Group 2\*, and not in Group 1\* for 2000, 2002 and 2003 while being correctly classified for 2001 and 2004 as belonging in Group 1\*. On the other hand, Macedonia and Kazakhstan are misclassified by the discriminant function as belonging to Group 1\* together with the EU8 countries, and not in Group 2\* as assumed in Table 2, for years 2000, 2001, 2003, 2004, 2003 and 2004, respectively. Macedonia is correctly classified by the discriminant function as belonging to Group 2\* in 2002, and similarly for Kazakhstan in 2000, 2001 and 2002.

When the estimation sample is shortened to three years, only three countries, Romania and Ukraine are misclassified in Group 2\*, and Macedonia is misclassified in Group 1\* in the training procedure for years 2000–2002 (Table 4). In the testing procedure, seven countries are not correctly recognized. Romania, Ukraine and Macedonia are misclassified in 2003 and 2004, while in 2004, Kazakhstan, Armenia,

Azerbaijan and Georgia are misclassified as countries belonging to Group 1\* (Table 4). The discriminant functions are as follows:

$$\begin{aligned}
 g_1(x) &= -35.7817 + 5.062x_3 + 0.4239x_6 + 0.17x_1 + 0.5746x_2 + 0.3776x_5 \\
 g_2(x) &= -21.5268 + 1.3402x_3 + 0.144x_6 + 0.1437x_1 + 0.4908x_2 + 0.5182x_5
 \end{aligned}
 \tag{6}$$

The variable  $x_4$  i.e. the EBRD index of banking sector reform is missing in the functions 6 because it is statistically insignificant.

When three groups of countries in Classification 1  $L=3$  are specified as in Table 2, the prediction results are weaker than the dichotomous classification as it is more difficult to discriminate among three classes than for two classes. The discriminant functions estimates (obtained for the training sample 2000–2003) are as follows:

$$\begin{aligned}
 g_1(x) &= -69.9931 + 28.0150x_3 + 0.2892x_1 + 0.284x_2 + 0.1975x_6 + 0.4377x_5 \\
 g_2(x) &= -43.0408 + 16.2573x_3 + 0.2321x_1 + 0.4208x_2 + 0.2784x_6 + 0.3513x_5 \\
 g_3(x) &= -31.8190 + 13.7277x_3 + 0.213x_1 + 0.3343x_2 + 0.0424x_6 + 0.5227x_5
 \end{aligned}
 \tag{7}$$

The variables:  $x_3, x_1, x_2, x_6$  and  $x_5$  are statistically significant. The EBRD index of enterprise reform remains the most important variable while the percentage GDP change seems to be the least important in the function 7.

When three groups are distinguished, the misclassified countries in the training procedure are Bulgaria, Romania, Croatia, Macedonia and Ukraine (Table 5). Croatia, for all years, and Bulgaria (for 2003 and 2004) are misclassified as belonging to Group 1 with the EU8 countries than what is assumed in Table 2. Romania and Ukraine (except 2002) are misclassified in Group 3 as having less business development rather than in Group 2 as assumed in Table 2. On the other

**Table 5** Misclassified countries Classification 1  $L=3$

| Country    | Discriminant Function 7 |      |      |      |      | Discriminant Function 8 |      |      |             |      |
|------------|-------------------------|------|------|------|------|-------------------------|------|------|-------------|------|
|            | Training Set            |      |      |      | Test | Training Set            |      |      | Testing Set |      |
|            | 2000                    | 2001 | 2002 | 2003 | 2004 | 2000                    | 2001 | 2002 | 2003        | 2004 |
| Bulgaria   |                         |      |      | ↑    | ↑    |                         |      |      | ↑           | ↑    |
| Croatia    | ↑                       | ↑    | ↑    | ↑    | ↑    | ↑                       | ↑    | ↑    | ↑           |      |
| Romania    | ↓                       | ↓    | ↓    | ↓    | ↓    | ↓                       | ↓    | ↓    | ↓           | ↓    |
| Ukraine    | ↓                       | ↓    |      | ↓    | ↓    | ↓                       | ↓    |      |             | ↓    |
| Macedonia  | ↑                       | ↑    |      | ↑    | ↑    | ↑                       |      |      | ↑           | ↑    |
| Kazakhstan |                         |      |      |      | ↑    |                         | ↑    | ↑    | ↑           | ↑    |
| Armenia    |                         |      |      |      |      |                         | ↑    | ↑    | ↑           | ↑    |
| Azerbaijan |                         |      |      |      |      |                         |      |      | ↑           | ↑    |
| Georgia    |                         |      |      |      | ↑    |                         |      |      |             | ↑    |

Source: Authors' calculations.

hand, Macedonia (other than 2002) is misclassified as having more business development in Group 2 rather than in Group 3. Lastly, Georgia and Kazakhstan are misclassified as belonging in Group 2 rather than in Group 3 for 2004.

In the experiments for Classification 1  $L=3$  countries using data for 2000–2002 as the training sample, the results indicate the misclassification (Table 5) for: Croatia and Romania for all 3 years; Armenia and Kazakhstan for years: 2001 and 2002, and Ukraine for years 2000 and 2001 and Macedonia in 2000. The discriminant functions contain only four variables:

$$\begin{aligned} g_1(x) &= -65.2419 + 23.5432x_3 + 0.2824x_1 + 0.4051x_2 + 0.4975x_6 \\ g_2(x) &= -40.7981 + 13.0215x_3 + 0.2298x_1 + 0.5135x_2 + 0.5402x_6 \\ g_3(x) &= -29.1056 + 10.3316x_3 + 0.2170x_1 + 0.4314x_2 + 0.3191x_6 \end{aligned} \quad (8)$$

For the testing sample Classification 1  $L=3$ , misclassification concerns the same countries as in the training sample with the additions of Bulgaria, Azerbaijan and Georgia. All countries are misclassified to a better group than what is assumed in Table 2, except Romania in 2003 and Ukraine in 2004, which are misclassified as being weaker than assumed. It is worth noting that in all the results misclassification concerns the neighboring groups.

In all the discriminant functions variables,  $x_3$ —EBRD index of enterprise reform,  $x_1$ —share of trade in GDP,  $x_2$ —private sector share in GDP,  $x_6$ —general government balance, are statistically significant.

To compare the efficiency of classification for all discriminant models the share of correctly recognized objects is used (Table 6) and it is calculated as:

$$E = \frac{n^*}{n} \cdot 100 \quad (9)$$

where:  $n^*$ —number of properly recognized objects in the whole sample (training or testing);  $n$ —number of objects in the whole sample (training or testing) i.e.  $n = p \cdot t$ ;  $p$ —count of countries (in our research  $p=27$ );  $t$ —number of periods taken into account (in our research  $t=3$  or 4 for the training sample, and  $t=1$  or 2 for the testing set).

The comparison of the efficiency classification models indicates that better results are obtained for the smaller number of groups. Thus, the dichotomous models for  $L=2$  correctly predict more countries. It is also indicates that for the testing sample, the share of correctly predicted cases is smaller in experiments that are made for years 2000–2002

**Table 6** Share of correctly recognized objects

| Number of Classes | Type of the Sample | Estimation Period |           |
|-------------------|--------------------|-------------------|-----------|
|                   |                    | 2000–2003         | 2000–2002 |
| $L=2$             | Training           | 86.5% (5)         | 91.4% (3) |
|                   | Test               | 85.2% (4)         | 81.5% (7) |
| $L=3$             | Training           | 86.1% (5)         | 84.0% (6) |
|                   | Test               | 74.1% (7)         | 72.2% (9) |

Authors' calculations

Numbers in parenthesis denote count of misclassified countries.

as the estimation period and for one year ahead prediction than for the shorter training sample (2000–2002) and the testing set containing data from years 2003 and 2004.

## Conclusion

The challenge to the transitional countries is to develop a business environment compatible to western and international business norms. The transitional countries have to speed up the privatization of the SOEs and liberalize and open its markets to foreign participation. The financial sector has to be developed sufficiently to support business transactions efficiently. Commercial laws and regulations have to be enforced to protect investors' rights, property rights and claims.

Applying two methods of classification (i.e. taxonomic synthetic measure and discriminant analysis), we found, assuming the EU8 countries as the classification benchmark pattern, that these eight countries are correctly classified as belonging to the group of highly transitioned countries with strong business development. Romania and Ukraine belong to the group of average transitioned countries that is assumed in the pattern recognition method and achieving relatively high rankings as evidenced from the clustering method. Bulgaria and Croatia are classified as transitioned countries very close to the EU8 countries. The level of business development in Macedonia, Georgia and Kazakhstan is similar to that in Ukraine and Russia. Our paper indicates that transitional countries have to sustain their pursuit of market reforms to achieve a business development that is compatible to the European Union and to be integrated into the global economy.

## Appendix

**Table 7** Descriptive measures for Classification 1 countries

| Classification 1 Countries | $x_1$  | $x_2$  | $x_3$  | $x_4$  | $x_5$  | $x_6$  |
|----------------------------|--------|--------|--------|--------|--------|--------|
| Year 2000                  |        |        |        |        |        |        |
| Average                    |        |        |        |        |        |        |
| Group 1                    | 95.20  | 57.50  | 2.15   | 2.39   | 5.67   | -2.80  |
| Group 2                    | 81.94  | 63.00  | 2.34   | 2.86   | 3.48   | -3.16  |
| Group 3                    | 87.80  | 49.64  | 1.76   | 1.87   | 6.88   | -2.33  |
| Dispersion coefficient     |        |        |        |        |        |        |
| Group 1                    | 0.2927 | 0.0966 | 0.1317 | 0.1484 | 0.3300 | 1.2762 |
| Group 2                    | 0.2115 | 0.0765 | 0.1253 | 0.2370 | 0.6450 | 1.7562 |
| Group 3                    | 0.4304 | 0.3052 | 0.2393 | 0.3158 | 0.6136 | 1.4804 |
| Year 2001                  |        |        |        |        |        |        |
| Average                    |        |        |        |        |        |        |
| Group 1                    | 98.13  | 59.04  | 2.17   | 2.44   | 5.90   | -2.11  |
| Group 2                    | 71.98  | 65.00  | 2.26   | 2.54   | 5.60   | -1.82  |
| Group 3                    | 79.62  | 50.00  | 1.72   | 1.92   | 6.65   | -1.89  |
| Dispersion coefficient     |        |        |        |        |        |        |
| Group 1                    | 0.2930 | 0.0947 | 0.1604 | 0.1294 | 0.3626 | 0.8561 |
| Group 2                    | 0.2014 | 0.0688 | 0.1140 | 0.2370 | 0.3322 | 1.7481 |
| Group 3                    | 0.3939 | 0.2928 | 0.2387 | 0.3269 | 0.6979 | 1.7372 |

**Table 7** (continued)

| Classification 1 Countries | $x_1$  | $x_2$  | $x_3$   | $x_4$  | $x_5$  | $x_6$  |
|----------------------------|--------|--------|---------|--------|--------|--------|
| Year 2002                  |        |        |         |        |        |        |
| Average                    |        |        |         |        |        |        |
| Group 1                    | 96.96  | 62.22  | 2.30    | 2.65   | 5.29   | -2.68  |
| Group 2                    | 70.70  | 66.00  | 2.26    | 2.80   | 4.96   | -1.38  |
| Group 3                    | 77.01  | 53.21  | 1.84    | 2.11   | 5.94   | -2.58  |
| Dispersion coefficient     |        |        |         |        |        |        |
| Group 1                    | 0.2355 | 0.0846 | 0.0921  | 0.1147 | 0.4047 | 1.0899 |
| Group 2                    | 0.1914 | 0.0567 | 0.1140  | 0.2236 | 0.0415 | 1.4568 |
| Group 3                    | 0.3508 | 0.2787 | 0.2096  | 0.2076 | 0.5899 | 0.9222 |
| Year 2003                  |        |        |         |        |        |        |
| Average                    |        |        |         |        |        |        |
| Group 1                    | 99.59  | 75.63  | 3.19    | 3.54   | 5.04   | -3.61  |
| Group 2                    | 74.98  | 67.00  | 2.34    | 2.80   | 6.14   | -1.66  |
| Group 3                    | 80.07  | 53.93  | 1.86    | 2.16   | 7.23   | -0.94  |
| Dispersion coefficient     |        |        |         |        |        |        |
| Group 1                    | 0.2235 | 0.0696 | 0.04557 | 0.0720 | 0.4425 | 1.1099 |
| Group 2                    | 0.2197 | 0.0761 | 0.1341  | 0.2236 | 0.3169 | 1.5186 |
| Group 3                    | 0.3562 | 0.2718 | 0.2161  | 0.2193 | 0.4913 | 3.0431 |
| Year 2004                  |        |        |         |        |        |        |
| Average                    |        |        |         |        |        |        |
| Group 1                    | 106.30 | 76.38  | 3.19    | 3.50   | 5.84   | -2.41  |
| Group 2                    | 77.32  | 68.00  | 2.40    | 3.00   | 7.38   | -0.82  |
| Group 3                    | 84.24  | 55.71  | 1.86    | 2.24   | 7.73   | -0.78  |
| Dispersion coefficient     |        |        |         |        |        |        |
| Group 1                    | 0.2061 | 0.0631 | 0.0456  | 0.1169 | 0.2669 | 0.8461 |
| Group 2                    | 0.2338 | 0.0750 | 0.1646  | 0.2573 | 0.3793 | 4.6280 |
| Group 3                    | 0.3366 | 0.2835 | 0.2161  | 0.2284 | 0.2848 | 2.8532 |

Authors' calculations

Variable  $x_1$ , describing share of trade in GDP, is adjusted and for many EU8 countries is bigger than 100.

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