

# REVIEW OF ECONOMIC AND BUSINESS STUDIES

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Alexandru Ioan Cuza University

Published by Alexandru Ioan Cuza University Press

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ISSN 1843-763X

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RESEARCH ARTICLE

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# GENERATION OF TAX REVENUES AND ECONOMIC DEVELOPMENT: A PANEL-ANALYSIS FOR EMERGING ECONOMIES IN ASIA

KLIMIS VOGIATZOGLOU\*, LIEN PHUONG NGUYEN\*\*

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**Abstract:** *Particularly in an emerging or developing economy context, generating sufficient tax revenues is essential for the provision and upkeep of well-needed public infrastructure/public capital that supports the development process. However, tax policy can also cause distortionary and negative effects to economic activity and growth, especially if excessive taxation is imposed. The aim of this paper is to examine the role of tax revenues and estimate its overall net impact on economic growth in emerging economies in Asia. The dataset covers emerging economies from South, Southeast, and East Asia during 1998-2015. The results show that tax revenues have an overall positive net impact on the growth rate of real GDP per capita, suggesting the positive effects associated with taxation outweigh the negative and distortionary effects of taxation. Thus, evidence is found that the collection of adequate amounts of tax revenues (with which public investments were financed) contributed significantly to economic development.*

**Keywords:** *Asia, Emerging Markets; Growth Regression; Public Finance; Taxation.*

**JEL Classification:** *O10, O47, H20*

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## 1. INTRODUCTION

The capacity of countries to generate tax revenues is crucial in giving governments the fiscal space to provide necessary public infrastructure and capital as well as key public goods and services. An effective taxation system, which on the one hand, generates sufficient tax revenues that are efficiently invested into essential public capital and services, and on the other hand, causes minimal market distortions, has a beneficial effect on productivity and economic growth and development. (e.g. Gruber, 2016; Barro and Sala-i- Martin, 1992).

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Especially, in a developing or emerging economy context, where public infrastructure and capital are rather deficient, public finance plays a particularly important role in the economic development process. It enables public investments and thus, the creation of necessary infrastructure that supports economic growth. Under this perspective, hence, it is essential that the tax policy: [i] generates a sufficient amount of tax revenues, [ii] uses efficiently the tax resources for public investment, and [iii] provokes the least possible negative effects to economic activity and growth.

Interestingly, the empirical evidence on the growth effect of total tax revenues is rather mixed, and there is no clear consensus. In some countries total tax revenues have been found to have a clearly positive impact on economic growth and development. This suggests that the positive effects of tax revenues / taxation (tax resources efficiently spent on public investment, infrastructure, etc.) outweigh the negative and distortionary effects (e.g. inefficient and misuse of tax resources leading to smaller amounts of public investments, heavy tax burden leading to economic disincentives and less private investment, etc.).

On the other hand, in many countries it seems that total tax revenues are associated with an overall mixed or neutral impact on growth (positive and negative effects are of equal magnitude). However, in some countries there is a clearly negative growth effect of tax revenues, indicating that the positive effects of taxation are smaller than the negative effects, leading to an overall negative effect of tax revenues on growth (e.g. Kneller and Misch, 2017; Johansson, 2016).

Furthermore, the literature suggests that besides broad cross-country views, an examination focusing on individual economies or country groups of the same region sharing similar economic characteristics has merits for a more precise and case specific assessment of the impact of taxation on economic development. In emerging and developing economies of South, Southeast, and East Asia, tax revenues and public finance is a highly relevant issue to economic development efforts (e.g. World Bank, 2016; Straub and Terada-Hagiwara, 2010). However, there is generally limited evidence on the subject matter.

Given this scarcity of detailed information on developing and emerging Asia, the objective of this paper is to empirically examine the the role and overall quantitative effect of tax revenues on economic development. By assessing the overall growth effect associated with taxation, we can infer the relative sizes of the

positive and negative effects of the tax policy and provide a quantitative estimate of the overall contribution of tax revenues to economic growth. The empirical growth analysis is conducted for emerging economies from the South, Southeast, and East Asia region over the 1998-2015 period.

The rest of the paper is organized as follows. The next section provides a brief review of the literature. The third section presents the econometric methodology. It also provides a description of the data and variables, as well as an analysis of the cross-country patterns and trends in tax revenues and economic growth and development over the sample period. The fourth section reports and discusses the empirical results. The final section offers the concluding remarks.

## 2. REVIEW OF THE LITERATURE

We briefly review the relevant literature, in which only the main points and findings are summarized, as there are plenty of recent in-depth review papers on this rich subject matter.<sup>1</sup> First, it has to be noted that the theoretical literature is based on growth models with public finance (e.g. Barro and Sala-i-Martin, 1992; Barro, 1990; 1991a; 1991b). Initially, the main interest and analytical focus was placed entirely on the growth effect of public capital, and subsequently, the role of taxation was also explicitly taken into account and analyzed.

A growing number of studies over the years have examined the effects of public capital/investment, and more recently, of taxation on economic growth (e.g. Alinaghi and Reed, 2017; Gaspar et al., 2016; Dackehag and Hansson, 2015; Macek, 2014; Fricke and Süssmuth, 2014; Attila, 2008; Arnold, 2008; Barro, 1991b). The most usual empirical approach is based on estimating growth regressions across a sample of countries, with either cross-section analyses or panel econometric techniques being applied. The focus is on analyzing either the growth effect of public capital/investment/expenditure or tax revenues.

The majority of studies examine developed and/or OECD countries, whilst due to data unavailability and other measurement issues, the number of studies focusing on developing countries is smaller. Government expenditures on investment as a percentage of GDP is usually taken as a proxy for public

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<sup>1</sup> For such reviews, see, for instance, Kneller and Misch (2017), Alinaghi and Reed (2017), and Johansson (2016).

capital/investment, whilst tax revenues as a percentage of GDP is the most commonly used empirical measure for taxation (which reflects the relative magnitude of both, revenues and tax burden). In general, the empirical evidence suggests that public finance (viewed and assessed through either government expenditures and / or tax revenues) has a significant positive impact, while some papers indicate a negative effect. However, it needs to be stressed that for total tax revenues, the evidence is more ambiguous and dependent on the specific country or countries under consideration.

One of the first comprehensive empirical studies on the role of public finance is Barro (1991b), which for a sample of ninety-eight countries during a 26-year period it is found that government expenditures associated with public investment contribute to economic growth. Rather than the role public finance is general, other studies specifically consider taxation.

For instance, Arnold's (2008) analysis for twenty-one OECD countries over a time span of 34 years indicates that overall tax revenues as well as property, consumption and personal income taxation have a significantly positive impact on growth, while the corporate income tax has a negative effect. By estimating an empirical endogenous growth model, Attila (2008) found that when high corruption is present in a country, taxation is harmful to economic growth. The study by Fricke and Süßmuth (2014) for eleven Latin American developing economies over a 20-year period concludes that tax revenues strongly and positively affect economic growth in the long-run.

Studies that focus particularly on developing economies in Asia are scarce. Acosta-Ormaechea and Yoo (2012) consider a large number of countries, including Asian economies. However, their growth analysis focuses on changes in tax composition rather than the effect of overall tax revenues. Loganathan et al. (2017) analyze how economic growth and the stock market affect tax revenues in six emerging Asian economies. Through panel cointegration and Granger causality tests they find that a bi-directional causality relationship exists, that is tax revenues cause growth and vice versa. Overall, thus, the evidence on Asian developing economies is rather insufficient.

### 3. METHODOLOGY

#### 3.1. Model Specification

The empirical counterpart of a Solow-type theoretical transitional growth equation in a cross-section framework can be represented by a regression equation of the following general form (Barro, 1991b; Mankiw et al., 1992):

$$\log(y_{i,t}) - \log(y_{i,0}) = \beta \log(y_{i,0}) + X\alpha + Z\varphi + \varepsilon_i \quad (1)$$

On the other hand, for conceptual and statistical reasons, the empirical growth model in a panel-data context should be specified as a dynamic panel regression, in which a lagged dependent variable is included as an additional regressor (Islam, 1995):

$$\log(y_{it}) = b \log(y_{it-1}) + X\alpha + Z\varphi + \mu_i + v_t + \varepsilon_{it} \quad (2)$$

$$b = (1 + \beta) \Rightarrow \beta = b - 1$$

Our sample is a panel-dataset, and consequently, we limit the presentation of the econometric methodology to the panel-data context. Equation (2) regresses the log of real GDP per capita on (i) time lagged log of real GDP per capita, (ii) a set of determinants based on growth theory including public finance, represented by matrix  $X$ , and (iii) a set of several general control variables in logs, included in matrix  $Z$ . In general,  $X$  includes the log of physical private capital, log of human capital, and the log of a public finance variable (public capital or taxation, depending on the analytical focus), which is in accordance with the theoretical growth equation.

Since the present empirical analysis focuses on the assessment of the overall effect of tax revenues on economic growth, the public finance variable included in the growth regression is total tax revenues as a percentage of GDP. The column vector of regression coefficients (including the constant) for  $X$  is  $\alpha$ , whilst that of  $Z$  is  $\varphi$ . Country specific fixed effects and time specific effects are denoted by  $\mu_i$  and  $v_t$ , respectively.

Because economic growth is an endogenous phenomenon, the dynamics of growth and the simultaneous and reverse causality (endogeneity) associated with the explanatory variables must be explicitly taken into account in the econometric estimation of the growth regression (Sasaki, 2015; Siddiqui and Ahmed, 2013; Acemoglu et al., 2003; 2001; Barro 1990). For instance, human capital can have a beneficial effect on growth and at the same time, economic growth and

development can have a beneficial effect on human capital. This applies more or less to other growth determinants as well, including tax revenues.

A common and widely-used dynamic panel-econometric approach that controls for the above mentioned issues and estimates consistently and efficiently an empirical growth model is the general method of moments (GMM) technique. First, the dynamic panel regression equation (2), in which all the variables are in logs, is first-differenced to account for the country fixed effects. This produces the following empirical panel growth regression, which is estimated by GMM using instrumental variables (lagged dependent and explanatory variables):

$$\Delta \log(y_{it}) = \alpha_0 + b\Delta \log(y_{it-1}) + \alpha_1 \Delta \log(TAX_{it-1}) + \alpha_2 \Delta \log(K_{it-1}) + \alpha_3 \Delta \log(H_{it-1}) + \Delta Z\phi + \Delta v_t + \varepsilon_{it} - \varepsilon_{it-1} \quad (3)$$

$$i = 1, 2, 3, \dots, 15$$

$$t = 1998, 1999, 2000, \dots, 2015$$

$$\beta = b - 1 \text{ (conditional convergence speed)}$$

with:

$\alpha_1 > 0$  (i) if tax revenues have an overall positive net impact on economic growth.

or

$\alpha_1 < 0$  (ii) if tax revenues have an overall negative net impact on economic growth.

or

$\alpha_1 = 0$  (iii) if tax revenues have an overall neutral net impact (various effects cancel out).

With respect to equation (3),  $\Delta$  denotes the first-difference operator, which transforms the log variables in first difference logs, that is in growth rates [ie.  $\Delta \log(y_{it}) = \log(y_{it}) - \log(y_{it-1})$ ];  $\varepsilon_{it} - \varepsilon_{it-1}$  is the stochastic error term (which follows a first order moving average process, MA(1), brought about by the first-difference transformation); TAX is the tax revenues (public finance) variable, K denotes private physical stock capital, and H stands for the human capital stock variable.

Since the dependent variable and all explanatory variables have been converted to growth rates, the regression coefficients reveal how an increase in the rate of growth of an explanatory variable (e.g. human capital stock) relates to a rise

in the growth rate of real GDP per capita.<sup>2</sup> More specifically, the estimated regression coefficients indicate the change in the real GDP per capita annual growth rate (in percentage-points) as a result of one percentage-point change in the growth rate of an explanatory variable.

The role and quantitative effect of tax revenues on economic growth, which is the main point of our empirical analysis, is assessed through the estimation of the dynamic panel-econometric equation (3). If the TAX variable is found to exhibit a statistically significant and positive regression coefficient, it indicates an overall positive net growth impact associated with tax revenues. In this case, we could infer that the various positive effects of tax revenues outweigh the adverse and distortionary effects, which cause a negative impact on growth.

Regarding the data, we have to underline that one particularly crucial issue is stationarity. Non-stationary data can lead to spurious relationships and dynamic instability, rendering the empirical findings unreliable and invalid. We have confirmed through panel-unit root testing that our panel-dataset is stationary. With respect to GMM estimation, the first-differenced GMM estimator (Arellano and Bond, 1991) may be biased in panels with a short time dimension and variables that exhibit a high degree of time persistence (eg. Bond, Hoeffler & Temple, 2001).

In such a situation, it is suggested that an alternative estimator (system GMM) should be employed, which, in addition to lagged levels as instruments for variables in first differences, uses lagged first differences as instruments for variables in levels (Arellano & Bover, 1995; Blundell and Bond, 1998).<sup>3</sup> Since in our panel, the time dimension is rather long and the variables are not highly persistent, the above mentioned issues do not arise. In any case, we have estimated equation (3) with both, the first-differenced GMM and the system GMM estimator. The empirical results that we obtained from the two GMM estimators are almost identical.

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<sup>2</sup> This is in accordance with the theoretical model, in which the various variables in the transition-to-the-steady-state (transitional growth) equation reflect accumulation / growth rates in the capital stocks and public finance variable.

<sup>3</sup> Through a Monte-Carlo simulation study, Blundell and Bond (1998) show that when the series are highly persistent (close to a random walk) in short panels, the system GMM estimator is more robust.

### **3.2. Data and variables**

The sample of our empirical analysis consists of fifteen Asian emerging and developing economies (Bangladesh, Bhutan, Cambodia, China, India, Indonesia, Malaysia, Mongolia, Nepal, Pakistan, Philippines, Sri Lanka, Thailand, Timor-Leste, Vietnam) during the 1998-2015 period. As the observations are pooled across countries and years, the sample is a panel-dataset. Furthermore, since data are available for all countries and all years under study, we have a fully balanced panel. Descriptive statistics are given in Table A3.

#### ***Economic development/ growth***

The two key variables in our analysis are economic development / growth (coded as DEV or y), which constitutes the dependent variable and is proxied by real GDP per capita (in constant 2010 US dollars), and tax revenues (TAX), as measured by total government tax revenues as a percentage of GDP.

#### ***Taxation***

The taxation variable we use indicates (in relative terms) both the tax revenues, with which public investments and other expenditures can be financed, and the tax burden on the private sector and economic agents (corporations, entrepreneurs, capital owners, workers, consumers, etc.). The above empirical measure is standard in the growth literature as well as in various literatures on taxation effects. The remaining variables included in the empirical analysis are factors associated with the augmented Solow growth model (see next section).

#### ***Other control variables***

A number of other general control variables are also included in order to account for additional economic factors and avoid omitted variable bias (economic openness; country population; economic restructuring away from agricultural production; and macroeconomic instability). Besides theory and prior empirical studies, the selection of control variables is based on the availability of data for all countries in our sample. The descriptions and data sources for all variables are reported in Table A1 in the appendix. As discussed in detail in the next section, all variables included in the empirical growth regression are transformed to logs and first-differenced (before econometric estimation), and thus the variables reflect annual rates of growth. Table A2 in the appendix, which reports the correlation

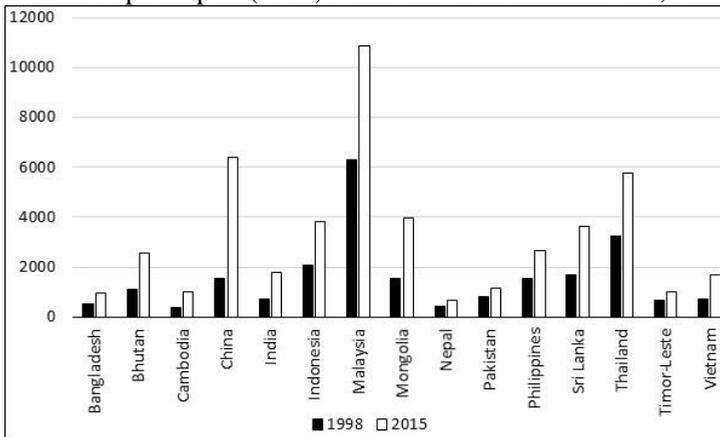
matrix as well as the variance inflation factors for the explanatory variables, indicates that there is no multicollinearity problem, and hence all variables can be retained and considered in the analysis.

**3.3. Descriptive patterns and trends 1998-2015**

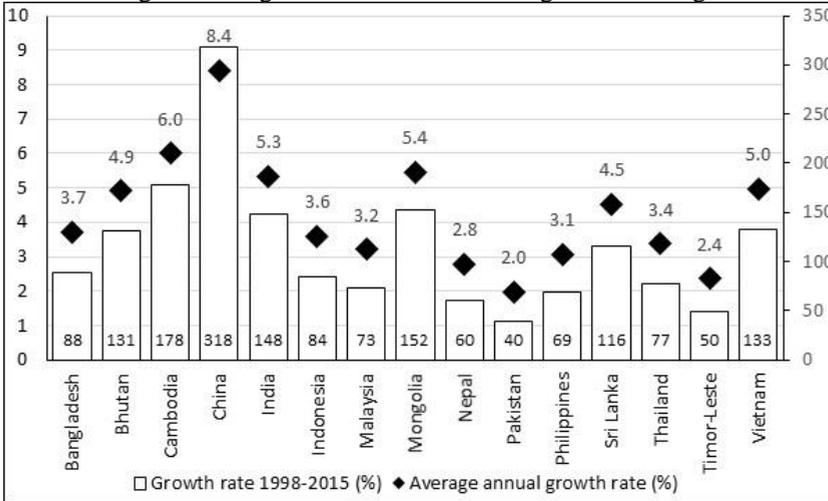
Before turning to the findings of the econometric analysis, it is informative to have a first look at the descriptive patterns and trace the trends of the two key variables across our sample of countries over the 1998-2015 period. First, as it is evident from Figure 1, in all countries real GDP per capita has increased between 1998 and 2015. In some economies this increase is small, whilst in several countries it is substantial (especially in China, as seen more clearly in the next Figure). According to this indicator, Malaysia, China, and Thailand appear to have the highest economic development level among the 15 countries from the South, Southeast, and East Asian region. On the other hand, Nepal, Bangladesh, Timor-Leste, and Cambodia are among the least developed.

Next, Figure 2 shows the average of the annual growth rates in real GDP per capita (%) over 1998-2015 (as diamond-shaped markers measured on the left vertical axis), as well as the overall growth (%) that has been achieved during that period (as white columns measured on the right vertical axis). It is apparent that China exhibits the highest average annual growth rate (8.4%) and has more than quadrupled its real GDP per capita between 1998 and 2015 (an increase of about 318%). Cambodia, Mongolia, and Vietnam show the next highest average growth rate and overall growth, while Pakistan and Nepal exhibit the lowest growth rates.

Figure 1: Real GDP per capita (*DEV*) in constant 2010 US dollars, 1998 and 2015



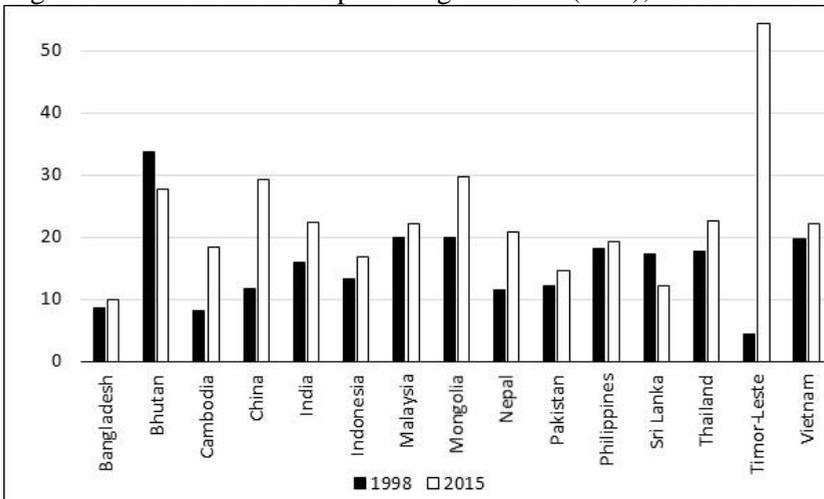
Source: Author(s) compilation based on data from WDI (World Development Indicators).  
 Figure 2: Average annual growth rate and overall growth during 1998-2015 (%)



Source: Author(s) compilation based on data from WDI (World Development Indicators).

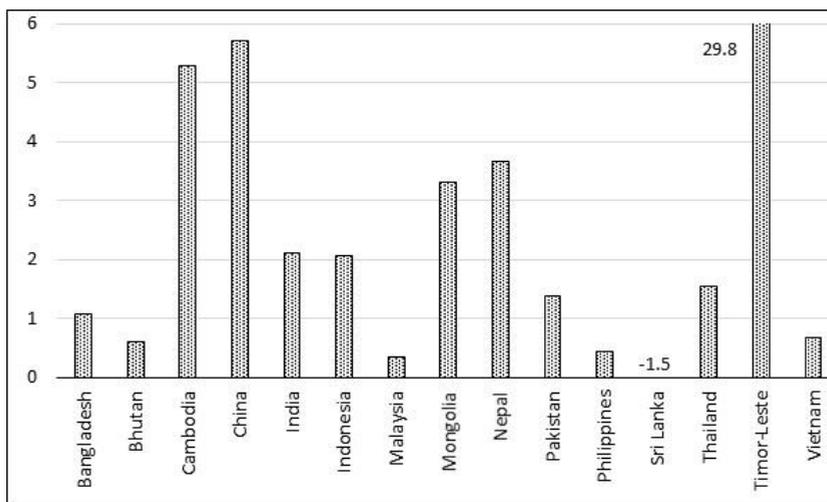
With respect to taxation, from Figure 3 it can be discerned that tax revenues as a percentage of GDP in 2015 are at a higher level compared to the level in 1998 (the initial year) in all countries except Sri Lanka and Bhutan.

Figure 3: Tax revenues as a percentage of GDP (TAX), 1998 and 2015



Source: Author(s) compilation based on data from World Economic Outlook, IMF.

Figure 4: Average annual growth rate of TAX (%) during 1998-2015

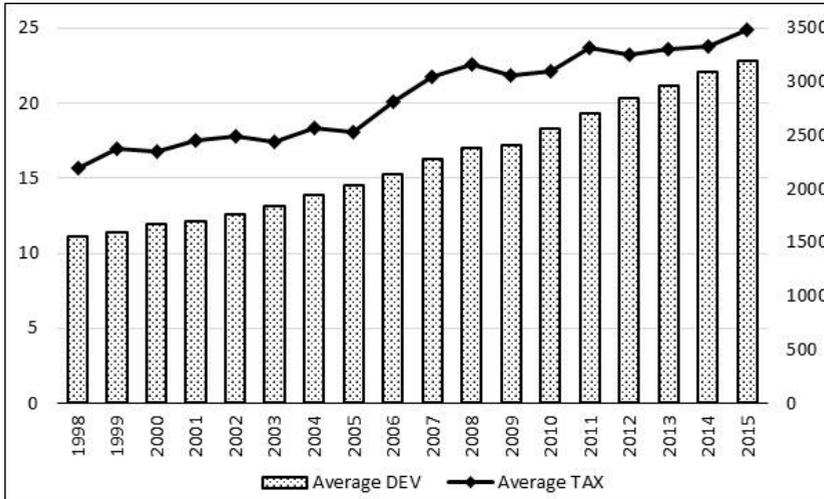


Source: Author(s) compilation based on data from World Economic Outlook, IMF.

However, only Sri Lanka has witnessed an overall and continuous decline in the *TAX* variable over the whole sample period (as reported in the next Figure). In addition to Timor-Leste (which represents a somewhat special case, exhibiting a huge increase from a very low level of tax revenues), Mongolia, China, Bhutan, Thailand, India, and Vietnam are among the countries with the highest *TAX* level in the end year of the sample period under study. Many of those countries have achieved the largest growth in tax revenues, as it is evident from Figure 4, which shows the average annual growth rate of *TAX* over 1998-2015. This growth rate is clearly “off the chart” in the case of Timor-Leste (29.8%), whilst negative only in Sri Lanka (-1.5%).

Finally, Figure 5, which depicts the evolution in the country-group average real GDP per capita (measured in constant US dollars on the right vertical axis) and tax revenues (measured as a % of GDP on the left vertical axis) over 1998-2015, it is evident that overall, there is a strong upward trend in the level of both *DEV* and *TAX*. Notably, average tax revenues (% of GDP) increased from a level of around 15% to almost 25%. This highlights the rising importance of tax revenues in the economy, and implies a substantial expansion in government expenditures and public capital and services. It also suggests that in recent years the average tax burden has become heavier, and is, to some extent, approaching medium-high levels.

Figure 5: Country-group average of real GDP per capita (*DEV*) and *TAX*, 1998-2015



Source: Author(s) compilation based on data from WDI and WEO.

## 4. RESULTS AND DISCUSSION

### 4.1. Short-run Impact of Taxation on Economic Growth

Since in dynamic panel-data models, short-run as well as long-run effects can be estimated, we have two sets of estimation results. First, Table 1 reports the findings for the short-run impact of the explanatory variables on the dependent variable and the beta convergence parameter, with which the speed of conditional convergence in real GDP per capita across countries is measured. In Table 2, we show the empirical results with regard to the long-run or cumulative effect of the independent variables. Overall, the estimated empirical growth model is satisfactory, as all but one independent variables are statistically significant. Furthermore, there is no problem with second-order serial correlation and the instruments are valid.

It is found that tax revenues have an overall positive effect on economic development. The short-run regression coefficient of *TAX*, which is highly statistically significant, indicates that the annual growth rate of real GDP per capita increases by about 0.042 percentage points due to a one percentage point increase in the growth rate of the *TAX* variable. The estimated short-term growth effect is conditional on all the other country factors included and considered (remaining

explanatory variables, country-specific characteristics captured by fixed effects, and initial development level).

Table 1: Estimation of Growth Determinants (Short-run Effects)

Explanatory Variables	Regression Coefficient	t-statistic	p-value
<b>Tax Revenues (<i>TAX</i>)</b>	<b>0.0419355</b>	<b>2.83</b>	<b>0.005</b>
Private Capital Investment	0.0166774	1.86	0.064
Human Capital Investment	0.2206300	1.81	0.070
Economic Openness	0.0053254	2.20	0.028
Country Population	0.1829114	2.10	0.035
Agricultural Production	-0.0957441	-3.76	0.000
Macroeconomic Instability	0.0030453	1.00	0.318
<i>b</i> (Lagged dependent variable)	0.8220466	26.17	0.000
$\beta = b - 1$ (convergence speed parameter)	-0.1779534	-5.67	0.000
<i>Statistics</i>			
AR(2) test ( <i>p-value</i> )	0.3102		
Sargan test ( <i>p-value</i> )	0.9893		
Wald test ( <i>p-value</i> )	0.0000		

Note: Results on short-run parameters obtained by estimating equation (3).

The same holds for the long-term estimates. Though the magnitude of the short-run growth impact might seem small, it has to be noted that it represents the instantaneous effect; that is to say, the effect of the current value of the *TAX* variable growth rate at time *t* on the current value of the income (real GDP per capita) growth rate at *t*.

#### 4.2. Long-run Impact of Taxation on Economic Growth

In the case of tax revenues, there might be reasons to expect that the size of the immediate impact on economic development to be less pronounced. Some of the beneficial effects on growth associated with taxation could take a certain amount of time to materialize. For instance, the productivity benefits to the economy associated with revenues that are spent on large-scale public investments on infrastructure, which require many years of construction, are likely to accrue

over a long time horizon. Hence, the long-run growth impact of taxation might be more informative.

The estimated long-run regression coefficient for the *TAX* variable suggests that, on average, the cumulative effect of a one percentage point increase in the tax revenues growth rate over the longer-term amounts to an increase of almost a quarter of a percentage point in the annual growth rate of real GDP per capita (Table 2).

Table 2: Estimation of Growth Determinants (Long-run Effects)

Explanatory Variables	Regression Coefficient	t-statistic	p-value
<b>Tax Revenues (<i>TAX</i>)</b>	<b>0.2356545</b>	<b>2.14</b>	<b>0.032</b>
Private Capital Investment	0.0937177	1.91	0.056
Human Capital Investment	1.2398190	2.13	0.034
Economic Openness	0.0299260	1.91	0.056
Country Population	1.0278610	2.32	0.020
Agricultural Production	-0.5380292	-3.64	0.000
Macroeconomic Instability	0.0171128	1.01	0.313

Note: Results on long-run (LR) effects obtained from short-run estimation results as follows:  $= \frac{\alpha}{1-b}$ , where  $\alpha$  is the estimated coefficient of a given independent variable and  $b$  is the coefficient of the lagged dependent variable.

Given that this estimate represents the overall net effect of tax revenues (which is determined by various positive and negative effects), the degree of the favorable influence is not unsubstantial. The importance of this finding lies in the fact that as the annual growth rate of a country is higher by a quarter of a percentage point [for instance, instead of 4.25% , which is the mean value in the sample, it is increased to a rate of 4.5%] for every year, the beneficial effect of tax revenues on economic development is compounded and accumulates. Thus, a country achieves a higher growth rate in its GDP per capita than what it would

have been without the overall positive growth effect of tax revenues, reaching thereby to a higher absolute GDP per capita level next year.

Now from this higher GDP level (due to the growth effect of tax revenues of the previous year), the higher growth rate in the next year (by almost 0.25 percentage points) increases further the level of GDP per capita in the future. In other words, the positive growth rate differential due to tax revenues occurs every year and drives the absolute level of economic development ever-more higher. Overall, the results for the long-run growth impact of tax revenues clearly show that the estimated positive effect is not only statistical significant but has considerable economic consequence on economic development in the long-run.

Regarding the other explanatory variables, it is evident that all regression coefficients, except macroeconomic instability, are statistically significant. Notably, growth in the human capital stock exerts a particularly strong impact on growth in real GDP per capita. In fact, this variable exhibits the highest marginal effect among all regressors. The estimated short-run coefficient indicates that a rise of one percentage point in the growth rate of the human capital stock is associated with an immediate effect of a 0.22 percentage point increase in the development growth rate. The long-run impact is more impressive, as it amounts to an increase of around 1.24 percentage points.

Population growth shows the second highest short-run and long-run coefficients. In the long-term, the growth rate in a country's economic development (per capita income) level is enhanced by about 1.03 percentage points as a result of a one percentage point increase in the growth rate of a country's population.

This highlights the crucial importance of "healthy demographics" not just for GDP growth, but also for per capita GDP growth in the economies of the South, Southeast, and East Asian region. Interestingly, our finding of the substantial economic growth impact of population dynamics echoes the views of various policy institutions, which greatly emphasize the role of demographics as an important growth factor (e.g. World Bank, 2016; European Commission, 2015; IMF, 2004).

The coefficient of agriculture as share of GDP, which proxies for economic restructuring towards non-agricultural activities such as, manufacturing, construction, and services, is negative and highly statistically significant. Thus, it indicates that as

the national economy shifts away from agriculture and towards other activities, there is a considerable beneficial effect on a country's economic development level. More precisely, the estimated long-run regression coefficient suggests that a one percentage point fall in the growth rate of the agricultural GDP share, raises more than a half percentage points the real GDP per capita growth rate.

The final two statistically significant explanatory variables, rate of growth in the private capital stock and in the extent of economic openness,<sup>4</sup> both have a positive impact, but the magnitude of the effect is relatively small.

As regards conditional beta-convergence, the corresponding parameter is negative and highly statistically significant. This indicates that, given all the explanatory variables and individual country characteristics considered in the analysis, countries converge towards their balanced growth paths. Hence, the discrepancy between their current income levels and their steady-state income levels is reduced. Countries that are further away from their steady-state growth levels exhibit higher growth rates. This in turn, may imply that economies with initial lower development level exhibit higher growth rates compared to countries with a higher initial level of per capita GDP. It has to be stressed that conditional  $\beta$ -convergence does not imply that countries are converging towards a common steady state growth path, leading to the convergence of real GDP per capita levels.<sup>5</sup>

Notably, we find that the speed of the  $\beta$ -convergence is particularly high. The estimated parameter suggests that, on average, the countries convergence to their balanced growth paths at about 17% a year. This is much higher than the convergence estimates of most cross-section studies, which are between 2% and 4% (e.g. Barro, 2015). However, usually panel-data analyses produce considerably larger convergence parameters (e.g. Islam, 1995; Caselli et al., 1996; Evans 1997; Barro, 2015), with some estimates for OECD economies indicating a convergence of more than 10% annually (Islam, 1995).

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<sup>4</sup> We have estimated the growth regression with a variety of different measures of economic openness (such as exports and imports as a % of GDP, several export-related variables, and a globalization index). However, only the openness indicator reported here was found to be clearly statistically significant at the 5% level.

<sup>5</sup> This is the notion of absolute (or unconditional) beta-convergence. Furthermore, another relevant concept that directly measures the extent of convergence/divergence of income levels among countries over time is  $\sigma$ -convergence.

Furthermore, it has been documented in the literature that when similar countries and/or countries from the same geographical regions are considered in the analysis, the estimated conditional  $\beta$ -convergence speed is significantly higher, implying, among other things, the existence of “convergence clubs” (e.g. Baumol, 1986; Baumol & Wolff, 1988; Dowrick & DeLong, 2003).

## 5. CONCLUDING REMARKS

This paper has first investigated the trends in total tax revenues and economic development across 15 emerging and developing economies from the South, Southeast, and East Asian region over 1998-2015. In addition, through GMM estimation of a dynamic panel growth regression, it has also examined the overall net growth effect of total tax revenues along with other relevant determinants of economic growth and development.

Our empirical research has found that during the sample period, the development level (as indicated by real GDP per capita) has increased consistently in all countries (especially in China, Cambodia, Mongolia, India, and Vietnam). Tax revenues have also expanded significantly across our sample (except in Sri Lanka). In many of the economies which have experienced a substantial growth in tax revenues, real GDP per capita growth has been particularly strong. In fact, our analysis highlights that a significant correlation exists between those two variables, and our econometric analysis confirms that tax revenues have an overall positive net effect on economic growth.

This implies that the positive effects associated with total tax revenues (such as the efficient spending of tax resources on public investment for the creation and accumulation of public capital and provision of public services) outweigh the distortionary effects (which have a negative impact on the growth rate). Notably, the magnitude of this overall net growth effect indicates that, in the long-run, the annual growth rate in real GDP per capita is increased by almost a quarter of a percentage point. The quantitative estimates of the short-run and long-run growth impact of tax revenues, suggest that tax policy has had an influential overall effect on economic growth. Consequently, generating sufficient amounts of tax revenues (in order to be efficiently spent on public investment) represents a vital factor for economic development in emerging and developing economies in Asia.

Our findings also underline the crucial importance of human capital, demographics, and economic restructuring away from agriculture towards manufacturing and services. As the empirical analysis reveals that increased tax revenues have helped the development process, it implies that, in a developing country context, tax revenues and public finance should play an important part in a country's economic growth efforts. Consequently, it is imperative that a sufficient amount of tax revenues are collected in order to maintain and generate new infrastructure and other forms of productive public capital as well as provide various vital government services. This is particularly true for developing economies with a substantial lack of infrastructure and public services.

Furthermore, the generation of adequate tax revenues allows a government to finance this infrastructure through own funds, avoiding thus the accumulation of domestic and external debt. When government debt becomes unsustainably high, it can cause a series of economic and fiscal problems and undermine future growth prospects.

On the other hand, it has to be noted that although a rise in tax revenues and productive public expenditures is expected to be beneficial (especially for countries with in initial low levels of taxation and public capital), the tax burden on the economy cannot be increased excessively and become too heavy. The reason is that the distortionary effects would become larger, causing probably the overall net growth impact of taxation to become smaller or even negative. Thus, the government's tax policy (from which public productive investments are to be financed) needs to be carefully designed in order to avoid distortionary effects and burdens on the private sector.



Table A3: Summary statistics of variables

Variable	Obs.	Mean	Std. Dev.
<i>DEV</i> or <i>y</i>	270	2260.8110	2098.3930
TAX	270	20.1823	9.7718
PC	270	28.4084	10.8685
HC	270	0.6059	0.0927
EO	270	3.0154	4.2663
PO	270	2.2300E+08	4.0700E+08
AG	270	19.5911	8.6019
MI	270	6.0703	5.6283

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## NEGATIVE BRAND NAMES

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**Abstract:** *We hear more and more often that positive things make our life more beautiful and make us more optimistic. But is it really true? If until a few years ago, the products had usual names, now it is desired for them to have a catchy name that would remain in the memory of the target audience. In this research I have analysed the attitude that young people have towards energy drinks with negative brand names, the impact of these energy drinks on them and also the influence they have on the decisional act of purchase. Among secondary objectives was the establishment of the notoriety of energy drinks that have negative names in the case of young people. Another secondary objective consisted in the comparative analysis of the impact that energy drinks with negative names have on men and women. Also, for the determination of the attitude that young people have towards energy drinks with negative names, it was necessary to get one at the time the feelings, the conviction offered by these energizers and also the intent of buying them among young people.*

**Keywords:** *Brand names, Negative connotation, notoriety, attitude.*

**JEL Classification:** *M31, M37*

### 1. RESEARCH PREMISES

#### 1.1 Studies regarding the impact of negative brand names over consumption

Many ingenious methods are used for promoting energy drinks. One of these methods begins with choosing a negative brand name. Names like “Burn”, “Monster”, “Cocaine”, “Hell” are brands which people can't easily pass by (Duncan et al, 2011). The people are aware why the companies chose those names.

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They consider names like “Cocaine” are named after a drug to make the younger customers they're fashionable (Bunting et al, 2013).

Negative energy drink brand names, like “Burn” or “Hell”, are easily distinguishable from the other names, thus easier to remember. Also, the logos and colours of the product are more recognizable when associated with negative brand names rather than the neutral brand names. Negative energy drink brand names are less liked than the neutral ones, but this aspect is attenuated over time (Duncan et al, 2011).

People are quick to remember the negative brand names, being preferred for inciting brands, by confident people (Estes, 2011, p. 530). Regarding promotion of the product, the ways to highlight energy drinks through tempting brand names, challenging images and bright colours, increased their notoriety (Pennay and Lubman, 2011).

Such negative names, are found in aggressively marketed energy drinks targeting students, the company using the aggressiveness to promote their product (O'Brien et al, 2008). On the topic of brand perception, people first notice the negative ones, then the positive ones, and finally the neutral ones (Garcia et al, 2010).

Energy drinks no longer need promotions, friends influence potential consumers to buy and consume them. Alongside advertisement, there are other factors that led to the growth in consumption like: the price, the distribution, but also the name and image of the brand (Jones and Barrie, 2009). Consumers are looking for the brand rather than the taste regarding energy drinks. Therefore when they go shopping, the name of the brand is very important to them (Moore, 2009, p. 6).

## **1.2. Research proposal**

In this research we analyzed the attitude of the people of Iasi aged 18-25 years old, towards negative energy drink names, their impact over consumers and also the influence it has over the final decision regarding purchase.

The main objective: determining the attitude of persons from Iasi aged 18-25 years old, regarding negative brand names for energy drinks.

The secondary objectives:

A. Establishing the spontaneous notoriety of negatively named energy drinks in relation to consumers from Iasi aged 18 to 25 years old.

B. Establishing the assisted notoriety of negative brand names regarding Iasi consumers aged 18-25.

C. Determining the intensity of emotions of Iasi people aged 18-25, created by negative energy drink names.

D. Determining the intensity of beliefs the people in Iasi have, in regards to negative energy drink brand names.

E. Determining the intensity of the intention of purchase among the consumers of negative energy drink brand names of Iasi.

F. The comparative analysis of the impact the energy drinks with negative brand names have over men and women in Iasi.

Hypotheses:

H1: Brands with names that have negative connotations have a higher notoriety than that of other brands.

H2: There are differences between the negative connotation perceptions of an energy drink name, depending on the consumer.

H3: Advantages of energy drinks with negative brand names are perceived by consumers to be greater than that of other energy drinks.

Methodology

Methods: Focus group and inquiry.

Firstly I made an exploratory research through a focus group. Through it I wanted to determine which are the feelings consumers have over negatively named energy drinks, which are their most frequented clubs and also what time do they get in those clubs.

The instrument used to gather data throughout the inquiry was a questionnaire. Considering that the questions are structured, during the research we followed strictly the objectives proposed above.

The questionnaire was applied on a sample consisting of 150 middle aged people from Iasi between ages 18 and 25. We made this choice because most energy drink consumers from our country are situated in this age interval.

Research period: 4-27 of April 2013

Location of the inquiry: at the entrance of 3 great clubs of Iasi: Skin, Skye and Queen's Club, because they're places the teen frequently visit, energy drinks being often consumed with friends during the time spent there.

Survey type: In order to be as objective as possible, in choosing people for this research, we used the non-probabilistic sampling method. The chosen variable was the person's gender. Thus, the sampling was formed by 77 women and 73 men from Iasi aged 18-25 years old.

**Table 1 The number of men and women questioned, sorted by weeks and days**

Days	Week 1		Week 2		Week 3		Week 4	
Thursday	6	Men	7	Men	6	Men	5	Men
	6	Women	7	Women	6	Women	6	Women
Friday	6	Men	6	Men	6	Men	6	Men
	7	Women	6	Women	7	Women	6	Women
Saturday	7	Men	6	Men	6	Men	6	Men
	7	Women	7	Women	6	Women	6	Women

The sorting of the people whom were questioned during the four weeks: as can be seen in Table 1, during each Thursday, Friday and Saturday, for four weeks we obtained data from 5-7 men and 6-7 women.

In the table above, each club in front of which I worked, is represented by a colour: Red – Queen's Club, Light Grey – Skye, Dark Grey – Skin. Therefore the three clubs can be easily differentiated.

## 2. RESEARCH RESULTS

### 2.1 Focus group

The main objective of this focus group was to determine aspects regarding the place of consumption of the energy drinks, the time that the teens arrive at the club, emotions associated with negative energy drink brand names, but also the reasons why teens purchase energy drinks, in Iasi, in order to create a precise questionnaire and to apply it in the most appropriate places.

Size: 8 participants

Composition: 4 women and 4 men aged 18 to 25, from Iasi, energy drink consumers that frequent the clubs and can speak English at least on an average level.

As consequence of this focus group it turned out that: most of the teens consume energy drinks in clubs. They have three clubs in Iasi they often frequent: Skin, Skye and Queen's Club, and most arrive at the club around 23.30. Among the motives they consume energy drinks are: the energy, the adrenaline, the power and focus. The negative names like "Burn", "Hell" and "Monster" inspire curiosity and fear, and they consider the most negative one to be "Hell". From the energy drinks "Power Horse", "Red Bull" and "Rienergy" the most positively named is "Rienergy".

## 2.2. Inquiry results

Objective: Establishing the spontaneous notoriety of negative energy drink brand names as seen by teens aged 18-25 from Iasi.

Question 4: Name three energy drinks:

Out of all 150 respondents, 147 named negative brand name "Burn", 94 named "Red Bull", and third place was held by "Hell" with a score of 87 respondents. The negatively named "Monster" was picked by 61 people and "Rienergy" was mentioned by only 50 persons. The least picked energy drinks were "Gatorade" and "Power Horse" with 6 respectively 5 votes.

Hypothesis H1: Brands with negative connotation have a higher notoriety than other brands.

We can see that out of the 7 mentioned types of energy drinks, the negative brand names: Burn, Hell and Monster took the first four places. Considering this aspect we can say that the brands with negative connotations have a higher spontaneous notoriety than the other brands. Therefore the hypothesis is proven true.

Objective: Establishing the assisted notoriety of the brands with negative connotations regarding people of Iasi aged 18 to 25.

Question 5: Which of the following energy drinks have you heard of?

Interpretation: All the respondents have heard of Burn and Red Bull and 139 of the respondents have heard of Hell. Only 137 out of 150 have heard of Rienergy and only 136 people have heard of Monster. On the last two spots are Power Horse and Gatorade with only 82, respectively 81 votes.

Hypothesis H1: Brands with negative connotations are more notorious than other brands.

We can see that out of the 7 types of energy drinks people have heard of, Burn took first place with 150 votes, Hell took third place with 139 votes and Monster was on the fifth place, missing only one point to take the fourth place occupied by Rienergy. Therefore energy drinks with negative connotations have a higher assisted notoriety than that of other brands, so the hypothesis is true.

Objective: Determining the intensity of emotions of teens in Iasi aged 18 to 25, created by negative energy drink brand names.

Question 6: Do you consider that the translations of the names of the following energy drinks have a predominantly negative or positive sense?

Interpretation: As for the translation of the word "Burn", of the 150 respondents, 147, representing 98%, translated "Burn" – "Arde", and 3 of them (2%), and translated "Burn" – "Foc". The names "Hell" and "Monster" were translated by all respondents as "Iad" and "Monstru" respectively.

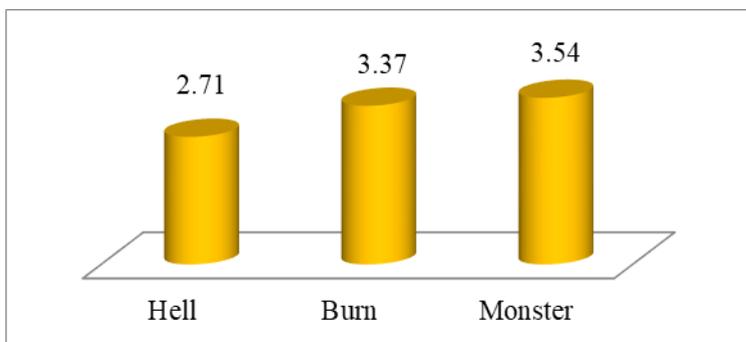


Fig. 1 The average values of connotations of the names of energy drinks

According to the average values, it appears that between the three energy drinks with negative brand names, the most negative meaning is held by "Hell", having an average of 2.71. Second is the name of the Burn, with an average of 3.37, and very close to it is "Monster" with the average of 3.54, the latter being considered the least negative.

Testing the H2 Hypothesis: There are differences between the perceptions of the negative connotation of the name of energy drinks according to the type of consumer.

In order to see whether there are significant differences between the perception of negative connotations of the names of energizing beverages on women and men, we applied several tests and we noticed that there are no significant differences between the average of the women's grades and the average

of the marks given by men for none from the meanings of Burn, Hell and Monster. Hence the H2 hypothesis is false.

The following results are based on:

Objective 1: Determining the intensity of emotions of young people from Iași aged 18-25 years created by energy drinks with negative brand names.

Objective 2: Determining the intensity of beliefs that young people from Iași aged 18-25 years have about energy drinks with negative brand names.

Objective 3: Determining the intensity of the intention to buy energy drinks that have negative brand names among young people from Iași aged 18-25 years.

**Table I2 Average values of the attitude**

<b>Atribute</b>	<b>Mean</b>	<b>Rank</b>
Have a negative meaning/ Have a positive meaning	2.93	2
Inspire fear/ Don't inspire fear	2.93	2
Offer a pleasant experience/ Offer a rather unpleasant experience	3.97	7
Offer more energy/ Offer less energy	2.99	4
Are consumed by the fashionable/ Aren't consumed by the fashionable	2.96	3
Make you curious/ Don't make you curious	2.80	1
Make you wish to buy them/ Don't make you wish to buy them	3.67	5
Make you intend to buy them/ Don't make you intend to buy them	3.70	6

Specification: The scale used is the same type in all cases, being an interval scale (semantic differential) with values between 1 and 7.

As a result of the average values above, energy drinks with negative names make young people more curious, have a more negative meaning than others and inspire fear. They are consumed by those who are trendy, giving them more energy than other energy drinks, making young people want to buy them, then intend to buy them, and lastly give them a more pleasant feeling than the other energizers.

We wanted to determine which of the names Burn, Hell and Monster influence the average of the connotations of the names of energy drinks with negative names taken together. We made a multiple linear regression based on the variables of the three connotations of the Burn, Hell and Monster names, which

account for 16.2% of the variation in average connotations for all three names taken together. The pattern is significant.

$$F(3,146)=9.414, p=0.000$$

The average connotation of Burn does not contribute significantly,  $p = 0.286$ . I have made a new analysis by removing this coefficient from the model.

We used the multiple linear regression model based on the variables of the two averages corresponding to the connotations of the Hell and Monster names, which account for 15.6% of the variation in the average connotations for all the names taken together. The pattern is significant.

$$F(2,147)=13.535, p=0.000. \text{ Both coefficients contribute significantly.}$$

The regression equation:

$$\text{Positive meaning/Negative meaning} = 1.701 + 0.185 * \text{meaning of Hell} + 0.206 * \text{meaning of Monster} \quad (1)$$

Most contributes the meaning of Monster, with the highest standard Beta coefficient equal to 0.286.

We grouped the categories in Table 3 according to the three dimensions of attitude (affective, cognitive and intentional):

**Table 3 Attitude dimensions**

<b>Affective Dimension</b>	<b>Cognitive Dimension</b>	<b>Intentional Dimension</b>
Negative meaning/ Positive meaning	Offer more energy/ Offer less energy	Make you curious / Don't make you curious
Inspire fear/ Don't inspire fear	Are consumed by the fashionable/ Aren't consumed by the fashionable	Make you wish to buy them/ Don't make you wish to buy them
Offer a pleasant experience/ Offer a rather unpleasant experience		Make you want to buy them/ Don't make you want to buy them

For the three dimensions above, we calculated an average response value, the results being as follows:

**Table 4 Average values obtained on each dimension of the attitude**

<b>Attitude dimension</b>	<b>Mean</b>
Affective Dimension	3.27
Cognitive Dimension	2.97
Intentional Dimension	3.39

According to Table 4 above, the cognitive component with the lowest average prevails, followed by the affective dimension with an average of 3.27 and then the intentional dimension with an average of 3.39.

Testing the H2 Hypothesis: There are differences between the perceptions of the negative connotation of the name of energy drinks according to the type of consumer.

In order to see whether there are significant differences between the perception of the negative connotations of the names of energizing beverages on women and men, we applied several tests t and I noticed that out of all eight cases, only in the case of "energy drinks with negative names inspire fear / don't inspire by fear " the average of women's marks ( $M = 2.26$ , Std Deviation = 1.257) differs significantly from the average of the men's scores ( $M = 3.26$ , Std Deviation = 1.642) T (df = 134.819) ,  $p = 0.009$ , for all other components hypothesis being false.

Objective: Comparative analysis of the impact of energy drinks with negative names on men and women in Iasi between the ages of 18-25 years.

Question 16: On a scale of 1 to 5 (1 – the smallest, 5 – the largest) how much does the name of the energy drink "Hell" make you think of: "Adrenaline", "Power"?

The name of the "Hell" energy drink brings the adrenaline to young people, given the average of 3.61 grades, of which the average of the women's scores was 3.78 and the average of the men's scores was 3.44.

On the other hand, the energy drink "Hell" makes young people think of power, with an average of grades of 3.86, of which the average of the women's marks was 3.66 and the average of the men's grades of 4.07.

Testing the H2 Hypothesis: There are differences between the perceptions of the negative connotation of the names of energy drinks depending on the type of consumer.

The results of the t tests show that:

The average of women's grades for the fact that the Hell name causes them to think about adrenaline ( $M = 3.78$ , Std Deviation = 0.968) does not differ significantly from the average of men's scores ( $M = 3.78$ , Std Deviation = 1.155).  $t$  (df = 140.745) = 1.954,  $p = 0.053$ . Therefore, the H2 hypothesis in this case is false.

The average of women's ratings for the fact that the Hell name makes them think power ( $M = 3.66$ , Std Deviation = 1.083) differs significantly from the average of men's scores ( $M = 4.07$ , Std Deviation = 1.058).  $t$  (df = 148) = -2.321,  $p = 0.022$ . Therefore, in this case, the H2 hypothesis is true.

Question 17: On a scale of 1 to 5 (1 – the smallest, 5 – the largest) how much does the name of the energy drink "Rienergy" makes you think about: "Adrenaline", "Power"?

The average of young people's grades regarding the Rienergy drink name's correlation with "adrenaline" is 2.44, of which the average of the women's mark is 2.60 and the average of the men's scores is 2.27.

On the other hand, the average of the young people's mark for the Rienergy drink's relation to "power" is about 2.54, of which the average of the women's marks is 2.31 and the average of the men's scores is 2.78.

Testing the H3 Hypothesis: The benefits of energy drinks that have brand names with a negative connotation are perceived by young people as being greater than the benefits of other energy drinks.

It can be seen that the averages for the Hell beverages (3.61 and 3.86) are higher than the average scores for Rienergy (2.44 and 2.54).

To see if these averages differ significantly we applied a Paired Samples T-Test. Thus, the average of the marks given by young people for the fact that the Hell drink leads them to adrenaline ( $M = 3.61$ , Std. Deviation 1.073) differs significantly from the average of the marks given by the young people that the Rienergy energizing drink leads them to adrenaline ( $M = 2.44$ , Std Deviation = 1.033). Therefore, the H3 hypothesis is true.

Also, the average of young people marks for the fact that the Hell drink leads them to power ( $M = 3.86$ , Std. Deviation 1.087) differs significantly from the average of young people's grades for the fact that the Rienergy energy drink leads them to power ( $M = 2.54$ , Std Deviation = 1.121). Therefore, the H3 hypothesis is true.

Question 19: What impact do the following brands of energy drink have on you? Bad Dog, Bomb, Crazy Horse, Dark Dog, Mad Bat, Mad Croc, Red Devil, Shark (" - 5" the most negative impact, "5" the most positive impact)

Interpretation: The most negative impact on young people is had by Red Devil, having an average of -3.69, and the least negative impact is had by the Bad Dog Energizer with an average of -0.01.

Testing the H2 Hypothesis: There are differences between the perceptions of the negative connotation of the name of energy drinks according to the type of consumer.

In order to see if there is any significant difference between the impact of the names of energy drinks on women and men, I have applied several tests and I noticed that the names of the energy drinks Bad Dog, Bomb, Crazy Horse and Red Devil impact on women differs significantly from the impact on males, and therefore H2 hypothesis is true in these cases.

On the other hand, the names of Dark Dog, Mad Bat, Mad Croc and Shark energies have an impact on women that does not differ significantly from their impact on men, and thus H2 hypothesis is false.

### 3. CONCLUSION

Following the results presented above, it has emerged that the energy drinks are known to young people. As far as spontaneous notoriety is concerned, when young people were asked by the names of three energizers they know, almost everyone answered Burn, followed by Red Bull and then by Hell and Monster. It results that of all seven mentioned energizers, those with negative names ranked first, respectively three and four.

Another objective was to find out the assisted notoriety of the energizers. So all young people have heard about Burn and Red Bull. Hell ranked second, and Monster in the fourth place. Concerning the connotations of the names of these energizers, those who translated the word Burn-"Foc" believe it has a more negative meaning than those who translated the word Burn-"Arde". Of all three negative energy drinks, young people think the most negative name is Hell, followed by Burn and then by Monster. Also here we found out that for women these names have a more negative meaning than men, but even so there are no significant differences.

As far as young people's attitude towards negative energy drinks is concerned, we have learned that they make young people more curious, have a more negative sense than others and inspire fear. They are consumed by those who are trendy, giving them more energy than other energizers, making young people wish to buy them, then intend to buy them, and lastly give them a more pleasant feeling. Of all these, the cognitive component predominates, followed by the affective dimension and then by the intentional dimension. Young people think that the most important is the energy these types of drinks offer, and the least important for them is to make them intend to buy them.

If Hell's offered adrenaline did not differ greatly between women and men's grades, in the case of Hell's power, men, unlike women, think it gives much greater power.

The advantages of energy drinks that have brand names with negative connotations are perceived by young people as being higher than the benefits of the other energy drinks because the average score of Hell energy drink are higher than the average score of Rienergy.

Women have the highest expectations of the energy drink called Bomb, and their lowest expectations are for the Red Devil energizer. On the other hand, men have the highest expectations of the energy drink called the Red Devil, while the smallest expectations come from the energizer named Bad Dog.

With regard to the impact of energy drinks that have negative brand names, the most negative impact on young people is had by the Red Devil energizer, and the most positive impact is had by the Bad Dog Energizer. The names of Bad Dog, Bomb, Crazy Horse and Red Devil drinks have an impact on women that differs significantly from the impact on men. On the other hand, the names of Dark Dog, Mad Bat, Mad Croc and Shark energizers have an impact on women that does not differ significantly from the impact they have on men.

Consequently, energy drinks with negative names are much more known to young people than other brands given their high reputation, and women perceive differently the connotations of names as opposed to men, even though there are no significant differences between consumer genders in all cases. In conclusion, energy drinks with negative names make young people more curious, thinking they have a more negative sense than others, while at the same time they inspire fear and are consumed by those who are fashionable.

### 3.1. Research limitations

As far as research is concerned, we have had some limitations.

Firstly, one of the research's limitations was that the questionnaire responders were not only consumers of energy drinks that have brand names with a negative connotation, but consumers of positively named drinks as well.

Another limitation was given by the fact that data collection took place in the evening in front of the clubs, because of this the refusal rate was high and a large number of those who agreed to respond to the questionnaire were in a hurry.

### 3.2. Managerial implications

This paper aimed to answer several questions. Is a negative connotation of the name of a brand a break or an accelerator for the buying decision? A negative brand name implies a negative perception towards that brand? For energy drinks is the negative meaning of the name a bad thing? Are teenagers rejecting brands with negative valence of the name?

Our findings showed that, at least for youngsters, shocking is good. A negative brand name can be an incentive to give it a try. Their attitude is rather positive, than negative due to that name. They notice easily these unusual words, because they are not so common and they speak about them. The worst connotation has the name "Hell", maybe because it reaches something related to their values and beliefs. But, nevertheless, that profoundly negative meaning is not stopping them to consume and to promote their consumption.

As a final conclusion we can say that a negative brand name is not affecting in a bad way the attitude and the perception. The intention to buy, especially for teenagers, can be supported by a negative connotation of the name of the brand. This research was conducted for energy drinks, but negative valence for the brand names can be observed for many other products. In the battle between marketing stimuli, a negative brand name becomes a voice to be heard. And maybe this is the ultimate purpose of the Marketing: to gain a place in the consumer's mind!

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## BIG DATA PROPRIETARY PLATFORMS. THE CASE OF ORACLE EXADATA

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**Abstract:** *The most prominent Big Data solutions – such as NoSQL systems, Hadoop Frameworks, Spark, etc. – have been open-sourced. Nevertheless, commercial providers have targeted niches of this huge market with products more or less viable and affordable. This paper addresses the problem of benchmarking Big Data platforms with a focus on Oracle Exadata solution provided by one the most important data technologies vendor. Many classical benchmark approaches, such as TPC-H, are based on a predefined set of queries, and consequently they are not prone to predictive modeling. By contrast, for the TPC-H benchmark schema, we generate a set of 500 random queries containing not only tuple filters (WHERE), but also tuple grouping (GROUP BY) and group filters (HAVING), we collected results of the queries execution on four Oracle Exadata settings. Query duration was the outcome variable. Various query parameters, such as the number of joins, the number of attributes of different types within SELECT and WHERE clauses, and also some environment metrics served as predictors. Results were interpreted using exploratory data analysis and also Multivariate Adaptive Regression Splines (MARS) for both predicting the performance and explaining the main drivers of the system performance.*

**Keywords:** Big Data, Oracle Exadata, TPC-H, MARS, R, earth package.

**JEL Classification:** C39, C88, M15

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### 1. INTRODUCTION

Big Data technologies have been targeting the storage, processing and analysis of the data deluge continuously generated by the current information technologies in a large variety of formats (Fotache and Hrubaru, 2016a). As they

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are affordable to large categories of companies and organizations, Big Data open-sourced solutions have gathered the main interest – NoSQL Systems, Hadoop ecosystems, Spark, etc. (Fotache and Hrubaru, 2016b).

By contrast, in this paper we start exploring the data processing performance of a proprietary Big Data persistence/processing solution – Oracle Exadata – provided by one the leading data technologies vendor. The main objective of the paper is to provide a preliminary predictive model for assessing the performance of the Oracle Exadata Big Data System on various settings and data processing requirements. This could be extended to a broader category of Big Data systems and might prove very useful for various companies in choosing and tuning the database systems according to their data needs and available resources.

Compared to mainstream approaches for Big Data systems benchmarking, this paper main contributions are:

- replace the given set of data processing queries with a much larger set of randomly generated queries covering a broad range of data processing tasks;
- applying Multivariate Adaptive Regression Splines for dealing with the non-linearity and building of a predictive model.

In section II, Oracle Exadata architecture is briefly examined. In section III the experimental designed is described for building a model targeting the explanation and prediction of Exadata performance for query processing on four scenarios/settings. A brief exposure to Multivariate Adaptive Regression Splines (MARS) is provided, since this is the method the model is based upon. In Section IV after examining the distribution of initial predictors and the outcome, in order to avoid further collinearity problems, some predictors will be removed from the model. Then two MARS models will be proposed for explaining and predicting the data query performance in four Exadata settings. Section V will interpret the model results and Section VI will focus on some of the study limits and further research directions.

## 2. ORACLE EXADATA ARCHITECTURE

Oracle Exadata machine is a preconfigured combination of hardware and software which provides a highly resilient and highly optimized platform for running one or more Oracle databases. The entire system is divided in two layers: the *database nodes* which are usually clustered in a RAC configuration and the *cell*

*nodes* which act as an intelligent and transparent storage provider for the database layer. Both layers are linked together using low latency Infiniband switches.

The “secret sauce” of the Exadata machine relies in its offloading capabilities (Farooq et al., 2015, p. 61). In an Exadata configuration the storage layer plays an active role, filtering the data according to the executed queries and pushing back the data already filtered. This saves IO/network bandwidth, but also CPU cycles on database nodes.

The most important Exadata offloading technics are:

- *Column projection*: Through column projection, Exadata cells send back to the database layer just the values from the relevant columns (Greenwald, et al., 2011, p. 91). These are the attributes in the SELECT list and the columns appearing in JOIN predicates. The big gain in performance comes from minimizing IO traffic. In a standard Oracle configuration the blocks having all the columns are read and only after that the columns which are not needed are discarded. That is not true anymore in Exadata, of course, provided that a smart scan can take place for the executed query.

- *Predicate filtering*: This technique is applied when the query has WHERE predicates. As soon as the query reaches the Exadata cells, the filtering is attempted on this layer and only the relevant rows are returned to the database server. Of course, the query must be eligible to be run in a “smart scan” context.

- *Storage indexes*: These storage indexes are created on the fly and speed up the predicate filtering even further. Unlike database indexes, they are in-memory structures and they reside only on the storage layer (Clarke, 2013, p. 553). A storage index keeps track of the value of a limited number of columns, on a one megabyte block basis. For every 1MB block, a minimum and a maximum value for a column inside that block is maintained so that, when a predicate filtering takes place, only the “interesting” blocks are read. This technique saves IO operations right into the storage layer.

### 3. METHODOLOGY AND TOOLS

The basic idea of this experimental design was to randomly generate a large number and variety of SQL queries that would be executed on different data scales (database size) and settings. Through various data analysis techniques, it was

expected that we might get a model for explaining and predicting Oracle Exadata performance for data processing related tasks.

### 3.1 DESIGN

The random queries to be executed on various subschema of TPC-H (TPC, 2014) database were generated by a module written in R programming language (Fotache and Hrubaru, 2016b). Each subschema was created and populated using DBGen utility (Kejser, 2014) for scale factors (data loading) of 1, 2, 10 – see table 1 – and have distinct, randomly generated records.

*Table no. 1 – Number of records for each table and scale factor*

Table in TPC-H schema	SF = 1	SF = 2	SF = 10
REGION	5	5	5
NATION	25	25	25
CUSTOMER	150,000	300,000	1,500,000
SUPPLIER	10,000	20,000	100,000
PART	200,000	400,000	2,000,000
PARTSUPP	800,000	1,600,000	8,000,000
ORDERS	1,500,000	3,000,000	15,000,000
LINEITEM	6,001,215	11,997,996	59,986,052

Initially, 500 queries were generated for each scale factor. Since the access time to Oracle Exadata was limited, the execution of longer queries was cancelled. For the next sections analysis 424 queries were kept for scale factor of 1, 415 queries for the scale factor of 2 and 358 for the scale factor of 10.

For every scale factor, each query was executed (and the duration collected) for six scenarios/settings:

- *Serial, without declaring the table primary keys*: the idea for this scenario was to maximize the chances for Exadata to use the “smart scan” access by favouring full table scans. The queries have been run on one Exadata node, without any parallelism on the query level.
- *Serial, with primary keys declaration*: for every table in the TPC-H schema the primary key constraint was enforced and all queries have been executed on one node, without any parallelism on the query level.
- *Parallel on one node, without declaring the table primary keys*: all queries were run on one node only, but, unlike the serial scenario, parallelism on the query level has been enabled. We have limited the degree of

parallelism to 8 processes, distributed on one node only. There is no guarantee that all queries were eligible for being executed in parallel, therefore was up to the Oracle optimizer to decide the execution plan.

- *Parallel on one node, with primary keys declaration*: this scenario is very similar with the previous one, but primary key constraints were enforced for all TPC-H tables. The same degree of 8 parallel processes was used.
- *Parallel on two nodes, without declaring the table primary keys*: the same degree of 8 parallel processes was used, but they were distributed on both nodes. No primary key constraint was enforced for this scenario.
- *Parallel on two nodes, with primary keys declaration*: the same scenario as the above one, but with all primary keys for all TPC-H tables enforced.

As Big Data processing usually refers to systems that store and process huge amount of data that do not fit on a single machine, the *serial* scenarios (first two) were used only as reference for the exploratory data analysis. MARS models were built based only on the *parallel* settings.

### 3.2 VARIABLES

The output (result) variable was *duration* which represents the time required for completion of each query. As table 2 shows, predictors referred mainly to the database size (from *scale\_factor* to *med\_n\_of\_rows*), result size (*result\_nrows*), and the main clauses of a query: SELECT (from *sel\_n\_of\_table* to *sel\_length\_vchar*), FROM (*n\_of\_joins*, ..., *fr\_n\_of\_int*), WHERE (*wh\_n\_of\_tables*, ..., *wh\_n\_of\_in\_values*), GROUP BY (*gr\_n\_of\_attributes* and *gr\_n\_of\_tables*), HAVING (*having\_length*) and ORDER BY (*order\_by\_length*).

Table no. 2 – Variable List

Variable Name	Name in MARS models	Details
duration	duration	Outcome variable. Time needed for completing (execution) a query
scale_factor	scale	Database scale factor (1, 2, and 10)
min_n_of_rows	min_rows	The minimum number of rows for tables appearing in the FROM clause
max_n_of_rows	max_rows	The maximum number of rows for tables appearing in the FROM clause
avg_n_of_rows		The average number of rows for tables appearing in the FROM clause
med_n_of_rows		The median number of rows for tables appearing in the FROM clause

result_nrows	res_rows	Number of rows in the query result
sel_n_of_tables		Number of tables in the SELECT clause

Table no. 2 (continued)

Variable Name	MARS abbrev.	Details
sel_n_of_distinct_tables	se_n_tab	Number of distinct tables in the SELECT clause (in some cases it is different from <i>sel_n_of_tables</i> because of the self-joins)
sel_n_of_attributes	se_n_attr	Number of attributes in the SELECT clause
sel_n_of_distinct_attributes		Number of distinct attributes in the SELECT clause
sel_n_of_char	se_n_char	Number of attributes of type CHAR appearing in the SELECT clause
sel_n_of_date	se_n_date	Number of attributes of type DATE appearing in the SELECT clause
sel_n_of_int	se_n_int	Number of attributes of type INTEGER appearing in the SELECT clause
sel_n_of_num	se_n_num	Number of attributes of type NUMERIC (real) appearing in the SELECT clause
sel_n_of_vchar	se_n_vchar	Number of attributes of type VARCHAR appearing in the SELECT clause
sel_length_char		Total length of the attributes of type CHAR appearing in the SELECT clause
sel_length_vchar		Total length of the attributes of type VARCHAR appearing in the SELECT clause
n_of_joins	n_joins	Number of joins
fr_n_of_tables		Number of tables in the FROM clause
fr_n_of_distinct_tables		Number of distinct tables in the FROM clause (in some cases it is different from <i>fr_n_of_tables</i> because of the self-joins)
fr_n_of_attributes		Number of attributes in the FROM clause
fr_n_of_distinct_attributes		Number of distinct attributes in the FROM clause
fr_n_of_int		Number of attributes of type INTEGER in the FROM clause (used in joins)
wh_n_of_tables	wh_n_tab	Number of tables in the WHERE clause
wh_n_of_distinct_tables		Number of distinct tables in the WHERE clause (in some cases it is different from <i>wh_n_of_tables</i> because of the self-joins)
wh_n_of_attributes		Number of attributes appearing in the WHERE clause
wh_n_of_distinct_attributes		Number of distinct attributes appearing in the WHERE clause
wh_n_of_char	wh_n_char	Number of attributes of type CHAR appearing in the WHERE clause
wh_n_of_date	wh_n_date	Number of attributes of type DATE appearing in the WHERE clause
wh_n_of_int	wh_n_int	Number of attributes of type INTEGER appearing in the WHERE clause
wh_n_of_num	wh_n_num	Number of attributes of type NUMERIC (real) appearing in the WHERE clause
wh_n_of_vchar	wh_vchar	Number of attributes of type VARCHAR appearing in the WHERE clause
wh_length_char		Total length of the attributes of type CHAR appearing in the WHERE clause
wh_length_vchar		Total length of the attributes of type VARCHAR appearing in the WHERE clause

Table no. 2 (continued)

Variable Name	MARS abbrev.	Details
wh_n_of_oper_between	wh_between	Number of BETWEEN operators appearing in the WHERE clause
wh_n_of_oper_comparison	wh_compar	Number of comparison operators (>, >=, etc.) appearing in the WHERE clause
wh_n_of_oper_in	wh_n_in	Number of IN operators appearing in the WHERE clause
wh_n_of_in_values	wh_in_val	Total number of values appearing as arguments of IN operators in the WHERE clause
gr_n_of_attributes	gr_n_attr	Number of attributes in the GROUP BY clause
gr_n_of_tables		Number of tables in the GROUP BY clause
having_length	ha_len	Number of characters in the HAVING clause
n_attr_order_by	ob_n_attr	Number of tables in the ORDER BY clause
order_by_length		Number of characters in the ORDER BY clause
pk_use	pk_use	Whether primary key constraint was enabled: 0 = no PK; 1 = with PK
n_of_nodes	nodes	Number of Exadata database nodes used to run the queries

Shorter names were necessary for the variables used in multi-variate adaptive splines models for displaying purposes. Otherwise, the analysis software (see next subsection) would replace longer names with (sometimes) cryptic abbreviations.

### 3.3 TECHNICAL PLATFORMS

For this experimental study, the database schema were deployed on an Oracle Exadata X2-2 quarter rack (Oracle, 2012), running an Oracle 11.2.0.4 Server, Enterprise Edition. This configuration has two database nodes and three cell/storage nodes as shown in the table 3.

Table no. 3 – Technical Platform

2 x Database Servers	2 x Six-Core Intel® Xeon® X5675 Processors (3.06 GHz), 96 GB Memory
Infiniband switches	2 x 36 port QDR (40 Gb/sec)
3 x Exadata Storage Servers	12 x 600 GB 15,000 RPM High Performance, SAS disks

Data analysis was performed with R (R Core Team, 2017) and RStudio (<https://www.rstudio.com>) platforms. For data processing the main R packages were: *dplyr* and *tidyr* (Wickham, 2017b) and also *stringr* (Wickham, 2017a). For data analysis, the most important packages were: *ggplot2* (Wickham, 2016), *e1071* (Meyer et al., 2017) *corrplot* (Wei and Simko, 2016), *earth* (Milborrow, 2017a) and *plotmo* (Milborrow, 2017b).

### 3.4 METHOD. MULTIVARIATE ADAPTIVE REGRESSION SPLINES

The Multivariate Adaptive Regression Splines (MARS) method is a technique of regression analysis which was introduced in 1991 by J. H. Friedman (Friedman, 1991). It is a multivariate non-parametric (and nonlinear) flexible recursive partitioning regression modeling of high dimensional data and can be seen as an extension of linear models that automatically models non-linearity and interactions between variables (Hastie et al., 2008).

MARS is an adaptive procedure for regression, well suited for high dimensional problems and it can be viewed as a generalization of stepwise linear regression or as a modification of the classification and regression tree (CART) method, to improve the latter's performance in regression setting.

The goal is to model the dependence of a response variable  $Y$  (output data) on one or more predictor variables (input data)  $X_1, X_2, \dots, X_n$  given realization data:  $\{y_i, x_{1i}, x_{2i}, \dots, x_{ni}\}_{i=1, \overline{N}}$ . The system that generated the data is presumed to be described by:

$$(1) \quad Y = f(X_1, X_2, \dots, X_n) + \varepsilon, \quad (\forall) X = (X_1, X_2, \dots, X_n) \in D \subset \mathbb{R}^n$$

where the stochastic component  $\varepsilon$ , whose expected value is defined to be zero, usually reflects the dependents of  $Y$  on quantities (other than  $X_1, X_2, \dots, X_n$ ) that are neither controlled nor observed. The aim of MARS, as the aim of regression analysis, is to use the known data to construct a function  $\hat{Y} = \hat{f}(X_1, X_2, \dots, X_n)$  that can serve as a "reasonable" approximation to  $Y = f(X_1, X_2, \dots, X_n)$  over the domain  $D$  of interest.

The MARS build models as a weighted sum of basis function of the form:

$$(2) \quad \hat{Y} = \hat{f}(X_1, X_2, \dots, X_n) = a_0 + \sum_{m=1}^M a_m B_m(X_1, X_2, \dots, X_n)$$

where:  $a_0$  and  $a_m, i = 1, \overline{M}$  are the estimated constant coefficients to yield the best fit of data,  $M$  is the number of spline basis functions included into the model and  $B(X) \equiv B_m(X_1, X_2, \dots, X_n), m = 1, \overline{M}$  are the spline basis functions that span the space of  $q$ -th order spline approximation.

Each multivariate spline basis functions  $B_m(X_1, X_2, \dots, X_n)$  takes one of the following three forms:

- a) a **constant function** equal with 1;
- b) a **hinge function** of the form:

$$\max(0, x-t) \equiv (x-t)_+ = \begin{cases} x-t & ; x > t \\ 0 & ; x \leq t \end{cases}$$

or

$$\max(0, t-x) \equiv (t-x)_+ = \begin{cases} t-x & ; x > t \\ 0 & ; x \leq t \end{cases}$$

where  $t$  is a constant, called *knot*. In the usual terminology (Hastie *et al.*, 2008), these are called *linear splines*. Those two hinge functions are a mirrored pair of functions or a *reflected pair*, and because a hinge function is zero for a part of its range, so can be used to partition the data into disjoint regions, each of them which can be treated independently;

- c) a **product of two or more hinge functions**. These basis functions can model the interaction between two or more variables. MARS has automatically produced a kink in the predicted  $\hat{Y}$  to take into account non-linearity.

Then, the spline basis functions  $B_m(X)$  take the general form:

$$(3) \quad B_m(X) \equiv B_m(X_1, X_2, \dots, X_n) = \prod_{k=1}^{K_m} [s_{km} \cdot (X_{v(k,m)} - t_{km})]_+ \equiv \prod_{k=1}^{K_m} h_k(X)$$

where  $K_m$  is the number of knots,  $s_{km}$  can be either +1 or -1 to indicate the right/left regions of the associated hinge function,  $v(k,m)$  is the label of explanatory predictor variable,  $t_{km}$  is the knot value (location) and  $h_k(X)$  are the *hinge functions* (linear splines).

The idea is to form reflected pairs of linear splines for each input variable  $X_j$  with knots at each observed value  $x_{ij}$  of the input variable. Therefore, the set of basis function is:

$$(4) \quad S = \left\{ \left( X_j - t \right)_+, \left( t - X_j \right)_+ \right\}_{t \in \{x_{1j}, x_{2j}, \dots, x_{Nj}\}}^{j \in \overline{1, n}}$$

where  $N$  it's a number of observations. If all the input values are distinct, there are  $2Nn$  spline basis functions altogether, and each basis function depends only a

single  $X_j$ , for example,  $B_m(X) \equiv B_m(X_1, X_2, \dots, X_n) = (X_j - t)_+$  it is considered as a function over the entire (input) space  $R^n$ .

The model-building method is like a forward stepwise linear regression, but instead using the original inputs, will be use spline linear functions from set  $S$  and their products. The input variables to be used and the knot values (locations) of the intervals for each explanatory variable are determined via an optimized search procedure. Given a choice for  $B_m$  from  $S$ , the coefficients  $a_m$  are estimated by minimizing the residual sum-of-squares, as in standard linear regression.

The optimal MARS model is developed through a two-steps forward/backward procedure. In the forward procedure, the construction of the basic functions  $B_m(X)$  will started with the constant function  $B_0(X) = 1$  and all basic functions in the set  $S$  are possible candidates functions. At each stage a pair of basis functions, which produces the largest decrease in the residual error is successively added into the current model. The process is continued until the model contains some preset maximum number of terms.

This model typically *overfits* the data, and so a backward deletion procedure is applied. The term whose removal causes the smallest increase in residual squared error is deleted from the model at each stage, producing an estimated best model  $\hat{f}_\lambda$  which contains  $\lambda$  number of terms. In the MARS procedure, for computational savings, generalized cross-validation (GCV) is uses instead cross-validation, to estimate the optimal value of  $\lambda$ . This criterion is defined as:

$$(5) \quad GCV(\lambda) = \frac{1}{N} \frac{\sum_{i=1}^N (y_i - \hat{f}_\lambda(x_i))^2}{(1 - M(\lambda)/N)^2}$$

where  $N$  is the number of observations,  $(1 - M(\lambda)/N)^2$  is the penalty measure of the model complexity. The value  $M(\lambda)$  is the effective numbers of parameters in the MARS model. Thus, if there are  $r$  linearly independent basis function in the model, and  $K$  knots were selected in the forward process, then the formula which give the value for  $M(\lambda)$  it is:

$$(6) \quad M(\lambda) = r + cK$$

where  $c = 2$  when the model is restricted to be additive, otherwise  $c = 3$ .

To facilitate interpretation, MARS allows evaluating the importance of explanatory variables on a scale of 0-100, and will be assessed by calculating the decrease in the calculated GCV values when the variable is removed from the model. The most important variable (with the highest decreases in the GCV) value score 100, all other variables receive lower scores, corresponding to the ratio of their decrease of GCV to that at the most important one (see section IV.4).

Another useful option in the MARS procedure is to set an upper limit on the order of interaction. For example, the EARTH algorithm (section IV.4) has preset a limit of second order interactions, allowing pairwise products of two piecewise linear functions (hinge functions), but not three- or higher-way products. Of course, setting the upper limit of 1 makes the model additive.

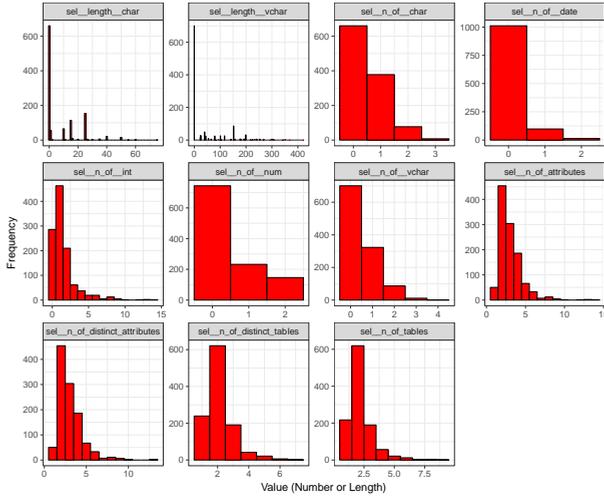
## 4. RESULTS

This section will present the distribution of main variables values and then the results gathered when executed the queries for scale factors of 1, 2 and 10. Correlations among predictors were examined. After removing some of the variables for avoiding collinearity troubles, two MARS models were built for both explaining and predicting the performance of four parallel Exadata settings/scenarios.

### 4.1 DISTRIBUTION OF PREDICTORS VALUES

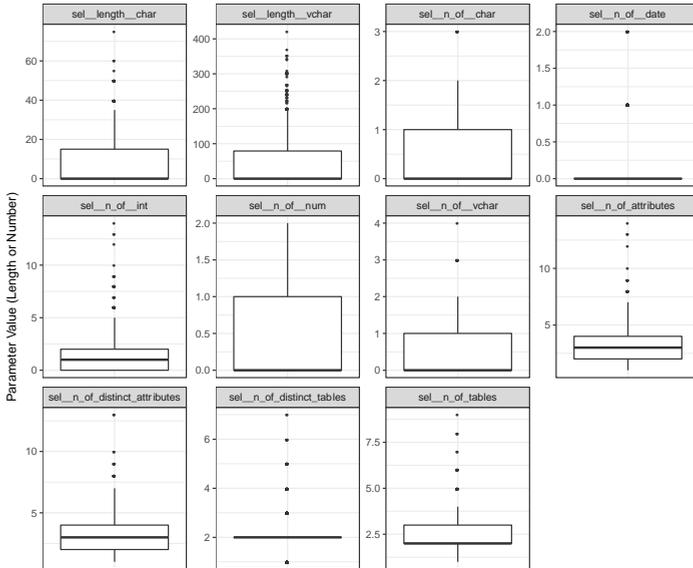
Predictors (see table 2) were examined by grouping them into clauses of SQL queries: SELECT, FROM, WHERE, GROUP BY, HAVING. Additional predictors refer to the volume of data processed by the query, and the configuration/scenario.

Figure 1 shows the distribution of the predictors associated with the SELECT clause. Since the variable measurement units were not homogeneous, for a proper display, each histogram in the figure has its own scale. All distributions are positively skewed. Figure 2 displays the same distributions but as boxplots. On average, the generated query had three attributes in the SELECT clause which were extracted from two tables. Variables *sel\_length\_char* (the total length of the CHAR attributes which occurred in SELECT clause) and *sel\_length\_vchar* (the same total for VCHAR attributes) had, naturally, the broader range, [0, 75] and [0, 421] respectively.



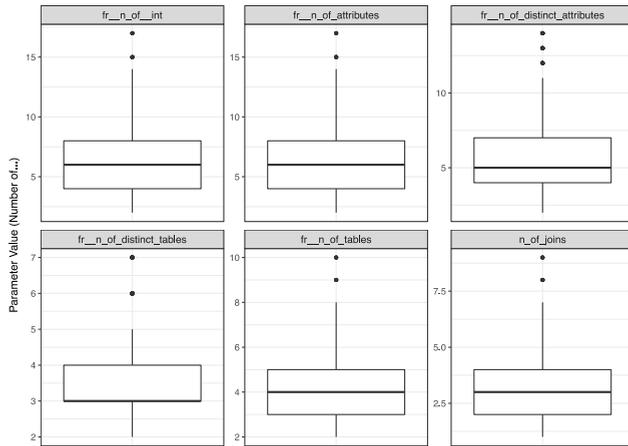
**Fig. 1** Number and Length of Main Attribute Types in the SELECT clause

By contrast, the narrowest ranges were recorded for variables *sel\_n\_of\_date* (number of attributes of type DATE occurring in the SELECT clause) and *sel\_n\_of\_num* (number of attributes of type REAL (numeric, non-integer)) – [0, 2].



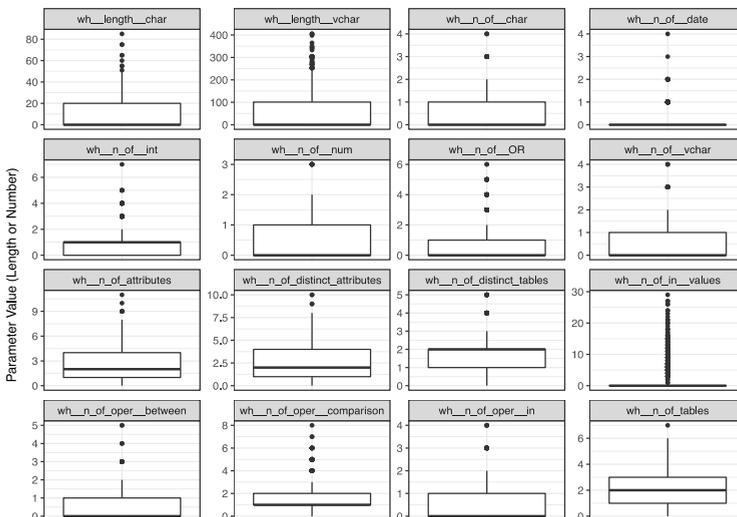
**Fig. 2** Number and Length of Main Attribute Types (char, varchar, date, integer, real) in the SELECT clause (as boxplot)

Predictors related to the FROM query have value distributions presented as boxplots in figure 3. Compared to the SELECT parameters, here distributions seem close to normality. On average, queries extracted data from four tables and needed three joins (apparently, because the longer queries were removed, self-joins did not occur with a significant frequency). Also, some predictor distributions in figure 3 is quite similar which suggest some collinearity issues (see section IV.2).



**Fig. 3 Main parameters of the FROM clause**

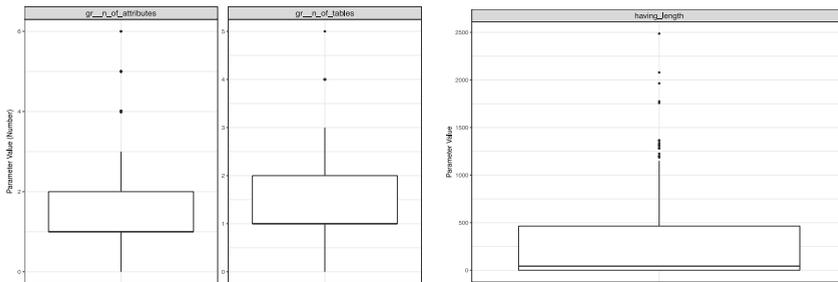
The group of predictors associated to various parameters of the WHERE clause was the most populated – see table 2 and figure 4.



**Fig. 4 Number and Length of Main Attribute Types in the WHERE clause**

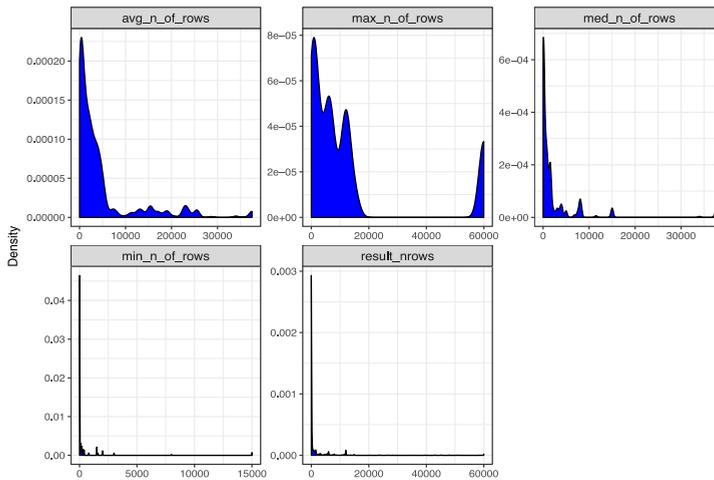
Apart from the number and the total length of attributes of different data types, and also the number of attributes and tables, some predictors referred to the number of OR operators (*wh\_n\_of\_OR*), number of comparison operators (*wh\_n\_of\_oper\_comparison*), and the usage of IN operator (both the number of INs – *wh\_n\_of\_oper\_in*, and the total of values appearing as arguments when using IN operator – *wh\_n\_of\_in\_values*). Some distributions were closer to normal (e.g. variables *wh\_n\_of\_tables*, *wh\_n\_of\_attributes*) and some others were very skewed (e.g. *wh\_length\_vchar*). On average, filters in the WHERE clause had 2.67 attributes extracted from 2 tables. Both operators BETWEEN and IN appeared in half of the queries. The largest number of values appearing as argument for an IN operator was 29.

Only three parameters were collected for both GROUP BY and HAVING clauses – see figure 5. Distribution of the number of attributes appearing in GROUP BY looks very similar to the distribution of the number of tables in GROUP BY.



**Fig. 5 Two parameters for the GROUP BY clause (left) and the length of the HAVING clause (right)**

On average GROUP BY clause contained 1.34 attributes extracted from 1.14 tables. The number of characters in the HAVING clause was, on average, 244.



**Fig. 6 Statistics About the Processed Rows and the Result Size**

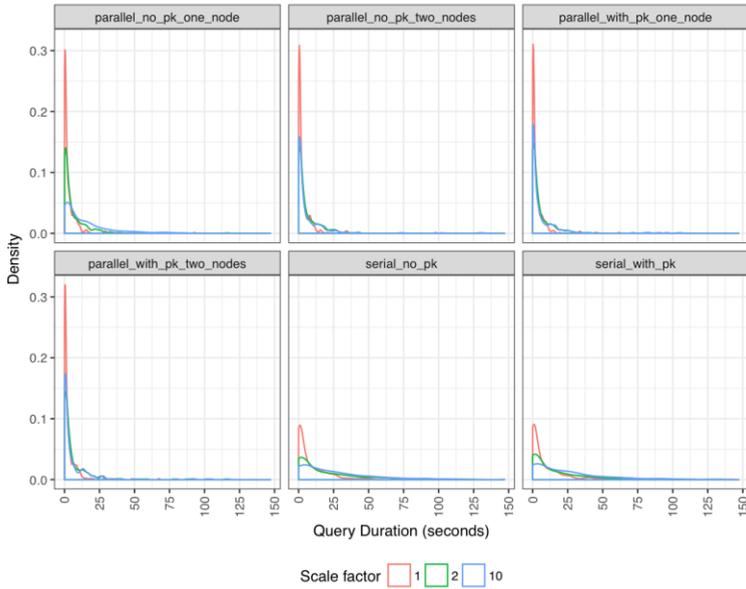
Figure 6 displays the distributions of parameters associated with the number of processed rows by the query and the size of the query result. The number of rows in the query result varied within  $[0, 589986]$  range, with an average of 4561 and median of 2231. The maximum number of rows for table appearing in a query was 59978 with a mean of 13424 and a median of 2231. Distributions seem very skewed, whereas the distribution for the maximum number of processed rows is bimodal.

## 4.2 OUTCOME (QUERY DURATION)

Because of the limited access to the product, all queries lasting more than 150 seconds were cancelled for all six scenarios/settings. The subsequent analysis covers the results of:

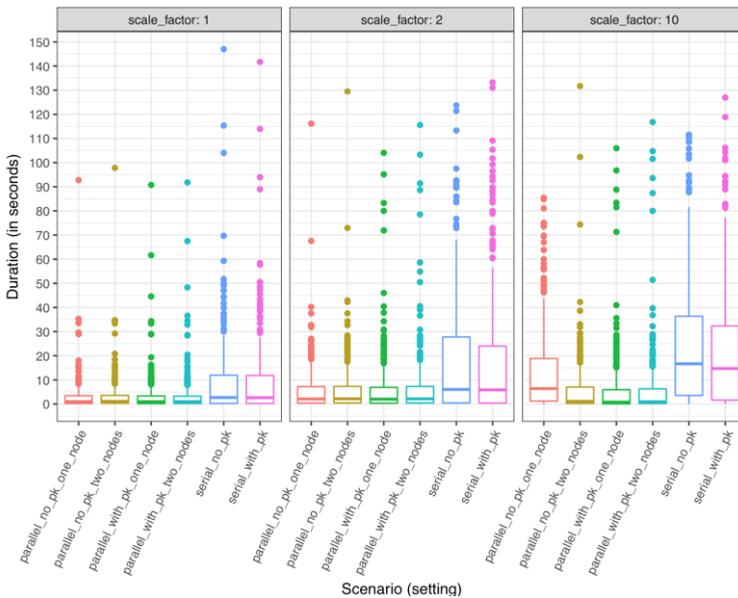
- 418 queries executed on the database of the scale factor (sf) = 1
- 343 queries for sf = 2
- 349 queries for sf = 10.

Overall, the outcome variable (*duration* in seconds) varied within  $[0.01, 147.01]$  range, with mean at 9.08 and median at 2.19. Figure 7 shows positively skewed distributions for all three database scale factors on the chosen six scenarios/settings. Overall skewness was 3.37 whereas the kurtosis was 13.89. Along the scale factors (1, 2 and 10), the outcome median was 1.24, 2.65, and 3,94 and the mean was consistently higher (4.98, 10.1, and 13.0). The skewness decreased from 5.74, to 3.18 and then 2.46 as well as the kurtosis: 49.0, 11.9, and 6.82.



**Fig. 7 Outcome distribution for each scale factors, by scenarios (settings)**

Figure 8 provides a more detailed picture of processing performance for all of the six settings. For all the three scale factors, the lowest median of duration was recorded for *parallel\_with\_pk\_one\_node* scenario (1.10) followed by the *parallel\_with\_pk\_two\_nodes* scenario (1.21) and *parallel\_no\_pk\_two\_nodes* (1.30). In terms of average duration, performance ranking was slightly different: *parallel\_no\_pk\_two\_nodes* (4.87), followed by *parallel\_with\_pk\_one\_node* scenario (4.95) and *parallel\_with\_pk\_two\_nodes* scenario (5.33). For the four parallel settings, results (distribution) were relatively similar for sf=1 and sf=2. But on the scale factor of 10 the *parallel\_no\_pk\_one\_node* shows an unusual scattered distribution of duration. To no surprise, both “serial” scenarios performed worst.



**Fig. 8 Performance comparison for each setting, by scale factors**

When passing from the scale factor of 1 to 2, outcome distribution is visibly more scattered. But surprisingly, when passing from 2 to 10 (a much more notable gap in terms of database size), with the exception of *parallel\_no\_pk\_one\_node* scenario, no other “parallel” scenario recorded a notable increase in the outcome scattering. That suggested a non-linear relationship between predictor and the outcome and triggered the interest for MARS modeling.

### 4.3 REMOVE HIGHLY CORRELATED VALUES

Previous sections show similar distributions for a large number of parameters. In this section each group of parameters were examined for identifying the highly correlated parameters and removing some predictors for avoid further problems that might arise from the predictors collinearity.

Correlation plots in the left-side of figure 9 show high correlation coefficients (from .87 to .99) between parameters like: *sel\_n\_of\_attributes* and *sel\_n\_of\_distinct\_attributes* (0.99), *sel\_n\_of\_tables* and *sel\_n\_of\_distinct\_tables* (.96), etc. For further analysis only parameters associated with SELECT clause that occur on the right side of figure 9 were kept.

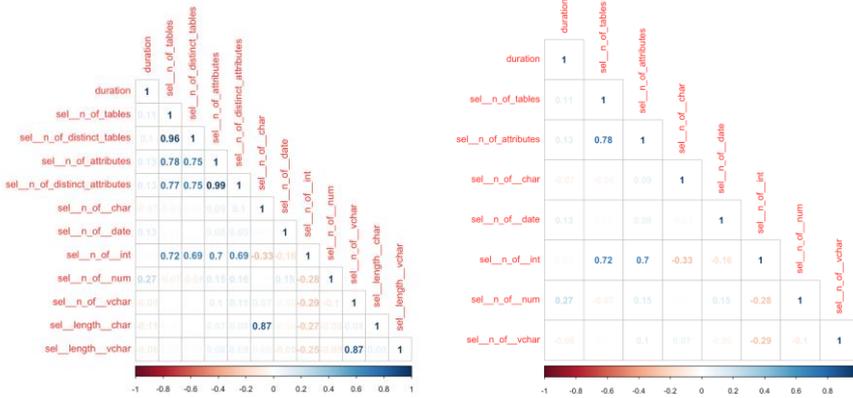


Fig. 9 Correlation plot for SELECT clause parameters – initial (left) and after removal of some variables (right)

As expected, figure 10 shows that all parameters in the FROM clause are heavily correlated. Even with some queries contained seft-joins, correlation between number of tables and the number of distinct tables appearing in the FROM clause were extremely high. That was the case with the number of attributes since every join requires usually two attributes. Consequently, only the predictor *n\_of\_joins* was kept.

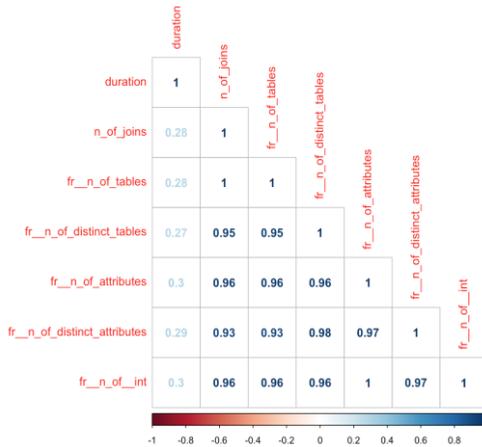
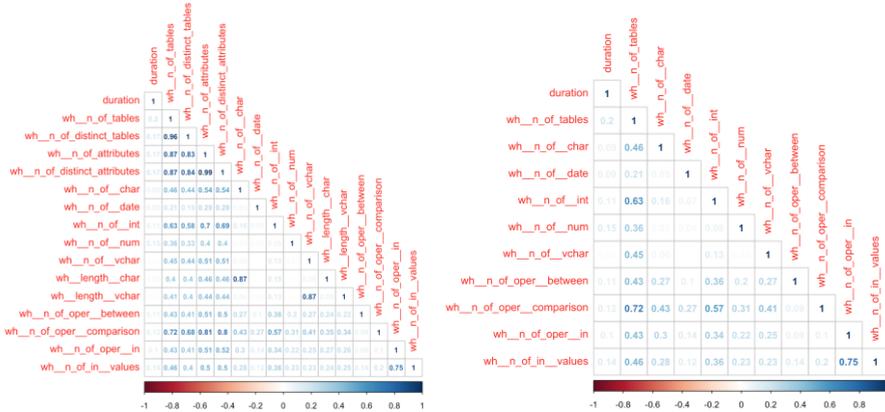


Fig. 10 Correlation plot for FROM clause parameters

As for WHERE clause predictors, correlation plots in the left-side of figure 11 show high correlation coefficients between parameters like: *wh\_n\_of\_attributes* and *wh\_n\_of\_distinct\_attributes* (0.99), *wh\_n\_of\_tables* and *wh\_n\_of\_distinct\_tables* (.96), etc. For the MARS analysis only parameters

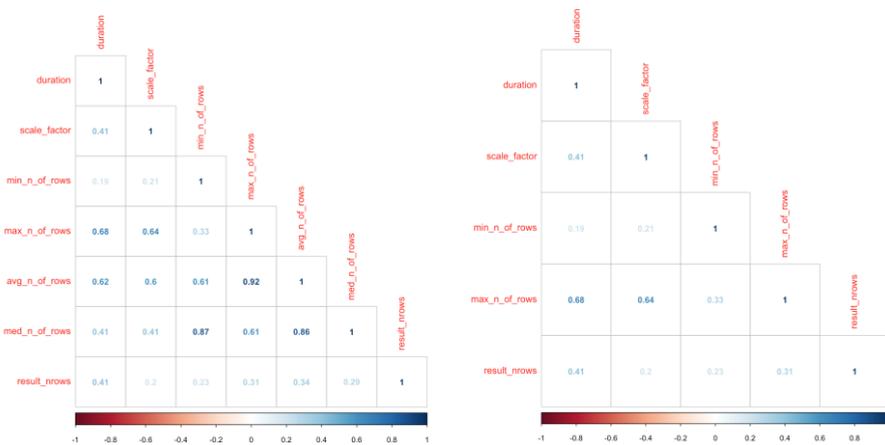
appearing in the right side of figure 11 were retained, the largest correlation coefficient being now .75 (between variables *wh\_n\_of\_oper\_in* and *wh\_n\_of\_in\_values*).



**Fig. 11** Correlation plot for WHERE clause parameters – initial (left) and after removal of some variables (right)

Two parameters were gathered for describing the GROUP BY clause, number of attributes and number of tables (appearing in this clause). As expected, correlation between them was high (0.89) so only first was kept in further models.

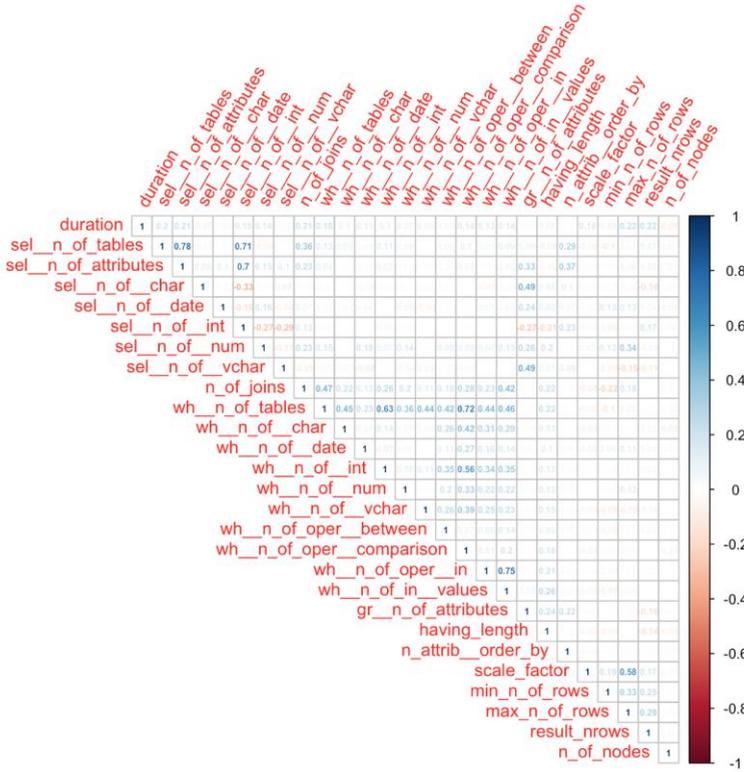
Among parameters describing the volume of data processed by the query and the query result the most heavily correlated predictors were *avg\_n\_of\_rows* with *max\_n\_of\_rows* (.92), *med\_n\_of\_rows* with *min\_n\_of\_rows* (.87), and *med\_n\_of\_rows* with *avg\_n\_of\_rows* (.86).



**Fig. 12** Correlation plot for parameters related to numbers of processed rows and the result size – initial (left) and after removal of some variables (right)

From the initial parameters, only those in the right side of figure 12 were retained – *scale\_factor*, *min\_n\_of\_rows*, *max\_n\_of\_rows* and *result\_nrows*.

Figure 13 displays the correlation plot for the resulted numeric predictor set. From the initial set of 46 predictors, only 27 were used in models presented in next sections (*pk\_usage* is a nominal variable and it was not included in the correlation plot).



**Fig. 13 Correlation plot for the variables kept in order to avoid collinearity problems**

As the correlation between predictors did not exceed .78, it was expected that in further regression models collinearity might not be an issue.

### 4.4 BUILDING THE MODELS WITH MULTIVARIATE ADAPTIVE REGRESSION SPLINES

Since we hypothesized that at least some of the predictors would be non-linearly related with the outcome, and interactions among predictors could also play an important role in predicting the outcome, MARS was a natural choice.

In R there are some packages which implement multivariate adaptive regression splines (MARS) algorithm. Package *earth* (Milborrow, 2017a) implements MARS and Fast MARS described in Friedman (1991) and Friedman (1993). The package title is *earth* (Enhanced Adaptive Regression Through Hinges) because MARS is trademarked (Milborrow, 2017c). MARS model plots are available through *plotmo* package (Milborrow, 2017b).

Figures 14 and 15 displays the most important information about the first MARS model. The outcome is the cube root of duration, since the distribution is positively skewed (section IV.2). Predictors are the variables kept after solving collinearity issues (in section IV.3). The model equation, with the intercept (4.25), two simple predictors (*pk\_usewithot\_pk* and *nodes*) and 22 hinge functions, is displayed on the left side of figure 14. After the forward pass, model 1's GRSq was 0.34 and RSq was 0.44. After the pruning pass GRSq was 0.37 and RSq slightly decreased at 0.42.

As described in section III.4, MARS approaches non-linear relationships between predictors and the outcome, identifying the inflexion points (knots) where predictor's slope changes. Each predictor's knots and the corresponding slope can be extracted from the model equation and the upper-right plot in figure 14. Some predictors, such as the number of INTEGER attributes occurring the SELECT clause (labeled 3 *se\_n\_int*) displays seems to have no influence on the outcome (suggested by the horizontal line). Others show a non-linear relationship. Predictor *number of joins* (labeled 4 *n\_joins* in the chart) has a constant influence on duration within all its [1, 6] values range. But when the number of joins exceeds 6, the coefficient (slope) increases significantly. Predictors 1 *se\_n\_tab*, 12 *max\_rows* and 13 *res\_rows* are even more spectacular since they present, on different ranges both positive and negative slopes (which might raise some doubts about the model when interpreting the results).

$$\sqrt[3]{duration} =$$

4.25	
+ 0.111	* pk_usewithout_pk
- 0.0868	* nodes
+ 0.469	* max( 0, se_n_tab - 5 )
+ 0.874	* max( 0, se_n_tab - 6 )
- 0.551	* max( 0, se_n_date - 1 )
+ 0.0958	* max( 0, 1 - se_n_int )
+ 0.323	* max( 0, n_joins - 6 )
+ 0.231	* max( 0, 1 - wh_n_tab )
+ 0.827	* max( 0, wh_n_char - 3 )
+ 0.127	* max( 0, wh_compar - 1 )
- 0.127	* max( 0, wh_compar - 3 )
- 0.103	* max( 0, 3 - wh_n_in )
+ 0.252	* max( 0, gr_n_attr - 2 )
- 0.323	* max( 0, gr_n_attr - 3 )
- 0.000237	* max( 0, 1281 - ha_len )
- 0.0524	* max( 0, ob_n_attr - 1 )
+ 0.336	* max( 0, ob_n_attr - 4 )
- 0.0000702	* max( 0, 11996 - max_rows )
- 0.000124	* max( 0, max_rows - 11996 )
+ 0.000128	* max( 0, max_rows - 15003 )
- 0.000652	* max( 0, res_rows - 800 )
+ 0.000665	* max( 0, res_rows - 3222 )
- 0.000627	* max( 0, 3544 - res_rows )
- 0.0000607	* max( 0, res_rows - 34379 )

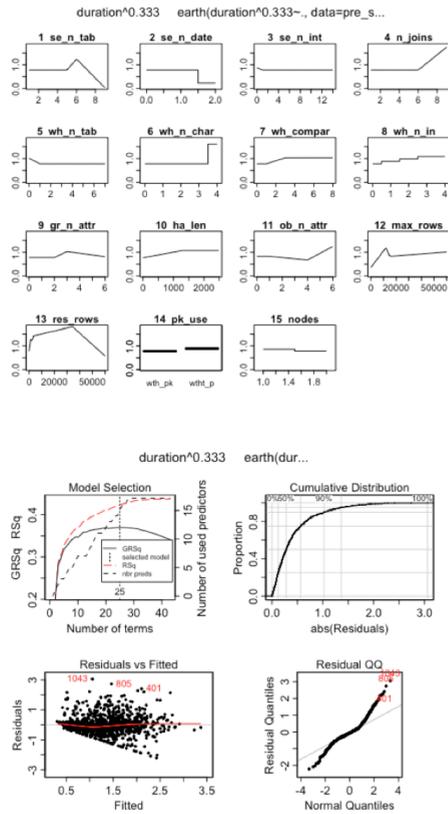


Fig. 14 First MARS model

The *Model Selection* plot in figure 14 shows how the fit depended on the number of predictors. As the number of predictors exceeded 5, the RSq (R Square) and GRSq (Generalized RSq) curves started to diverge, since an increased penalty was applied to the GCV. The vertical dotted line indicates that the best model had 25 terms. In the forward step, with from 27 predictors MARS built 43 terms (including the basis functions). After the backward (pruned) step, 15 predictors were kept which appeared in 25 terms.

The *Residuals vs Fitted* graph is similar to “classic” linear models. Ideally the residuals should have constant variance (homoscedasticity), but in MARS this requirement is not as important as in linear regression. *Cumulative Distribution* plot shows the cumulative distribution of the absolute values of residuals. Ideally, the line would reach 1 as steep (quick) as possible. The median absolute residual is

around 0.3 and 90% of the absolute values of the residuals are less than 1.1. The *Residual QQ* plot compares the residuals distribution to a normal distribution. Similar to the homoscedasticity, in MARS normality of the residuals is not as important as in the classic linear regression.

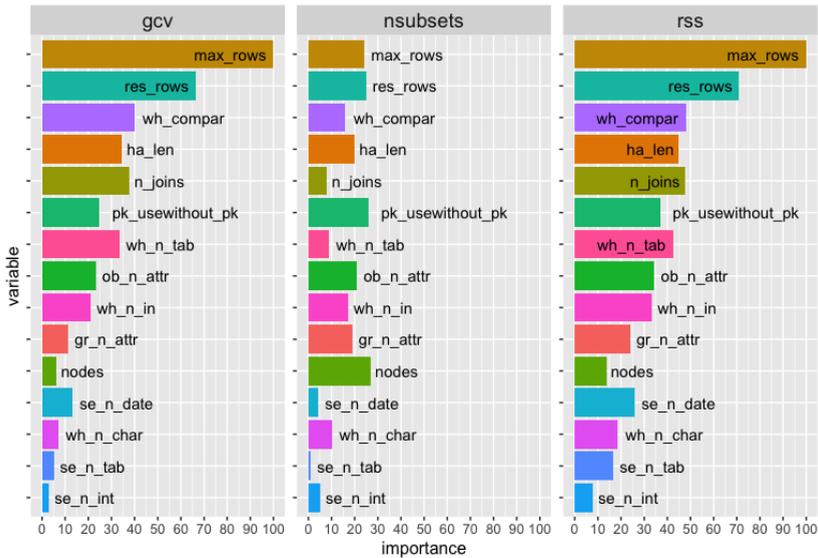
In practice, when dealing with a large number of variables, analyzing the inflexion points and the corresponding slopes for every variable's range could prove unfeasible and must be limited to only the relevant predictors. For the first MARS model, figure 15 displays the variable importance, that is, the expected effect of the variable on the outcome averaged over entire population (Milborrow, 2017c). Estimating variable importance could be severely altered by the collinearity, but in section IV.3 we addressed this issue. Function *evimp* in package *earth* uses three criteria for estimating variable importance in MARS models (Milborrow, 2017c):

- The *nsubset* criterion counts the number of model subsets (generated by the backward/pruning step) that include the variable; larger numbers suggest higher importance.
- The *rss* (Residual Sum of Squares) criterion uses the decrease in the RSS for each subset, relative to the previous subset; then, for each variable, the decreasing is summed up over all subsets that include the variable; finally, the summed decreased are scaled to 100. Variables causing larger decreases in the RSS are considered more important.
- The *gcv* criterion is similar to the *rss*, but uses GCV instead of RSS.

The plot shows some differences in variable importance estimation among the three criteria. Overall, the maximum number of rows in a table processed by the query (*max\_rows*), expressed in thousands, seemed the most important variable, followed by the number of rows in the query result (*res\_rows*). But the number of processing nodes (*nodes*) appears as the most important predictor by *nsubsets* criterion, whereas it has no importance at all, judging by both *gcv* and *rss* criteria. Less striking but notable differences occurred in the importance estimation for the use of primary keys (*pk\_use*) variable.

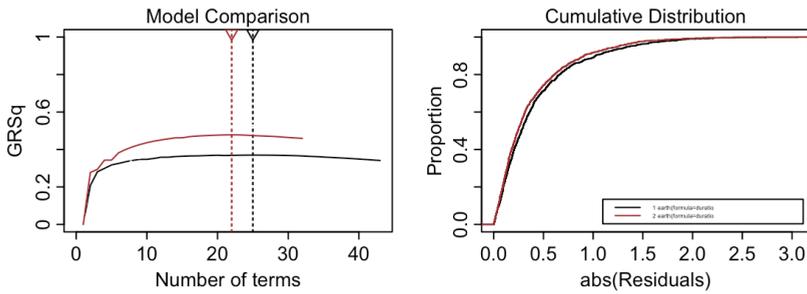
As figure 14 shows, *max\_rows*, which seems to be the most important variable for explaining duration variability, have three different slopes corresponding to two knots, 11996 and 15003. In model 1's equation three of the terms contain *max\_rows* variable:  $duration \wedge 0.33 = \dots - 0.0000702 * max(0,$

$11996 - \max\_rows) - 0.0001237308 * \max(0, \max\_rows - 11995.91) + 0.0001278347 * \max(0, \max\_rows - 15002.58) + \dots$ . Keeping all other predictors fixed, every increase of  $\max\_rows$  with 1000 units (100000 rows) within [0, 12000] range determines an *increase* in  $\sqrt[3]{duration}$  with 0.07 units. Every 1000 unit increase of  $\max\_rows$  within [12000-15000] determines a *decrease* of the outcome with 0.12 units. Above 15000, a 1000 unit increase of the variable is associated with an tiny increase of the outcome with 0.02.



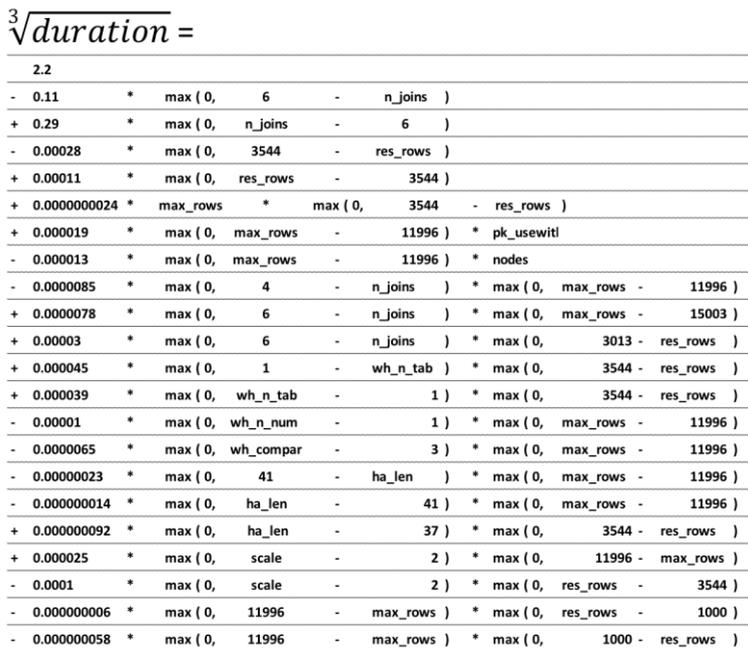
**Fig. 15 Variable importance in first MARS model**

Next we addressed the interactions among predictors, in order to determine if that would increase model performance in predicting the outcome. Consequently, a second MARS model was fit by adding interactions. Here, after the forward pass the GRSq was 0.457 and RSq was 0.532. After the backward pass, 22 (out of 32) terms and 10 (out of 27) predictors were selected. The computed value of GRSq was 0.48 whereas RSq was 0.53. Figure 16 shows that in terms of both GRSq and cumulative distribution the second model outperforms the first one.



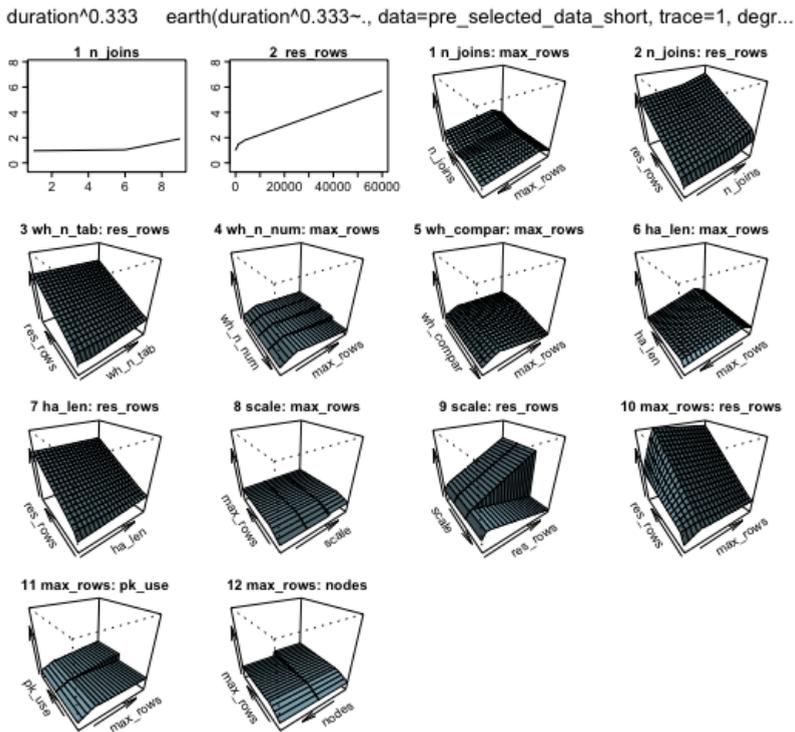
**Fig. 16 The two MARS models comparison**

When examining figures 17 and 18, it becomes obvious that the model improvement came with a price. The second model is much more difficult to interpret, since many terms in the model’s equation are products of two hinge functions, so determining the influence of each variable is considerably more cumbersome.



**Fig. 17 Second MARS model (with interactions)**

Fortunately, *plotmo* function (of the *plotmo* package) provides a helpful way of displaying the effect of most important interactions (between pairs of variables) on the outcome, as seen in figure 18.



**Fig. 18 Relationships between the outcome and the main predictors for the second MARS model**

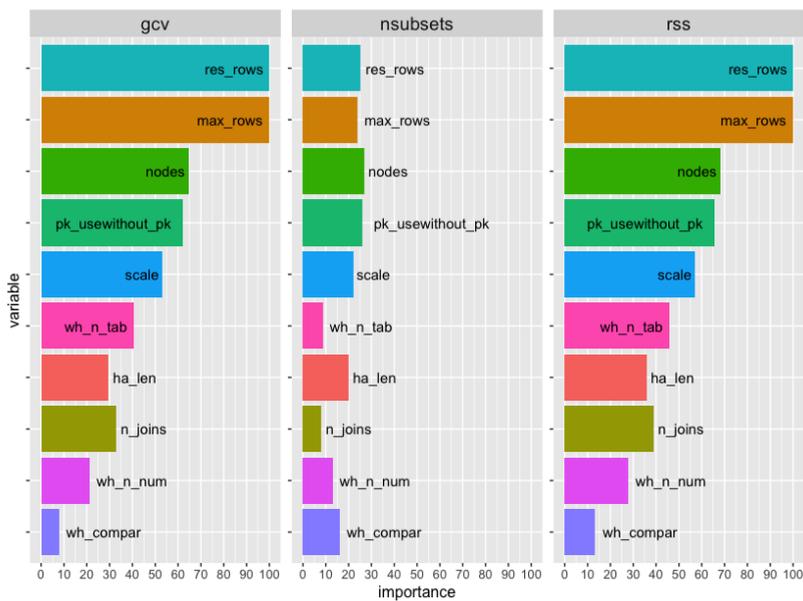
Relative to the first model, variable *res\_rows* (the number of records in the result set, labeled 2 *res\_rows* in the chart) seems to behave more realistic, with a constant slope for all its values range. Variable related to the number of joins (labeled 1 *n\_of\_joins*) continue to have a knot at 6, but the slope for its [6, 10] range is less impressive that in the first model.

The main interest of the figure is in the three-dimensional charts showing how the outcome (on z axis) could vary as a result of two predictors on x and y axes (the arrows and the axes show how the predictor's value increases). Some interactions are trivial, such as 2 *n\_joins:res\_rows* and 8 *scale:max\_rows*, or simply unimportant for the model's goal, such as 1 *n\_joins:max\_rows*, and 4 *wh\_n\_num:max\_rows*.

But others show interesting relationships among predictors. Taking for example the term 9 *scale:res\_rows*. For the scale factors of 1 and 2 the outcome basically follows the slope of the 2 *res\_rows* term. But for the scale factor of 10,

the outcome seems negatively related (or, as the slope is not steep, one can interpret as *unrelated*) to the number of records in the query result. So the influence of predictor *res\_rows* varies among different levels of the *scale* predictor. Also interaction *10 max\_rows:res\_rows* is also notable.

Before presenting the variable importance as resulted from the second MARS model, it is important to point out that, in *earth* package, for interaction terms, each variable gets equal credit for the entire term, even though one variable in that term could be more important than the other (Milborrow, 2017c). Consequently, interaction terms are counted more than once.



**Fig. 19 Variable importance for the second MARS model**

Figure 19 displays the computed variable importance for the second MARS model, using all three criteria. As for the first model, there are some differences among the criteria results. Variables *res\_rows* and *max\_rows* share the position of the most important variable by *gcv* and *rss* criteria, but are ranked slightly behind *pk\_use* and *nodes* “preferred” by the *nsubsets* criterion.

Compared with the first model, the second MARS model ranks the variable importance more realistic (as far as we were concerned), since after *res\_rows* and *max\_rows*, variables *nodes* (the number of processing node), *use\_pk* (the use of primary keys) and *scale* play now a central role.

## 5. DISCUSSION

The performance of Oracle Exadata, as a Big Data proprietary platform, was investigated by setting up six configurations (scenarios) among which some Exadata tuning parameters were changed (sections III.1 and III.3). For each scenario, three TPC-H database schema were populated (using Dbgen utility) with increasing number of records, for scale factors of 1 GB, 2GB and 10GB (section III.1). For each scale factor about 500 queries were randomly generated, containing the main SQL clauses: SELECT, FROM, WHERE, GROUP BY, HAVING (with and without subqueries), and ORDER BY. Generated queries were related to the scale factor, so that that the vast majority of queries would yield non-empty results. For each query, various parameters were collected (section III.2) for determining the most influential in explaining and predicting the system performance (measured through the duration of query execution), including the volume of data processed by the query and the result size.

As the data volume and number of joins and self-joins increased, some queries required a considerable amount of time. Because of the limited access to the platform, queries lasting more than 150 seconds were cancelled for all six scenarios (section IV.2). That is a serious limitation of the study.

As expected, the outcome (query duration) distribution was positively skewed, overall, and on each scenario and scale factor, with both skewness and kurtosis constantly decreasing among the scale factors (figures 7 and 8 in section IV.2). The two *serial* settings recorded the highest duration and also the most scattered distribution for the outcome. On the scale factor of 10 the *parallel\_no\_pk\_one\_node* shows an unusual scattered distribution of duration. Among the four *parallel* settings, the use of primary key seemed to be as important as the number of processing nodes. But admittedly that could be determined by the small range of values (just 1 and 2) for variable *nodes*.

Also the performance gap between scale factors was smaller than expected, especially between scale factor of 2 GB and of 10GB and that could be interpreted as a non-linear relationship between predictors and the outcome and prompted for the use of MARS modeling.

Almost every data analysis techniques, MARS included, is considerably affected by the collinearity among predictors. In section IV.2, predictors were checked for collinearity on groups corresponding the queries main clauses –

SELECT (figure 9), FROM (figure 10), WHERE (figure 11) – and also the volume of processed data (figure 12). The correlation plot (figure 13) shows no correlation larger than .78 among the kept numeric predictors.

As previously pointed out, MARS was applied mainly for two reasons:

- We suspected that some predictor's influence would not be linear, i.e. not constant for the entire range of predictor's values.
- We also hypothesized that interactions among variables could play an important role in explaining the outcome's variability.

The analysis of predictors' distribution (section IV.1) revealed various degrees of skewness. Nevertheless, in MARS models no predictor transformation was applied, mainly for two reasons, the interpretability of the results and also the fact that MARS is not as sensitive to normality (and homoscedasticity) as the classical linear regression is.

The two MARS models in section IV.4 fitted the transformed outcome ( $\sqrt[3]{duration}$ ) to all predictors kept after dealing with collinearity and adding the nominal predictor related to the use of primary keys (*pk\_use*). As Big Data is usually related to distributed data storage and/or processing, we kept for analysis only the results describing the four *parallel* settings. Data was blocked by randomly assigning each query (and the corresponding result) to only one of the four parallel settings.

Interactions among pairs of predictor variables were introduced in the second model. As detailed in the section, the second model seems to be more accurate in gathering and describing the relationship between predictors and the outcome (figure 18) but at the expense of interpretability.

Both models ranked the volume of processed data (expressed by variable *max\_rows*) as the most important predictor (figures 15 and 19). That was consistent with (our) expectations. Not as expected was the equally high rank of the number of records in the query result (variable *res\_rows*). Compared with the first model, the second MARS model also ranked higher the variables describing the number of processing nodes (*nodes*) and the use of primary keys (*pk\_use*).

Also both models show that the influence of predictors like the maximum number of table rows processed by the query (*max\_rows*) or the number of joins (*n\_joins*) is not constant among entire predictor's range, but varies on intervals delimited the knots determined through the MARS algorithm.

The second model showed that some interactions among predictors are particularly important in explaining the outcome variability (figure 18). On scale factors of 1 and 2 the outcome basically follows the variability of the number of records contained in the result (*res\_rows*). But for the scale factor of 10, the outcome seems unrelated (even slightly negatively related) with the number of records in the query result. So the influence of predictor *res\_rows* varied among different levels of the *scale* predictor. Also interaction between variables *max\_rows* and *res\_rows* was notable.

## 6. CONCLUSIONS, LIMITS AND FURTHER RESEARCH

In trying to identify and assess the data processing performance drivers for Oracle Exadata system as a Big Data proprietary platform, MARS technique results were encouraging, especially in dealing with the predictors non-linearity and interactions. Measured by  $R^2$  and Generalized  $R^2$  (around 50%) were not very impressive for an experimental setting, mainly because of data limitations.

The most important limits of this study could be presented as follows:

- Technological limitations:
  - Exadata version (quite older): version 11.2.3.3.1 for cell nodes and version 11.2.0.4.0 for the Oracle database nodes.
  - Exadata configuration: the setup we used was an Exadata X2-2 quarter rack. This model was released in 2010, therefore the performance of its hardware components start to fade in the light of the new Exadata models.
  - Limited access: the scenarios we run were imagined to be conducted in isolation, without any other disturbing workloads on the system. Because we were granted a limited time frame for exclusive access on this Exadata machine, we couldn't afford to measure the execution time of any long running query.
- Data limitations:
  - Data was loaded and query results were collected only for the scale factors of 1, 2 and 10 GB. Though relevant, this scale factors are the very low end of Big Data. Higher scale factor (100GB, 1TB, ...) are needed to build more accurate models.
  - Generated queries for all scale factors covered a broad range of joins, self-joins, subqueries, but finally only short queries (less than 150 second queries) were run and analyzed. Consequently, a large subpopulation of queries missed from the models (also this could explain only the decent levels of  $R^2$  and  $GR^2$ ).
  - Apart from the predictors related to the database seize (*max\_rows*, *res\_rows*, *scale*), also the variable number of processing nodes (*nodes*) had not enough variability. Additional scenarios with larger number of processing nodes are expected to prove that this

predictor is much more important in explaining and predicting the outcome.

- Cost limitations. Oracle Exadata is a very expensive technology, so not many companies could afford it.

This study could be enhanced/developed in many respects:

- Improve the technical platform. Increase the number of nodes, include other optimization techniques available in Exadata, etc.
- Generate more queries adapted to the companies data processing requirements. In feeding the models with relevant data, it is important to execute (and gather the results) longer queries for covering a broader scope of real-world SQL queries.
- Also for building performant models, one must use much larger scale factors (database size).
- Improve the estimation of model performance and variable importance by using *earth* package cross-validation features or by using additional packages, such as the *caret* package that implements bagged earth models.
- Compare the result with other big data platforms (Hadoop, in-memory systems, NoSQL data stores).

Despite its limitations, this study showed that when non-linearity and interaction among variables are two real concerns in building models for explaining and predicting the performance of Big Data systems, MARS could be a suitable solution. Consequently, this study could serve as a starting point for measuring processing performance for other Big Data platforms.

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# IMPACT OF SAFTA ON CAPITAL MARKET INTEGRATION OF SOUTH ASIA: EVIDENCE FROM COINTEGRATION ANALYSIS

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**Abstract:** *Regional Trade agreements (RTAs) are increasing worldwide because of associated economic benefits such as increased cross border investment and trade, development and integration markets. This paper investigates how South Asian Free Trade Agreement (SAFTA) impact on the integration of South Asian capital markets. Weekly data of capital market indices of three countries (India, Pakistan and Sri Lanka) have been analyzed for overall (1998-2017) and two sub periods, 1998-2006 (Pre SAFTA) and 2009-2017 (Post SAFTA). Correlation coefficients, Unit root tests and Johansen and Juselius (JJ) Cointegration technique has been applied to access the integration between the markets. The main findings suggest that integration between the South Asian capital markets has been increased in Post-SAFTA period. The evidence that SAFTA pact results in increased integration of regional capital markets has important implications for investors and policymakers.*

**Keywords:** *Regional Trade Agreements, SAFTA, Capital Markets, SAARC, unit root test, Cointegration.*

**JEL Classification:** *F36, F04, F60, G1*

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## 1. INTRODUCTION

Last two decades evidenced many Regional Trade Agreements (RTAs onwards) and economic blocs, around the world. Their prime objective is to accelerate economic growth, economic cooperation, liberalization, and market integration. The literature on the advantages of RTAs and their impact on the integration of capital markets is growing rapidly. Integration of capital markets

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means comparable and correlated prices/returns on the assets issued and traded in different countries (Stulz, 1981). Aggarwal and Kyaw (2005) found the positive impact of NAFTA agreement on the integration of three capital markets (Canada-Mexico-US) North American region. Hooy and Goh (2007) studied 26 stock markets and 5 free trade blocs and concluded that RTAs have a significant role in capital market integration. EU stock markets have a higher level of integration, while EFTA and AFTA markets have a lower level of integration. However, there is no study focusing on RTAs and capital market integration in South Asian region.

A regional trade agreement known as South Asian Association for Regional Cooperation (SAARC onward) was initiated in 1985 between seven south Asian countries that is Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka. The main objective of SAARC is to enhance “accelerated economic growth, social progress and cultural development in the region” for the welfare of the region and peoples (SAARC Secretariat, 2006). To achieve above targets, in 1995, a South Asian Preferential Trading Agreement (SAPTA) was signed among SAARC countries. However, unfortunately, SAPTA failed to achieve the desired outcomes to enhance the regional cooperation. Then again in early 2004, SAARC member countries come together to form a regional trade agreement. As a result, South Asian Free Trade Agreement (SAFTA) was initiative in 2006 to promote regional cooperation among SAARC countries (Weerakoon and Thennakoon, 2006). SAFTA was introduced to overcome the hurdles that SAPTA could not handle to develop regional cooperation. The south Asian region is considered as less developed as compared with other regions. The proponents of regional trade agreements (RTAs) except SAFTA to increase the intraregional trade and welfare in the region. It will have a positive impact on the businesses and it will improve the market access of the region, there will be a boost in the exports among the SAARC countries, and overall trade will increase. Eventually, the all the markets will come closer to each other and integration among the stock markets of SAARC countries is expected to be increased.

The purpose of this study is to expand the empirical literature on RTAs and capital markets integration by analyzing the impact of SAFTA (South Asian Free Trade Agreement) on the integration of capital markets of South Asia. We use weekly benchmark stock indices data of three Non-LDC (Least developed countries) stock markets i.e. Nifty 500 for India, KSE 100 index for Pakistan and

CSE all share index for Sri Lanka for cointegration analysis. Overall period of study (1998-2017) has been divided into two sub periods, Pre and Post SAFTA. The period from 30 June 1998 to 30 June 2006 is classified as Pre-SAFTA sub period and Post SAFTA sub period is from 1 July 2009 to 30 June 2017. The period from 2007-2009 is excluded because of great financial depression. We apply the ADF, PP and KPSS unit root tests to check the stationarity of data and JJ cointegration to find the long run relationship before and after IFRS adoption. Results show that there is cointegration between the three markets for the Overall, Pre-SAFTA and Post-SAFTA period in weekly series. However, cointegration increased in the Post-SAFTA period. In other words, SAFTA passage results in an increased integration between the South Asian capital markets.

The current study contributes to the RTAs consequences research by providing the evidence from the unexplored area of South Asia. It also extends the capital markets integration research by providing the first evidence (to the best of our knowledge) about the impact of SAFTA on capital markets integration of South Asia. Findings of this study are important for investors, managers, policymakers, and scholars of not only South Asian countries, but also other countries who are interested in this region. If the markets are integrated investor have better liquidity and portfolio diversification, business managers and policymakers will take their decisions accordingly.

The rest of the paper is organised as follow: section 2 gives the further insight of literature review and background; section 3 explains the data and methodology used; section 4 discusses the empirical results and findings, and section 5 gives the conclusions and recommendations.

## **2. LITERATURE REVIEW AND BACKGROUND:**

In 1985, South Asian Association for Regional Cooperation (SAARC) was initiated as a result of the political meeting. During its initial years, it does not have great success in promoting trade preferences among its member's countries. In 1993 SAARC plan to create the South Asian Preferential Trade Area (SAPTA) and finally it incorporated in 1995, However, the actual exchange of preferences remained extremely limited (Panagariya, 2002). The SAPTA framework provides for periodic rounds of trade negotiations for the exchange of trade concessions on tariff, para-tariff and non-tariff measures using a combination of negotiating

approaches. In view of the modest progress made in the initial years, the deadline for a free trade area, which was finally envisaged for 2001-2005, has been postponed to 2008 for non-LDC members (India, Pakistan and Sri Lanka) and 2010 for LDC members (Bangladesh, Bhutan, Nepal, and Maldives).

SAARC evolved over the time for regional economic growth and welfare. Formation of SAPTA (1995) in which there were commodity-by-commodity negotiations between the SAARC countries for tariffs was the first step for the free trade. However, it was not beneficial because of highly laborious and time taking work. And it did not achieve the desired impact on the intra-regional trade. A milestone in the advancement of the SAARC was the signing of SAFTA in January 2006, during the 12<sup>th</sup> SAARC summit held at Islamabad, Pakistan. The idea takes the SAARC a step ahead from the mere trying out tariffs under SAPTA to establish a regional free trade area. The SAFTA agreement has greater potential than just trade liberalization and economic integration. If it achieves its objectives, the region will attract more foreign investments and trade, which result in fastest economic growth in South Asian countries (Mehta and Kumar, 2005). Sultana and Asrat (2015), and Regmi et al. (2017) found an increase in the bilateral exports and imports, among the SAARC member countries in post SAFTA period. As a result, markets will come closer to each other, and integration among the stock markets is expected to be increased.

Researchers almost agreed on the positive impact of recent trade liberalizations and globalization on the enhancement overall welfare of the society. However, the impact of regional free trade agreements on capital markets is inconclusive and debatable (e.g. Bhagwati and Panagariya, 1999). There is a number of studies which focused on the advantages of RTAs and their impact on the integration of Capital markets. Like for NAFTA region, Easterly et al. (2003) measure the impact of NAFTA on the economic convergence of North American region and conclude that institutional differences among countries are a hindrance in economic convergence and convergence seems stuck. However, Aggarwal and Kyaw (2005) found the positive impact of NAFTA agreement on the integration of three capital markets. Adjaouté and Danthine (2000) examine the integration between the EU capital markets, from the variance-covariance matrices of weekly returns they conclude that there is significant increase in the correlation of stock returns, whether computed on the basis of market indices or sector indices.

Fratzscher (2002) analyzed the daily returns with a GARCH model and evidenced an increased correlation between stock returns within the Euro area. Hooy and Goh (2007) studied 26 stock markets and 5 free trade blocks and conclude that economic bloc plays an important role in stock market integration. The level of integration is highest among stock markets in the EU countries, while those in EFTA and AFTA are most segmented.

In the South Asian region, intraregional trade is very low compared to other regions. The major reason for this low trade is high tariff rates among the countries. South Asia, as a region, has higher average tariff rates than in any other region in the world (Raihan, 2012). However, policy makers and business community of the region are optimistic about SAFTA. SAFTA has significant potentials to expand trade among the member countries. It is also hoped that the member countries will be able to gain significantly by having greater market access in other South Asian countries and especially in India. Raihan (2012) concludes that benefits from trade acceleration in South Asia are much higher than the gains from a mere reduction in tariff in goods. Therefore, in order to make SAFTA effective, trade liberalization is a necessary condition, but not a sufficient one. With the passage of time the integration among the countries will increase.

Above studies provide the importance of regional trade and economic agreements and their impact on the integration of different markets. It is also concluded that SAFTA has a potential to impact on the SAARC capital markets. However, how the SAFTA will impact on the regional capital markets integration has not been investigated yet, which is the main objective of the current study.

RTAs eliminate the barriers to cross border trade and align the legal and regulatory bodies, previous studies document that such RTAs result in increased economic integration of the territories (Mehta and Kumar, 2005). Cross border equity investments result in lower cost of capital, and as a result of RTAs cross border investments of the region increased, which may result in the greater integration of capital markets. Same is expected for the SAARC region that SAFTA increases the capital market integration of the region. However, if countries cross border trade and investment is not increased by SAFTA than capital markets may behave locally rather than regionally, and there are lower chances of capital markets integration.

### 3. RESEARCH DESIGN, METHODOLOGY, AND DATA

Integration of capital markets means comparable and correlated returns on the assets issued and traded in different countries (Stulz, 1981). The coefficient of correlation and cointegration tests are well recognized to measure the integration between stock markets, (e.g. Chung and Liu, 1994, Kasa, 1992, Richards, 1995, Darrat and Zhong, 2005, Atteberry and Swanson, 1997). Similarly, current study analyzed the impact of SAFTA agreement on the integration of stock markets by using correlation coefficients and cointegration tests. There are total eight countries in the SAARC region. However, only three countries have well-developed stock markets so the study is considering only those.

Benchmark indices of each market are used to represent the whole stock market, that is S&P BSE-100 Index as a proxy for Indian, KSE-100 index for Pakistani, and CSE all share index for the Sri Lankan stock markets. Weekly stock prices data have been gathered from the Thomson Reuters Eikon DataStream for analysis.

Weekly data on stock prices for the period of nineteen years starting from 30 June 1998 ending on 30 June 2017 have been downloaded from the Thomson Reuters Eikon datastream. In order to capture the incremental impact of SAFTA agreement on the integration, overall period of study has been divided into two sub periods, Pre and Post SAFTA. The period from 30 June 1998 to 30 June 2006 is classified as Pre-SAFTA sub period and Post SAFTA sub period is from 1 July 2009 to 30 June 2017. The period from 1<sup>st</sup> July 2006 to 30<sup>th</sup> June 2009 has been excluded from analysis because of great financial depression of 2007-2009. All the analysis are made for the overall period and for each of the two sub periods using weekly stock indices prices data.

#### **Correlation coefficient analysis:**

One widely applied approach to access the global capital market integration in economics and finance literature is by calculating the correlation between the stock indices. Bekaert and Harvey (1995) are first to use this approach, later on (Cai & Wong, 2010; Chambet & Gibson, 2008; Goetzmann & Rouwenhorst, 2004; Heston & Rouwenhorst, 1994) also used the correlation coefficient to examine the capital market integration. In order to calculate the Pearson Correlation coefficient;

first of all, stock returns are calculated by taking the natural logarithm of one lag difference of stock prices. With the following formula,

$$R_{i,t} = \ln(P_{i,t}/P_{i,t-1}) \quad (1)$$

Where  $R_{i,t}$  is the stock return of  $i$ 's country for the time  $t$ ,  $\ln$  is the natural logarithm operator and  $P$  represent the stock price of  $i$ 's country for the time  $t$ .

Then Pearson's correlation coefficients were calculated by using the weekly returns calculated with the above formula for the both Pre-SAFTA and Post-SAFTA Periods. Then these coefficients are compared in two periods to access the increase or decrease in correlation, which is the proxy for integration.

### Cointegration Analysis:

Cointegration modeling is a widely used approach to investigating long-run equilibrium of returns among capital markets. Previously a number of studies, use the similar analysis to access the integration between markets like Serletis and King (King, 1997) analyzed the convergence of EU stock markets. While (Click & Plummer, 2005; Manning, 2002; Yabara, 2012; Yu, Fung, & Tam, 2010) apply this cointegration analysis to access Asian capital market integration. Specifically, we used the following model in error correction model (ECM) framework with  $l$  lags is considered:

$$\Delta P_t = v + \alpha P_{t-1} + \sum_{i=1}^l \mu_i \Delta P_{t-1} + \varepsilon_t \quad (2)$$

where  $P_t$  is a  $(n \times 1)$  vector of stock prices at time  $t$ ,  $v$  is a  $(n \times 1)$  vector of parameters,  $\alpha$  is a  $(n \times r)$  parameter matrix with rank  $r < n$ ,  $\mu_1, \dots, \mu_l$  are  $(n \times n)$  matrices of parameters, and  $\varepsilon_t$  is a  $(n \times 1)$  vector of random errors.

Where the parametric matrix  $\mu$  indicates whether the vector of stock prices ( $P_t$ ) has long run equilibrium dynamic relationship or not. The core of the approach is to identify  $r$ , a number of cointegrating vectors. If  $n$  variables with unit roots have  $r$  cointegrating relationships, they have been  $n - r$  common stochastic trends. Thus if  $r$  equals  $n - 1$ , stock markets are perfectly integrated under one common long-run trend. Alternatively, if  $r$  equals 0, all data series are independent (Kasa, 1992).

Johansen and Juselius (Johansen & Juselius, 1990) derive two likelihood-ratio tests to infer on  $r$ , known as the trace statistics and the maximum-eigenvalue statistics. But these tests are only valid if the data series is of same integration order.

Before applying the cointegration test, it is important to check the stationarity of the time series as cointegration tests are sensitive to stationarity moreover, some time series is not stationary. So, Unit root tests (ADF, PP, and KPSS) are applied to check the order of integration.

#### 4. EMPRICAL FINDINGS

##### Descriptive Statistics:

Table 1 presents the descriptive statistics for weekly stock returns for the three countries studied, India, Pakistan and Sri Lanka for three periods. The findings show that the Pakistani stock index (KSE100 index) have higher mean returns compared with India and Sri Lanka in all the periods, while Indian stock index (BSE100 index) have the lowest mean returns. Pakistan and Sri Lanka have a higher standard deviation in Pre-SAFTA period while in Post-SAFTA period India has the higher standard deviation. As is common for such series, there is skewness and kurtosis in these data with higher levels of kurtosis for each of the three series. However, skewness shows a negative pattern for India and Pakistan in Pre-SAFTA period while positive for other. Overall, KSE100 index is performing well among the three countries. Jarque-Bera test results show that there is no issue of normality for these data series.

**Table 1: Descriptive Statistic (Returns)**

	Panel A: Pre-SAFTA			Panel B: Post SAFTA			Panel C: Overall		
	<i>BSE100</i>	<i>KSE100</i>	<i>CSEA</i>	<i>BSE100</i>	<i>KSE100</i>	<i>CSEA</i>	<i>BSE100</i>	<i>KSE100</i>	<i>CSEA</i>
<i>Mean</i>	0.0032 4	0.0113 3	0.0086 1	0.0018 9	0.0044 8	0.0024 2	0.0025 6	0.0079 0	0.0055 2
<i>Median</i>	0.0060 8	0.0071 4	0.0017 1	0.0029 3	0.0062 4	0.0002 6	0.0041 9	0.0068 6	0.0009 3
<i>Max</i>	4.6381	4.6578	4.6628	4.6368	4.6387	4.6411	4.6381	4.6578	4.6628
<i>Mini</i>	- 4.6 28 7	- 4.6 60 4	- 4.6 28 7	- 4.6 01 6	- 4.6 13 6	- 4.6 24 3	- 4.6 28 7	- 4.6 60 4	- 4.6 28 7
<i>Std. Dev.</i>	1.1932	1.3483	1.3123	1.2149	1.0212	1.1265	1.2034	1.1953	1.2222
<i>Skewness</i>	0.00 1	0.13 3	0.0675	0.0063	0.3171	0.0162	0.0032	0.0077	0.0492

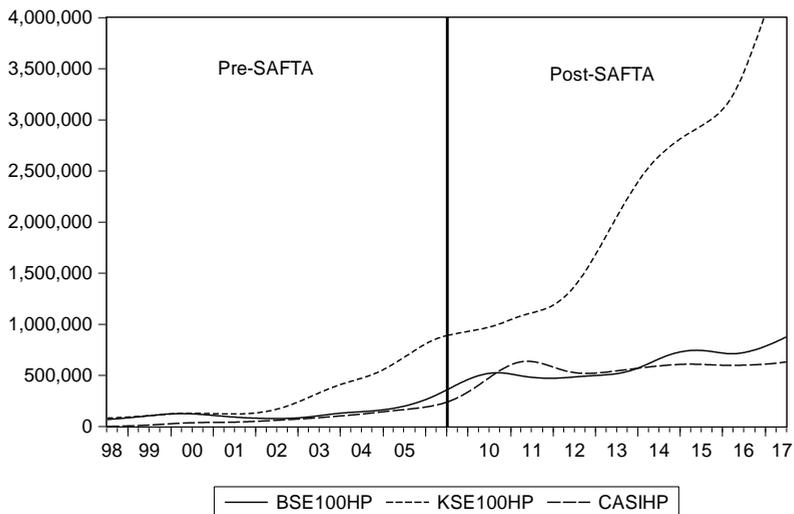
<b>Kurtosis</b>	7.7189	7.3028	6.6498	6.5680	11.044 6	10.169 7	7.1250	8.8310	8.0698
<b>J-Bera</b>	387.84	323.63	232.32	221.73	1134.1 4	895.30	592.71	1184.3 4	895.66
<b>N</b>	418	418	418	418	418	418	836	836	836

*Note 1:* BSE 100 represents the Bombay Stock Exchange 100 index (India), KSE 100 Index represents the Karachi Stock Exchange 100 Index (Pakistan) and CSE All Share represents Colombo Stock Exchange All Share (Sri Lanka).

*Note 2:* throughout the manuscript, \*, \*\*, \*\*\* denote significance at the 10%, 5%, and 1% significance levels respectively.

*Note 3:* Period from 1 July 1998 to 30 June 2006 is Pre-SAFTA, and the period is from 1 July 2009 to 30 June 2017 posts SAFTA period. The overall period spans from 1 July 1998 to 30 June 2017. However, the period from 1<sup>st</sup> July 2006 to 30<sup>th</sup> June 2009 has been excluded from analysis because of great financial depression of 2007-2009.

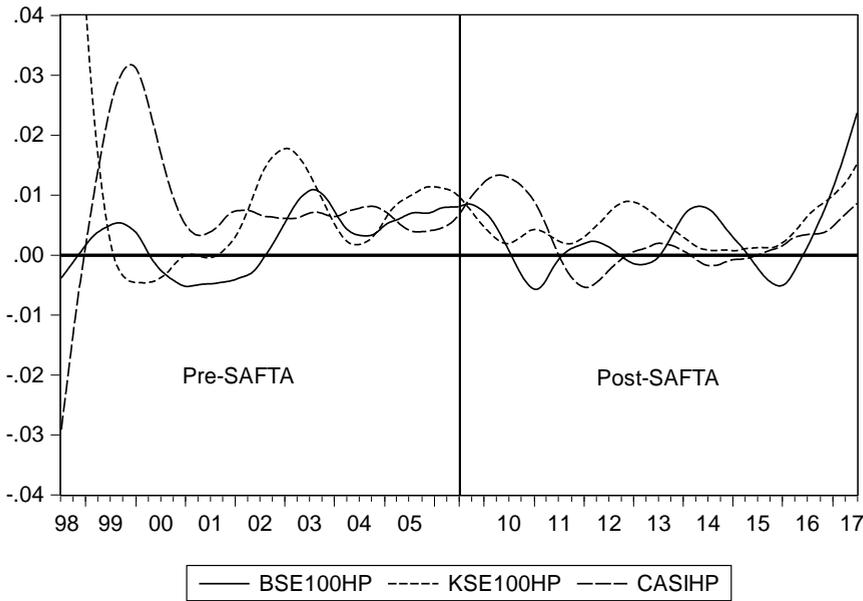
Fig. 1 shows the plot of weekly stock index prices. From the graphic inspection of the plot we can see that up till 2001 the stock prices of all three countries have similar patterns, later on, Pakistani stock prices goes up. While Indian and Sri Lankan index prices remain close to each other. Overall, there is an increasing trend in the stock prices of all three countries.



*Note 1:* BSE 100 represents the Bombay Stock Exchange 100 index (India), KSE 100 Index represents the Karachi Stock Exchange 100 Index (Pakistan) and CSE All Share represents Colombo Stock Exchange All Share (Sri Lanka).

*Note 2:* Prices are scaled with **Hodrick-Prescott (HP) filter** for the smooth view and trend analysis. The lambda value used is 270400 because of weekly data.

Figure 2: shows the weekly returns of all three stock markets. Returns are scaled with **Hodrick-Prescott (HP) filter** for the smooth view and trend analysis. The lambda value used is 270400 because of weekly data. Overall, returns graph shows a similar trend in all three markets except the start of the period when the Pakistani stock returns are decreasing while the Sri Lankan is increasing.



Note 1: BSE 100 represents the Bombay Stock Exchange 100 index (India), KSE 100 Index represents the Karachi Stock Exchange 100 Index (Pakistan) and CSE All Share represents Colombo Stock Exchange All Share (Sri Lanka).

Note 2: Prices are scaled with **Hodrick-Prescott (HP) filter** for the smooth view and trend analysis. The lambda value used is 270400 because of weekly data.

Table 2 shows the person correlation matrices of all the three countries for the weekly stock returns. The lower diagonal part shows the Post-SAFTA correlations while upper diagonal bold part represents the Pre-SAFTA correlations. Overall, all the correlations are small, Pakistani stock index have negative correlations with both Indian and Sri Lankan markets while Indian and Sri Lankan markets have a positive correlation with each other in the Pre-SAFTA. In Post-SAFTA period, there is a small negative correlation between all the returns.

Correlation coefficient has not evidenced any integration between the markets, we need a further powerful test to check the behavior of the markets.

**Table 2: Correlations (Returns)**

	<i>BSE100</i>	<i>KSE100</i>	<i>CSEAI</i>
<i>BSE100</i>	1	-0.0245	0.0246
<i>KSE100</i>	<b>-0.0202</b>	1	-0.0493
<i>CSEAI</i>	<b>-0.0092</b>	<b>-0.0558</b>	1

Note 1: BSE 100 represents the Bombay Stock Exchange 100 index (India), KSE 100 Index represents the Karachi Stock Exchange 100 Index (Pakistan) and CSE All Share represents Colombo Stock Exchange All Share (Sri Lanka).

Note 2: The overall period is divided into two sub periods—the pre and post- SAFTA periods. Upper diagonal Pre-SAFTA (July 1998-June, 2006) and Lower diagonal (**bold**) Post-SAFTA (July 2009-June,2017).

### Unit root Tests:

Before applying the cointegration test, it is important to check the stationary of the time series as cointegration tests are sensitive to stationarity (Stock and Watson, 1989) moreover some time series may not be stationary. Therefore, first of all, we apply the unit root tests to check the order of integration. Three methodologies Augmented Dickey Fuller (ADF) unit root test by Dickey and Fuller (Dickey & Fuller, 1979)), Philips-Perron (PP) unit root test by (Perron, 1988; Phillips, 2008), and Kwiatkowski-Philips-Schmidt-Shin (KPSS) stationarity test by (Kwiatkowski, Phillips, Schmidt, & Shin, 1992) are applied to all country's indexes data, for the overall, Pre-SAFTA and Post-SAFTA periods, for levels as well as first differences, with and without intercept to analyze unit roots. Lag lengths are determined by Schwarz information criteria (SIC) for ADF while Bandwidths are determined with bartlett kernel estimation criteria in PP and KPSS. Table 3 reports the results of unit roots for India, Pakistan, and Sri Lanka.

**Table 3: Unit root test results**

		Intercept only						Trend and Intercept					
		Overall 1998-2017		Pre-SAFTA 1998-2006		Post SAFTA 2009-2017		Overall 1998-2017		Pre-SAFTA 1998-2006		Post SAFTA 2009-2017	
		t-/LM	l	t-/LM	l	t-/LM	l	t-/LM	l	t-/LM	l	t-/LM	l
		statis		statis		statis		statis		statis		statis	
		s		s		s		s		s		s	

**Panel: A BSE 100 (India)**

AD F	level	-0.82	8	-1.13	6	-3.41*	5	4.98**	6	-3.28*	4	1.91**	0
		16.38		14.81		19.38		31.61		18.80		20.05	
PP KPS S	level	**	21	*	15	*	13	**	20	*	15	*	10
	level	3.32	23	1.40	16	2.06	14	0.35	21	0.48	15	0.21*	11
AD F	Ist	-		-		-		-		-		-	
	d	17.72		14.27		15.3*		17.73		14.29		15.3*	
PP KPS S	Ist	*	7	*	5	**	5	*	7	*	5	**	5
	d	16.52		17.39		16.62	11	16.62		13.28		17.33	11
AD F	Ist	*	35	-121***	49	*		*	35	*	50	*	
	d	0.04***	30	0.01***	2	0.10***	67	0.02***	30	0.01***	2	0.08***	67

**Panel: B KSE 100 (Pakistan)**

AD F	level	1.58	16	2.03	13	-1.52	5	-1.09	16	-3.35*	5	19.10**	0
		10.59		9.54*		11.87		29.28		19.37		19.83	
PP KPS S	level	*	20	**	12	*	14	*	21	*	13	*	10
	level	3.13	21	2.14	16	2.41	16	0.77	22	0.60	14	0.35	10
AD F	Ist	-		-		-		-		-		-	
	d	12.70		11.19		17.85		12.91		10.66		17.83	
PP KPS S	Ist	*	15	*	11	*	4	*	15	*	13	*	4
	d	0.04***	30	0.01***	2	0.10***	67	0.02***	30	0.01***	2	0.08***	67

PP	<i>Ist</i>	-											
	<i>d</i>	11											
	<i>i</i>	8.2											
PP	<i>f</i>	**											
	<i>f</i>	*	14										12
	<i>f</i>			*	62								
KPS	<i>Ist</i>	-											
	<i>d</i>												
	<i>i</i>												
S	<i>f</i>	0.08***	19	0.17***	44	0.22***	13	0.02***	19	0.05***	44	0.16*	13
	<i>f</i>												
	<i>f</i>												

## Panel: C CSE All Share (Sri Lanka)

AD	F	<i>level</i>	<i>s</i>	-1.41	7	0.37	13	*	0	**	7	*	1	*	0		
PP	KPS	<i>level</i>	<i>s</i>	9.7		8.0		16.		26.		18.		17.			
				9*		3*		53		41		76		00			
				**	17	**	11	*	11	*	19	*	11	*	10		
S	<i>level</i>	<i>s</i>	3.27	23	2.34	16	0.91	13	0.31	21	0.61	12	0.22	12			
			<i>Ist</i>														
AD	F	<i>d</i>	<i>i</i>	20.		11.		14.		20.		11.		14.			
				51		22		42		49		28		42			
				**		**		**		**		**		**			
PP	KPS	<i>f</i>	<i>f</i>	*	6	*	12	*	6	*	6	*	12	*	6		
				<i>Ist</i>													
S	<i>d</i>	<i>i</i>	<i>f</i>	17		25		10		17		40		11			
				3.8		8.6		8.9		3.6		2.1		1.7			
				**		**	41	**		**		**	41	**			
KPS	<i>Ist</i>	<i>d</i>	<i>i</i>	*	87	*		*	59	*	87	*		59			
				<i>f</i>													
				<i>f</i>													
S	<i>f</i>	<i>f</i>	<i>f</i>	0.08***	12	0.13***	62	0.09***	59	0.08***	12	0.08***	62	0.07***	59		

Note: 1 ADF, PP, and KPSS refer to Augmented Dickey Fuller, Philips-Perron and Kwiatkowski-Philips-Schmidt-Shin unit root tests.

Nifty 500 represents the National Stock Exchange of India index, KSE 100 Index represents the Karachi Stock Exchange of Pakistan 100 Index and CSE All Share represents Colombo Stock Exchange All Share.

*l* represents Lag length and bandwidths. Lag lengths are determined by Schwarz information criteria (SIC) for ADF. Bandwidths in PP and KPSS are determined with Bartlett kernel estimation criteria.

Note 2: throughout the manuscript, \*, \*\*, \*\*\* denote significance at the 10%, 5%, and 1% significance levels respectively.

Note 3: Test critical values for the ADF(intercept) are -3.441, -2.866, and -2.569 for 1%, 5% and 10% significance levels respectively. Similarly, asymptotic critical values for ADF (trend and intercept) are -3.974, -3.418, and -3.131 for 1%, 5% and 10% significance levels respectively. Test critical values for the PP (intercept) are -3.436, -2.864, and -2.568 for 1%, 5% and 10% significance levels respectively. Similarly, asymptotic critical values for PP (trend and intercept) are -3.966, -3.414, and -3.129 for 1%, 5% and 10% significance levels respectively. Asymptotic critical values for the KPSS (intercept) are 0.739, 0.463, and 0.347 for 1%, 5% and 10% significance levels respectively. Similarly, asymptotic critical values for KPSS (trend and intercept) are 0.216, 0.146, and 0.119 for 1%, 5% and 10% significance levels respectively.

From the results reported in table 3, PP test results fail to reject the null hypothesis of a unit root for all the series during all three periods. ADF provide mixed results for level data but reject the unit root hypothesis for first differences in all series. However, KPSS reject the null hypothesis of stationarity in levels but fail to reject the null hypothesis in case of first difference of series in all the three periods. Therefore, we conclude that all three stock indexes are not stationary at levels but their 1st difference is stationary during all three periods<sup>6</sup>. So the results are consistent with the overall weak form of stock market efficiency. We conclude that all the three indices are I(1) series.

### **JJ Cointegration Analysis:**

The co-movement of stock prices between different markets represent the integration between them. Since all the series are of same integration order, I (1) we applied JJ cointegration (1990) test to analyse whether stock returns hold any long run equilibrium relationship or not. In order to apply cointegration test first of all lag, lengths are determined in VAR framework, using all five information criteria: i-e LR, Final prediction error (FPE), Akaike information criterion (AIC), Schwarz information criterion (SC), Hannan-Quinn information criterion(HQ). For an overall period of series, LR, FPE, and AIC tests suggest optimum lag length as twelve (12) when we apply these criterias with maximum lag length 13 and above while SC suggests 6 and HQ suggest 8 optimum lags. So for JJ cointegration, we will use 12 lags. Similarly, For Pre-SAFTA series, three out of five criteria suggest the optimum lag length is 9 when we apply these criterias with maximum lag length 9 or above. For Post-SAFTA series, four out of five criteria suggest the optimum lag length is six when we apply these criterions with maximum lag length 6 or above.

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<sup>6</sup> It is a general rule of statistic about hypotheis testing that a null hypothesis can only be affirmed not proved. However, rejecting a null hypothesis menas it is really not true. Thus alternative hypothesis is always a stronger hypothesis than the null hypothesis.  
<https://stats.stackexchange.com/questions/30569/what-is-the-difference-between-a-stationary-test-and-a-unit-root-test/235916#235916>

**Table 4: JJ cointegration tests for SAARC equity markets Before and after SAFTA agreement**

		rank	$\lambda$ -Trace	5% CV*	$\lambda$ -max	5% CV*
<i>Ind-Pak-SL</i>	<b>Overall period</b>	$r=0$	31.013	29.797	25.408	21.132
		$r \leq 1$	5.605	15.495	4.858	14.265
		$r \leq 2$	0.747	3.841	0.747	3.841
	<b>Pre-SAFTA</b>	$r=0$	50.782	29.797	36.854	21.132
		$r \leq 1$	13.928	15.495	13.572	14.265
		$r \leq 2$	0.356	3.841	0.356	3.841
	<b>Post-SAFTA</b>	$r=0$	57.456	29.797	32.870	21.132
		$r \leq 1$	24.586	15.495	23.306	14.265
		$r \leq 2$	12.794	3.841	1.279	3.841

Note 1: *Ind-Pak-SL* represents *India-Pakistan-Sri Lanka* respectively.  $\lambda$ -Trace represents Trace Statistic and  $\lambda$ -max Max. Eigen statistic respectively.

Note 2: Johansen cointegration tests are used allowing for a constant term, but no trend, in the cointegrating equation and linear deterministic trend in data for the system of all three stock exchanges.

Table 4, shows the results of JJ (1990) cointegration test, which represents the Trace statistic, Max Eigen statistic at 5% confidence level value, for all three markets. Results of both trace statistic as well as max. eigen statistic suggests the existence of single cointegration vector at 5% significance level among the three markets for the overall period and Pre-SAFTA periods. While in case of Post-SAFTA, both max. eigen values and trace statistic suggest the existence of two cointegration vectors among three markets. So we conclude that all these three markets hold long run equilibrium relationship in the Overall, Pre and Post-SAFTA period. However, cointegration increased in the Post-SAFTA period. So results found a positive evidence that the SAFTA pact increases the cointegration between the capital markets of the South Asian countries. These findings are consistent with the prior studies on the RTAs and capital market integration in the other regions of the world such as Aggarwal and Kyaw (2005) found the positive impact of NAFTA agreement on the integration of NAFTA region; Adjaouté and Danthine (2000) and Hooy and Goh (2007) document increased integration in EU after EU agreement. However, findings of current study contradict to Easterly et al. (2003)

did not found a positive impact of NAFTA on the economic convergence of North American region.

Findings suggest that the trade agreement (SAFTA) increased the capital market integration of the region which is the evidence of positive impact of the trade agreement. It shows that SAFTA removes the barriers to the cross border capital movements resulting in increased foreign investments. Hence the capital is more efficiently allocated and cost of capital is lower. The integrated and well-functioning capital markets result in the enhanced economic growth of the region and have a positive impact on all the economy. The region will benefit in number of ways by these integrated markets, it helps in diversification of risks, reduced information asymmetry and cost to investors; the financial institution will be more competitive and will provide the better service and products; overall it will attract the investors from other parts of the world as well (Irving, 2005).

## 5. CONCLUSIONS

Regional trade agreements are important for the economic growth and welfare enhancement. South Asian Free Trade Agreement (SAFTA) also have the same objectives such as to remove different trade tariffs and quotas which result in increased imports and exports. This elimination of trade barriers followed by increased regional trade. The present study investigates the impact of SAFTA on capital markets integration of the south Asian region. Weekly data from three representative countries for the period of 1998-2017, divided into two sub periods 1998-2006 (Pre-SAFTA) and 2009-2017(Post-SAFTA) has been examined. The period from 2007-2009 is excluded because of great financial depression. This study documents that the cointegration between the capital markets of South Asia has increased after SAFTA passage. Stock markets of south Asian region move closer to each other as a result of SAFTA. It can also be concluded that SAFTA has a positive impact on the intra-regional trade and markets are closer to each other. It implies that RTAs like SAFTA enhance the linkages between the stock markets, and investors should consider such agreements before making a decision about an investment. The probable rationale behind is that cross border portfolio investments increased significantly between SAARC countries so that it has an incremental impact on the integration of capital markets.

Overall, current study the evidenced that equity markets of South Asia are more integrated after SAFTA agreement that reflects the positive impact of the free trade agreement on the regional capital markets. To further enhance the benefits of SAFTA, it is recommended to synchronize the financial markets infrastructure, strengthen the surveillance mechanisms, and encourage the foreign investors.

Further research is recommended for this region to explore the effectiveness of the SAFTA, its impact on the bilateral FDIs and cross-border portfolio investments.

### **Acknowledgments:**

Authors thanks to reviewers and participants of Globalization and Higher Education in Economics and Business Administration 10<sup>th</sup> edition, an International Conference held in Oct 2017 at the Alexandru Ioan Cuza University, in Iasi, Romania, for their valuable suggestions and comments to an earlier version of this study.

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# INFLUENCE OF LOCAL VERSUS FOREIGN CORPORATIONS, AS SHAREHOLDERS, ON FINANCIAL PERFORMANCE OF ROMANIAN LISTED COMPANIES

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**Abstract:** *In the actual context of global mobility of investors and capitals, diverse categories of local and foreign shareholders (institutional investors, governmental agencies, corporations or individual investors) influence business activities, management and results of the owned entities. Shareholders' monitoring ability is related to their interests and their involvement in the investee's business. This study contributes to the on-going debate referring to local and foreign shareholders and investigates the influence of both local and foreign corporate shareholders on financial performance of Romanian listed companies during 1997-2016. Results of fixed-effects panel regression analysis reveal that local corporations positively influence the profitability of their affiliates, as measured by ROE. However, foreign corporate shareholders do not significantly influence financial performance of Romanian entities. Thus, the expected benefits associated with foreign ownership do not enhance the performance of local companies. These findings helps future privatisation or investment decisions in Romanian listed companies. Moreover, the results raise further questions regarding the interests of foreign companies investing in Romanian stock market.*

**Keywords:** *corporate shareholders, foreign ownership, ROA, ROE.*

**JEL Classification:** *G32, M40, L25*

## 1. INTRODUCTION

Ownership composition is recognized as one of the numerous factors that determine financial characteristics of the firms (Boubakri et al., 2004; Bhagat and Bolton, 2007). Shareholders diversity, with distinct interests and expectations about the investees, influences managerial decisions and financial results of the

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companies. Moreover, globalisation phenomenon and spread of multinational businesses have a considerable influence on worldwide economies, and thus, on local business environment as well (Lskavyan and Spatareanu, 2008). Ownership is divided in both local and foreign shareholders, and its structure substantially varies across countries and firms. Thus, questions are raised regarding the differences in monitoring effectiveness, performance influence, interactions and strategic goals of both local and foreign investors. These topics are considered under-researched, and more evidence is demanded about the consequences of increased mixture of shareholders around the world (Ormazabal, 2018).

Moreover, an important distinction exists among shareholders regardless of their country of origin. According to the purpose of their investment, owners are classified as transactional owners (which are only interested in the returns of their investment), and relational owners, or strategic shareholders (which target long-term involvement, and both profits and growth of the acquired entity) (Aguilera and Crespi-Cladera, 2016). It is intuitively clear that the relational or strategic owners are those that make an impact on the development of investee companies. Among those, four categories of investors can be defined: state, institutional investors, corporations, and individuals (including employees). Whereas ownership empirical studies mainly refer to state ownership, family business, or institutional investors, there is a lack of conclusive evidence regarding the influence of corporate ownership on the acquired entities. This paper aims to fill this gap and investigates the effect of corporate investors, both local and foreign, on financial performance of investee companies. Existing studies indicate mixed and contradictory results regarding the influence of foreign corporate ownership on financial characteristics of local firms (Konings, 2001; Masca and Ciupac-Ulici, 2013; Akman *et al.*, 2015; Carausu, 2016), and country context is a distinctive factor of the relation investors-investee. Therefore, the current study refers to the specific case of Romania, as a competitive frontier market in Central and Eastern Europe.

As strategic interests of investing companies vary, it is expected that local and foreign corporations exert distinctive monitoring and business influence on their investees. Romania, as a developing economy and frontier financial market, offers diversification opportunities to foreign investors. In the same time, similar to the other countries from the region, Romania internationally competes and seeks to attract foreign capital that contributes to its economic growth (Hansen *et al.*, 2015).

Thus, this study investigates the consequences of corporate investment in local entities in order to verify if generally expected benefits of foreign investors are significant for the local market. The research is conducted in the context of continuous movements of the foreign corporate investors in Romania. Some well-known multinational companies are interested in the local entities, whereas other big players announce their intention to leave the country and close their operations in Romania. Institutional environment, political factors or the performance of the investee companies explain the changes in ownership structure of entities. This study analyses business results as a consequence of changes in ownership composition, and compares the influence of foreign corporate shareholders with local corporate shareholders.

All stakeholders and shareholders appear capable of influencing managerial actions to some extent, but on a different manner (Ormazabal, 2018). The influence of foreign shareholders is characterised by high information asymmetries and liability of foreignness (Kang and Kim, 2010), although it is associated with higher firm valuations, better operating performance, or lower capital expenditures (Ormazabal, 2018). In contrast, literature lacks on evidence regarding the influence of local corporate shareholders. This study is innovative by questioning the financial effect of investments of both foreign and local corporations in local firms. This relationship is analysed over time and covers the period of transition and development of Romanian stock market, immediately after the reopening of Bucharest Stock Exchange (in 1995), until current years. It is noticed that ownership structure significantly changed during the studied period, 1997-2016, with a decrease of the state ownership in the public entities, and an increase of corporate shareholders, which strategically held a dominant share of local entities. At the moment of the study, 86 companies were listed on the regulated segment of Bucharest Stock Exchange. Due to missing data for time-dimension and exclusion of financial and utilities companies, a reduced sample of 65 firms was analysed (28 companies mainly held by foreign corporate shareholders and 37 companies mainly held by local corporate shareholders).

The results of fixed-effects panel regression analysis indicate that local corporations have a positive effect on profitability of listed investees, private ownership being beneficial for public entities. In contrast, foreign corporations do not influence the performance of their local affiliates. These findings raise questions and

suspicious about the interests of foreign corporations that invest in Romanian entities. Moreover, these results may inspire policy-makers' decisions responsible for privatization of state entities or in charge with foreign investments policies, management and representatives of local entities, or foreign investors interested in Romanian companies. The study contributes to a better understanding of the ownership composition of local public entities, and its evolution over the last two decades. It shows that Romania has opened their capital market to foreign investors, but the result of foreign investment do not indicate a visible enhancement of performance of Romanian entities. It is the unique contribution of the paper to investigate the problem of corporate ownership in Romania, over the entire period of re-opening, transition and development of Bucharest Stock Exchange.

The content of the paper is structured as following: section two covers the literature insights and hypothesis development; section three presents the methodology and descriptive analysis of corporate shareholdings of Romanian listed companies; sections four presents the empirical study and discussions of the results; and section five presents the conclusions.

## **2. THEORETICAL BACKGROUND AND HYPOTHESIS DEVELOPMENT**

Existing literature presents various studies on performance and financial stability of state companies, implications of privatization process, competition between foreign and local entities, or the role and interests of institutional investors, in different contexts (Konings, 2001; Masca and Ciupac-Ulici, 2013; Akman *et al.*, 2015; Carausu, 2016). These studies indicate that the diverse types of shareholders, especially if they have a strategic position in terms of voting rights and control over the investee, express distinctive interests (Tam and Tan, 2007). Accordingly, they influence the activity and performance of acquired companies (Chen *et al.*, 2014a).

Generally, it is assumed that foreign corporations are different from local ones by numerous aspects as: dimension and scale effects benefits, experience and notoriety in international transactions, superior technologies, organisational and managerial structures, financing opportunities, etc. (Narula and Pineli, 2016; Taran *et al.*, 2016). Local entities affiliated to foreign corporations are a kind of foreign entities as well, and thus, it is expected they have a higher financial performance in comparison with local firms. This is explained by the advantages of having a foreign shareholder, which is likely to significantly reorganise the activity and enhance the

value of local investees (Chari *et al.*, 2009; Omran, 2009; Ongore, 2011; Chen *et al.*, 2014a). On the other hand, the entities with local establishment have experience in the local business environment and a better knowledge of labour market, potential suppliers, available resources, customers' preferences, or local legislation (Dunning and Pearce, 1988). Therefore, the differences between local companies with local ownership and those with foreign ownership have multiple forms.

According to Konings (2001), who compared financial performance of foreign and local companies from Poland, Romania and Bulgaria, only foreign companies operating in Poland registered better results than their local counterparts during 1993-1997. Basti *et al.* (2011) observed as well that there are not significant differences in financial performance of manufacturing companies from Turkey either owned by local or foreign shareholders.

Phung and Mishra (2016) studied the influence of the various types of shareholders on financial performance of companies from Vietnam during the period 2007-2012. Their results show that there are non-linear relationships between financial performance and both state and foreign ownership of the listed firms, with positive influence in the case foreign investments. Like Romanian companies, many Vietnamese firms had operated in a centrally planned economy and then, passed through a partial or total privatization process during the period of transition to a market economy. According to Phung and Mishra (2016), it seems that foreign ownership contributes to development of local companies.

Distinctive categories of shareholders influence owned companies in various ways. For instance, besides the broad interest of profit maximization, state companies have social and political interests such as decrease of unemployment rate or local production enhancement (Phung and Mishra, 2016). Individual investors or family businesses have a positive effect on financial performance of their investees (Ongore, 2011) due to reduced informational asymmetry (Maury, 2006; Kowalewski *et al.*, 2010). Institutional investors have also a positive influence on performance of the firms by efficiently monitoring the management (Imam and Malik, 2007; Hsu and Wang, 2014; Nashier and Gupta, 2016). However, institutional investors' interest is mainly financial, without active and long-term perspectives of involvement in the activities of the firms (Douma *et al.*, 2006). Thus, the diverse categories of shareholders affect the management and strategic decisions of the companies (Choi *et al.*, 2012) by having different

informational requirements and goals (Douma *et al.*, 2006; Chen *et al.*, 2014a). When it comes to corporations as investors, literature addresses the problem of subsidiaries and how their performance and financing policies are influenced by parent companies (Avarmaa *et al.*, 2011; Fuest *et al.*, 2011; Chang *et al.*, 2013; Lee *et al.*, 2014; Berry, 2015; etc.). Existing studies indicate that there are various differences between subsidiaries of domestic firms and subsidiaries of multinational firms, and the main channel by which foreign entities outperform local companies is attributed to knowledge transfer and innovation (Lee *et al.*, 2014; Berry, 2015).

Previous research reported mixed results regarding Romanian context as well. According to Bredea (2014), ownership concentration and ownership composition do not influence financial performance, but affects capital structure of listed entities. Masca and Ciupac-Ulici (2013) indicated that foreign ownership does not necessarily influence the performance and productivity of local entities, while Carausu (2016) found that foreign shareholders positively influence financial results of large listed companies from Central and Eastern Europe, including Romania. As a reply to these contradictory findings, we investigate the specific influence of both local and foreign corporations as shareholders on financial performance of listed companies from Romania.

Based on the aforementioned literature insights, we expect to notice a different influence of local and foreign corporate investments on financial performance of local investees, as expressed by the following hypothesis:

***H1. Local and foreign corporations as shareholders of Romanian listed companies have a different influence on financial performance of investee entities.***

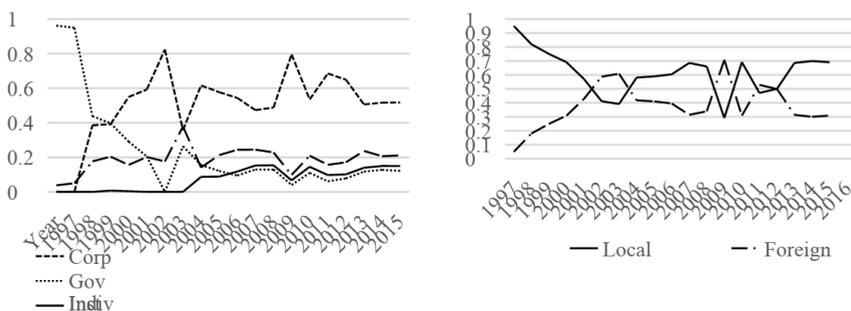
As foreign corporations may invest in local entities for strengthening their position on the local market, for advantages in terms of access to resources, for diversification purposes (Dunning and Pearce, 1988), or numerous other strategic reasons, it may be understood that their influence on local entities can be either positive or negative. Some of the same reasons may explain the local corporate investments on the listed companies, and thus, we assume that influence of local ownership on financial performance of investee can also be mixt. However, it is clear that business experience of local and foreign corporations as parent entities is different. Therefore, regardless of their distinctive influence, it is expected that both local and foreign corporations significantly influence the financial

performance of local investees. This assumption is motivated by the presumed long-term interest of corporations in their investments.

### 3. DATA AND METHODOLOGY

First of all, we conduct a descriptive analysis of ownership composition of Romanian listed companies in order to provide a better understanding of the research context and its specificities. The analysed period is 1997-2016 or since the Bucharest Stock Exchange became functional after the re-opening in 1995 until the latest available data at the date of the research. On the regulated segment of Bucharest Stock Exchange were listed 86 companies when the study was conducted. All companies were considered for analysis. The evolution of their ownership composition was investigated. Data was retrieved from Thomson Reuters Eikon database. Based on the dominant percentage of shares held by local and foreign shareholders, the dataset was divided into two sub-samples: sample of firms owned by local shareholders, and sample of firms owned by foreign shareholders. Moreover, regardless of the distinction local versus foreign, four categories of investors define the ownership of Romanian listed companies: state, institutional investors, corporations, and individuals (including employees). As expected, data exploration reveal that the ownership composition of Romanian listed companies significantly changed over time. **Figure 1** presents the evolution of ownership composition of selected companies during 1997-2016.

**Figure 1. Ownership composition of Romanian listed companies during 1997-2016**  
(average of firm level ratio of shares held by each category of investors in total shares)



Note: **Corp** represents Corporate shareholders; **Gov** – Governmental authorities;  
**Indiv** – Individuals; **Inst** – Institutional investors.

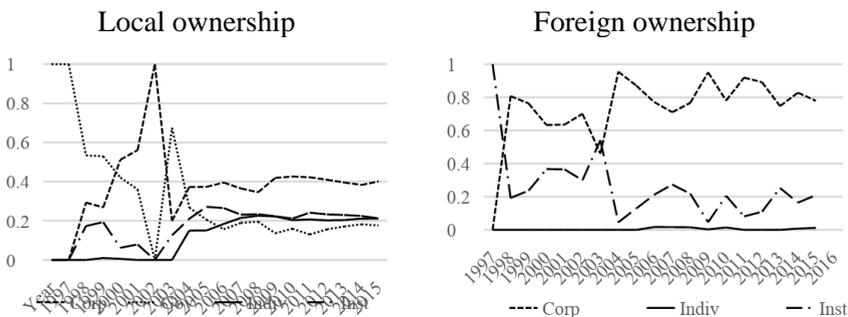
Source: own processing of ownership data

Many of the Romanian listed companies were state entities in the past. Because of privatisation waves, the state became nowadays the category with the lowest share in overall capital of listed companies. Its place seems to be taken by corporate investors. Institutional investors, and more recently, individual investors have enhanced their position on the market as well. However, although local investors mainly held the capital of Romanian listed companies, foreign investors overcame local ownership in certain periods (at the beginning of 2000s or during the recent financial crisis, 2009-2011).

As further detailed in **Figure 2**, local ownership is represented by corporations, state agencies, institutional and individual investors, whereas foreign ownership is mainly represented by corporations, institutional investors, and some individuals. Individual foreign investors represent a minor category for Romanian stock market. This descriptive analysis of ownership structure indicates that Romanian financial market is stable and predictable. Corporations, either local or foreign, represent the dominant category of investors on the local market. It is expected that they will maintain the investments over time because the relationship between parent and investee entities is a business operating relationship. Therefore, studies of ownership structures, at least for Romanian setting, need to distinguish corporations or corporate shareholders as the dominant category of investors.

**Figure 2. Composition of local and foreign ownership of Romanian listed companies during 1997-2016**

(average of firm level ratio of shares held by each category of investors in total shares)



Note: *Corp* represents Corporate shareholders; *Gov* – Governmental authorities; *Indiv* – Individuals; *Inst* – Institutional investors.

Source: own processing

It is relevant and interesting to analyse also the origins of foreign investors. From **Figure 2**, it is noticed that foreign corporations increased their shares in Romanian market after 2005, since close to the accession date of Romania to European Union. As presented in **Table 1**, Romanian listed companies attracted diverse foreign corporations from multiple countries since the same period, after 2005. Thus, companies from Western Europe, Cyprus, Belize or Cayman Islands, Russia, Saudi Arabia or the United States of America have invested in Romanian stock market. Considering that some of these countries are known as famous off-shores, it is interesting to observe how these foreign corporations influence financial results of Romanian investees.

**Table 1. Number of foreign corporate investors per country of origin during 1997-2016**

Country	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Austria									2	2	2	3	2	2	2	2	2	2	2	3
Belgium												1	1				1			
Belize											2	2	2	2	2	2	2	2	2	2
Cayman Islands												1	2	2	2	2	3	3		
Cyprus			4	7	7	5	1	1	6	7	8	7	4	2	3	5	8	5	6	4
Czech Republic				1	1				1	1	1	1	1	1	1	1	1	1	1	1
France													1	1	1	1	2	2	2	2
Germany									1	1	2	1	1	1	1	1	1	2	2	2
Greece									8	8	8	3	2	1	1	1	1	1	1	1
Luxembourg									1	1	1	1	1	1	1	1	1	1	1	1
Netherlands									1	1	2	1	1	1	1	1	1	2	4	4
Russia									1	1	1	2	2	2	2	2	1	1	1	1
Saudi Arabia											1	1	1	1	1	1	1	1	1	1
Switzerland					1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2
United Kingdom													1	1	1	1	1	2	2	3
United States												1	1				1		1	1

*Source: own processing*

Having understood the evolution of ownership composition of Romanian listed companies, we further design the empirical study of the influence of local and foreign corporations on financial performance of investee entities. In this regard, the dataset was refined in order to cover only the companies with corporate shareholders. Moreover, financial and utilities entities were excluded due to their distinctive business profile. Variations in number of listed companies over the analysed period (1997-2016), variations in ownership structure, and data availability restrictions led to a reduces sample size of 230 firm-years observations for the sub-sample of entities

owned by local corporations, and 172 firm-years observations for the sub-sample of companies dominantly held by foreign corporations.

The variables were selected based on literature evidence. First, the two types of corporate shareholders, local and foreign investors, and the ratio of their shares held in total outstanding shares of the listed companies were considered (Basti *et al.*, 2011; George and Kabir, 2012; Chen *et al.*, 2014a; Mihai, 2014). Second, financial performance was two-fold measured: as operating performance or return on assets (ROA) (Kowalewski *et al.*, 2010; Ongore, 2011; George and Kabir, 2012; Mihai, 2014; Akman *et al.*, 2015), and as performance of the entire activity of the firms or return on equity (ROE) (Kowalewski *et al.*, 2010; Basti *et al.*, 2011; Ongore, 2011; Mihai, 2014). Third, additional variables with effect on financial performance were selected as control variables: company size measured by total assets (Akman *et al.*, 2015; Chang *et al.*, 2013; Berry, 2015), and a dummy variable which reflects the effect of adoption of International Financial Reporting Standards (IFRS) for financial reporting purposes, during the analysed period. A synthesis of the selected variables is presented in **Table 2**.

**Table 2. Selected variables**

Variables	Formula / Definitions	Explanations
Local corporate shareholders (LO)	Ratio of shares held in total shares of the company	Local corporations as shareholders
Foreign corporate shareholders (FO)	Ratio of shares held in total shares of the company	Foreign corporations as shareholders
Return on Assets (ROA)	Operating Income / Total Assets	Financial performance from the operating activity
Return on Equity (ROE)	Net Income / Shareholders' Equity	Financial performance from the entire business activity
Size (LnTA)	Natural logarithm of Total Assets	Size of the company
IFRS	0 – Romanian Accounting Standards 1 - International Financial Reporting Standards (IFRS)	Financial standards applied by the reporting company for yearly financial statements

According to the purpose of the study, the statistical method applied for investigating the influence of local and foreign corporate ownership on financial performance of the firms is least squares panel regression analysis, with cross-

section and period fixed effects. The approach is similar to Bredea (2014). Fixed effects are included in order to control for specific particularities of the individual companies and events that occurred during the analysed period (Baltagi, 2008). The general specification of the applied model is:

$$DV_{it} = \beta_0 + c_i + u_t + \beta_1 Own_{it} + \beta_2 LnTA_{it} + \beta_3 IFRS_{it} + \varepsilon_{it}$$

where *DV* represents the dependent variable (ROA, respective ROE); *Own* represents corporate ownership (local - LO or foreign -FO); *LnTA* is the company size control variable, *IFRS* is the control variable for financial reporting standards, *i* stands for firm *i*, and *t* for period *t*; *c<sub>i</sub>* represent cross-section fixed effects, *u<sub>t</sub>* are the time fixed effects, and  $\varepsilon_{it}$  is the error term.

Descriptive statistics of selected variables are presented in **Table 3**. It can be observed that for both local and foreign corporate shareholders the ratio of shares held ranges from very small to almost unit values. This indicates that not all entities may be significantly influenced by their corporate investors. However, on average, the level of corporate ownership is close to 0.5 or above, which shows an overall dominance of corporate investors. In terms of performance, Romanian listed companies seem to have financial difficulties, as illustrated by minimum and mean values of ROA and ROE. The two sub-samples are comparable in terms of size of acquired entities, and IFRS adoption.

**Table 3. Descriptive statistics**

<b>Panel A: Firms with local corporate ownership</b>					
<b>Variables</b>	<b>N</b>	<b>Mean</b>	<b>Std. dev.</b>	<b>Min</b>	<b>Max</b>
LO	235	0.490	0.238	0.031	0.938
LnTA	235	18.674	1.066	16.306	23.192
IFRS	235	0.608	0.489	0	1
ROA	230	0.039	0.086	-0.358	0.538
ROE	230	-0.044	1.528	-13.986	11.598
<b>Panel B: Firms with foreign corporate ownership</b>					
<b>Variables</b>	<b>N</b>	<b>Mean</b>	<b>Std. dev.</b>	<b>Min</b>	<b>Max</b>
FO	176	0.544	0.291	0.011	0.996
LnTA	173	19.530	1.801	16.420	24.487
IFRS	176	0.511	0.501	0	1
ROA	168	0.027	0.152	-1.102	0.827
ROE	172	-0.024	1.146	-9.109	4.690

More details regarding the relationships among variables are revealed by the results of correlation analysis, as presented in **Table 4**. Surprisingly, correlation analysis indicates that nor local or foreign corporate ownership is significantly related to financial performance of listed firms. It also shows that control variables related to dependent or other independent variables differ between the two analysed samples. This suggests that entities owned by local companies are different in size and financial reporting practices then foreign owned entities. Whereas companies with local corporate ownership have operational performance (ROA) negatively associated with IFRS adoption, companies with foreign corporate shareholders have the overall business performance (ROE) positively associated with IFRS adoption. Moreover, the share of corporate ownership is positively correlated with the size of acquired entities for both sub-samples (local versus foreign corporate ownership).

**Table 4. Pearson correlation matrix**

<b>Panel A: Firms with local corporate ownership</b>				
	<b>ROA</b>	<b>ROE</b>	<b>LnTA</b>	<b>IFRS</b>
<b>ROE</b>	0.190***			
<b>LnTA</b>	-0.074	0.081		
<b>IFRS</b>	-0.299***	0.023	0.097	
<b>LO</b>	0.044	0.007	0.183***	0.004
<b>Panel B: Firms with foreign corporate ownership</b>				
	<b>ROA</b>	<b>ROE</b>	<b>LnTA</b>	<b>IFRS</b>
<b>ROE</b>	0.349***			
<b>LnTA</b>	0.158*	-0.010		
<b>IFRS</b>	0.130	0.141*	0.209**	
<b>FO</b>	-0.044	0.072	0.216**	0.287***

\*\*\*, \*\*, \* represents significant at 0.01, 0.05, respective 0.1 level.

#### 4. RESULTS

Despite of presumptions drawn from previous descriptive and correlation analyses, the influence of local and foreign corporate ownership on financial performance of Romanian listed companies is investigated through fixed effects panel regression analysis. Two distinct models are estimated for the two dependent variables considered: ROA, and ROE. The results for the companies with local corporate shareholders are presented in **Table 5**.

**Table 5. Results of least squares panel regression analysis for firms with local corporate ownership**

Dependent Variable	ROA		ROE		
	Independent Variables	Expected sign	Coefficients (t-statistics)	Expected sign	Coefficients (t-statistics)
LO		+/-	-0.030 (-0.789)	+/-	1.721* (1.894)
LnTA		+	0.047*** (3.282)	+	0.396 (1.175)
IFRS		+/-	-0.008 (-0.495)	+/-	0.112 (0.289)
Constant			-0.818*** (-3.006)		-8.355 (-1.329)
N			230		230
R-squared			0.708		0.485
F Statistics			7.654***		2.979***

\*\*\*, \*\*, \* represent significant at 0.01, 0.05, respective 0.1 level.

The estimated results indicate that local corporate ownership do not have a significant influence on the financial performance from operating activity. However, in comparison to ROA model, local corporations as dominant shareholders have a positive significant influence on the profitability of listed companies as measured by ROE. This can be explained by the investing and financing operations in which local entities are involved under the influence of the local shareholders corporations. These affect the investees' net income and are captured by the measurement of financial performance as ROE. Return on Assets is significantly related to companies size, and their total assets.

In contrast, the fixed effects panel regression analysis for the group of firms with foreign corporate shareholders reveals that foreign ownership does not significantly influence the financial performance of Romanian listed companies. The estimated results are presented in **Table 6**.

**Table 6. Results of least squares panel regression analysis for firms with foreign corporate ownership**

Dependent Variable	ROA		ROE		
	Independent Variables	Expected sign	Coefficients (t-statistics)	Expected sign	Coefficients (t-statistics)
FO		+/-	-0.098 (-1.048)	+/-	1.248 (1.636)
LnTA		+	-0.036 (-0.801)	+	0.186 (0.504)
IFRS		+/-	-0.017 (-0.339)	+/-	0.086 (0.210)
Constant			0.797 (0.907)		-4.373 (-0.611)
N			168		172
R-squared			0.343		0.216
F Statistics			1.334		0.728

\*\*\*, \*\*, \* represent significant at 0.01, 0.05, respective 0.1 level.

Although the sign of estimated coefficients are similar for the two categories of investors, local and foreign, they differ by their level of significance. From the perspective of performance of operating activity, it seems that neither foreign nor local corporations invested in or request the renewal of operating capacities of their investees. Moreover, thinking at the countries of origin of foreign corporations that invested in Romanian entities, most of them countries with a controversial reputation or tax regime, it is wondered what are the interests of these investors in their local affiliates (Mueller and Peev, 2007). This represents a further research avenue inspired by the current study. It is known that foreign corporations invest in local entities for strengthening their position on the local market, for advantages in terms of access to resources or for diversification purposes (Dunning and Pearce, 1988), but it is surprising that their influence is not visible in terms of financial performance of the acquired companies.

Overall, our results are in line with Akman *et al.* (2015) who found that foreign ownership does not significantly influence financial performance of owned entities when financial performance is measured based on accounting data, such as ROA. Moreover, they partially support findings of Brendea (2014), who indicated that ownership concentration has no effect on firm performance, and contradict the

findings of Carausu (2016), who indicated that foreign ownership significantly influence the financial performance of firms from Central and Eastern European region. However, our research hypothesis is confirmed, being found that local and foreign corporate ownership differ in their influence on financial performance of Romanian listed companies. Thus, our study emphasizes that local and foreign shareholders have a distinctive effect on the local entities, and that corporations, as shareholders, needs to be considered a distinctive category of owners, which should be analysed accordingly.

Corporate diversification of companies that invested in domestic listed firms can be theoretically interpreted through agency and resource-based perspectives. Corporate investments lead to market power advantages, ability to exploit excess firm specific assets and share resources with/ from acquired companies, tax and other financial advantages associated with diversification (George and Kabir, 2012). On the other hand, diversifying activities of a firm can generate disadvantages, such as inefficient resource allocation or information processing problems (George and Kabir, 2012). Our results indicate that corporate investment efficiency is not reflected by the financial results of investee entities, and foreign shareholders do not enhance the profitability of domestic companies. In contrast, stronger business ties exist among local corporate shareholders and investees, and those are beneficial for domestic firms. This suggests that for future privatisation projects or strategic changes in ownership structure of domestic entities more credit should be given to local investors. Their monitoring and controlling abilities, and their involvement in investees' businesses have a positive effect on profitability. On the other hand, our findings suggest that foreign corporate investors may be also reserved in investing in local market due to the lack of association between financial performance of local entities and existing foreign ownership.

Additional robustness checks were conducted in order to prove the consistency of the estimated results. Herfindahl Index, as a measure of ownership concentration, replaced the ratios of shares held by corporate investors in empirical analysis. This index is determined as sum of squared ratios of shares held by each shareholder (Brendea, 2014; Chen et al., 2014b). The estimated results are presented in **Table 7**. The findings of the study remain similar and robust to changes in measurement of ownership variables.

**Table 7. Results of least squares panel regression analysis with ownership concentration measures as robustness tests**

<b>Dependent Variable</b>	<b>Local corporate ownership</b>		<b>Foreign corporate ownership</b>	
	<b>ROA</b>	<b>ROE</b>	<b>ROA</b>	<b>ROE</b>
<b>Independent Variables</b>	<b>Coefficients (t-statistics)</b>	<b>Coefficients (t-statistics)</b>	<b>Coefficients (t-statistics)</b>	<b>Coefficients (t-statistics)</b>
HI	-0.072 (-1.351)	4.494*** (3.953)	-0.113 (-1.324)	1.141 (1.626)
LnTA	0.048*** (3.337)	0.158 (0.586)	-0.036 (-0.794)	0.196 (0.532)
IFRS	-0.007 (-0.440)	-0.300 (-1.500)	-0.015 (-0.292)	0.067 (0.163)
Constant	-0.827*** (-3.116)	-3.967 (-0.798)	0.773 (0.882)	-4.300 (-0.600)
N	230	230	168	172
R-squared	0.710	0.484	0.347	0.216
F Statistics	7.728***	4.572***	1.355*	0.728

\*\*\*, \*\*, \* represent significant at 0.01, 0.05, respective 0.1 level.

## 5. CONCLUSIONS

This study investigated the effect of ownership composition on financial performance of Romanian listed companies, during 1997-2016. It was revealed that corporate shareholders, both local and foreign, represent the dominant category of investors on local stock market. The analysis of their influence on financial performance, as measured by ROA and ROE, led to surprising results. Partially in line with previous literature, it was found that results from the operating activity are not significantly influenced by corporate ownership. However, the financial performance as measured by ROE is affected by local corporate investors. Moreover, although expected to bring benefits for local entities, foreign corporations as investors do not influence financial performance of Romanian listed companies.

This research is limited to only two indicators of financial performance, but reflects that corporations as investors influence the results of local entities from the perspective of overall business performance. With a considerable relevance for investors, managers and policy-makers, the study reveals the role of corporations as representative shareholders for Romanian stock market. Moreover, the study questions the interests of foreign corporate investors in local entities. Further research may consider the nature and origin of foreign corporate investors in order to investigate what are the motivations and purposes of their investments in Romania.

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# CULTURE AND STOCK PRICE REACTION TO PRIVATE INFORMATION

ANITA TODEA\*

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**Abstract:** *This paper examines the impact of culture on stock price informativeness in a sample of firms from 23 developed stock markets. We find that the information content of private information in stock prices is higher in more individualistic countries and in low uncertainty-avoiding countries. Moreover, financial openness stimulates the incorporation of private information into individualistic countries and in low uncertainty-avoiding countries.*

**Keywords:** *price informativeness, private information, individualism, uncertainty avoidance, firm-specific information, financial openness.*

**JEL Classification:** *G14, G15*

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## 1. INTRODUCTION

The production and aggregation of information as a result of the trading process is one of the core functions of financial markets (Kyle, 1985). This implies that financial markets have an effect on the real economy and are not just a sideshow (Bond et al., 2012). The basic idea is that stock prices may contain certain information that managers do not have, and they can learn from this information about the prospects of their own firms. This private information refers in particular to the external environment of the firm and may relate to the competitive environment in which it operates, the implications of past decisions of the firm's managers, and the firm's investment opportunities. Pricing private information will guide managers in making corporate decisions, such as the decision on corporate investments. This idea is supported by the theories developed by Dow and Gorton (1997) and Subrahmanyam and Titman (1999) and the

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empirical results obtained by Durnev et al. (2004); Chen et al. (2007), Bakke and Whited (2010), or Fressard (2012).

The reflection of private information in stock prices or price informativeness differs from one market to another. Mork et al. (2000) propose a set of factors explaining these differences, and recently Nguyen and Truong (2013) and Eun et al. (2015) have added to this list certain dimensions of culture, such as individualism, tightness and uncertainty avoidance. Both studies use stock price synchronicity as a proxy for price informativeness.  $R^2$  measures the relative amount of market-wide information versus firm-specific information impounded into stock price, thus being an inverse measure of stock price informativeness. Despite being the most popular measure of price informativeness, it is highly controversial in recent literature. First, it is not clear whether price synchronicity reflects informativeness or noise traders (Teoh et al., 2009; Chan and Chan, 2014) or whether it is a direct or an inverse measure (Dasgupta et al., 2010; Kan and Gong, 2017). Second, stocks with low  $R^2$  should have those features that facilitate the incorporation of private information into stock prices, such as fewer impediments to arbitrage and lower information costs. On the contrary, Kelly (2014) shows that low  $R^2$  stocks are infrequently traded, small and with high bid-ask spreads and high price impact. Third,  $R^2$  captures firm-specific information, which is a wider information set that actually includes private information. But business managers are only interested in private information in substantiating their decisions.

The aim of this study is to investigate the relationship between the incorporation of private information into stock prices and two of the culture dimensions proposed by Hofstede (2010), namely individualism / collectivism and uncertainty avoidance. The originality of the empirical approach is given by the use of the information measure of Llorente et al. (2002). By construction, this measure has the potential to capture more accurately the incorporation of private information into stock prices. The main contribution of this study is given by the validation or invalidation of the conclusions obtained by Nguyen and Truong (2013) and Eun et al. (2015), using an alternative measure of stock price informativeness which is less exposed to criticisms.

## 2. CULTURE AND STOCK PRICE INFORMATIVENESS

An accepted definition of culture is provided by Hofstede (1980), according to which 'culture is a collective programming of the mind that distinguishes members of one human group from another'. Different dimensions of culture explain the values of a particular culture and its effects on the organization, workplace and investors' behavior.

The role of culture in the development and functioning of capital markets is widely evidenced in literature. Weber (1930) is among the first to claim that in certain cultures, financial markets have a better development environment than others. More recently, Lal (1999) considers that certain dimensions of culture have led to a more pronounced development of economies and stock markets in Western economies. Empirically, the association between different dimensions of culture and the development of financial markets is highlighted by Dutta and Mukherjee (2012). Other studies highlight the impact of culture on some variables that characterize the way stock markets operate. Different dimensions of culture influence the links between stock markets (Lucey and Zhang, 2010; Beugelsdijk et al., 2010), commonality in liquidity (Moshirian et al., 2017) or stock market volatility (Zheng, 2015).

Individualism / collectivism represents one of the six cultural dimensions analyzed by Hofstede et al. (2010) and, according to the studies of Nguyen and Truong (2013) and Eun et al. (2015), may be the most important cultural factor that determines the incorporation of firm-specific information into stock prices. Specifically, they have shown that firm-specific information content of stock prices is higher in individualistic countries and lower in collectivistic ones. Acting on personal behalf, rather than fulfilling the groups' interests, individualistic investors exhibit superior capacities to gather and analyze firm-specific information. The review of literature by Nguyen and Truong (2013) show that individualistic investors are prone to overconfidence, self-attribution biases and also have high preference for risk. These features of individualistic investors, in conjunction with a series of behavioral models from literature, theoretically support the possibility that, in more individualistic (less collectivistic) nations, firm-specific information is more substantially incorporated into stock prices.

Uncertainty avoidance is the fourth dimension of culture analyzed by Hofstede et al. (2010) and according to Nguyen and Truong (2013) is inversely

correlated with firm-specific information incorporated into stock prices. This dimension refers to the amount of anxiety people have regarding the unknown or ambiguous outcomes. People from more uncertainty-avoiding cultures are more conservative, have a stronger risk aversion and prefer formally structured activities. In their societies, the institutions impose more rules. On the contrary, people from less uncertainty-avoiding cultures prefer more flexible rules, informal activities, and are more open to change and innovation. The theoretical arguments of Nguyen and Truong (2013) are built on the association of conservatism and risk aversion with the results of behavioral models developed by De Long et al. (1990), Shleifer and Vishny (1997) and Barberis et al. (1998).

### 3. MEASUREMENT OF VARIABLES

#### 3.1. Dependent variable

Our dependent variable is the information measure of Llorente et al. (2002). The measure was also used as a proxy for stock price informativeness in relevant studies by Fernandes and Ferreira (2009), Fresard (2012), and De Cesari and Huang-Meier (2015).

This measure starts from the premise that investors are analyzing the trading volumes that provide information on the future stock price. By dividing investors into two categories, those performing hedging operations and speculators based on private information, it is assumed that there will be different dynamics of the stock price. Thus, speculative trades generated positive autocorrelations of returns while hedging trades generate negative autocorrelations.

For each firm-year from the time-series regression we estimate the annual amount of private trading information  $\gamma_{ij}$  from the model:

$$r_{i,j,t} = a_{i,j} + b_{i,j}r_{i,j,t-1} + \gamma_{i,j}(r_{i,j,t-1} \times V_{i,j,t-1}) + \varepsilon_{i,j,t}(1)$$

where  $r_{i,j,t}$  is the return of stock  $i$  of country  $j$  and  $V_{i,j,t-1}$  is the log daily turnover of stock  $i$  detrended by subtracting a 200 trading day moving average. Higher values of  $\gamma_{i,j}$  denote more information-based trading incorporated in stock prices. The intuition behind this interpretation is that in periods of high volume, stocks with a high degree of information-based trading tend to display positive return autocorrelation. Our dependent variable  $\gamma_j$  is an equally weighted average of the  $\gamma_{ij}$  of the individual stocks in country  $j$ .

### 3.2. Independent variables

The *independent* variables of interest are individualism and uncertainty indexes provided by Hofstede (2010). They take values in the range 0-100 and are time invariant.

In order to ensure the comparability of our results with those obtained by Eun et al. (2015) we selected the following control variables. For information opaqueness we have chosen a measure of the intensity of analyst activity following Chan and Hameed (2006). This is the *number of analysts* who issued earnings forecasts for a company during a calendar year. The variable is determined for each country-year as the average of the number of analysts. The data are extracted from I/B/E/S International, taking into account only constituents of the stock market indexes. The *good government index* is determined annually as the sum of the percentile ranks of government effectiveness index and control of corruption index from World Bank database.

We control for economic and financial development with  $\ln(\text{GDP per capita})$  and  $\ln(\text{number of stocks})$ . For macroeconomic instability we use *GDP growth volatility* measured by sample variance of the annual GDP per capita growth using a five-year moving window following Fernandes and Ferreira (2009). Another structural variable included is  $\ln(\text{country size})$  which is log of geographical size in square kilometers for each country. Industrial concentration (*Ind. Herfindahl index*) and firm concentration (*Firm Herfindahl index*) are measured by Herfindahl indexes determined from the annual sales of all listed companies on the markets under study.

## 4. THE DATA AND DESCRIPTIVE STATISTICS

The study includes 23 stock markets which, according to the Morgan Stanley classification, are classified as developed. We have built a balanced panel over a 14 year sample period, from January 2004 to December 2016. We restricted the sample to developed markets only for two reasons. First, the estimates for the various measures of stock price informativeness can be biased when stocks are illiquid, which is especially true for the developing markets. Second, differences in cross-section on stock price informativeness between developed and developing markets could lead to an easy acceptance of the study assumptions. In this study we are also interested in whether the conclusions obtained by Eun et al. (2015), on a

sample of 47 countries remain valid on a more homogeneous sample formed exclusively from developed markets.

Table-1: Summary statistics of sample. The  $R^2$  and  $\gamma_j$  are averages of annually values of synchronicity and information measure of Llorente The Individualism and Uncertainty avoidance (UAI) measures are from Hofstede et al. (2010).

Country	Stock index	No. of stoc ks	$R^2$	$\gamma_j$	Individualism	UAI
Australia	ASX50	1666	0.164	0.00751	90	51
Austria	ATX	68	0.237	-0.00493	55	70
Belgium	BEL20	329	0.226	0.01083	75	93
Canada	TSX60	745	0.257	0.04811	80	48
Denmark	OMXC20	139	0.203	0.0333	74	23
Finland	OMXH25	141	0.279	0.02037	63	59
France	CAC40	820	0.187	-0.0001	71	86
Germany	DAX	394	0.266	-0.00011	67	65
Hong Kong	HSI	1352	0.143	0.00043	25	29
Israel	TA35	422	0.169	-0.00654	54	81
Italy	FTSE MIB	331	0.289	0.00173	76	75
Ireland	ISE20	30	0.262	0.02302	70	24
Japan	TOPIX100	3619	0.263	0.00687	46	92
New Zealand	NZX	146	0.249	0.03183	79	33
Netherlands	AEX	104	0.292	-0.00423	80	53
Norway	OBX	172	0.234	0.00259	69	50
Portugal	PSI20	57	0.266	-0.02586	27	104
Singapore	STI	572	0.202	0.00474	20	8
Spain	IBEX35	200	0.325	-0.00627	51	85
Sweden	OMXS30	504	0.253	0.01519	71	23
Switzerland	SMI	183	0.214	0.01427	68	56
UK	FTSE100	1382	0.176	0.00086	89	51
US	S&P500	1536	0.235	0.00301	91	26

In the first stage we selected all listed stocks on these markets during the period 2004-2014. Of these, only those that have been listed in at least 80% of the stock exchange sessions of each year have been retained in the final sample. We

extract daily and weekly closing prices, as well as their daily trading volumes, weekly prices for each local stock market index and MSCI World index. All data denominated in dollars is obtained from Thomson Reuters Eikon. Table 1 provides summary statistics of our sample.

## 5. EMPIRICAL RESULTS

To test the relation between culture and stock price informativeness, we estimate several specifications of the following model:

$$\text{StocPriceInform}_{j,t} = \alpha_0 + \alpha_1 \text{Culture}_j + \sum_k \beta_k \text{Controls}_{k,j,t} + \varepsilon_{j,t} \quad (2)$$

where  $\text{StocPriceInform}_{j,t}$  is each of the two measures proposed for the stock price informativeness of country  $j$  in year  $t$ ,  $\text{Culture}_j$  is Individualism index and Uncertainty avoidance index,  $\text{Controls}$  is a set of control variables and  $\varepsilon_{j,t}$  is an error term.

Through this model we study if: a). the findings of Nguyen and Truong (2013) and Eun et al. (2015) regarding price synchronicity and the two dimensions of culture remain valid also for our sample formed exclusively from developed markets and with variables measured over another timeframe; b). the relationship between price informativeness and the two dimensions of culture is preserved when using the private information measure of Llorente et al. (2001); c). stock market openness weakens the relationship between price informativeness and culture, conclusion supported by Eun et al. (2015).

### 5.1. Culture and stock price synchronicity

Following Mork et al.(2000), we estimate annually for each stock the following model:  $r_{i,j,t} = \alpha_{i,j} + \beta_{1,i} r_{L,j,t} + \beta_{2,i} r_{W,t} + \varepsilon_{i,j,t}$  (3)

where  $r_{i,j,t}$  is the weekly return of stock  $i$  of country  $j$  in week  $t$ ;  $r_{L,j,t}$  and  $r_{W,t}$  are the weekly local/global market return in week  $t$ . Price synchronicity is the coefficient of determination  $R^2$ . A high  $R^2$  indicates that less firm specific information is impounded into stock price and thus the stock price is less informative. Given the cross-country nature of this study, we use an equally weighted average of the  $R^2$ s of the individual stocks in country  $j$ . The dependent variable is a logistic transformation of  $R^2$ , respectively:

$$\Psi_j = \log \left( \frac{R_j^2}{1-R_j^2} \right) \quad (4)$$

Even in the case of developed stock markets, low- $R^2$  stocks are small, young, and covered by few analysts (Kelly, 2014). For this reason, we measured separately stock price synchronicity including only constituents of the stock market indexes which were continuously traded during the study period.

Table 2 provides the estimation results of several regressions between price synchronicity and culture. Thus, in models (1), (3), (5) and (7),  $\Psi_j$  is determined based on all the stocks in the sample, while in models (2), (4), (6) and (8) is based only on the constituents. According to the results obtained by Nguyen and Truong (2013) and Eun et al. (2015) we expect the Individualism parameter to be negative and the UAI parameter to be positive.

For the other dimension of culture, UAI, the positive sign of the coefficient is found only in model (4) where is determined on the basis of the constituent stocks. In models (5) - (8) we re-evaluated the parameters including the dimensions of culture. In models (1) and (2) the coefficients of the individualism variable are negative and statistically significant at 1% level. In models (5)-(8) we reestimate the parameters including dimensions of culture. To mitigate the effect of possible multicollinearity between individualism and UAI, we create an orthogonal variant of individualism (UAI) by regressing individualism (UAI) on UAI (individualism) and replacing individualism (UAI) in models (5)-(8) with the residual from these regressions. The signs of the coefficients indicate that the results do not change qualitatively even in this case.

## 5.2. Culture and private information

Specific information also includes private information, but it is a wider information set targeting the company. According to the theories developed by Dow and Gorton (1997) and Subrahmanyam and Titman (1999), managers learn from the price of their own actions when it incorporates particular private information that they do not know. To investigate the relationship between the two dimensions of culture and the incorporation of private information into stock prices we used as a dependent variable the information measure of Llorente et al. (2002).

In models (1) and (2) of Table 3 we studied the relationship between information measure ( $\gamma_j$ ) and the two dimensions of culture without introducing the control variables. The sign of the parameters indicates a direct link for individualism and an inverse one for the UAI at 1% significance level. The introduction of control variables in models (3) and (4), as well as the simultaneous presence of the two dimensions of culture in models (5) and (6), lead to similar qualitative results.

The results indicate that in more individualistic societies investors incorporate more private information into stock prices than in collectivistic societies. Individualists tend to analyze titles individually, while collectivistic investors are more likely to have holistic thinking and tend to analyze the stocks jointly (Todea and Buglea, 2017). At the same time, more uncertainty-avoiding cultures incorporate less private information into stock prices. Conservatism, aversion to higher risk, and rigid rules are features of these societies that may inhibit certain private information-based transactions.

Table-2: Culture and stock price synchronicity

	Dependent variable – $\Psi_j$							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Individualism	-0.0026*** (-2.76)	-0.0033*** (-3.67)			-0.0035*** (-3.61)	-0.0025** (-2.49)		
UAI			-0.0015 (-1.51)	0.0022*** (3.40)			-0.0018*** (-2.65)	0.0020*** (2.99)
Individualism (residual)							-0.0039*** (-4.20)	-0.0022** (-1.97)
UAI (residual)					-0.0022*** (-3.36)	0.0018** (2.40)		
No. of analysts	0.0045 (1.27)	0.0183*** (5.00)	0.0064* (1.80)	0.0171*** (5.37)	0.0061* (1.94)	0.0169*** (5.08)	0.0060* (1.93)	0.0169*** (5.09)
Good Government Index	-0.0031*** (-2.62)	-0.0043*** (-2.97)	-0.0037*** (-3.70)	-0.0026** (-2.36)	-0.0045*** (-5.02)	-0.0031*** (-3.29)	-0.0046*** (-5.02)	-0.0031*** (-3.28)
Ln(GDP per capita)	0.0964 (0.90)	0.1529* (1.79)	-0.0011 (-0.01)	0.1553** (2.02)	0.0553 (0.51)	0.1877** (2.14)	0.0555 (0.52)	0.1874** (2.14)
GDP growth volatility	-1.097 (-0.15)	-1.7876 (-0.36)	-2.188 (-0.32)	-2.2896 (-0.46)	-1.1866 (-0.17)	-1.711 (-0.35)	-1.183 (-0.17)	-1.718 (-0.35)
Ln(number of stocks)	-0.0353** (-2.06)	-0.0001 (-0.03)	-0.0473** (-2.13)	0.0055 (0.42)	-0.0443** (-2.49)	0.0073 (0.58)	-0.0441** (-2.48)	0.0073 (0.58)
Ln(country size)	0.0465*** (3.72)	0.0101 (0.82)	0.0337*** (2.70)	0.0208*** (-3.20)	0.0635*** (5.36)	-0.0037 (-0.26)	0.0633*** (5.36)	-0.0041 (-0.29)
Ind. Herfindahl index	0.4146** (2.22)	0.1448* (1.67)	0.1895 (1.45)	-0.3043** (-2.01)	0.6492*** (3.67)	-0.0419 (-0.46)	0.6474*** (3.67)	-0.0466 (-0.48)
Firm Herfindahl index	-0.337 (-1.63)	-0.1319** (-2.26)	-0.0441 (-0.16)	0.3427** (2.18)	-0.5613** (-2.40)	0.0467 (0.85)	-0.5602** (-2.40)	0.0516 (0.86)
Constant	-1.292 (-1.31)	-1.2869 (-1.55)	0.0155 (0.02)	-1.527** (-2.28)	-0.739 (-0.72)	-1.7503** (-2.17)	-0.8667 (-0.79)	-2.028** (-2.39)
R-squared	0.172	0.455	0.174	0.466	0.207	0.475	0.207	0.475

Note: Standard errors are double clustered at country and year levels, as in Thompson (2011). T-statistics are reported in brackets. \*, \*\*, and \*\*\* indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table-3: Culture and private information

	Dependent variable – Llorente et al. (2002) measure ( $\gamma_j$ )					
	(1)	(2)	(3)	(4)	(5)	(6)
Individualism	0.0003** (2.32)		0.0006*** (2.83)		0.0006*** (2.74)	
UAI		-0.0003*** (-2.94)		-0.0002** (-2.23)		-0.0001* (-1.86)
Individualism (residual)						0.0006*** (2.71)
UAI (residual)					-0.0001* (-1.67)	
No. of analysts			-0.0005* (-1.91)	-0.0005** (-2.08)	-0.004 (-1.53)	-0.0004 (-1.51)
Good Government Index			0.0006*** (2.73)	0.0004* (1.66)	0.0006** (2.47)	0.0006** (2.47)
Ln(GDP per capita)			-0.0067 (-0.72)	0.0002 (0.02)	-0.0083 (-0.88)	-0.0083 (-0.88)
GDP growth volatility			0.0566 (0.14)	0.2057 (0.43)	0.0531 (0.13)	0.0531 (0.13)
Ln(number of stocks)			-0.0006 (-0.24)	-0.0005 (-0.20)	-0.0010 (-0.34)	-0.0010 (-0.34)
Ln(country size)			-0.0041** (-2.10)	0.0009 (0.94)	-0.0035* (-1.88)	-0.0035* (-1.88)
Ind. Herfindah l index			- 0.0889 ***	-0.0109 (-0.31)	-0.0802** (-2.60)	-0.0802** (-2.60)
Firm Herfindah l index			0.1359** (2.56)	0.0495 (1.15)	0.1267** (2.239)	0.1267** (2.239)
Constant	-0.0136 (-1.51)	0.0243*** (3.55)	-0.0097 (-0.10)	-0.0743 (-0.66)	0.0119 (0.12)	0.0119 (0.12)
R-squared	0.053	0.080	0.258	0.212	0.261	0.261

Note: Standard errors are double clustered at country and year levels, as in Thompson (2011). T-statistics are reported in brackets. \*, \*\*, and \*\*\* indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

### 5.3. Openness, culture and private information

According to Eun et al. (2015) financial openness diminishes the relationship between culture and stock price synchronicity because of the transactions on domestic markets of foreign investors belonging to different cultures. For financial openness we construct the total value of portfolio equity holdings by foreign investors divided by country's stock market capitalization. The cross-border

portfolio investment holdings in equity securities are obtained from the Coordinated Portfolio Investment Survey Guide. Although the relationship is weak, the positive sign of the Openness parameter in Models (1) and (2) of Table 4 indicates that the presence of foreign investors on domestic markets facilitates the incorporation of private information into stock prices.

Table-4: Openness, Culture and private information

	Dependent variable – Llorente measure ( $\gamma_j$ )					
	(1)	(2)	(3)	(4)	(5)	(6)
Openness	0.0039*	0.0009	-0.0092**	0.0088*	-0.0101**	0.0107***
	(1.80)	(0.40)	(-2.12)	(1.80)	(-2.18)	(2.82)
Individualism ×Openness			0.0002***		0.0002***	
UAI× Openness			(2.64)	-0.0002**	(2.76)	-0.0001***
				(-2.43)		(-3.41)
Individualism	0.0006***		0.0004*		0.0003	
	(3.04)		(1.79)		(1.48)	
UAI		-0.0002**		-0.0001		-0.0001
		(-2.37)		(-0.41)		(-1.12)
Individualism (residual)						0.0006***
UAI (residual)					-0.0001	(2.86)
					(-0.64)	
No. of analysts	-0.0007***	-0.0005**	-0.0007***	-0.0005**	-0.0006**	-0.0007***
	(-3.26)	(-2.34)	(-3.20)	(-2.50)	(-2.34)	(-2.61)
Good Government Index	0.0006***	0.0004*	0.0006***	0.0004*	0.0006***	0.0005***
	(2.74)	(1.65)	(2.79)	(1.65)	(2.62)	(2.60)
Ln(GDP per capita)	-0.0048	0.0014	-0.0060	0.0017	-0.0071	-0.0048
	(-0.45)	(0.12)	(-0.56)	(0.14)	(-0.67)	(-0.46)
GDP growth volatility	0.5540	0.6894	0.5417	0.7314	0.5299	0.5911
	(0.96)	(1.04)	(0.99)	(1.11)	(0.95)	(1.03)
Ln(number of stocks)	-0.0012	-0.0016	-0.0006	-0.0017	-0.0008	-0.0014
	(-0.47)	(-0.61)	(-0.27)	(-0.61)	(-0.31)	(-0.48)
Ln(country size)	-0.0038**	0.0015	-0.0042**	0.0019	-0.0039*	-0.0031
	(-1.98)	(1.25)	(-2.41)	(1.47)	(-1.86)	(-1.45)
Ind. Herfindah l index	-0.0937***	-0.0282	-0.0877***	-0.0299	-0.0841***	-0.0924***
	(-4.43)	(-1.10)	(-5.07)	(-1.08)	(-5.15)	(-4.94)
Firm Herfindah l index	0.1380***	0.0704**	0.1351***	0.0744**	0.1322***	0.1416***
	(3.34)	(2.03)	(3.57)	(2.07)	(3.39)	(3.51)
Constant	-0.0276	-0.0860	0.0018	-0.0955	0.0159	0.0139
	(-0.27)	(-0.69)	(0.02)	(-0.77)	(0.14)	(0.13)
R-squared	0.307	0.252	0.319	0.264	0.320	0.317

Note: Standard errors are double clustered at country and year levels, as in Thompson (2011). T-statistics are reported in brackets. \*, \*\*, and \*\*\* indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Interesting are the results obtained in models (3) - (6), where the parameter of Individualism  $\times$  Openness is positive and the parameter of UAI  $\times$  Openness is negative. These results differ from those obtained by Eun et al. (2015) and show that financial openness is a stimulating factor of price informativeness – individualism relationship and an inhibitor of price informativeness – UAI relationship. In a highly globalized world, individualistic investors take advantage of financial openness and incorporate more private information in price than collectivists. On the contrary, greater anxiety and higher aversion to risk of more uncertainty-avoiding cultures may be more pronounced when financial openness generates higher uncertainty in domestic markets.

## 6. CONCLUSIONS

The relationship between the incorporation of specific information into stock prices and different dimensions of culture, such as individualism/collectivism or uncertainty avoidance, has recently been highlighted in the literature by Nguyen and Truong (2013) and Eun et al. (2015). This study starts from the premise that private information is that part of the specific information that companies' managers are particularly interested in. Therefore, the study objective was to reinvestigate the relationship using a more appropriate measure of private information incorporation into stock prices than stock price synchronicity, such as the information measure of Llorente et al. (2002).

The empirical results shed light on three researched aspects. First, we reinvestigated and validated the relationship between stock price synchronicity and the two dimensions of culture on a more homogeneous sample of developed markets only. We have thus tried to take into account the criticisms in the literature on the inadequacy of the price synchronicity measure in case of developing markets that are illiquid. Second, we validated the hypotheses of the study according to which more private information is incorporated into individualist societies and less in uncertainty avoiding societies. Finally, we showed that financial openness is a stimulating factor of price informativeness – individualism relationship and an inhibitor of price informativeness – uncertainty avoidance relationship.

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## EFFECT OF MONETARY INCENTIVES ON THE DEMAND FOR ELECTRICITY OF DOMESTIC CONSUMERS – CASE OF ISRAEL

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**Abstract:** *This research, based on a pilot study performed by the Israeli Electricity Company (IEC) in the framework of a demand management arrangement, focused on an economic approach for influencing domestic customers' electricity consumption. The main objectives were to find out if monetary incentives in the form of a constant discount in the household consumer's electricity bill (with no connection to consumption levels) influence consumers participating in a demand management arrangement with their electricity provider (here the IEC) and if such an incentive will lead to a decrease in the participants' electricity consumption and/or a shift in their consumption from peak to low demand hours. The study examined also the monetary incentive's influence on the participants' willingness to join a future arrangement. The findings show that the participants who received a constant incentive increased their consumption, contrary to the expected behaviour, suggesting the presence of a "rebound effect". One of the incentives that predicted a tendency to save electricity was the pro environmental attitude of the consumer, whereas financial incentives did not predict a tendency to save electricity. Damage to consumer comfort caused by load shedding exerted no significant influence. The economic incentive of a discount in the electricity bill increased the consumers' willingness to join a future arrangement, even at the cost of compromising their privacy, although the possibility that this arrangement would lead to the loss of their control of home electric appliances as a result of load shedding drastically decreased this willingness. A positive financial incentive was found to have a minor influence on consumers' willingness to participate in a demand management arrangement, while a negative incentive (the wish to avoid fines) was found to be very influential. Comparing to previous studies, the results are mixed, confirming some previous findings and contradicting others – and they offer an important contribution for the worldwide debate on energy conservation and household electricity reduction, through the Israeli dimension in a complex puzzle.*

**Keywords:** *Electricity Demand, Demand- Side Management, Smart Grid, Rebound Effect, Monetary Incentive, Consumer Behaviour, Household Electricity Consumption.*

**JEL Classification:** *M21, M38, Q40, H41*

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## INTRODUCTION

Energy conservation and energy efficiency are almost universally accepted desiderates of modern, sustainable societies. A culture of energy conservation makes people obtain important savings, on one side, and helps fighting against global warming, pollution and greenhouse gas emissions, as well as various other threats of our ecosystems, on another side. Reducing electricity consumption is part of the energy conservation endeavour, and household consumers are among targets. The demand for energy and the difficulties encountered by energy providers worldwide in supplying consumers' demand for electricity are, however, increasing. These increases are due to rapid population growth and rising standards of living (Benders et al., 2006), electricity being linked to both living standards and cultural dimensions in complex ways (Brager & de Dear, 2003). Adding in the equation the dramatic changes produced by the air-conditioning technologies, the explosion of smart devices and the continuous price reduction of electrical products, it is no surprise that both researchers and governmental specialists have drawn attention to the importance of better managing the electricity demand, to save a country's energy resources and to prevent the collapse of electricity systems as a result of the electricity companies' inability to meet increasing electricity peak demands habits (Tabori, 2012). In this light, experiences from all countries and from particular economic, geographic and cultural contexts around the world are important, considering that previous studies have shown important differences in attitudes about comfort (Brager & de Dear, 2003) or materialistic values (Ger & Belk, 1996). Israel would be a perfect case from this point of view – high economic development, moderate attitude towards materialism, high degree of population education, specific geographic conditions indicating high expected levels of energy use in both seasons (winter for heating, summer for air-conditioning).

The home consumption sector (household consumers) in Israel, which up to 2012 was not included in demand shifting programs, received the government's "recognition" as a sector whose inclusion in demand shifting programs could significantly improve demand shifting in peak hours (Ronen 2012a). Furthermore, this sector is an important target in the government's policy for decreasing electricity demand (Abrahamse et al., 2005). Among other things, this situation has resulted in recognition of the need to erect a smart electricity grid in Israel. A smart electricity grid is based on technology upgrading of the existing electricity network

and is realized by combining advanced information and communication systems, with the aim of achieving an efficient, trustworthy, economic, and safe network that would grant Israel energy security (Yahav, 2012; Israeli Smart Energy Association, 2013). In order to decrease the gap between electricity supply and demand, the smart electricity grid network uses an approach called Demand Side Management (DSM). This approach involves various devices aimed to improve both the electricity system on the consumer side and consumers' energy consumption behavior. Among the means exercised are the use of more efficient insulation materials and electrical products that are more energy efficient, pricing methods that include monetary incentives for engaging in certain consumption behaviors, and sophisticated real-time control of decentralized electricity resources that leads to consumers behavioral changes. In the DSM approach, an accepted means of encouraging household consumers to reduce their electricity consumption is through exercising economic incentives of various kinds, such as programs based on dynamic pricing, in which the consumer reacts to a tariff that changes according to demand hours clusters, i.e., the tariff is higher in peak demand hours and lower in low demand hours (Fan & Hyndman, 2011). In order to supply demand during peak hours, all power stations are operated and all fuel mixes used, including the most polluting ones. Programs exist, based on positive monetary incentives, such as giving consumers a bill discount for reducing electricity consumption during peak hours (Mizobuchi & Takeuchi, 2012) and negative monetary incentives, such as applying fines for consumers who exceed the electricity consumption quota determined by a block rate arrangement framework. An additional program allows consumers to participate in a demand management arrangement according to which the consumer receives a monetary incentive from the electricity supplier for closing electrical appliances in the home during peak hours (Demand Response (DR)). Previous studies (Faruqui & Sergici, 2013; Derby, 2010) have shown that a higher-level awareness of financial aspects influences consumer behavior and encourages a decrease in electricity demand, in particular when the additional information allows a clearer image of electricity use. From the consumers' viewpoint, electricity is almost "invisible" and their involvement in the field of the demand for electricity is low (Watson et al., 2002).

Various approaches were suggested in order to reduce electricity demand, based on rational-economic, social, or psychological behavioral factors (Elbaz &

Zait, 2017). The present research is part of a more complex one, which investigates, in several stages, consumers' perceptions, stated and actual behavior towards the most important approaches and mechanisms used worldwide. We focused on the economic approach, examining the influence of a monetary incentive on consumer behavior and the electricity demand patterns of household consumers in Israel. Its goal was to examine whether a monthly monetary incentive at a constant level causes household consumers to decrease their electricity demand and/or shift it away from peak hours. Furthermore, it examined the influence of the monetary incentive on consumers' readiness to join a demand management arrangement in the future.

The research was based on a pilot study performed in Israel, in which the Israeli Electricity Company (IEC) examined the application of a smart board that allows "load shedding" - automatic remote cutting off of electrical appliances in the household, during peak load hours. The results of this study – the first one that addressed the household consumers' economic point of view towards instituting a smart grid for demand management in Israel, could help build better electricity systems, that consider the needs and constraints of the electricity network on the one hand, and the needs and expectations of the consumers, on the other.

## **1. RESEARCH CONTEXT**

### **1.1 Electricity Demand in Israel**

The electricity production capacity in the Israeli economy is 17,360 MW, of which the IEC produces about 13,600 MW, which comprises approximately 78% of electricity production capacity (Public Utilities Authority, 2015). The IEC is a governmental public company responsible for supplying most of the electricity consumed in the Israeli market, according to a license granted by the power of the electricity market law (Israel Electric Corporation, 2016). The rest of the electricity, approximately 22%, is supplied by private electricity suppliers, who account for about 4,000 MW, that is, approximately 23.5% of the total production capacity. A further 850 MW is produced using renewable energies produced by photo voltage (PV) technology, a technology for generating electricity from solar energy, constituting approximately 4.5% of the total electricity produced in Israel.

The electricity produced in Israel has to meet the demand of about 2.65 million customers, of whom about 2.4 are household consumers, whose average demand for electricity in Israel in 2015 was approximately 6,600 kwh a year (Central Bureau of Statistics, 2016). These household consumers have contributed to the rise that has occurred in the total annual demand for electricity in Israel. During the last 20 years, the electricity demand in Israel has grown at an average annual rate of approximately 4%. The electricity demand forecast predicts that the total demand for electricity in Israel will double in two decades (Mor et al., 2008) and will grow at an annual average rate of 3.5-3.8%. In the last decade alone (2005-2015), the electricity demand grew by about 30% and the electricity demand during peak hours by approximately 40% (Herzog & BDO, 2016). Moreover, the electricity demand growth rate in Israel is high as compared to the OECD average and is derived from characteristics unique to the Israeli market, which are as follows:

1. The natural population growth in Israel is the highest among the OECD countries, approximately 2% per annum. This figure is three times higher than that of OECD countries, the demographic growth of which is 0.6% on average (OECD, 2016). The reasons for this high rate of population growth are the high fertility rates, positive immigration of Jews from all over the world, and a rising average life expectancy.
2. Economic growth and rising average income per capita causes a rising standard of living expressed in purchasing many electric appliances and/or those having high energy consumption. These factors increase the demand for electricity (Benders et al., 2006). As a result, the current monthly expenditure on electricity is increasing. Fuchs and Lorek (2005) found that an increase of 1% in income can lead to an increase of up to 4% in energy consumption.
3. Climate change influences electricity consumption, especially in situations of extreme temperature that cause fluctuations in electricity demand peaks during cold and hot periods (Golan-Angelko & Brauer, 2008), mostly because of the growing demand for refrigeration in summer (air-conditioning) and heating during winter (electric heating) (Israel Climate Change Information Center, 2011).

## **1.2 Characteristics of Household Consumers' Electricity Demand**

A unique characteristic of electricity is that it is an “invisible product,” which the consumer cannot perceive by regular cognitive means. As opposed to physical products, the consumption of which can be seen, electricity is simply a product that reaches the home and makes appliances operate (Watson et al., 2002; Darby, 2006). In this sense, it also differs from other energy products, such as car fuel. Even if the consumer cannot see these products, he/she can perceive them and their cost in simple terms, such as price per liter and number of kilometers per liter. In general, for most consumers the demand for electricity is a field in which their involvement is low (Watson et al., 2002). Electricity consumption is mostly spontaneous and uncalculated, or not governed actively by a specific person or body. At this point, it should be mentioned that in situations where there is no competition, for example in Israel, probably the consumer involvement is even lower, as the consumer conceives electricity as a basic product, the consumption of which cannot be significantly reduced and for which there are few substitutes (Tabori, 2012). In fact, the common conception is that the level of household consumer electricity demand is rigid, that is, a price change will not significantly change the amount of electricity demanded, and consumers feel that they cannot influence the electricity bill or its price in any way. In general, it is obvious that many consumers are not aware of their electricity consumption level or the change that modifying their electricity demand behavior could bring about in the amount of their consumption (Darby, 2006). Consumers tend to consume electricity without any forethought, by habit and expecting to receive electricity services automatically when performing routine actions, such as turning on a light, air conditioner, or heating appliance. In fact, consumers view electricity as a simple consumption product and expect it to be supplied the instant they activate the switch (SGCC, 2011).

## **1.3 Influence of an Economic Incentive (Positive/Negative) on the Household Consumer's Demand for Electricity – a literature review**

Studies conducted in recent years indicated that an economic incentive or compensation has a positive influence on the consumer's decisions, expressed in a decrease in the household consumer's demand for electricity (Petersen et al., 2007; Mizobuchi & Takeuchi, 2012). Nevertheless there are studies (such as Geller, 2002

and Abrahamse et al., 2005) indicating that economic compensation has only a short-term influence, and the positive effect disappears the moment it is no longer given. A model that was found to influence consumers' behavior in the framework of a demand management arrangement is giving a discount in the electricity bill to a consumer who has reduced electricity consumption during peak hours. This model requires that a "baseline period" be determined against which the reduction can be measured. For example, in an electricity saving program in California (the 20/20 Rebate Program) household consumers were offered a 20% discount in the electricity bill if they reduced their electricity consumption by 20% during the summer months as compared to the same period in the previous year (Goldman et al., 2002). The results of a survey on the subject show that about a third of the household consumers decreased their consumption in at least one of the summer months. Nevertheless, the survey's successful results should be considered with certain caution, because, in addition to the economic incentive of a discount in the electricity bill, the electricity saving program was accompanied by a campaign (an explanatory program) that elevated the consumers' cognition of the issue; that is, the success of the program was derived not only from the economic incentive but also from improving the consumers' cognition of the issue of possible economic saving embedded in the program.

Israel instituted a program based on the California 20/20 Rebate Program as a consequence of the fear of an "electricity drought" in the summer of 2012, in which about 181,000 households (approximately 600,000 people) participated. These consumers reduced their electricity usage by approximately 10% in June and 8.5% in July, a saving in monetary terms totaling 286,000 dollar. Furthermore, in addition to the actual saving of about 6 million kilowatt during the months of June and July, a saving of about 3 million was registered in their electricity bills (Ministry of National Infrastructures, Energy and Water resources, 2012). In a similar field study carried out in Japan (Mizobuchi & Takeuchi, 2012), household consumers were offered a monetary incentive of 2.5\$ for each 1% savings in electricity as compared to the same period in the previous year, which resulted in a 5.9% reduction in household consumers' electricity demand. An additional model that was found to influence electricity demand positively during peak hours was a DR program, a dynamic type of demand management that enables the electricity supplier to directly control (Direct Load Control) consumers' electrical appliances remotely and cut off only

non-critical appliances during peak load hours at short notice (Sevradolev and Dolev, 2009; DOE, 2006). This program entails a contract between the electricity supplier and the household consumers (Mohsenian-Rad et al., 2010) participating in it. The consumer usually receives a monetary incentive in the form of a discount in the electricity bill in return for participating in a demand management arrangement, and in return, the electricity supplier commits to performing “load shedding” (an automatic remote cutoff) that complies with conditions agreed with the customer, such as the number of annual “load shedding” events, duration of each “load shedding” event, notification of a “load shedding” event (such as SMS) a short time before it is scheduled, etc. This program requires the use of tools offered by the smart network, such as a smart meter and a smart electricity board. An additional model that may influence consumer behavior in a demand management arrangement involves a monetary fine (punishment) dependent on the electricity demand volume.

Public bodies (for example, government bodies and electricity suppliers) significantly influence consumers’ economic behavior (Soman, 2007) and therefore they utilize various tools for influencing their economic decisions (Lusardi et al., 2007). One of these tools is the imposition of various taxes and fines on the consumer, which influence his/her decisions. For example, a mechanism called the Inclining Block Rate tariff, based on a variable electricity price that is dependent on the total electricity quantity that the customer consumed, is applied. This mechanism comprises two or more steps (most mechanisms comprise two steps, but there are also others that comprise three or more steps), where the electricity quota and tariff at each step are different and determined by the electricity supplier’s goals and the household consumer’s characteristics. At the first step, a basic quantity of electricity is charged at a reduced price, deviation from which takes the consumer to the second step, where a certain quantity of electricity is charged at a higher price. The first tariff is 15% lower than the uniform tariff and the second is 25% higher than the uniform tariff. This mechanism, which includes both a discount when consumers do not exceed their quota and a fine when they do, encourages a behavior change among household consumers that is expressed in a reduction in their electricity demand (Dolev et al., 2012). The use of a stepped tariff is not new and is applied by many electricity companies worldwide. A 2008 survey conducted by the Canadian electricity company, Bc Hydro, among 88 electricity companies in the USA, Europe, and Asia found that approximately 38%

of the electricity companies use a stepped tariff and approximately 53% use a uniform tariff (Bc Hydro, 2008).

The use of electricity quotas as a means of decreasing electricity demand was also found to be efficient in an “electricity drought.” For example, Tabori (2012) presented a study of the Brazilian government’s management of an electricity shortage, during which consumers were given an electricity quota. Consumption in excess of their quota caused them an electricity supply disruption, so that they had to pay higher prices (fines) ranging between 50% and 200% for the excess. Using this mechanism of stepped tariffs in conjunction with other factors, such as a discount in the electricity bill for consumers who saved electricity, led to an electricity consumption decrease of 25% in Brazil. In Israel, the electricity tariff is homogeneous, whereas a stepped tariff is applied in the water market.

#### **1.4 Concept of Demand Management – relevant literature**

One of the major problems faced by electricity suppliers worldwide and in the Israeli market in particular is the need to provide a regular supply and meet the demand during peak hours or a possible deviation from the electricity capacity. The electricity market in Israel is defined by energy policy makers as an “energy island,” as it is required to meet the electricity demand at any given minute and during a peak in electricity demand electricity cannot be bought from neighboring countries, as occurs in Europe and the USA (Tabori, 2012). The cost to the market of not supplying electricity at these times is variable and, among other factors, depends on the cost of backup systems, economic value, and the cost of damages caused by electricity outages. In general, it can be stated that the economic costs of not supplying electricity are high for the market; for example, the immediate market cost of an electricity outage is estimated at 34.6 dollar per kilowatt (ERCG, 2011), so that one hour of electricity outage costs the market 183 million dollar, of which the household consumers’ sector will absorb damage equivalent to approximately 26.5 million dollar. Furthermore, the need to meet electricity demands also in peak periods necessitates the erection of expensive power plants on a limited land resource, plants that are in fact required during only a few hours a year (Sverdlov & Dolev, 2009). In Israel there are one hundred yearly critical peak hours (Grossman, Eylon, & Goldrath, 2007), mostly recorded in the summer

season (caused by air conditioners operating in the middle of the day, mainly in public, industrial, and business facilities) and usually due to extreme weather conditions (Golan-Angelko & Brauer, 2008).

As a means of reducing the gap between demand and supply during those hours when the IEC cannot meet the full demand for electricity on one hand, and to decrease the damage caused to the market during a shortage on the other, the management of customers' electricity usage is emphasized. In fact, this approach involves several means used by various large corporations. The concept of managing customers' electricity usage, called Demand Side Management (DSM), is aimed at improving both the electricity system at the consumer side and consumers' energy consumption behavior. Among the means activated are the use of more energy efficient insulation materials and end products (electric appliances), tariffs that include monetary incentives for certain consumption patterns, and smart online control of decentralized electricity resources that lead to a change in customer behavior. In fact, every action performed on the consumption side of the electricity system is included in the definition of the DSM, from replacing old light bulbs with more economic ones to instituting a dynamic system for regulating loads. In the past, this concept was aimed more at the electricity supplier, who was requested to construct various systems to regulate demand. This approach changes, and it looks like in the future it will be aimed more at customer behavior (Palensky and Dietrich, 2011).

It is important to understand that there is a big difference between electricity consumers: big business consumers have a greater ability to anticipate and manage their activity demands than private consumers, who act more intuitively and individually. Although electricity saving devices, such as insulation and economic electric appliances, are very important, the main area on which DSM focuses is the management of consumer demand through the use of smart electricity networks that enable consumers to make educated decisions concerning their use of electricity through information they receive from the network itself. In addition, electricity suppliers also use the information they collect about decreasing loads during peak demand periods. In fact, the household consumer's educated use of electricity means that they engage in consumption behavior aimed at reducing and avoiding waste of electricity, and shifting loads from peak to low demand hours, thus limiting the demand at peak hours in the national electricity supply system.

The importance of this approach was expressed in a plan initiated by the International Energy Agency (IEA), which is a combined effort of 19 western countries for promoting and identifying opportunities for reducing electricity demand during peak hours. The program includes a line of studies aimed at achieving an optimal combination of production sources to meet the changing electricity demand (International Energy Agency, 2011b). Thus, a demand management system contributes to reducing the gap between electricity demand and supply without needing an enlargement of production capability. It can therefore be considered an additional resource (“energy source”) similar in scope to a power station, because it is an alternative means of making the necessary energy available rather than increasing the electricity production capacity. The electricity unit (watt) saved as a result of increasing energy efficiency or reducing electricity demand is called a “negative watt” (nega-watt). Stated simply, the cheapest electricity unit is that one which was never produced (Bartram, Rodgers, & Muise, 2010). Sverdlov and Dolev (2009) even noted that, according to the experience accumulated in the USA, the realization of plans for energy efficiency and electricity demand management is cheaper than building power stations providing a similar capacity. Furthermore, these plans contribute to reducing fuel consumption, greenhouse gas emissions, and pollution, and can be operated in a short time. For example, Rogers, Messenger, and Bender (2005) showed in their study conducted in California that the cost of saving a kilowatt in the framework of investing in projects for efficiency and demand management is 0.03\$, as compared to the 0.06\$-0.17\$ cost of producing a kilowatt in a conventional power station.

In order to encourage household consumers to perform actions aimed at managing their electricity demand in a way that would influence the shape and level of their electricity demand curve ( Gellings & Chamberlin, 1993; Cheng, 2005), mainly by shifting or reducing electricity demand from peak hours, various policy tools and other means could be implemented. For example, a price policy could be instituted, compatible with the reasonable consumption of the individual, whereby the consumer receives incentives and favorable tariffs to reduce electricity demand in peak load times. Planned cutoffs (load shedding) of electricity during peak hours, performed by DR, a type of dynamic demand management where the electricity company controls households’ electricity remotely and can cutoff non-critical loads during peak hours, can also be applied (Sverdlov & Dolev, 2009).

Demand management works at four different levels: (1) reducing maximum demand at peak times, (2) shifting consumption to non-peak hours, thus increasing demand at low load times as a balance for demand reduction at peak times, (3) reducing the consumption rate in general by adopting aware consumer behavior, and (4) consumption planning. All these are done while maintaining a high service level and good comfort level, relying on a combination of using energy efficient electricity appliances and efficient behavior patterns that reduce the average probable demands of consumption (Bonneville, 2006).

### **1.5 Smart Grid approach**

Despite technological advancement, there have been no significant changes in traditional electricity networks in most electricity markets in the world for several decades. These networks suffer from inefficiency and many mishaps due to old equipment and technology and a (central) hierarchical structure that does not suit the severe requirements of the electricity supply today (Gungor et al., 2011). Especially demands from stakeholders and various regulatory bodies are problematic, related to such issues as decreasing air and environmental pollution by reducing electricity production during peak hours, shifting to renewable energy sources, and improving energy efficiency, which involves decreasing electricity consumption in general and decreasing peak demands for electricity in particular (Epri, 2011). Furthermore, the traditional electricity grid is not technologically compatible with the cooperation required for combining sources of decentralized and renewable electricity production, such as wind turbines and PV cells for producing electricity from the sun's rays, which require new production processes (Potter et al., 2009). All these factors have led electricity markets in several countries worldwide, mostly the USA, Europe, and Asia, to grant high priority to the development and assimilation of smart advanced grids that would replace the old traditional electricity grid, in a way that constitutes a world technological revolution in the management of the electricity market (Mazza, 2003). They could considerably change the way electricity consumption is conceived by consumers and influence the manner in which this consumption is managed by decision makers, such as governments, regulators, electricity companies, and consumers (DOE, 2012).

The term “smart grid” can be interpreted variously, but basically the intent is to create a grid based on a combination of the existing electricity network and communication, control, and information systems. The international energy association defines a smart grid as an electricity network that uses advanced digital and other technology for managing and controlling the electricity supply from all production sources to meet changing consumer demand (International Energy Agency, 2011a). The objective of the smart grid is to fit the demand for electricity with the electricity production capacity (Yahav, 2012), and therefore, in contrast to existing traditional electricity networks, the smart grid is characterized by a two-way flow of electricity, from the electricity utility to consumers, and from consumers, who have turned into producers – their new label being “Prosumers” (Lampropoulos, Vanalme, and Kling, 2010) - and provide electricity to the network from renewable electricity sources, to the electricity utility. For example, some consumers possess photo voltaic (PV) facilities for producing electricity from the sun and can provide information of electricity consumption in real time (Von Dollen, 2009).

After the thorough analysis of these previous studies and the context of the Israel market, a research was performed in order to find out the effects of a monetary incentive experiment on household electricity consumption, described in the next section.

## **2. RESEARCH METHODOLOGY**

### **2.1 Research Plan**

As mentioned above, this research was based on a pilot study performed by the IEC, in the framework of which a smart board aimed at allowing the use of a DR program for decreasing home consumers’ use of electricity during peak hours was utilized. The smart board enables the IEC to directly control home consumers’ home appliances (DLC) and remotely disconnect them, automatically and selectively (disconnecting only home appliances with non-critical loads) during hours when the load on the electricity network is high. The pilot study had a duration of 16 months, in which the IEC performed interventions in each consumer’s home demand management (“load shedding”) according to the consumers’ preference for the circuit’s essentiality. The pilot study focused on

examining demand management during summer and winter, which are characterized by “peak” demands.

One hundred home consumers who agreed to participate in a demand management arrangement received a constant monthly financial incentive of 85 dollar through a discount in the electricity bill for the entire period of the pilot study in return for allowing the “load shedding.” Most of these consumers lived in the same neighborhood in an Israeli city, Netanya, and 59 lived in the same building of apartments. All were consumers in the top 3-4 percentiles of electricity consumption. The participants were requested to define the order in which they preferred their home appliances to be disconnected during peak load; for example, the dish washer should be the first and the air conditioner the last appliance to be disconnected. Measurements were taken during three periods: before, during, and after the demand management arrangement. All measurements refer to the hours in which the electricity consumption was at its peak. The electricity value measurement represents the total of the electricity demand in five months: two summer months and three winter months. In the findings section, these measurements are labeled “electricity demand survey.” Furthermore, in order to examine the stances on home consumers’ electricity demand amongst the arrangements’ participants (experimental group) and among participants who did not participate in the arrangements (control group), 36 out of the 100 participants in the arrangement were invited to a meeting where they were asked to fill in a questionnaire. These results are labeled “stances survey” in the findings chapter.

## **2.2 Research Goal**

The research focused on the financial aspects of electricity consumption and its goal was to examine whether a constant monthly monetary incentive (with no correspondence with actual consumption) given to household consumers who participated in a DSM with the electricity supplier (IEC) would lead them to decrease their electricity demand and shift it away from the peak hours. Furthermore, the research examined the influence of an economic incentive on the household consumer’s willingness to join a demand management arrangement in the future.

## **2.3. Research Questions**

The main questions for the research were:

1. How does a monetary incentive managed through a smart board affect the demand for electricity of household consumers during peak hours?
2. How does a monetary incentive managed through a smart board affect the tendency of household consumers to reduce their electricity demand?
3. How does a monetary incentive affect the consumers' willingness to join a future demand management arrangement?
4. What is the effect of a monetary incentive on the consumers' tendency to save electricity relative to other factors, such as other economic incentives, convenience motive, and environmental protection motive?

## **2.4 Research hypotheses**

Based on the results of previous studies analyzed in the literature review, several hypotheses were formulated:

2. H1: A monetary incentive managed through a smart board has the effect of reducing household consumers' electricity demand during peak hours.
3. H2: A monetary incentive managed through a smart board affects the tendency of the household consumer to reduce electricity demand.
4. H3: A monetary incentive affects consumers' willingness to join a future demand management arrangement.
5. H4: A monetary incentive has a stronger positive influence on the consumer's tendency to save electricity than other factors.

## **2.5 Research instruments and sample population**

In order to check the hypotheses we used data gathered in the internal operational system of the IEC, for the experimental group, as well as data obtained through the questionnaire based survey from part of the experimental group and the control group. The internal data included the figures for electricity consumption during peak hours of 59 electricity consumers who participated in the IEC pilot study. They included three reports about electricity consumption during peak hours in summer and winter, which were produced for three periods: the year before, the year of, and the year after the pilot study. A short and focused questionnaire was designed for examining further research hypotheses. The questionnaire was adapted for the examined population based on scales used in three previous studies

( Ek & Söderholm, 2010, Ma et al., 2013, and Wang et al., 2011). The sample population that filled the questionnaires consisted of 116 subjects, of whom 57 were men and 59 women, aged 25-73 years. Of the subjects who participated in this research study, 36 had participated in the IEC pilot study, which dealt with the demand management arrangement, and 80 had not participated (control group).

### 3. MAIN FINDINGS

#### 3.1 Electricity Demand Survey

In order to examine the first hypothesis, we analyzed if there are differences in the average demand for electricity (expressed in KW) for the group of consumers who had participated in the IEC pilot study for managing the demand for electricity. A one factor variance analysis (ANOVA Repeated Measures) of the three measurement periods was conducted (see Table 1). A significant difference was found in consumers' average demand for electricity during the pilot period and in the period after the pilot ended. ( $F_{(2,116)} = 54.207, p < 0.0001$ )

**Table 1. One way variance of the differences in electricity consumption in the different periods of the pilot study**

Period	Average monthly power consumption during peak hours (kWh)	$F_{(2,882)}$
Before the pilot	574.40	**54.207
During the pilot	687.14	
After the pilot	736.78	

\* $p < 0.05$ ; \*\* $p < 0.01$

A significant difference (sig.<0.01) in electricity consumption between periods was found in a comparison of period pairs (LSD Pair wise Comparisons) between the periods before and after the pilot study (MD=-112.73, SE=15.798). A significant difference (sig.<0.01) was also found in electricity consumption between the periods before and after the pilot study (MD=-162.37 SE=17.70). It should be noted that the demand for electricity in fact rose during the pilot study period, in contrast to the expectation. Thus, H1 was not confirmed – electricity consumption did not decrease during the pilot study, the monetary incentive having the opposite effect.

## 3.2 Attitudes Survey

### 3.2.1 Descriptive statistics

An examination of the data of the research participants who filled the research questionnaire, divided into those for the group that participated in the demand management arrangement and those for the group that did not participate shows that, in general, approximately 50% of the participants were men and 50% women (49.1% and 50.9%, respectively). A comparison of the groups reveals that the representation of men (56.3%) was slightly higher in the arrangement group and that of women (61.1%) was slightly higher in the group without an arrangement, but this is not a significant difference. Most of the participants were married (88.8%), both in the arrangement group and the group without the arrangement. Also, over a third of the arrangement group lived in a household consisting of five people (35.7%) and above three quarters (77.6%) of this group were employees in a full-time job. The picture is similar for the group without an arrangement. It seems that about two thirds of the arrangement group earned between 2,286 and 3,429 or above 3,429 dollar. These figures were repeated for the group that did not participate in the demand management arrangement.

**Table 2: Distribution of the research sequential variables**

Variabl	The entire sample			Pilot group			Control group		
	SD	M	N	SD	M	N	SD	M	N
Age	9.21	40.84	114	7.29	39.75	36	9.98	41.35	78
Years of study	2.61	15.65	110	2.93	14.51	33	2.31	16.14	77
Propensity to save electricity	0.65	3.42	116	0.69	3.58	36	0.63	3.35	80
Willingness to participate in the demand management arrangement	0.98	2.68	116	0.98	3.13	36	0.92	2.47	80
Discount in the electricity bill	0.82	4.14	116	0.74	4.53	36	0.8	3.96	80
Subsidization	0.91	4.09	116	1.19	4.19	36	0.75	4.04	80
Monetary fine	1.25	3.31	116	1.41	3.28	36	1.19	3.32	80

From table 2, which shows the distribution of the research continuous variables of the groups that did and did not participate in the experiment, it can be seen that the average age of the participants was approximately 41 years, and their years of education were on average 15.65. It can also be seen that those who participated in the demand management arrangement paid a little more attention to electricity savings than those who did not. Furthermore, it can be seen that among those who participated in the demand management arrangement there is a greater

willingness to join a demand management arrangement in the future than among those who did not. From the aspect of the financial incentives for saving electricity, it seems that those who participated in the demand management arrangement attributed more importance to the economic incentive and to being able to buy energy-efficient electric appliances at subsidized prices as incentives for saving electricity. In contrast, there is no significant difference between the two groups in terms of the importance attributed to a fine as a motive for saving electricity.

### 3.2.2 Inferential Statistics

In order to test the second hypothesis, that there is a difference in the average propensity of consumers who did and did not participate in the demand management arrangement (pilot study) to reduce their electricity demand, a t test was conducted for the two independent samples. Table 3 presents the analysis results.

**Table 3: Results of t test to examine the differences between subjects participating/not participating in the pilot study in terms of a tendency to save electricity**

Variable	Group that did not participate in the demand management arrangement		Group that participated in the demand management arrangement		t(df=114)
	SD	M	SD	M	
Tendency to save electricity	0.628	3.35	0.689	3.58	1.819

\* $p < 0.05$ ; \*\* $p < 0.01$

The results of the analysis show no significant differences on average between the two groups of subjects in terms of the demand for electricity. Thus, the second research hypothesis is not confirmed.

To test the third hypothesis, a Spearman's correlation analysis of the relationships between the various types of incentives and the willingness to join a future arrangement among consumers who participated in the demand management arrangement (pilot study) was conducted. The results are shown in Table 4.

**Table 4: Correlation matrix of the relationship between receiving a financial incentive and willingness to join a future arrangement among participants in a demand management arrangement**

Variable	Discount in an electricity bill	Monetary fine	Subsidies on buying electrical appliances
Willingness to join a future demand management arrangement	0.220	0.349*	-0.009

\* $p < 0.05$ ; \*\* $p < 0.01$

The results of the analysis show that there is a statistical significant correlation between the willingness to join a future arrangement and the identification of a monetary fine as a factor that would influence electricity savings ( $r=0.349$ ;  $p=0.037$ ). No statistical significant correlation was found between the consumers' willingness to join a future arrangement and the identification of a subsidy of electric appliances or a discount in the electricity bill as factors that would influence their electricity savings. A comparison of the two groups showed that the statistical correlation between the readiness to join a future arrangement and a monetary fine was significant only in the group that participated in the pilot ( $r=0.349$ ;  $p=0.037$ ) and was not found significant in the group that did not participate in the pilot ( $r=0.108$ ;  $p=0.342$ ). In order to deepen the understanding of the influence of a financial incentive of a discount in the electricity bill on the willingness to participate in a demand management arrangement in the future, a correlation analysis was conducted among all the participants in the sample population (those who had participated in the pilot and those who had not) to examine the relationship between the willingness to participate in an arrangement and a monetary incentive of a discount in the electricity bill, when the arrangement involves an invasion of privacy, loss of control of the use of appliances, and the control of household appliances being given to an external company. The results are shown in Table 5.

**Table 5: Correlation matrix to examine the relation between a discount in the electricity bill and the types of arrangements**

Variable	Agreement to an arrangement where an external company controls appliances	Agreement to an arrangement involving loss of control of electrical appliances	Agreement to an arrangement involving privacy invasion
Receiving a monetary incentive in the form of a discount in the electricity bill	0.035	0.079	*0.233

\* $p < 0.05$ ; \*\* $p < 0.01$

According to the analysis results, it seems that there is a significant statistical correlation between a monetary discount in the electricity bill and the willingness to join a demand management arrangement in the future that could negatively affect the consumer's privacy ( $R=0.233$ ;  $p < 0.05$ ). Nevertheless, in cases where the control of home electricity appliances is lost and the control is turned over to external companies, no significant statistical correlation was found between receiving a monetary discount in the electricity bill and the willingness to join a demand management arrangement in the future. Accordingly, only a partial confirmation of the third research hypothesis H3 is obtained.

To test the fourth hypothesis H4, a regression analysis was performed, to examine the tendency to save electricity as a result of financial incentives, convenience motives, and environmental protection motives among all participants (both those who had participated in the arrangement and those who had not). The results are presented in Table 6.

**Table 6: Regression analysis of the tendency to save electricity based on financial incentives, comfort incentives, and environmental protection incentives**

Variable	Tendency to save electricity		
	$\beta$	SE B	B
Discount in an electricity account	0.117	0.080	0.092
Receiving a subsidy in purchasing energy efficient appliances	-0.042	0.071	-0.030
Monetary fine	0.116	0.045	0.060
Protection of the environment	**0.432	0.054	0.270
Discomfort	0.051	0.056	0.033
<b>R<sup>2</sup> Adj.</b>		0.172	
<b>F</b>		*5.786	

\* $p < 0.05$ ; \*\* $p < 0.01$

From the results in Table 6, it can be deduced that the results of the regression model were significant ( $p < 0.01$ ). An examination of the variables showed that, among the motives that predict an electricity savings, only environmental protection was found to be significantly predictive ( $\beta = 0.432$ ;  $p < 0.01$ ). That is, the more a person has pro environmental attitudes, the greater his/her propensity to save electricity. Contrary to the assumption, no significant influence was found for financial incentives. Therefore, no confirmation of the fourth research hypothesis is obtained.

### **3.3 Qualitative Findings**

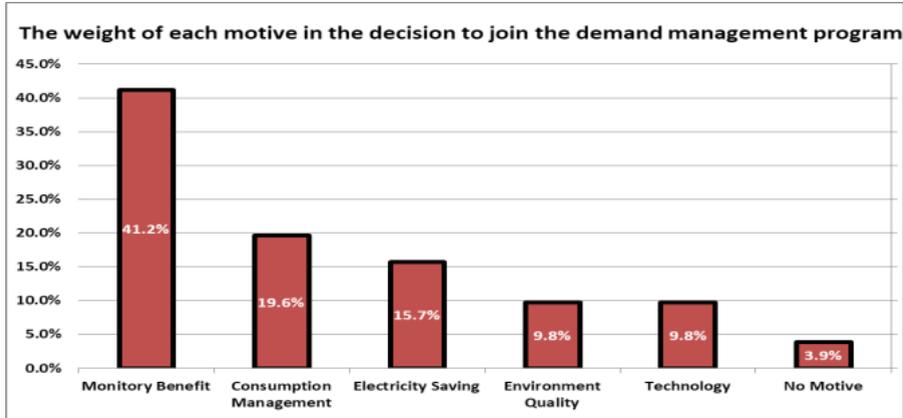
Qualitative research findings are intended to support and strengthen quantitative results. The qualitative results of this study are based on two open questions incorporated in the questionnaire that was administered to 36 consumers who participated in the IEC pilot study, focusing on three main content categories:

1. The consumers' motive for joining a demand management arrangement scheme of the IEC;
2. The electricity consumption pattern of consumers following a demand management arrangement;
3. The consumers' experience in participating in a demand management arrangement and their general impression of this arrangement.

#### **3.3.1 Consumers' motive to join a demand management arrangement with the electricity company**

The consumers' responses to the question "What is the motive for your joining a load management arrangement with the Israel Electricity Company?" shows that several motives exist for the decision to join a load management arrangement, which can be arranged according to their relative importance (weight). As can be seen in Figure 1, the participants' main motive was monetary benefit (41.2%). Nevertheless, it can be seen that, on the consumer side, the consumption was managed by personal measures taken by the customer, such as using high energy appliances during less loaded hours or changing to economic light bulbs, and on the supplier side, it was managed by the IEC controlling home electrical appliances remotely to reduce electricity consumption. All these measures reduced electricity consumption. Therefore, the two motives,

consumption management (which eventually leads to electricity savings) and electricity savings, together have the highest weight (35.3%) in the decision to join this arrangement.



**Figure 1: Weight of each motive in the decision to join the demand management arrangement**

The economic motives, expressed in costs derived from the demand management arrangement (for example, the cost of buying a smart board), monetary savings, and the effect on the electricity bill (similar to Wimberly, 2010), directly influence consumers in the smart electric network, so that, in fact, decreasing the payments to consumers is a preliminary key requirement in the smart electric network (SGCC, 2011). Two additional motives are salient in the decision to join the demand management arrangement: environmental quality, which characterizes consumers who are concerned with the manner in which electricity consumption affects the environment through such things as carbon emissions from power stations, or consumers who are defined as “green” idealists and are enthusiastic energy savers, and therefore constitute a group that is compatible with the installation of smart meters and a personal electricity tariff (similar to Zhang et al., 2012). A technological motive characterizes consumers who are fans of new technologies that improve performance or offer new services (as does the smart board). Despite the relatively low weight of these motives in the decision to join the demand management arrangement, it is certain that these

consumers would be the first to adopt programs for managing demand in the framework of the smart electricity network (similar to SGCC, 2011).

### **3.3.2 The electricity consumption pattern of consumers in the framework of the demand management arrangement**

The answers of consumers to the question “Will there be a change in the electricity consumption pattern in your home following the load management arrangement? If so, note several of your actions in this area” indicate a change will occur in the electricity consumption pattern of approximately 88% of consumers. The consumers who stated that there will be a change reported that they take measures to save electricity, such as operating electric appliances, for example, the washing machine and dryer, at night, installing a “Sabbath clock” for the electric boiler, replacing appliances that are not energy efficient, mostly the refrigerator and light bulbs, with economic ones, turning off electricity when leaving the house, setting the air conditioner’s temperature at 25 degrees, and more.

In fact, there are consumers who have succeeded in adopting a behavior pattern of “decrease” that demands new habits, such as operating electric appliances during less loaded hours or regulating the air conditioner’s temperature, in addition to behavior based on energy efficiency, such as replacing the refrigerator and light bulbs with more economic ones (similar to Gardner & Stern, 2002; Abrahamse et al., 2005).

### **3.3.3 General impression of the demand management arrangement**

Open interviews, in which general questions not prepared in advance were asked, were conducted with consumers in order to obtain general information about the experience of participating in a demand management arrangement with the electricity company and their personal impression of this arrangement. In general, consumers expressed satisfaction with the arrangement because of the monetary benefit of a discount in the electricity bill and the possibility of managing their electricity consumption such that they benefit from electricity savings. Nevertheless, there were consumers who were afraid of allowing the electricity company to remotely control their appliances, on the grounds that the company could use this to forward its own interests.

One of the issues about the arrangement that was mentioned by consumers was comfort. Consumers reported a lack of comfort as a result of “load shedding” in various orders of importance. They expressed that a slight inconvenience was caused by the air conditioner’s ceasing to work for several minutes, a medium inconvenience by the oven ceasing to work in the middle of baking a cake, and a great inconvenience by the stopping of a child’s oxygen machine following “load shedding” (critical event, after which a switch enabling the consumer to turn of the “load shedding” was inserted in the smart board). An interesting point was the choice of the order in which electric appliances should be cut off during the “load shedding.” Consumers chose electric appliances, such as the oven, drying machine and refrigerator, and in fact most of them did not give high priority to lighting, which is the first interface in which the consumer notices an electricity cutoff. Another point that interviewees mentioned during the interviews was their lack of knowledge about operating the smart board. The only information that the consumers had received was the one provided at the beginning of the pilot study by the representative of the firm that had developed the smart board. The representative explained in general the goals of the pilot study, and the possibility of using the smart board to obtain information about electric appliances in the house through connecting to an Internet portal. Many consumers felt that they lacked technical information about operating the smart board so that they could manage their electricity consumption and achieve electricity savings. If more information had been provided, the number of consumers whose electricity demand pattern changed as a result of the demand management arrangement could have increased.

## **4. DISCUSSION AND CONCLUSIONS**

### **4.1 Meaning of Findings**

The first research hypothesis was that a monetary incentive in the framework of a demand management arrangement would influence the electricity demand pattern of the household consumer, decreasing it. Although the data showed a change in the electricity consumption of consumers who participated in the pilot study, it can be seen that during the pilot period the electricity consumption of the consumers actually increased. That is, the first research hypothesis was not confirmed. A possible explanation for this finding is that the monetary incentive

the household consumers had received for participating in the pilot study was a fixed sum of 85 dollar and the manner in which it was received was a direct discount in their electricity bill. It may be that the users conceived the discount as a sort of possibility “to go wild” in their electricity consumption and chose to use more of the electricity resource to realize the economic saving. This result, which is opposite to that expected, raises the assumption that among consumers who participated in the pilot study a phenomenon called the “rebound effect” occurred, that is, a phenomenon caused by the unexpected consequences of a certain step (see, for example, Berkhout et al., 2000 & Mizobuchi, 2008). Furthermore, a severance of a correspondence between the level of use of the consumer and the sum that in fact he/she has to pay for the same consumption leads to wasteful behavior (Marujelos & Young, 2011). Indeed, in this case a complete severance between the use and payment did not occur. This may mean that the constant sum and the fact that it was given directly as a discount in the electricity bill, and not, for example, in the form of cash or check, were the factors that eventually lead to a rise in use. As noted by Goldman et al., an experiment conducted in California, where there was a connection (although not linear) between a consumption decrease and an economic incentive, showed the incentives to be efficient (Goldman et al., 2002). These findings are also compatible with those of other studies that showed that an incentive based on variable pricing is more efficient than a constant economic incentive for creating consumers’ active involvement in managing demand (Maria & Julija, 2013) and has the ability to lead a change in consumers’ consumption patterns (Fan & Hyndman, 2011).

The second research hypothesis was that a demand management arrangement through the smart board and a monetary incentive would influence the propensity for reducing the consumers’ demand for electricity. This hypothesis was, again, not confirmed. A possible explanation for this finding is that electricity consumers feel that the electricity is a product with a low involvement level (Watson et al., 2002). In fact, electricity consumers perceive electricity as a basic product, the consumption of which cannot be significantly decreased (Tabori, 2012), even when the electricity company installs a smart board and gives a monetary incentive to consumers that would decrease the demand for electricity during peak hours. This finding strengthens the concept that the demand for electricity among household consumers is rigid, that is, that a change in price will

not significantly change the quantity of electricity demanded, and consumers feel that they cannot significantly influence the electricity bill and its price in any way.

The third research hypothesis - that various financial incentives influence consumers' willingness to join a demand management arrangement in the future - was only partially confirmed. Only a monetary fine was found to influence consumer's willingness to join a demand management arrangement. The salient point is that the consumers' willingness to participate in a demand management arrangement is derived from the wish to avoid a monetary fine (as a result of not entering an arrangement or as a result of a deviation in their electricity consumption). These findings confirm those of previous studies, according to which using a negative incentive can lead to more economic consumption behavioral patterns (Dolev et al., 2012). Furthermore, the examination of consumers' willingness to join a possible arrangement in the future in return for a monetary incentive of a discount in the electricity bill showed that if the arrangement involved invasion of privacy, Israeli consumers would be ready to accept this (assuming that they would receive the monetary incentive). This finding contradicts the results of other studies which reported that household consumers were concerned about invasion of privacy and safety, and that information about them would be shared with a third party as a result of their participation in household energy management programs (SGCC, 2011). Nevertheless, if the arrangement included losing control of electric appliances in the house or turning over the control to an external company, the willingness decreased drastically. These findings also confirm those of other studies which showed that customers' low willingness to participate in household energy management programs is derived from customers' cautiousness in all that concerns the electricity company's motives, and consumers do not always view the benefit of these programs in the same manner as the electricity companies do (SGCC, 2011). Nevertheless, consumers are willing to join programs of managing electricity if this would result in a decrease in their electricity bill (similar to Guthridge, 2010). It may be that the great resistance to losing control of electricity appliances is derived from the fear of damaging the comfort that these appliances provide, as it seems that the possible damage to privacy almost did not influence the attitude of the potential participants, and only the possibility that they would not be able to completely control their comfort level was a factor that influenced their resistance to the

programs. Previous studies (for example KEMA, 2010) showed that complaints in trials of load shedding programs commonly concerned damage to comfort, similar to the complaints that consumers who participated in the pilot study expressed, and therefore, it is clear that the issues of control and comfort are important. The importance of these issues is derived from the fact that in many instances the electricity appliances that supply maximum “comfort” are those related to temperature regulation and are therefore especially energy greedy appliances (one should not compare electricity consumed by an economy light bulb with that consumed by an air conditioner, for example). The fact that no differences were found between the different groups of participants examined in the pilot study is evidence of a “universality” of comfort preference, and it should be considered when planning a policy.

The fourth research hypothesis – that a constant monetary incentive of a discount in the electricity bill would be the dominant variable amongst the variables that influence the propensity to save electricity - was surprisingly not confirmed, and no relationships were found between the monetary incentives (negative or positive) and the propensity to save electricity consumption. This is in contrast to the results of many previous studies which suggested that a discount in electricity influenced the consumer to save electricity (see, for example, Mizobuchi & Takeuchi, 2012 and Goldman et al., 2002) as did a negative incentive, which is, fining consumers who deviated from the defined quantity of consumption. Studies found that frequently levying fines is an efficient strategy for influencing individuals’ behavior, especially concerning consumption (for example, Lusardi et al., 2007). No connection was found between the consumers’ comfort and their propensity to save electricity. This is in contrast to the findings of the pilot study, where the participating consumers complained that cutting off electric appliances remotely damaged their comfort and that this had a negative influence on their propensity to save electricity. This research study’s findings show that the only factor that had a significant dominant influence on consumers’ propensity to save electricity was the environmental awareness of the consumers. Recent studies conducted in Israel show that the Israeli consumers’ consciousness of environmental issues has grown in recent years (see, for example, Bendes-Jacob, Donitz, & Reznikowski, 2012). Nevertheless, one should treat this finding with caution as studies (for example, Sagi et al., 2008) have shown that the connection between consumers’ pro-environmental stances and their actual behavior is a tenuous.

## 4.2 Contribution of the Research

Demand management is an important tool for decreasing electricity consumption in smart electricity networks and for decreasing the hours during which the demand for electricity is at the “peak” by shifting demand from peak to low load hours. Furthermore, demand management contributes to improving the energy safety and to building future electricity systems that produce low levels of carbonates and include electricity from renewable electricity sources, taking into consideration environmental and health aspects of the state of Israel. Without customer readiness and without their active participation, the program’s contribution to demand management will be smaller than expected and maybe not even be real because of decreased economic feasibility.

Thus far, research in Israel has dealt with various aspects of the smart network that focus on its technical and technological aspects. This research is the first study conducted in Israel that addresses the issue of the smart network from the consumers’ perspective. Its contribution is in its examination and analysis of the behavior response to financial incentives and the manner in which the consumers’ experience of participating in the system for managing load from the demand side influences their willingness to take an active part in the smart network and decrease consumption. There is no doubt that, without the active participation of consumers, the efficiency of the smart network in general and of the system for managing demand in particular will be limited.

The insight provided by this research will help decision makers, both in the government and in the electricity company, to understand better various aspects of the interaction between consumers and various elements in the network, aspects that usually are not included in studies that focus only on technology or economic costs. The research findings will facilitate the planning of a better system that takes into consideration the needs and constraints of the electricity network on the one hand and the needs and expectations of the consumers on the other.

Results are important for the debate about energy conservation and energy efficiency from all over the world and not only from Israel. The various theories explaining electricity consumer behavior are culturally sensitive, experiences from various countries bring new, specific perspectives, so the results from the Israeli market, especially the unexpected ones, add an important piece to the electricity saving puzzle.

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CASE STUDY

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# DETERMINANTS OF FOREIGN DIRECT INVESTMENT: A REVIEW

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**Abstract:** *When investigating foreign direct investment, scientists focus on different combinations of factors. They often emphasize the economic ones, while underestimating the others. Among the non-economic factors, there are several problems regarding the identification of relevant FDI determinants. The aim of this paper is the provision of a comprehensive review of the factors that are considered to impact the attraction of FDI and the identification of relevant FDI determinants. From the variety of factors, mentioned in the specialty literature, we identified eleven categories of FDI determinants. We also provided a comprehensive review of categorical and methodological interferences of the identified factors, proposing potential working hypothesis for future researches in the field. The final assessment of this study is the creation of a Synthesis of the factors influencing FDI.*

**Keywords:** *Foreign Direct Investment, FDI, FDI determinants, classification, synthesis.*

**JEL Classification:** *F21, F23*

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## 1. INTRODUCTION

Foreign direct investment is one of the economic concepts that are seen as the determinants of economic development of the countries in the context of the market economy. That is why it is widely considered in a variety of economic studies. A great part of the researches are based on the examination of FDI as a key determinant of economic growth and technological development, due to the fact that “the very essence of economic development is the rapid and efficient transfer and adoption of “best practice” across borders” (Kok & Ersoy, 2009).

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The great role of Foreign Direct Investment in countries' welfare incents to frequent studying of the factors which stimulate/restrain the attraction of FDI into countries' economies in order to explain the location of FDI across the world.

The most investigations concentrate on economic determinants of FDI flows, while other groups of factors are often ignored or reduced to simple mentioning. When the researches investigate non-economic factors, the lists of factors, the approaches and the results are so different that appears the question of the relevance of factors and credibility of the results. The exploration of economic factors is necessary, because of the evident linkage of FDI with economic phenomena, though it must not lead to the diminution of other factors' importance.

Sparks et al. (2014) concludes that only 22,46 % of the variation of countries' FDI can be explained by economic factors. Even if there is a question about the relevance of the Country Liquidity Index using as a proxy for economic factors, the statement that economic determinants are not sufficient for the explanation of the location of FDI appears to be correct.

Usually, in this field researches present a narrow image of the factors that incite FDI. Only a limited number of non-economic determinants are mentioned, among them some factors predominate, while the others seem to be avoided. Very rarely a study may be encountered proposing a large set of factors. That is why we intended to collect a large variety of factors that are supposed to influence cross-border investments. For a more comprehensible presentation, we systematized this variety of factors into eleven categories. In the context of these categories, we analyzed the interferences and discrepancies between different approaches, highlighting the significant outcomes. Significant relationships confirmed by several researches have led to the elaboration of working hypotheses which are very useful for a potential research in the field.

Another contribution to the literature in the field is offered through the Synthesis of the factors influencing FDI, which includes all the identified factors from the specialty literature, placed according to the category and the results obtained by researchers.

Of course, the proposed hypotheses cover the significant relationships identified within the limits of this study, but which can be inferred with at least a satisfactory level of credibility. The lack of some factors among the presented hypotheses signifies the necessity for more in-depth studies on the influence of

these factors on FDI, yet it does not mean the irrelevance of their application in potential research.

The purpose of this paper is the provision of a comprehensive review of the factors that are considered to impact the attraction of FDI and the identification of relevant FDI determinants, which would be useful for potential research in the field.

In order to achieve this aim the following objectives are set:

1. Furnishing of an extensive and consistent survey of the determinants of the FDI flows.
2. Establishment of the pertinent groups (categories) of factors.
3. Identification of relevant and significant factors.
4. Elaboration of potential working hypotheses.
5. Elaboration of a synthesis of factors by approach and relation discovered.

The paper proceeds with separate sections for every group of discovered FDI determinants: Economic factors, Infrastructure, Technology, Institutional-political factors, Specific risk, Human factor, Legal integration, Space factor, Entrepreneurial matters, Cultural and Paracultural factors. We placed Culture in this position not in order of its importance, because it is one of the key factors to impact FDI, but to underline the special role it plays in the decision making process regarding foreign investment.

## **2. ECONOMIC FACTORS**

It is obvious that economic factors play a very important role in the explanation of FDI flows, due to the fact that FDI is itself an economic concept. Probably that is why most researchers consider these factors when analyzing FDI. However, focusing on economic matters is frequently associated with a relatively minor accent on other factors' influence on FDI.

Most researchers focus on macroeconomic concepts as main incentives of FDI inflows, among them, Market size (in terms of GDP) is the most commonly mentioned. Larger markets (economies) will attract a larger volume of FDI due to the influence of the economies of scale in the context of market-seeking investments. In some cases, this factor may be the key determinant of foreign investment (Sharma & Bandara, 2010).

Although the name of this factor for each study differs, all investigations refer to Gross Domestic Product, either it is called Market size (Mateev, 2009; Riedl, 2010; Sharma & Bandara, 2010; Khachoo & Khan, 2012), Economic size (Tang, 2011), The size of the economy (Jurcau et al., 2011), Size of domestic market (Arbatli, 2011), or directly GDP (Hayakawa et al., 2013; Kersan-skabic, 2013). Nevertheless, the methodology is different, as for example: Sharma & Bandara (2010) and Riedl (2010) apply the level of GDP in currency units, Mateev (2009) and Kersan-Skabic (2013) use GDP per capita, other researchers use the logarithm of GDP (Tang, 2011; Jurcau et al., 2011). Almost all investigations discovered a positive significant effect of the Market size on FDI flows. Only Arbatli (2011) provided a research, which results show a significant negative relationship between GDP per capita and FDI flows. The author suggests that this variable is related to the capital-to-labor ratio and, hence, the productivity of capital; countries with lower level of per capita income might attract more inflows, consistent with a higher marginal productivity of capital. Although, these results are not confirmed by other researches and cannot be considered relevant. Thus, the great majority of studies prove that Market Size is one of the most important incentives influencing investors' decisions.

Being an indicator of high productivity in the economy, Market size growth can stimulate the attraction of foreign direct investment. Each author suggests a different name for this factor, yet all refer to GDP growth. However, only a few studies obtained significant results: Noorbakhsh & Paloni (2001), Kok & Ersoy (2009) and Pearson et al. (2012). All this investigations emphasize positive influence of GDP growth on FDI. However, considering empirical results, we cannot affirm the existence of a reliable relationship between this factor and FDI.

Another macroeconomic factor that is considered to influence FDI flows is Inflation, which is meant to measure instability at the macro level (Kersan-Skabic, 2013). However, only two out of four identified researches obtained statistically significant results, although they were opposite and do not provide credible assumptions: Kok & Ersoy (2009) state that inflation affects negatively FDI flows, while Kersan-Skabic (2013) received a positive sign of the relation, contrary to expectations.

It is widely known opinion that openness to trade might stimulate the attraction of foreign investments. Therefore, Trade in its different aspects is found

to be a determinant of foreign investment. Only a half of the detected researches obtained statistically significant results: Kok & Ersoy (2009), Kersan-Skabic (2013) and Noorbakhsh & Paloni (2001) state that Trade has a positive impact on FDI flows, as expected.

Labour costs reflected in level of wages are often seen as one of the main determinants of FDI inflows, low wages being regarded as an advantage in attracting foreign firms, because of the diminution of production costs. However, the methodology of the variable forming is dissimilar: Du et al. (2012) and Hayakawa et al. (2013) use the average payment for manufacturing workers, Mateev (2009) utilizes the percentage change in overall cost of labour, Khachoo & Khan (2012) apply the natural logarithm of the wage rate, whereas Riedl (2010) uses real unit labour costs. All mentioned researches have obtained significant results, with a predominantly negative sign of the relationship, as expected. Therefore, we can easily deduct a potential working hypothesis based on the relationship between labour costs and FDI.

A factor of the influence on FDI flows that is closely related to wages is Income. It is not frequently mentioned in specialty literature, though we identified two authors who obtained significant results in analyzing different aspects of income in the context of FDI. However, the results are ambiguous and do not lead to a concrete and relevant conclusion.

The macroeconomic factor of Exchange Rate is also considered to be an influential factor when studying foreign investment. Arbatli (2011) proposes two variables to investigate it: Real exchange rate and Exchange Rate Classification. The first one does not have any statistically significant relationship with FDI. For Exchange Rate Classification the author introduces dummy variables on the basis of IMF's de facto classification of exchange rate arrangements and obtains significant results, stating that the exchange rate fixation or volatility affects foreign capital inflows.

Economic freedom is a variable that characterizes a market economy. It is a common opinion that the degree of economic freedom is associated with the attractiveness to foreign investors. Jimenez et al. (2011) introduce in their model the Economic Index of Freedom, while Pearson et al. (2012) use the variable Economic freedom. The relation between this index and FDI is negative, because the study focuses on Spanish investment in Europe, and they are mostly present in

countries with geographical and cultural proximity, which do not have relatively high scores of the Index (Jimenez et al., 2011). Pearson et al. (2012) utilize Fraser's Institute degree of economic freedom index, obtaining a positive and highly significant relationship, specifically a high degree of economic freedom will lead to an increase in FDI inflows. We can certainly affirm that the relationship exists, though its direction is not quite clear.

Several researches investigate the role of Liquidity in FDI directing. Arbatli (2011) uses average real interest rates in G-7 countries under the name International liquidity. This study discovers a negative influence of this factor on FDI, as expected: lower interest rates tend to increase FDI flows. Sparks et al. (2014) utilize Country Liquidity Index, which is based principally on economic criteria and measures how well a government manages available cash. This factor has a positive significant influence on FDI flows, taken by the authors as the influence of aggregate economic factors. Since reserves play an important role in maintaining liquidity, we added to this group the factor named Total Reserves, utilized by Khachoo & Khan (2012). The natural logarithm of total reserves has a positive impact on FDI flows, the accumulation of reserves helps to attract more FDI into a country. Therefore, the significant positive relationship between liquidity and FDI is more likely to exist, than a negative one.

Different aspects of FDI are also considered in some researches to influence the flows of FDI. For example, Crespo & Fontoura (2007) aggregate different factors into a composite determinant named FDI characteristics, and Noorbakhsh & Paloni (2001) apply Past changes in FDI to GDP ratio. However, the results are equivocal and cannot serve for potential hypotheses.

The impact of the development of industry sectors on location decisions of foreign investors is reflected in the Agglomeration factor, which appears in the analysis of Riedl (2010) and Du et al. (2012). Still, the methodology of factor's quantification differs: Riedl (2010) takes the ratio of industry GDP to total sector GDP, while Du et al. (2012) measures separately horizontal and vertical agglomeration, using four variables. It is important that both approaches found a significant positive relationship between Agglomeration and FDI flows, stating about the relevance of this factor.

Several scientists investigate determinants of FDI that belong to Capital factors. Two variables that represent the Capital formation factor are introduced by

Kok & Ersoy (2009): Domestic gross fixed capital formation and Gross capital formation, with a significant result only for the second variable. Holmes et al. (2013) use the factor Capital Availability that includes capital investments, money supply, net reserves and total foreign debt. The results of the research suggest that economic institutions that provide capital availability discourage inward FDI. Jurcau et al. (2011) utilize the variable Stock market capitalization to GDP ratio as a measure of the size of financial market, which has a positive impact on FDI inflows. A factor that is connected to the previous one by describing financial market and also with Capital availability is named Domestic credit. It reflects the amount of credit provided to private sectors and has a significantly positive impact on cross-border investment. These two factors show that larger financial markets are more attractive for foreign investors (Jurcau et al., 2011). Though these factors may be significant in the context of a proper study, identified papers present single results, unconfirmed by several researches.

Kok & Ersoy (2009) use in their research two variables to measure the impact of Debt on Foreign investment: Total external debt, which is the debt owed to nonresidents, and Total debt service as a percent of GDP. The authors obtain a significant result only for Total debt service, thus making the relevance of the Debt factor unclear in the context of a future research.

The analysis of specialized literature demonstrates that the group of economic factors is the most frequently studied, which was expected due to economic nature of the concept of Foreign Direct Investment. Therefore, there is a lot of empirical evidence regarding the influence of this group of determinants on cross-border investments. However, only a few of the identified factors can claim (within the limits of this research) to have a clear and significant relationship with FDI, on which we could formulate several working hypotheses.

H1: Market Size has a significant positive impact on the attraction of FDI.

H2: The level of salaries correlates negatively with the volume of FDI inflows.

H3: Liquidity level influences positively the FDI inflows.

H4: Agglomeration has a significant positive impact on inward FDI.

### 3. INFRASTRUCTURE

Infrastructure facilities, such as energy supply, communication facilities and transportation determine production and transaction costs, thus influencing incentives for the attraction of FDI into a country (region). Infrastructure factors are often mentioned in specialty literature, although referring to different aspects.

The first one may be Electric power consumption. Electric is exceptionally important for efficiency-seeking FDI (Kok & Ersoy, 2009). The author did not obtain any significant results, though. Khachoo & Khan (2012) use the same indicator in logarithmic form and name it Infrastructure. The results show a significantly positive relationship between this variable and FDI inflows, being one of the main determinants of the last ones.

Telephone mainlines is a factor that may represent communication facilities. Kok & Ersoy (2009) utilize data per 1000 people to capture this determinant. The authors discovered a strong positive effect of Telephone mainlines on FDI, this factor thus being the best FDI determinant in their analysis.

We discovered two researches that utilize the factor named Infrastructure. Mateev (2009) proposes a generalizing approach, using the EBRD Index of Infrastructure Reform. Although this variable was expected to have positive sign of correlation, the author did not obtain any significant results. Under the name Infrastructure Du et al. (2012) understand highway density, the length of highway per square kilometer. This factor appears to have a significant positive influence on FDI, proving the fact that superior transportation facilities increase the attractiveness of a country to foreign investors.

Although we do not have large empirical evidence about the influence of infrastructure factors on FDI, the existence of this impact is certain. Based on the identified relationships, we can formulate only one reliable (though general) hypothesis.

H5: Infrastructure facilities have a positive impact on the level of FDI inflows.

### 4. TECHNOLOGY

It is a well-known fact that FDI are seen by developing countries as the main way to facilitate technology transfer from developed countries and reduce the technological gap. Several researches introduce technology in a way or another in their models as a determinant of the FDI flows.

Technology gap is a factor that represents the difference of technology level between two countries, as it is used by Kok & Ersoy (2009). Crespo & Fontoura (2007) expand this concept and mention more generalized factor Absorptive capacity and technological gap, which adds the capacity of a country to modify foreign knowledge in order to fit internal applications. Unfortunately, the relevance of this factor is unclear, based on the identified papers.

Gauselmann et al. (2011) introduced two variables related to technology in a qualitative research. The first one is Access to local knowledge and technology, which is discovered to be an important strategic motive for investment. The second one is a location factor that shows the perceived quality of Potential for technological cooperation in Central-Eastern Europe and appears to be of a high level of quality, which means that the investors' motive matches perceived location factor.

Sharma & Bandara (2010) mention Knowledge capital as a key location factor of FDI, particularly among developed countries. It happens through the differences in cross-country level of technology, determined by differences in Knowledge capital. The relationship between this variable and FDI was found to have an unexpected negative sign. A limitation of this result is that the authors investigate Australian outward investment. Second, as mentioned by the authors, measuring Knowledge capital through R&D expenditure is problematic because not all of this expenditure is commercially successful and contributes to Knowledge capital. However, this finding represents a single result, unconfirmed by further studies.

For this reason, and taking into account the results of the other researches, we cannot provide any relevant and credible hypothesis regarding the relationship between technological factors and foreign direct investments at the moment. Though, this area clearly requires further investigation.

## **5. INSTITUTIONAL-POLITICAL FACTORS**

There is no doubt that political environment (political regime, stability, risk, etc.) influence uncertainty in the process of making decisions about foreign investment. Institutional environment has an impact on investors' costs, protection of their interests etc. and, thus, also influences decisions regarding FDI. Institutional and political factors are interconnected and define each other.

Among this group of factors one of the most commonly mentioned is Corruption. The methodology of this factor quantification is different, depending on the investigation. The Corruption Perception Index, elaborated by Transparency International can be a variant. We discovered two investigations, which used this indicator to quantify the factor called Corruption. Mateev (2009) found this variable to have a positive relationship with FDI flows, as expected, because the higher score of the index means less corrupt business environment in the country. Barassi & Zhou, (2012) apply World Bank's Governance Indicator in addition to Corruption Perception Index. The scores were multiplied to -1; therefore, the higher score indicates a higher level of corruption. The results show a significantly negative impact of corruption on the probability of FDI taking place. Though, after correcting for location choice, the impact of corruption on FDI stocks turns to be positive, providing support for "helping-hand" role of corruption. Two other researches named the factor after the indicator – Corruption Perception Index. The results are diametrically opposite. Kersan-Skabic (2013) obtained results that express an expected positive relationship between the Index and FDI, while Jimenez et al. (2011) discovered an unexpected negative relationship, due to the fact that Spanish FDI are concentrated in countries with a relatively low score of the CPI (high level of corruption), because of cultural and geographical proximity. Du et al. (2012) constructed an indicator, based on Survey of China's Private Enterprises, and named it Government corruption. This investigation also states that a higher level of corruption leads to lower FDI inflows. Therefore, the negative sign of the relationship between the level of corruption and FDI is unequivocal and confirms theoretical statements.

Privatization is an institutional factor that is specific for transition economies, and is considered to explain FDI distribution across transformation economies. We identified two authors who discovered the FDI determinant named Privatization: Mateev (2009) and Riedl (2010). Unfortunately, neither author discovered a significant influence of privatization on FDI. Kersan-Skabic (2013) exploit two variables to highlight the impact of privatization: Large scale privatization and Small scale privatization, finding significant results only for the first one. Thus, the significance of this factor is not confirmed and its relevance is unclear.

Corporate tax rates directly influence the returns of foreign investment, and, thus, the decisions of investors when initiating FDI. Several scientists investigated the influence of this factor on FDI flows. Arbatli (2011) and Tang (2011) found a significantly negative influence of Corporate Tax Rates on FDI flows, as expected: higher host country's tax rates discourage FDI inflows. The investigated relationship in the analysis of Hayakawa et al. (2013) is either negative or insignificant, depending on the model parameters. Consequently, the logic of the economic phenomena is confirmed by most identified empirical studies and should be reflected in appropriate assumptions.

Country's tariff rates influence firms' costs and are also considered to determine FDI flows. However, only a few researches obtained significant results: Arbatli (2011) and Hayakawa et al. (2013) suggest there is a negative relationship between tariff rates and FDI flows, although the results are not significant in all model variants, elaborated by Hayakawa et al. We can likely affirm that the relationship exists, though its significance is questionable in the context of this study.

The level of Government intervention, which directly affects the rights of the enterprises, may stimulate or diminish the activity of foreign actors on the market. The proportion of entrepreneurs that request government support in case of business disputes, named Government intervention in business operations is used by Du et al. (2012), while Siegel et al. (2013) propose the factor Government intervention distance to highlight the effects of government intervention in the economy. The studies obtained opposite sign of this factor's relationship with FDI inflows. The difference in results is caused by different approaches to the quantification of Government intervention variable, thus making the nature of the relationship unclear.

In Du et al. (2012) analysis is also present another factor, related to the previous one. It is called Government promotion policies and is represented by two dummy variables. The authors suggest that Government promotion policies reflected in development zones produce a significant and positive impact on FDI entry. Gauselmann et al. (2011) introduce a location factor named Availability of state support. The results of qualitative analysis show that investors found the Availability of state support as comparatively the weakest location factor, concerning Central-Eastern Europe. Such results do not permit us to make any credible statements, due to their ambiguity.

A factor named Regulatory institutions, expressing several ways (policy and laws) the governments exercise control over organizations, is proposed by Holmes et al. (2013). Regulatory institutions realizing greater control over the activities of organizations appear to influence negatively inward FDI.

Environmental regulation distance measures the difference between countries' environmental regulation regimes expressed by Esty and Porter's (2001) Environmental Regulatory Regime Index (ERRI). The greater distance in environmental regulation is associated with a lower level of FDI. An explanation can be the fact that firms' technologies and organizational structures are adjusted to certain environmental regulation modes (Siegel et al., 2013).

Another factor that points out the state's regulatory function is the one proposed by Arbatli (2011) and named Restrictions in capital account transactions related to FDI. The author uses two indicators from the AREAR database of IMF to quantify the implications of this factor. These restrictions influence negatively the inflow of FDI, though the results are not significant for all variants of the model.

An institutional factor that is also considered to influence decisions regarding FDI is Property rights. The utilization of Intellectual property rights (IPR) protection is a variant for the analysis (Du et al., 2012). The authors found an expected positive impact of IPR protection on FDI flows, which is even greater when FDI sources are more culturally distant.

Contract enforcement is a factor, which is related to the protection of the enterprises' rights. As a variable, it is elaborated and applied by Du et al. (2012) and measures the proportion of the lawyers in total population. The results demonstrate an unexpected negative impact of the Contract enforcement on FDI entry. However, this impact decreases when the cultural distance from the source country rises. These outcomes lead to a question regarding the representativeness of the proportion of lawyers for the measurement of Contract enforcement.

We discovered two researches which utilize Political Constraints Index as a determinant of FDI flows. The research of Tang (2011) applies the Political constraints index, elaborated by Henisz (2000), and calls the factor Political environment, while Jimenez et al. (2011) introduces in the analysis the same author's index, though an earlier variant (Henisz, 1998). The results obtained by the studies are ambiguous. The dissimilarity of the results in these cases ensues from the difference in chosen methodologies.

Political risk is a factor that is related to the previous one and is frequently considered to influence firms' decisions regarding FDI. It can be presented in different ways, capturing diverse aspects of political risk, depending on the research. Riedl (2010) and Arbatli (2011) both use indicators of political risk and obtain diametrically opposed results. The first one applies Euromoney political risk indicator in the investigation as a variable named Political risk. The results permit him to affirm that Political risk is a relevant determinant of FDI. Thus, the development of political stability, expressed by lower values of the risk indicator lead to greater FDI inflows (Riedl, 2010). The second author brings into analysis the factor Legal, political and institutional environment. To quantify it he uses several political risks ratings, elaborated by ICRG. Results show a positive relationship of the variable with FDI. It is a result of the fact that a higher rating of the variable indicates lower risk. A more favorable political and institutional environment causes more FDI inflows (Arbatli, 2011). Therefore, the outcomes of the two investigations do not contradict, are both significant and logic.

Holmes et al. (2013) study the means through which government officials and other individuals enact institutional changes. This factor is called Political Democracy. The results demonstrate a negative influence of the Political Democracy on the flows of FDI. The authors explain this relationship with the fact that democracy causes instability and lower predictability, while Multinational enterprises prefer to minimize uncertainty.

Bhardwaj et al. (2007) studies a factor called Governance infrastructure index. It is a generalized approach, compared to previous ones. The author discovered a significant positive influence of the Governance infrastructure index on inward FDI.

Institutional-polical factors are very often applied in the specialty literature, which demonstrates their importance. But the diversity of these factors raises the question of their relevance, because only a few relationships are confirmed by more than one paper. As we can observe, the great majority of identified factors represent either single and questionable, or insignificant results. This fact makes it difficult to formulate credible hypotheses.

Although the corruption factor may have an ambiguous influence on FDI attraction, as demonstrated by the above-mentioned researches, most studies demonstrate the preponderance and the significance of the negative relationship.

H6: The level of corruption has a significant negative impact on FDI inflows.

Besides, we have identified only two determinants, for which the existence of the relationship with FDI is confirmed by the results of several researches - the level of corporate tax rates and the level of Political Risk.

H7: The level of corporate tax rates influences negatively and significantly the level of FDI.

H8: Lower values of the Political risk are correlated significantly with greater FDI inflows.

## 6. SPECIFIC RISK

Sometimes there are factors, investigating the notion of risk, which cannot be attributed to a group or another and we named them “specific risk” factors. In the research of Arbatli (2011) we can find two factors that delineate specific risk. The first one is called Risk environment and is a generalized indicator of global uncertainty. The results show a negative influence of Risk environment on FDI flows, though it is significant during certain periods. The second factor is called Conflicts, revolutions and labor strikes and includes four domestic conflict event variables from Cross-National Time-Series Data Archive (CNTS). As logically expected, this factor has a significant negative impact on inward FDI flows.

Mateev (2009) proposes the variable named generally “Risk”, though it is very concrete. This factor is based on Moody’s Credit Rating for host countries, converted into numbers on a scale from 1 to 8. As a result of the research, Risk is found to be positively related to FDI inflows. Therefore, a better credit rating of the host country is associated with greater inflows of FDI.

Indeed, risk is a factor influencing firms' investment decisions, while it is not frequently mentioned in the literature. Although the significance of the hypotheses is questionable, the logic of the statements supports the idea of their reliability.

H9: Conflicts, revolutions and strikes have a negative impact on the volume of FDI in the economy.

H10: The higher credit rating is positively correlated with a higher level of FDI inflows.

## 7. HUMAN FACTOR

Human factor is one of the most important factors that influence decisions regarding location of FDI. This is determined by the fact that a market's demand is formed by consumers and depends on the purchasing power of the population. People also form the labor force of the future enterprise, the level of local professionalism affects additional costs and influence management decisions. Therefore, the human factor influences investors' decisions regarding different levels of the future activity, from production to sale of products and services.

A frequently used factor of this group in specialty literature is Population. Different authors suggest this factor in different contexts. Mateev (2009) analyzes the impact of population as the expression of the demand of local consumers, by using data from World Bank. Jimenez et al. (2011) are less explicit in describing this factor. They mention the applying of data for countries' population from World Bank. Both studies discovered a positive relationship between country's population and FDI inflows, mentioning Population as one of the key determinants of FDI.

Education (Human capital) is a factor that develops another aspect of the human factors, the qualitative one. Several researches present Education as a relevant determinant of FDI. Noorbakhsh & Paloni (2001) provide a systematic approach, using three variables to capture the effect of a factor named Human capital. Mateev (2009) name his factor Literacy and use the percentage of the labor force that possesses tertiary or higher education. Arbatli (2011) and Du et al. (2012) apply the factor called Education: the first research utilizes the average years of school attainment, while the second one – the ratio of the number of students enrolled in higher education institutions to total population. All investigations, except the Mateev's one obtained significant results. They suggest a positive influence of Education on FDI flows. Though, Du et al. (2012) notes a relatively small size of this impact.

Noorbakhsh & Paloni (2001) propose another variable, pointing out the quantitative aspect. The factor is called Labour force and measures the growth rate of labour force. The authors underline a positive impact of the labour force growth on FDI inflows. Quantitative supply of labour is a location factor, utilized by Gauselmann et al. (2011). The qualitative investigation shows that investors find this factor as being of a weaker level of quality, compared to other factors, when

analyzing Central-Eastern Europe. However, considering these empirical results, we cannot formulate a reliable assumption about the investigated relationship.

An important human factor that is also a macroeconomic indicator is Unemployment rate. Jimenez et al. (2011) use data obtained from the World Bank, and expect a positive relationship of this variable with FDI, because high rates of unemployment signal the possibility of contracting employees without difficulties. Pearson et al. (2012) utilize data from the Bureau of Labor Statistics (BLS). The expected sign of the relationship is negative, because the higher rates generate socio-economic problems, such as high crime rate. Both researches provided similar results: the high Unemployment rate is associated with a lower inflow of FDI. These results were unexpected for Jimenez et al. (2011), therefore, they stated that „Spanish MNEs associate high unemployment rates with rigidity in the labour market”.

The application of various factors belonging to this group in the researches regarding cross-border investment has provided meaningful results that allow us to enunciate certain hypotheses.

H11: The larger population is positively and significantly correlated with FDI inflows.

H12: The level of education is positively and significantly correlated with FDI inflows.

H13: The higher level of unemployment has a negative impact on the volume of FDI.

## **8. LEGAL INTEGRATION**

The legal system of a country represents many characteristics, which are substantial for potential investors. The difference in legal systems of source and host country leads to the increasing of additional adaptation costs. Various aspects regarding investment regulations, taxation and capital repatriation are of great value for investors. Different treaties and participation in different supranational structures are meant to ameliorate conditions of investment.

Siegel et al. (2013) are controlling for legal differences in their research, using the factor Legal family affiliation. To seize its impact, the authors apply a dummy variable, which takes the value 1 when source and host countries belong to

different legal families. Different legal family affiliation appears to have a negative impact on the FDI flows.

Another factor belonging to this group may be called Bilateral agreements. Tang (2011) introduces in his analysis a dummy variable, which indicates if a host and home country have an agreement on income and capital taxation. The author named the factor Administrative distance. The results confirm that the existence of an agreement between the countries increase the level of FDI flows. Siegel et al. (2013) propose two variables: Bilateral investment treaties and Bilateral treaties on double taxation. Nevertheless, only the second factor shows a significant impact on FDI: the existence of bilateral treaties on double taxation stimulates the inflows of FDI. Thus, two different researches discovered the same significant relationship of agreements on taxation between countries with foreign investment.

Supranational integration is another factor among legal ones that influence economic processes, including foreign investment. All discovered researches propose dummy variables to quantify this factor and obtained evidence that supranational membership incents the inflows of FDI, though Hayakawa et al. (2013) also received an unexpected negative sign of the relationship in a variant of the model.

The factors of legal integration exert an influence on economic phenomena that goes far beyond the legal aspect of things. Legal institutions created by bilateral agreements and supranational integration provide important signals and incentives for potential investors, which ultimately leads to an increase in foreign direct investment flows.

The empirical results of the specialized papers confirm the importance of this category of factors and logically lead to the following hypothesis.

H14: Supranational integration and bilateral agreements have a positive and significant impact on the level of FDI inflows.

## 9. SPACE FACTOR

Other factors that should be considered by potential investors when making decisions regarding investment can be summarized as space factors. Traditional locations for FDI are examined in a first place by the investors, due to the familiarity with countries' specifications and their vast previous experience of hosting FDI. Geographic distance directly influence company's costs and is frequently associated with cultural, legal and institutional distances, thus increasing time and costs of the adaptation.

Among space factors, the most often observed is Geographic distance. Mateev (2009) takes the route distance between the capitals of the source and the host country calculated in kilometers. Another variant can be the using of the logarithm of the great circle distance between the capitals of two countries in kilometers (Tang, 2011). The minimum geographic distance between pairs of countries is used as a proxy for Geographic distance by Siegel et al. (2013), while Hayakawa et al. (2013) take data for geographical distance from the CEPII website. An important fact is that the results of all researches confirm initial expectations: greater geographic distance from FDI source countries discourages FDI inflows. Crespo & Fontoura (2007) mention the factor Regional effect, highlighting that FDI spillovers have a geographical dimension or, at least, they decrease with distance.

Location is another view on the space factors, considered by several scientists. It is based on the idea that investors mainly concentrate on certain regions and countries when making decisions about investing abroad. However, none of the investigations discovered a significant relationship between location and FDI, except one dummy variable: Central and Eastern Europe dummy is highly significant and positive. This might be explained given their geographical proximity to the European market and other characteristics (Arbatli, 2011).

Therefore, geographical distance is the only factor, the significant impact of which on FDI is confirmed by several researches in the field.

H15: Greater geographical distance has a negative and significant impact on FDI flows between countries.

## 10. ENTREPRENEURIAL MATTERS

The factors regarding entrepreneurial activity, enterprise characteristics, natural resources and other entrepreneurial matters are also commonly mentioned in specialty literature as important determinants of FDI location.

Entrepreneurial activity distance is a factor based on data from World Bank Group Entrepreneurship Survey, proposed by Siegel et al. (2013). The results of the research show that Entrepreneurial activity distance is a significant determinant of FDI. Societal propensity toward entrepreneurship influences positively the direction of FDI flows.

Kersan-Skabic (2013) uses the variable Enterprise restructuring based on EBRD transition indicator. The results suggest that progress in Enterprise restructuring diminish FDI flows. The author explains that this happens because of the competition effect, though it is difficult to state the trustworthy nature of the relationship.

Crespo & Fontoura (2007) identify a factor named Domestic firms characteristics. The authors are seizing attention on the export capacity of domestic firms, their size and form of ownership. Jimenez et al. (2011) introduces three variables which present firm characteristics: The number of employees, Return on Equity (ROE) and International experience. The results are significant only for two variables out of three: The number of employees has an unexpected negative influence on FDI outflows, while International experience positively influence the FDI, greater internationalization experience being an important asset when entering new markets.

Gauselmann et al (2011) point out four strategic motives of foreign investors that can be associated to specific entrepreneurial matters: Cost advantages of production factors, Economies of scale, Product diversification in the foreign investor's network and Access to localized natural resources. The results of the qualitative research suggest that the most important factor that motivates investors to provide FDI into Central-Eastern Europe is Cost advantages of production factors. Economies of scale and Product diversification are also important. The less important motive is the Access to localized natural resources.

Factors that refer to entrepreneurial elements demonstrate some single results, unconfirmed by a set of researches. This puts us in a difficult situation, because theoretically we can only suggest one hypothesis.

H16: Distance in entrepreneurial activity between countries is positively correlated with the FDI flow.

## 11. CULTURAL FACTORS

Foreign direct investment is a priori about interaction between different countries and, thus, different cultures. The distance between cultures can directly influence expenditures of money and time in initiating and developing a business abroad and can play a decisive role in the successfulness of the investment. Cultural factor is frequently mentioned in specialty literature, however there are not many investigations that emphasize in an explicit way the influence of cultural variables on FDI flows, the variables do not seem to cover the whole impact of culture.

Some scientists tried to highlight cultural influence by using a generalizing factor – Cultural distance. It is worth noting that all authors use in a way or another cultural dimensions proposed by Geert Hofstede. Nevertheless, the only significant result was obtained by Lee et al. (2008): the interaction between Cultural distance and Direction of investment was negative, and there is no evidence of the influence of Cultural distance on actual FDI flows.

One of the most commonly used cultural factors in specialty literature is Language. The majority of the authors use dummy variables to underline language factor, although every one points attention to a different aspect and obtains results of different relevance. For example, Sharma & Bandara (2010) analyze if the host country speaking language is English (value 1) or not, using the factor Language and culture similarity, and the results show a positive relation between FDI flows and the variable, even so, this can be relevant only for English speaking countries. Tang (2011) and Siegel et al. (2013) utilize dummy variables to indicate whether two countries speak the same language, naming the factors Language and, respectively, Common language. Both researches affirm that the impact of the common language on FDI is positive, although Siegel et al. (2013) do not find significant results in all of the models. This approach has a limitation – it does not take into account if two countries speak different languages, yet close to each other, being in the same branch or family of languages, while the number of countries that share languages is limited. Mateev (2009) introduces the factor Cultural similarities. It is based on language similarities and points out the fact that countries are / are not from the same language family. Nevertheless, significant

results are not obtained. The most systematized approach to the investigation of Language factor is proposed by Vidal-Suarez & Lopez-Duarte (2013). The factor named Language distance is represented by three different variables. The first one is a dummy variable that shows if the country's official language is Spanish (value 0) or not, thus we see an approach that opposite to ones presented above – the authors point out language distance, not similarities. The second one is a scale variable that focuses on grouping languages in families, branches within a family and different level sub-branches; it measures the distance between Spanish and the official language majority speak in a country. The third one, based on the same scale, measures the distance between Spanish and the closest official language spoken in a country. The results show negative relationship between Language distance and entry mode choice, reflecting that language distance increases ex ante and ex post costs regarding acquisition process.

Cultural dimensions, elaborated by Geert Hofstede, who was the first to quantify aspects of culture and investigate their influence on economic processes, are also considered as determinants of FDI flows, not only as cumulative indexes (above mentioned), but also separately.

Uncertainty avoidance is applied in studies of Bhardwaj et al. (2007) and Tang (2011). The first one defines it as the average of survey responses to questions regarding rule orientation, employment stability and stress. The second one uses the net difference between source and host country's scores in uncertainty avoidance. Both researches obtained significant results that reflect negative relationship between Uncertainty avoidance and FDI flows.

Tang (2011) also introduces in his analysis the cultural dimension of Individualism, using a difference between country score. Holmes et al. (2013) mention the factor named Collectivism, which is related to Individualism and calculated by GLOBE. However, only Tang (2011) highlights a positive relationship between Individualism and the stock of FDI.

The cultural dimensions of Power distance and Masculinity are also utilized by Tang (2011). As in previous cases, the net difference between countries scores in dimensions is introduced into a model. The author discovers a negative relationship between both cultural distances and FDI stocks.

Bhardwaj et al. (2007) includes in the analysis the factor named Trust. It measures the percentage of people who responded approvingly to the question that

most people can be trusted, and one does not need to be too careful interacting with people. The level of Trust is found to be positively related to inward FDI. The interesting fact is that the level of Trust interact with Uncertainty avoidance in order to form an impact on FDI, the level of Trust predict FDI flows only when Uncertainty avoidance is entered into the model.

Future orientation, a dimension of culture that is elaborated by GLOBE project, is considered in the research of Holmes et al. (2013). However, the authors do not mention any relationship between this variable with inward FDI.

Siegel et al. (2011) build the research on Egalitarianism, a key cultural dimension, as the authors consider. Egalitarianism is assumed to play a central factor in every culture, it is “the belief that all people are of equal worth and should be treated equally in society” (Schwartz, 2001). The results show that Egalitarianism distance between countries is negatively related to FDI flows, as expected by authors. As Egalitarianism distance expresses the level of institutional compatibility between markets, a greater distance on egalitarianism will cause a lower flow of investment.

The same authors in a more recent analysis include two cultural factors, also elaborated by S.H. Schwartz: Embeddedness / autonomy distance and Mastery / harmony distance. The influence of these factors on FDI flows appears to be insignificant or negative, depending on the characteristics of the model.

Cultural factors are rightly considered among the most important determinants of FDI flows. Many studies attempt to capture the influence of culture, but the results confirm its complex and controversial nature. However, the analysis of specialty literature provides us with some important conclusions in the context of the cultural factor’s impact on FDI.

H17: Linguistic proximity between countries has a positive and significant impact on FDI, and the linguistic distance is, respectively, associated with a low FDI flow.

The set of cultural dimensions proposed by Geert Hofstede is among the most often mentioned cultural factors. However, only for the Uncertainty Avoidance dimension we managed to identify two studies which confirm its significant impact on FDI, thus providing a potential research with a working hypothesis.

H18: Uncertainty avoidance is positively and significantly correlated with the FDI inflows.

## 12. PARACULTURAL FACTORS

Factors that are closely related to cultural or aggregate factors which include cultural aspects can't be incorporated in the previous group, and have been generally named as Paracultural factors.

Dow & Ferencikova (2010) utilize the factor Psychic distance, which is a formative index, consisting of differences in language, religion, industrial development, education and degree of democracy. The relationship between Psychic distance and FDI flows is negative. Gauselmann et al. (2011) include in the analysis the variable Socio-cultural environment that includes: culture on offer, health services, housing, no hostility against foreign workers, child minding facilities and the image of the region. The qualitative research shows that investors find this location factor of a highest level of quality in Central-Eastern Europe. Drogendijk & Martin Martin (2015) propose a formative index named Country distance (COD). This factor is based on three dimensions: socio-economic development distance, cultural and historical distance and physical distance. The results of the analysis express a significantly negative influence of the Country distance on outward FDI. Colonial heritage is a factor that shows if two countries share a common colonizer and is closely related to cultural proximity. Siegel et al. use it as a dummy variable and obtains a positive relationship between Colonial heritage and FDI, although it is not significant in all variants of the model.

The factors belonging to this group are unique, mostly elaborated by the authors, based on the specialty literature, although we cannot deny their applicability in different contexts. However, in this context it is difficult to formulate credible assumptions.

## 13. CONCLUSIONS

The results of the specialty literature analysis show an extremely high accent on economic factors when investigating FDI, as expected. However, only a few of the identified factors can claim (within the limits of this research) to have a clear and significant relationship with FDI, on which we could formulate several working hypotheses. The most frequently mentioned economic factor is Market size, which regardless of the differences in methodology shows in almost all cases a significantly positive impact on the foreign investment. The level of salaries is

expected to influence negatively the volume of FDI inflows, while Liquidity and Agglomeration have a positive impact on foreign investment.

Although we do not have large empirical evidence about the influence of infrastructure factors on FDI, the existence of this relationship is certain. Based on the identified relationships, we could hypothesize that infrastructure facilities would have a positive impact on the level of FDI inflows.

Technological factors do not suggest pertinent relationship between technology and foreign investment, despite the fact that Gauselmann et al. (2011) highlight the Access to local knowledge and technology as an important factor in FDI attraction.

The diversity of Institutional-political factors raises the question regarding their relevance, because only a few relationships are confirmed by more than one paper, although the factors belonging to this category are among the most frequently applied. We identified only three significant relationships, which lead to logical statements. The level of corruption, corporate tax rates and political risk are all expected to have a negative correlation with FDI inflows.

Specific risk factors are statistically significant, yet not certain FDI determinants. Population and Education are mostly significant and impact positively the inflows of FDI, regardless of the methodology. The significantly negative influence of the unemployment rate on foreign investments is double-confirmed by different approaches. Among Space factors, Geographic distance is the only one to show significant unambiguous influence on the attraction of foreign investment.

Entrepreneurial matters include unique significant factors to influence the foreign investment, among them – generalizing factors and firm characteristics. These factors' utilizing would depend on the interest of research and would require additional investigation.

Cultural factors are found to be of a great importance for the scientists. This group is one of the most frequently examined when studying FDI. The fact that a lot of studies used indicators, based on Hofstede's cultural dimensions, together with Tang's (2011) significant results for separate investigation of the dimensions lead to the idea of the necessity of Hofstede's approach considering when examining the influence of culture on foreign investment. Among Hofstede's cultural dimensions, Uncertainty avoidance's relevance was confirmed by two

studies: this factor influences negatively the inward FDI. Another frequently mentioned FDI determinant is Language. Most studies confirmed the significantly positive impact of common language on foreign investment. The variables used as proxies may have specific relevance for each research, yet different variables show the importance of this factor.

Most Paracultural factors are unique and elaborated by the authors, based on the specialty literature, although we cannot deny their applicability in different contexts. However, in this context it is difficult to formulate credible assumptions.

Analyzing the literature, we can easily observe a greater accent on some groups of factors (as, for example: economic, institutional-political or cultural), while other categories' impact on FDI remains uncertain, especially due to the necessity of additional investigation. However, we consider that this study proposes a comprehensive overview of the existing research in the field and a set of reliable hypotheses, which highlight a great variety of factors and may be of great importance for potential researches.

Even if the proposed hypotheses cover FDI determinants within the limits of this study, they can be inferred with at least a satisfactory level of credibility. The lack of some factors among the presented hypotheses signifies the necessity for more in-depth studies on the influence of these factors on FDI, yet it does not mean the irrelevance of their application in potential research.

The applying of relevant and significant determinants of FDI together with the additional investigation of several factors would lead to a viable research with valid results.

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**Table- 1: Synthesis of the factors influencing FDI**

Group of factors	Factor	Authors by relationship discovered			
		Positive	Negative	Not significant	Other
Economic factors	Market size	Mateev (2009), Riedl (2010), Sharma & Bandara (2010), Tang (2011), Jurcau et al. (2011), Khachoo & Khan (2012), Kersan-Skabic (2013), Hayakawa et al. (2013)	Arbatli (2011)		Gauselmann et al. (2011) / Most important
	Market size growth	Noorbakhsh & Paloni (2001), Kok & Ersoy (2009), Pearson et al. (2012)		Sharma & Bandara (2010), Arbatli (2011), Jurcau et al. (2011), Kersan-Skabic (2013)	
	Inflation	Kersan-Skabic (2013)	Kok & Ersoy (2009)	Riedl (2010), Arbatli (2011)	
	Trade	Noorbakhsh & Paloni (2001), Kok & Ersoy (2009), Kersan-Skabic (2013)		Mateev (2009), Arbatli (2011), Khachoo & Khan (2012)	
	Wages	Du et al. (2012), Kersan-Skabic (2013)	Mateev (2009), Riedl (2010), Khachoo & Khan (2012), Hayakawa et al. (2013)		
	Income	Arbatli (2011)	Pearson et al. (2012)		
	Exchange rate			Arbatli (2011), Jurcau et al. (2011)	Arbatli (2011) / Significant
	Economic freedom	Pearson et al. (2012)	Jimenez et al. (2011)		
	Economic Stability			Sharma & Bandara (2010)	
	Liquidity	Khachoo & Khan (2012), Sparks et al. (2014)	Arbatli (2011)	Holmes et al. (2013)	

	FDI characteristics	Noorbakhsh & Paloni (2001)		Jimenez et al. (2011)	Crespo & Fontoura (2007)
	Agglomeration	Riedl (2010), Du et al. (2012)			
	Capital formation	Kok & Ersoy (2009)		Kok & Ersoy (2009)	
	Capital Availability		Holmes et al. (2013)		
	Financial market	Jurcau et al. (2011)			
	Debt		Kok & Ersoy (2009)	Kok & Ersoy (2009)	
Infrastructure	Electric power consumption	Khachoo & Khan (2012)		Kok & Ersoy (2009)	
	Communication facilities	Kok & Ersoy (2009)			
	Infrastructure	Du et al. (2012)		Mateev (2009)	
Technology	Technology gap			Kok & Ersoy (2009)	Crespo & Fontoura (2007)
	Technological cooperation				Gauselmann et al. (2011) / Important, High level
	Knowledge capital		Sharma & Bandara (2010)		
Institutional-political factors	Corruption	Mateev (2009), Kersan-Skabic (2013)	Jimenez et al. (2011), Du et al. (2012), Barassi & Zhou, (2012)		Barassi & Zhou, (2012) / Neutral
	Privatization	Kersan-Skabic (2013)		Mateev (2009), Riedl (2010), Kersan-Skabic (2013)	
	Corporate tax rates		Tang (2011), Arbatli (2011), Hayakawa et al. (2013)	Riedl (2010), Hayakawa et al. (2013)	
	Tariffs	Sharma & Bandara (2010)	Arbatli (2011), Hayakawa et al. (2013)	Riedl (2010), Hayakawa et al. (2013)	
	Government intervention	Du et al. (2012)	Siegel et al. (2013)		

	Government support	Du et al. (2012)			Gauselmann et al. (2011) / The weakest
	Regulatory institutions		Holmes et al. (2013)		
	Environmental regulation distance		Siegel et al. (2013)		
	Restrictions in capital account transactions		Arbatli (2011)	Arbatli (2011)	
	Property rights	Du et al. (2012)		Kersan-Skabic (2013)	
	Contract enforcement		Du et al. (2012)		
	Political Constraint Index	Jimenez et al. (2011)	Tang (2011)		
	Political Risk	Arbatli (2011)	Riedl (2010)		
	The distance on political stability			Siegel et al. (2013)	
	Political Democracy		Holmes et al. (2013)		
	Governance infrastructure index	Bhardwaj et al. (2007)			
Specific risk	Risk environment				Arbatli (2011) / Significant
	Conflicts, revolutions and labor strikes		Arbatli (2011)		
	Risk	Mateev (2009)			
Human factor	Population	Mateev (2009), Jimenez et al. (2011)		Tang (2011)	
	Education	Noorbakhsh & Paloni (2001), Arbatli (2011), Du et al. (2012)		Mateev (2009)	
	Labour force	Noorbakhsh & Paloni (2001)			Gauselmann et al. (2011) / Weaker level
	Unemployment rate		Jimenez et al. (2011), Pearson et al. (2012)		

Legal integration	Legal family affiliation		Siegel et al. (2013)		
	Bilateral treaties	Tang (2011), Siegel et al. (2013)		Siegel et al. (2013)	
	Supranational integration	Sharma & Bandara (2010), Tang (2011), Hayakawa et al. (2013)	Hayakawa et al. (2013)		
Space factor	Geographic distance		Mateev (2009), Tang (2011), Siegel et al. (2013), Hayakawa et al. (2013)		Crespo & Fontoura (2007)
	Distance			Riedl (2010)	
	Location			Sharma & Bandara (2010), Arbatli (2011)	
Entrepreneurial matters	Entrepreneurial activity distance	Siegel et al. (2013)			
	Enterprise restructuring		Kersan-Skabic (2013)		
	Firm characteristics	Jimenez et al. (2011)	Jimenez et al. (2011)	Jimenez et al. (2011)	Crespo & Fontoura (2007)
	Cost advantages				Gauselmann et al. (2011) / Most important
	Economies of scale				Gauselmann et al. (2011) / Important
	Product diversification				Gauselmann et al. (2011) / Important
	Access to localized natural resources				Gauselmann et al. (2011) / Less important
	Role of Oil Sector				Arbatli (2011)

Cultural factors	Cultural distance		Lee et al. (2008)	Dow & Ferencikova (2010), Du et al. (2012)	
	Language	Sharma & Bandara (2010), Tang (2011), Siegel et al. (2013)	Vidal-Suarez & Lopez-Duarte (2013)	Mateev (2009), Siegel et al. (2013)	
	Uncertainty Avoidance		Bhardwaj et al. (2007), Tang (2011)		
	Individualism	Tang (2011)			
	Collectivism			Holmes et al. (2013)	
	Power distance		Tang (2011)		
	Masculinity		Tang (2011)		
	Trust	Bhardwaj et al. (2007)			
	Future orientation			Holmes et al. (2013)	
	Egalitarianism distance		Siegel et al. (2011)		
	Embeddedness/autonomy distance			Siegel et al. (2013)	
	Mastery/harmony distance			Siegel et al. (2013)	
Paracultural factors	Psychic distance		Dow & Ferencikova (2010)		
	Country distance		Drogendijk & Martin Martin (2015)		
	Socio-cultural environment				Gauselmann et al. (2011) / Highest level
	Colonial heritage	Siegel et al. (2013)		Siegel et al. (2013)	