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EDITORIAL

In the first number of the second year of publishing the Journal of Economic and Social Development we present the best quality papers from two Conferences on Economic and Social Development.

The 7th International Scientific Conference on Economic and Social Development was held on 24 October 2014 in New York, USA. From total of 74 papers, the best 7 papers are included in this Journal. The topics are very different: production economics of Egyptian cotton in the salt-affected land, creativity and entrepreneurship in informational metropolitan regions, innovation climate as a source of competitive advantage, social media usage in banking industry and its managerial view: case study for Mexican banking system, analysis of impact of macroeconomic shocks on Croatian economy using the SVAR methodology, analysis of tax systems in Slovakia and Hungary and finally predicting indicators at small scale using entropy econometrics.

The 8th International Scientific Conference on Economic and Social Development was held on 19 December 2014 in Zagreb, Croatia. From total of 52 papers, the best 3 papers are included in this Journal. The topics from this conference are: Shareholders value and catastrophe bonds: an event study analysis at European level, Using digital frequencies to detect anomalies in receivables and payables: an analysis of the Italian universities and Organizational change resistance: experience from public sector.

We are proud to inform you that starting from this volume, we also publish the hard copy of our journal.

Fran Galetic
Co-editor

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Ali Ahmed Ibrahim Ali El-Shahat [1]

PRODUCTION ECONOMICS OF EGYPTIAN COTTON IN THE SALT-AFFECTED LAND

Abstract

Water is the natural resource that exerts the greatest constraint on Egypt's agricultural production system. Most of Egypt's cultivated lands depend on irrigation from Nile. However, Egypt's agriculture is under pressure to justify its use of water resource, which is scarce due to increased competition for water resources. The water management problem is currently increasing in the context of the on-going national transition from a government-controlled market with government intervention in the management of all activities to a free-market economy. Furthermore, due to the ambitious programs of desert agricultural development, the shortage of water supplies is becoming more serious after El Nahdda dam. Issues of equitable distribution of dwindling water supplies are becoming more serious and more is needed to assure fair access to water and more efficient use and allocation of it. On the other hand, accumulation of excessive salt in irrigated soils of Egypt negatively affects crop yields, reduce the effectiveness of irrigation, ruin soil structure, and affect other soil properties. High level of water table and shortage in irrigation supply in the salt-affected land doubles from the harmful effects of salinity problems. Consequently, the average productivity of the cultivated crops in salt-affected land is less than the half of corresponding averages at the national level. Cotton is the one of the main cultivated summer crops in the salt-affected land in Egypt. The main objective of the study is studying the production economics of cotton in the salt-affected land. The impacts of production factors used to produce cotton crop in salt-affected land will identify and measure. The various combinations of manure and irrigation water inputs which produce or yield equal production to cotton producers will derive and identify. The impacts of technical changes on the quantities produced of cotton and on the optimal and maximum-profit production levels will measure. The relationship between the quantity produced and the production costs of cotton crop will estimate and investigate. The levels of optimal and maximizing profits for the studied crop in the salt-affected land will identify and determine.

Keywords

cotton, production, salt-affected land

1. Introduction

Water is the natural resource that exerts the greatest constraint on Egypt's agricultural production system. Most of Egypt's cultivated lands depend on irrigation from Nile. However, Egypt's agriculture is under pressure to justify its use of water resource, which is scarce due to increased competition for water resources. The water management problem is currently increasing in the context of the on-going national transition from a government-controlled market with government intervention in the management of all activities to a free-market economy. Furthermore, due to the ambitious programs of desert agricultural development, the shortage of water supplies is becoming more serious after El Nahdda dam.

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Issues of equitable distribution of dwindling water supplies are becoming more serious and more is needed to assure fair access to water and more efficient use and allocation of it. On the other hand, accumulation of excessive salt in irrigated soils of Egypt negatively affects crop yields, reduce the effectiveness of irrigation, ruin soil structure, and affect other soil properties. High level of water table and shortage in irrigation supply in the salt-affected land doubles from the harmful effects of salinity problems. Consequently, the average productivity of the cultivated crops in salt-affected land is less than the half of corresponding averages at the national level.

2. Methdological background

In economics, a production function relates physical output of a production process to physical inputs or factors of production. The production function is one of the key concepts of mainstream neoclassical theories, used to define marginal product and to distinguish allocative efficiency, the defining focus of economics. The primary purpose of the production function is to address allocative efficiency in the use of factor inputs in production and the resulting distribution of income to those factors, while abstracting away from the technological problems of achieving technical efficiency, as an engineer or professional manager might understand it. In general, economic output is not a (mathematical) function of input, because any given set of inputs can be used to produce a range of outputs. To satisfy the mathematical definition of a function, a production function is customarily assumed to specify the maximum output obtainable from a given set of inputs. The production function, therefore, describes a boundary or frontier representing the limit of output obtainable from each feasible combination of input. (Alternatively, a production function can be defined as the specification of the minimum input requirements needed to produce designated quantities of output, given available technology.) By assuming that the maximum output, which is technologically feasible, from a given set of inputs, is obtained, economists are abstracting away from technological, engineering and managerial problems associated with realizing such a technical maximum, to focus exclusively on the problem of allocative efficiency, associated with the economic choice of how much of a factor input to use, or the degree to which one factor may be substituted for another. In the production function, itself, the relationship of output to inputs is non-monetary; that is, a production function relates physical inputs to physical outputs, and prices and costs are not reflected in the function. In the decision frame of a firm making economic choices regarding production—how much of each factor input to use to produce how much output—and facing market prices for output and inputs, the production function represents the possibilities afforded by an exogenous technology. Under certain assumptions, the production function can be used to derive a marginal product for each factor. The profit-maximizing firm in perfect competition (taking output and input prices as given) will choose to add input right up to the point where the marginal cost of additional input matches the marginal product in additional output. This implies an ideal division of the income generated from output into an income due to each input factor of production, equal to the marginal product of each input. The inputs to the production function are commonly termed factors of production and may represent primary factors, which are stocks. Classically, the primary factors of production were Land, Labor and Capital. Primary factors do not become part of the output product, nor are the primary factors, themselves, transformed in the production

process. The production function, as a theoretical construct, may be abstracting away from the secondary factors and intermediate products consumed in a production process. The production function is not a full model of the production process: it deliberately abstracts from inherent aspects of physical production processes that some would argue are essential, including error, entropy or waste, and the consumption of energy or the co-production of pollution. Moreover, production functions do not ordinarily model the business processes, either, ignoring the role of strategic and operational business management. (For a primer on the fundamental elements of microeconomic production theory, see production theory basics).

The production function is central to the marginalist focus of neoclassical economics, its definition of efficiency as allocative efficiency, its analysis of how market prices can govern the achievement of allocative efficiency in a decentralized economy, and an analysis of the distribution of income, which attributes factor income to the marginal product of factor input. The firm is assumed to be making allocative choices concerning how much of each input factor to use and how much output to produce, given the cost (purchase price) of each factor, the selling price of the output, and the technological determinants represented by the production function.

A production function can be expressed in a functional form as the right side of

$$Q = f(X_1, X_2, X_3, ..., X_n) \quad \text{..... (1)}$$

Where:
Q = Quantity of output
$X_1, X_2, X_3, ..., X_n =$ quantities of factor inputs (such as capital, labour, land or raw materials).

In economics, the Cobb–Douglas production function is a particular functional form of the production function. It is widely used to represent the technological relationship between the amounts of two or more inputs, particularly physical capital and labor, and the amount of output that can be produced by those inputs. The Cobb-Douglas form was developed and tested against statistical evidence by Charles Cobb and Paul Douglas during 1927–1947.

In its most standard form for production of a single good with two factors, the function is

$$Q = AL^{\beta}K^{\alpha} \quad \text{..... (2)}$$

Where:
Q = total production (the quantity produced in a year)
L = labor input (the total number of person-hours worked in a year)
K = capital input (the real value of all machinery, equipment, and buildings)
A = total factor productivity
α and β are the output elasticities of capital and labor, respectively. These values are constants determined by available technology.

Output elasticity measures the responsiveness of output to a change in levels of either labor or capital used in production, ceteris paribus. For example if α = 0.45, a 1% increase in capital usage would lead to approximately a 0.45% increase in output.

Further, if $\alpha + \beta = 1$, the production function has constant returns to scale, meaning that doubling the usage of capital K and labor L will also double output Y. If $\alpha + \beta < 1$, returns to scale are decreasing, and if $\alpha + \beta > 1$, returns to scale are increasing. Assuming perfect competition and $\alpha + \beta = 1$, α and β can be shown to be capital's and labor's shares of output. The total, average, and marginal physical product curves mentioned above are just one way of showing production relationships. They express the quantity of output relative to the amount of variable input employed while holding fixed inputs constant. Because they depict a short run relationship, they are sometimes called short run production functions. If all inputs are allowed to be varied, then the diagram would express outputs relative to total inputs, and the function would be a long run production function. If the mix of inputs is held constant, then output would be expressed relative to inputs of a fixed composition, and the function would indicate long run economies of scale.

Rather than comparing inputs to outputs, it is also possible to assess the mix of inputs employed in production. An isoquant (see below) relates the quantities of one input to the quantities of another input. It indicates all possible combinations of inputs that are capable of producing a given level of output. An isoquant represents those combinations of inputs, which will be capable of producing an equal quantity of output; the producer would be indifferent between them. The isoquants are thus contour lines, which trace the loci of equal outputs. As the production remains the same on any point of this line, it is also called equal product curve. The Marginal Rate of Technical Substitution (MRTS) is the amount by which the quantity of one input has to be reduced when one extra or additional unit of another input is used, so that output remains constant. In other words, it shows the rate at which one input (e.g. nitrogen or water) may be substituted for another, while maintaining the same level of output. The MRTS can also be seen as the slope of an isoquant at the point in question. So it is diminishing. In economics, a cost curve is a graph of the costs of production as a function of total quantity produced. In a free market economy, productively efficient firms use these curves to find the optimal point of production (minimizing cost), and profit maximizing firms can use them to decide output quantities to achieve those aims. There are various types of cost curves, all related to each other, including total and average cost curves, and marginal ("for each additional unit") cost curves, which are equal to the differential of the total cost curves. Some are applicable to the short run, others to the long run. Assuming that factor prices are constant, the production function determines all cost functions. The variable cost curve is the inverted short-run production function or total product curve and its behavior and properties are determined by the production function. Because the production function determines the variable cost function it necessarily determines the shape and properties of marginal cost curve and the average cost curves. If the firm is a perfect competitor in all input markets, and thus the per-unit prices of all its inputs are unaffected by how much of the inputs the firm purchases, then it can be shown that at a particular level of output, the firm has economies of scale (i.e., is operating in a downward sloping region of the long-run average cost curve) if and only if it has increasing returns to scale. Likewise, it has diseconomies of scale (is operating in an upward sloping region of the long-run average cost curve) if and only if it has decreasing returns to scale, and has neither economies nor diseconomies of scale if it has constant returns to scale. In this case, with perfect competition in the output market the long-run market equilibrium will involve all firms operating at the minimum point of their long-run average cost curves (i.e., at the borderline between economies and diseconomies of scale).

Relationship between different costs curves:

- Total Cost = Fixed Costs (FC) + Variable Costs (VC)
- Marginal Cost (MC) = dC/dQ; MC equals the slope of the total cost function and of the variable cost function
- Average Total Cost (ATC) = Total Cost/Q
- Average Fixed Cost (AFC) = FC/Q
- Average Variable Cost = VC/Q.
- ATC = AFC + AVC
- The MC curve is related to the shape of the ATC and AVC curves:

o At a level of Q at which the MC curve is above the average total cost or average variable cost curve, the latter curve is rising.

o If MC is below average total cost or average variable cost, then the latter curve is falling.

o If MC equals average total cost, then average total cost is at its minimum value.

o If MC equals average variable cost, then average variable cost is at its minimum value.

In economics, average cost or unit cost is equal to total cost divided by the number of goods produced (the output quantity, Q). It is also equal to the sum of average variable costs (total variable costs divided by Q) plus average fixed costs (total fixed costs divided by Q). Average costs may be dependent on the time period considered (increasing production may be expensive or impossible in the short term, for example). Average costs affect the supply curve and are a fundamental component of supply and demand.

$$AC = \frac{TC}{Q}$$

In economics and finance, marginal cost is the change in the total cost that arises when the quantity produced changes by one unit. That is, it is the cost of producing one more unit of a good.[1] In general terms, marginal cost at each level of production includes any additional costs required to produce the next unit. For example, if producing additional vehicles requires building a new factory, the marginal cost of the extra vehicles includes the cost of the new factory. In practice, this analysis is segregated into short and long-run cases, so that over the longest run, all costs become marginal. At each level of production and time period being considered, marginal costs include all costs that vary with the level of production, whereas other costs that do not vary with production are considered fixed.

If the good being produced is infinitely divisible, so the size of a marginal cost will change with volume, as a non-linear and non-proportional cost function includes the following:

- variable terms dependent to volume,
- constant terms independent to volume and occurring with the respective lot size,
- jump fix cost increase or decrease dependent to steps of volume increase.

In practice the above definition of marginal cost as the change in total cost as a result of an increase in output of one unit is inconsistent with the differential definition of marginal cost for virtually all non-linear functions. This is as the definition finds the tangent to the total

cost curve at the point q which assumes that costs increase at the same rate as they were at q. A new definition may be useful for marginal unit cost (MUC) using the current definition of the change in total cost as a result of an increase of one unit of output defined as: TC(q+1)-TC(q) and re-defining marginal cost to be the change in total as a result of an infinitesimally small increase in q which is consistent with its use in economic literature and can be calculated differentially. If the cost function is differentiable joining, the marginal cost is the cost of the next unit produced referring to the basic volume.

$$\frac{\mathrm{d}\,C}{\mathrm{d}\,Q}$$

3. Objectives of the study

Cotton is the one of the main cultivated summer crops in the salt-affected land in Egypt. The main objective of the study is studying the production economics of cotton in the salt-affected land. The impacts of production factors used to produce cotton crop in salt-affected land have been identified and measured. The various combinations of manure and irrigation water inputs which produce or yield equal production to cotton producers have been derived and identified. The impacts of technical changes on the quantities produced of cotton and on the optimal and maximum-profit production levels have been measured. The relationship between the quantity produced and the production costs of cotton crop is estimated and investigated. The levels of optimal and maximizing profits for the studied crop in the salt-affected land is identified and determined.

4. Emprical model and data sources

Field primary data concerning the inputs and outputs of cotton in the selected farms have been collected and conducted from five targeted villages in Sharkia Governorate. These villages are El Rewad, Tark Ben Ziad, El Ezdehar, El Salah and Khaleed Ben El Waleed. A random Stratified Cluster Sample Size of 150 holders from the five studied villages were targeted according the number of the population and the cultivated area in each village. Questionnaire sheets covering the inputs and outputs data have been used to collect the field primary data. The cotton production, total costs and average costs functions approach as well as the multiple regression models have been used to accomplish the main objectives of the study. In addition the isoquant production curve for the improved cotton varieties is used to estimate the impacts of technical changes on the quantities produced of cotton. As well as the averages total and marginal costs for the improved cotton varieties have been used to estimate the impacts of technical changes on the optimal and maximum production levels of cotton crop.

5. Results and discussion

5.1. Production Function of Cotton Crop

5.1.1. The Production Function

The Cobb–Douglas production function for cotton crop is estimated as follow:
Where:

$$Q_c = 0.014\ (\text{seed})^{0.474}\ (\text{manure})^{0.227}\ (\text{phosphorus})^{0.215}\ (\text{water})^{0.398} \quad \ldots\ldots (1)$$
$$(12.9)^{**} \qquad (12.3)^{**} \qquad (13.5)^{**} \qquad (9.93)^{**}$$

$$R\backslash 2 = 0.949 \qquad \text{F-ratio} = 208.9$$

LnQc = the natural logarithmic for the production quantity of cotton in kintar/feddan
LnSeedb = the natural logarithmic for the quantity used from cotton seed in kg/feddan
LnPhosphorusb = the natural logarithmic for the quantity used from phosphorus fertilizer in kg/feddan
LnManureb = the natural logarithmic for the quantity used from manure in cubic meter/feddan
LnWaterb = the natural logarithmic for the quantity used from irrigation water in cubic meter/feddan
The numbers between brackets are t-statistical values

The previous production function model indicates that: (i) The estimated parameters and the estimated model are statistically significant. The quantities used from seeds, manure, phosphorus and water have great statically effect on the production quantity of cotton in the salt-affected land. (ii) The production elasticities of seed, manure, phosphorus fertilizers and irrigation water are positive and less than one, i.e., the usage of those factors are in the second production stage or the economic production stage. (iii) the variations in the studied four factors explain 95% of the variations in the quantity produced of cotton in the salt-affected land. (iv) the returns to scale of the four studied factors in cotton production are increasing (i.e., 1.314). That means a 100% increase in the four factors usage would lead to approximately a 131% increase in the cotton output. (v) total factor productivity is positive and less than one (0.014).

An isoquant shows the extent to which the farm in question has the ability to substitute between the two different inputs (e.g., phosphorus fertilizers and irrigation water) at will in order to produce the same level of output. The isoquant curve for cotton represents those combinations of two inputs, which will be capable of producing an equal quantity of output; the producer would be indifferent between them. The cotton isoquant curve for the various combinations of phosphorus fertilizer and irrigation water (figure 1) can be derived from the functional form number (1) using the average quantity produced of cotton (6.13 kintar/feddan), average quantities used of seeds (37.35 kg/feddan) and manure (10.46 m3/feddan) as follows:

$$\text{Water} = \{45.825(\text{phosphorus})^{-0.215}\}^{(1/0.398)} \quad \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Figure (1) shows that: (i) The Marginal Rate of Technical Substitution (MRTS) between phosphorus fertilizer and water is diminishing. On the other word, the amount by which the quantity of phosphorus input has to be reduced when one extra or additional unit of water input is used, so that output of cotton remains constant. (ii) the technological tradeoff between phosphorus and irrigation water in the cotton production function is decreasing marginal returns of both inputs. Adding one input while holding the other constant eventually leads to decreasing marginal output, and this is reflected in the shape of the isoquant.

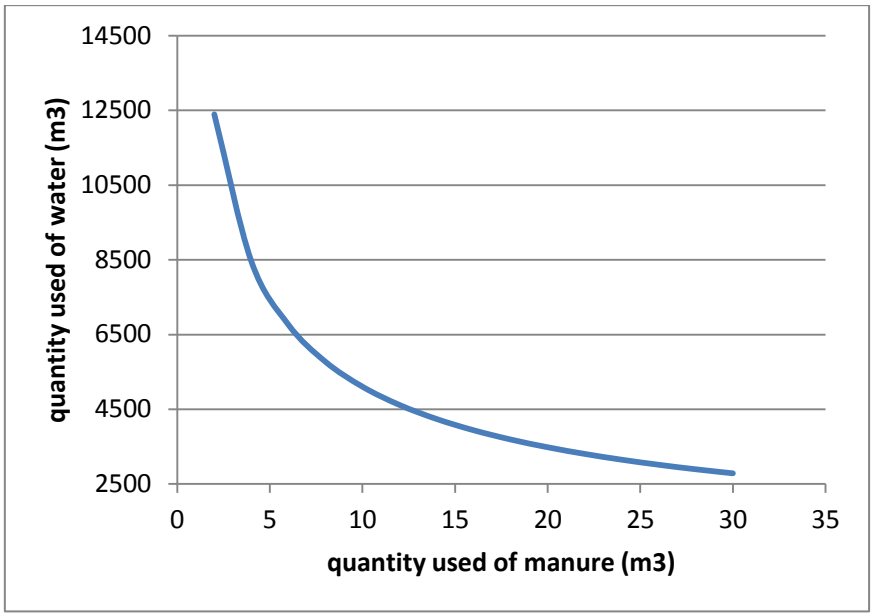

Figure 1. *The cotton isoquant curve for the various combinations of phosphorus fertilizer and irrigation water (Equation 2 and the Cotton field primary data, 2011)*

5.1.2. The Impacts of Technological Changes on Production Level

The impacts of technological changes on the cotton production using isoquant curves will investigate in this part of the study. The interviewed farmers indicate that the improved varieties of cotton increase the yield of cotton from 6.13 kintar/feddan to 7.36 kintar/feddan, i.e., an increase of 20%. Using this fact and recalculation the models number (1) and (2), the cotton isoquant curve can be derived in model number 3 as follows:

$$\text{Water} = \{54.99\ (\text{phosphorus})^{-0.215}\}^{(1/0.398)} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (3)$$

Figure (2) shows that the farmers will produce high level of cotton output when they use improved varieties. The cotton isoquant curve for the improved varieties (Q\) is higher than the cotton isoquant curve for the old varieties (Q). Consequently the farmers can produce more output of cotton under the same quantity used of irrigation water and manure.

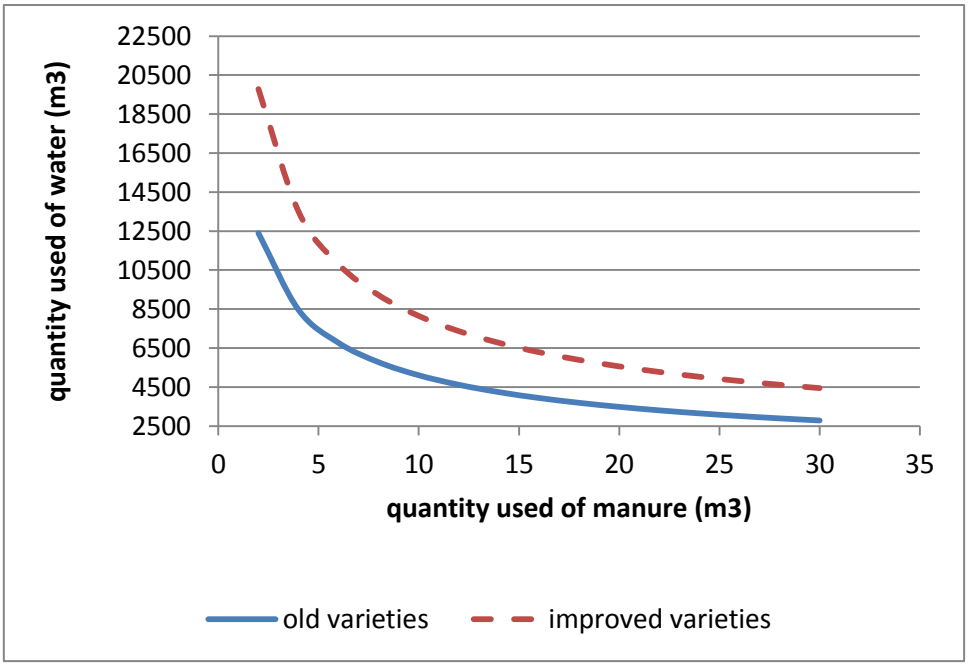

Figure 2. *The impacts of improved varieties on the cotton isoquant curve of cotton crop in salt-affected land (Equation 3 and the Cotton field primary data, 2011)*

5.2. The Production Cost Function of Cotton Crop

5.2.1. Total Cost Function

The total production cost function of cotton can be estimated as a cubic function, equation no. 4 and figure (3).

$$TC_c = \underset{(3.3)^{**}}{265.3} + \underset{(5.6)^{**}}{1531.9\,Q} - \underset{(-5.3)^{**}}{283.7\,Q^2} + \underset{(1.96)^{*}}{19.2\,Q^3} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4)$$

$$R\backslash^2 = 0.22 \qquad \text{F ratio} = 3.2^{*}$$

Where:

TCc = the total production cost of cotton in LE/kintar

Q = the quantity produced from cotton in kintar/feddan

The previous production cost function Indicates that: (i) all estimated parameters and the model are statistically significant. (ii) the variation in the cotton yield (Q) explain 22% of the variation in total production costs. (iii) the cotton farmers will maximize their profits by producing about 9 kintar per feddan where the slopes of total cost curve and total return curve are equal. (iv) the total production costs of cotton at the maximum profit level is estimated at 5037 LE/feddan.

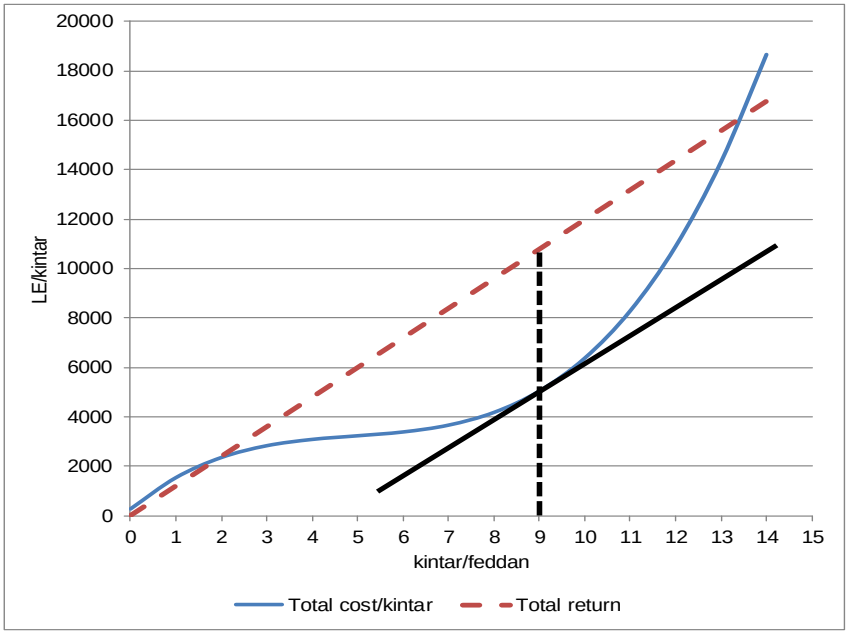

Figure 3. *the total production function of cotton crop in the salt-affected land (Equation 4 and the Cotton field primary data, 2011)*

5.2.2. The Averages Total Cost Function

The average total cost function of cotton can be estimated as a quadratic function, equation no. 5 and figure (4).

$$ATC_c = 1714.9 - 321.1\ Q + 21.5\ Q^2 \quad \text{..... (5)}$$
$$(5.5)^{**} \quad (-2.8)^{**} \quad (2.15)^{*}$$
$$R\backslash^2 = 0.34 \qquad \text{F- ratio} = 12.6$$

Where:
ATCc = the average total production cost of cotton in LE/kintar
Q = the quantity produced from cotton in kintar/feddan

The marginal cost (MCc) function of cotton can be derived from equation 5 as follows:

$$MCc = 1714.9 - 642.3\ Q + 64.6\ Q^2 \quad \text{..... (6)}$$

The average total costs and marginal cost functions are presented in figure (4). The previous two functions indicate that: (i) all estimated parameters and the models are statistically significant. (ii) the variation in the quantity produced (Q) explain 34% of the variation in average production costs. Figure (4) present that: (i) both the average total cost and marginal cost curves take U shape (logically agree with the economic theory). (ii) the marginal cost curve intersects the average total cost curve at the minimum point. (iii) the cotton farmers will minimize their total costs by producing 7.5 kintar per feddan where the slopes of total cost curve and marginal cost curve are equal. The total production cost of cotton at the minimum level of costs is estimated at 518 LE/feddan. (iv) the cotton farmers will maximize their profit by producing 9 kintar/feddan. The total production cost of cotton at the maximum-profit level is estimated at 569 LE/feddan.

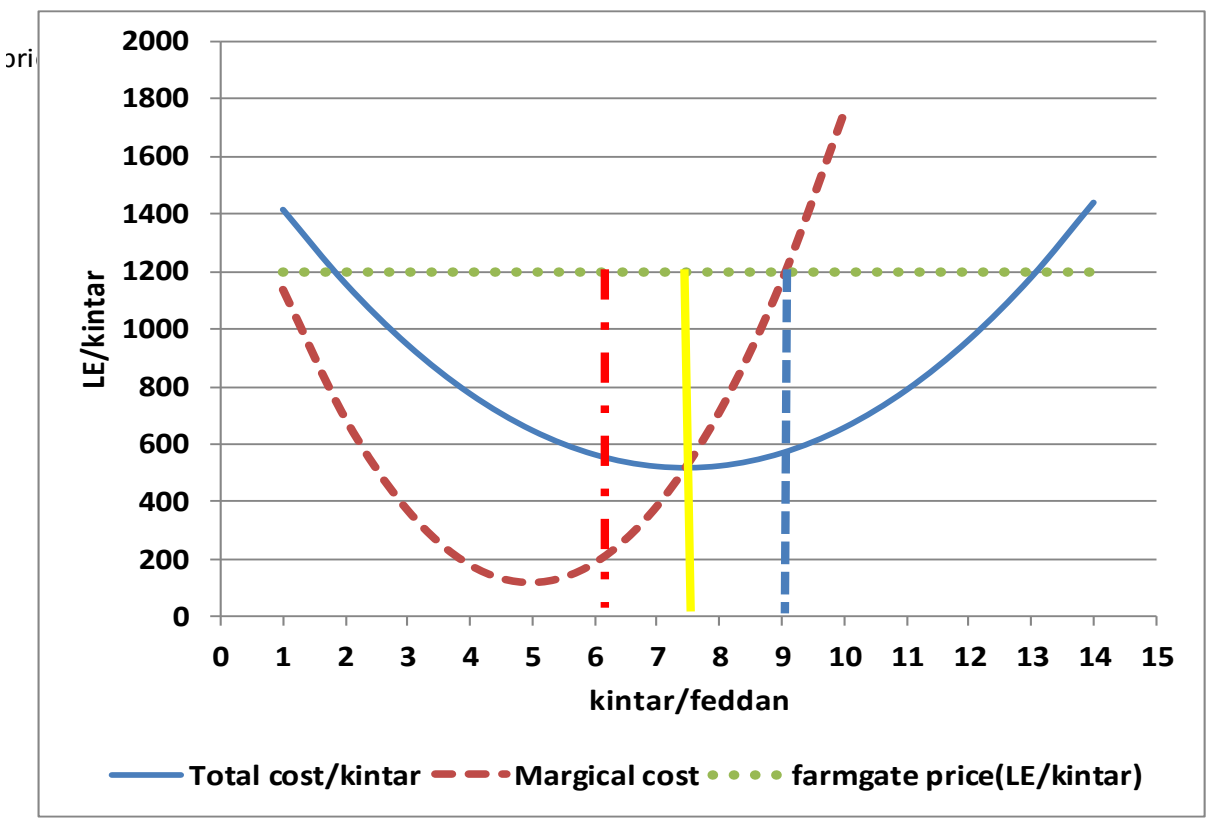

Figure 4. *The average production functions of cotton crop in the salt-affected land (Equations 5,6 and the Cotton field primary data, 2011)*

5.2.3. Income Forgone

The steps of calculation of income forgone for cotton farmers in the salt-affected land are presented in table (1). The results in the table indicate the following indicators: (i) the actual, optimal and maximizing-profit quantities produced of cotton are estimated at 6.13 kintar/feddan, 7.5 kintar/feddan and 9 kintar/feddan, respectively. The average farmgate price of cotton is estimated at 1198 LE/kintar. Thus, the actual, optimal and maximizing-profit total returns are estimated at 7344 LE/feddan, 8985 LE/feddan and 10782 LE/feddan, respectively. (ii) the average production costs at the actual, optimal and maximizing-profit production levels of cotton are 557 LE/kintar, 518 LE/kintar and 569 LE/kintar, respectively. Therefore, the total costs at the at the actual, optimal and maximizing-profit production levels of cotton are 3414 LE/feddan, 3885 LE/feddan and 5121 LE/feddan, respectively. (iii) the profit at the actual, optimal and maximizing-profit production levels of cotton are 3929 LE/feddan, 5100 LE/feddan and 5661 LE/feddan, respectively. Consequently the income forgone for cotton farmers at the optimal and maximizing-profit production levels are 1171 LE/feddan and 1732 LE/feddan, respectively.

Item	Unit	Actual production level	Optimal production level	Maximizing-profit production level
Production	kintar/feddan	6.13	7.5	9
farmgate price	LE/feddan	1198	1198	1198
total return	LE/feddan	7343.74	8985	10782
Average cost	LE/kintar	557	518	569
total costs	LE/feddan	3414.41	3885	5121
Profit	LE/feddan	3929.33	5100	5661
income forgone	LE/feddan		1171	1732

Table 1. *The actual, optimal and maximizing-profit productions, costs and returns for cotton farmers, 2012 (Figure 4 and the Cotton field primary data, 2011)*

5.2.4. The Impact of Technological Changes on the Average Production Costs Levels

As mentioned above the cotton farmers in the salt-affected land reveal that the improved varieties increase yield by 20% (i.e., from 6.13 kintar/feddan to 7.36 kintar/feddan). The average total cost functions of improved cotton varieties (ATC\c) can be estimated as a quadratic function, equation no. (7).

$$ATC\backslash_c = 1714.9 - 267.6\,Q + 14.96\,Q^2 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (7)$$
$$(5.4)^{**} \quad (-2.8)^{**} \quad (2.1)^{*}$$
$$R\backslash^2 = 0.34 \qquad F\ ratio = 12.6$$

The marginal cost function of improved cotton varieties (MC\c) can be derived from equation (7) as follows, equation no. (8):

$$MC\backslash c = 1714.9 - 535.2\,Q + 44.87\,Q^2 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (8)$$

The average total cost and marginal cost functions of old varieties (equations 5 and 6) and the average total cost and marginal cost functions of improved varieties (equations 7 and 8) are presented in figure (5). the results can be concluded from the figure are: (i) 20% increase in the yield of cotton because of improved varieties cultivation leads to obvious moving the average total cost and marginal cost functions to the right. Therefore the production levels which minimize the total costs and maximize the profits of cotton farmers move to the right. (ii) The minimum points of averages costs and the maximum points of profits move obviously to right. The optimal production level of cost has been moved from 7.5 kintar/feddan for old cotton varieties to 9 kintar/feddan for improved cotton varieties. In addition the maximize-profit level has been moved from 9 kintar/feddan for old cotton varieties to 10.85 kintar/feddan for improved cotton varieties.

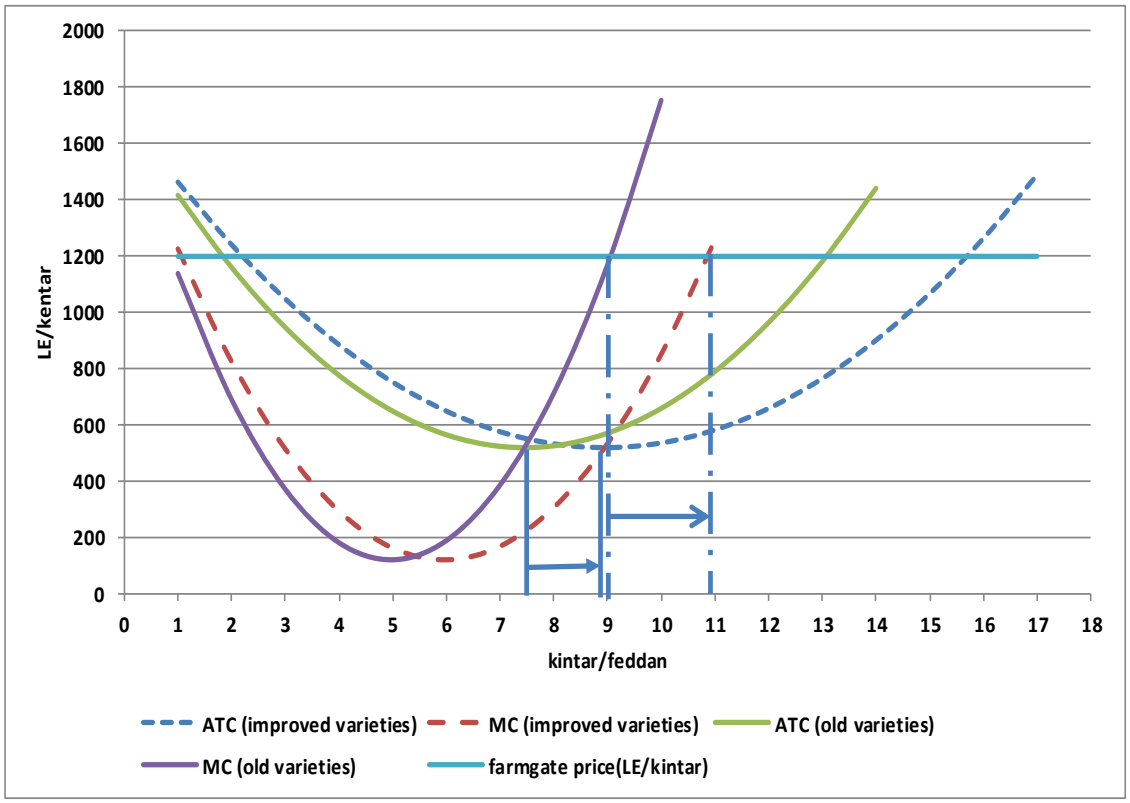

Figure 5. The impacts of improved varieties on the averages total and marginal costs of cotton crop in salt-affected land (Equations 7,8 and the Cotton field primary data, 2011)

6. Conclusions

The main results can be summarized as follows: (i) the relationship between the quantity produced of cotton and inputs used of seed, manure, phosphorus fertilizers and irrigation water are positive, less than one and statistically significant. In addition the returns to scale for cotton production are increased. (ii) The cotton isoquant curve for the improved varieties is higher than the cotton isoquant curve for the old varieties. Consequently the farmers can produce more output of cotton under the same quantity used of irrigation water and manure. (iii) the cotton farmers will minimize their total costs by producing 7.5 kintar per feddan where the slopes of total cost curve and marginal cost curve are equal. The total production cost of cotton at the minimum level of costs is estimated at 518 LE/feddan. (iv) the cotton farmers will maximize their profit by producing 9 kintar/feddan. The total production cost of cotton at the maximum-profit level is estimated at 569 LE/feddan.

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CREATIVITY AND ENTREPRENEURSHIP IN INFORMATIONAL METROPOLITAN REGIONS

Abstract

Due to the growing importance of metropolitan regions for the economy this work aims at analyzing what fosters economic prosperity. We propose the theory that creativity generates new ideas and enhances the entrepreneurship level in the city. In this research the focus lies on metropolitan regions, located around 30 Informational World Cities, which are prototypical cities of the knowledge society. Referring to Friedmann, we extended our focus to regions (surrounding the cities) and went beyond administrative boundaries for the purpose of economic integration and commuting flows to be included. The main task entails finding a possible correlation between creativity, entrepreneurship and economic prosperity. In order to do so, we had to determine adequate indicators describing these aspects. Regarding the economic prosperity we elaborated the GDP per capita. As for entrepreneurship, we focused on the self-employment rate and establishment of new firms. For the purpose of measuring the creativity we had to define it first, namely as constructiveness and innovative problem solving. This means creativity is not only to be found in the field of arts, but also in the fields of science, technology and research. Therefore, we chose the following four indicators to measure the level of creativeness: the Bohemian Index according to Florida which measures the amount of creative people within the city, the creative infrastructure, the scientific (publications) and the technological output (patents). To sum up, our research questions are: Can it be stated that in the informational metropolitan regions the more creative the city is, the more entrepreneurs it has? And, is there any correlation between creativity, economic prosperity, and entrepreneurship?

Keywords

Creativity, Economic prosperity, Entrepreneurship, Metropolitan regions, Informational World Cities

1. Introduction

Metropolitan regions have been gaining in importance for the economy. Thus, in this work we investigate if there is a correlation between indicators of creativity and entrepreneurship in informational metropolitan regions in order to ascertain what fosters economic prosperity. These regions are located around 31 potential Informational Cities designated by

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Mainka et al. (2013) (see appendix). Informational Cities are the prototypical cities of the knowledge society and the new centers of power, which have a "glocal" orientation since they can act out both—locally and globally (Stock, 2011; Mainka, Khveshchanka, Stock, 2011). Castells (1989) bespeaks Informational Cities as parts of knowledge societies. In such cities two kinds of spaces coexist: the "space of places" and the "space of flows," meaning the flows of information, capital and power. Informational Cities are important nodes of the space of flows (Castells, 2000) and if they are important glocal cities, they often are world cities as well. Furthermore, global cities serve as locations for the headquarters of global companies that require information and expert knowledge. And since there are a lot of different companies with various talents and expertise within one global city, the city itself becomes an information center (Sassen, 2001).

According to Friedmann (1995, p. 23), "world cities are large, urbanized regions that are defined by dense patterns of interactions rather than by political-administrative boundaries." Thus, for the purpose of this research, the focus was expanded from just the cities themselves to the metropolitan regions they lie in, because "metro-regions are based on agglomerations, which include the commuter belt around a city" (Eurostat, 2013) and so, "this approach corrects the distortions created by commuting" (Eurostat, 2013).

Since this work aims at analyzing the correlation of creativity and entrepreneurship, these concepts have to be defined first. As for creativity, it is not possible to find an explicit definition. According to Florida (2003, p. 40), "creativity is multifaceted and multidimensional." He identifies three different kinds of creativity: technological creativity or innovation, economic creativity or entrepreneurship, and artistic and cultural creativity, which are dependent and reinforce each other. One theory to explain regional development is "human capital," i.e. the importance of highly educated and productive people. The higher the number of talented people, the more further talent is attracted, which includes existing firms as well as the creation of new enterprises (Florida, 2005). Florida identifies the "creative capital" as a type of human capital and the key to economic growth. Creative people prefer places which are diverse, tolerant and open to new ideas (Florida, 2002), so his creativity-based theory consists of the "3 T's" of economic development: technology, talent and tolerance. As a result, Florida has used different indicators to verify this theory. Besides the Innovation Index, the Gay Index and several more indicators, the Bohemian Index reveals a region's level of aesthetic creativity and measures artistically creative people like authors, designers, musicians, composers, actors, directors, painters, sculptors, artist printmakers, photographers, dancers, artists, and performers. Moreover, he defined the Creative Class in a broader way with the main aspects of marketability and creative problem-solving. This includes occupational fields of scientists and engineers, artists and designers, as well as creative professionals, managers and technicians (Florida, 2003). Concerning the overlap of the Bohemian Index and the Creative Class as well as the difficulty of finding data comparable to Florida's values, another established term was used to capture the habitat of creative workers: "creative industries," also called "cultural industries" or "creative economy" (Hesmondhalgh, 2002; Howkins, 2001). The British Department for Culture, Media and Sport (DCMS) describes the creative industries as "those industries which have their origin in individual creativity, skill and talent and which have a potential for wealth and job creation through the generation and exploitation of intellectual property" (DCMS, 2001, p. 4). In 2006, the DCMS recognized twelve creative sectors including advertising, architecture,

crafts, arts, design, fashion, film, video, photography, software, computer games, publishing, music, performing arts, television, and radio. Nevertheless, there still remain different though similar comprehensions of the term "creative industries." For example in the USA the creative industries are defined as industries composed of arts-related businesses that range from non-profit museums, symphonies, and theaters to for-profit film, architecture, and advertising companies. In other regions it is the "creative and cultural industries," not directly implying which sectors are included or if creative industries contain cultural industries per se.

Besides creativity, the second important concept is entrepreneurship. It can be defined as the process by which individuals follow opportunities without regarding resources they currently control (Stevenson, Jarillo, 1990). The most obvious process of entrepreneurship is a business coming into existence (Gartner, 1989). A possible coherence between both creativity and entrepreneurship might be the circumstance that researchers can be seen as academic entrepreneurs. Innovations, which researchers create and release in the form of publications and patents, are not only a type of creativity, but also a kind of entrepreneurship since "they 'sell' their products at conferences, journals" (Erdös, Varga, 2012, pp. 157-158). According to Etzkowitz (1983, p. 199), research groups can even be declared "quasi-firms."

1.1. Indicators

To quantify the aspects of creativity and entrepreneurship, several indicators were defined. Our index describing entrepreneurship consists of two indicators: the number of enterprise births (Lee, Florida, Acs, 2004) and the self-employment rate—two measures which are also to be found in the literature (Glaser, Kerr, 2009; Blanchflower, Oswald, 1998). It is stated that self-employment is the "simplest kind of entrepreneurship" (Blanchflower, Oswald, 1998, p.27). Apart from these indicators, a third one counting the number of small and medium enterprises (SME) was initially included. Since it was found that in most of the regions the ratio of SMEs amounted to more than 98%, it was decided that this indicator would not show significant differences between the various investigated regions and was thus removed from the Entrepreneurship Index. The Creativity Index is comprised of four indicators: the ratio of creative workers, the creative infrastructure (on city level, because data could not be found consistently on regional level), the scientific output and the technological output. In accordance to Florida's Bohemian Index and his Creative Class (2002), the ratio of creative workers was calculated by computing the percentage of employed people in the creative industries in relation to all employed people. What accounts for a creative city is not only "cultural production" but also "cultural consumption" (Hall, 2004, p. 257), which is why the creative infrastructure was included into the Creativity Index as well. Furthermore, the afore-mentioned three types of creativity (Florida, 2003) were incorporated into the compiled list of indicators. So, to cover the aspect of creativity not only in the sense of culture and arts, innovation as a form of creativity was taken into consideration as well by measuring the scientific output (published articles) and the technological output (number of international patents). Apart from the Entrepreneurship Index and the Creativity Index, two further general indicators were incorporated into the statistical analysis. One of these indicators is the GDP per capita to capture the economic

prosperity of the metropolitan region. In this way, we are able to answer the question whether creative people foster the economy. The second general indicator is the population in order to put the other indicators into perspective and get comparable results for each of the investigated regions.

1.2. Research questions

Based on the defined indicators the following research questions were formulated:

- Can it be stated that in the informational metropolitan regions the more creative the city is, the more entrepreneurs or economic prosperity (Florida et al., 2011) it has?
- Is there any correlation between creativity, economic prosperity, and entrepreneurship?
- Are there any distinctions between different continents or nations which can lead to the assumption of diverse cultural influence and development?
- Which type of creativity has the greater impact on economic prosperity, if any?

Answering all these questions is a challenge to meet and requires the right tools to obtain significant results like a variety of methods to collect and correlate the data. This approach is explained in the following.

2. Methods

During the investigation of the introduced research questions different methods were used. These encompass working with official statistics, informetrics (consisting of bibliometrics and patentometrics), online content, and statistical analysis.

2.1. Official Statistics

Official statistics, which are based on the respondents' obligation to give truthful and unmitigated information, were used to obtain profound statements about the investigated indicators. To enable an international comparison between regional currencies, the prices were adapted to US dollars. Furthermore, all statistical data was preferably collected from the year 2012 and from an extended period of time in case the data for 2012 was not available. In this respect, finding data for Dubai turned out to be a problem since hardly any data could be found. Due to that, it was decided to leave Dubai out as one of the originally 31 informational cities; hence, this research focused on metropolitan regions located around the remaining 30 informational cities.

2.2. Informetrics

As an indicator to study a region's technological output (patentometrics) and scientific output (bibliometrics), the number of its patents and publications from 2003 to 2012 was derived from respective databases. To determine the number of patent applications, a

search was performed in the Patentscope database of the World Intellectual Property Organization (WIPO). The database enables a patent search on city level (field: AAD), at the same time considering the priority date of an application (field: PD). Every city located in a region had to be included with disjunction, except for the regions of the United States where only principal cities could be regarded. By involving a country restriction (field: AADC) homonymous city names were avoided (e.g. London, UK and London, Ontario). To include different notations, a city's English name was linked to its national language's name, if necessary, and alternate spellings were utilized for the German umlauts. Furthermore, only the number of international patents (WO applications) was taken into consideration, which enabled a better comparability between the different regions.

The number of publications (scientific output) was ascertained using the interdisciplinary database Web of Science by Thomson Reuters, which allows searching for a city (field: CI) and a publication year (field: PY).

2.3. Online content analysis

Useful information can also be provided by conventional websites. Since not every data was available through official statistics, especially data describing the creative infrastructure (theaters, galleries etc.), and the number of start-up companies were retrieved from reliable websites.

2.4. Statistical analysis

Previous to the computation of any correlations, the indicators expressed by absolute numbers had to be made comparable, taking into consideration the size of the region, so that small regions were not disadvantaged compared to the greater ones. Therefore, such indicators were relativized by the population size of the respective area.

To determine possible correlations between the entrepreneurial and the creative indicators, the correlation coefficient by Pearson was applied to all of the statistical series comparing every indicator with all other indicators. As a result of the application of the Pearson coefficient for each two compared indicators, a value figure between -1 and 1 was obtained. Any figure between 0 and 1 shows a positive correlation between the indicators while a figure between 0 and -1 signifies a negative correlation. The greater the distance to 0, the stronger the correlation. These correlations were computed not only for the comparison of all metropolitan regions but also for metropolitan regions within a country or a continent, which are the United States of America, Europe and Asia. As it was not intended to compare the metropolitan regions within these areas on the level of the single indicators, they were agglomerated to two indexes: an Entrepreneurship and a Creativity Index. For comparison, the agglomeration approach was also conducted for all investigated metropolitan regions. Both, the Entrepreneurship Index as well as the Creativity Index, are composite, agglomerated indicators (Saisana, Saltelli, Tarantola, 2005). There is no “real counterpiece” of such indicators; they are pure constructs.

To agglomerate the different indicators within one index, the found data for each of them (and not the relativized values) was turned into a percentage. 100% were designated to the highest value within each indicator. All other values were calculated as the percentage of the previously determined highest value. Subsequently, the average of all indicators' percentages had to be computed for each region to obtain its index value. To calculate the Entrepreneur Index, for example, the average of the appertaining indicators self-employment rate and enterprise births was computed.

3. Results

The correlation of the described indicators resulted in the values listed in table 1. The highest value is 0.541, which represents the coherence between the population and the ratio of creative workers. In contrast, the most negative correlation exists between the population and the scientific output (-0.509). Remarkable results are the correlation of creative facilities and the scientific output (0.529) as well as a mediocre negative coherence between the GDP per capita and both the self-employment rate (-0.378) and the ratio of creative workers (-0.374).

As mentioned in the introduction, creativity is measured in different ways depending on the region's definition standards. Hence, it is difficult to compare the values of creativity homogeneously. Furthermore, it was not possible to find all information for every city. For instance, the number of enterprise births could not be found for Hong Kong. Therefore, to find a better way to compare entrepreneurship and creativity, and to obtain more significant results, it was more reasonable to create agglomerated indexes as well as to distinguish between the different continents the metropolitan regions are located in (table 2). This way, continentally and nationwide differing trends could be examined.

Total	*GDP per capita in Dollar*	*Population*	*Self-employ-ment rate*	*Enterprise births per 1,000 inhabitants*	*Ratio of creative workers*	*Creative facilities per 1,000 inhabitants*	*Scientific output per 1,000 inhabitants*	*Technological output per 1,000 inhabitants*
GDP per capita in Dollar	1							
Population	-0,270	1						
Self-employment rate	**-0,378(*)**	0,094	1					
Enterprise births per 1,000 inhabitants	0,114	**-0,373***	0,049	1				
Ratio of creative workers	**-0,374**	**0,541**	0,119	**-0,364**	1			
Creative facilities per 1,000 inhabitants	0,071	**-0,475****	-0,041	0,297	-0,100	1		
Scientific output per 1,000 inhabitants	**0,398***	**-0,509****	-0,166	0,108	-0,128	**0,529****	1	
Technological output per 1,000 inhabitants	**0,479****	-0,124	-0,282	-0,098	-0,033	0,241	**0,438****	1

Table 1. *Correlations of the investigated informational metropolitan regions (Multiple sources; own calculation); significance level of 10% (*), 5% *, 1% ***

	GDP per capita in Dollar	*Population*	*Entrepreneurship*	*Creativity*
Total				
GDP per capita in Dollar	1			
Population	-0.270	1		
Entrepreneurship	-0.106	-0.242	1	
Creativity	**0.304**	-0.242	-0.041	1
Asia				
GDP per capita in Dollar	1			
Population	-0.086	1		
Entrepreneurship	**0.775**	-0.109	1	
Creativity	**0.311**	**0.525**	0.365	1
Europe				
GDP per capita in Dollar	1			
Population	0.297	1		
Entrepreneurship	**-0,416**	-0,105	1	
Creativity	0,040	**-0,387**	-0,219	1
USA				
GDP per capita in Dollar	1			
Population	**-0.398**	1		
Entrepreneurship	**-0,330**	**0,745**	1	
Creativity	**0,910***	**-0,482**	**-0,465**	1

Table 2. *Agglomerated correlations of the investigated informational metropolitan regions by region (Multiple sources; own calculation); significance level of 5% **

As can be seen in table 2, there are considerable differences between the correlations of the different continents and countries, and all metropolitan regions in total. However, it has to be considered that these values are not representative of the whole continent or country itself, but only for the investigated informational metropolitan regions located there. In this work, the focus lies on the correlation between creativity and entrepreneurship. Whereas the consideration of all regions in total did not reveal special findings, there are expressive results regarding the continental or nationwide correlation values. In the US regions, the GDP per capita and creativity correlate highly positive (0.910). In contrast, a relation of this kind cannot be found for the European regions (0.04). Taking a glance at the whole table, it can be seen that for each country or continent the significant correlation values differ enormously. The most remarkable difference can be observed between the correlation of the GDP per capita and entrepreneurship in Asia and Europe. In Asia, there is a high correlation of 0.775, while there is a mediocre negative correlation of -0.416 for European Informational World Cities.

These numerical results allow assumptions about the significance of the dependence of creativity and entrepreneurship as well as of the other investigated indicators which are discussed in the following paragraph.

4. Discussion

The focus of this research lay on the impact of creativity on the entrepreneurship in informational metropolitan regions. After analyzing the elaborated results, we can state that there do exist coherences between entrepreneurship and creativity to a varying degree depending on the investigated region and the agglomeration. The correlation of the agglomerated indicators (table 2) shows that in total there is a slightly positive correlation between creativity and the GDP per capita, which represents the region's economic prosperity. A glance at table 1 reveals that this is mainly due to the positive correlations of the scientific and technological output, whereas the creative facilities only have a noticeably weak correlation with the GDP per capita; the amount of creative workers even correlates not inconsiderably negative with the economic prosperity.

This finding inevitably leads to a discussion about Florida's thesis that creativity and economic growth interrelate. He states that in the American society the people "now live in an 'information' or 'knowledge' economy. This economy is powered not by information or by knowledge, but by human creativity" (Florida, 2003, p. 39). As the correlation of the agglomerated indicators shows (table 2), this is unmistakably true for the USA: creativity and the GDP per capita correlate positively with a remarkable correlation value of 0.910. This assertion originally made for the USA does not necessarily hold for the other investigated regions, though. While in Asia there still is a slightly positive correlation to be found (0.311), there is no considerable correlation for Europe (0.04).

The most striking correlation value for all investigated metropolitan regions (table 1) is the correlation between the creative facilities per 1,000 inhabitants and the scientific output per 1,000 inhabitants. This value can only be of fortuitous nature, though, since no immediate causal relation between these indicators could be found. A possible explanation might be that both indicators are in the same way influenced by another third indicator and, therefore, correlate. The slightly positive correlation between the scientific output per 1,000 inhabitants and the GDP per capita (0.398) for all investigated regions possibly arises from the fact that the more prosperous a region is, the more higher education institutions it can afford; and at the same time it might imply that the scientific output, and thus the work of higher education institutions, fosters the economic prosperity of a region.

Regarding creativity, the scientific and technological output have the highest influence on the GDP per capita, which explains the strength of the USA in this area with an average of 20.8 publications and 3.7 patents per 1,000 inhabitants. Although Asia has a huge ratio of creative workers, the correlation is even highly negative (-0.796), which underlines that the output or production of a creative city is more important than just the number of employed people in the creative sector, because Asia has the least scientific and technological output. With reference to the GDP and entrepreneurship, differences arise between Asia and the USA or Europe. While the GDP in Asian regions is growing with the increase of entrepreneurship (0.775), in western regions a lower amount of large enterprises tendentially suggests economic prosperity and one seems to be less willing to take risks. Furthermore, the indicator enterprise births per 1,000 inhabitants is obviously more expressive in the context of GDP per capita than the self-employment rate as Europe, for example, has the highest average self-employment rate (12.9%) but nevertheless a negative

correlation between GDP per capita and entrepreneurship (-0.416). The GDP per capita and the population can only be minimally associated with each other, where the type of cohesion is different for the European regions (0.297) than for the US regions (0.398). For the investigated European metropolitan regions it is the case that a higher population implies a higher degree of prosperity, while in the investigated US regions, a smaller population comes along with a higher GDP per capita. A linkage between the population and entrepreneurship can only be detected for the analyzed metropolitan regions of the USA, but in this particular case a rather conspicuous one. Since the USA is the weakest of the regions in terms of entrepreneurship and only there the population and entrepreneurship correlate positively, and additionally fairly high (0.745), it seems that from a certain degree of existent entrepreneurship in a metropolitan region onwards, the size of the population does not play a major role anymore. Concerning the correlation of the population and creativity, there are differences to be noticed between the Asian and the western regions. The greater the population in the Asian regions, the higher the degree of creativity, especially the percentage of people employed in the creative industries. As the Asian regions have a larger population on average (16.8 million inhabitants), the impression that creativity in these regions is generated through quantity instead of scientific and technological output (in contrast to the western regions) can be confirmed. Positive correlations between entrepreneurship and creativity can also only be spotted in the Asian regions.

5. Conclusion

Overall, it cannot be stated that in the informational metropolitan regions creativity always generates more entrepreneurship or prosperity, but most certainly there are correlations between these aspects, although to different degrees. It was found that the influence of creativity on economic prosperity is mainly caused by a certain type of creativity, which is the technological creativity and innovation, while creative workers and creative facilities only play a minor role in this respect. Moreover, the investigated metropolitan regions of the USA and Asia seem to be greatly different in respect of entrepreneurship and creativity, while the European regions do not show such high extremes but have correlations that are rather tendentially prone to those of the USA than those of the Asian regions. Hence, it can be stated that the initially posed research questions cannot be answered for all investigated metropolitan regions in total. Future investigations could work out the differences and the specific reasons therefore. Besides promotion programs for entrepreneurs or creative workers, also the hard and soft location factors of metropolitan regions should be considered, as they attract more human capital.

During the search for and the analysis of the official statistics several obstacles arose in so far as that the international comparison had been complicated by the absence of a coherent, transnational standard for statistics of all administrative levels. On the one hand, data for the same indicators were partly findable by different terms and on the other hand, some terms, especially within the creative sector, denote distinct entities. With regard to the alleged informativeness of these world cities, there still is potential for improvement to guarantee an optimal data acquisition. Additionally, a useful step would be the extension of statistics for metropolitan regions because they are the engines of economic prosperity and this growing importance should be describable in facts and figures.

In conclusion, it can be said that creativity in general has a more distinct positive correlation with the economic prosperity of a metropolitan region than entrepreneurship. At the same time, creativity and entrepreneurship correlate with each other both positively as well as negatively—depending on the country or continent one lives in: positively in informational regions in Asia, slightly negatively in Europe and very negatively in the USA.

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Appendix

The Informational World Cities according to Mainka et al. (2013):

Amsterdam (The Netherlands); Barcelona (Spain); Beijing (China); Berlin (Germany); Boston (U.S.A.); Chicago (U.S.A.); Dubai (U.A.E.); Frankfurt (Germany); Helsinki (Finland); Hong Kong (China, SAR); Kuala Lumpur (Malaysia); London (United Kingdom); Los Angeles (U.S.A.); Melbourne (Australia); Milan (Italy); Montreal (Canada); Munich (Germany); New York City (U.S.A.); Paris (France); San Francisco (U.S.A.); Sao Paulo (Brazil); Seoul (Korea); Shanghai (China); Shenzhen (China); Singapore; Stockholm (Sweden); Sydney (Australia); Tokyo (Japan); Toronto (Canada); Vancouver (Canada); Vienna (Austria).

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INNOVATION CLIMATE AS A SOURCE OF COMPETITIVE ADVANTAGE

Abstract

Innovation is the result of the interactions and exchanges of knowledge involving a diversity of actors in situations and interdependences (Landry, Amara, & Lamari, 2002). Innovation requires the convergence of different kinds of knowledge from different types of actors (Landry et al., 2002). There is scarce literature measuring innovation potential. In this work the well-known Tidd et al. (2005, pp. 566-568) instrument for measuring innovation climate is used. The instrument measures five categories, namely strategy, processes, organization, ties and learning. On grounds of an internet survey of the Croatian manufacturing sector Croatian innovative audit is presented. The survey targeted 2443 Croatian manufacturing companies with over 10 employees. After two months of the launch of the survey 135 valuable questionnaires are obtained. The instrument shows that Croatian average innovation climate index is 4,7 out of 7 which means that there is much potential for improvement. Using factor analysis the questionnaire is tested, because so far we could not find the validation of the instrument. The results show that indeed the instrument has high validity. Then using structural equation modeling, the effects of organizational climate on new product launch, time to market and revenues from new products is evaluated. The results show that strategy and learning have the biggest influence on number of innovations; ties have the biggest influence on time to market of new products, and organization has the biggest influence on revenues from new products.

Keywords

competitive advantage, Croatia, innovation audit, innovation climate, structural equation model

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1. Introduction

Sudies show that there is a high correlation between business results and innovation (IFP, 2003). New products, either modifications or radically new products enable to capture new market or retain the existing market share (Tidd, 2006). In case of existing products, competitiveness and growth of revenues comes not only from price reductions but also from various nonfinancial factors as better design, customization and enhanced quality (Govindarajan and Gupta, 2001). Life cycle of products is becoming ever so short and life cycle of mobile phones and MP3 players are now measured in months. Slightly more

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complex products such as cars have life cycles measured in a year. It is important to launch a new product before the competition; because that creates a temporary monopoly that will bring additional revenues until the competition catches up. That means that it is vital to launch new products but also to launch them before the competition. This puts a tremendous pressure on today's companies (Tidd et al, 2005, p.5; BCG, 2010). When talking about innovation usually it is assumed that the term means new modified products or radically new products. However, process innovations are of equivalent importance. Process innovations enable companies to work more efficiently, of better quality and more productively (OECD, 2005). Studies show that incremental innovations may cumulatively bring better efficiency and gains in the long run than sporadic radical innovations (Hollander, 1965; Hammer, 2004). The current literature does not provide comprehensive frameworks for the measurement of innovation capability and its effects. Input measurement evaluates how the innovation activities have been arranged and how resources are allocated to them. It includes the funds used in R&D activities and education. Input measurement is problematic, because it tells how much is devoted, not if anything has been accomplished. Output measurement mainly includes the organization's patents and licenses. The problem of output measurement is that they are only suitable for certain types of innovations and organizations (Tura et al., 2008). Becheikh et al. (2006, p. 649) on grounds of works of Archibrugi and Pianta (1996), Coombs et al. (1996), Hagedoorn and Cloodt (2003), Kleinknecht et al. (2002), Michie (1998) and Patel (2000) list pros and cons of indirect and direct measurement of innovation. Becheikh et al. (2006, p. 649) propose direct methods, via questionnaires, asking for number of new products, revenues form new products, time to market and level of R&D investments in order to bypass the negative sides of indirect measurement of innovation. The aim of this work is to analyze in what way organizational climate for innovation (Tidd et al., 2005, pp. 566-568) influence direct measures of innovation defined by Becheikh et al. (2006, p. 649). Furthermore, it will be analyzed how each of the five dimensions of innovation climate (strategy, processes, organization, ties and learning) influence direct measures of innovation.

2. Innovation climate

Even from the time of Schumpeter it is known that new products represent potential for growth of companies but also better living conditions for population in general. Therefore in the nineteen sixties it was very popular to heavily invest in R&D departments. Unfortunately, after ten years or so, it was found out that higher level of investment in R&D does not yield more new products. Research has shown that innovation depends on number of factors, such as economy, organizational culture, management etc. To illustrate the complexity of innovation Trott (2009, p. 8) stresses three important steps in the innovation process:

- Generation of new knowledge for innovation,
- Usage of acquired knowledge for generating new products and processes,
- Economically benefit from new products launched on the market.

The three steps depict that innovation and its commercialization is indeed an interdisciplinary process. Innovation necessities are teamwork and creative deployments of various types of knowledge. Researches also show that proactive human resources

management will have a positive effect on business results (Pfeffer, 1998; Ahmad and Schroeder, 2003; Mathieson, 2006) and on innovation (Laursen and Foss 2003; Lau and Ngo, 2004; Dorenbosch et al., 2005; McLean 2005).

Creative climate is developed through organizational culture which in some part is a function of proactive human resources management. Organizational culture is complex but can be defined as common values, beliefs and norms of behavior. Management of the company cannot easily change the culture and it is usually built by stimulating and compensating desired behavior. Building innovation culture requires compensating innovations. Organizational innovation climate is less tangible and by far more difficult to measure, but according to Akkermans (2008), can be influenced more easily.
Lamers (2007), Tidd et al., (2005) and many other authors researched what fosters innovation. There is still no consensus; however in all researches a common set of themes were present in all innovative companies.

- Strategy – the upper management highly supports and propagates innovation
- Ties – it is vital that there exist a very good communication inside and outside of the company
- Processes – innovation necessities that the company can quickly adapt through efficient rules and procedures
- Organizational structure – it has to be designed to support innovation
- Learning – that is the basic element for generating new knowledge

Tidd et al. (2005) questionnaire captures all those dimensions and therefore was chosen to investigate the Croatian innovation climate.

3. Methodology and sample description

The survey took place in June 2013 exclusively via a web based survey. The e-mail addresses were obtained from Croatian Chamber of Economy. The questionnaire was sent to 2443 companies with more than 10 employees. The reason for this cut off on 10 employees is because in micro companies a lot of different tasks are done by one person so it would be harder to isolate specific influences. After a month 135 completed questionnaires were obtained representing 5,53% response rate. This is quite low but it is attributed to the web based survey for which is usually to yield lower response rate than paper surveys.

All participants obtained their personal innovation audit in a day. However, the sample was checked for representativeness by size and industry and it proved to be representative. In the sample 64% of companies were small companies with less than 50 employees, 22% medium sized companies (50 – 250 employees), and 14% of large companies with more than 250 employees.

Even though there is still recession in Croatia, 34,6% companies will invest more into research and development. For the time being small companies on average invest 10,88% of sales, medium companies 8,58% of sales and large companies 5% of sales. This might look inconsistent, however since small companies usually have smaller revenues it is logical that

they have to invest more in percentage points to get a comparable budget as large companies. 64% of respondents say that R&D investment is too low.

As it can be seen in Table 1., the companies in Textile and Apparel industry and Pharmaceutics on a Likert scale from 1- non important to 5 most important think that innovation is key for staying competitive. The average of all companies is 4 modified products and 3 completely new products which is quite high, and contrary to current belief, it is actually medium and bigger companies that innovate more. The development phase for modified products is on average 5 months, while for new products more than 7 months.

Industry	Importance
C14 Apparel And Other Finished Products Made From Fabrics And Similar Materials	4,7
C21 Pharmaceutics	4,7
C26 Measuring, Analyzing, And Controlling Instruments; Photographic, Medical And Optical Goods; Watches And Clocks	4,1
J58 Software development	4,0
C13 Textile Mill Products	3,7
J62 Computer programing and consulting	3,6
C28 Industrial And Commercial Machinery And Computer Equipment	3,6
C15 Leather And Leather Products	3,5
C17 Paper And Allied Products,	3,5
C20 Chemicals And Allied Products	3,5
C22 Rubber And Miscellaneous Plastics Products	3,5
C27 Electronic And Other Electrical Equipment And Components, Except Computer Equipment	3,5
C32 Miscellaneous Manufacturing Industries	3,5
C30 Manufacture of other transport equipment	3,3
J63 Analysis of data, Web design	3,3
C25 Fabricated Metal Products, Except Machinery And Transportation Equipment	3,0
C10 Food And Kindred Products	3,0
C11 Beverages	3,0
C16 Lumber And Wood Products, Except Furniture	3,0
C23 Nonmetal and mineral products	3,0
C24 Fabrication of metal	3,0
C29 Manufacture of motor vehicles, trailers and semi-trailers	3,0
C31 Furniture And Fixtures	2,8
C18 Printing, Publishing, And Allied Industries	2,0

Table 1: *Importance of innovation by industries (1 – not important, 5-highly important)*

As far as revenues are concerned again an unpredictable result is obtained. On the whole sample greater returns are obtained from modified products than from radically new. It might mean that in modification less is invested and all together gain is bigger. For radically new product very much has to be invested first.

There is a discrepancy in the strategy component in the obtained results. In the questionnaire it showed that 71% responders see higher management as the leaders of innovation. However the question 7 questioned if this higher management vision is clear to

all employees the result was on average 4 on 7 point Likert scale, where 7 would be true, and 1 not true.

As for measurement of innovation, 62% of companies measure it by customer satisfaction and then revenues from new products (15%). The rest are other measures. As for impediments to innovation the dominant causes are too lengthy process, and deciding which project to give a green light since they are all inherently risky. Many complain about inadequate marketing of new products.

For the whole sample the innovation audit looks as presented on Figure 1.

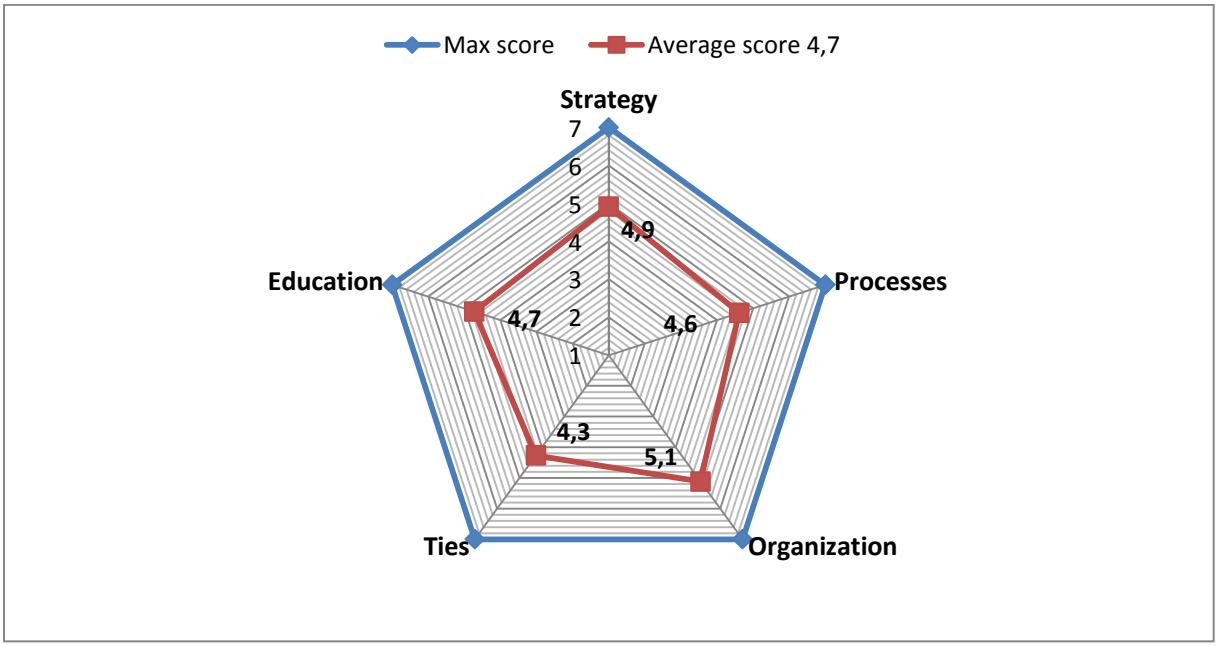

Figure 1: *Croatian innovation audit*

Figure 1 reveals that organization has the highest score meaning that the organization can quickly adapt to changes, but ties is the lowest score meaning that communication in house and with outside partners has to enhance.

4. Results

Literature research did not reveal the validness of the Tidd et al. (2005) instrument so our first step was to check the validity using Cronbach alpha test which is presented in Table 2.

Construct	Questions from the questionnaire*	Cronbach Alpha	Sig.
Strategy	f1 f6 f11 f16 f21 f26 f31 f36	0,918	0,000
Processes	f2 f7 f12 f17 f22 f27 f32 f37	0,899	0,000
Organization	f3 f8 f13 f18 f23 f28 f33 f38	0,906	0,000
Ties	f4 f9 f114 f19 f24 f29 f34 f39	0,851	0,000
Education	f5 f10 f15 f20 f25 f30 f35 f40	0,850	0,000

** Question can be found in Tidd et al. (2005, pp. 566-568)*

Table 2: *Cronbach alpha test of the constructs*

It can be seen that all Cronbach alpha values are over 0,8 which is very good. Then confirmatory factor analysis is conducted in order to see if the grouped questions fit in the proposed groups.

Method of Estimation: ML	Chi-Square Statistic: 2573,33
Discrepancy Function: 19,8	Degrees of Freedom: 740
Maximum Residual Cosine: 7,71E-005	Chi-Square p-level: 0,000000
Max. Abs. Gradient: 0,000149	Steiger-Lind RMSEA
ICSF Criterion: 2,53E-006	--->Point Estimate: 0,13
ICS Criterion: 0,000197	-->Lower 90% Bound: 0,125
Boundary Conditions: 0	-->Upper 90% Bound: 0,136
Joreskog GFI=0,822	RMS Stand. Residual: 0,431

Table 3: *Result of the confirmatory factor analysis*

All the parameters including Joreskog GFI (>0,8) are satisfactory and the model can be said to be valid and proven for further use.

However the main aim of this work is to see how each of these constructs relate to measurable outputs of innovation – number of new products, revenues from those products and time to market. Using structural equation modeling we obtained following results.

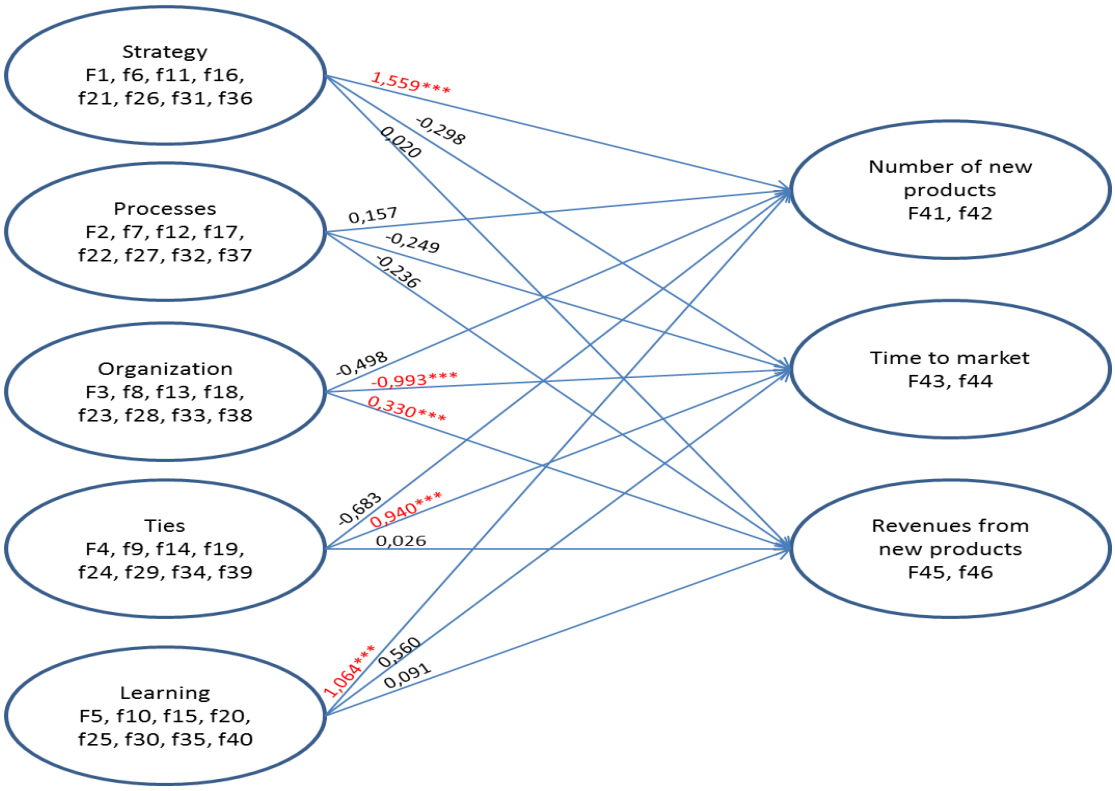

Figure 2: *Result of the structural equation model*

Before going into drawing conclusion from this model it is necessary to check if the model is valid. Therefore in Table 4 are characteristics and indicators of the model.

Method of Estimation: ML	Chi-Square Statistic: 2604,37
Discrepancy Function: 42,7	Degrees of Freedom: 974
Maximum Residual Cosine: 0,00283	Chi-Square p-level: 0,000000
Max. Abs. Gradient: 0,0157	Steiger-Lind RMSEA
ICSF Criterion: 0,00173	--->Point Estimate: 0,124
ICS Criterion: 0,00891	-->Lower 90% Bound: 0,116
Boundary Conditions: 1	-->Upper 90% Bound: 0,132
Joreskog GFI=0,927	RMS Stand. Residual: 0,429

Table 4: *Goodness of fit of the model*

Looking only at Joreskog GFI=0,927 it can be seen that the model shows extremely good model fit, so it is safe to draw conclusions.

In Figure 2. some indices are larger than 1 because those are not correlation coefficients but covariance. Looking only at the red significant values one can draw following conclusions:
1. The higher level management in propagation and rewarding innovation will in fact augment the number of new products.
2. Organization has a negative effect on time to market, and the more rigid organization is, it will it take more time to launch a new product. However, organization is extremely important for assuring commercial success of the innovation and that means that this organization is necessary for commercialization and it is not enough to have an idea of a new product.
3. Ties within the company and with outside partners will significantly lower time to market. It is good to invest into interpersonal relationships for innovation.
4. Learning significantly affects number of new products. So it is absolutely important to invest into R&D but also in employees' learning.

5. Conclusion

This work is a pilot project for conducting survey via internet in Croatia. It can be said that the response rate is lower than for the paper copies of questionnaires which even for survey of 12 pages deliver around 10% response rate. However we obtained 135 valuable answers which are enough for this investigation that we presented. The questionnaire had 40 questions taken from the Innovation audit Tidd et al. (2005, pp. 566-568) for measuring the innovativeness of the company, but with additional questions regarding number of new products (modifications and radically new products), time for development of new products (modifications and radically new products), and revenues from new products (modifications and radically new products). Each respondent in a couple of days received his personalized Innovation audit with recommendations where to invest into enhancing its innovation index.
Apart from descriptive statistics, the work represents the valuation of the Tidd et al. (2005, pp. 566-568) survey instrument using confirmatory factor analysis. We believe it is a valuable contribution since our search of literature did not show that someone already conducted this evaluation. The instrument is proven solid as by Cronbach alpha, so with model factor estimators. The most important part of this paper is the model how latent variables constructed from the questionnaire (strategy, processes, organization, ties, learning)

influence another set of latent variables (number of new products, time to market, revenues from new products). The model was tested and Joreskog GFI is over 0,9 which shows good model fit. The phenomenon of innovation is really a complex matter which includes not only engineering, employee knowledge, but also research in domains of psychology and sociology, and therefore it can be really sad with great assurance that it is an interdisciplinary process. Therefore this work is only a little part of an ongoing investigation in the field of innovation. Finally this work is a contribution to exploring the innovativeness of Croatian manufacturing companies with many recommendations for improvement.

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SOCIAL MEDIA USAGE IN BANKING INDUSTRY AND ITS MANAGERIAL VIEW: CASE STUDY FOR MEXICAN BANKING SYSTEM

Abstract

Being a basic platform of worldwide electronic business, the Internet has emerged as the world's major distribution channel for goods and services, the easiest and cheapest way for communication and interaction. These changes, which have influenced more or less all business areas by making them to be drastically transformed, require new challenges, communication approaches and creative behavior in the "dot com upheaval". It has affected banking industry and made them to deal with radically new challenges. It has offered lots of opportunities for businesses that can be seen even in the short period. And here managers need to create and establish new ways and methods to transform and adjust their organizations to the new changes, to communicate and interact to customers, which best can be done via Social Media.

Social media has become a part of human life. It has entered consumers' day to day lives. It has tremendous impact on today's world especially in business world. The rapid progresses in technology seem to have more impact on changes in the banking industry than any other. This article is focused on social media usage in banking industry. We define social media as a manifestation, development and transformation of human's most impressive characters: communication and interaction, which nowadays are done throughout the new channels. The right communication is linked with customer satisfaction, which itself is linked with customers loyalty and retention. Thereby, in our opinion social media is a new challenge in banking industry the ignorance of what can cost banks customers' loss.

In fact, today banking industry is extensively debating, discussing and thinking on Social Media usage in financial world. Banks have begun to catch that social media is a new challenge for them and it can become a crucial constituent of banking strategy. Social media in banking industry is a discussion topic of this article which than comes up with its current usage in Mexican banks and its managerial view.

Keywords

customer care, customer satisfaction, communication, social media

1. Introduction

New technologies based on the Internet, World Wide Web and wireless communications have changed the business world in 20th century. Being a basic platform of worldwide electronic business, the Internet has emerged as the world's major distribution channel for goods and services, the easiest and cheapest way for communication and interaction.

Social media is almost an endless source and an important tool for communication. It has radically impacted today business world. And todays customers have proved this fact. Social media is influencing customers' financial decisions. The traditional world of mouth has been changed in social media world of mouth. Thus banking management needs to identify ways

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to make profitable use of social media. By developing presence in social media banks will be closer to customers. We believe that the fastest way to grow a business entity is through social media and networking. Thus social media and its current usage in banking are discussion topic of our paper. It presents the managerial view concerning to social media usage in Mexican banks, its barriers and challenges. Based on statistics and researches in social media area, we present a set of hypothesis and test them in Mexican banks by doing survey among managers, directors and social media representatives in Mexican banks.

2. Social media challege in global economy and its added value for banking industry

The communication ways and methods have been changed, nowadays banks have to be more communicative, more customer-centric and innovative. Social media is a result of these changes and it has a crucial influence on todays business world. Here is presented the theoretical research concorning our topic. As we know, the last two decades have seen multiple visions for “banking in the future” (Gates, 1995) that comprehended banking from a customer perspective. Alt & Puschmann (2012) supposed that four drivers have become fairly prevalent causing a stronger transformation in the forthcoming years: the financial crises, the changing behavior of banking customers, the pace of diffusing innovative downstream IT-solutions, and the emergence of non-banks. All these have direct or indirect connection with social media phenomenon. Indeed in few years social media showed an explosive growth and established itself as “the media of choice all across the world”. (Hun, 2010).

Ernst & Young (2012) in “Global banking outlook: 2013-14” based on their global research advises that banks need to develop new business models and implement new operating models, because customers “disturbing the status quo — they continue to need banking services but are starting to look beyond banks to alternative providers”. “A major overhaul of the organization will be needed to adapt to the new environment”.

The rapid success of social media has left corporations “in the dust” as they seek to promote their products on these platforms, develop strategies and policies, and fill newly created social media-related positions with qualified individuals (Kelly, 2010).

King (Bank 3, 2013) told that there has never been a new media type that has such a deep impact on business messaging and dialogue in such a short period of time – ever. When we put it in that light, there are many banks that should have been taking social media far more seriously for quite some time already. But perhaps those banks are waiting for the crash, the dot-bomb of social media.

Jenkins (2006) described the contemporary media landscape as being innovative, convergent, every day, appropriative, networked, global, generational and unequal. Gharibi (2013) pointed out that a crucial element to ensure social media success is to have executive level support for enabling and encouraging experimenting and learning. This makes it easier to “stick with it” since it takes substantial commitment, time, and resources to be successful in social media. Murdough (2009) emphasized that firms try to realize their aims through social media. Steinman & Hawkins (2010) added that the viral feature of social media makes

it fantastic for business environment. Kirakosyan & Dănăiaţă (2013) showed the link between communication, customers' satisfaction and customers' loyalty/retention. Which means that e-Communication is not only a crucial variable on customer satisfaction but also on their loyalty/retention.

Tapscott & Williams (2006) developed an idea of "wikinomics" and explained the use of mass collaboration in a business environment. They mentioned that leaders must think differently to compete and be profitable, and "embrace a new art and science of collaboration". Financial sectors, especially the heart of it: banks, have to harness the power of social media. "Perhaps akin to the development of websites in the latter part of the 20th century, organizations today sense that social media is––and will remain––an important fabric of commerce, and that they must get on board". (Weinberg & Pehlivan, 2011). Edosomwan (et al 2011) underscored that "Social media helps conversations to reach a wider audience leveraging the "long tail" concept, which means conversations that can be conveyed to different forums". Paridon & Carraher (2009) stressed that "Social media is a cost-effective method for marketing activities". Merrill (et al 2011) emphasized that "via Social networking sites banks should be focused on deeper relation between customers, which will grow to "know, like, and trust". And for each kind of businesses they mentioned "But the opportunity to interact with anyone, anywhere, anytime is too world-changing to ignore". Brown (2010) mentioned "It is well-established that people feel more connected with a company when they have direct communication on an ongoing basis and opportunities to express their opinions." Nadkarni (2013) wrote "But the benefits of engaging with customers on these channels outweigh the cons, primarily, because engagement via social media keeps an organization on its toes and ensures customer grievances are addressed immediately." Vaynerchuk (2009) emphasized that social media gives businesses an unprecedented opportunity for interacting with their customers and communicating their messages. Catherine Zhou pointed out that businesses have been talking for many years about how customers are empowered by information. And now, more and more customers are seeking that information via social media, and it is being filtered by their peers. (Ernst & Young, 2012)

Gallup's Retail Banking Industry survey finds that social media and written materials are by far the most likely to lead to a sales conversion. And if we compare the social media costs (some social media channels are free by the way) with other sources like calls from customer service representative, we will see that social media is the challenge that worth to undertake (Leonard & Youra, 2013).It showed as well that the first place where customers look for bank information is social media.

Samuel (2013) mentioned that social media demanded attention. It needs to be put into the rotation, but that doesn't mean we take something off our calendars to accommodate it, we should just add it to our teams' tasks, challenging them to figure it out until they could make a business case for hiring full-time social media staffers. "If social media is worth doing, than it's worth making time for".

Some banks have special departments for CRM implementation. Via social media channels it is very easy and cheap to manage customer relationship. Thomas (2010) mentioned that social media is "CRM for millennia" but not a just simple marketing tool and its form may be

different direct in the future but it's not going away. But statistics show that businesses don't use social media for CRM purposes extensively as they should. Particularly Social Media Marketing report for 2012 released by Awareness (Brown, 2012) presented that the social CRM issue continues to be one that's lacking in uptake, with only 16% of businesses currently using a social CRM system. While 21% are planning to, 17% don't know what a social CRM system is and why businesses need it.

Hensel & Deis (2010) stated the connection between social media and cross-selling. They mentioned that in social media platform on-line groups communicating with each provide cross-selling opportunities for businesses.

Pearson (2013) mentioned about another benefit. He pointed out that social media can play a role in business process management. Some leading companies are already using the power of social media to shape their business process management (BPM) agendas.

Jiang et al. (2012) in their research paper showed that via social media stock market performance can be predicted. This connection was a research topic for many researchers. Das & Chen (2007) pointed out that online social media such as firm-related web forums are valuable sources in explaining subsequent stock behavior. Tetlock (2011) et al. showed that there are three main sources of information for stock prediction: analysts' forecasts, accounting variables in financial statements, and information appearing in news and social media.

3. Social media usage in mexico

In Latin America internet usage grows very rapidly. World Bank indicators showed that Argentina, Brazil, Mexico, and Colombia have the highest rates of internet usage in the region. A September 2011 report "The Rise of Social Networking in Latin America" found that half of the top ten worldwide markets by time spent on social networking are in Latin America. (Dominguez, 2013). And Mexico has its unique place in this growth. In October 2012, when Facebook passed 1 million users, 19 percent of those users live in Latin America. Mexico is the first country in Latin America where the president and cabinet became engaged in social media. (Dominguez, 2013). The governments of virtually all large Latin American cities now use social media to engage with citizens, and smaller cities are quickly following suit. The Inter-American Development Bank recently found that social media is used by governments of Latin American in 70 percent of the region´s 140 "emerging cities" (those having 100,000 to 2 million residents and above-average economic growth rates). (Moreno, 2012)

Global Digital Statistics 2014 done by We are social's snapshot of key indicators, presented the worldwide internet and social media usage. According to it, total world population is 7,095,476,818, from which 2,484,915,152 are internet users. Approximately 35% of worldwide population are using internet and from this over 1,856,680,860 are active social network users. Which means approximately 26% of worldwide population is in social networks. Where else business can find such a huge market? Only Facebook had more than 1 million active users for January 2014. (Global Digital Statistics, 2014)

The population in Mexico in different sources are presented different; by National institute of statistics and geography it is 112 336 538 (http://www.inegi.org.mx/), by world population statistics it is 117 410 000 (http://www.worldpopulationstatistics.com/), by Mundi index it is 116,220,947 (http://www.indexmundi.com/). According to Global Digital Statistics 2014, in Mexico only Facebook users, by the way active ones, are 50,000,000. That means, in Mexico approximately 43 percent of population are using Facebook. And this figure is without taking into consideration that 27.4% of population are in the age of 0-14 years (Mundi index). That means, the target for banks only in Facebook in Mexico is more than it 43% of its population.

In Mexico each day the internet users spend average 5h 22m internet, from which 3h 46 minutes they use social media, which penetration as a percentage of the total population is 33%. Table 1 presents overall social media usage in Mexico and we can see that the list leads Facebook. (Global Digital Statistics, 2014)

	Own an account (%)	Used in the past month (%)
Any social network	98%	72%
FACEBOOK	94%	61%
GOOGLE+	74%	29%
TWITTER	62%	27%
LINKEDIN	36%	12%
INSTAGRAM	28%	8%

Table 1: *Social media usage in Mexico (Global Digital Statistics, 2014)*

The survey "Digital Marketing and Social Networks in Mexico, 2013" done by AMIPCI (Mexican Association of Internet) shows that 85% use social networks, that means 8 from 10 companies have some social profile. But only 13% of companies devote more than 20 hours in their social networking profiles in a week, though 68% of companies have special staff to manage their profiles (almost 7 from 10), in general the time devoted to social media engagement in a week is not pretty much: 33% less then 3 hours, 29% 4-6 hours in a week, 16% 7-10 hours in a week, 3% 11-15 hours in a week, 6% 16-20 hours in a week.

The same survey " done among internet users found out that 93% of them use social media. If in case of companies only 21% have presence in social media more than 3 years, in case of social media users this figure is much more; 84% users are in social media 3 and more years. (AMIPCI, 2013)

The most popular social media platforms for internet users are Facebook, Twitter, YouTube, LinkedIn and Google+.

	Registered (%)	Daily access (%)	Men (%)	Women (%)
Facebook	96	93	45	55
Twitter	69	66	44	56
YouTube	65	65	45	55
Google+	57	56	48	52
LinkedIn	38	27	42	58

Table 2: *The most popular social media platforms among internet users*

Another important factor is the age in social media platforms. In average for the most popular platforms generally the age is 18-24, then comes 25-34. (Table 3)

Age	Facebook (%)	Twitter (%)	YouTube (%)	Google+ (%)	LinkedIn (%)
18-24	39	48	48	44	26
25-34	26	26	25	24	31
35-44	16	14	12	15	21
45-54	13	8	11	11	15
More than 55	6	4	4	6	7

Table 3: *The social network users' age is different for different social media platforms (AMIPCI, 2013)*

Social media has become the place where customers look for information, promotions, products have become the fans of any of those products, and last but not least, are influenced to make purchase. Thus, from social media users 51 % follow some brand and 40 % are fans for them. The survey shows that 59% social media users had its influence for decision to buy something. (Figure 1)

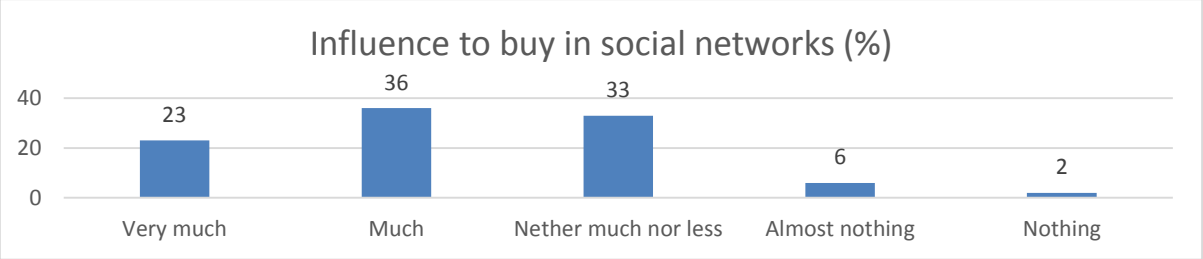

Figure 1: *Main social media platforms (AMIPCI, 2013)*

4. The managerial view of social media usage in mexican banks

Mexican banking system is very large. It has Mexican Banks, foreign-owned banks, development banks and others. Based on statistics and findings about social media usage which were mentioned in the 1st and 2nd chapters, we set hipothesis and to testify them we have done survey among Mexican banking system and had interviewed 33 managers, directors and social media responsible working there by selected the questions that allow us to validate our hypothesis about social media barriers and challenges.

H1: Mexican banking system has a strong social media presence
H2: The banks in Mexico consider that there are several barriers in social media adoption.
H3: The banks in Mexico consider that social media adoption brings a set of challenges for the banks.
H4: Social media is used among Mexican banks for various purposes.
H5: Social media has a strong impact on Mexican banks.

H1: The banks in Mexico are present on most of the known social media platforms.

90% of the respondents said their bank has presence in social media platforms. The leading platforms are Twitter, Faebook, Linkedln, YouTube, Wikipedia (Figure 2).

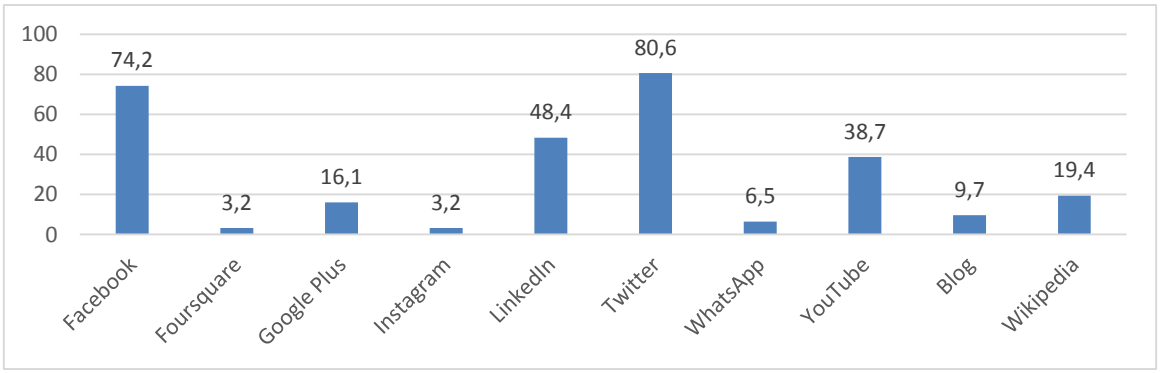

Figure 2: *The main social media platforms in Mexican banks for 2014*

H2: The banks in Mexico consider that there are several barriers in social media adoption.

69.6% respondent think that one of the barriers is the lack of strategy around social media usage (Figure 3, Multiple-choice question whereby respondents selected all the categories that applied to them).

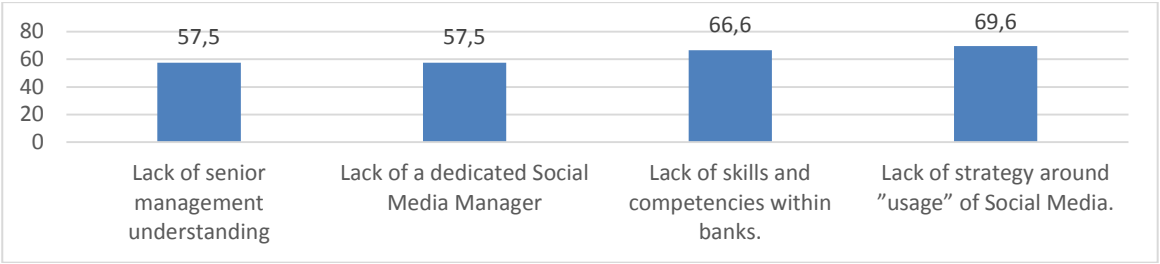

Figure 3: *Managerial view on Social media adoption barriers in Mexican banks, 2014*

H3: The banks in Mexico consider that social media adoption brings a set of challenges for the banks.

81.8% respondent think that one of the challenges in social media usage is customers' demand and behavior recognition (Figure 4, Multiple-choice question whereby respondents selected all the categories that applied to them).

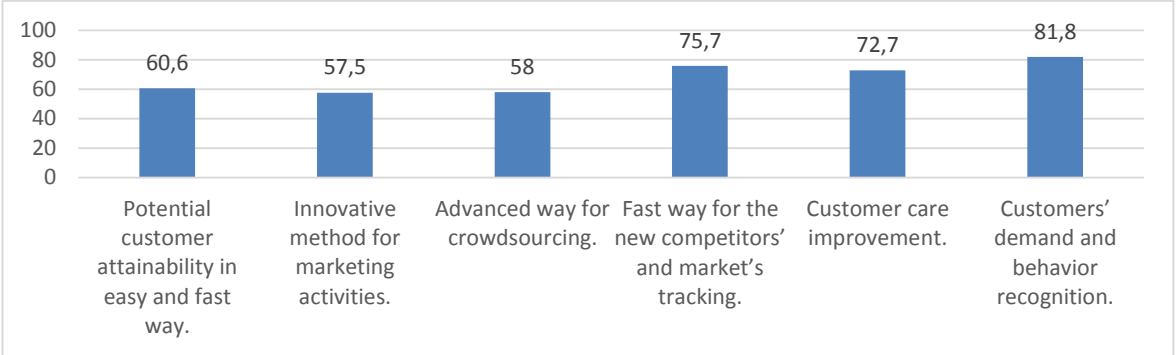

Figure 4: *Managerial view on social media challenges in Mexican banks, 2014*

H4: Social media is used among Mexican banks for various purposes.

The managerial view for social media usage in banking industry shows that 42.4 % respondents do strongly agree that social media is a tool for brand strengthening. Table 4

presents the managerial view concerning to the purposes of social media usage in banking (Multiple-choice question whereby respondents selected all the categories that applied to them by rating scale).

For what purpose banks use social media	Strongly agree (%)	Agree (%)	Neutral (%)	Disagree (%)	Strongly disagree (%)	N/A (%)
For conversation with audience	21.2	30.3	24.2	9.1	9.1	6.1
To build relation with existing and potential customers	12.1	30.3	30.3	15.2	9.1	3.0
To reach banking transparency/visibility	12.1	27.3	27.3	15.2	15.2	3.0
For Customer loyalty / retention programs	18.2	36.4	21.2	12.1	12.1	0.0
To monitor public awareness	12.1	24.2	36.4	18.2	9.1	0.0
For information distribution	36.4	36.4	15.2	12.1	0.0	0.0
For brand strengthening	42.4	30.3	15.2	9.1	3.0	0.0
For Customer Relationship Management	15.2	42.4	21.2	15.2	3.0	3.0
For cross-selling	18.2	18.2	39.4	12.1	9.1	3.0
To reduce advertisement expenses	15.2	24.2	30.3	15.2	9.1	6.1
For HR purposes	9.1	24.2	33.3	15.2	3.0	15.2

Table 4: *Social media usage purposes for Mexican banks, 2014*

H5: The banks in Mexico consider that they benefit from social media usage.

More than 50 % agree that via social media the bank can restore trust among stakeholders. Table 5 presents the managerial view on benefits from social media adoption (Multiple-choice question whereby respondents selected all the categories that applied to them by rating scale).

	Strongly agree (%)	*Agree (%)*	*Neutral (%)*	*Disagree (%)*	*Strongly disagree (%)*	*N/A (%)*
Social media reduces workload in the branches.	15.2	39.4	24.2	18.2	3.0	0.0
Social media reduces call workload.	18.2	42.4	21.2	15.2	3.0	0.0
Social media increases banking recognition.	39.4	39.4	15.2	6.1	0.0	0.0
Social media effects banking reputation.	30.3	45.5	15.2	3.0	6.1	0.0
Via Social media the bank can restore trust among stakeholders.	12.1	51.5	18.2	18.2	0.0	0.0

Table5: *Managerial view on Benefits from Social Media adoption for Mexican banks, 2014*

The hypothesis test

H1: Accepted; 90% of the respondents said their bank have presence in social media platforms

H2: Accepted; 50% of our respondents agree with our barriers

H3: Accepted; over 60% of our respondents agreed with the chosen set of challenges

H4: Accepted; banks use intensively or moderately all of the mentioned purposes and activities

H5: Accepted- strong influence of social media on banking recognition, bank reputation.

5. Conslusion

The most important stakeholders for banks are customers. And this factor forces banks to change the way they interact with them and put attention on relationship and communication which can't be done without using all modern online communication channels. From which the most popular and powerful one is social media. Banks must start to take the social media industry seriously and develop a clear strategy. Some banks have already started using social media for their services. While some are focusing on providing information about products and trying to generate leads, others are providing transactional services. By taking into consideration that Social Media has a big impact on today's business world, banking management needs to identify ways to make profitable use of social media. Social Media is a powerful tool for gaining customer and for communicating with potential and existing ones. It allows banks to reach end-consumers at comparably low cost and higher level of efficiency than can be achieved with more traditional communication tools. Though being a new way of communication it is not an easy task for its usage. It requires new methods, new ways of thinking. And the results can be not always satisfying, because there are no well-known or well-researched methods and tools for Social Media involvement. The key factor for the success of social media is conversation, communication and interaction first, then product and service marketing. Banks needs to be there where present and potential customers are talking, blogging, complaining, expressing their pleasure or dissatisfaction about their products and services.

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THE ROLE OF EXTERNAL SHOCKS IN CROATIA: BLOCK EXOGENEITY SVAR APPROACH

Abstract

The aim of this paper is to analyze the impact of foreign shocks on the Croatian economy in the last decade. The Croatian small open economy (SOE) does not affect prices nor other macroeconomic variables of the foreign sector, but its economic activity depends on foreign economic trends. The crucial characteristic of the small open economy is the exogeneity of foreign variables for the domestic economy, whereat foreign variables impact the domestic economy while the restriction of the model is that domestic variables do not impact foreign variables. Therefore, the structural vector autoregressive (SVAR) model is estimated in order to assess the impact of foreign shocks on the Croatian economy. The impact of the euro area and income and price shocks is analyzed, with the emphasis on the relative importance of domestic versus foreign shocks. The impulse response functions and the variance decomposition analysis have confirmed that the foreign variables have a substantial impact on domestic variables and that the inclusion of the euro area variables is necessary for macroeconomic modelling of the Croatian economy.

Keywords

Block exogeneity restrictions, Foreign shocks, Small open economy (SOE), Structural vector autoregressive (SVAR) model

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1. Introduction

The concept of small open economy has been a subject of research for decades (de Vries, 1973; Kuznets, 1960; Scitovsky, 1960), but a consensus on what characterises the small open economy still has not been reached. Therefore, Davenport (2001) suggested defining the small economy based on its share in the world economy and not based on demographic indicators. Based on the named criterion, a country is to be considered a small economy if its share in the total world trade amounts to less than 0.03%. Namely, small economies, despite their significant trade openness, usually have a very small share in the world trade.

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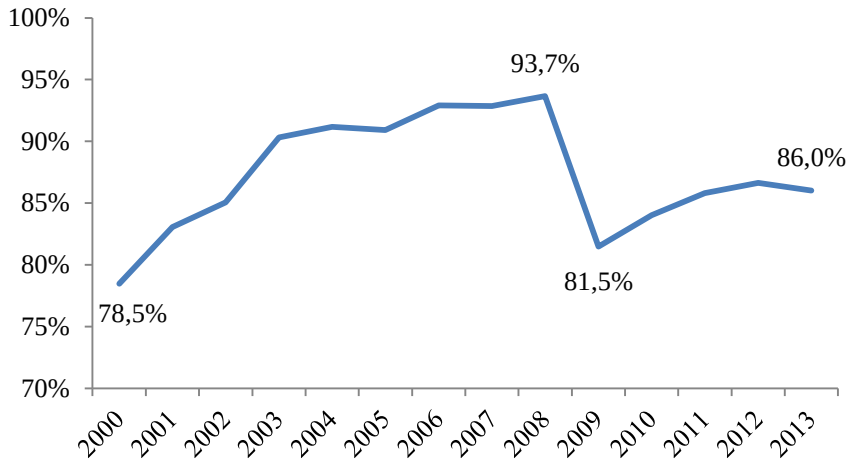
For many years, empirical research has focused on the effects of macroeconomic shocks and channels of their transmission, especially small and open economies. However, the recent global economic crisis in the period 2008-2009 has additionally emphasised the importance of understanding the source of shocks on key macroeconomic variables.

Defining the variable openness presents a prerequisite for understanding the openness of the Croatian economy. Based on empirical research, openness of an economy is defined as the share of the sum of export and import in the gross domestic product (Kovačević and Tomić, 2012). The openness of the Croatian economy has been shown in Graph 1 using annual data on export, import and GDP. In the period from 2000 to 2008, Croatia was characterised by relatively high coverage of import by export, resulting in a higher openness of the economy, i.e. the average share of foreign trade in GDP amounted to 88.7%. The Republic of Croatia was least open to the international market in 2000, when the share of foreign trade in GDP amounted to 78.5%, while, on the other hand, it was most open to it in 2008 with the named share amounting to 93.7%. However, the beginning of the global crisis changed this trend, i.e. there was a significant decrease in export and even more drastic decrease in import, which consequently resulted in the reduced openness. Consequently, the share of foreign trade in GDP decreased as well and amounted to 81.5% in 2009.



Graph 1 *Openness of the Republic of Croatia in the period from 2000 to 2013*
Source: Authors' calculations based on the data of the Croatian Bureau of Statistics

The decrease in openness of the Croatian economy, i.e. the decrease of the share of foreign trade in GDP in 2009 is a result of the decrease of economic activity in the euro area member states. As it has been explained in Section 3, the decrease of income in the euro area has resulted in the decrease of the total demand for goods, and consequently the demand for Croatian goods as well.

The Croatian small open economy is characterised by a pronounced openness of the economy, whereby the share of foreign trade in GDP in certain years, for instance in 2008, exceeded 90%. Furthermore, in addition to unfavourable international trade, i.e. strong dependence on export and very weak competitiveness of domestic products, more than half of foreign trade is conducted with the euro area countries. Moreover, the Croatian economy is significantly indebted with the foreign debt amounting to more than 100% of GDP. In addition to a passive monetary policy, resulting from the focus on the currency control

aimed at maintaining price stability, there is also the inability to influence real movements, i.e. insufficient possibilities for using the monetary policy in dealing with shocks. The Republic of Croatia is also characterised by the dependence of its financial sector on the euro area. In other words, due to the unfavourable structure of the national economy, as it has been explained above, all adjustments of the monetary policy by the European Central Bank or changes in the economic activity in the euro area would significantly reflect on economic fluctuations in Croatia (Dumičić and Krznar, 2013).

In line with the empirical facts stated above regarding the SOE of Croatia, the aim of this research is to identify and examine the reaction of the domestic economy to foreign shocks whereat foreign shocks refer to euro area shocks. In other words, the aim of this study is to quantify the domestic and the euro area shocks by assessment of the relative importance of each shock for macroeconomic developments in Croatia.

After the literature overview, the structural vector autoregressive (SVAR) model with block exogeneity restrictions is described and the empirical analysis of the impact of domestic and foreign shocks on the Croatian economy is conducted. Finally, the conclusions of the research are stated as well as limitations of the study and a future research perspective.

2. The overview of the research of domestic and external shocks in Croatia

Authors	Model	Sample	Variables
Broz (2008)	SVAR model with Blanchard- Quah long-run restrictions	1995Q1 - 2006Q4	the domestic and the euro area variables: real GDP, inflation approximated by GDP deflator
Dumitru and Dumitru (2011)	SVAR model with Blanchard- Quah long-run restrictions	1997Q1 - 2009Q2	the domestic and the euro area variables: GDP growth rate, GDP deflator (inflation indicator)
Erjavec, Cota and Jakšić (2012)	SVAR model with Blanchard- Quah long-run restrictions	1998M1 - 2011M9	real relative income expressed as the difference of the real industrial production index in the Republic of Croatia and EU-27), kuna real exchange rate against the euro, relative price level (difference between CPI in the Republic of Croatia and HCPI in EU-27)
Fidrmuc and Korhonen (2001)	SVAR model with Blanchard- Quah long-run restrictions	1995Q1 - 2001Q2	real GDP and inflation
Jovančević, Arčabić and Globan (2012)	VAR model	1997Q1 - 2010Q4; subperiod 2000Q1 - 2010Q4	real GDP cyclical components obtained by HP filter for Austria, France, Germany, Italy, UK and EU-15

Koukouritakis, Papadopoulos and Yannopoulos (2013)	Global VAR (GVAR) model	2000M1 - 2011M12	the domestic and the euro area variables: real effective exchange rate, harmonised consumer price index, industrial production index and money market interest rate; global variable: euro nominal exchange rate against the dollar
Nabil (2009)	SVAR model with Blanchard- Quah long-run restrictions	1997Q1 - 2005Q3	real GDP, CPI (inflation indicator)
Krznar and Kunovac (2010)	VAR model with block exogeneity restrictions	2000Q2 - 2010Q1	real GDP EU, global raw material prices in kuna; GDP EU, production price index and consumer price index
Petrevski, Bogoev and Tevdovski (2013)	SVAR model with block exogeneity restrictions	2000Q2 - 2011Q4	the euro area variables: GDP gap, Euribor, HCPI (inflation indicator); domestic variables: GDP gap, inflation, money market interest rate, the share of public debt in GDP

Table 1 *The summary of empirical research of the impact of foreign shocks on the Croatian economy*

The most relevant studies which examine the impact of foreign shocks on the Croatian economy are given in Table 1. The detailed analysis of existing literature in Croatia is conducted (for the explanation of methods, see, for example, Žugaj, Dumičić and Dušak, 2006). Fidrmuc and Korhonen (2003), Broz (2008) and Dumitru and Dumitru (2011) did not find that there is a relationship between foreign and domestic economic fluctuations. There could be several reasons for such results. First of all, GDP data for the period before 2000 differ substantially in the way of measurement compared to data for the period after the year 2000, and such data are not consistent and comparable to each other. Secondly, Broz (2008) and Dumitru and Dumitru (2011) use the GDP deflator as an indicator of inflation. However, the GDP deflator measures the prices of all products that are produced in a particular country, whether or not these products are aimed for export. On the other hand, the Consumer Price Index (CPI) measures the prices of goods produced and consumed in a particular country as well as the prices of imported goods. Thus, unlike the GDP deflator, CPI includes import, but excludes export. Since a significant portion of goods in Croatia is imported, it would be more appropriate to use CPI rather than the GDP deflator as an indicator of the price level. Finally, aforementioned authors use data in the period before 2000 in which the Croatian economy was not dependent on external economic developments to a large extent. However, the effect was intensified primarily by the entry of foreign banks to the Croatian banking market. The results of other studies (see Nabil, 2009; Krznar and Kunovac, 2010; Erjavec, Cota and Jakšić, 2012; Jovančević, Arčabić and Globan, 2012; Koukouritakis, Papadopoulos and Yannopoulos, 2013; Petrevski, Bogoev and Tevdovski, 2013) indicate that the Croatian economy is highly vulnerable to the foreign shock, in particular to shocks coming from the euro area.

3. The preparation of data for the empirical analyisis

Time series data used for the purpose of the empirical analysis refer to the quarterly data for the period from the first quarter 2000 to the fourth quarter 2013 for Croatia, supplied by the

Croatian National Bank (CNB) as the official source. In order to prepare data for the empirical analysis, certain transformations of variables are conducted, such as the logarithmic transformation and the seasonal adjustment. Moreover, the stationarity of the time series is tested using the augmented Dickey–Fuller test (ADF) as a unit root test (for more details on the ADF test see, for example, Enders (2010)).The results of the ADF test are not presented in the paper due to its conciseness, but are available on request. ADF stationarity testing shows that time series in levels are not stationary, while the first differences of variables are stationary, suggesting that the variables in the model are integrated of order one.

The selected variables are divided into two blocks:

- The first is the foreign block which represents the economy of the euro area. It consists of the growth rate of seasonally adjusted real GDP (DSLBDP_EZ) with the base year 2005=100 and the growth rate of CPI (DLCPI_EZ). The foreign block does not include the referent interest rate in the European interbank market (Euribor) because its inclusion would not contribute to the interpretation of results. The Euribor stems from the Taylor (1993) rule of the European Central Bank, meaning that GDP is taken into account when defining the level of interest rate and therefore the results of the estimated impulse response functions have the same interpretation regardless of whether the model includes only GDP or both the Euribor and GDP (Krznar and Kunovac, 2010).
- The second block refers to the domestic economy, in this case the SOE of Croatia, and consists of the growth rate of seasonally adjusted real GDP (DSLBDP_RH) with the base year 2005 =100, the growth rate of CPI (DLCPI_RH) and the growth rate of seasonally adjusted real exchange rate against the euro (DSLRER). The domestic block does not include the money market interest rate because the Croatian National Bank does not conduct monetary policy that relies on the interest rate channel and therefore the interest rate does not have a significant role in the financial system, nor the impact on the real sector (Krznar, 2004).

4. The estimation of svar model with block exogeneity restrictions

Despite numerous advantages of the VAR model and its common application in empirical research, Colley and LeRoy (1985) criticised its use. The most common critique of the VAR model refers to the fact that economic theory is not taken into account while defining the model, and variables are not classified as endogenous and exogenous in advance. Sims (1986) and Bernanke (1986) therefore suggested a new model form, the so-called structural vector autoregression model or identified VAR model, overcoming the named flaws. When the SVAR model is used, the analysis is not based on the estimation of autoregression parameters as when the VAR model is used, but the model identification is based on error terms (innovation process) which are interpreted as a linear combination of exogenous shocks.

The reduced form of the VAR model is given by (Lütkepohl and Kratzig, 2004):

$$\Delta y_t = \Pi y_{t-1} + \Gamma_1 \Delta y_{t-1} + \ldots + \Gamma_{p-1} \Delta y_{t-p+1} + \nu_t \quad , \qquad (1)$$

whereat $\Pi = A^{-1}\Pi^*, \Gamma_j = A^{-1}\Gamma_j^*, j = 1,\ldots,p-1, A_j = A^{-1}A_j^*, j = 1,\ldots,p$ and $\nu_t = A^{-1}B\varepsilon_t$, what relates error terms vt with the corresponding structural shocks εt. For the purpose of the empirical research, vector yt, which consists of five endogenous variables, is given by:

$$y_t = \left[DSLBDP\_EZ, DLCPI\_EZ, DSLBDP\_RH, DLCPI\_RH, DSLRER\right]'.$$

It consists of the growth rate of seasonally adjusted real GDP in the euro area, the growth rate of the price level in the euro area, the growth rate of seasonally adjusted real GDP in Croatia, the growth rate of the price level in the Republic of Croatia and the growth rate of the seasonally adjusted real exchange rate against the euro at the end of period.

In order to estimate the SVAR model, it is necessary to introduce a certain number of constraints on the parameters of the matrix to identify the parameters in the structural form. The Cholesky ortogonalization is used in the formation of accurately identified model. In this case, the order of variables can have a significant effect on the result obtained and the variables are ordered with regard to the economic theory. As it is previously mentioned, Croatia is a SOE which does not have a significant impact on economic developments in the euro area. Therefore, the euro area variables are determined to be the first in the model, followed by the variables which refer to Croatia.

Specifically, the variables introduced into the model are:

- The first variable is the GDP of the euro area, which is considered to have a direct impact on all the other variables in the model.
- The next variable is the price level in the euro area, which is considered not to have an immediate impact on the GDP of the euro area, but it impacts other variables in the model. Therefore, GDP is put prior to the price level.
- The intuition is that it is considered that the euro area is one of the most important world economies, whose demand for certain products may affect the price level in the world market. After the foreign variables, using the same intuition, domestic variables are placed in the model. So, the third variable is the domestic GDP. As it has previously been mentioned, changes in economic activity or price changes in the euro area may be transmitted to the Croatian economy through a trade channel, due to the fact that the euro area is one of the biggest trading partners for Croatia. An increased demand in the euro area leads to the increase in foreign prices, and thus to an increase in demand for Croatian goods, which ultimately increases the GDP of Croatia (Andonova and Petkovska, 2011).
- The last variable in the order is the real exchange rate because it is considered that it responds to changes in the aforementioned variables (Kim and Roubini, 2000).

The following matrix representation describes the abovementioned economic relations:

$$\begin{bmatrix} \varepsilon_t^{DSLBDP\_EZ} \\ \varepsilon_t^{DLCPI\_EZ} \\ \varepsilon_t^{DSLBDP\_RH} \\ \varepsilon_t^{DLCPI\_RH} \\ \varepsilon_t^{DSLRER} \end{bmatrix} = \begin{bmatrix} b_{11} & 0 & 0 & 0 & 0 \\ b_{21} & b_{22} & 0 & 0 & 0 \\ b_{31} & b_{32} & b_{33} & 0 & 0 \\ b_{41} & b_{42} & b_{43} & b_{44} & 0 \\ b_{51} & b_{52} & b_{53} & b_{54} & b_{55} \end{bmatrix} \begin{bmatrix} \nu_t^{DSLBDP\_EZ} \\ \nu_t^{DLCPI\_EZ} \\ \nu_t^{DSLBDP\_RH} \\ \nu_t^{DLCPI\_RH} \\ \nu_t^{DSLRER} \end{bmatrix}$$

Since it is necessary to introduce at least K(K-1)/2 restrictions for the identification of the matrix, and thus the structural shocks, using Cholesky decomposition 10 restrictions is

introduced, what allows accurate identification of the model. For the explanation of Cholesky ortogonalization see, for example, Lutkepohl and Kratzig (2004).

It is well known that the shocks in SOEs have very little impact on major foreign countries and therefore it is proper to treat the foreign variables as exogenous to domestic economy. As a result, the model is divided in two blocks: the euro area block and the domestic (Croatian variables) block.

Therefore, the first block represents the foreign euro area economy while the second block to represents the Croatian economy. Thus the vector yt, which represents the vector of endogenous variables, is to be divided into two blocks what can be written in the following form:

$$y_t = [y_{1t}, y_{2t}]'.$$

Vector y1t is comprised of the variables representing euro area economy and it is given by $y_{1t} = [DSLBDP\_EU, DSLCPI\_EU]'$, while y2t represents Croatian economy and is given $y_{2t} = [DSLBDP\_RH, DSLCPI\_RH, DSLNER]'$.

Accordingly, the VAR model may be presented in the following way:

$$y_t = \begin{bmatrix} y_{1t} \\ y_{2t} \end{bmatrix}, \Gamma_j = \begin{bmatrix} \Gamma_{j,11} & \Gamma_{j,12} \\ \Gamma_{j,21} & \Gamma_{j,22} \end{bmatrix}, \nu_t = \begin{bmatrix} \nu_{1t} \\ \nu_{2t} \end{bmatrix},$$

where $\Gamma_{j,11}$ i $\Gamma_{j,12}$ are coefficients related to the euro area economy, while $\Gamma_{j,11}$ i $\Gamma_{j,12}$ refer to coefficients of domestic economy. Since Croatia is a SOE, domestic shocks do not have a significant impact on the economy of the euro area and therefore the block-exogeneity restriction is introduced in the form $\Gamma_{j,12} = 0$, what fits the assumption that domestic (Croatian) shocks have no impact on the foreign (euro area) block, while foreign shocks may impact the domestic economy.

5. Results of the empirical analysis

The results of the empirical analysis are based on impulse response functions and variance decomposition. The main objective of the vector autoregression methodology is the analysis of the relationship among variables, for which innovation analysis is used. Innovation analysis includes analysis of the impulse response function and variance decomposition. The advantage of conducting innovation analysis is suitable interpretation of parameters and simplicity of drawing conclusions about the dynamics of group of economic variables (Dumičić and Čibarić, 2010). Figure 1 reports the impulse response functions of domestic variables to one standard deviation shock in the variables from the euro area.

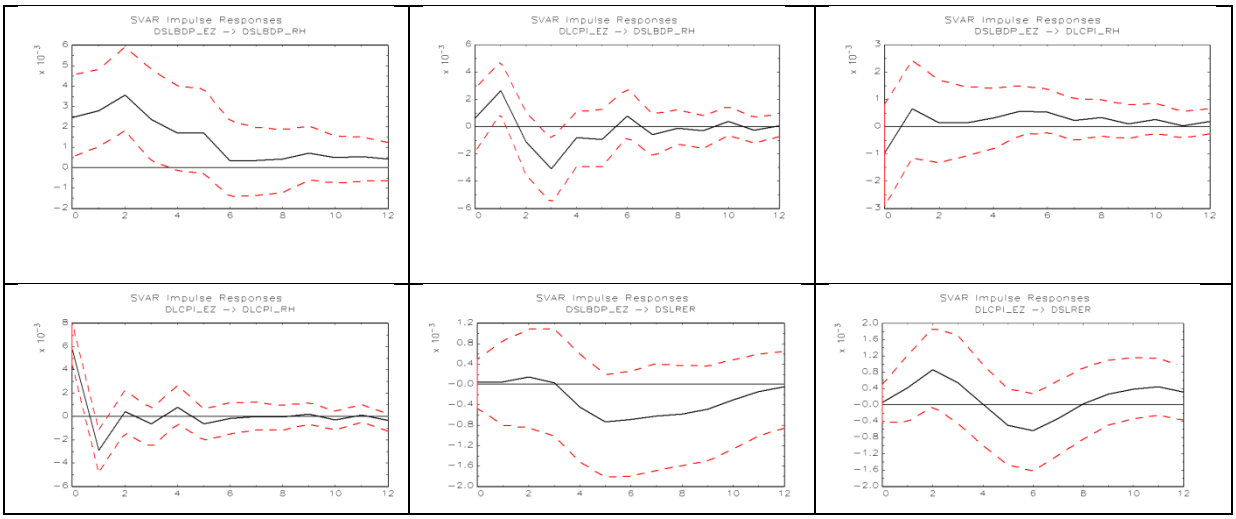


Figure 1: *The impact of one-unit shock in the euro area variables on the domestic economy (Authors' calculation using JMulti software)*

The results suggest that economic developments in the euro area have a significant effect on domestic economic fluctuations. The positive shock of one standard deviation in the growth rate of GDP in the euro area has a positive effect on the domestic GDP. This effect is the strongest in the first year after the shock. However, it weakens with time and three years after the shock, the domestic GDP is around its initial level. The result is in line with the economic theory and empirical research referring to SOEs. Taking into account the empirical fact that the Croatian economy is largely dependent on the trade with the euro area countries, an increase of economic activity in the euro area stimulates demand for Croatian products, thus increasing Croatian export, which consequently increases the domestic GDP. Furthermore, an increase of the foreign GDP leads to inflationary pressures, although after that the growth rate of the CPI decreases and then fades out a year and a half after the shock. The effect of the foreign GDP on the real exchange rate is not significant.

Variable	Period	Shock				
		DSLBDP_EZ	DLCPI_EZ	DSLBDP_RH	DLCPI_RH	DSLRER
DSLBDP_RH	1	0,15	0,01	0,84	0,00	0,00
	4	0,32	0,18	0,46	0,01	0,02
	8	0,34	0,19	0,43	0,01	0,03
	12	0,34	0,18	0,43	0,01	0,04
DLCPI_RH	1	0,02	0,71	0,11	0,17	0,00
	4	0,02	0,7	0,09	0,14	0,05
	8	0,03	0,68	0,09	0,14	0,06
	12	0,04	0,68	0,09	0,14	0,06
DSLRER	1	0,00	0,00	0,06	0,03	0,91
	4	0,00	0,08	0,05	0,07	0,8
	8	0,08	0,09	0,08	0,11	0,64
	12	0,10	0,10	0,10	0,11	0,59

Table 1: *Variance decomposition of domestic variables (Authors' calculation)*

Moreover, the results of variance decomposition of domestic variables are given in Table 1. Presented variance decomposition shows the extent to which the domestic shocks and the euro area shocks account for fluctuations in domestic variables. On the basis of variance decomposition, it can be concluded that one third of variation of economic activity in Croatia

can be explained by the euro area income shock, i.e. the demand side shock in the euro area. Moreover, when the foreign prices shock is included, more than half of the domestic GDP fluctuations are explained by euro area shocks. Accordingly, more than 70% of the forecasting errors variation in the domestic price level is explained by the price shock and the demand shock in the euro area.

6. Conclusion

In order to establish the appropriate economic model, economic policy makers should be acquainted with the source of fluctuations in the domestic economy. Since Croatia is a SOE, it is considered that external shocks have a significant effect on its economic development. Therefore, the aim of this paper is to develop an econometric model which would be able to comprise the most important macroeconomic shocks which affected the Croatian economy in the period from 2000 to 2013. Thus, the reaction of the domestic economy to foreign economic fluctuations, i.e. economic shocks in the euro area, was analysed. The fluctuations in the domestic economy primarily arise from a significant dependence of the Republic of Croatia on the euro area in respect of foreign trade and a high dependence of its financial system on the euro. Such an unfavourable economic structure makes the domestic economy highly vulnerable to negative economic fluctuations in the euro area. In other words, the aim of this paper is to establish the reaction of the domestic economy to the fluctuations in the euro area and determine the relative importance of each individual domestic and foreign shock on the economic fluctuations in the Republic of Croatia.

The application of the structural vector autoregression model with block exogeneity restrictions resulted in impulse response functions showing that economic fluctuations in the euro area have a significant impact on the domestic economic fluctuations. The increase of economic activity in the euro area results in the increase of the domestic economic activity, the price level increase and the real exchange appreciation. On the other hand, an increase of prices in the euro area influences the fluctuations in the Republic of Croatia, but this influence is short term and inconsistent. The results of the estimated impulse response functions indicate that the economic fluctuations in the euro area have a significant influence on the domestic economic fluctuations.

Variance decomposition has shown that one third of the variability in economic activity in the Republic of Croatia can be explained by shocks on the demand side in the euro area, i.e. the income shock in the euro area. Similarly, more than a half of GDP fluctuations, including foreign price shocks, can be explained by the euro area shocks. On the other hand, more than 70% of the forecasting error variation in the domestic price level can also be explained by supply and demand shocks in the euro area. As far as Croatian kuna real exchange rate against the euro variations are concerned, external shocks have the least relevant influence on the variability of the named variable, and after three years most variations are explained by the variable itself. This confirms that the relative contribution of the euro area variables to the domestic fluctuations is higher than the contribution of domestic variables.

Although the estimated SVAR model with block exogeneity restrictions resulted in satisfactory results, its use still remains limited. First of all, due to a limited time period the

research could include only key macroeconomic variables, since the inclusion of additional variables would reduce the number of degrees of freedom and would render obtained results questionable. Therefore, multidimensional models such as the factor VAR model or the DSGE model are recommended for future economic research. In addition, the influence of external shocks is not to be limited to observing the influence of the euro area and it is necessary to estimate the influence of oil price fluctuations on the global market as well. To conclude, despite the named research limitations and given guidelines for research improvement, the obtained results can be significant to economic policy makers because they clearly indicate that the variability of foreign economic fundamentals needs to be taken into account in all future research of domestic economic fluctuations.

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ANALYSIS OF TAX SYSTEMS IN SLOVAKIA AND HUNGARY

Abstract

Taxes are very important and significant economic and political tool in a market economy. Various definitions of taxes are known from the fiscal theory and practice. In general, the tax can be characterized as a mandatory, legally established, non-equivalent, usually recurring payment, which is paid by taxpayers to the State in a specified amount and within a specified period. Each country has its own tax system, which is the result of historical development. Tax systems have gradually changed, they have been adapted to the specificities and needs of each country. The aim of this paper is to examine the tax systems of two neighbouring Central European countries, namely Slovakia and Hungary, and to determine their position within the European Union. There will be made an analysis of tax revenues in these countries and also an analysis of trends in tax rates. The analyses will be focused mainly on personal income tax, corporate income tax and value added tax; a comparison of the tax burden will be made between Slovakia, Hungary and the European Union Member States. When examining the tax burden the indicator of the tax quota will be used, this is currently one of the most common indicators of measurement and comparison of the tax burden.

Keywords

tax burden, tax rate, tax system

1. Introduction

Taxes are an important economic, financial, social and political tool of the state. Each state uses taxes as one of the most important sources of public budgets' revenues. In the literature we can meet various definitions of tax. As Široký says (2012, p. 28) the tax is a compulsory amount, which is predetermined by law and which puts a strain on a part of the nominal income of an economic entity. Taxes belong to the group of indirect economic management tools; they are a tool of redistribution of the created product and they significantly influence the size of the disposable income of individual subjects (Schultzová, 2011, p. 12). Application of taxes and their use is the role of tax policy in each economy.

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Subject to tax policy (which is very closely linked with the fiscal policy and also with the entire economic policy of the state) is the application of tax principles and measures so that taxes serve to enforce economic, social and political objectives of the state. Through taxes the state influences many microeconomic and macroeconomic variables such as unemployment, economic growth of the country, inflation, foreign investment, consumption of the population etc. (Korečko, Suhányiová, 2012, p. 20). Changes in taxes affect the behaviour and the decision making of every economic entity, whether positive or negative. Reducing the tax burden leads the business entities to an increase in economic activity, to a growth of the performance of the economy and it contributes to an increased rate of growth of the national economy. If the tax rates are decreasing, there is an increase in the after-tax disposable income, and that is what motivates them and encourages them to work, to create savings and to invest. Then, the positive result is the expanding production; there is an increase in the tax base and also an increase in the tax revenue for public budgets.

2. Analysis of the tax burden of the member states of the European Union

One of the crucial issues is the problem of the tax burden - from the macroeconomic point of view as well as from the microeconomic point of view. The tax burden reflects the extent to which the tax system (or more precisely the tax) affects the financial resources resulting from the profit of the taxpayer, based on the application of economic or fiscal policy (Schultzová, 2011, p. 23). The tax burden can be measured, respectively expressed by various macroeconomic indicators. One such indicator is the tax quota, which is expressed as a share of collected taxes on gross domestic product for the relevant tax period. To monitor the tax burden of individual EU member countries (28 Member States) the Statistical Office of the European Union - Eurostat (http://ec.europa.eu/eurostat) usually uses indicators of tax quota. In this study, the tax quota was determined as a proportion of total tax revenues (taxes and compulsory social contributions) and gross domestic product.

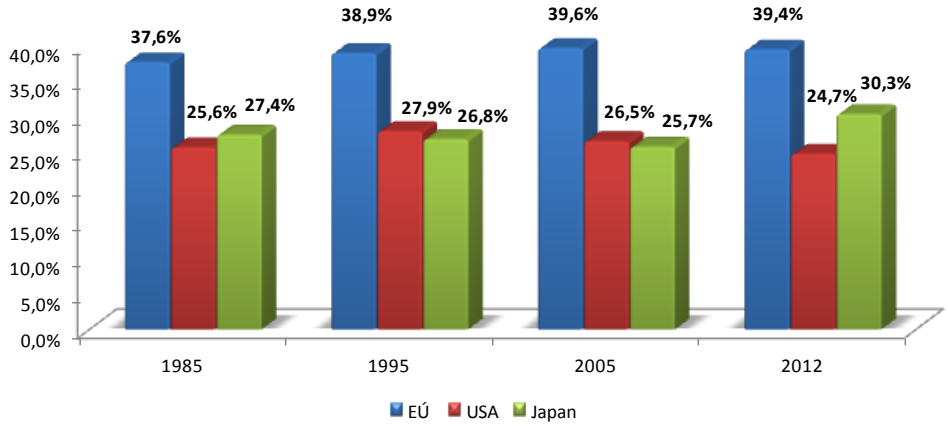


Figure 1: *Tax revenue (including social contributions) EU Aggregates and selected counties (% of GDP) (Source: self elaboration based on "Taxation trends in the European Union" 2010 & 2014)*

According to the report of the European Commission issued in June 2014 (Taxation trends in the European Union, European Commission, Brussels, 2014), the European Union is a zone with high taxes. As highlighted in Figure 1, from the three most advanced industrial centres of the world the highest tax burden in the long term perspective is in the European Union. In 2012, the total share of taxes (that is the sum of taxes and compulsory social contributions)

on the weighted average of GDP was represented by 39.4% in the 28 EU Member States. It is almost 15% higher than in the U.S.A. and approximately 10% above the level of Japan.

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Difference 2003 to 2012	Ranking 2012	Revenue 2012 (mil. €)
EU-28 avarages weighted	**38,8**	**38,6**	**38,9**	**39,4**	**39,3**	**39,2**	**38,3**	**38,3**	**38,8**	**39,4**	**0,6**		**5 109 446**
Austria	43,4	43,0	42,1	41,5	41,7	42,7	42,4	42,1	42,2	43,1	-0,3	7	132 334
Belgium	44,7	44,8	44,8	44,4	43,9	44,2	43,4	43,8	44,2	45,4	0,7	2	170 619
Bulgaria	31,0	32,5	31,3	30,7	33,3	32,3	29,0	27,5	27,3	27,9	-3,1	27	11 070
Croatia	37,5	36,7	36,6	37,1	37,4	37,1	36,5	36,4	35,3	35,7	-1,8	13	15 684
Czech Republic	35,4	35,9	35,7	35,3	35,9	34,4	33,4	33,6	34,6	35,0	-0,4	16	53 540
Cyprus	32,2	33,0	35,0	35,8	40,1	38,6	35,3	35,6	35,3	35,3	3,1	15	6 250
Denmark	48,0	49,0	50,8	49,6	48,9	47,8	47,8	47,5	47,7	48,1	0,1	1	118 064
Estonia	30,8	30,6	30,6	30,7	31,4	31,9	35,3	34,0	32,3	32,5	1,7	21	5 659
Finland	44,1	43,5	43,9	43,8	43,0	42,9	42,8	42,5	43,7	44,1	=	5	84 878
France	43,1	43,3	43,8	44,1	43,4	43,2	42,1	42,5	43,7	45,0	1,9	3	913 542
Germany	39,1	38,3	38,3	38,6	38,7	38,9	39,4	38,4	38,5	39,1	=	10	1 042 990
Greece	32,1	31,3	32,2	31,7	32,5	32,1	30,5	31,7	32,4	33,7	1,6	17	65 348
Hungary	**38,0**	**37,7**	**37,4**	**37,3**	**40,4**	**40,3**	**40,1**	**38,1**	**37,3**	**39,2**	**1,2**	**9**	**38 008**
Ireland	38,8	30,1	30,6	32,1	31,5	39,5	38,1	28,0	28,2	28,7	-10,1	23	47 037
Italy	41,0	40,4	40,1	41,7	42,7	42,7	42,9	42,5	42,4	44,0	3,0	6	689 289
Latvia	28,6	28,6	29,2	30,6	30,6	29,2	26,6	27,2	27,6	27,9	-0,7	26	6 216
Lithuania	28,8	28,9	29,1	30,0	30,2	30,7	30,4	28,5	27,4	27,2	-1,6	28	8 962
Luxembourg	38,1	37,3	37,6	35,9	35,6	37,5	39,8	38,1	38,2	39,3	1,2	8	16 846
Malta	30,4	31,3	32,9	33,0	33,9	33,0	33,4	32,2	33,0	33,6	3,2	18	2 304
Netherlands	37,4	37,5	37,6	39,0	38,7	39,2	38,2	38,9	38,6	39,0	1,6	11	233 808
Poland	32,2	31,5	32,8	33,8	34,8	34,3	31,8	31,8	32,3	32,5	0,3	20	123 933
Portugal	31,6	30,5	31,4	32,1	32,8	32,8	31,0	31,5	33,2	32,4	0,8	22	53 433
Romania	27,7	27,2	27,8	28,5	29,0	28,0	26,9	26,8	28,4	28,3	0,6	25	37 297
Slovenia	38,0	38,1	38,6	38,3	37,7	37,3	37,2	37,7	37,2	37,6	-0,4	12	13 276
Slovakia	**32,9**	**31,5**	**31,3**	**29,3**	**29,3**	**29,1**	**28,7**	**28,1**	**28,6**	**28,3**	**-4,6**	**24**	**20 134**
Spain	33,9	34,8	35,9	36,8	37,1	32,9	30,7	32,2	31,8	32,5	-1,4	19	334 796
Sweden	47,8	48,0	48,9	48,3	47,3	46,4	46,5	45,4	44,4	44,2	-3,6	4	180 292
United Kingdom	34,4	34,9	35,4	36,1	35,7	37,1	34,3	35,0	35,8	35,4	1,0	14	683 841

Table 1: *Total Taxes (including Social Security Contribution) as % of GDP (2003-2012) (Source: self elaboration based on "Taxation trends in the European Union", 2014)*

Tax revenues and social security contributions expressed as a percentage of GDP reached a level of 38.8% in the reference year 2003 in the 28 countries that are now a part of the European Union. In the year 2012 it was 39.4%, it means that for the period 2003-2012 the average share of tax on GDP increased by 0.6%. The second most noticeable decrease of the tax burden was in Slovakia (it was -4.6%) immediately after Ireland (with a decrease -10.1%). The same increase in the tax burden of the EU countries can also be seen in 2012 compared to 2011, when it reached the same level as in 2003 (38.8%), thus the annual increase was 0.6%.

There has been significant differences in the tax burden in the EU countries in 2012. The lowest tax burden (taxes and compulsory social contributions) has been in Lithuania (27.2%), in Bulgaria and Latvia (identically 27.9%), and in Slovakia and Romania (identically 28.3%). On the other side, the highest burden was in Denmark (48.1%), Belgium (45.4%), France (45%) and Sweden (44.2%). When evaluating the above data in the Table 1, we can say that in 2012 Slovakia had the third strongest decline compared to 2011 within the EU Member States, when the tax burden decreased more significantly only in Portugal and the UK. At the same time Slovakia had the fourth lowest tax burden across the EU (together with Romania). In Hungary can be seen an increase by 1.9% in 2012 compared to 2011. It was the most significant increase in the EU. Hungary was followed by Italy with an increase in the tax

burden by 1.6%, and more than 1% of tax burden increase was experienced in other 5 countries. The tax burden increased in Italy from 42.4% to 44%; in Greece from 32.4% to 33.7%; in France from 43.7% to 45%; in Belgium from 44.2% to 45.4%; and in Luxemburg from 38.2% to 39.3%. The Hungarian tax burden is the 9th highest among the 28 EU Member States.

3. Comparative analysis of the tax system in hungary and slovakia

The following text contains a brief analysis of the tax systems of the two neighbouring and historically close EU member states, namely Slovakia and Hungary. Data to compare the basic features of the tax systems and the development of the individual tax rates were drawn from the freely available Eurostat database and the tax laws of the countries analyzed.

Hungary is located in the Central Europe; it is a multiparty republic with a unicameral Parliament. The head of state is the president. The population is about 10 million inhabitants, the area of 93,030 km2. It has borders with Slovakia, Ukraine, Romania, Serbia, Croatia, Slovenia and Austria. The capital is Budapest. Hungary is a member of NATO, OECD and UNO (United Nations Organisation). It joined the European Union in 2004. The National Currency is the Hungarian Forint HUF (on 07/22/2014 the ECB exchange rate was: 1 EUR / 309.63 HUF). The International Code of Hungary is “HU”.

Hungarian tax system distinguishes many kinds of taxes, the exact number is not quantified, since one law provides more types of taxes. Hungarian tax system is divided into the State (Central) System and Local Subsystem.

Among the State Taxes are the Direct Taxes (such as: personal income tax, corporate income tax, capital return tax, simplified entrepreneurial tax, special taxes and tax on the rent, vehicle tax), but also Social Security Contributions.

The State Indirect Taxes are for example the VAT (value-added tax), excise tax, registration tax, energy tax.

The Local Taxes are for example the building tax, land tax, tourist tax, and local business tax. For the Hungarian Tax System it is characteristic the strong concentration of so-called main taxes. The four main taxes (personal income tax, corporate income tax, VAT, excise taxes) represent more than two-thirds of the total revenues of the central budget.

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Hungary: Taxes as % of Total Taxation										
Direct Taxes	25,3	24,1	24,3	25,3	25,7	26,3	24,9	22,6	18,7	19,2
Indirect Taxes	41,5	43,3	42,2	41,0	40,2	39,7	42,1	45,5	45,8	47,1
Social Security	33,2	32,6	33,5	33,6	34,1	34,0	32,9	31,9	35,5	33,8
Hungary: Structure by level of government (% of total taxation)										
Central government	58,1	57,6	57,0	57,0	56,7	61,4	61,9	62,4	58,6	60,2
Local government	11,4	12,0	11,6	11,7	11,1	6,4	6,7	6,5	6,5	6,3
Social security funds	30,5	29,9	30,6	30,6	31,3	31,3	30,7	30,5	34,2	33,0
EU institutions*	n.a.	0,5	0,8	0,8	0,9	0,9	0,7	0,7	0,7	0,6

Table 2: *Taxes in Hungary (2003-2012)*

** Note: Transfer of the part of the national VAT revenue (as determined by the methodology) to the common EU budget to cover the annual appropriations for payments and commitments.*

Slovakia is located in the Central Europe; it is a multiparty state with a unicameral Parliament and the President. It has an area of 49 036 km2, and about 5.43 million inhabitants. It has borders with Czech Republic, Austria, Poland, Ukraine and Hungary. The capital is Bratislava. Slovakia is a member of NATO, OECD and UNO. It joined the EU in 2004. Since 2009 it is member of the European Monetary Union – Eurozone and the official currency became to be the Euro, which replaced the previous Slovak Crown. The International Code of Slovakia is "SK".

The tax system of Slovakia is legislatively determined by the Law on Income Tax, Law on Value Added Tax, six Laws on Excise Taxes and the Law on Local Taxes and Local Fees for Municipal Waste and Minor Construction Waste. Important contributions with tax character include the Social Insurance and the Health Insurance.

The Direct Taxes collected by the State are the personal income tax and the corporate income tax.

The Indirect Taxes collected by the State are the VAT and the six types of excise taxes.

The Direct Taxes collected by the Local Self-Government are for example the real estate tax, tax on motor vehicles, tax on non-winning game machines, tax on the dog, tax on the use of public place, and so on.

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Slovakia: Taxes as % of Total Taxation										
Direct Taxes	21,7	19,4	19,2	20,7	21,0	22,3	19,2	19,1	19,2	19,7
Indirect Taxes	36,4	39,0	40,4	39,2	39,0	37,0	37,2	37,2	37,9	36,1
Social Security	42,0	41,6	40,4	40,1	39,9	40,7	43,6	43,7	42,9	44,2
Slovakia: Structure by level of government (% of total taxation)										
Central government	54,8	54,3	49,3	48,7	49,0	47,7	44,7	46,4	46,3	45,0
Local government	4,0	4,3	10,7	10,8	10,3	11,1	11,5	9,7	10,4	10,5
Social security funds	41,1	40,9	39,1	39,5	39,4	40,0	42,8	42,9	42,2	43,5
EU institutions*	n.a.	0,5	0,9	1,0	1,3	1,2	1,0	1,1	1,1	1,1

Table 3: *Taxes in Slovakia (2003-2012)*

(Source: self elaboration based on "Taxation trends in the European Union", 2014)

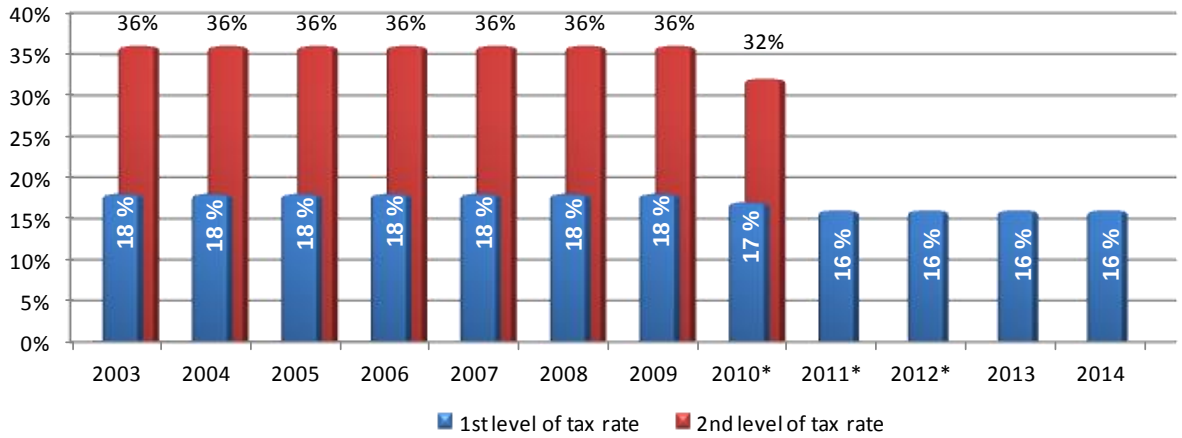
* Note: Transfer of the part of the national VAT revenue (as determined by the methodology) to the common EU budget to cover the annual appropriations for payments and commitments.

3.1. Analysis of the personal income tax in Hungary and Slovakia

Hungary

By the year 2010 the personal income tax become to be progressive, there has been one tax rate of 18% and one rate of 36% (Figure 2). The so called "tax-free allowance" (a non-taxable part of the base) has been deducted from the tax base before determining the tax liability, approximately in the amount of the minimum wage. Since 2010, the tax rates were reduced to 17% respectively 32%, but the tax base was increased of the social security contributions

27% (the so called "super gross tax base"). In 2011, the progressive personal income tax system was replaced by a flat tax rate of 16%, but the tax was still calculated from the so called "super gross tax base" and therefore the real tax burden was actually at the level of 20%. Since 2012, it has been abolished the "tax-free allowance" (a non-taxable part of the base), but still it is possible to reduce the tax base by various deductions; for example families with one or two children, the disabled person etc. The determination of the tax base by the "super-gross methodology" was only applied when exceeded a certain level of income. The use of the so called "super gross tax base" was definitely discharged from the system in 2013. [Act. No. CXVII from 1995 on personal income tax, and subsequent amendments]



* the use of the increased tax base (the so called "super gross tax base")

Figure 2: *Development of the personal income tax rate in Hungary*
(Source: Act. CXVII from 1995 on personal income tax, and subsequent amendments – HU)

Slovakia

Till 2004, the tax base of individuals in Slovakia was taxed by a progressively moving tax rate, which ranged from 10% to 38% (Figure 3). The reform of the Slovak tax system, in 2004, was a fundamental reform, which was launched in the year of Slovakia's accession into the European Union. Since 2004, the flat tax rate of 19% was applied in the personal income tax.

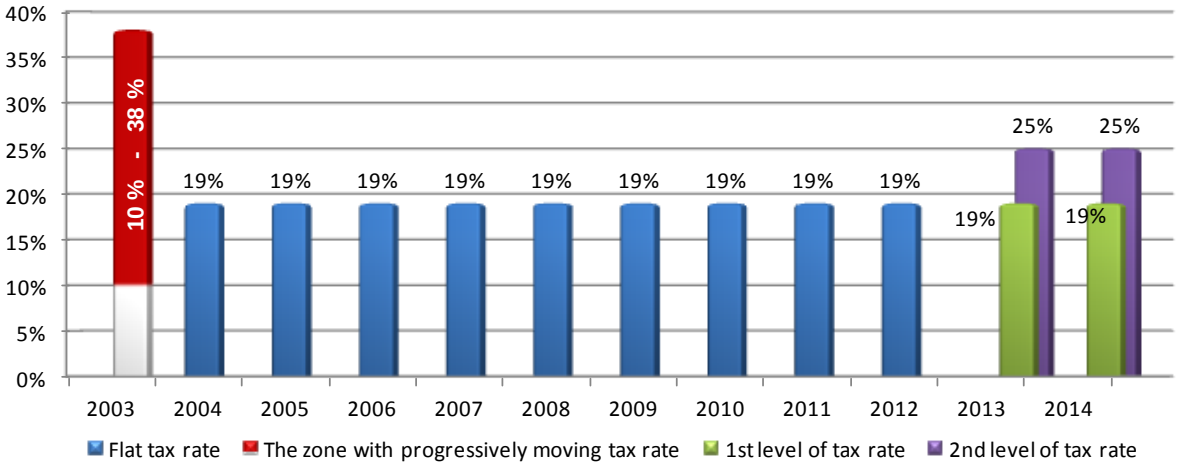


Figure 3: *Development of the personal income tax rate in Slovakia*
(Source: Act. No. 286/1992 Coll. on the personal income tax; and Act. No. 595/2003 Coll. on personal income tax, and subsequent amendments)

Since 2013, the flat personal income tax rate has been removed and actually the personal income tax rate is 19% of that part of the tax base, that do not exceed the amount of the current subsistence minimum 176.8 times; and from that part of the tax base, which exceeds the current subsistence minimum more than 176.8 times the tax rate is 25%. The tax base is adjusted by the "tax-free allowance" (a non-taxable part of the base), that by the amount which can reduce the basis for assessment of the tax itself. This amount is determined as 19.2 times the value of the subsistence minimum for that year. In 2009 and 2010, under the Government's measures to mitigate the impact of the global crisis, it was reduced the tax burden through the increase of the tax-free allowance (a non-taxable part of the base), which was changed to an amount equal to the subsistence minimum multiplied by 22.5. Since 2011 has been made another change in this field and the situation returned to the original state that of force before the year 2009. The tax-free allowance (a non-taxable part of the tax base per one taxpayer) for the year 2014 is equal to 3803 euro. [Act. No. 286/1992 Coll. on the personal income tax; and Act. No. 595/2003 Coll. on personal income tax, and subsequent amendments]

3.2. Analysis of the corporate income tax in Hungary and Slovakia

Hungary

Till the year 2006 the corporate tax rate was flat in Hungary. By the year 2003 it was on the level of 18% and since 2004 it was of 16% (see Figure 5). Since 2006, the tax rate was 10% for the tax base lower than 5 million of Forints (Ft) and 16% for the tax base over 5 million of Ft. Another change has been done since 2008, when the tax rate was at the level of 10% for the tax base fewer than 50 million of Ft and above this limit it was of 16%. Since 2010, the tax rate of the tax base fewer than 500 million Forints (about 1.615 mil. Euros) was on the level of 10%, and above this amount remained of 19%. By the reduced tax rate the government wanted to encourage the development of small and medium enterprises. However, the corporate tax base can be reduced by many ways and many tax reliefs in Hungary, this is why the real corporate tax burden is around 10%. [Act. No. LXXXI. from 1996 on corporate income tax, and subsequent amendments]

Small firms, whose total annual income does not exceed the threshold of 30 million of Forints (about 96,900 Euros), may apply the simplified business tax (flat tax rate of 37% of total revenue), if they so choose.

Slovakia

Till the year 2001 the corporate revenues were taxed by a flat tax rate of 29% of the tax base. In the years 2002 and 2003 it was a flat rate of 25%. The reform of the Slovak tax system in 2004 decreased the corporate income tax rate to the level of 19% (see Figure 5). Thus, it was introduced a general flat tax, which means that the same tax rate was applied on corporate income, on personal income, and the same rate was applied also for VAT. Since 2013, the general flat income tax rate was abolished. The tax rate on corporate income was set on the level of 23% for the year 2013; and, at the present, since January 2014, the tax rate on the taxable income (tax base) of the legal entity is 22%. [Act. No. 286/1992 Coll. on the income tax; Act. No. 595/2003 Coll. on the income tax, and their subsequent amendments]

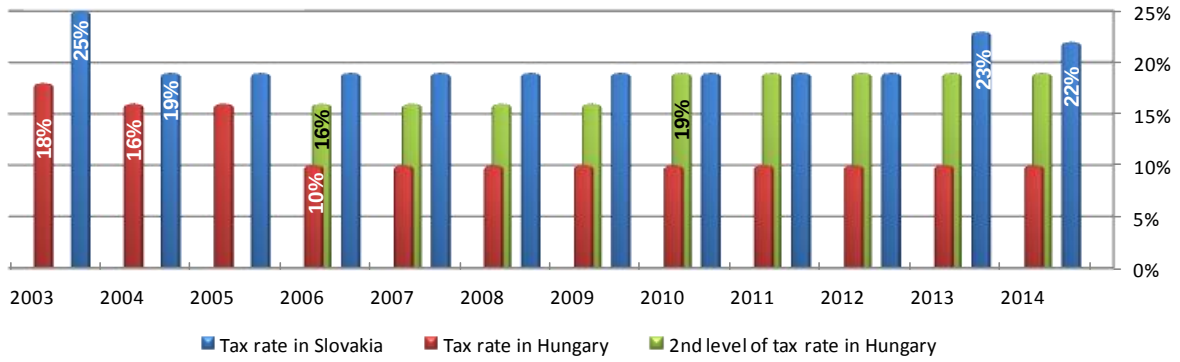


Figure 5: *Development of the corporate income tax*
(Source: Source: self elaboration based on the national legislation)

Tax on income in both countries

In the following Table 4 can be seen the comparison of the collected amount of tax on income (incl. personal and corporate) in the countries analyzed with regard to the EU.

	2004	2005	2006	2007	2008	2009	2010	2011	2012
EU 28 countries	1 238 787,5	1 329 101,9	1 473 946,4	1 586 134,2	1 564 354,9	1 366 456,4	1 415 054,4	1 484 416,9	1 553 704,6
Hungary	7 157,8	7 721,6	8 150,9	10 014,1	10 848,4	8 833,7	7 493,5	6 107,2	6 502,8
Slovakia	1 933,2	2 164,6	2 539,2	3 203,7	3 975,8	3 257,0	3 325,0	3 571,7	3 744,0

Table 4: *Tax on income (in millions of euro)*
(Source: self elaboration based on the data from Eurostat)

We can see that Hungary has collected more of income taxes than Slovakia, but we have to take into account that Hungary has approximately twice as many inhabitants as Slovakia. This is why it is much more useful to compare the collected amount of tax on income per inhabitant (Figure 4). Here we can see, that in the last years the income tax burden per inhabitant is higher in Slovakia, in spite of the fact that Hungary has collected higher amount of income taxes as a total.

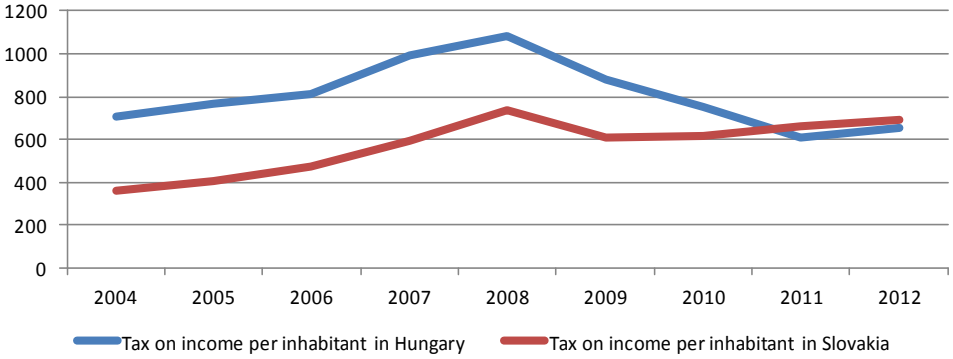


Figure 4: *Collected tax on income per inhabitant (in €)*
(Source: Source: self elaboration based on the data from Eurostat)

3.3. Analysis of the value added tax in Hungary and Slovakia

The Value Added Tax is used in the EU Member States since 1970. The legislative activities of the EU aim to coordinate and harmonize the legislation on VAT to ensure the proper

functioning of the internal market (Nerudová, 2011, p. 42). The aim of the Council Directive 2006/112/EC (Directive on the common system of value added tax, and its subsequent amendments and adjustments) is to codify a measure that guides the introduction of a common system of VAT, which applies to the production and distribution of goods and services bought and sold for consumption in the European Union. The common system of VAT applies just to goods and services bought and sold for consumption within the EU. The amount of collection of VAT type taxes in the EU and in the analyzed countries can be seen in the Table 5.

	2004	2005	2006	2007	2008	2009	2010	2011	2012
EU 28 countries	723 764,8	769 985,7	821 013,5	879 079,4	868 247,6	789 058,4	867 253,0	908 729,0	926 909,0
Hungary	7 278,3	7 484,6	6 812,8	8 009,8	8 224,1	7 820,2	8 442,0	8 516,5	9 084,1
Slovakia	2 639,8	3 028,1	3 320,3	3 699,0	4 453,5	4 221,3	4 182,1	4 710,9	4 327,7

Table 5: *Value added type taxes (VAT) (in millions of euro)*
(Source: self elaboration based on the data from Eurostat)

As mentioned, Hungary is bigger country than Slovakia; this is why we will once again compare the collected amount of VAT type taxes in regard to the number of inhabitants (Figure6).

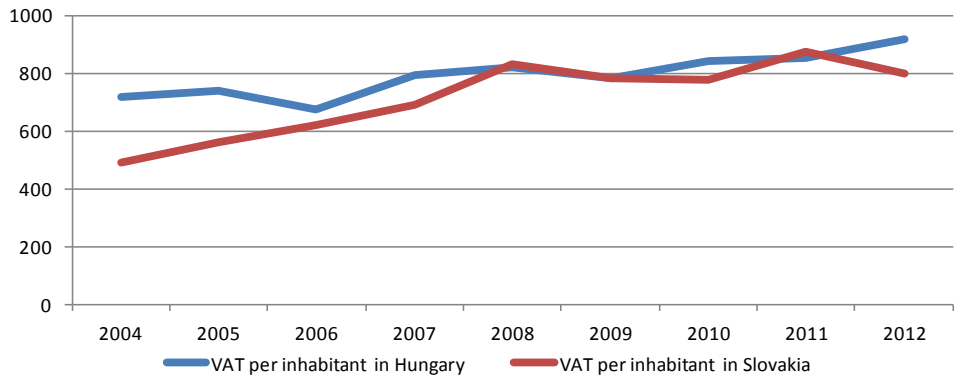


Figure 6: *Collected VAT per inhabitant (in €)*
(Source: Source: self elaboration based on the data from Eurostat)

In the Hungarian and Slovak central budget, the indirect taxes have a lot of weight. The most important tax between the indirect taxes is the value added tax. The year of introduction of VAT in Slovakia was 1993, and in Hungary it was introduced in 1988. The value added tax is a dominant tax also in terms of households, for two reasons. The first is that the VAT is a major source of revenue for the central budget, what means that it contributes the most to the tax burden of households by reducing their disposable income. The second reason is the versatility of the VAT, which in contrast to other duties is concerned to all of the households without exception, because it affects the final consumption.

		2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
EU-28	Standard	19,6	19,5	19,6	19,5	19,6	19,5	19,9	20,5	20,8	21,1	21,5	21,5
HU	Standard	25	25	25	20	20	20	25	25	25	27	27	27
	Reduced	12	5; 15	5; 15	5; 15	5	5	5; 18	5; 18	5; 18	5; 18	5; 18	5; 18
SR	Standard	20	19	19	19	19	19	19	19	20	20	20	20
	Reduced	14	-	-	-	10	10	10	6, 10	10	10	10	10

Table 6: *Development of the VAT rates*
(Source: self elaboration based on the data from "Taxation trends in the European Union 2014", p.26)

Hungary

Hungary applies a reduced tax rate of 18% and 5%. The standard tax rate was changed in 2009 from 20% to 25%. In 2012 the rate of the VAT increased from 25% to 27%, in fact we can say that in Hungary is the highest rate of VAT between the EU Member States. The obligation to register for VAT arises when the annual turnover exceeds 5 million of Hungarian Forints (approximately 16,200 Euros).

Slovakia

Since the year 2011 has been reduced the number of VAT rates in Slovakia. From the original three rates (6%, 10% and 19%) in 2010, remained only two of them in the year 2011. In addition to reducing the number of rates from three to two, there was also changed the level of the basic rate, which increased from 19% to 20%. This rate increase was a result of the measures to reduce the government deficit and it was declared as a temporary solution, but nowadays it is still on this level. The increase in the basic VAT rate was planned only till the government deficit will fall below 3% of GDP. The VAT rate of 10% on selected medical goods and books will remain. The taxpayers are not obliged to register for VAT if their annual turnover does not exceed the amount of 49,790 Euros.

4. Conclusion

Specificities and differences in the development of each country are also reflected in the large and small differences in their tax systems. This is obvious, because each state is built often on different social, economic, social or political principles; each society recognizes the diverse values and traditions and the development of taxes (tax systems) is necessarily conditioned by these factors. The tax burden of the EU countries - but also the amount and number of tax rates - shows strong differences. It can be concluded that the tax burdens in Slovakia and Hungary are below the European Union average. Tax revenues in Hungary - where the income tax calculated per capita - were significantly higher compared with the Slovak income tax revenues, but from 2011 are about the same level in both countries. It is surprising, that despite the higher VAT rate in Hungary, the revenue from the value added tax per capita in both countries is almost the same.

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PREDICTING INDICATORS AT SMALL SCALE USING ENTROPY ECONOMETRICS

Abstract

Statistical information for empirical analysis is very frequently available at a higher level of aggregation than it would be desired. Economic and social indicators by income classes, for example, are not always available for cross-country comparisons, and this problem aggravates when the geographical area of interest is sub-national (regions). In this paper we propose entropy-based methodologies that use all available information at each level of aggregation even if it is incomplete. This type of estimators have been studied before in the field of Ecological Inference. This research is related to a classical problem in geographical analysis called to modifiable area unit problem, where spatial data disaggregation may give inaccurate results due to spatial heterogeneity in the explanatory variables. An empirical application to Spanish data is also presented.

Keywords

Disaggregated regional data, distributionally weighted regression, generalized cross entropy.

1. Introduction

One relatively frequent limitation for empirical economics is the lack of data available at an appropriate spatial scale. Although the target, in principle, would be to work at a smaller geographical scale, the non-availability of geographically disaggregated information usually limits the conclusions of the analysis at an aggregate level. There is a growing need to produce economic and social indicators at a disaggregate geographic scale and this kind of information has become a focus of recent academic enquiry and planning policy concerns. In this paper we propose entropy-based methodologies that use all available information at each level of aggregation even if it is incomplete. This type of estimators have been studied before in the field of Ecological Inference (EI) (see Judge et al., 2004; Fernandez-Vazquez et al., 2013, Peteers and Chasco, 2006; Bernardini Papalia, 2013, Bernardini Papalia et al., 2013). Generally speaking, EI is the process of estimating disaggregated information from data reported at aggregate level. The foundations of EI were introduced in the seminal works by Duncan and Davis (1953) and Goodman (1953), whose techniques were the most prominent in the field for more than forty years, although the work of King (1997) supposed a substantial development by proposing a methodology that reconciled and extended previously adopted approaches.

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Within the set of techniques used for EI problems, the estimation procedures based on entropy econometrics are gaining weight. Recent applications can be found in Judge et al. (2004), Peeters and Chasco (2006) or Bernardini Papalia (2010). This research is related to a classical problem in geographical analysis called to modifiable area unit problem, where spatial data disaggregation may give inaccurate results due to spatial heterogeneity in the explanatory variables. On this background, our proposal is to address within an IT framework the research question of how to exploit all the available aggregate information in order to improve the estimation of disaggregated economic/social indicators. In such a situation, we propose to approach the EI problem by using distributional data to estimate a weighted regression that will be estimated by Generalized Cross Entropy. The proposed estimators present the advantages to produce disaggregated indicators by balancing the costs and errors of the disaggregation for a study area of interest. The methods also account for spatial effects of data autocorrelation and heterogeneity. Autocorrelation is where certain variables included in the model as determinants are related in space, and hence violate traditional statistical independence assumptions, and heterogeneity is where the associationss between variables change across space. The proposed estimators present the advantages to produce disaggregated indicators by balancing the costs and errors of the disaggregation for a study area of interest. The methods also account for spatial effects of data autocorrelation and heterogeneity. Autocorrelation is where certain variables included in the model as determinants are related in space, and hence violate traditional statistical independence assumptions, and heterogeneity is where the associationss between variables change across space. The paper is divided into five further sections. The next section presents the estimation of disaggregated data in terms of a Distributionally Weighted Regression (DWR). The use of entropy econometrics in the context of DWR estimators that account for parameter heterogeneity is presented in section three. Section four evaluates the performance of this type of estimators by means of a numerical simulation under several scenarios. Section four presents an empirical application with Spanish data. The last section presents the main conclusions and possible further lines of research.

2. Distributionally weighted regression: an overview

Consider a geographical area that can be divided into $i = 1,..,T$ smaller spatial sub-areas. Further to this geographical division, suppose that there is another dimension on which we would like to observe some variable or indicator. Consider that this second dimension is the classification into $j = 1, \dots, K$ different classes (for example, population classified by income, age, etc.). The objective of the estimation problem would be to recover the values of the variable disaggregated by sub-areas and by classes, from aggregate information.

We start by paying attention to some indicator of interest which is observable at the level of the $i = 1, \dots, T$ geographical areas, $y_{i.}$ In the context of a DWR, $y_{i.}$is usually defined as a weighted sum of the latent indicators y_{ij}. i.e.:

$$y_{i.} = \sum_{j=1}^{K} y_{ij}\theta_{ij}\ ;\ \forall i = 1, \dots, T \qquad (1)$$

where θ_{ij} stands for the observable weights given to class *j* in area *i* defined as population shares:

$$\theta_{ij} = N_{ij}/N_{i.} \qquad (2)$$

Being $N_{i\cdot} = \sum_{j=1}^{K} N_{ij}$. In DWR, the relations between the (latent) disaggregated indicators y_{ij} and the (observable) aggregates $y_{i\cdot}$ are only contained in equation (1). However, other possible relations between disaggregate and aggregate information could be observable as well. Sometimes, aggregate indicators across the i geographical areas for each one of the j classes are available as well and they could be incorporated to the estimation process. Consider the aggregate indicator $y_{\cdot j}$ defined as:

$$y_{\cdot j} = \sum_{i=1}^{T} y_{ij}\eta_{ij}\ ;\ \forall j = 1, \dots, K \tag{3}$$

where η_{ij} stands for the observable weights given to the area i in class j defined now as population shares:

$$\eta_{ij} = N_{ij}/N_{\cdot j} \tag{4}$$

where $N_{\cdot j} = \sum_{i=1}^{T} N_{ij}$. Note that the additional information considered here are just the K aggregates defined in equation (3), since the weights η_{ij} are, by definition, observable if the θ_{ij} weights are observable too.

Next, the values for the unobservable indicators y_{ij} are modeled as functions of H observable explanatory variables for the class j in each area i ($\boldsymbol{X}_{ij}$, which can include a specific intercept for each class j in area i) and R aggregate covariates observable at the level of the $i = 1, \dots, T$ geographical areas ($\boldsymbol{Z}_i$). Assuming a linear relation between the indicator of interest and the covariates, but without loss of generality, this function is defined as:

$$y_{ij} = \sum_{ij,h=1}^{H} \beta_{ij,h} x_{ij,h} + \sum_{i,r=1}^{R} \gamma_{i,r} z_{i,r} + \varepsilon_{ij}, \tag{5}$$

where $\boldsymbol{\beta}_{ij}$ and $\boldsymbol{\gamma}_i$ are the vectors with the parameters to be estimated and ε_{ij} is a residual.[3]

3. Entropy econometrics

The estimation of DWR models like (5) can be based on the use of Entropy Econometrics (EE) for estimating linear models. Generally speaking, EE techniques are used to recover unknown probability distributions of random variables that can take M different known values. The estimate $\tilde{\boldsymbol{p}}$ of the unknown probability distribution $\boldsymbol{p}$ must be as similar as possible to an appropriate *a priori* distribution $\boldsymbol{q}$, constrained by the observed data. Specifically, the Cross-Entropy (CE) procedure estimates $\tilde{\boldsymbol{p}}$ by minimizing the Kullback-Leibler divergence $D(\boldsymbol{p}\|\boldsymbol{q})$ (Kullback, 1959):

$$\underset{\boldsymbol{p}}{\text{Min}}\, D(\boldsymbol{p}\|\boldsymbol{q}) = \sum_{m=1}^{M} p_m \, ln\left(\frac{p_m}{q_m}\right) \tag{6}$$

The divergence $D(\boldsymbol{p}\|\boldsymbol{q})$ measures the dissimilarity of the distributions $\boldsymbol{p}$ and $\boldsymbol{q}$. This measure reaches its minimum (zero) when $\boldsymbol{p}$ and $\boldsymbol{q}$ are identical and its minimum is reached when no constrains are imposed. If some information (for example, observations on the variable) is available, each piece of information will lead to an update of the *a priori* distribution $\boldsymbol{q}$. When $\boldsymbol{q}$ is set as uniform (a situation without a priori information to favour some of the results), minimizing () is equivalent to maximizing the Shannon's entropy:

[3] Note that in this specification the parameters are allowed to vary across the T areas and K classes.

$$\underset{\boldsymbol{p}}{\text{Max}}\, H(\boldsymbol{p}) = -\sum_{m=1}^{M} p_m \, ln(p_m) \tag{7}$$

And the CE procedure is turned into a Maximum-Entropy (ME) problem.

The same underlying idea can be applied for estimating the parameters of general linear models, which leads us to the so-called Generalized Cross Entropy (GCE). The point of departure consists in assuming the parameters to be estimated ($\boldsymbol{\beta}_{ij}$ and $\boldsymbol{\gamma}_i$) as discrete random variables that can take values considered in some supporting vectors with $M \geq 2$ possible values (namely, $\boldsymbol{b^{\beta}}$ and $\boldsymbol{b^{\gamma}}$) with respective unknown probabilities $\boldsymbol{p^{\beta}}$ and $\boldsymbol{p^{\gamma}}$. The ε_{ij} errors are treated in terms of a discrete random variable with unknown probability distribution as well. The uncertainty about the realizations of these errors is introduced in the problem by considering each element ε_{ij} as a discrete random variable with $L \geq 2$ possible outcomes, contained in a supporting vector $\boldsymbol{v'} = \{v_1, \dots, 0, \dots, v_L\}$. The unknown probability distribution for the support vectors will be denoted as $\boldsymbol{w}$.

In general, the support spaces for parameters and errors are constructed as discrete, bounded entities, but it is possible to construct unbounded and continuous supports within the same framework (Golan, Judge and Miller, 1996). The support points in vectors $\boldsymbol{b^{\beta}}$ and $\boldsymbol{b^{\gamma}}$ for the parameters are chosen on the basis of some *a priori* information[4]. However, such knowledge is not always available, and symmetric parameter supports around zero are generally used in the presence of scarce prior information about each parameter. The set of possible values for the ε_{ij} errors in vector $\boldsymbol{v'}$ are usually assumed to be symmetric ($-v_1 = v_L$) and centered on zero. With regard to the bounds in this support vector for the errors, the "three-sigma rule" can be used (Golan, 1996). This rule implies to set as upper and lower bounds $\pm$ three times the standard deviation of the dependent variable in a regression model, which in this case is the observable indicator $y_{i\cdot}$. The *a priori* distribution for the parameters (namely, $\boldsymbol{q^{\beta}}$ and $\boldsymbol{q^{\gamma}}$) and the error ($\boldsymbol{w^0}$), without any additional prior information, can be naturally set as uniform and the GCE solution reduces to the Generalized Maximum Entropy (GME) one.

Under a GCE framework, the full distribution of each parameter and each error (within their support spaces) is simultaneously estimated under minimal distributional assumptions, by means of the following program:

$$\underset{p^{\beta},p^{\gamma},W}{Min}\, D(\boldsymbol{p^{\beta}}, \boldsymbol{p^{\gamma}}, \boldsymbol{w} \| \boldsymbol{q^{\beta}}, \boldsymbol{q^{\gamma}}, \boldsymbol{w^0}) = \sum_{h=1}^{H}\sum_{i=1}^{T}\sum_{j=1}^{K}\sum_{m=1}^{M} p_{ijhm}^{\beta} ln\left(\frac{p_{ijhm}^{\beta}}{q_{ijhm}^{\beta}}\right) + \sum_{r=1}^{R}\sum_{i=1}^{T}\sum_{j=1}^{K}\sum_{m=1}^{M} p_{irm}^{\gamma} ln\left(\frac{p_{irm}^{\gamma}}{q_{irm}^{\gamma}}\right) + \sum_{i=1}^{T}\sum_{j=1}^{K}\sum_{l=1}^{L} w_{ijl}\, ln\left(\frac{w_{ijl}}{w_{ijl}^{0}}\right) \tag{8}$$

Subject to:

$$\sum_{m=1}^{M} p_{ijhm}^{\beta} = \sum_{m=1}^{M} p_{irm}^{\gamma} = \sum_{l=1}^{L} w_{ijl} = 1; \quad \forall i = 1, \dots, T;\ \forall j = 1, \dots, K;\ \forall h = 1, \dots, H;\ \forall r = 1, \dots, R \tag{9}$$

[4] The choice of M, and the choice of continuous support spaces and different priors, is discussed in Golan, Judge and Miller, (1996).

$$y_{i\cdot} = \sum_{j=1}^{K}\left[\sum_{h=1}^{H}\sum_{m=1}^{M} p_{ijhm}^{\beta} b_{ijhm}^{\beta} x_{ij,h} + \sum_{r=1}^{R}\sum_{m=1}^{M} p_{irm}^{\gamma} b_{irm}^{\gamma} z_{i,r} + \sum_{l=1}^{L} w_{ijl} v_l\right]\theta_{ij}; \quad \forall i = 1,\dots,T \tag{10}$$

In the case that only the aggregate indicators considered in (2) are available, the sample information is contained in (10). If, additionally, aggregate information across the T areas for each one of the K classes is available as in (3), the following additional constrain can be included in the GCE program:

$$y_{\cdot j} = \sum_{i=1}^{T}\left[\sum_{h=1}^{H}\sum_{m=1}^{M} p_{ijhm}^{\beta} b_{ijhm}^{\beta} x_{ij,h} + \sum_{r=1}^{R}\sum_{m=1}^{M} p_{irm}^{\gamma} b_{irm}^{\gamma} z_{i,r} + \sum_{l=1}^{L} w_{ijl} v_l\right]\eta_{ij}; \quad \forall j = 1,\dots,K \tag{11}$$

Once estimated the coefficients in (5), the estimates of the indicators for each class j in each area i will be given by:

$$\hat{y}_{ij} = \sum_{ij,h=1}^{H} \hat{\beta}_{ij,h} x_{ij,h} + \sum_{i,r=1}^{R} \hat{\gamma}_{i,r} z_{i,r} + \hat{\varepsilon}_{ij} \tag{12}$$

The optimal solutions depend on the prior out-of-sample information (the *a priori* distributions and supporting vectors), the data in (10) and (11) and the normalization constrains in (9), which should be found by means of numerical optimization techniques.

4. A numerical simulation

In this section we try to find some empirical evidences, by means of some numerical simulations, on the comparative performance of the DWR estimator to recover a set of $(T \times K)$ disaggregated latent indicators. The point of departure of the experiment is the unknown elements of a target matrix, which are drawn from a log-normal distribution with mean 10 and standard deviation 2. The choice of a log-normal to simulate the target variable is motivated because economic variables like income or productivity often follow this distribution. Once these values are generated, they are divided by the (observable) corresponding population totals N_{ij} to obtain the y_{ij} indicators.

As usual in DWR estimation, regressors to explain the y_{ij} indicators should be available. In order to keep our simulation as simple as possible, we first consider that only one disaggregated regressor x_{ij} is assumed observable. The disaggregated regressor x_{ij} contains some imperfect information on the target indicators. To reflect this idea, in the experiment the elements of the $(T \times K)$ matrix $\boldsymbol{X}$ have been generated in the following way:

$$x_{ij} = y_{ij} + u_{ij};\ \forall i = 1,\dots,T;\ \forall j = 1,\dots,K \tag{13}$$

Where $\boldsymbol{u} \sim N(0, \sigma y_{ij})$ and σ is a scalar that adjusts the variability of this noise making it proportional to the respective element y_{ij} and it has been set to 0.1. In this context, the latent indicators will be modeled by means of a simple linear regression like:

$$y_{ij} = \alpha_{ij} + \beta_{ij} x_{ij} + \varepsilon_{ij} \tag{14}$$

Being α_{ij} an area and class-specific intercept. Additionally, an aggregate regressor z_i is incorporated into the model, being the values of this aggregate indicator generated in a similar way, where:

$$z_i = y_{i\cdot} + \epsilon_i;\ \forall i = 1, \dots, T \quad (15)$$

Where $\boldsymbol{\epsilon} \sim N(0, \sigma y_{i\cdot})$ and σ is the same scalar previously defined. In such a case, the DWR model to estimate is:

$$y_{ij} = \alpha_{ij} + \beta_{ij} x_{ij} + \gamma_i z_i + \varepsilon_{ij} \quad (16)$$

The parameters in (14) and (16) will be estimated by the GCE program described in equations (8) to (11) with equal supporting vectors for all them (-100 ,0, 100) with $M = 3$. For the error terms, again the support with $L = 3$ values has been chosen applying the three-sigma rule with uniform a priori weights. The a priori probability distributions taken for the coefficients are uniform as well, so the CGE estimation is equivalent to a GME program.

Two different scenarios with various levels of available aggregate information will be assumed: i) the usual situation where only aggregates for each one the i areas $y_{i\cdot} = \sum_{j=1}^{K} y_{ij}\theta_{ij}$ are known, and ii) an alternative scenario where, additionally, aggregates for each j class $y_{\cdot j} = \sum_{i=1}^{T} y_{ij}\eta_{ij}$ are observable as well.

In the experiment we evaluate the performance of the DWR modeling with and without the additional constrain considered in (11) under different scenarios. Six different dimensions of the target matrix have been considered in the experiment. The six types of matrices reflect several situations with different number of regions (T) and classes (K). For example, in matrices 1, 2 and 3, the number of geographical areas is small ($T = 20$), whereas in cases 4, 5 and 6 more geographical areas are considered ($T = 200$). In each one of these simulated scenarios several possibilities for the number of classes (K) have been considered: namely 2, 4 and 8. In each one of the twelve resulting scenarios 1,000 trials have been carried out and the average of two measures of error have been computed: the root of the mean squared error (RMSE), and the weighted absolute percentage error (WAPE). Table 1 summarizes the results.

		Matrix 1 (20×2)		Matrix 2 (20×4)		Matrix 3 (20×8)		Matrix 4 (200×2)		Matrix 5 (200×4)		Matrix 6 (200×8)	
		WAPE	RMSE	WAPE	RMSE	WAPE	RMSE	WAPE	RMSE	WAPE	RMSE	WAPE	RMSE
One regressor	DWR	10.46	120.24	14.36	123.85	23.77	209.69	8.06	75.29	11.81	116.52	21.93	209.65
	DWR with additional information	6.22	55.35	9.83	75.85	16.59	123.68	7.74	75.02	11.32	103.01	21.26	203.32
Two regressors	DWR	5.18	47.93	12.64	117.13	22.74	205.67	6.73	66.65	9.84	96.11	21.38	207.32
	DWR with additional information	5.12	44.28	8.68	74.39	15.75	120.33	6.73	66.62	9.19	83.76	20.73	200.86

Table 1: *Results of the numerical experiments (1,000 replications)*

5. Empirical application

Complementarily to the numerical simulation carried out in the previous section, the two approaches are tested in an empirical application using a data set for Spain. Spain is administratively divided into 50 provinces for which official data on gross value added by industry (classified into 5 different sectors) are regularly published in the Regional Accounts by the National Statistical Institute (INE). However, the provincial and sectoral aggregates are available much sooner than the disaggregated information, whereas the disaggregated data by industry and province are made public with a time lag of several years. In this context, it would be interesting the application of an estimation procedure that produce disaggregated values quicker than the official ones. The empirical application will be conducted taking as reference year 2005. The target variable is the distribution of GVA per unit of labor by province and industry (now we aim at a latent indicator-target instead of a level-target). The industry aggregates are assumed as observable, as well as additional information required to define the weights θ_{ij}. Specifically, for weights we use that data on labor units (thousands of workers) by industry and province in year 2005. This is a realistic situation, given that the Spanish Labor Force Survey (EPA) publishes estimates of labor by industry and province with quarterly and annual frequency. With all this information the DWR equation has been estimated by means of GME. Tables 2 and 3 compare the results with the actual values by obtaining the absolute percentage error. Table 2 reports the average absolute deviations in percentage over the aggregate GVA by province, whereas Table 3 shows the same average deviation measures in relative terms to the industry aggregates.[5] As a first indicator of the accuracy of the DWR technique, the average absolute error in the estimation of value added per worker is approximately 16%. The general trend that can be observed is that the errors obtained are concentrated in the agriculture and energy activities, and they diminish for the industries with a major share in the economic structure in Spain (manufacturing and services). In terms of variability in the error of the DWR approach across sectors, the biggest provinces in terms of population presented deviation that are above the average error (with the exception of Madrid and Valencia).

Province	*GCE*	*DWR*	*Province*	*GCE*	*DWR*
Albacete	9.33	14.26	Jaén	5.47	9.19
Alicante	2.59	11.90	León	2.74	16.65
Almería	11.90	12.06	Lerida	4.18	12.43
Álava	6.44	8.26	Lugo	11.70	13.45
Asturias	0.78	13.30	Madrid	1.08	12.60
Ávila	21.68	13.93	Málaga	11.11	12.44
Badajoz	12.91	12.42	Murcia	1.59	15.51
Bal. Islands	10.00	14.02	Navarra	7.46	10.75
Barcelona	2.20	12.18	Orense	8.82	10.44
Vizcaya	2.74	11.99	Palencia	11.21	12.06
Burgos	9.84	7.90	Las Palmas	10.34	12.65
Cáceres	19.37	10.74	Pontevedra	1.87	11.93
Cádiz	2.59	14.30	Rioja	6.21	17.31
Cantabria	2.42	10.40	Salamanca	8.10	10.90
Castellón	3.60	11.34	Tenerife	9.53	11.05
Ciudad Real	12.27	15.47	Segovia	15.59	15.71
Córdoba	3.60	8.37	Sevilla	2.62	13.59
Coruña	1.66	11.48	Soria	27.56	11.27
Cuenca	17.00	13.02	Tarragona	5.38	10.05
Gipuzcoa	10.95	7.95	Teruel	19.71	9.08
Gerona	4.48	12.00	Toledo	6.79	15.05

[5] The results are weighted averages where each province and industry is weighted by their number of workers.

Granada	12.19	14.07	Valencia	0.76	13.50
Guadalajara	14.85	9.74	Valladolid	5.79	11.67
Huelva	4.43	17.66	Zamora	19.97	14.54
Huesca	8.52	12.25	Zaragoza	3.78	12.59
Average percentage abs. error DWR = 12.35					

Table 2: *Absolute percentage errors by province (real GDP vs. Estimates)*

Industry	DWR
Energy and manufacturing	8.17
Construction	17.14
Commerce, trade and transport and communic. services	6.61
Financial, insurance and real estate services	15.12
Non-market services	14.71
Average percentage abs. error DWR = 12.35	

Table 3: *Absolute percentage errors by industry (real GVA vs. Estimates)*

6. Final remarks

In this paper a distributionally weighted regressions (DWR) Entropy-based approach to Ecological Inference is formulated in presence of spatial heterogeneity throughout simulation experiments and a real data application. If compared to the traditional EI problem formulations, our approach is remarkably different and presents two distinctive differences in terms of model formulation: (i) spatial heterogeneity of parameters and (ii) data contraints for available aggregate information are introduced. The performance of the proposed approach is tested by means of numerical simulations under several scenarios. We studied the effect of the informative contribution contained in the “non target” variable to predict the sub-area values (or sub-area indicators) for target variables. We also evaluated the performance of the formulation in presence of different number of classes. The results observed in the simulation showed the goods results of the DWR estimator expecially in small samples cases and when additional information at aggregate level is included. The application of the proposed approach is illustrated by means of a real-world example with data of Spain, where the target is the estimation of GVA per unit of labor by province and industry in 2005. The average deviations are similar to those obtained in the numerical simulation and, the DWR equation considered reduces the variability of the deviations across provinces and industries. In this study we have considered the case of continuous target variables. Further work should be done to explore the performance of the competing methods: (i) within a panel data framework; (ii) by improving model specification when the covariates alone do not succeed in accounting for the spatial heterogeneity; (iii) by exploring new IT- based composite estimators. Future research is also needed to evaluate the predictive accuracy of the proposed approaches by the use of discrete target variables and count data.

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SHAREHOLDERS VALUE AND CATASTROPHE BONDS. AN EVENT STUDY ANALYSIS AT EUROPEAN LEVEL

Abstract

Considering that the E.U. based (re)insurance companies are increasingly active within the segment of alternative risk transfer market, the aim of the present paper is to emphasize the impact of issuing cat bonds on the shareholders' value for highlighting the competitive advantages of the analysed (re)insurance companies while pursuing the consolidation of their resilience in a turbulent economic environment.

Eminently an applicative research, the analysis employs an event study methodology whereas adjusting the market model residuals with the aim of accounting for generalized autoregressive conditional heteroskedastic (GARCH) effects through advanced econometric procedures. To account for the shareholders' value, the research employs high frequency financial data (daily returns of stock-exchange listed (re)insurance companies) and the cat bonds' announcement dates as economic events.

Keywords

alternative risk transfer solutions, catastrophe bonds, competitive advantage, event study, GARCH model

1. Introduction

Sustainable economy and, implicitly, sustainable development are more and more influenced by the occurrence of large natural catastrophes as they pose important social and economic consequences both at the level of the society as a whole, and at the level of companies. Furthermore, there is a worldwide consensus that their impact, in terms of financial costs, is growing as the social and economic activity is developing towards areas more prone to catastrophe risks – a fact of great concern at E.U. level, especially in the context of the climate change concerns. As one of the most affected business regarding the natural disasters, the companies within the (re)insurance industry adapted their risk management strategies while accessing the capital markets' capacity through the development of sustainable financial tools and instruments. One of the most prominent examples is the case of the securitization of the disaster risks by issuing catastrophe bonds (cat bonds).

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Considering the growing importance and potential of these innovative risk management instruments, the scope of the present paper is three fold:
(1) to emphasize the impact of issuing cat bonds on the shareholders' value while employing a GARCH enhanced event study methodology
(2) to analyse the market of the catastrophe bonds from a European perspective
(3) to highlight several competitive advantages of the analysed (re)insurance companies while pursuing the consolidation of their resilience in a turbulent economic environment

2. Literature review

2.1. Event studies – selective literature

Although the starting point of the event study methodology is acknowledged to be the research of Dolley (1933) that focuses on the price impact of stock splits (referenced by Cam, Ramiah, 2014, 171; Nageswara Rao, Sreejith, 2014, 41), there are the seminal works of Ball and Brown (1968) and Fama, Fisher Jensen, and Roll – FFJR (1969) that are considered to be the modern inception studies within this field (Bowman, 1983, 561; Corrado, 2011, 207).

Considering the two afore mentioned studies, the specialized literature acknowledges two well-identified typologies of event studies: (a) information impact event studies, as is the one developed by Ball and Brown (1968), in which there are investigated the effects particular events have on the company investors' wealth (b) market efficiency testing event studies, following that of FFJR (1969), where there is investigated the behaviour of the stock prices while adjusting to specific new information (Bowman, 1983, 562; Binder, 1998, 111).

Furthermore, Kothari and Warner (2007, 5), referring to the relevance of the event studies in financial economics, highlight that: (i) the short-horizon oriented event studies show importance of the policy decisions at corporate level while centring on the announcement impact around a particular event and (ii) the long-horizon oriented event studies are significant while testing market efficiency when analysing the persistence of abnormal returns following a specific event. Along with this typologies, Bowman (1983, 573-575) acknowledge a third and fourth typology: (a) model evaluation event studies, in which the core is the expectation model employed in inferring the information content and (b)metric explanation event studies, cantered on finding "variables which explain the excess return metric observed in an information content or market efficiency test" (Bowman, 1983, 574).

2.1.1. Outlining the basics of the event study methodology

There are several studies that outline the design and steps of an event study (e.g. Bowman, 1983; MacKinlay, 1997; Kothari, Warner, 2007), defining, broadly, the following fundamental stages:
(1) Defining the event and the event window. As specified by Bowman (1983), the event specification impacts on the assumptions to be tested, while crucial aspects are also represented by the precision in establishing the occurrence timing or the presence of confounding events. With regard to the event window, this refers to the period of time

established for investigating the assets' price behaviour induced by the analysed event. Prior to the event window, there is also established the so called estimation window which serves for examining the movements of the prices.
(2) Companies sample selection. With respect to this aspect, the specialized literature recommends establishing criteria for including companies within the analysed sample like listing criteria or industry membership (MacKinlay, 1997, 15).
(3) Defining a reference process for the normal returns behaviour. The normal or benchmark returns are those used to determine the abnormal returns through comparing with the assets returns. The most frequently used methods for computing normal returns are: (i) mean adjusted returns (ii) market adjusted returns and (iii) conditional (market and risk) adjusted returns (Brown, Warner, 1980, 207-208; Nageswara Rao, Sreejith, 2014, 45). Mean adjusted returns are based on a benchmark determined as the average return over the estimation window (the pre-event window period). In a market adjusted returns approach, there is assumed that the companies included in the sample yield as the market over the event window. Conditional risk adjusted returns are based on regression models to determine the expected returns, while accounting for the stock return – stock market index nexus (a variety of the Capital Asset Pricing Model).
(4) Determining and cumulating the abnormal returns. In order to infer information on the stock price changes, the abnormal returns are aggregated across time and securities/companies (Henderson Jr., 1990, 285-286; MacKinlay, 1997, 21). Therefore, taking into account that there is an interest in the performance of the price both around the event and on longer periods of time around the event, the abnormal returns can be aggregated: across companies, in correspondence with each event period (AAR – average abnormal returns), across time (CAR – cumulative abnormal returns). MacKinlay, 1997, 21). Further, either AAR or CAR is aggregated to obtain cumulative abnormal average returns (CAAR) – inferring on the abnormal returns' aggregated impact For example, in order to obtain CAAR, average abnormal returns could be cumulated over the days of the event widow.
(5) Employing statistical tests to investigate the significance of the results. In this respect, Henderson Jr. (1990, 297-298) emphasizes that there are main concerns: the choice of a parametric or a nonparametric test and the choice of the test. Generally, the literature recommends the use of parametric tests and, more precisely the student t-test (Henderson Jr., 1990, 298)

2.1.2. Using GARCH models in event studies

Since the inception of the seminal work of Fama et al. (1969), the literature of event studies proved to be prolific. However, as Kothari and Warner (2007, 8) point out, there have been only two pivotal variations from the methodological perspective: the prevalence of daily and intraday returns employment and the advancement in complexity of the abnormal returns' estimation and statistical significance testing.

As mentioned by Corhay and Tourani Rad (1996, 529), the specialized literature acknowledged that eluding the "time dependence in stock return series" can inflict both on the efficiency of the parameter estimates and on the predictability of the test statistics. Furthermore, Mills et al. (1996, 559) affirm that erroneously specified market models could conduct to flawed inferences regarding the effect of a specified event on the stock returns.

Cam and Ramiah (2014), while comparing seven expected returns models (including GARCH and EGARCH) for studying the effects of catastrophic events (terrorist attacks and, also, the subprime crisis) on stock market returns, conclude that different asset pricing models conduct to different results in terms of the magnitude and sign of the effect.

Cosistent with the above findings, several research papers address the issue of autoregressive conditionally heteroskedastic effects (ARCH) of the residuals resulting from the market model by employing the generally acknowledged GARCH models originally developed by Bollerslev (1986).

For example, Brockett et al. (1999), while accounting for the well-known stylized facts regarding the stock returns (e.g. fat tails, autocorrelation in squared returns), improve the market model by employing AR(1) and GARCH(1,1) processes in order to examine the impact of the California's Proposition 103 on the insurance stocks returns.

Sabet et al. (2012) investigate the impact of two events (British Petroleum oil spill and the USA moratorium on exploration) on companies from the oil and gas sector through a GARCH(1,1) enhanced event study after identifying ARCH effects.

Thomann (2013) examines the effect of both the 9-11 attacks and natural catastrophes on insurance stocks volatility by employing multivariate GARCH models (a DCC-GARCH (1,1)) and infer that in order to obtain unbiased results while studying the impact of insured catastrophes with event studies there should be considered the nonstationarity of beta.

2.2. Stock returns reaction to cat bond activity – event studies insights

Mueller (2002) centres on the impact of issuing catastrophe bonds on the stock returns of listed insurance and reinsurance companies. Considering a series hypothesis regarding the stock prices (H1: Issuing cat bonds is value enhancing – positive reaction, H2: Considering the spread of the cat bonds, prices will be negatively affected – negative reaction, and H3: Considering the spread of the cat bonds, prices will not be affected – neutrality) the author runs a market model for the normal returns, using both an aggregate and an individual approach regarding the cat bonds issues. As benchmarks, the author employs MSCI World, the MSCI World Insurance, and the FT All World Insurance index, while also determining an equally weighted price index that tracks the performance of the companies included in the sample. Both the private placement offering memorandum (for 16 issues) and the press/news alerts (for 12 issues) are used to infer the event date. The general conclusion supported hypothesis three, the cat bonds being revealed as a substitute for the reinsurance.

Bierley (2008) and Bierley et al. (2008), focusing on several hypothesis regarding the corporate demand for insurance, examine through both a multi-factor and a single-factor event study the response of the stock market returns to cat bonds issuance, complemented by a cross-sectional analysis. The sample comprises 44 transactions developed between 1997 and 2007 by 20 companies from three sectors: financial, energy, and entertainment. The benchmarks are local stock market indices as well as the MSCI World Index as a proxy of

the world capital markets. The event study is structured to test the semi-strong form regarding the efficient market, while considering the immediate impact of the announcements on the stock returns. In order to test the statistical significance of the results, there are used three tests: two parametric (the Patell z Test and the Standardized Cross-sectional z Test) and one non-parametric (the Generalized z Test). The results regarding the impact of a series of factors on firm value indicate that the event date has a significant positive effect; firm size had a significant negative effect; industry/sector dummy variable (insurer versus non insurer) reflected a positive and significant impact for the non-insurer, while the trigger dummy variable reflected that investors favour modelled loss triggers.

Hagendorff et al. (2012), centring on a 80 cat bond sample issued by 25 companies up to May 2010, examine the wealth effects associated to the issuance and announcement dates of catastrophe securitization. The employed methodology generates market-adjusted abnormal returns, while the benchmark is an insurance index tracking, also, reinsurance companies' performance. In terms of the robustness of the results, the authors employ both parametric (two tailed t-test) and non-parametric (Mann-Whitney-Wilcoxon) tests. The authors, first, develop an univariate analysis through which there are investigated the wealth benefits of announcing the cat bonds issuance, concluding that issuing cat bond does not imply strong wealth increases for the stock investors of the cedent company. Further, the study accounts for value effects while analysing both the hedging benefits (with triggers and initial rating as proxies) and cost savings (with the loss ratio and the underwriting cycle as proxies). The results suggest there are no differences in the abnormal returns around announcements of cat bonds issue when including the trigger type, while lower loss uncertainty and soft market issued cat bonds generates higher abnormal returns. Therefore, the cost savings motivations overcome the hedging ones in terms of wealth effects. The research is complemented by a multivariate analysis that confirms the findings of the univariate one.

3. Development of the empirical analysis

3.1. Data and methodology

Since the aim of the paper is to give a recent outlook on investor value concerning (re)insurance companies within the EU, we have selected all Cat bonds issued by companies with headquarters within EU Member States. As within the other insurance securitization event-studies (Mueller, 2002; Bierley, 2008; Bierley et al. 2008; Hagendorff et al., 2012), we considered within our research those bonds where coupons and/or principal payments are related to a specific set of risks associated property damage or casualties as a consequence of natural catastrophes. However, we excluded transactions that pertain to the life/mortality or to auto/credit insurance risks as we want to capture exclusively the effect of the cat bonds through which natural catastrophe risks are securitized. It is noteworthy to mention that the structure of the bonds is irrespective of the actual risks and, more importantly, there is no difference in the risk related markets. The considered cat bond deals were selected from the well-known www.artemis.bm website.

All companies considered within the study are listed companies with widely available data, and, in this regard, we used daily frequency returns for all 8 major Cat bonds cedents/sponsors (Allianz SE, Hannover Re, Munich Re, AXA, SCOR, Assicurazioni Generali, Amlin and Catlin) from 03-Oct-2005 to 22-Aug-2014 gathered from Thomson Reuters Eikon. Additionally, we used the Euro Stoxx 600 index as the market index for our forecasting model, evidently, using the same frequency and time interval. Minor adjustments were necessary since two companies are listed in Pound Sterling hence, the conversion was made in Euros using the European Central Bank rate.

The highlight of our data gathering effort is materialised in our events sample which is comprised indiscriminately of Cat bond issue announcements for all considered companies within the reference time period. The data sample was compiled from three main sources consisting of AON, Artemis, and Alacrastore. Additional confirmations concerning the announcement dates were also gathered from additional sources. Overall, we have gathered 43 Cat bonds announcement dates which constitute themselves in our events sample.

Part of the reason why we selected multiple sources is the fact that currently available data presents a relative high degree of inconsistency which leaves room for discussion on the actual sample correctness. This uncertainty is currently generalised in the study of Cat bonds and its impact stretches beyond localised result quality. In this regard, it is important to mention the fact that the results of different similar event studies have a relatively lesser degree of comparability due to lack of a common set of announcement dates which induces a bias in results from one study to another. As suggested by Hagendorff, Hagendorff, and Keasey (2013), this issue would not be resolved however, by substituting announcement dates with issue dates due to the fact that Cat bonds are sold on a book-building basis which signifies that issuers already contact potential investors at the time of the issue. Part of the rationale of this behaviour is given by the fact that issuers need to assess investor reactions regarding the size and structure of potentially issued Cat bonds which signifies that investors already adjust their trading behaviour based on a company's intention to issue a Cat bond before the issue date. (Hagendorff, Hagendorff, and Keasey, 2013, 288) In the end, this signifies that announcement dates cannot be substituted with issue dates due to the uniqueness of carry-over information.

In this paper, the basic event study methodology will involve analysing stock market valuation effects as a consequence to a company's Cat bond issue announcement. This is primarily done by statistical significance testing (simple t-test) of market-model adjusted abnormal returns (AR) and cumulative abnormal returns (CAR) across days and firms. Abnormal returns and cumulative abnormal returns are computed for 20 days period before and after each event.

$$AR_{it} = r_{it} - r_{mt}$$

where:

r_{it} is the return of company i on day t and

r_{mt} is the return forecasted from an estimation (based on 100 intervals before) of a GARCHX model, where the mean equation uses the market index, and the variance equation is a standard GARCH(1,1) model, which, to our knowledge, stands for an innovative approach within the event studies regarding the effects of the cat bonds issuances on the stock returns as proxy for the wealth of the shareholders. The study was developed in MATLAB.

3.2. Hypothesis development

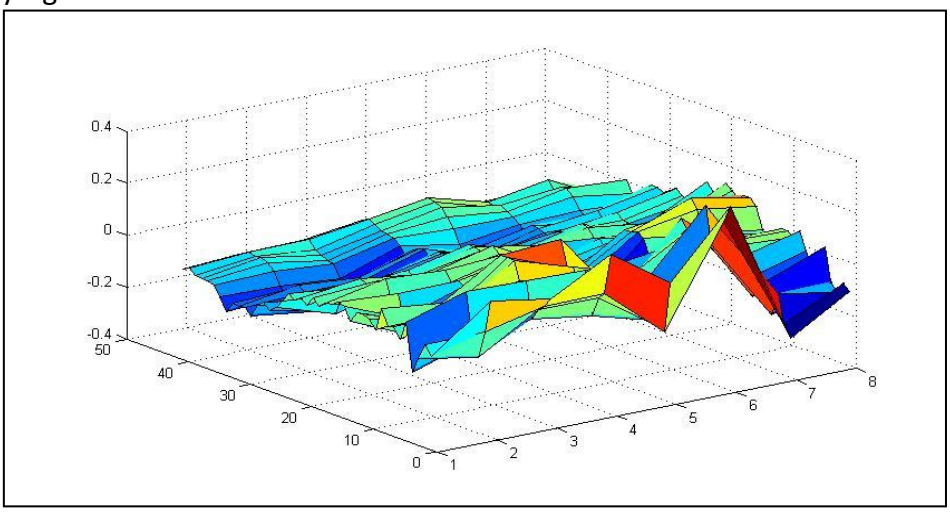
By using the event study methodology we test the abnormality hypothesis of returns from (re)insurance companies which issued Cat bonds starting from the market efficiency hypothesis that signifies that asset returns assimilate new information concerning current and future performance. In essence, if an event has any impact on the market or individual performance, its returns will vary as soon as the information was processed by the market. Cumulative abnormal returns which are statistically significant indicate a strong impact on the company or market while non-significant returns indicate their ability to recover from jolts.

In this regard, we have formulated two work hypotheses:
1. At a market level, individual announcements of Cat bonds issues do not influence the performance of all other companies;
2 At a company level, individual announcements of Cat bonds issues do not influence the performance of the single issuing company

These two hypotheses ensure the fact we keep both an overall market focus and allow us to examine in more detail which of the 8 considered companies is more susceptible to changing investor perception around Cat bonds announcement dates.

3.3. Empirical findings

We first ran our event study to check for the overall market reaction to Cat bonds announcements. After computing our abnormal returns, cumulative abnormal returns and t-statistics we observed that there are no statistically significant cumulative abnormal returns. This signifies that individual Cat bonds issue announcement do not influence the overall market comprised of the 8 EU based (re)insurance companies. This does confirm our first hypothesis and signifies that the market captures in an efficient and unbiased manner information concerning these type of events irrespective of the time frame around the event. As the figure bellow illustrates, the close to 0 t-values leave no room for finding any statistically significant CAR.



Source: authors' contribution (developed in Matlab)

Figure 1. *t-statistics for all 8 companies for the [t-20; t +20] event window*

By further investigating individual company reactions to the events we came to the collusion that for 6 out of 8 companies the individual CARs for their own Cat bond announcements were not statistically significant and consistent with our findings at a market level. However, for two of the companies we have identified three and respectively 6 statistically significant CARs . The tables bellow illustrate the days before or after the announcement in which the statistically significant CARs were identified, the actual computed CARs and associated t-stats and p-values.

Event window	***[t-20; t+20]***		
	CAR	**t-stat**	**p-value**
t-20	-0,015**	-2,119	0,10
t-19	-0,018**	-2,628	0,06
t-18	-0,022**	-2,307	0,08
** statistically significant at 10% *** statistically significant at 5%			

Source: authors' contribution (developed in Matlab)

Table 1. *Value effects of Cat bond announcements on an individual company (AXA)*

Event window	***[t-20; t+20]***		
	CAR	**t-stat**	**p-value**
t+14	-0,102**	-3,942	0,059
t+15	-0,102***	-6,708	0,022
t+16	-0,103***	-30,885	0,001
t+18	-0,093***	-4,678	0,043
t+19	-0,099***	-6,493	0,023
t+20	-0,105***	-6,752	0,021
** statistically significant at 10% *** statistically significant at 5%			

Source: authors' contribution

Table 2. *value effects of Cat bond announcements on an individual company (Amlin)*

Our findings indicate that for two companies in our sample, Cat bonds issue announcement do exert some influence on an individual level. This challenges our second hypothesis and signifies that for some companies the information comprising of Cat bond announcements is captured in a biased manner starting as soon as 20 to 18 days prior the announcement and 14 to 20 days after the announcement. One particularly noteworthy aspect is represented by the negative abnormal returns which implies negative valuation effects on a company level as a consequence to cat bond announcements. However, as one can noticed, in the case of the first company, the abnormal returns are registered before the announcement date and, though negative, have a rather small value. Furthermore, the identified and considered number of transactions is quite low. For the second company, the results, though significant, could be the outcome of a low number of developed transactions while also suggesting that shareholders might be reticent to the initial entry on a rather new alternative risk management market and the associated costs.

4. Conclusions

In recent years, the amount and intensity of natural disasters have led insurance and reinsurance companies to deal with the very complex situation of seeking alternative risk transfer solutions. Cat bonds are regarded as an acceptable solution since these transfer catastrophe-related risks to capital markets and, in this regard, issuing Cat bonds should offer a number of potential benefits. However, current state-of-the-art mentions significant uncertainties on whether or not Cat bonds actually bring these benefits to issuing companies. It is this uncertainty which justifies our endeavour to empirically examine the shareholder wealth effects for a data set consisting of 8 EU based Cat bond issuers from 2005 to 2014.

Specifically, on an individual company level, some evidence of shareholder effects was registered, for two of the companies. Significant CARs were recorded respectively, before and after the events. Very interesting facts are the generalised negative impact of announcements and the overall clustering of statistically significant CARs of two companies. However, provided the relatively low number of Cat bond issues and the overall uncertainty of actual announcements, our results have to be interpreted with due caution and should be regarded as guidelines rather than recommendations. Considering these aspects, we do not interpret the results as conducting to shareholder's value destruction, but rather as a "novelty effect" considering the experience of the cedent/sponsor company on the cat bond market. This could also support the fact that Cat bond issuers should take the responsibility to communicate with investors prior to any issue announcement more seriously in order to give these a better understanding of these bonds. *Therefore, the second hypothesis was partially confirmed, suggesting that, generally, the stock returns of the more experienced companies on the cat bond market have a neutral reaction to the issuance of these financial products.*

On a market level, some interesting results of our study reveal that there is not sufficient evidence to support or disprove performance gains. In this regard, no statistically significant abnormal returns were registered by all 8 companies in relation to individual events. This supports evidence of efficient markets and leads to believe that Cat bond announcements do not generate biased investor reactions. Some conclusions may be drawn, in this regard, concerning the lack of localised contagion where the overall mass of companies is not affected by individually occurring announcements. *Therefore, the first hypothesis is confirmed indicating an unbiased response at the level of the sponsors' stock returns as these issue catastrophe bonds.*

In conclusion, our paper highlights some present shareholder value effects regarding the performance of E.U. headquartered (re)insurance companies that issue Cat bonds. While considering the present state of this market at E.U. level (e.g. the current coverage through these instruments), the results seem to confirm that there is generally a neutral response to the securitization of natural catastrophe risks. Therefore, as in Mueller (2002), at the level of our sample, the results seem to suggest that for the moment the cat bonds stand for alternative to reinsurance. However, we would also add that, considering the resistance of these financial products, especially in turbulent times, nowadays, they stand for a viable alternative.

Therefore, in terms of competitive advantages, at this point, we could infer two statements: (1) Overall, the cat bond market at the level of E.U. based companies, seems to be in a state of equilibrium between costs and benefits of issuing cat bonds, as they are perceived by investors. This state of art, along with further liquidity and more transparency within the cat bond market, could lead to generate shareholders value.
(2) At individual level, companies that have a rather stable presence on the cat bond market, though are not currently recording positive stock returns to the cat bonds' issuance, seem to exhibit a better perception in this respect from their investors when compared with those companies that new or enter rarely on this market.

As further research, at the level of this sample, the research could be complemented by considering a series of improvements encountered in the specialized cat bond literature: accounting for other structural features of the deals while analysing the results of issuing cat bonds for the ceding companies or considering other types of effects (both in terms of financial performance and risk).

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USING DIGITAL FREQUENCIES TO DETECT ANOMALIES IN RECEIVABLES AND PAYABLES: AN ANALYSIS OF THE ITALIAN UNIVERSITIES

Abstract

Motivation: The research aims at evaluating the anomalies and unusual patterns of accounting numbers reported by Italian universities.

Prior literature and evidence on local authorities suggest that failing institutions may engage in fraudulent financial reporting to conceal their distress and avoid regulatory intervention. They manipulate accounting values within the scope of the generally accepted accounting principles, using estimates and adjustments for achieving a desired result. Often, they overestimate the receivables and underestimate the payables in order to present a higher level of surplus or a minor deficit.

Therefore, the research examines the receivables and payables values contained in the financial reports of Italian universities during the years 2004-2012, hypothesizing that a gradual reduction of the ordinary funding from the Ministry, and the difficulty of attracting private resources, caused financial stress and led management to accounting manipulations.

Object and methodology: We apply a mathematical law, known as Benford's Law, to the receivables and payables reported values, obtained from the Statistical Office of the Ministry of Higher Education, for identifying the existence of manipulated numbers.

Benford's Law implies that, in a naturally occurring set of numbers, the leading digits of the numbers are discrete exponentially distributed rather than uniformly distributed, meaning that the numbers 1 through 9 do not have equal probability of occurring. In particular, the number 1 occurs as the leading digit about 30% of the time, while the number 9 occurs as the first digit less than 5% of the time. As Benford's Law shows that there is some predictability in the distribution of the first digit in a series of data, it can be used to indicate the presence of fictitious or artificially manipulated numbers.

Results: Surprisingly, the statistical tests show a large degree of compliance between the observed and the expected distributions. The conformity is clear and persistent over all the 9 years.

Keywords

Benford's Law, Italian univerisities, receivables and payables manipulations

1. The institutional context of Italian universities

The art. 33 of the Italian Constitution entrusts to the law the power to lay down the general rules for education and to establish public schools for all orders and degrees. The same article recognizes the private's right to establish schools and educational institutions, and states that they can adopt their own regulations within the limits set by the laws. Therefore, Italian education is a public good and a public responsibility, and universities, state and non-

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state they are, develop a public function serving the community. They are endowed with legal status and they have greater teaching, scientific, organizational, financial and accounting autonomy. In accordance to the New Public Management move, the conditions they have to respect derive from the role of the Ministry of Higher Education (MIUR) as a monitor of the universities' efficiency and effectiveness as well as the functionality of the whole higher education sector (Mandanici, 2011, pp. 5-30).

The expansion of university autonomy has been taking place since the Law n. 168/1989. The major change refers on the amount and modalities by which resources flow from national government to universities. Particularly, the Law n. 537/1993 provided a new funding formula, partially associated with results: each university receives a global lump-sum budget (called Fondo di Finanziamento Ordinario, briefly FFO), without previous stringent restrictions on internal allocations, shaped in accordance to both the educational and research performance. During the years, this system has been reinforced by the Law n. 244/2007 and the Legislative Decree n. 19/2012, according to which MIUR selects and rewards with additional funds those universities that had the ability to achieve their planned objectives.

The rise of public debt and the general crisis have contributed to accelerate the implementation of the financial autonomy. This phenomenon is common to other EU and OECD countries. Italy was among the countries that have set the main cut to the university sector: about 20% of the FFO from 2008 to 2013. This choice has appeared critical for the following reasons.

First, public funding represents, on average, close to 75% and 84% of, respectively, EU and OECD universities' financial structures (EUA 2011, p. 80; OECD 2013, p. 200), and in Italy the percentage rises to 90%.

Second, Italy traditionally invests in tertiary education a value consistently lower than the average of other countries. For example, in 2010 Italy has invested 1% of its GDP, while the EU and the OECD, respectively, 1,4% and 1,6%. Splitting the percentage between public and private funding, it appears more difficult for Italian universities to attract private resources than other countries: expenditure covered by individuals and business, in percentage of GDP, ranges from an average of 0,2% in Italy to 0,3% in EU and 0,5% in OECD countries.

Third, students contributions, or fees, potentially constitute the most directly available financial source. The amount of fees charged to students is however a choice that pertains to the national government, being related to the design of the fiscal policy of each country. In Italy, universities determine the level of tuition fees under a strait ceiling set by law: the art. 5 of the Decree of the President of the Republic n. 306/1997 states that the students contributions cannot exceed 20% of the annual FFO. Consequently, the cut in the public funding will also have the effect of diminishing the universities income from tuition fees.

These considerations show that Italian universities rely heavily on public funding. This means that any change can potentially have the highest impact on their stability and durability.

In the same period, the massification of higher education and the new societal demands on universities have increased costs they are confronted with.

The widening funding gap has put universities finances and financial reports even more under pressure. In order to conceal distress and avoid regulatory intervention, university managers may have been engaged in accounting manipulations. Therefore, this study aims at evaluating the anomalies and unusual patterns of accounting numbers reported by Italian universities in their financial reports.

The next section presents the characteristics of the financial report made by Italian universities, and explains why we chose to analyze the receivables and payables accounting numbers. The section 3 describes the methodology and introduces the mathematics relating to the Benford's Law used for the empirical investigation. Results are presented in the section 4, and the section 5 provides the conclusions.

2. The accounting system of Italian universities

The current accounting system of Italian universities is a cash accounting system, intended to register and control the revenues and expenses, measuring the change of the financial wealth over time.

Management operations are authorized through the budget approved by the Board of Directors. On the revenue side, the accounting records verify the right to collect the money, and the time of the money collection. On the expenditure side, the accounting entries verify the occurrence of the debt, then its liquidation, which certifies the execution of the service, and, finally, the payment. At the end of the year, the receivables are all the rights expected to collect in cash from third entities during next years, while the payables are obligations not paid yet to creditors. In one year, therefore, revenues may refer to the right to collect money verified in the current year, and to the right of the previous one or more years, that is receivables. Similarly, in the same year, payments can be linked to the debt occurred in the current year, and to the debt of the previous one or more years, that is the payables.

The financial report derives from the sequence of these operations, highlighting the balance between revenues and expenditures. If the result is positive, the surplus can be used during the next years to cover new spending and to make new investments; if negative, the deficit will have to be repaid with a policy aimed at reducing expenditures or increase revenues. The remedies have to be made within a time limit related to the amount of monetary stock: when it runs out, there will be a lack of liquidity, which will lead to financial crisis.

It might seem that a university whose report shows a surplus should not face a financial risk. However, the literature and empirical studies on the failure of local authorities (Gori et al., 2013; Manes Rossi, 2010; Cimbolini and Moriconi, 2009; Tenuta, 2008) demonstrate that the surplus does not always indicate the good performance of the institution. Particularly, the Italian Court of Auditors (2012) noted that, in the year preceding the declaration of insolvency, only a minority of the failed local authorities recorded a deficit. Obviously, these

institutions reached a surplus thanks to the manipulation of receivables and payables accounting numbers.

In a survey carried out by the Italian Ministry of Economy and Finance (MEF) (2009, p. 55), the receivables are considered among the most critical factors influencing the financial risk of the local authorities. Even the Court (2011, p. 412) indicates the presence of receivables as one of the most common causes of financial distress. Specially, the Court says that it is dangerous to keep in the financial report all the receivables overvalued, antiquated and bad, or at least those of difficult and doubtful collectability.

Indeed, according to the art. 228 of the Legislative Decree n. 267/2000 (known briefly as TUEL), the local authority has to review the reasons for maintaining all or part of the receivables in the financial report: it is not allowed to keep receivables that are difficult to turn into cash resources, since it involves an undue expansion of the surplus, or an erroneous deficit reduction. Similarly, it is necessary to eliminate payables related to debts taken out to finance works that have proved to be successful. This would free up resources no longer needed to fund expenses, transferring economies to the surplus.

The opposite behavior creates an accounting irregularity, and it hinders the clear and accurate representation of management operations.

However, the number of declarations of insolvency has decreased over time (Gori and Fissi, 2013, pp. 328-329), and it is less than the number of local authorities in financial distress (MEF, 2008, p. 60). This means that many administrators hide the deficit with unreal receivables, condemning their institution to remain or even increase the instability.

Many authors observe that public managers may engage in accounting manipulations to avoid the declaration of insolvency and the external compulsory administration. The current legislation states that local authorities should provide independently to its rehabilitation, without any financial help from the central government. This can lead the managers to dislike the declaration of insolvency, since the reorganization affects directly and totally on the local community. According to the previous regulation (the Legislative Decree n. 166/1989), the national government contributed to the financing of past debts of the local authorities. After the Constitutional Law n. 3/2001, the State can no longer help any entities with extraordinary contributions: all financial resources must be found through the sale of real estate assets, the cost savings, the services reduction, and the taxation. Therefore, today the local authority uses the declaration of insolvency only when management is undermined by the executive actions of creditors, and when, especially after inspections, there is a need to bring the budgets within the limits of the accounting and financial legitimacy, damaged by accounting manipulation.

Even university managers may engage in accounting manipulations to avoid the declaration of insolvency and the external compulsory administration. These tools are introduced by the Legislative Decree n. 199/2011, and they are in line with the current legislation on local authorities. Further, the decree defines a set of parameters that the board of auditors of each university has to apply to the financial report for assessing the state of insolvency (Villa,

2012). The subsequent Legislative Decree n. 49/2012 indicates the red flag level of these parameters and the conditions leading to the external compulsory administration.

We might assume that the university managers use estimates and adjustments to avoid the red flag level of the parameters. Specifically, they may overestimate the receivables and underestimate the payables in order to report a higher amount of surplus or a minor deficit, influencing the level of financial performance. Consequently, in the next section we examine the receivables and payables numbers contained in the financial reports of Italian universities, after a brief discussion on the meaning of accounting manipulation in a cash-based accounting system.

2.1. The accounting manipulations in a cash based accounting system

The concept of accounting manipulation arises in the private sector, and has become an issue of critical importance when the Enron, WorldCom and Tyco financial statement frauds rocked the financial community. Despite the growing literature on the subject, there is no common definition of the phenomenon, either it has been applied to the public sector.

In most cases, researchers argue that accounting manipulation tied to a profit aim, being a technique or a set of actions deliberately employed by managers to achieve a desired level of reported earning. Healy and Wahlen (1999, p. 368) consider it occurs «when managers use judgment in financial reporting and in structuring transactions to alter financial reports to either mislead some stakeholders about the underlying economic performance of the company or to influence contractual outcomes that depend on the reported accounting numbers».

There are many ways that managers can exercise judgments in financial reporting, and the range of manipulation can vary within the context of legal and illegal actions. In Italy, the law and the accepted accounting principles allow for a certain degree of interpretation and choices. To be legal, the interpretation has to be in keeping with their spirit. In general, accounting manipulation refers to a deliberated action that operates within the letter of the law and the accounting standards, but it is clearly against their spirit.

Practically, profit oriented entities may engage in accounting manipulations through, for example, the extension of the useful life of a depreciable asset or the change of inventory evaluation method from FIFO to LIFO.

Universities are public entities, and they do not have a profit aim. Consequently, they cannot manage the earning, but the financial aspect of their operations, determining the surplus or the deficit in the financial report. Therefore, on the revenue side, they can anticipate the accounting entries, or they can overvalue the receivables, or maintain those receivables which are difficult and doubtful to collect. On the expenditure side, they can postpone an accounting entries or a liquidation of a service already received.

Alternatively, managers may engage in fraudulent financial reporting techniques, such as falsification of documents and alteration of accounting records. These are clearly not within the standards.

Whatever is the technique, the intensity and the motivation for accounting manipulations, two research designs are commonly used in the literature to detect frauds and irregularities. The first approach uses the existence and amount of accruals as a proxy of earning management, hypothesizing that increased discretionary accruals indicate the opportunistic manipulations of financial reporting numbers. This approach can be used in the private sector, where the accounting system is accrual-based (Jones, 1991; Beneish, 1999).

The second approach tests the presence of accounting manipulation by examining the distributions of numbers in large sample of data. The abnormal digit frequencies indicate a manipulation of data sets. This approach is known as digit analysis, and we apply it because universities have used so far a cash accounting system.

3. Methodology

In an article published in the American Journal of Mathematics in 1881, the astronomer Simon Newcomb described a pattern, which was seemingly inexplicable, regarding the numbers. He (1881) observed: «That the ten digits do not occur with equal frequency must be evident to any one making much use of logarithmic tables, and noticing how much faster the first pages wear out than the last ones. The first significant figure is oftener 1 than any other digit, and the frequency diminishes up to 9».

Based on the above observation, Newcomb came to the conclusion that if we consider a sequence of positive real numbers and assuming that the mantissas of their logarithms are equally probable, then it is possible to determine the percentage of the numbers whose first digit is 1 up to 9. Similarly, it is possible to determine the percentages of the second digit (from 0 to 9), and so on up to n-th digit. He went so far as to sketch out the formula he expected the first digit to follow.

In particular, the probability of observing the digit d1 as the first significant digit (D1) of the number is computed as follows [1]:

$$Prob(D_1 = d_1) = \log_{10}\left(1 + \frac{1}{d_1}\right) \qquad d_1 \in \{1, 2, \dots 9\} \qquad [1]$$

The probability of the digit d_2 appearing as the second significant digit (D_2) is given by [2]:

$$Prob(D_2 = d_2) = \sum_{d_1=1}^{9} \log_{10}\left(1 + \frac{1}{d_1 d_2}\right) \qquad d_2 \in \{0, 1, \dots 9\} \qquad [2]$$

The table 1 shows the expected frequencies for the first digit (D_1) and the second digit (D_2) of a number. The frequencies of the first digits are heavily skewed with a probability of 30,1% for the digit 1, and only 4,58% for the digit 9. This is more evident in the Figure 1,

which graphically shows the expected frequencies for the first digit (D_1). The second digit frequencies are less skewed, with a probability of 11,97% for the digit 0, and 8,50% for the digit 9 (Figure 2).

d1/d2	0	1	2	3	4	5	6	7	8	9	**p(d1)**
1	0,0414	0,0378	0,0348	0,0322	0,0300	0,0280	0,0263	0,0248	0,0235	0,0223	**0,3010**
2	0,0212	0,0202	0,0193	0,0185	0,0177	0,0170	0,0164	0,0158	0,0152	0,0147	**0,1761**
3	0,0142	0,0138	0,0134	0,0130	0,0126	0,0122	0,0119	0,0116	0,0113	0,0110	**0,1249**
4	0,0107	0,0105	0,0102	0,0100	0,0098	0,0095	0,0093	0,0091	0,0090	0,0088	**0,0969**
5	0,0086	0,0084	0,0083	0,0081	0,0080	0,0078	0,0077	0,0076	0,0074	0,0073	**0,0792**
6	0,0072	0,0071	0,0069	0,0068	0,0067	0,0066	0,0065	0,0064	0,0063	0,0062	**0,0669**
7	0,0062	0,0061	0,0060	0,0059	0,0058	0,0058	0,0057	0,0056	0,0055	0,0055	**0,0580**
8	0,0054	0,0053	0,0053	0,0052	0,0051	0,0051	0,0050	0,0050	0,0049	0,0049	**0,0512**
9	0,0048	0,0047	0,0047	0,0046	0,0046	0,0045	0,0045	0,0045	0,0044	0,0044	**0,0458**
p(d2)	**0,1197**	**0,1139**	**0,1088**	**0,1043**	**0,1003**	**0,0967**	**0,0934**	**0,0904**	**0,0876**	**0,0850**	**1,0000**

Table 1: *Expected digital frequencies D_1 and D_2*

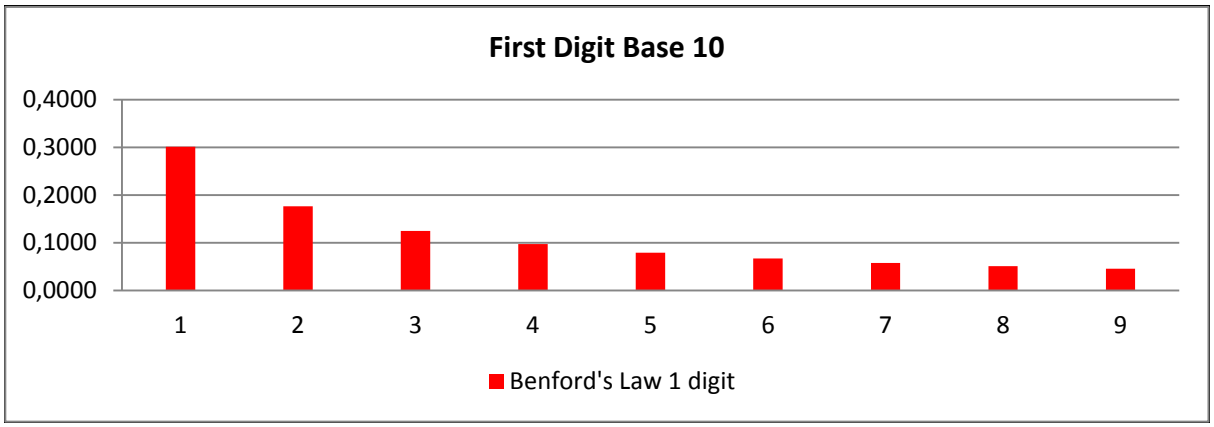

Figure 1: *Expected frequencies for the first digit D_1*

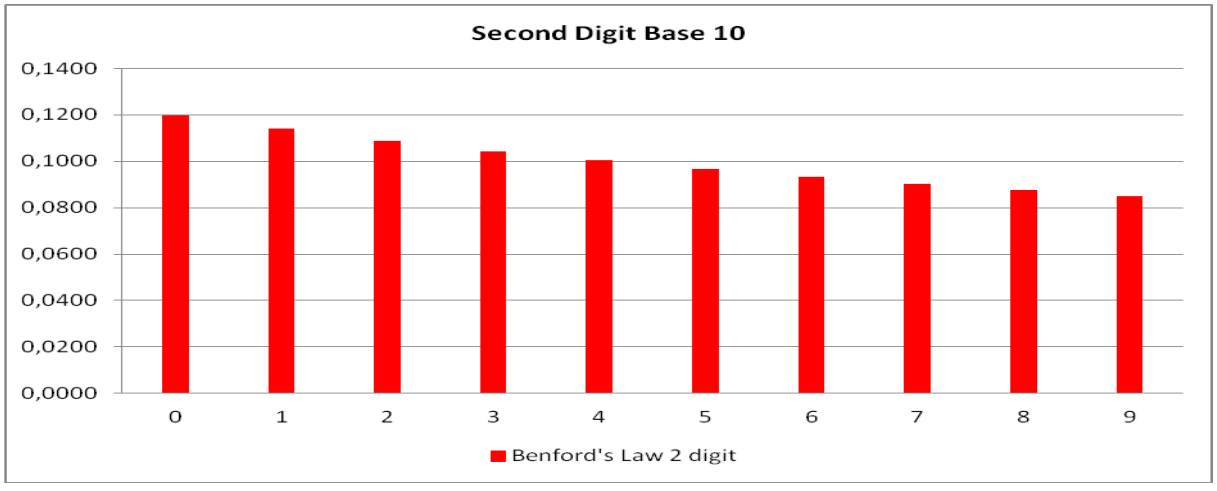

Figure 2: *Expected frequencies for the second digits D_2*

Many years later, the physicist at General Electric laboratories, Frank Benford, presented in a publication (1938) various numerical sequences (length of the rivers, populations sizes,

physical constants, etc...) that showed a surprisingly great adaptation to this logarithmic law. Since then, the law has been referred to as Benford's Law.

The fact that a series of random numbers respected Benford's Law has suggested using it to detect fraudulent data in applications as diverse as election campaign finance (Tam Cho and Gaines, 2007) and toxic gas emission (De Marchi and Hamilton, 2006). Among the fields of Benford's Law application, there are also accounting and financial statements (Ciaponi and Mandanici, 2014; Quick and Wolz, 2005; Durtschi et al., 2004; Skousen et al., 2004; Van Caneghem, 2002; Burgstahler and Dichev, 1997; Thomas, 1989; Carslaw, 1988), tax auditing (Watrin et al., 2008; Niskanen and Keloharju, 2000; Nigrini, 1996), and auditing procedures (Guan et al., 2006; Jackson and Pitman, 2001; Nigrini and Mittermainer, 1997). Generally, many studies addressed the earnings management issues through the use of Benford distribution. This is the first time it is applied to the cash-based accounting system adopted by universities.

Specifically, the research hypothesis are as follows:
H1: the observed distribution of receivables and payables numbers does not conform to the expected Benford's Law distribution, evidencing intentional manipulations.
H2: the degree of accounting manipulation grows when the ministerial funding decreases.

We expect that the result is consistent with the results of a recent survey conducted on the financial risk of the Italian state universities. Mandanici and Pace (2014) define and translate the financial risk factors in a series of 12 warning indicators of crisis, and they calculate a synthetic financial risk indicator as the sum of the scores recorded by each of them, for the years from 2009 to 2012. They found that the medium sized universities are riskier than small, large and very large universities. For many universities defined riskier, the results are matching to the facts reported in the major national newspapers, as for the University of Siena and the University of Pesaro-Urbino.

We can hypothesize that the riskier universities manipulate their reported values more frequently than the other universities. Therefore, in order to allow comparison, we can operate a stratification of the data in 4 macro classes, following the same dimensional criteria adopted in the cited survey.

3.1. Data collection

The analysis was conducted on the financial reports of the Italian universities provided by the Statistical Office of the MIUR. This ensures the consistency of the data collected. We excluded universities that have adopted the accrual-based accounting as well as universities whose data are lacking in one or more years from 2004 to 2012. The first column of the tables in the Appendix lists all the 61 analysed universities.

We can apply the Benford's Law to their receivables and payables reported numbers because they satisfy the following conditions (Nigrini, 2012):

- all the numbers are recorded in the same unit of measurement;
- the numbers do not have an arbitrary maximum and/or minimum cut-off point;

- the numbers are not assigned, such as personal identification numbers, invoice numbers and postal codes;
- the numbers are not influenced by human thought, such as psychological supermarket prices (which often have 9 as a last digit, like 1,99 €);
- the numbers do not have a wide dispersion (Raimi, 1976).

3.2. Testing methodology

We identify receivables and payables manipulations by searching for abnormal first digits and second digits frequencies in numbers recorded by each university in their 2004-2012 financial report. The degree of deviation from the Benford distribution is assessed by the Chi-squared test.

The most common tests are the Z-statistic and the Chi-square. The first test measures the significance of the deviation from the expected digit distribution for each digit separately. It is a digit-by-digit analysis that shows whether a single digit occurs more or less often than it is expected according to Benford's Law.

Our objective is to signal suspicious of receivables and payables manipulation during the years, and not what figures in the number are more or less frequently used.

Consequently, this research uses the Chi-square test, a test-by-test analysis, which compares the expected distribution over all digits with the observed distribution, indicating whether the observed distribution significantly differs from the expected one. The literature (Cleary and Thibodeau, 2005) also suggests the use of test-by-test analysis to catch data sets, which are under suspicion of having been manipulated, and the use of digit-by-digit analysis for an in-depth investigation regarding the causes behind the abnormality.
The Chi-square test is determined through the following equation [3]:

$$Chi - square = \sum_{i=1}^{K} \frac{(AC - EC)^2}{EC} \qquad [3]$$

where AC is the observed digit frequency, EC is the expected digit frequency according to Benford's Law, and K is the number of possible digits *I* in the first position in numbers (K = 9). The numerator is the residual of the compared distributions, squared in order to get rid of negative values. It is divided by the expected observations, to normalize bigger and smaller counts.

The conformity of the whole distribution is tested choosing an alpha level of significance. Generally, the alpha level varies according to the size of the sample observed from 0,05 to 0,01 or 0,001. We choose the level 0,05.

The appendix provides the results of the computed Chi-squared test of the first and the second digit of receivables and payables numbers. The test shows that the observed data are clearly correspondent with the Benford's distribution, during all the years 2004-2012. In other word, there is statistically no difference between the distribution of receivables and

payables numbers and the distribution expected from Benford's Law. The conformity is clear and persistent over all the 9 years. Therefore, the two hypothesis are rejected, and any dimensional stratification does not involve changes to the results.

4. Results and findings

The results provide empirical evidence that:

- the receivables and payables values conform to Benford's Law;
- during financial distress, universities did not carry out intentional manipulations.

The first result was expected, not the second. We tried the reasons and we have identified the following:

- the lack of legislation on financial distress of universities during the analysed years 2004-2011;
- the freedom to allocate public funding and private resources to different budget lines, independently from the MIUR.
-

The declaration of insolvency was introduced in the Italian universities only with the mentioned decrees in 2011 and 2012. Clearly, they can have a negative impact on key stakeholders, penalizing the financial and organizational autonomy, as well as the credibility of both the training and research conducted by the university. During the investigated period, universities have not been forced to heavy accounting manipulations by such a punitive legislation. Manipulations could be undertaken to achieve a balance between revenues and expenditure in financial reporting. Probably, universities will engage more frequently in accounting manipulations when this legislation comes into force. Such a behavior would be in line with that taken by local authorities as a result of the Constitutional Law n. 3/2001. In the absence of a state extraordinary contributions, all financial resources must be found within the university. Consequently, we expect that universities will resort to receivables and payables manipulation in order to avoid the declaration of insolvency.

We also expect a greater use of manipulations into the universities which cannot allocate their funds, independently from the MIUR, to the different budget lines. Therefore, the line-item funding systems may represent an incitement to manipulations in respect to the block-grant systems. The majority of the EU countries uses the block grant formula. The sum is split into broad categories and there are no or limited possibilities to move funds between these. This is the case of France, Portugal and Sweden. In Italy, like other EU countries such as UK, Norway, The Netherlands and Spain, in addition to the block grant funding formula, there are no restrictions on the internal allocation of funds, and, moreover, the surplus can be kept by universities without any external approval or amount limitation. This reduces the use of accounting manipulation among the different budget lines, because the liquidity is already employed by the single university for expenses considered strategically appropriated.

5. Conclusions

During the last years, there has been a general tendency of reforming traditional cash accounting of public entities towards business-like accrual accounting. In particular, through a long process started with the Legislative Decree n. 240/2010, the MIUR is reforming the university sector, putting on the same level the economic and financial conditions, and introducing, among other documents, the accrual accounting and the balance sheet. The main reason is that the cash accounting is perceived as being too much focused on a legislative control mechanism of public funds, without providing management information. On the contrary, the new accounting system aims at measuring academic assets and liabilities, and at improving performance management and long.term sustainability.

Therefore, future researches will have the opportunity to apply the Benford's Law to a long list of discretionary accruals, and not only to the receivables and payables numbers.

The novelty in the use of Benford's Law is that managers (and auditors) analyse the relationships between the elements of a data set of accruals to determine whether they are reasonable, focusing on the consistency of the data set as a whole rather than on the single value. More specifically, they could assume that the reported accruals follow Benford's Law, assigning an expected frequency to each number of a list. They could carry out a statistical analysis, and they should focus on the significant deviations of numbers from their expected values or their uncommon variation over particular periods: deviations might signal irregularities and might refer to numbers that have been deliberately manipulated.

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Appendix: *Chi-squared test on receivables and payables numbers from 2012 to 2004*

YEARS 2012	Receivables 1° digit	Number of observations	Receivables 2° digit	Number of observations	Payables 1° digit	Number of observations	Payables 2° digit	Number of observations
Polytechnic MARCHE	0,52	41	0,44	41	0,04	96	0,66	96
BARI	0,84	35	0,48	35	0,70	135	0,93	135
BOLOGNA	0,02	65	0,27	64	0,27	102	0,50	102
CAGLIARI	0,12	49	0,38	48	0,84	76	0,74	76
CASSINO	0,87	31	0,38	31	0,87	64	0,20	64
CATANIA	0,84	38	0,12	38	0,55	138	0,07	135
FERRARA	0,29	45	0,63	44	0,78	113	0,36	113
FIRENZE	0,05	34	0,22	34	0,93	123	0,27	123
GENOVA	0,39	56	0,35	56	0,07	95	0,59	95
SALENTO	0,93	36	0,94	36	0,41	107	0,83	107
MACERATA	0,40	35	0,08	34	0,64	80	0,34	80
MESSINA	0,83	36	0,51	35	0,91	128	0,98	128
MILANO	0,07	44	0,36	44	0,58	98	0,71	98
Polytechnic MILANO	0,11	35	0,82	34	0,38	97	0,96	97
MODENA and REGGIO EMILIA	0,04	50	0,39	50	0,75	122	0,07	121
NAPOLI Federico II	0,68	62	0,49	62	0,71	119	0,04	119
PADOVA	0,04	45	0,71	45	0,54	85	0,71	84
PALERMO	0,24	44	0,14	44	0,61	124	0,06	124
PARMA	0,68	17	0,38	16	0,68	76	0,73	74
PAVIA	0,25	57	0,40	57	0,72	114	0,90	111
PERUGIA	0,02	55	0,14	55	0,54	103	0,67	103
PISA	0,24	46	0,15	46	0,87	113	0,43	113
ROMA La Sapienza	0,88	52	0,47	52	0,24	121	0,50	120
ROMA Tor Vergata	0,15	42	0,04	42	0,69	88	0,39	88
SALERNO	0,98	50	0,17	50	0,80	123	0,57	123
SASSARI	0,54	50	0,11	50	0,06	112	0,52	112
SIENA	0,43	21	0,50	21	0,12	113	0,82	113
TORINO	0,49	75	0,25	75	0,15	106	0,60	106
VITERBO	1,00	48	0,31	48	0,28	107	0,47	107
VENEZIA Ca' Foscari	0,27	39	0,33	39	0,38	102	0,78	102
VENEZIA I.U.A.V.	0,48	30	0,37	30	0,72	85	0,25	85
BASILICATA	0,55	37	0,34	37	0,95	102	0,20	101
MOLISE	0,61	36	0,05	36	0,47	55	0,45	55
VERONA	0,46	32	0,28	32	0,34	102	0,54	100
NAPOLI Parthenope	0,56	32	0,80	32	0,27	106	0,39	106
NAPOLI L'Orientale	0,00	36	0,91	35	0,02	82	0,15	80
PISA Normale	0,47	19	0,55	19	0,43	70	0,30	70
PISA Sant'Anna	0,84	31	0,63	31	0,57	57	0,70	57
TRIESTE S.I.S.S.A.	0,30	24	0,08	24	0,67	87	0,12	86
BRESCIA	0,49	39	0,66	39	0,67	118	0,67	118
REGGIO CALABRIA	0,60	31	0,51	31	0,02	85	0,40	84
Polytechnic BARI	0,23	47	0,40	46	0,30	104	0,31	103
NAPOLI Seconda Università	0,19	40	0,72	40	0,06	99	0,05	98
BERGAMO	0,59	28	0,86	28	0,69	85	0,84	85
CHIETI-PESCARA	0,15	32	0,92	32	0,08	93	0,72	90
L'AQUILA	0,05	24	0,64	24	0,84	67	0,24	67
URBINO	0,09	26	0,24	25	0,32	89	0,26	88
University for Foreigners of SIENA	0,43	18	0,62	18	0,64	83	0,89	82
University for Foreigners of PERUGIA	0,14	24	0,61	24	0,08	56	0,99	56
ROMA TRE	0,63	30	0,68	30	0,55	73	0,32	72
TERAMO	0,77	27	0,19	27	0,07	88	0,75	88
ROMA Foro Italico	0,54	20	0,62	20	1,00	74	0,76	73

BENEVENTO	0,56	29	0,48	29	0,33	75	0,57	74
CATANZARO	0,12	34	0,30	34	0,68	75	0,45	74
MILANO Bicocca	0,11	43	0,38	40	0,61	101	0,91	101
INSUBRIA	0,61	40	0,32	40	0,91	81	0,62	80
PIEMONTE ORIENTALE	0,63	51	0,76	51	0,36	79	0,87	79
FOGGIA	0,84	33	0,12	33	0,29	104	0,83	103
PAVIA I.U.S.S.	0,82	17	0,48	17	0,71	62	0,50	61
LUCCA I.M.T.	0,83	18	0,73	18	0,52	76	0,75	76
FIRENZE S.U.M.	0,50	11	0,29	11	0,44	47	0,86	47

YEARS 2011	**Receivables 1° digit**	**Number of observations**	**Receivables 2° digit**	**Number of observations**	**Payables 1° digit**	**Number of observations**	**Payables 2° digit**	**Number of observations**
Polytechnic MARCHE	0,12	45	0,61	45	0,73	75	0,60	75
BARI	0,31	32	0,24	32	0,19	112	0,38	110
BOLOGNA	0,54	68	0,79	67	0,95	91	0,82	91
CAGLIARI	0,81	47	0,94	47	0,92	99	0,90	98
CASSINO	0,78	31	0,33	31	0,03	52	0,27	52
CATANIA	0,15	34	0,52	34	0,61	96	0,60	96
FERRARA	0,56	48	0,40	48	0,28	101	0,31	101
FIRENZE	0,26	35	0,08	35	0,64	112	0,97	112
GENOVA	0,91	57	0,73	60	0,33	98	0,75	98
SALENTO	0,49	41	0,87	41	0,95	107	0,45	107
MACERATA	0,59	33	0,30	33	0,58	80	0,79	80
MESSINA	0,85	31	0,87	31	0,03	128	0,92	128
MILANO	0,20	44	0,65	44	0,75	98	0,24	98
Polytechnic MILANO	0,85	40	0,55	40	0,21	97	0,17	97
MODENA and REGGIO EMILIA	0,18	49	0,18	49	0,80	122	0,40	122
NAPOLI Federico II	0,74	60	0,65	60	0,65	119	0,19	119
PADOVA	0,10	43	0,38	43	0,49	85	0,90	85
PALERMO	0,15	44	0,56	44	0,89	124	0,68	124
PARMA	0,57	18	0,82	18	0,36	76	0,08	76
PAVIA	0,06	54	0,10	54	0,90	114	0,24	114
PERUGIA	0,15	61	0,21	61	0,75	103	0,20	103
PISA	0,61	48	0,56	48	0,68	113	0,76	113
ROMA La Sapienza	0,76	50	0,09	50	0,75	121	0,21	121
ROMA Tor Vergata	0,10	41	0,66	41	0,28	88	0,42	88
SALERNO	0,79	53	0,58	53	0,17	123	0,50	123
SASSARI	0,63	50	0,11	50	0,78	112	0,28	112
SIENA	0,06	23	0,20	23	0,53	113	0,51	113
TORINO	0,62	78	0,80	78	0,69	106	0,61	106
VITERBO	0,45	46	0,35	46	0,38	107	0,52	107
VENEZIA Ca' Foscari	0,64	50	0,46	50	0,66	102	0,55	102
VENEZIA I.U.A.V.	0,46	29	0,02	29	0,24	85	0,12	85
BASILICATA	0,71	38	0,20	38	0,69	102	0,19	102
MOLISE	0,69	44	0,11	44	0,26	55	0,11	55
VERONA	0,73	34	0,06	34	0,14	102	0,21	102
NAPOLI Parthenope	0,44	32	0,59	32	0,49	106	0,89	106
NAPOLI L'Orientale	0,45	34	0,16	33	0,49	82	0,64	82
PISA Normale	0,41	22	0,69	22	0,58	70	0,38	70
PISA Sant'Anna	0,95	40	0,03	40	0,39	57	0,14	57
TRIESTE S.I.S.S.A.	0,00	27	0,59	27	0,70	87	0,25	87
BRESCIA	0,40	38	0,59	38	0,61	118	0,27	118
REGGIO CALABRIA	0,92	34	0,88	34	0,34	85	0,68	85
Polytechnic BARI	0,51	49	0,93	48	0,46	104	0,17	104
NAPOLI Seconda Università	0,12	37	0,28	37	0,49	99	0,24	99
BERGAMO	0,18	27	0,10	27	0,81	85	0,46	85
CHIETI-PESCARA	0,39	32	0,12	32	0,70	93	0,37	93
L'AQUILA	0,47	25	0,42	25	0,88	67	0,81	67
URBINO	0,58	30	0,01	30	0,71	89	0,52	89

University for Foreigners of SIENA	0,08	23	0,65	23	0,19	83	0,78	83
University for Foreigners of PERUGIA	0,00	20	0,12	19	0,21	56	0,80	56
ROMA TRE	0,61	26	0,02	26	0,10	73	0,42	73
TERAMO	0,76	27	0,31	27	0,70	88	0,24	88
ROMA Foro Italico	0,40	26	0,52	26	0,44	74	0,29	74
BENEVENTO	0,85	30	0,81	30	0,42	75	0,72	75
CATANZARO	0,20	34	0,04	32	0,31	75	0,23	75
MILANO Bicocca	0,26	45	0,26	43	0,55	101	0,81	101
INSUBRIA	0,26	45	0,26	43	0,71	81	0,45	81
PIEMONTE ORIENTALE	0,67	59	0,62	59	0,10	79	0,87	79
FOGGIA	0,76	35	0,42	35	0,26	104	0,40	104
PAVIA I.U.S.S.	0,66	14	0,39	14	0,78	62	0,67	62
LUCCA I.M.T.	0,22	16	0,50	16	0,70	76	0,23	76
FIRENZE S.U.M.	0,17	12	0,97	12	0,54	47	0,22	47

YEARS 2010	**Receivables 1° digit**	**Number of observations**	**Receivables 2° digit**	**Number of observations**	**Payables 1° digit**	**Number of observations**	**Payables 2° digit**	**Number of observations**
Polytechnic MARCHE	0,55	42	0,56	42	0,70	77	0,20	77
BARI	0,86	31	0,24	31	0,19	114	0,38	114
BOLOGNA	0,48	70	0,79	70	0,95	94	0,82	94
CAGLIARI	0,74	44	0,94	44	0,92	99	0,90	99
CASSINO	0,29	30	0,33	30	0,03	51	0,27	51
CATANIA	0,25	37	0,52	37	0,61	97	0,60	97
FERRARA	0,17	48	0,40	48	0,28	101	0,31	101
FIRENZE	0,67	33	0,08	33	0,64	113	0,97	113
GENOVA	0,91	58	0,73	58	0,57	99	0,50	99
SALENTO	0,61	40	0,87	40	0,28	110	0,62	110
MACERATA	0,47	32	0,30	32	0,98	79	0,21	79
MESSINA	0,62	29	0,87	29	0,51	128	0,09	128
MILANO	0,13	42	0,65	42	0,92	100	0,33	100
Polytechnic MILANO	0,41	38	0,55	38	0,79	98	0,84	98
MODENA and REGGIO EMILIA	0,24	47	0,18	47	0,92	125	0,67	125
NAPOLI Federico II	0,7	57	0,65	57	0,80	121	0,48	121
PADOVA	0,88	45	0,38	45	0,58	86	0,54	86
PALERMO	0,21	45	0,56	45	0,21	121	0,63	121
PARMA	0,37	18	0,82	18	0,20	76	0,71	76
PAVIA	0,19	53	0,10	53	0,45	115	0,30	115
PERUGIA	0,61	64	0,21	64	0,79	102	0,44	102
PISA	0,63	48	0,56	48	0,21	112	0,23	112
ROMA La Sapienza	0,24	53	0,09	53	0,28	123	0,32	123
ROMA Tor Vergata	0,68	40	0,66	40	0,09	89	0,85	89
SALERNO	0,65	54	0,58	54	0,24	124	0,79	124
SASSARI	0,29	49	0,11	49	0,92	110	0,30	110
SIENA	0,12	24	0,20	24	0,57	115	0,78	115
TORINO	0,74	79	0,80	79	0,33	109	0,54	109
VITERBO	0,21	45	0,35	45	0,15	105	0,31	105
VENEZIA Ca' Foscari	0,36	53	0,46	53	0,09	99	0,19	99
VENEZIA I.U.A.V.	0,73	26	0,02	26	0,63	84	0,31	84
BASILICATA	0,86	37	0,20	37	0,30	102	0,38	102
MOLISE	0,27	43	0,11	43	0,83	54	0,12	54
VERONA	0,54	32	0,06	32	0,46	103	0,16	103
NAPOLI Parthenope	0,81	33	0,59	33	0,37	106	0,76	106
NAPOLI L'Orientale	0,44	32	0,16	32	0,33	84	0,60	84
PISA Normale	0,11	24	0,69	24	0,42	67	0,14	67
PISA Sant'Anna	0,1	39	0,03	39	0,35	57	0,19	57
TRIESTE S.I.S.S.A.	0,89	25	0,59	25	0,83	89	0,83	89
BRESCIA	0,79	40	0,59	40	0,15	121	0,18	121
REGGIO CALABRIA	0,81	37	0,88	37	0,90	88	0,20	88

Polytechnic BARI	0,35	48	0,93	48	0,10	101	0,36	101
NAPOLI Seconda Università	0,62	40	0,28	40	0,92	100	0,78	100
BERGAMO	0,26	30	0,10	30	0,30	82	0,76	82
CHIETI-PESCARA	0,73	34	0,12	34	0,65	96	0,84	96
L'AQUILA	0,89	25	0,42	25	0,10	64	0,54	64
URBINO	0,66	32	0,01	32	0,22	86	0,58	86
University for Foreigners of SIENA	0,54	20	0,65	20	0,47	84	0,59	84
University for Foreigners of PERUGIA	0,25	21	0,12	21	0,16	56	0,34	56
ROMA TRE	0,39	24	0,02	24	0,21	70	0,73	70
TERAMO	0,5	27	0,31	27	0,27	91	0,82	91
ROMA Foro Italico	0,36	23	0,52	23	0,28	76	0,74	76
BENEVENTO	0,36	29	0,81	29	0,38	78	0,64	78
CATANZARO	0,45	31	0,04	31	0,28	76	0,11	76
MILANO Bicocca	0,67	43	0,26	43	0,16	100	0,73	100
INSUBRIA	0,86	48	0,26	48	0,21	78	0,23	78
PIEMONTE ORIENTALE	0,21	62	0,62	62	0,65	78	0,83	78
FOGGIA	0,59	37	0,42	37	0,84	101	0,70	101
PAVIA I.U.S.S.	0,64	16	0,39	16	0,19	62	0,21	62
LUCCA I.M.T.	0,11	19	0,50	19	0,45	79	0,53	79
FIRENZE S.U.M.	0,56	14	0,97	14	0,35	45	0,15	45

YEARS 2009	**Receivables 1° digit**	**Number of observations**	**Receivables 2° digit**	**Number of observations**	**Payables 1° digit**	**Number of observations**	**Payables 2° digit**	**Number of observations**
Polytechnic MARCHE	0,25	44	0,62	44	0,72	76	0,48	76
BARI	0,23	33	0,24	33	0,19	114	0,38	114
BOLOGNA	0,52	69	0,79	69	0,95	92	0,82	92
CAGLIARI	0,55	45	0,94	45	0,92	96	0,90	96
CASSINO	0,09	27	0,33	27	0,03	50	0,27	50
CATANIA	0,63	37	0,52	37	0,61	100	0,60	100
FERRARA	0,37	46	0,40	46	0,28	101	0,31	101
FIRENZE	0,89	33	0,08	33	0,64	111	0,97	111
GENOVA	0,3	57	0,73	57	0,57	97	0,50	97
SALENTO	0,5	41	0,87	41	0,28	108	0,62	108
MACERATA	0,61	29	0,30	29	0,98	79	0,21	79
MESSINA	0,15	30	0,87	30	0,51	131	0,09	131
MILANO	0,16	41	0,65	41	0,92	100	0,33	100
Polytechnic MILANO	0,82	39	0,55	39	0,79	100	0,84	100
MODENA and REGGIO EMILIA	0,66	45	0,18	45	0,92	123	0,67	123
NAPOLI Federico II	0,15	58	0,65	58	0,80	122	0,48	122
PADOVA	0,35	48	0,38	48	0,58	88	0,54	88
PALERMO	0,44	42	0,56	42	0,21	122	0,63	122
PARMA	0,73	17	0,82	17	0,20	77	0,71	77
PAVIA	0,58	50	0,10	50	0,45	115	0,30	115
PERUGIA	0,24	61	0,21	61	0,79	105	0,44	105
PISA	0,64	47	0,56	47	0,21	112	0,23	112
ROMA La Sapienza	0,09	50	0,09	50	0,28	120	0,32	120
ROMA Tor Vergata	0,59	37	0,66	37	0,09	91	0,85	91
SALERNO	0,31	56	0,58	56	0,24	126	0,79	126
SASSARI	0,23	48	0,11	48	0,92	112	0,30	112
SIENA	0,73	27	0,20	27	0,57	113	0,78	113
TORINO	0,76	82	0,80	82	0,33	112	0,54	112
VITERBO	0,52	45	0,35	45	0,15	104	0,31	104
VENEZIA Ca' Foscari	0,76	55	0,46	55	0,09	96	0,19	96
VENEZIA I.U.A.V.	0,45	28	0,02	28	0,63	83	0,31	83
BASILICATA	0,86	40	0,20	40	0,30	99	0,38	99
MOLISE	0,28	43	0,11	43	0,83	52	0,12	52
VERONA	0,83	30	0,06	30	0,46	106	0,16	106

NAPOLI Parthenope	0,81	35	0,59	35	0,37	105	0,76	105
NAPOLI L'Orientale	0,51	34	0,16	34	0,33	87	0,60	87
PISA Normale	0,36	25	0,69	25	0,42	67	0,14	67
PISA Sant'Anna	0,63	41	0,03	41	0,35	57	0,19	57
TRIESTE S.I.S.S.A.	0,22	23	0,59	23	0,83	86	0,83	86
BRESCIA	0,69	42	0,59	42	0,15	119	0,18	119
REGGIO CALABRIA	0,62	35	0,88	35	0,90	87	0,20	87
Polytechnic BARI	0,39	47	0,93	47	0,10	102	0,36	102
NAPOLI Seconda Università	0,34	39	0,28	39	0,92	97	0,78	97
BERGAMO	0,78	30	0,10	30	0,30	80	0,76	80
CHIETI-PESCARA	0,28	31	0,12	31	0,65	95	0,84	95
L'AQUILA	0,56	23	0,42	23	0,10	65	0,54	65
URBINO	0,08	35	0,01	35	0,22	84	0,58	84
University for Foreigners of SIENA	0,56	17	0,65	17	0,47	81	0,59	81
University for Foreigners of PERUGIA	0,55	19	0,12	19	0,16	59	0,34	59
ROMA TRE	0,38	27	0,02	27	0,21	73	0,73	73
TERAMO	0,91	27	0,31	27	0,27	90	0,82	90
ROMA Foro Italico	0,52	23	0,52	23	0,28	76	0,74	76
BENEVENTO	0,15	27	0,81	27	0,38	79	0,64	79
CATANZARO	0,62	32	0,04	32	0,28	73	0,11	73
MILANO Bicocca	0,56	42	0,26	42	0,16	103	0,73	103
INSUBRIA	0,2	47	0,26	47	0,21	78	0,23	78
PIEMONTE ORIENTALE	0,47	64	0,62	64	0,65	75	0,83	75
FOGGIA	0,67	37	0,42	37	0,84	104	0,70	104
PAVIA I.U.S.S.	0,63	19	0,39	19	0,19	63	0,21	63
LUCCA I.M.T.	0,34	17	0,50	17	0,45	80	0,53	80
FIRENZE S.U.M.	0,73	13	0,97	13	0,35	45	0,15	45

YEARS 2008	**Receivables 1° digit**	**Number of observations**	**Receivables 2° digit**	**Number of observations**	**Payables 1° digit**	**Number of observations**	**Payables 2° digit**	**Number of observations**
Polytechnic MARCHE	0,55	46	0,12	46	0,56	78	0,23	78
BARI	0,92	31	0,24	31	0,19	115	0,38	115
BOLOGNA	0,77	66	0,79	66	0,95	92	0,82	92
CAGLIARI	0,41	48	0,94	48	0,92	93	0,90	93
CASSINO	0,43	30	0,33	30	0,03	48	0,27	48
CATANIA	0,25	40	0,52	40	0,61	102	0,60	102
FERRARA	0,56	44	0,40	44	0,28	99	0,31	99
FIRENZE	0,82	36	0,08	36	0,64	110	0,97	110
GENOVA	0,40	59	0,73	59	0,57	98	0,50	98
SALENTO	0,34	40	0,87	40	0,28	111	0,62	111
MACERATA	0,25	26	0,30	26	0,98	77	0,21	77
MESSINA	0,53	30	0,87	30	0,51	129	0,09	129
MILANO	0,24	41	0,65	41	0,92	101	0,33	101
Polytechnic MILANO	0,50	40	0,55	40	0,79	97	0,84	97
MODENA and REGGIO EMILIA	0,20	46	0,18	46	0,92	120	0,67	120
NAPOLI Federico II	0,70	60	0,65	60	0,80	123	0,48	123
PADOVA	0,83	46	0,38	46	0,58	89	0,54	89
PALERMO	0,52	44	0,56	44	0,21	125	0,63	125
PARMA	0,55	15	0,82	15	0,20	74	0,71	74
PAVIA	0,56	53	0,10	53	0,45	118	0,30	118
PERUGIA	0,87	63	0,21	63	0,79	104	0,44	104
PISA	0,17	45	0,56	45	0,21	109	0,23	109
ROMA La Sapienza	0,71	50	0,09	50	0,28	121	0,32	121
ROMA Tor Vergata	0,16	39	0,66	39	0,09	94	0,85	94
SALERNO	0,53	53	0,58	53	0,24	127	0,79	127
SASSARI	0,78	47	0,11	47	0,92	115	0,30	115
SIENA	0,54	25	0,20	25	0,57	115	0,78	115

TORINO	0,50	83	0,80	83	0,33	112	0,54	112
VITERBO	0,36	42	0,35	42	0,15	106	0,31	106
VENEZIA Ca' Foscari	0,20	58	0,46	58	0,09	97	0,19	97
VENEZIA I.U.A.V.	0,75	27	0,02	27	0,63	82	0,31	82
BASILICATA	0,29	40	0,20	40	0,30	99	0,38	99
MOLISE	0,20	46	0,11	46	0,83	50	0,12	50
VERONA	0,45	32	0,06	32	0,46	107	0,16	107
NAPOLI Parthenope	0,08	37	0,59	37	0,37	103	0,76	103
NAPOLI L'Orientale	0,70	33	0,16	33	0,33	90	0,60	90
PISA Normale	0,17	25	0,69	25	0,42	64	0,14	64
PISA Sant'Anna	0,42	40	0,03	40	0,35	55	0,19	55
TRIESTE S.I.S.S.A.	0,36	22	0,59	22	0,83	88	0,83	88
BRESCIA	0,09	39	0,59	39	0,15	122	0,18	122
REGGIO CALABRIA	0,76	34	0,88	34	0,90	86	0,20	86
Polytechnic BARI	0,38	49	0,93	49	0,10	105	0,36	105
NAPOLI Seconda Università	0,22	39	0,28	39	0,92	98	0,78	98
BERGAMO	0,69	33	0,10	33	0,30	81	0,76	81
CHIETI-PESCARA	0,20	32	0,12	32	0,65	97	0,84	97
L'AQUILA	0,89	26	0,42	26	0,10	66	0,54	66
URBINO	0,52	32	0,01	32	0,22	81	0,58	81
University for Foreigners of SIENA	0,78	16	0,65	16	0,47	84	0,59	84
University for Foreigners of PERUGIA	0,56	20	0,12	20	0,16	60	0,34	60
ROMA TRE	0,63	28	0,02	28	0,21	72	0,73	72
TERAMO	0,85	30	0,31	30	0,27	91	0,82	91
ROMA Foro Italico	0,44	24	0,52	24	0,28	77	0,74	77
BENEVENTO	0,14	26	0,81	26	0,38	76	0,64	76
CATANZARO	0,80	35	0,04	35	0,28	71	0,11	71
MILANO Bicocca	0,87	43	0,26	43	0,16	100	0,73	100
INSUBRIA	0,18	46	0,26	46	0,21	75	0,23	75
PIEMONTE ORIENTALE	0,21	65	0,62	65	0,65	73	0,83	73
FOGGIA	0,44	39	0,42	39	0,84	107	0,70	107
PAVIA I.U.S.S.	0,24	22	0,39	22	0,19	62	0,21	62
LUCCA I.M.T.	0,13	20	0,50	20	0,45	79	0,53	79
FIRENZE S.U.M.	0,33	13	0,97	13	0,35	45	0,15	45

YEARS 2007	**Receivables 1° digit**	**Number of observations**	**Receivables 2° digit**	**Number of observations**	**Payables 1° digit**	**Number of observations**	**Payables 2° digit**	**Number of observations**
Polytechnic MARCHE	0,65	47	0,13	47	0,61	79	0,80	79
BARI	0,30	31	0,24	31	0,19	116	0,38	116
BOLOGNA	0,46	63	0,79	63	0,95	89	0,82	89
CAGLIARI	0,20	46	0,94	46	0,92	91	0,90	91
CASSINO	0,15	29	0,33	29	0,03	48	0,27	48
CATANIA	0,22	39	0,52	39	0,61	103	0,60	103
FERRARA	0,33	44	0,40	44	0,28	102	0,31	102
FIRENZE	0,10	37	0,08	37	0,64	113	0,97	113
GENOVA	0,38	56	0,73	56	0,57	96	0,50	96
SALENTO	0,40	39	0,87	39	0,28	114	0,62	114
MACERATA	0,67	24	0,30	24	0,98	80	0,21	80
MESSINA	0,24	28	0,87	28	0,51	129	0,09	129
MILANO	0,42	44	0,65	44	0,92	103	0,33	103
Polytechnic MILANO	0,11	40	0,55	40	0,79	96	0,84	96
MODENA and REGGIO EMILIA	0,22	48	0,18	48	0,92	121	0,67	121
NAPOLI Federico II	0,25	57	0,65	57	0,80	124	0,48	124
PADOVA	0,16	44	0,38	44	0,58	91	0,54	91
PALERMO	0,69	47	0,56	47	0,21	124	0,63	124
PARMA	0,77	17	0,82	17	0,20	71	0,71	71
PAVIA	0,76	51	0,10	51	0,45	119	0,30	119

PERUGIA	0,39	64	0,21	64	0,79	107	0,44	107
PISA	0,63	48	0,56	48	0,21	106	0,23	106
ROMA La Sapienza	0,08	51	0,09	51	0,28	120	0,32	120
ROMA Tor Vergata	0,19	36	0,66	36	0,09	97	0,85	97
SALERNO	0,84	56	0,58	56	0,24	129	0,79	129
SASSARI	0,78	50	0,11	50	0,92	115	0,30	115
SIENA	0,78	26	0,20	26	0,57	115	0,78	115
TORINO	0,32	81	0,80	81	0,33	112	0,54	112
VITERBO	0,90	45	0,35	45	0,15	105	0,31	105
VENEZIA Ca' Foscari	0,90	61	0,46	61	0,09	94	0,19	94
VENEZIA I.U.A.V.	0,72	25	0,02	25	0,63	81	0,31	81
BASILICATA	0,60	38	0,20	38	0,30	100	0,38	100
MOLISE	0,38	48	0,11	48	0,83	50	0,12	50
VERONA	0,65	29	0,06	29	0,46	110	0,16	110
NAPOLI Parthenope	0,59	37	0,59	37	0,37	105	0,76	105
NAPOLI L'Orientale	0,90	34	0,16	34	0,33	89	0,60	89
PISA Normale	0,78	25	0,69	25	0,42	66	0,14	66
PISA Sant'Anna	0,54	41	0,03	41	0,35	53	0,19	53
TRIESTE S.I.S.S.A.	0,13	25	0,59	25	0,83	87	0,83	87
BRESCIA	0,26	42	0,59	42	0,15	120	0,18	120
REGGIO CALABRIA	0,30	34	0,88	34	0,90	85	0,20	85
Polytechnic BARI	0,64	49	0,93	49	0,10	106	0,36	106
NAPOLI Seconda Università	0,47	36	0,28	36	0,92	97	0,78	97
BERGAMO	0,41	32	0,10	32	0,30	79	0,76	79
CHIETI-PESCARA	0,70	31	0,12	31	0,65	94	0,84	94
L'AQUILA	0,34	23	0,42	23	0,10	66	0,54	66
URBINO	0,44	30	0,01	30	0,22	84	0,58	84
University for Foreigners of SIENA	0,63	15	0,65	15	0,47	84	0,59	84
University for Foreigners of PERUGIA	0,61	17	0,12	17	0,16	62	0,34	62
ROMA TRE	0,48	27	0,02	27	0,21	75	0,73	75
TERAMO	0,13	33	0,31	33	0,27	91	0,82	91
ROMA Foro Italico	0,24	27	0,52	27	0,28	76	0,74	76
BENEVENTO	0,70	25	0,81	25	0,38	73	0,64	73
CATANZARO	0,67	35	0,04	35	0,28	68	0,11	68
MILANO Bicocca	0,79	46	0,26	46	0,16	100	0,73	100
INSUBRIA	0,72	48	0,26	48	0,21	73	0,23	73
PIEMONTE ORIENTALE	0,53	64	0,62	64	0,65	72	0,83	72
FOGGIA	0,34	40	0,42	40	0,84	104	0,70	104
PAVIA I.U.S.S.	0,33	24	0,39	24	0,19	64	0,21	64
LUCCA I.M.T.	0,30	19	0,50	19	0,45	78	0,53	78
FIRENZE S.U.M.	0,11	12	0,97	12	0,35	45	0,15	45

YEARS 2006	**Receivables 1° digit**	**Number of observations**	**Receivables 2° digit**	**Number of observations**	**Payables 1° digit**	**Number of observations**	**Payables 2° digit**	**Number of observations**
Polytechnic MARCHE	0,29	45	0,68	45	0,22	77	0,38	77
BARI	0,56	31	0,24	31	0,19	119	0,38	119
BOLOGNA	0,28	65	0,79	65	0,95	86	0,82	86
CAGLIARI	0,60	43	0,94	43	0,92	91	0,90	91
CASSINO	0,53	27	0,33	27	0,03	49	0,27	49
CATANIA	0,63	38	0,52	38	0,61	105	0,60	105
FERRARA	0,80	46	0,40	46	0,28	99	0,31	99
FIRENZE	0,77	35	0,08	35	0,64	111	0,97	111
GENOVA	0,74	53	0,73	53	0,57	97	0,50	97
SALENTO	0,18	36	0,87	36	0,28	112	0,62	112
MACERATA	0,74	25	0,30	25	0,98	83	0,21	83
MESSINA	0,83	25	0,87	25	0,51	130	0,09	130
MILANO	0,76	41	0,65	41	0,92	101	0,33	101
Polytechnic MILANO	0,39	43	0,55	43	0,79	93	0,84	93

MODENA and REGGIO EMILIA	0,25	51	0,18	51	0,92	118	0,67	118
NAPOLI Federico II	0,69	56	0,65	56	0,80	121	0,48	121
PADOVA	0,44	43	0,38	43	0,58	93	0,54	93
PALERMO	0,38	49	0,56	49	0,21	122	0,63	122
PARMA	0,20	17	0,82	17	0,20	68	0,71	68
PAVIA	0,72	53	0,10	53	0,45	118	0,30	118
PERUGIA	0,46	61	0,21	61	0,79	106	0,44	106
PISA	0,92	49	0,56	49	0,21	109	0,23	109
ROMA La Sapienza	0,32	52	0,09	52	0,28	123	0,32	123
ROMA Tor Vergata	0,53	38	0,66	38	0,09	97	0,85	97
SALERNO	0,49	55	0,58	55	0,24	126	0,79	126
SASSARI	0,16	53	0,11	53	0,92	118	0,30	118
SIENA	0,35	24	0,20	24	0,57	115	0,78	115
TORINO	0,85	80	0,80	80	0,33	113	0,54	113
VITERBO	0,40	44	0,35	44	0,15	107	0,31	107
VENEZIA Ca' Foscari	0,21	59	0,46	59	0,09	91	0,19	91
VENEZIA I.U.A.V.	0,41	23	0,02	23	0,63	81	0,31	81
BASILICATA	0,50	38	0,20	38	0,30	99	0,38	99
MOLISE	0,45	51	0,11	51	0,83	52	0,12	52
VERONA	0,47	28	0,06	28	0,46	111	0,16	111
NAPOLI Parthenope	0,70	39	0,59	39	0,37	108	0,76	108
NAPOLI L'Orientale	0,87	31	0,16	31	0,33	92	0,60	92
PISA Normale	0,46	23	0,69	23	0,42	69	0,14	69
PISA Sant'Anna	0,33	39	0,03	39	0,35	51	0,19	51
TRIESTE S.I.S.S.A.	0,44	24	0,59	24	0,83	86	0,83	86
BRESCIA	0,77	40	0,59	40	0,15	121	0,18	121
REGGIO CALABRIA	0,75	36	0,88	36	0,90	87	0,20	87
Polytechnic BARI	0,13	48	0,93	48	0,10	105	0,36	105
NAPOLI Seconda Università	0,31	37	0,28	37	0,92	95	0,78	95
BERGAMO	0,92	30	0,10	30	0,30	78	0,76	78
CHIETI-PESCARA	0,85	34	0,12	34	0,65	93	0,84	93
L'AQUILA	0,65	21	0,42	21	0,10	67	0,54	67
URBINO	0,32	30	0,01	30	0,22	86	0,58	86
University for Foreigners of SIENA	0,21	14	0,65	14	0,47	82	0,59	82
University for Foreigners of PERUGIA	0,46	17	0,12	17	0,16	65	0,34	65
ROMA TRE	0,28	26	0,02	26	0,21	78	0,73	78
TERAMO	0,16	36	0,31	36	0,27	92	0,82	92
ROMA Foro Italico	0,81	25	0,52	25	0,28	76	0,74	76
BENEVENTO	0,35	28	0,81	28	0,38	76	0,64	76
CATANZARO	0,73	37	0,04	37	0,28	71	0,11	71
MILANO Bicocca	0,86	48	0,26	48	0,16	100	0,73	100
INSUBRIA	0,33	45	0,26	45	0,21	76	0,23	76
PIEMONTE ORIENTALE	0,50	64	0,62	64	0,65	72	0,83	72
FOGGIA	0,09	43	0,42	43	0,84	102	0,70	102
PAVIA I.U.S.S.	0,42	25	0,39	25	0,19	61	0,21	61
LUCCA I.M.T.	0,34	17	0,50	17	0,45	76	0,53	76
FIRENZE S.U.M.	0,80	9	0,97	9	0,35	46	0,15	46

YEARS 2005	**Receivables 1° digit**	**Number of observations**	**Receivables 2° digit**	**Number of observations**	**Payables 1° digit**	**Number of observations**	**Payables 2° digit**	**Number of observations**
Polytechnic MARCHE	0,15	44	0,22	44	0,62	74	0,09	74
BARI	0,40	31	0,24	31	0,19	117	0,38	117
BOLOGNA	0,76	68	0,79	68	0,95	85	0,82	85
CAGLIARI	0,49	42	0,94	42	0,92	94	0,90	94
CASSINO	0,63	24	0,33	24	0,03	46	0,27	46
CATANIA	0,29	41	0,52	41	0,61	106	0,60	106
FERRARA	0,80	45	0,40	45	0,28	99	0,31	99

FIRENZE	0,42	36	0,08	36	0,64	108	0,97	108
GENOVA	0,15	51	0,73	51	0,57	97	0,50	97
SALENTO	0,62	34	0,87	34	0,28	115	0,62	115
MACERATA	0,14	25	0,30	25	0,98	85	0,21	85
MESSINA	0,76	24	0,87	24	0,51	127	0,09	127
MILANO	0,54	43	0,65	43	0,92	104	0,33	104
Polytechnic MILANO	0,78	46	0,55	46	0,79	90	0,84	90
MODENA and REGGIO EMILIA	0,62	51	0,18	51	0,92	117	0,67	117
NAPOLI Federico II	0,61	58	0,65	58	0,80	120	0,48	120
PADOVA	0,16	46	0,38	46	0,58	93	0,54	93
PALERMO	0,84	50	0,56	50	0,21	124	0,63	124
PARMA	0,81	18	0,82	18	0,20	71	0,71	71
PAVIA	0,42	50	0,10	50	0,45	121	0,30	121
PERUGIA	0,38	61	0,21	61	0,79	107	0,44	107
PISA	0,31	49	0,56	49	0,21	111	0,23	111
ROMA La Sapienza	0,43	55	0,09	55	0,28	120	0,32	120
ROMA Tor Vergata	0,87	41	0,66	41	0,09	95	0,85	95
SALERNO	0,54	54	0,58	54	0,24	128	0,79	128
SASSARI	0,68	51	0,11	51	0,92	121	0,30	121
SIENA	0,68	21	0,20	21	0,57	114	0,78	114
TORINO	0,61	83	0,80	83	0,33	116	0,54	116
VITERBO	0,77	46	0,35	46	0,15	104	0,31	104
VENEZIA Ca' Foscari	0,24	62	0,46	62	0,09	93	0,19	93
VENEZIA I.U.A.V.	0,47	25	0,02	25	0,63	80	0,31	80
BASILICATA	0,34	40	0,20	40	0,30	99	0,38	99
MOLISE	0,37	50	0,11	50	0,83	53	0,12	53
VERONA	0,72	31	0,06	31	0,46	108	0,16	108
NAPOLI Parthenope	0,28	39	0,59	39	0,37	107	0,76	107
NAPOLI L'Orientale	0,45	30	0,16	30	0,33	93	0,60	93
PISA Normale	0,25	24	0,69	24	0,42	66	0,14	66
PISA Sant'Anna	0,81	36	0,03	36	0,35	50	0,19	50
TRIESTE S.I.S.S.A.	0,52	22	0,59	22	0,83	87	0,83	87
BRESCIA	0,24	39	0,59	39	0,15	121	0,18	121
REGGIO CALABRIA	0,77	34	0,88	34	0,90	87	0,20	87
Polytechnic BARI	0,72	48	0,93	48	0,10	107	0,36	107
NAPOLI Seconda Università	0,83	38	0,28	38	0,92	97	0,78	97
BERGAMO	0,27	31	0,10	31	0,30	81	0,76	81
CHIETI-PESCARA	0,53	31	0,12	31	0,65	90	0,84	90
L'AQUILA	0,31	22	0,42	22	0,10	68	0,54	68
URBINO	0,35	28	0,01	28	0,22	84	0,58	84
University for Foreigners of SIENA	0,89	11	0,65	11	0,47	79	0,59	79
University for Foreigners of PERUGIA	0,87	20	0,12	20	0,16	66	0,34	66
ROMA TRE	0,08	26	0,02	26	0,21	81	0,73	81
TERAMO	0,19	35	0,31	35	0,27	89	0,82	89
ROMA Foro Italico	0,22	22	0,52	22	0,28	75	0,74	75
BENEVENTO	0,09	29	0,81	29	0,38	77	0,64	77
CATANZARO	0,38	40	0,04	40	0,28	74	0,11	74
MILANO Bicocca	0,47	49	0,26	49	0,16	97	0,73	97
INSUBRIA	0,57	48	0,26	48	0,21	79	0,23	79
PIEMONTE ORIENTALE	0,52	61	0,62	61	0,65	74	0,83	74
FOGGIA	0,60	41	0,42	41	0,84	103	0,70	103
PAVIA I.U.S.S.	0,22	22	0,39	22	0,19	63	0,21	63
LUCCA I.M.T.	0,64	17	0,50	17	0,45	79	0,53	79
FIRENZE S.U.M.	0,92	7	0,97	7	0,35	43	0,15	43

YEARS 2004	**Receivables 1° digit**	**Number of observations**	**Receivables 2° digit**	**Number of observations**	**Payables 1° digit**	**Number of observations**	**Payables 2° digit**	**Number of observations**

Polytechnic MARCHE	0,12	43	0,11	43	0,51	75	0,73	75
BARI	0,11	28	0,24	28	0,19	115	0,38	115
BOLOGNA	0,17	69	0,79	69	0,95	84	0,82	84
CAGLIARI	0,56	41	0,94	41	0,92	91	0,90	91
CASSINO	0,60	21	0,33	21	0,03	47	0,27	47
CATANIA	0,44	44	0,52	44	0,61	107	0,60	107
FERRARA	0,92	44	0,40	44	0,28	100	0,31	100
FIRENZE	0,74	36	0,08	36	0,64	110	0,97	110
GENOVA	0,75	49	0,73	49	0,57	99	0,50	99
SALENTO	0,38	36	0,87	36	0,28	116	0,62	116
MACERATA	0,27	28	0,30	28	0,98	84	0,21	84
MESSINA	0,50	26	0,87	26	0,51	127	0,09	127
MILANO	0,50	45	0,65	45	0,92	104	0,33	104
Polytechnic MILANO	0,92	45	0,55	45	0,79	92	0,84	92
MODENA and REGGIO EMILIA	0,09	52	0,18	52	0,92	114	0,67	114
NAPOLI Federico II	0,37	59	0,65	59	0,80	117	0,48	117
PADOVA	0,86	46	0,38	46	0,58	95	0,54	95
PALERMO	0,78	53	0,56	53	0,21	125	0,63	125
PARMA	0,85	16	0,82	16	0,20	72	0,71	72
PAVIA	0,45	53	0,10	53	0,45	124	0,30	124
PERUGIA	0,37	62	0,21	62	0,79	107	0,44	107
PISA	0,46	47	0,56	47	0,21	110	0,23	110
ROMA La Sapienza	0,60	55	0,09	55	0,28	119	0,32	119
ROMA Tor Vergata	0,75	44	0,66	44	0,09	97	0,85	97
SALERNO	0,46	56	0,58	56	0,24	129	0,79	129
SASSARI	0,60	51	0,11	51	0,92	121	0,30	121
SIENA	0,36	22	0,20	22	0,57	112	0,78	112
TORINO	0,24	85	0,80	85	0,33	116	0,54	116
VITERBO	0,10	49	0,35	49	0,15	102	0,31	102
VENEZIA Ca' Foscari	0,78	64	0,46	64	0,09	91	0,19	91
VENEZIA I.U.A.V.	0,35	24	0,02	24	0,63	77	0,31	77
BASILICATA	0,41	42	0,20	42	0,30	102	0,38	102
MOLISE	0,31	52	0,11	52	0,83	52	0,12	52
VERONA	0,76	31	0,06	31	0,46	107	0,16	107
NAPOLI Parthenope	0,79	41	0,59	41	0,37	104	0,76	104
NAPOLI L'Orientale	0,32	32	0,16	32	0,33	96	0,60	96
PISA Normale	0,52	22	0,69	22	0,42	63	0,14	63
PISA Sant'Anna	0,08	36	0,03	36	0,35	48	0,19	48
TRIESTE S.I.S.S.A.	0,24	21	0,59	21	0,83	86	0,83	86
BRESCIA	0,44	40	0,59	40	0,15	123	0,18	123
REGGIO CALABRIA	0,17	33	0,88	33	0,90	84	0,20	84
Polytechnic BARI	0,90	51	0,93	51	0,10	110	0,36	110
NAPOLI Seconda Università	0,89	36	0,28	36	0,92	96	0,78	96
BERGAMO	0,43	28	0,10	28	0,30	84	0,76	84
CHIETI-PESCARA	0,52	34	0,12	34	0,65	90	0,84	90
L'AQUILA	0,84	20	0,42	20	0,10	66	0,54	66
URBINO	0,46	29	0,01	29	0,22	82	0,58	82
University for Foreigners of SIENA	0,36	12	0,65	12	0,47	77	0,59	77
University for Foreigners of PERUGIA	0,88	22	0,12	22	0,16	67	0,34	67
ROMA TRE	0,73	28	0,02	28	0,21	82	0,73	82
TERAMO	0,23	38	0,31	38	0,27	91	0,82	91
ROMA Foro Italico	0,13	22	0,52	22	0,28	77	0,74	77
BENEVENTO	0,43	26	0,81	26	0,38	75	0,64	75
CATANZARO	0,83	42	0,04	42	0,28	71	0,11	71
MILANO Bicocca	0,78	51	0,26	51	0,16	98	0,73	98
INSUBRIA	0,59	46	0,26	46	0,21	81	0,23	81
PIEMONTE ORIENTALE	0,10	59	0,62	59	0,65	76	0,83	76
FOGGIA	0,79	43	0,42	43	0,84	104	0,70	104

PAVIA I.U.S.S.	0,59	20	0,39	20	0,19	65	0,21	65
LUCCA I.M.T.	0,92	15	0,50	15	0,45	78	0,53	78

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ORGANIZATIONAL CHANGE RESISTANCE: EXPERIENCE FROM PUBLIC SECTOR

Abstract

The study described in the paper aimed to measure the level of resistance of public sector employees to organizational changes, in order to draw a conclusion on whether the level of resistance is a risk to the successful implementation of change or not. The differences between the resistance of several categories of employees were observed, depending on age, education and satisfaction with personal monthly income. In addition, the most important causes of resistance to change within the sample were determined, such as: lack of involvement of employees in the process of planning change, conviction of employees about non-existence of adequate rewards for the accomplishment of change and high levels of stress at work. The findings indicate that the level of change resistance in public sector is within moderate limits, which means that this issue needs further attention in planning and management of organizational change, but, on the other hand, the situation can not be characterized as highly risky for the process of change implementation. The paper also provides a brief theoretical overview of the most important findings in the field of organizational changes in the public sector.

Keywords

organizational change, public sector, motivation, resistance to change

1. Introduction

In the modern business environment, characterized by high level of uncertainty, dynamism and turbulence, change is the only constant. In these circumstances, the ability to adapt to change in the external, as well as initiating and implementing the necessary changes in the internal environment, are essential for the growth and development of organizations, both in private and public sector.

In Serbia, as in many other countries that were faced with the transition process, which began in the late twentieth century, it was necessary to perform a number of different organizational and other changes in the public sector. Public sector reform was one of the key preconditions for successful transition. There was a need to make public enterprises to some extent independent, to abolish monopolies and to improve public sector by rational organization of operations and changes in management style. Some of the planned changes are implemented more or less successfully, while others represent a plan for the future.

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To make the change possible, there has to exist an adequate level of knowledge and skills of managers leading the change. The literature discusses the various factors that influence the outcome of organizational change. Kotter (1995) dealt with the reasons why organizational change fail and identified eight of these various factors. Other authors have identified factors which lead to the success of organizational changes in public sector (Fernandez, Rainey, 2006), such as, inter alia, the construction of the internal support to change and overcoming the resistance of employees. Almost every organizational change requires that an employees change some of their routine operations, the way they perform their work and their behavior (Petković, Janićijević, Bogićević-Milikić, 2010: 562). Therefore, it is of great importance to understand the opinions and views of employees regarding organizational change in order develop the necessary tools to motivate employees to change, so that their resistance can be reduced to the lowest possible level.

The very important leader's role in the process of implementing organizational changes is related to overcoming resistance to changes, and it represents one of the most significant as well as most difficult tasks of a leader in the process of their implementation

Reducing change resistance is important because employees' reactions to change are considered critical for the success of change efforts (Van Dam et al. 2008). There is a huge consensus that a key factor in determining the success of any organizational change involves employees acceptance of it (Oreg and Berson 2011).

In this study, we will deal with measuring the degree of employee's resistance to organizational changes in public organizations in Kragujevac, in order to highlight the impact that their views have on the risk of the change implementation process. In addition, the focus was put on a wide set of variables that proved to be important for understanding resistance to change, such as: age of respondent, level of education, position in the organization, personal monthly income and satisfaction with personal monthly income.

2. Organizational change management

More and more organizations are engaged in multiple and ongoing-change events, such as the introduction of new top management teams, reorganizations or restructurings, downsizing, layoffs, and new strategic initiatives. The potential impacts of change on people working in organizations are significant: on the positive side, change can provide a wealth of opportunities for growth and development; but, on the negative side, there can be substantial costs to having to negotiate new relationships, skills and patterns of activity (Cartwright, Cooper, 1992; Kotter, 1995).

In order for changes to be successful and to lead to positive results, it is necessary to properly manage the process of their implementation by agents of change. Agent of change is the individual or group responsible for managing the changes actions. They may or may not be managers, the current employees in the organization, new employees or external consultants (Robbins, Judge, 2009:646).

There are different models of change management, all of which consist of certain interrelated activities that may be called phases or steps. Different authors recommend different steps in change management, which actually represent a kind of instructions or recommendations for managers who lead this process. According to (Kotter,1998), mentioned activities can be classified into ten groups:

Change initiaion - This is the phase where the management of the organization has to recognize the need for change, as well as their causes, to overcome inertia, make the decision to initiate change, choose an agent of change, define its tasks and to establish a productive relationship with him.

Diagnosis of the state of the organization and the causes of change - This is a group of activities in the process of change through which a state of organization and the reasons why change is necessary are determined. This group of activities is performed by the diagnostic model and includes data collection and analysis in order to determine the causes of changes.

Creating a vision and making a plan for new organization – The phase includes activities of planning the desired state of organization to which the change should lead. This module also includes the creation of a vision of the new organization, as well as its expansion throughout the organization.

Planning and organizing the proces of change – This step in the management of organizational change involves planning the flow of change, as well as the building of the structure which will support realization of change.

Motivation for change - Management to motivates employees to accept and implement change and raises the energy needed to successfully implement changes.

Change implementation - The sixth stage involves the implementation of a change in the strict sense. During this phase, managers perform changes in several cycles. They plan and implement initial success and support and accelerate the implementation of change.

Management of power structures and political processes – One group of activities must be commited to shaping the power structure in the organization which will, if not favor, then at least enable changes.

Management of personal transition – This group of activities is commited to work with people. During the implementation of change, management has to manage emotions and give support to personal transition of members of the organization. They have to provide training and counseling, and the largest possible participation of employees in changes. Most importantly, management has to reveal and overcome resistance to change.

Stabilization of change through their involvement in the organizational culture – During this phase, the implemented changes are being frozen, which means they are being included in the organizational climate and therefore becoming legitimate way of organizing and functioning of enterprise.

Monitoring and control of organizational change – The last stage in managing organizational change is to monitor, measure and control the effects of changes.

It is possible to single out two general objectives of organizational change. First, the planned change aims to increase the organization's ability to adapt to changes in the environment. Second, it seeks to change the behavior of employees. (Robbins, Judge, 2009:646). As each organizational change requires a change in employee behavior, it is of great importance to

ensure acceptance of change by employees, motivate them to actively participate in the change implementation, and reduce the change resistance, as much as possible.

3. Resistance to change

Employee motivation for change is an extremely important task without which it is not possible to successfully make organizational changes. They must be confident that the change will have a positive impact on themselves and their organization. Only then, the people will accept the changes and commit to its implementation. Managers who act as agents of change are largely responsible for the motivation of employees. They must apply the appropriate techniques and strategies of motivation, but above all, they must be personally motivated and willing to change in order to transfer their enthusiasm to the employees. The literature reveals two basic strategies to motivate employees to change (Janićijević, 2008:416):

1. ***Creating dissatisfaction with the current situation*** - Dissatisfaction with the current situation can be caused by various reasons, such as: informing about the real situation and prospects of the company; setting high standards of performance or disconfirmation of existing behavior and the development of a sense of guilt.
2. ***Development of positive expectations of change*** - Positive expectations of change can be created by the development of psychological security and expectations of gains from the change. It is necessary to create and present a vision of the new organization and to develop positive expectations of the new organization. Therefore, it is extremely important to apply the following techniques to motivate employees, such as: communication with employees, exposing objective information, teamwork, planning and control.

It is very important to perceive that resistance is a common phenomenon which follows all types of changes and it should be seen as a natural and inevitable occurrence (Robbins,1992,p.193). It is precisely resistance that can be a sign of something significant and unusual happening in a company, and if it is a case of radical, transformational moves which bring bigger changes, strong and often dramatic reactions should be expected.

When faced with changes for the first time, a common human reaction is fear. The reason for this is the fact that the change involves abandoning the status quo and the way in which the work was previously performed, and the acceptance of the unknown. Even when the change is positive, there is always a some sense of uncertainty. Hence, change agents are often faced with the problem that concerns not only low motivation, but also the active or passive resistance of employees to change.

In order for managers to successfully overcome the resistance, it is necessary to understand the cause of this resistance, as well as to develop the proper tactics by means of which this problem is solved.

The following four may be pointed out as the most important causes of change resistance (Kotter, Schlesinger, 2008:132-134):

1. ***Parochial self-interest*** – People think that they will lose something of value as a result of the change. In these cases, people focus on their own best interests and not on those of total organization.
2. ***Misunderstanding and lack of trust*** – People also resist change when they don't understand its implications and perceive that it might cost them much more than they will gain. Such situations often occur when trust is lacking between the person initiating the change and the employees.
3. ***Different assesments*** – Another common reason people resist organizational change is that they assess the situation differently from their managers or those initiating the change and see more costs than benefits resulting from change, not only for themselves but for their company as well.
4. ***Low tolerance for change*** – People also resist change because they fear they will not be able to develop new skills and behavior that will be required of them. All human beings are limited in their ability to change, with some people much more limited than others.

After the managers come to the knowledge of the cause of resistance, they must choose the right strategy for solving this problem. The strategy depends on many different factors, and each strategy has its positive and negative effects. Therefore, it is important to carefully consider the situation in which the organization is based, to collect the necessary information, to determine the causes of resistance and to assess whether employees have the power to resist change. In addition, the cost-benefit analysis must be conducted, in order to draw a conclusion whether it is profitable to apply a particular strategy. The following table shows the most commonly used methods or strategies for solving the problem of resistance to change.

Approach	Commonly used in situations	Advantages	Drawbacks
Education + communication	Where there is a lack of information or inaccurate information and analysis.	Once persuaded, people will often help with the implementation of change.	Can be very time consuming if lots of people are involved.
Participation + involvement	Where the initiators do not have all the information they need to design the change, and where others have considerable power to resist.	People who participate will be commited to implementing change, and any relevant information they have will be integrated into the change plan.	Can be very time consuming if participators design an inappropriate change.
Facilitation + support	Where people are resisting because of adjustment problems.	No other approach works as well with adjustment problems.	Can be time consuming, expensive, and still fail.
Negotiation + agreement	Where someone or some group will clearly lose out in change, and where the group has considerable power to resist.	Sometimes it is relatively easyway to avoid major resistance.	Can be too expensive in many cases if it alerts others to negotiate for

			compliance.
Manipulation + co-optation	Where other tactics will not work or are too expensive.	It can be a relatively quick and inexpensive solution to resistance problems.	Can lead to future problems if people feel manipulated.
Explicit + implicit coercion	Where speed is essential, and the change initiators possess considerable power.	It is speedy and can overcome any kind of resistance.	Can be risky if it leaves people mad at the initiators.

Table 1. *Methods for dealing with resistance to change*
Source: Kotter, P.J., Schlesinger, A.L., 2008:7

When we speak of Serbian companies and other organizations and institutions in the public sector, it is often assumed that the resistance of employees to organizational change is extremely high given that these organizations operated by habitual patterns over many years, relying on the bureaucracy. However, some research has shown that, despite the Serbian national culture is generally labeled as a culture with a low tolerance of change and uncertainty, 78% of employees in local companies have shown the will to engage in a process of organizational change, if they believe it will bring improvement for the company in which they work, and for themselves. (Šapić, Stojanović Aleksić, Erić, 2009: 410).

Research in 2007 showed similar results (Stojanovic -Aleksic, 2007). As the most important causes of resistance to changes, respondents have stated a lack of information regarding changes (62%), a fear of losing one's position in the company (20.3%), distrusting the leader in charge of changes (14.5%) and a lack of knowledge and competence to get involved in changes (3.2%). Therefore, the largest number of respondents opposes changes due to insufficient amount of information which is, in a sense, favorable for leaders of domestic companies as this kind of resistance can be easily overcome by better informing employees about all important aspects of changes. After all, informing represents one of the most significant strategies for overcoming resistance to changes, which was discussed in the paper.

4. Changes in the public sector

The public sector is part of the national economy, which includes the general government and nonfinancial enterprises controlled by the state (public companies) that are primarily engaged in commercial activities (Budget System Law).

The public sector is the institutional system of economic engagement of the state and it consists of different sub-sectors (Vigvari, Raićević, Brnjaš, 2003:23-24):

1. *Budget sub-sector* – which involves bureaucratic regulation of state authorities, whose activity takes place in a special system of rules and with direct political control by political parties and relevant ministries.
2. *State-owned enterprises* (public companies) sub-sector – which includes a number of enterprises, institutions, agencies, associations and other forms of organization of companies, established by the state or local governments, aimed at marketing, sale

and distribution of state's products and services, in order to meet the public needs of the population.

3. *Non-profit and non-governmental organizations and institutions sub-sector* – which includes a wide range of services, oriented to the promotion of democratization, the realization of the rights of various marginalized political, social, religious and other groups in the community, as well as education and training groups for inclusion in the socio-political system of a country.

Activities and functions of the state and its organs usually are directed towards satisfying the public's needs. It is important to note that there is a fundamental difference between the needs of the organization of public services and public administration. The public services are established exclusively to meet the needs of the whole community, but also every citizen, individually, within the following industries: farming, scientific, educational, health, social and other.

Public administration aims at the implementation of the legal provisions and bylaws adopted by the Parliament or the Government of the Republic of Serbia. Their function is prevention, counseling, and control, as well as the application of legally prescribed penal provisions against entities that do not comply with the statutory provisions.

The frequently asked question is whether it is possible to achieve efficiency in the process of organizational change in public organizations, on the same level as it is the case in private sector. Designed to hold organizations accountable for a broad range of objectives, there are many rules and procedures that lead to rigid bureaucratic structures that can inhibit effective organizational change in public sector. Such elements as civil service systems, inflexible reward systems, specialized and invariant job designs, highly formalized processes and procedures, and strict reporting requirements yield centralized, bureaucratic hierarchies and the highly political nature of public arena frequently lead to assumption that organizational changes are difficult to implement successfully in the public sector. (Robertson, Seneviratne, 1995: 548).

However, nowadays public organizations are increasingly switching to market-motivated way of doing business, which includes a focus on users. Consequently, they must carry out a series of changes in the organizational structure, such as downsizing, establishing new sectors, changes in the delegation of authority and coordination, and more. Transition countries, such as Serbia, are particularly interesting area for conducting these kind of research because the public sector in these countries is often the subject of criticism.

The importance of the public sector of the Republic of Serbia, with an estimated cca 700,000 employees, is reflected both in the redistribution of gross domestic product in taxes and public spending, and in the share of public investment of 15% of total investments (Arsic et al, 2010:143). The main characteristic of the public sector in Serbia is low efficiency and a high level of expenses, compared to the quality and scope of services that the sector provides. (Veselinović, 2014: 143).

Key problems in the functioning of the public sector of the Republic of Serbia are (Veselinović, 2014: 144):

- High costs of public administration and public services, in the form of the wage bill and their share in gross domestic product;
- A common practice of forming various government agencies and similar institutions,without prior assessment of the existing infrastructure and assessment whether there already exists an organization that conducts such activities or have the capacity to perform them;
- Irrational spending of budget funds by subsidizing inefficient public enterprises;
- Inefficient system of pension insurance, social security and health care, and education;
- Inefficient and bureaucratic administration that encourages the private sector to the informal economy.

The Government of the Republic of Serbia, attaches a special importance, within the economic reforms, to the measures directed towards public companies at all levels of government. Specific austerity measures are defined by the Program of measures for public sector reform (Program of Measures for Public Sector Reform, Ministry of Finance, Republic of Serbia, 2013:9-11):

1. *Introduction of rules in the operation of public companies* - the dominant direct impact on the work of state bodies of public enterprises, reduction of direct and indirect subsidies from the budget of the Republic, stricter control over the issuance of guarantees.

2. *Improving the control of the number of employees and wage bill in the public sector* - the establishment of the Public Registry of employees in the public sector, the transition to a centralized calculation of personal income of employees, determining the optimal number of employees, reduction of other additional and related costs to minimum.

3. *Structural reforms of the public sector* - the completion of the restructuring process in 179 companies in this status, increase efficiency, independence and transparency of public companies (consistent application of the Law on Public Enterprises, better tracking result of any work by introducing key performance indicators, corporatization and strengthening public-private partnerships) sale and / or withdrawal of capital in certain public of enterprises.

The World Bank uses Governance Indicators to evaluate how well certain states manages public sector. Based on all six indicators, Serbia is far below average compared to other countries in the region. (Veselinović, Milovanović, 2009:403). Hence, it is necessary to implement a series of organizational changes in the public sector in Serbia, some of which are listed above. Providing support and motivation of employees in public organizations and overcoming the resistance are some of the biggest challenges for managers.

Therefore, this study puts the focus on the opinion of employees in public sector on specific organizational changes that were implemented in their organizations. This provides a basis for measurement of the degree of change resistance and its impact on the success of the change implementation process. Research has been conducted in a number of public organizations on the territory of Kragujevac, as one of the largest cities in Serbia.

5. Empirical research

Bearing in mind the above identified problem area, the subject of this study will be: measurement of the degree of resistance to organizational changes in public sector institutions in the territory of Kragujevac, as well as its impact on the risk of the change implementation process.

Taking into consideration the defined problem area and formulation of the subject, the main goal of scientific research is gathering relevant data and information, that lead to precise and objective knowledge of the views and opinions of employees in the public sector in the territory of Kragujevac about organizational changes, their resistance, and it's impact on the outcome of the change implementation proces.

This set of basic goal helps define the following derived objectives:

- Examine the relationship between respondents' age and level of resistance to organizational change.
- Examine the relationship between the education level of the respondents and the degree of resistance to organizational change.
- Examine the relationship between employees' satisfaction with personal monthly income and level of resistance to organizational change.

In accordance with the defined subject, and according to the research objectives, the paper starts from the certain hypothesis, which will be tested.

Basic hypothesis (H0): Resistance to change is an important factor that affects the risk in organizational change implementation in the public sector.

Derived hypothesis (H1): The youngest employees will show a lower degree of resistance to organizational change.

Derived hypothesis (H2): Employees with higher level of education will show a lower degree of resistance to organizational change.

Derived hypothesis (H3): Employees who are more satisfied with personal monthly income will show a lower level of change resistance.

Methodology of research As a diagnostic tool, the CRS will be used to determine the overall resistance to an organizational change and its contribution to the risk of implementation failure. The Change Resistance Scale (CRS) (Conner, 2011) is designed to serve as an aid in dealing with the human aspects of an organization's adaptation to change. The CRS can be used in following situations:

- While organizational change is being considered or during initial planning.
- Before the change has been announced.
- Anytime after the announcement has been made.
- After project implementation is complete.

The Change Resistance Scale profiles people's perceptions of a specific change. It comprises 25 items that correspond to 25 primary ways people respond to organizational change. Each item is measured on a scale of 1 to 10 and repondents place a check mark above the number that best reflects their view of each of the following items.

In addition to this instrument, the qualitative analysis and comparison with the existing literature and scientific knowledge was used in this research.

The sample consisted of 72 respondents from six public organizations on the territory of Kragujevac, as one of the largest cities in Serbia. Of all respondents, 36 (50%) are male, while 36 (50%) are female. The following tables (Table 1, Table 2) show the structure of the sample by age and by level of education of the respondents. The largest percentage of respondents are between 39-49 years old (37.5%), while more than half of the respondents have a university level of education (54.2%).

Age	Frequency	Percent
18-27	7	9,7 %
28-38	24	33,3 %
39-49	27	37,5 %
> 50	14	19,4 %
Total	72	100,0 %

Table 2. *Age of the respondents*

Level of education	Frequency	Percent
University degree	39	54,2 %
College degree	12	16,7 %
Secondary education	16	22,2 %
Skilled worker	5	6,9 %
Total	72	100,0 %

Table 3. *Level of education of the respondents*

Employees from the following organizations were involved in the study:

- Electric Power Industry of Serbia - The company "CENTER" LTD Kragujevac
- Clinical Center Kragujevac
- Ministry of Finance – Tax Administration - Regional Center Kragujevac
- "Public Enterprise for the City Construction" Kragujevac
- Public Utility Company ,,City Market“ Kragujevac
- Public enterprise "Post Serbia" - a business unit of Kragujevac

The empirical data will be processed using the following softwares:

1. Microsoft Office Excel 2007 - Within this framework, various mathematical operations will be used in order to calculate the CRF in different categories.
2. The software package SPSS (Statistical Package for the Social Science), version 20.00 - Within this framework, the techniques of descriptive statistics will be used in order to describe the sample, as well as to observe relations between the analyzed variables.

Based on the survey results, the average Change Resistance Factor (CRF) for all respondents was 49.21 which implies an intermediate level of resistance. Intermediate level of resistance,

according to CRS, affects the formation of a moderate risk in the implementation of organizational changes. This means that the level of resistance to change should be taken as a significant factor in predicting the success or failure of the change implementation process in public sector in Kragujevac. Thus, target resistance will be a pivotal element in the project's outcome and, therefore, requires special attention and resources in the planning and execution of the implementation steps.

Table 4 provides some of the descriptive statistic indicators and other information about the dependent variable - the level of risk in the implementation of change, measured by CRF.

			Statistic	Std. Error
CRF		Mean	49,21	1,651
	95% Confidence Interval for Mean	Lower Bound	45,92	
		Upper Bound	52,50	
		5% Trimmed Mean	49,20	
		Median	49,80	
		Variance	196,273	
		Std. Deviation	14,010	
		Minimum	18	
		Maximum	79	
		Skewness	-,109	,283
		Kurtosis	-,612	,559

Table 4. *Descriptive statistical measures*

Among the results are the skewness and kurtosis, which describe the distribution of results within the two groups. The distribution is negatively skewed (-,109), ie most of the results are greater than the average value. On the other hand, the distribution is flatter than the normal (-,612). The average deviation of CRF of all respondents of the mean value is 14,010 points.

The results can also be observed depending on the organization in which employees work. In all six organizations surveyed, the average CRF is at the intermediate level and indicates a moderate level of risk for the implementation of organizational changes. Comparative review of the individual average CRF for each organization is given in the following chart (Chart 1). Employees in company "Center" have shown the highest level of resistance (CRF = 55.69), while the lowest factor has been recorded in "PE for the City Construction" (CRF = 39,24), which is somewhat logical, bearing in mind that only incremental changes have been implemented in this organization.

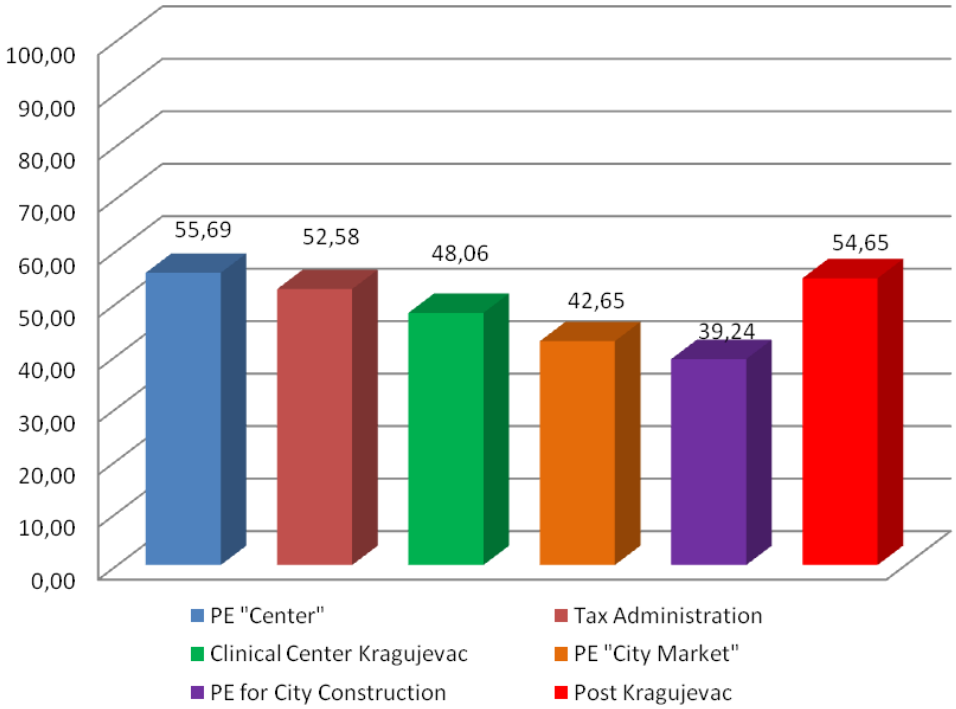

Chart 1. *Change resistance factor in public organizations in Kragujevac*

It was hypothesized that different control variables affect the level of resistance of public sector employees to organizational change, such as their age, education and satisfaction with personal monthly income. In order to come to conclusion about the way that each variable affects the level of resistance, average values of CRF for each of the observed categories were calculated. Some of the most significant results are shown below.

Although the results of all four age groups are within the moderate risk category (Chart 2), one of them particular stands out. This group includes respondents aged between 18 and 27 years, whose CRF is 40.86 which is significantly lower compared to older employees. This speaks about the lower level of resistance in the youngest group of employees, as was assumed in one of the hypotheses, ***hypothesis (H1)***.

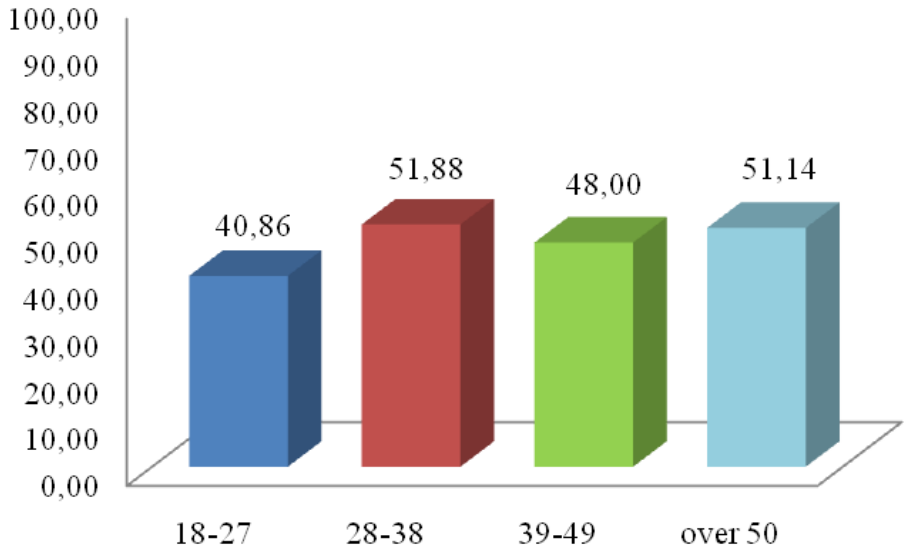

Chart 2. *The impact of age on the level of resistance to organizational change*

As for the education level of the respondents, this factor proved to be extremely important for the degree of resistance to organizational change. Specifically, employees with higher education (university degree) showed significantly lower levels of resistance in relation to qualified workers ***hypothesis (H2).*** Their average CRF is close to 43 (moderate risk), while CRF of respondents with the lowest level of education (skilled worker) reaches 67,04, indicating high risk in change implementation. There may be symptoms of resistance such as low morale, miscommunication, defensiveness, territoriality and hostility.

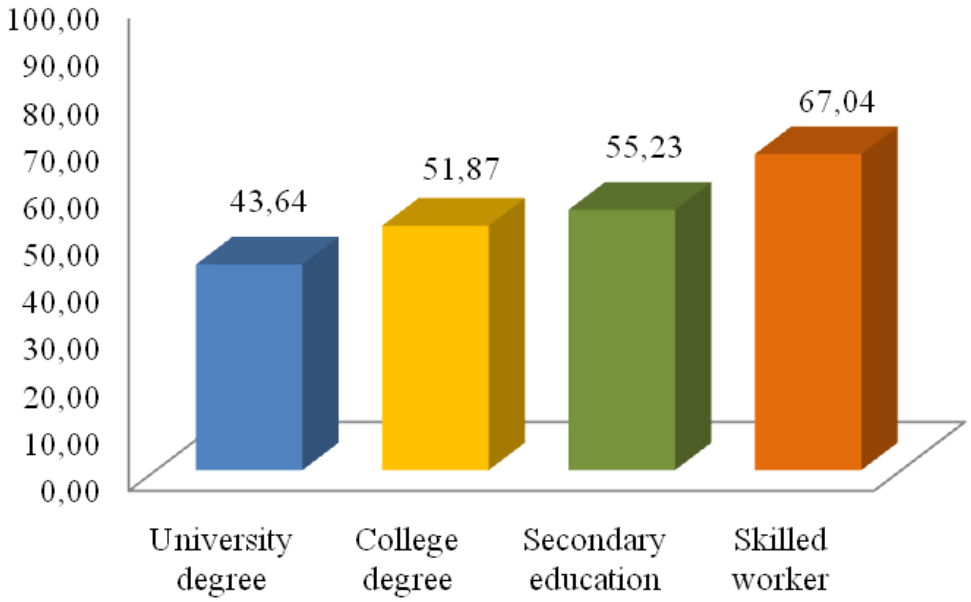

Chart 3. *The impact of education on the level of resistance to organizational change*

Based on Chart 4 it can be noted that employees who have declared themselves dissatisfied with personal monthly income have shown a higher level of resistance to organizational change (average CRF = 53.51) compared with the employees who have declared themselves satisfied with personal monthly income (average CRF = 42 , 02), ***hypothesis (H3)***. However, both values of CRF belong to the category of intermediate level of resistance that leads to moderate risk in change implementation. Thus, although dissatisfied respondents have shown higher resistance, the difference is not as high as one would perhaps assume.

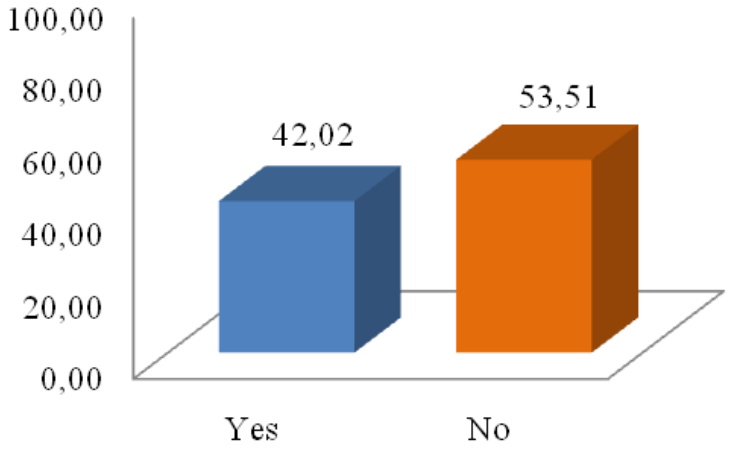

Chart 4. *The impact of satisfaction with monthly income at the change resistance level*

There are different reasons why there is a certain level of resistance among employees. Based on the survey, the three causes of resistance to change within the sample were set aside as the most important:

1) One of the most important cause of resistance is the *lack of involvement of employees in the process of planning change*. Asked “How involved have you been in the planning of this change"? even 47.2% of respondents gave a rating of 10, which means complete exclusion from the planning changes. Grades 6-9 were given by 20.9% of respondents, while only 8.3% reported a rank of 1 - meaning that they utterly agree with the statement “I have been involved in planning of this change". It is human nature for people to support what they have helped to create. If people do not believe that they have a significant degree of input into the planning of change, resistance usually increases.

2) Another important cause of resistance refers to the *conviction of employees of the non-existence of adequate reward for the accomplishment of specific change*. Asked “Do you believe that adequate rewards are being provided to accomplish this change"? only 1.4% gave the answer 1 which implies complete agreement with the statement “I believe that there are adequate rewards for accomplishing this change". Even 30.6% of responses are in the range 8-10, while 16.7% of them explicitly said they do not believe in the existence of adequate reward for the implementation of the change, giving a rating of 10 points. This result is logical considering the inflexible system of rewards in public sector.

3) *High levels of stress at work* could also be singled out as one of the major causes of resistance to organizational changes in the observed sample. When asked "How much stress

are you currently facing in your job", 61.1% of respondents gave grades in the range of 6-10, of whom 15.3% fully agreed with the statement "I am overly stressed or burdened by my current workload," giving a rating of 10 points. On the other hand, only 5.6% of respondents completely disagreed with the statement "I am not overly stressed or burdened by my current workload". As creators of CRS tools emphasize, when people are already busy and under stress, the additional pressure of a change may become too much for them to assimilate.

Limitations and recommendations for future research. The study has several limitations that could serve as opportunities for future research within the monitored area. First, it is possible to carry out more complex statistical analyzes in order to reach more precise conclusions about the relationship of certain variables. Second, study was conducted in a short period of time, exclusively on the territory of Kragujevac. It would be desirable for similar studies to be undertaken in successive time intervals, in order to anticipate progress in suppressing the resistance of employees to change. In addition, it is possible to extend the sample by including employees of public organizations in several major cities in Serbia. Finally, it would be valuable to repeat the study in the private sector. In this way, the level of resistance in these two sectors could be compared and the advantages and disadvantages of the process of change management in both sectors could be determined. The results of this study may be useful for identifying certain practices and solutions that have proven successful in the private sector and adapting them to public sector organizations.

6. Conclusion

Despite the existence of the usual assumptions about the high level of resistance to public sector employees to organizational changes, as well as the fact that the Serbian national culture is generally labeled as a culture with a low tolerance of change and uncertainty, we came to the conclusion that resistance is not at a level that would represent a distinct threat to the future success of the implementation of changes. The resistance is within the moderate boundaries, which does not mean that the additional attention during the planning and management of the change process is not needed. It is clear that the implementation of wide range of techniques and strategies for motivating employees to change represents a necessity in the future, in order to reduce the existing resistance to the lowest possible level. The study found that the youngest respondents, the ones with higher levels of educational attainment, as well as employees who are satisfied with their personal incomes, show lower resistance to change. Therefore, more attention must be paid to motivation of other categories of employees, such as people olders than 50 years and employees with lower levels of education. Bearing in mind that the key decisions about the level of personal monthly income are under the jurisdiction of the Government of the Republic of Serbia, managers in the public sector have a negligible impact on this factor. However, it is the application of certain forms of short-term earnings based on performance, such as bonuses and special prizes, which can serve to increase employee satisfaction with incomes, and reduce their resistance to change.

In addition, the contribution of this study is reflected in the obtaining of information about the dominant causes of resistance to organizational changes, such as: lack of involvement of employees in the process of planning change, conviction of employees of the non-existence

of adequate reward for the accomplishment of specific change and high levels of stress at work. Particular attention is drawn to second factor, which may be associated with the previously mentioned, dissatisfaction with personal income, all of which leads to an unambiguous conclusion about the need to intensify efforts in terms of building an adequate award system. Also, efforts for creating pleasant working conditions, good organizational communication and employee involvement in the planning process of change, by taking into account their opinions and suggestions are priorities in order to improve the change management process in the public sector.

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