Software Protection and Piracy Focusing on the 2008 Crisis: A Comparative Study and Simulation Modeling Regarding the Case of Greece, Germany, and England

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Introduction

A recent global economic event blocked the path of an economic pillar that strived to advance and sustain our everyday lives and caused a sudden breakdown. That phenomenal crisis is the well-known 2008 global economic crisis that stemmed through America with great negative effects, such as dumping of merchandise and unemployment rate expansion (Bronner and de Hoog 2013). This crisis flood affected the very heart of economic sustainability, forcing a huge amount of businesses to close (Daryanto et al. 2013).

Other scale factors have not gone unaffected. Software protection was not equivalent with the 2008 global economic recession, which supported the florescence of software piracy. Countries with lesser economic power were spotted to be affected the most by software piracy than others. Greece belongs to this category, whereas England and Germany belong to countries sustaining their economic variance in stable levels during that crisis (Gimenez et al. 2015).

Simulations are well known for information and communication technology usage. A real procedure can be simulated, with no real resources needed and no fear of loss. Anylogic 7.2 University is a well-known tool used for this purpose (Dimitrios et al. 2013). E-Views 8 and Regression analysis technique is used in a given sample window spectrums to locate and record certain variables and, eventually, clarify their importance (Jara-Bertin 2015).

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There have been only two studies regarding software protection, piracy, and simulation modeling. At the same time, no other study has been conducted so far that shows the association between those factors, combining simulation modeling and regression analysis for the case of Greece, Germany, and England, making this paper one of a kind (Deepdyve 2016). Thorough research through this paper showed that Greece was the country having increased piracy ratings during this crisis, comparing with Germany and England.

Variables that Affect Piracy Rates During the 2008 Economic Crisis and Data Sources

GDP

The level of economic development, Real GDP, shows the possibility of people to demand. GDP Economic Activity is controlled by GDP Nominal and GDP Current. Among software protection dependencies is the financial empowerment which means the greater a country's worth the better the software rights protection (Daryanto et al. 2013). GDP is negative related to piracy rates. GDP per capita in purchasing power is taken from data indicators coming from the World Bank's World Development (World Bank 2016).

Education Level Measured in Years

This variable represents a measurement of a countries potential to adopt a new technology. Years of education is strongly related to education itself, thus the key factors of education are Previous Student Attainment, the Socio Economic Status, Cultural Status, Intellectual Level, Collaboration Adoption Level, and Perception or Insight. A negative relation appears between this factor and piracy rates (Barro 2001). Data were obtained as well from the World Bank's World Development database (World Bank 2016).

Research and Development

A negative relation appears in this factor too, because countries with higher Research and Development (R&D) levels tend to protect in a stronger manner intellectual property rights. In order for R&D to be implemented, Entrepreneur Thinking Adoption must be adopted. In a second stage, innovation will take place giving New Improved Tech and Competitive Advantage (Kumar and Phrommathed 2005). R&D expenditures are taken from the same data as GDP per capita (World Bank 2016).

Software Protection Index

Other known as software trademark index and a combination of civil and criminal codes, Law Protection, and the Level of Quality are strongly related. A positive effect is indicated between this factor and piracy rates (Andrés 2006). Information about software protection index comes from the other known as World Intellectual Property Organization (WIPO), UNESCO which stands for United Nations Educational, Scientific, and Cultural Organization and the WTO, the World Trade Organization (WIPO 2016; UNESCO 2016; WTO 2016).

Dependent, Independent Variables and Monte Carlo Simulation

Piracy rate is the dependent variable. The Business Software Alliance holds national software piracy rates in yearly measurement for eight countries since 1994 (BSA 2011). The independent variables of our model are the software protection index which represents the trademark application variable, GDP per capita in purchasing power, Research and Development expenditures, and education level in education years (Chin 2003). The data that were searched and collected in the databases as explained before.

In Fig. 1, we can see these variables as regarding the three nations that will be analyzed; Greece, Germany, and England, in time window of 1994–2010. Piracy rates is the dependent variable as explained before, Research and development

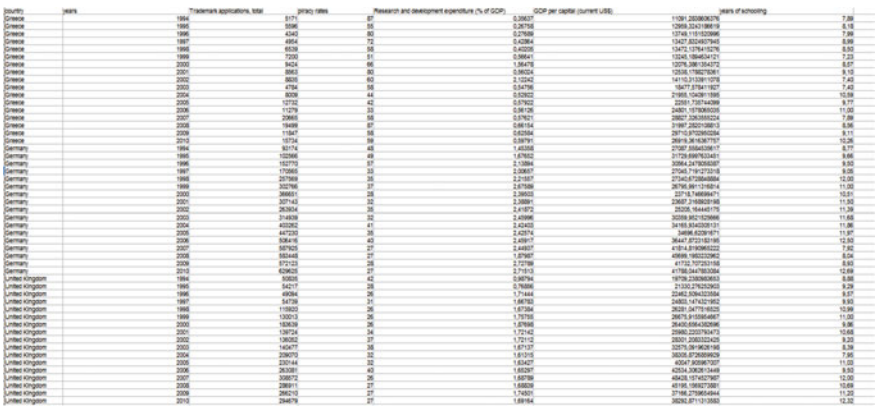

Fig. 1 Dependent and independent variables and Greece, Germany, and England for the years 1994–2010

expenditure (% of GDP), GDP per capita (current US$), Trademark applications, total and years of schooling are the independent ones.

Some information values were missing. Monte Carlo simulation method was used in order to close the missing variable gap by multiplying and fill those missing variables with random ones, varying between the highest and lowest value range of each specific variable.

Econometric Model Specification and Analysis Steps

C(1), C(2), C(3), C(4), C(5), will be estimated with C(1) being the constant variable.

$$\begin{aligned} PIRACY\_RATES = {} & C(1) + C(2) * GDP\_PER\_CAPITA\_CURRENT \\ & + C(3) * RESEARCH\_AND\_DEVELOPMENT \\ & + C(4) * TRADEMARK\_APPLICATIONS + C(5) * YEARS\_OF\_SCHOOLING \end{aligned}$$

Panel data econometric analysis is used, which explains the chronological perspective of the three nations as shown in Fig. 1 and Table 1. Empirical analysis is carried out to run a simple panel fixed effects regression, selecting the variables using the famous method of Least squares (Chin 2003).

Table 1 Regression results from panel data analysis using least squares estimation method

	Coefficient	Std. error	t-Statistic	Prob.
c(1)	84.30559	12.78404	6.594599	0.0000
c(2)	−0.000583	0.000268	−2.172696	0.0350
c(3)	−13.36137	3.957176	−3.376491	0.0015
c(4)	9.20E-06	2.00E-05	0.461358	0.6467
c(5)	−0.617765	1.369085	−0.451225	0.6539
Mean dependent var	43.43137			
S.E. of regression	12.34089			
Sum squared resid	7005.683		S.D. dependent var	17.89106
Log likelihood	−197.8935		Akaike info criterion	7.956607
Deviance	–		Schwarz criterion	8.146001
Avg.log likelihood	–		Hannan-Quinn crit.	8.028980
Obs with Dep = 0	–		Restr. deviance	–
Obs with Dep = 1	–		Total obs	51

Empirical Analysis of Simple Panel Fixed Least Squares Regression

In Table 1, the importance of a variable factor is analog to the minimization of Prob. Value. The lesser the value, the highest the importance of a variable. According to this, Research and Development factor affects Piracy Rates the most comparing to the other values. Consequently, the negative sign in C(3) factor indicates the negative correlation between R&D and Piracy Rates.

Dynamic Model of the Simulation System

Our dynamic model consists of stocks, flows, converters and connectors. Each of these elements is further described in this section: A Stock represents the accumulation of physical or nonphysical quantity. A Flow represents an activity that fills or reduces a pool. The arrow indicates the direction of positive flow, in or out. A Converter can keep values stable or serve as an external input to the standard or convert inputs into results, through the user-defined algebraic relations or graphics functions. Connectors provide connections between the elements of models. Continuous cable is an action connector and the dotted wire is an information connector (Dimitrios et al. 2013).

Identification and Explanation of the Dynamic Simulation Model

First, t-Statistics were multiplied with "Company_Resources" value to provide the appropriate resources needed to implicate each variable factor (Candelon et al. 2012). In Fig. 2 "Company_Resources" stock, supply the four Stocks around it which represent the independent variables and how they could be fulfilled by a hypothetical company. With a percentage given in "Entrepreneur_Thinking_Adoption" "Innovation" is triggered. A percentage of "Company_Resources" is given in the "Economic_Activity_Control" Stock through the CR2EAC flow. Coming to the "Trademark_Application_Factor." In order to be implemented, "Company_Resources" are given first in "Law_Protection" Stock via CR2LP flow and next resources are given in "Consistent_Level_Of_Quality" through the LP2CLOQ flow. Last but not least, the "Education" Stock. A percentage of "Company_Resources" is being given too. All the previous converge in a certain satisfaction level, presenting a negative relation with the "Piracy_Rates" Stock according to the theory. The "Piracy_Rates" Stock is negatively related to the "Company_Resources" Stock. That can be seen through the red flow color. That indicates negative relation between a certain amount of resources and the piracy rates level. The higher the second the lower the first and vice versa.

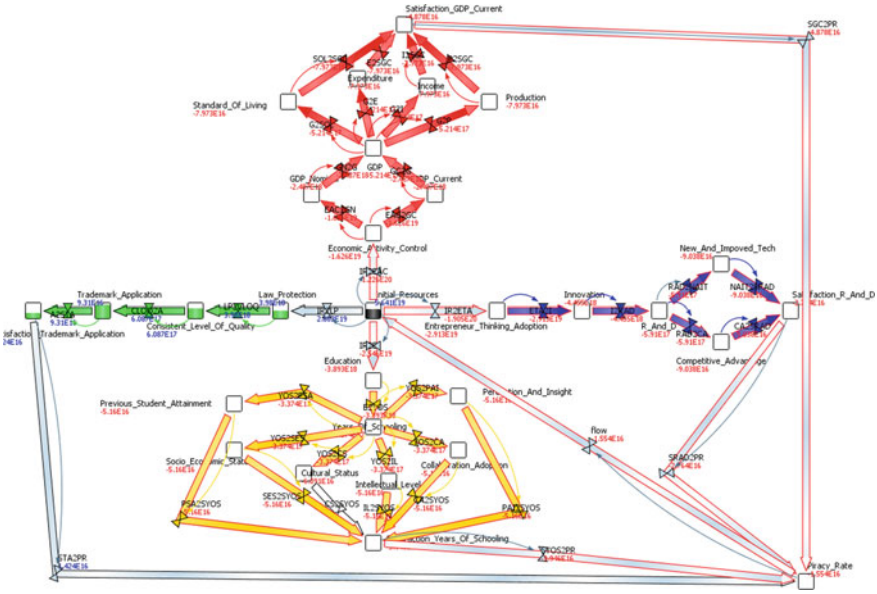

Fig. 2 Dynamic simulation model analysis

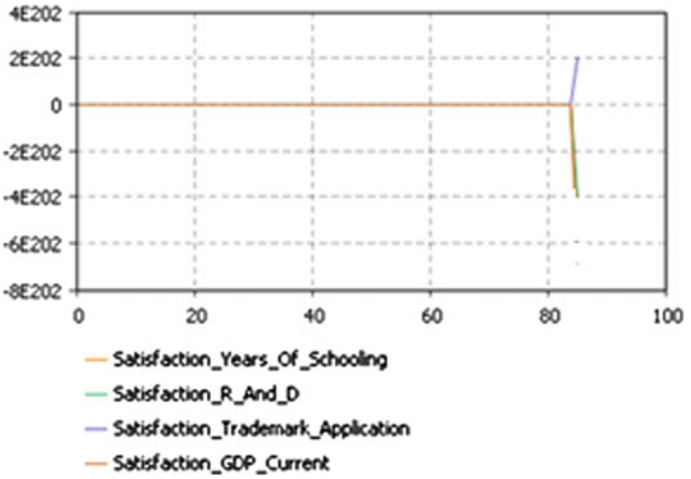

Fig. 3 Time-chart and pie-chart: Satisfaction_Years_Of_Schooling, in conjunction with Satisfaction_R_And_D, in conjunction with Satisfaction_Trademark_Application, in conjunction with Satisfaction_GDP_Current

Figure 3 shows that the satisfaction percentage as regarding all four leading factors is raising significantly during the first months and then they gain stability. Results agree with empirical statistics, showing that Research and Development factor affects with higher negative extend the Piracy Rates factor.

Conclusions

In this research, an attempt was made to simulate the connection between Software Protection and Piracy focusing on the 2008 Crisis, using Anylogic 7.2 University and E-Views 8, and conducting a comparative study and simulation modeling regarding the case of Greece, Germany, and England. The nature of the variables examined is dynamic. Regression analysis is used to calculate the statistical importance and depict it in dynamic modeling. This article attempts to steer the reader to the right direction concerning the influence between Software Protection and Piracy, on the basis of the 2008 economic crisis, using the cases of Greece, Germany and England as a benchmark, by measuring the appropriate satisfaction levels (Dimitrios et al. 2013). Extensive research, statistical analysis and simulation modeling through this paper revealed that R&D has the biggest negative impact in Piracy Rates. The second biggest negative impact is given by GDP Current levels per Capita variable, comparing to the rest of the leading factors. Further research could be conducted on a given software product, the company's objectives and size, as well as the limitations of the firm.

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