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ANALYSING OF TOTAL AND FEMALE ENTREPRENEURIAL ACIVITY BY SUPPORT VECTOR REGRESSION

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Abstract:*Economic development cannot be achieved without active participation of women in all aspects of life. There is consensus among scholars that women can play key role in the entrepreneurial phenomenon. The share of women's contribution to the economic and social development depends on the promotion of gender equality and gender blind support from the institutions. Although women constitute about fifty percent of the world population, compared to men, they have less opportunity to control their lives and make decisions. Women entrepreneurs have been designated as the new engines for growth and the rising stars of the economies in developing countries to bring prosperity and welfare. The main goal of the study was to analyze the total and female entrepreneurial activityby support vector regression (SVR).*

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Key words:*SVR; forecasting; female entrepreneurial activity; business.*

1. INTRODUCTION

Entrepreneurship is a multilevel and complex phenomenon that gained importance in the global economy as a result of changes in employee qualifications, work contents, and psychological contracts in the employment field. Entrepreneurship contributes to economic growth in being a conveyor of new or existing knowledge spillover and creative ideas that might otherwise not be utilized and realized for the benefit of all. Linking entrepreneurship to economic growth means linking the individual level to the aggregate levels. The most significant contribution of small businesses and entrepreneurial activity is their ability to innovate.

Female entrepreneurship has attracted increasing attention in recent years in light of concrete evidence of the importance of new business creation for economic growth and development [1, 2]. Not only does female entrepreneurship contribute to economic growth and employment creation, but it is increasingly recognized to also enhance the diversity of entrepreneurship in any economic system and to provide avenues for female expression and potential fulfillment. These benefits are rarely leveraged in a systematic way, however, given that female entrepreneurship talent and potential remain largely untapped in many contexts.

Women entrepreneurs have been designated as the new engines for growth and the rising stars of the economies in developing countries to bring prosperity and welfare. A variety of stakeholders has pointed at them as an important 'untapped source' of economic growth and development. The growth of the proportion of women entrepreneurs in developing countries has drawn the attention of both the academic and the development sector. However, despite this growing number of initiatives and resources made available to promote and develop women's entrepreneurship in developing countries, women still own and manage fewer businesses than men, they earn less money with their businesses that grow slower, are more likely to fail and women tend to be more necessity entrepreneurs.

Various studies show that entrepreneurs contribute to economic development, job creation, and different aspects of wellbeing through creative destruction [3]. Results in [4] were indicated specific ways of constructing gender identity which result in gendered practices: how women act as entrepreneurs by 'doing' and 'redoing' gender. The degree at which entrepreneurship affects the economy depends on numerous factors, including the quality, gender composition, and type of entrepreneurial activity. Gender equality and female entrepreneurship are key factors in economic development. In study [5] was analyzed the relationship between gender-related economic development and women entrepreneurial activity and results suggested that female entrepreneurial activity is not significantly correlated with gender equality. Women's political leadership may contribute to women's entrepreneurship by removing existing constraints on the economic behavior of women, assuming these changes are then enforced [6].Methodological aspects of investigating (female) entrepreneurship by distinguishing between two measures of female entrepreneurship: the number of female entrepreneurs and the share of women in the total number of entrepreneurs was analyzed in [7] and in this light it is important that governments are aware of what they want to accomplish (i.e. do they want to stimulate the number of female entrepreneurs or the gender composition of entrepreneurship) to be able to select appropriate policy measures. The purpose of paper [8] was to offer a new gender-aware framework to provide a springboard for furthering a holistic understanding of women's entrepreneurship and for the women entrepreneur, this analysis has implications for understanding the sources of the challenges they face by providing insights on the importance of the interplay of both individual and societal factors that impact on their enterprise. The study [9] was aimed to discuss one of the most significant economic and social developments in the world – the rise of the female entrepreneurship phenomenon. Women's acquisition of entrepreneurial capital may be restricted by demand side identity constraints as women who pursue non-traditional entrepreneurial livelihoods may stand at odds with activity-regulating social norms [10].

In this investigation the main aim is to apply the soft computing method for total and female entrepreneurial activity analysing. Support vector regression (SVR) was used as the computational intelligence tool [11].

2. ENREPRENEURIAL ACTIVITY

Incorporating qualitative dimensions and interpretive paradigm, together with any quantitative components from the positivist belief system that is deemed appropriate, has created unique research design and integration of methods for questions under investigation. The entrepreneurial world is in constant evolution and entrepreneurship itself is a socially constructed phenomenon, thus draws attention to the different layers in which entrepreneurship takes place. In the paper emphasize in on the relevance of this notion for studying women's entrepreneurship empirically, with implications emerging for how female entrepreneurs might be fostered. In the paper the standardized data collection and statistical multivariate techniques for data analysis are used on International Labour Organization database. The dataset was taken from World Bank database for European Union countries (www.worldbank.org). The following inputs were used in this study (www.worldbank.org):

1. GNI per capita.
2. Services, etc., value added (% of GDP).
3. Unemployment, female (% of female labour force)

Services include value added in wholesale and retail trade (including hotels and restaurants), transport, and government, financial, professional, and personal services such as education, health care, and real estate services. Also included are imputed bank service charges, import duties, and any statistical discrepancies noted by national compilers as well as discrepancies arising from rescaling. Value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs. It is calculated without making deductions for depreciation of fabricated assets or depletion and degradation of natural resources. Unemployment refers to the share of the labor force that is without work but available for and seeking employment.

GNI per capita (formerly GNP per capita) is the gross national income. GNI is the sum of value added by all resident producers plus any product taxes (less subsidies) not included in the valuation of output plus net receipts of primary income (compensation of employees and property income) from abroad. GNI, calculated in national currency, is usually converted to U.S. dollars at official exchange rates for comparisons across economies, although an alternative rate is used when the official exchange rate is judged to diverge by an exceptionally large margin from the rate actually applied in international transactions. The following outputs were used in this study (www.worldbank.org):

1. Total entrepreneurial activity (%).
2. Female entrepreneurial activity.

3. SUPPORT VECTOR REGRESSION

The fundamental working principle of SVMs is to perform the data mapping in some spaces through non-linear mapping and perform the linear algorithm in the feature space. If a way of computing the inner product in a feature space is available directly as a

function to the original input points, it is possible to build a non-linear learning machine, which is known as a direct computation method of a kernel function, denoted by K.

The flexible nature of the SVM is attributed to the kernel functions that implicitly chart the data to a higher-dimensional feature space. A linear solution in the higher-dimensional feature space corresponds to a non-linear solution in the original, lower-dimensional input space. There are some available methods that employ non-linear kernels in their strategy for regression problems and that simultaneously apply SVMs. The most common kernel function is polynomial kernel function. This polynomial kernel function is suitable for highly nonlinear data. In this study the following polynomial kernel function was used:

$$K(x, y) = (x^T y + c)^d \quad (1)$$

where x and y are vectors of features computed from training or test samples, and c is a constant making a tradeoff for the influence of higher-order versus lower-order terms in the polynomial.

As a data-driven model, the ability of the SVR to make reasonable estimations is mostly dependent on input parameter selection. Adequate consideration of the factors controlling the system studied is therefore crucial to developing a reliable network.

To assess the success of the SVR models and other soft computing techniques, some statistical indicators were examined as follows:root-mean-square error (RMSE) and coefficient of determination (R^2).

4. RESULTS

Figures 1 and 2 shows scatter plots of SVR forecasting of the total and female entrepreneurial activity. This observation can be confirmed with very high value for coefficient of determination. The number of either overestimated or underestimated values produced is limited. Consequently, it is obvious that the forecasted values enjoy high level precision. Figure 3 shows the forecasting of female entrepreneurial activity in comparison with experimental data for each input separately.

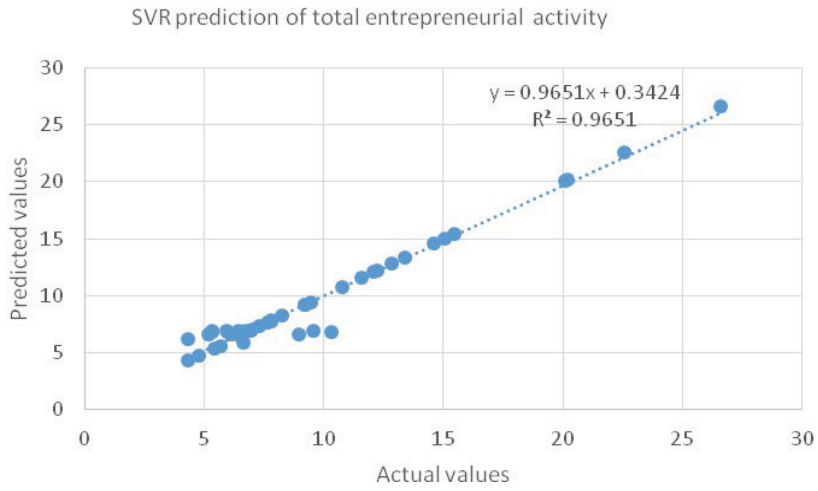


Figure 1. Forecasting of total entrepreneurial activity

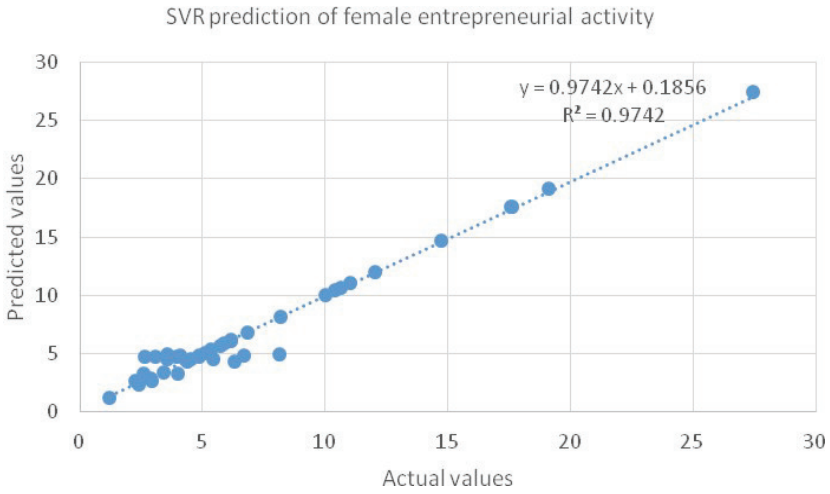
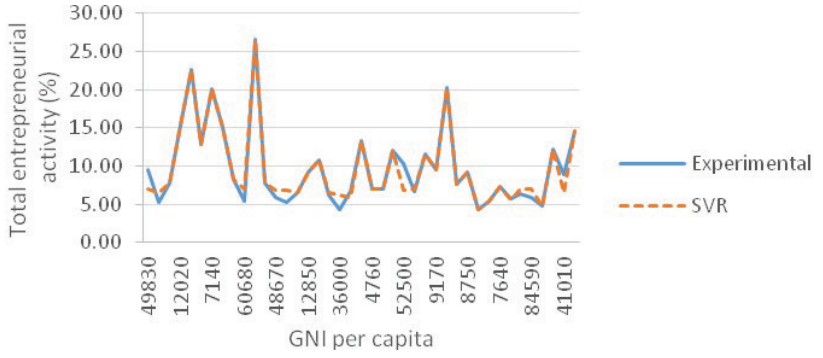
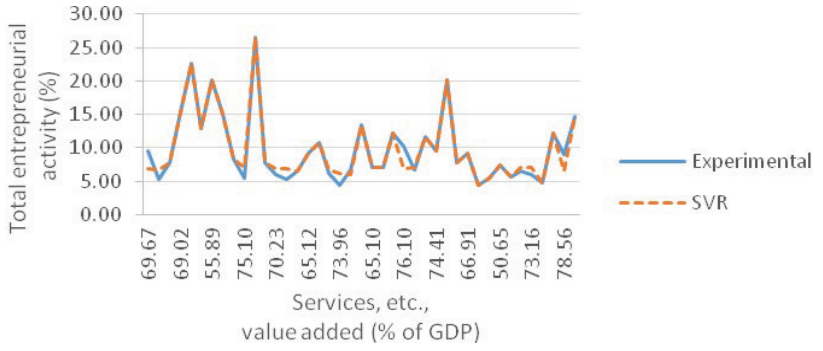


Figure 2. Forecasting of female entrepreneurial activity



(a)



(b)

(c)

Figure 3. Forecasting of female entrepreneurial activity in comparison with experimental data for each input separately

The root-mean-square error (RMSE) and coefficient of determination (R^2) served to evaluate the differences between the expected and actual values for SVR.

Table 3.SVR performances for total and female entrepreneurial activity forecasting

		SVR
Forecasting of total entrepreneurial activity	R^2	0.9651
	RMSE	0.9614
Forecasting of female entrepreneurial activity	R^2	0.9742
	RMSE	0.8761

5. CONCLUSION

The increase in the role of women in economic development and their greater presence in social activities, calls for investigating various dimensions of women entrepreneurial activity in the context of development. This study contributes novel insights into factors that affect the construction of gendered identities and the enactment of gendered practices, helping to address some of the gaps in the literature regarding women business owners.

Forecasting of the future total and female entrepreneurial activity is complex due to the many indicators and factors which influence the total and female entrepreneurial activity. Therefore in this study was proposed a new approach to overcome the forecasting difficulties by applying computational intelligence approach.

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