

# Influence of Various Business Regulations on the Amount of Foreign Direct Investments

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*Abstract:* - The aim of this paper is to establish connections between 25 quantitative indicators on business regulations, laws and the protection of property rights, and the amount of foreign direct investment that can be expected accordingly. In this area, a growing number of econometric and survey-based studies have been published already. Their focus is mostly on the macroeconomic factors which determine the level of FDI in a country, but relatively few studies cover the link between FDI and laws, regulations and institutional arrangements that shape the daily economic activity in every country. For the purposes of this research publicly available databases from the Internet were used. The data mining rule-based approach, CN2 rule method was used. The findings of this research could be used to build an expert system for predicting the amount of FDI, based on the input of relevant business indicators.

*Key-Words:* - Foreign direct investments, business regulations, data mining, CN2 rule induction algorithm.

## 1 Introduction

Foreign direct investment (FDI) represents long-term investment interest by a foreign direct investor in an enterprise resident in an economy other than that in which the foreign direct investor is based: it is the sum of equity capital, reinvestment of earnings, other long-term capital, and short-term capital, as shown in the balance of payments [22, 3]. We define the direct investor as

- an individual,
- an incorporated or unincorporated public or private enterprise,
- a government,
- a group of related individuals, or
- a group of related incorporated and/or unincorporated enterprises.

Foreign direct investment should not be mistaken with other kinds of international investment. The purpose of FDI is to gain a lasting interest in, or effective management control over an enterprise in another country [19]. Recommendation of the

International Monetary Fund (IMF) is to consider only investments that account for at least 10 percent of voting stock as foreign direct investment [18]. That allows the direct investor to have a say in the decision making process. Absolute control is, by no means, a necessity. Although, one has to keep in mind that many countries set their limits higher than 10 percent [12]. The foreign direct investor may acquire 10 percent or more of the voting power of an enterprise in an economy

- by incorporating a wholly-owned subsidiary or company,
- by acquiring shares in an associated enterprise,
- through a merger or an acquisition of an unrelated enterprise, or
- by participating in an equity joint venture with another investor or enterprise [24].

The research conducted in this paper is closely related to quantitative business indicators in a country such as business regulations, laws and the

protection of property rights, and the amount of foreign direct investment that can be expected consequently. Specifically, the aim of this paper is to establish connections between 25 carefully selected business indicators and the amount of FDI.

A growing number of econometric and survey-based studies related to this problem have been published already but focusing mostly on the macroeconomic factors which determine the level of FDI in a country. Relatively few studies cover the link between FDI and indicators that shape the daily economic activity in every country. In our study, a novel approach, one of data mining methods will be used for this purpose.

Section 2 presents short research background, followed by the methodology description and analysis of input data in section 3. Results are presented in section 4, while section 5 discusses the results and concludes the paper.

## 2 Research background

A lot of research was made to establish if there is an actual connection between the level of FDI and the growth rate of an economy. So the question is: does a higher level of FDI actually contribute to a positive productivity effect in the host economy? What are the benefits of attracting a lot of foreign direct investors?

A high level of FDI is something that is generally deemed to be very positive for the development of the host economy. FDI equals more money, so it enables additional investment in both human and physical capital. This is especially important for developing countries that do not have abundant financial flows.

Besides this obvious advantage, there is also the transfer of know-how and the, so called, "technology spillovers". This happens as a consequence of the employee training programs, the process of imitation, links created between foreign and local businesses etc. [2]. But is this always the case?

According to numerous studies cited in the same paper, an increase in FDI is positively correlated with higher growth rates in countries that are considered to be financially developed, compared to rates observed in financially poor countries. This could be partially explained by the fact that the local circumstances, such as the level of development of financial markets and the quality of educational system, affect the impact FDI will have on the economic growth of a country.

Borensztein, De Gregorio, and Lee [6] came to the conclusion that the host economies have to reach a certain educational level threshold in order to make good use of the new technologies and the know-how at their disposal, thus benefiting from FDI.

A relatively new point of interest for researchers is the connection between FDI and the effectiveness of the financial markets. According to Hermes and Lensink [21], Alfaro et al. [2] and Durham [15], countries that have well developed financial markets and better financial market regulations, profit more from a high level of FDI. Developed financial markets make it easier for potential investors to finance their projects.

Since the late 1990s, a number of authors have also studied the link between the level of FDI and the quality of domestic institutions. Results proved the significance of the civil and property rights protection, economic and political freedom and a low level of corruption [4].

The same study points out the importance of public efficiency as a determinant of inward FDI. Term "public efficiency" encompasses the following: quality of tax systems, easiness to create a company, lack of corruption, transparency, contract law, security of property rights, efficiency of justice and prudential standards.

According to the findings of a recent study by Busse and Groizard [8], countries need a sound business environment in the form of good government regulations to be able to benefit from FDI. To maximize the positive effects from FDI inflows, policymakers should make it their priority to revise the institutional setting and regulatory framework in their countries. This applies to several specific categories:

- the time, cost and the number of procedures needed to start a business,
- labour market regulations,
- contract regulations,
- creditor rights and
- insolvency regulations.

As illustrated, there is no agreement on common set of indicators affecting the FDI outcomes although there are studies focusing on one or more influencing factors. To the best of our knowledge this is a novel approach using the rule-based approach to determining the influence of various business regulations on the amount of FDI in a country.

### 3 Research data and methodology

Data mining methods, one of which is used in this research rely on the high achievements of information technology, mathematics and statistics. Basically, it is an analytical process of relationship and structure discovering among the variables and the creation of new knowledge [5].

It is important to have good knowledge about data mining methods and features (here, a CN2 rule induction algorithm), data pre-processing methods, and industry branch the problem originates from [26]. These aspects are presented hereinafter.

#### 3.1 Data preparation

Publicly available, online databases were used as a secondary source of data for the purpose of this research. A table with different business indicators for 179 countries was taken from Doing Business website [14]. Data concerning the target variable, foreign direct investment were compiled from two websites: Earth Trends (2010) [17] and UNCTAD Stats (2010) [30]. The first web site covered the period from 2005 to 2006 while the second one served as the source of data for the year 2007. Data on FDI were adapted from the World Development Indicators 2008 publication [13], the World Bank's annual compilation of data about development. It provides a detailed overview of development, drawing on data from the World Bank and more than 30 partners. The data on foreign direct investment were taken from the balance of payments data reported by the International Monetary Fund (IMF), supplemented by data on net foreign direct investment reported by the Organization for Economic Co-operation and Development (OECD), and official national sources. Data are reported in millions of current U.S. dollars.

There are some issues concerning data reliability. One should keep in mind that cross- country comparisons on the basis of FDI could sometimes be misleading and fail to objectively portrait the situation. This is because of the differences in defining components that constitute foreign direct investment in different countries.

As mentioned in previous section(s), there are three key parts that should be included when calculating the level of FDI:

- equity investment,
- reinvested earnings, and
- short- and long-term intercompany loans between parent firms and foreign affiliates.

However, many countries interpret the long-term loans in a different manner. Omission of the reinvested earnings from the calculations is also a common problem that requires attention [31].

By merging the data from the three above-mentioned web sources, a table in Excel 2007 was created and imported into the freeware program for data mining - Orange Canvas. This table contains over 15.000 entries (covering 179 countries for a three-year period).

The data needed to be filtered and cleansed before any further analysis. This was done by using the Purge domain module in Orange Canvas. The constructed data mining model with the modules used is illustrated in Fig. 1 bellow.

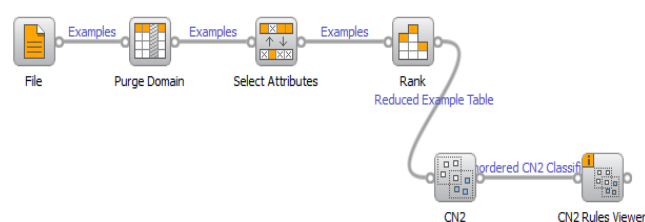


Fig. 1 Data mining model constructed in Orange Canvas

After the pre-processing of data, a comparison of the 25 selected business indicators for a given year was carried out. These indicators were ranked by information gain, Gini ratio and Gini gain. Those that made the top 15, according to the aforementioned criteria, were used in the further research. The final step was pushing the data through the CN2 rules module, and viewing the results using the CN2 rules viewer.

The collected data on FDI had to be properly grouped to be rendered useful. This was done by calculating the quartiles for the total amount of FDI, broken down by country and year.

In descriptive statistics, a quartile is any of the three values which divide the sorted observations into four equal parts, so that each part represents one fourth of the sampled population [11].

Each quartile contains 25 percent of the total observations. 25 percent of all the data analyzed is allocated within the first quartile, observations falling between 25.1 percent and 50 percent are allocated in the second quartile, observations falling between 51 percent and 75 percent are allocated in the third quartile, and finally, the remaining observations are allocated in the fourth quartile [29].

Each country was ranked from one to four, according to this rule (see Table 1):

1. If the amount of FDI exceeds the minimum value, and is less than or equal to the first quartile, the country is ranked 1;
2. If the amount of FDI exceeds the first quartile, and is less than or equal to the second quartile, the country is ranked 2;
3. If the amount of FDI exceeds the second quartile, and is less than or equal to the third quartile, the country is ranked 3;
4. If the amount of FDI exceeds the third quartile, the country is ranked 4.

Table 1. Rules for ranking countries

Rank	Rule for ranking
1	First quartile (25th percentile)
2	Median value (50th percentile)
3	Third quartile (75th percentile)
4	Fourth quartile (remaining observations)

### 3.2. Description of the quantitative indicators on business regulations and laws

As previously mentioned, the aim of this paper is to uncover the effect of 25 different business indicators on the amount of FDI. These indicators were grouped into eight different categories, covering a broad range of issues.

Every category was further partitioned into smaller components. For example, we have the Starting a business category which encompasses several different indicators:

- the number of procedures needed to start a business,
- the time it takes to get it running and
- the associated cost.

For an overview of the categorization, refer to Table 2. For detailed information about each indicator, refer to Doing Business website [14], whereas short description of each business indicator category can be found in the following eight paragraphs.

**C1. Starting a Business:** A procedure is defined as any interaction of the company founder with external parties (for example, government agencies, lawyers, auditors or notaries). Time needed to start a business is recorded in calendar days. It represents the median duration that incorporation lawyers indicate is necessary to complete a procedure with minimum follow-up with government agencies and

no extra payments. Cost is expressed as the percentage of the economy's income per capita. It includes all official fees and fees for legal or professional services if such services are required by law.

**C2. Dealing with Construction Permits:** All procedures that are required for a business to build a standardized warehouse are included. Time is recorded in calendar days. It depicts the median duration that local experts indicate is necessary to complete a procedure in practice. Cost of obtaining construction permits is expressed as the percentage of the country's income per capita.

**C3. Employing Workers:** Difficulty of hiring index has values that range between 0-100. Higher values indicate more rigid regulation of hours. Redundancy cost refers to the cost of advance notice requirements, severance payments and penalties due when terminating a redundant worker. It is expressed in weeks of salary.

**C4. Registering Property:** All procedures that are legally, or in practice required for registering property, are included. Time is recorded in calendar days. It captures the median duration that property lawyers, notaries or registry officials indicate is necessary to complete a procedure. Cost of registering property represents a percentage of the economy's income per capita. Only official costs required by law are taken into account, including fees, transfer taxes, stamp duties and any other payment to the property registry, notaries, public agencies or lawyers.

**C5. Getting Credit:** Strength of legal rights index ranges from 0 to 10. Higher scores indicate that collateral and bankruptcy laws are better designed to expand access to credit. Depth of credit information index also ranges from 0 to 6. If the value is higher, that indicates the availability of more credit information, from either a public registry or a private bureau. Transparency of information helps to facilitate lending decisions.

**C6. Protecting Investors:** Extent of Director liability index ranges from 0 to 10. Higher values indicate greater liability of directors. Ease of shareholder suits index goes from 0 to 10. Higher values indicate greater powers of shareholders to challenge the transaction. Strength of investor protection index represents the average of the extent of director liability index and the ease of shareholder suits index. It ranges from 0 to 10, with higher values indicating more investor protection.

Table 2. List of all categorized quantitative indicators on business regulations and laws

<b>C1. Starting a Business (Sb)</b>
Procedures
Time
Cost
<b>C2. Dealing With Construction Permits (Cp)</b>
Procedures
Time
Cost
<b>C3. Employing Workers (Ew)</b>
Difficulty of hiring index
Rigidity of hours index
Difficulty of redundancy index
Redundancy cost
<b>C4. Registering Property (Rp)</b>
Procedures
Time
Cost
<b>C5. Getting Credit (Gc)</b>
Strength of legal rights index
Depth of credit information index
<b>C6. Protecting Investors (Pi)</b>
Extent of director liability index
Ease of shareholder suits index
Strength of investor protection index
<b>C7. Paying Taxes (Pt)</b>
Tax Payments
Time
Total tax rate
<b>C8. Trading Across Borders (Tb)</b>
Documents
Time
Cost

**C7. Paying Taxes:** Tax Payments refer to the total number of taxes and contributions that have to be paid. Time is recorded in hours per year. The indicator measures the time to prepare, file and pay (or withhold) 3 major types of taxes and contributions: the corporate income tax, value added or sales tax and labor taxes, including payroll taxes and social contributions. Total tax rate measures the amount of taxes and mandatory contributions payable by the business in the second year of operation, expressed as a share of commercial profits.

**C8. Trading Across Borders:** The total number of documents required per shipment to export and import the goods is recorded. Time is expressed in calendar days. Cost measures the fees levied on a 20-foot container in U.S. dollars. All the fees associated with completing the procedures to export/import the goods are included.

### 3.3 Rule-based classification (CN2 rule induction algorithm)

Rules are a good way of representing information or bits of knowledge [20]. A rule-based classifier uses a set of IF-THEN rules for classification. An IF-THEN rule is an expression of the form

IF *condition* THEN *conclusion*.

The “IF”-part (on the left-hand side) of a rule is known as the rule antecedent or precondition. The “THEN”-part (on the right-hand side) is the rule consequent. An example is rule R1,  
R1: IF *credit information index* = 5 AND *construction permit cost* ≤ 104.5% of *income per capita* THEN *country* = 4.

In the rule antecedent, the condition consists of one or more attribute tests (such as *credit information index* = 5, and *construction permit cost* ≤ 104.5% of *income per capita*) that are logically connected (AND). The rule’s consequent contains a class prediction (in this case, we are predicting whether a country will be ranked as 1, 2, 3 or 4 with respect to the amount of FDI). R1 can also be written as

R1: (*credit information index* = 5) ∧ (*construction permit cost* ≤ 104.5% of *income per capita*) → (*country* = 4).

If the condition (that is, all of the attribute tests) in a rule antecedent holds true for a given tuple, it can be claimed that the rule antecedent is satisfied (or simply, that the rule is satisfied) and that the rule covers the tuple.

A rule  $R$  can be assessed by its coverage (see Fig. 2). Given a tuple,  $X$ , from a class labeled data set,  $D$ , let  $n_{\text{covers}}$  be the number of tuples covered by  $R$  and  $|D|$  be the number of tuples in  $D$ . The coverage of  $R$  can be defined as in formula:

$$\text{coverage}(R) = n_{\text{covers}} / |D| \quad (1)$$

A rule's coverage is the percentage of tuples that are covered by the rule i.e. whose attribute values hold true for the rule's antecedent [20].

With regards to conflict resolution strategy to figure out which rule gets to assign its class prediction to a tuple there are two different strategies – size ordering and rule ordering. Most rule-based classification systems use a class-based rule-ordering strategy applied in this case as well.

IF-THEN rules can be extracted directly from the training data (i.e., without having to generate a decision tree first) using a sequential covering algorithm. Rules are learned sequentially (one at a time), where each rule for a given class will ideally cover many of the tuples of that class.

Newer, alternative approach suggests using associative classification algorithms for generating rules by searching for attribute-value pairs that occur frequently in the data.

Popular variations of sequential covering algorithms include AQ, CN2, and RIPPER [20]. The general strategy is as follows: “Rules are learned one at a time. Each time a rule is learned, the tuples covered by the rule are removed, and the process repeats on the remaining tuples. This sequential learning of rules is in contrast to decision tree induction. Because the path to each leaf in a decision tree corresponds to a rule, we can consider decision tree induction as learning a set of rules simultaneously” (p. 322).

As mentioned, CN2 is a learning algorithm for rule induction; see [7], and [10]. Rule induction is one of the most important methods of machine learning. It is used to derive formal rules from a set of observations. These rules may represent a complete scientific model of the data, or just the local patterns and regularities in the data.

We can define machine learning as a scientific discipline focused on development of intelligent learning algorithms that make it possible for computers to learn to automatically recognize complex patterns in a given dataset [25]. Machine learning can be used for many different purposes.

The end results of using this method are usually better if we compare them to those obtained by human experts.

The list of benefits does not stop there: using machine learning methods, such as rule induction, is simple, fast and it can be applied even to the “noisy” data [16].

Results of the analysis can also be easily interpreted. No special skills are needed to understand IF-THEN results. If we were to hire a human expert for this task, he would probably come up with a list of rules that is, both semantically and structurally similar, to the one produced automatically [28].

CN2 algorithm enables learning an unordered set of classification IF-THEN rules from data [1]. Regarding the evaluation functions we have used the original Laplace rule quality evaluation (suggested by [9]) as opposed to m-estimate of probability and WRACC (weighted relative accuracy). Laplace expected error estimate measures expected accuracy directly and is given by the formula:

$$\text{LaplaceAccuracy} = (n_c + 1) / (n_{\text{tot}} + k) \quad (2)$$

where  $k$  is the number of classes in the dataset,  $n_c$  is the number of tuples in the predicted class  $c$  covered by the rule and  $n_{\text{tot}}$  is the total number of examples covered by the rule.

With regards to pre-pruning of rules, Alpha parameter that determines required significance of a rule when compared to the default rule is set to 0.05.

The second parameter, Stopping Alpha is set to 0.2 - in this case the rule is compared to its parent rule (it verifies whether the last specialization of the rule is significant enough).

The third parameter, Minimum coverage was set to 0, specifying the minimal number of examples that each induced rule must cover whereas the Maximal rule length was not limited.

Beam width was set to 5 as the number of best rules that are, in each step, further specialized. Other rules were discarded.

Covering and removing examples was done as in the original CN2 by exclusive covering, i.e. removing all covered examples and continuing learning on remaining examples. Alternative type of covering is weighted covering, which only decreases weight of covered examples instead of removing them.

CN2 viewer module visualizes rules learned by rule learning widgets with rule properties like quality, number of covered learning examples, length, and the class distribution among the covered examples (ibid). These criteria can also be used for sorting the list of rules as shown in section 4.

#### 4 Results of the research

A list of classification rules was generated for every year, for the time period of 2005 - 2007.

This was done using the described CN2 rule induction algorithm.

Obtained rules were ordered by the predicted class. At the top of every list, we have the predictions of conditions that need to be met, for a country to be in the first rank (the smallest amount of FDI). Then we have the rules that predict patterns for countries ranked 2, 3 and finally 4 (the biggest amount of FDI).

The list of rules does not have to be sorted by the predicted class. Other criteria can be used, like rule quality (Laplace) or rule length.

It would take up too much space to present in detail the complete lists of obtained rules. Only a short overview of generated results is given, sorted by rule quality.

Here is an excerpt from the top of the rule list for year 2007 (sorted by rule quality):

1. If the Depth of credit information index is 5, Strength of investor protection index is greater than 5.3, and the Cost of trading across borders is less or equal to 604\$ per container, country will be ranked 4.
2. If the Depth of credit information index equals 6, and the Cost of getting a construction permit is less or equal to 104.5 percent of country's income per capita, country will be ranked 4.
3. If the Cost of starting a business exceeds 25.6 percent of country's income per capita, the Number of documents required per shipment to export and import the goods is less than or equal to 6, and if the Total number of tax payments is less than or equal to 57, country will be ranked 1.

Here is an excerpt from the top of the rule list for year 2006 (sorted by rule quality):

1. If the Depth of credit information index equals 5, the Ease of shareholder suits index is less than or equals 5, and if Trading across borders takes up to 32 days, country will be ranked 4.

2. If the Cost of starting a business exceeds 108.4 percent of country's income per capita, the Total number of tax payments is less than or equal to 32, and the Strength of legal rights index is greater than 0, country will be ranked 1.
3. If the Strength of investor protection index exceeds 6.7, and the Cost of registering property is less or equal to 7.5 percent of the property value, and the Cost of trading across borders is less or equal to 960\$ per container, country will be ranked 4.

Here is an excerpt from the top of the rule list for year 2005 (sorted by rule quality):

1. If the Depth of credit information index equals 5, and the Time needed to start a business takes up to 34 days, country will be ranked 4.
2. If the Strength of legal rights index is less than or equal to 2, and Cost of advance notice requirements, severance payments and penalties due when terminating a redundant worker is less or equal to 26 expressed in weeks salary, and the Depth of credit information index exceeds 0, country will be ranked 1.
3. If the Depth of credit information index equals 5, the Difficulty of redundancy index exceeds 28, and the Strength of legal rights index exceeds 3, country will be ranked 4.

To get an idea of the type of output of the data mining module, see Fig. 2. The rules are sorted by predicted class for year 2007.

For example, the first part of the image shows that the FDI rank for a given country is 4 if the number of days needed for Trading across borders is less or equal to 14, and the cost of registering property is less than 5.4 percent of the economy's income per capita.

The second rule says that the country will be ranked 4 if the Depth of credit information index is 6 and the cost of Dealing with construction permits is less or equal to 104.5 percent of the percentage of the country's income per capita.

The third rule says that the country will be ranked 4 if the Depth of credit information index is 5, the Extent of director liability index is greater than 5.3, and the cost of Trading across borders is less or equal to 604\$.

The rest of the image shows the rules for countries belonging to class 3, class 2 and the class 1 which depicts the lowest level of FDI.

These rules can be interpreted in the same fashion as rules for class 4.

Length	Quality	Coverage	Class	Distribution	Rule
2	0.833	4.0	4	<0.0,0.0,0.0,0.0,4.0>	IF 2007.000Tbt<=14.000 AND 2007.000RpC>5.400 THEN 2007.000TDFIgr=4.000
2	0.900	8.0	4	<0.0,0.0,0.0,0.0,8.0>	IF 2007.000GcI=[6.000] AND 2007.000CpC<=104.500 THEN 2007.000TDFIgr=4.000
3	0.929	12.0	4	<0.0,0.0,0.0,0.0,12.0>	IF 2007.000GcI=[5.000] AND 2007.000PiI>5.300 AND 2007.000Tbc<=604.000 THEN 2007.000TDFIgr=4.000
4	0.833	4.0	3	<0.0,0.0,0.0,4.0,0.0>	IF 2007.000Tbc>4.867 AND 2007.000CpC>139.400 AND 2007.000GcI=[6.000] AND 2007.000SbC<=75.600 THEN 2007.000TDFIgr=3.000
2	0.875	6.0	3	<0.0,0.0,0.0,6.0,0.0>	IF 2007.000Tbc>960.000 AND 2007.000SbC<=60.600 THEN 2007.000TDFIgr=3.000
2	0.875	6.0	3	<0.0,0.0,0.0,6.0,0.0>	IF 2007.000GcI=[3.000] AND 2007.000CpC<=139.800 THEN 2007.000TDFIgr=3.000
2	0.833	4.0	2	<0.0,0.0,4.0,0.0,0.0>	IF 2007.000SbC>90.900 AND 2007.000TbC<=1.129 THEN 2007.000TDFIgr=2.000
3	0.857	5.0	2	<0.0,0.0,5.0,0.0,0.0>	IF 2007.000TbT>18.000 AND 2007.000TbT>64.000 AND 2007.000SbC>7.000 THEN 2007.000TDFIgr=2.000
3	0.875	6.0	2	<0.0,0.0,6.0,0.0,0.0>	IF 2007.000SbT>35.000 AND 2007.000Tbd>11.000 AND 2007.000TbT<=35.000 THEN 2007.000TDFIgr=2.000
2	0.875	6.0	1	<0.0,6.0,0.0,0.0,0.0>	IF 2007.000SbC>26.500 AND 2007.000CpC<=36.400 THEN 2007.000TDFIgr=1.000
4	0.875	6.0	1	<0.0,6.0,0.0,0.0,0.0>	IF 2007.000GcI=[0.000] AND 2007.000PiI>4.300 AND 2007.000Tbc>2.050 AND 2007.000Tbt<=35.000 THEN 2007.000TDFIgr=1.000
3	0.889	7.0	1	<0.0,7.0,0.0,0.0,0.0>	IF 2007.000PiD=[1.000] AND 2007.000GcI=[0.000] AND 2007.000PiI<=4.300 THEN 2007.000TDFIgr=1.000

Fig. 2 Output of CN2 rules viewer module with IF-THEN rules  
(sorted by predicted FDI class for 2007, top 3 rules per class)



### 5 Discussion and conclusion

By looking at the rule lists, it is possible to determine which categories of business indicators influence FDI the most. For instance, regulations and laws concerning getting credit and protecting investors are more important than dealing with construction permits inline with Qian’s findings [27].

One business indicator stands out in particular. It is the Depth of credit information index ranging from 0 to 6. Higher values indicate the availability of more credit information, from either a public registry or a private bureau, to facilitate lending

decisions. This indicator can be found in most of the rules.

See Fig. 3 for states’ FDI rankings according to Depth of credit information index.

Croatia (marked with an arrow) is ranked in FDI class 3 (out of 4) in 2007. With regards to this, most important indicator, Depth of credit information index for Croatia, from 2005 to 2007 was the lowest, i.e. 0.

In 2008 and 2009 the index increased to 3 which will certainly impact Croatia’s rankings and FDI outcomes in our future research activities for years 2008 onwards.

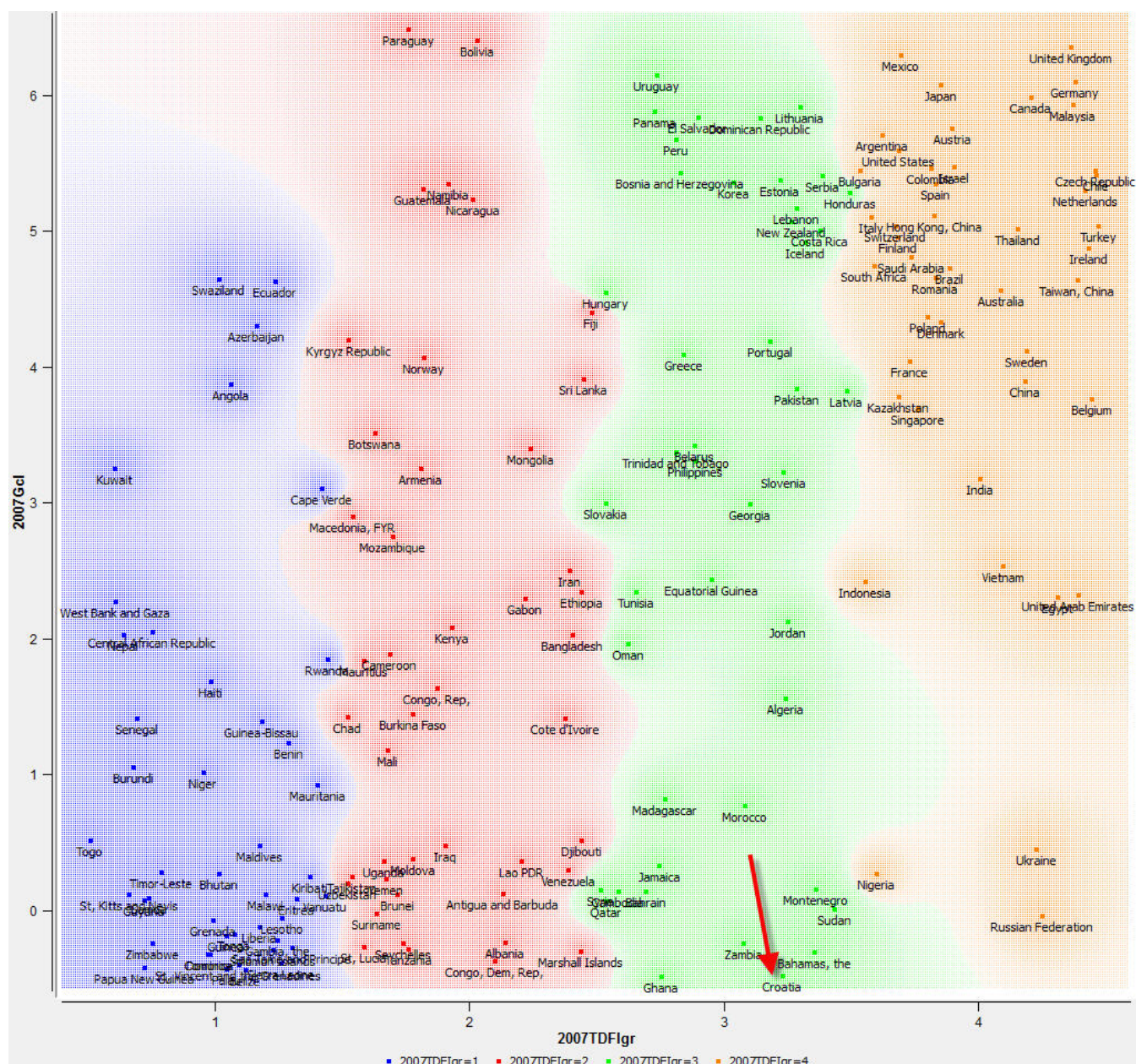


Fig. 3 States’ FDI rankings according to Depth of credit information index



Countries that want to adjust their laws, regulations and institutional arrangements in order to attract foreign direct investments, can use the findings of this research to determine the key areas that need to be addressed. They should first focus their efforts on improving the banking system by making the credit information more transparent.

The other crucial area of concern is creating a safe environment for investors [23]. Categories, such as property registration procedures, are not as critical.

The results of a study done by Busse and Groizard [8], that was conducted using the Doing Business website database, also stress the importance of government regulations, such as those concerning creditor rights and investor protection. Their conclusion is that governments should make changes in their institutional framework and regulations if they want to maximize the positive effects of FDI on the economy (ibid).

The results of this study of factors relevant for FDI attraction emphasize the importance of business environment on investors' decision to invest. The results could easily be used to build (and feed) an expert system for predicting the amount of FDI in a country, based on the input of aforementioned business indicators.

In one of the subsequent researches, in addition to CN2 rules, decision tree (DT) method will be used to recognize stronger rules with regards to the target variable. The two methods are a good combination for "quick profiling".

Also, comparison of the research results with the results of publicly available FDI surveys, usually conducted among FDI companies will be done in detail.

To summarize, the article deals with an interesting, yet not enough investigated topic of the influence of institutional factors on FDI-inflows.

Although we combined quite comprehensive data from various databases, there is one limitation of the study related to data i.e. lack of macroeconomic and political factors for FDI attraction. On the other hand, there are a growing number of studies that deal with macroeconomic factors which determine the level of FDI in a country, but relatively few studies cover the link between inward FDI and soundness of business environment.

#### References:

- [1] AiLab (Artificial Intelligence Laboratory) website, University of Ljubljana, Faculty of computer and information science [online]. Available from: [<http://www.ailab.si/orange>], 2010.
- [2] Alfaro L., Chanda A., Kalemli-Ozcan S. and Sayek S., "How Does Foreign Direct Investment Promote Economic Growth? Exploring the Effects of Financial Markets on Linkages," *NBER Working Papers 12522*, National Bureau of Economic Research, Inc., 2006.
- [3] Aliber, R. and Click R. (Eds.), *Readings in International Business: A Decision Approach*. MIT Press (MA), 1993.
- [4] Bénassy-Quéré, A., Coupet, M. and Mayer, T., "Institutional Determinants of Foreign Direct Investment," *The World Economy*, Blackwell Publishing, vol. 30(5), 2007, pp 764-782.
- [5] Berry, M. and Linoff, G., *Data mining techniques: for marketing, sales, and customer relationship management*, Indianapolis: Wiley Publishing, Inc., 2004.
- [6] Borensztein, E., De Gregorio, J. and Lee, J-W., How Does Foreign Direct Investment Affect Economic Growth?, *Journal of International Economics*, Elsevier, vol. 45(1), 1998, pp 115-135.
- [7] Boswell, R. and Clark, P., Rule Induction with CN2: Some Recent Improvements, *Machine Learning, European Working Session on Learning*, Porto, Portugal, March 6-8, 2001.
- [8] Busse, M. and Groizard C., Foreign Direct Investment, Regulations and Growth. World Bank Policy Research Working Paper No. 3882, 2006.
- [9] Clark, P. and Boswell, R., Rule Induction with CN2: Some Recent Improvements. In Proceedings of the European Working Session on Machine Learning (EWSL '91), Yves Kodratoff (Ed.). Springer-Verlag, London, UK, 1991., 151-163.
- [10] Clark, P. and Niblett, T., The CN2 Induction Algorithm, *Machine Learning 3(4)*, 1989. pp 261-283.
- [11] Craig, A. and Hogg, R., Introduction to Mathematical Statistics, [online]. Available from: [<http://math.bnu.edu.cn/~chj/lect-0.pdf>], 2008.

- [12] Davidson, W., The Location of Foreign Direct Investment Activity: Country Characteristics and Experience Effects, *Journal of International Business Studies*, 11 (2), 1980, pp. 9-22.
- [13] Development Data Group, World Development Indicators, [online]. The World Bank. Available from [http://go.worldbank.org/UOFSM7AQ40], 2008.
- [14] Doing Business Website, The World Bank, [online]. Available from: [http://www.doingbusiness.org/Documents/FullReport/2009/DB\_2009\_English.pdf], 2009.
- [15] Durham, K. B., Absorptive Capacity and the Effects of Foreign Direct Investment and Equity Foreign Portfolio Investment on Economic Growth, *European Economic Review*, Elsevier, vol. 48(2), 2004. pp 285-306.
- [16] Dyer C., *Machine Learning- Lecture Notes*, University of Wisconsin - Madison, 2003.
- [17] Earth Trends, [online]. Available from: [http://www.earthtrends.wri.org], 2010.
- [18] Falzoni, A., Statistics on Foreign Direct Investment and Multinational Corporations, [online]. Available from: [http://www.cepr.org/research/Networks/FDIMC/Papers/Data.pdf], 2000.
- [19] Froot, K., *Foreign Direct Investment*, University of Chicago Press, 1993.
- [20] Han, J. and Kamber, M., *Data Mining: Concepts and Techniques*, 2nd edition, Morgan Kaufmann, CA: San Francisco, 2006.
- [21] Hermes, N. and R. Lensink, "Foreign Direct Investment, Financial Development and Economic Growth," *Journal of Development Studies*, 40, 2003.
- [22] IMF, International Monetary Fund: Balance of Payments Manual, [online] Available from: [http://www.imf.org/external/np/sta/bop/bopman.pdf], 1993.
- [23] Mello, L., FDI in Developing Countries: A Selective Survey, *Journal of Development Studies*, 34, 1997, pp1-34.
- [24] Mohamed, A., World Economy: Globalization-International Financial system, [online]. Available from: [http:// xa.yimg.com], 2009.
- [25] Nilsson, N., *Introduction to Machine Learning: Draft of a Proposed Textbook*, Stanford University, 1996, pp 175-188.
- [26] Panian, Ž. and Klepac, G., *Poslovna inteligencija*, Zagreb: Masmedia, 2003.
- [27] Qian, J., *How Law and Institutions Shape Financial Contracts: The Case of Bank Loans*, PE Strahan: Boston College, 2005.
- [28] Sillen, R., Optimizing Iron Quality Through Artificial Intelligence, *Modern Casting Publication*, November 1996.
- [29] Steel, R. and Torrie, J., *Principles and Procedures of Statistics*, New York: McGraw, 1960.
- [30] UNCTAD Stats website, [online] Available from: [http:// www.stats.unctad.org], 2010.
- [31] World Bank, World Debt Tables 1993-1994: External Finance for Developing Countries, Vol. 1., 1993.