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The Determinants of Software Piracy Approach by Panel Data and Instrumental Variables

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ABSTRACT

We try identify factors explaining the software piracy by testing empirically some hypotheses on the determinants of the rate of software piracy and more specifically, we try to check the relationship between piracy rates and revenue per capita. To do this, we use the method of panel data on a sample of 96 countries and covering a period from 1996 to 2010. We also addressed the problem of endogeneity by adopting an approach based on instrumental variables.

Keywords: Income per capita, piracy; given panel.

INTRODUCTION

In recent years, software piracy, which is a form of violation of intellectual property rights is emerging as a major problem for the global economy. This phenomenon is in full quantitative expansion. In its 2009 report, the BSA (Business Software Alliance) announces a piracy rate amounting to 43% and with an increase of two percentage points compared to 2008. One reason for this expansion is the recent development of new information technologies. The internet and spread of information technology and communication in recent years, has created an infrastructure that has made it easier to share digital products and reproduction at zero cost. These digital transformations have increased the possibility of a further escalation of infringement of intellectual property in general and copyright in particular. To check this, several measures were taken summers. At the international level, efforts have been made towards the unification and standardization of strengthening IPR globally. At the heart of these actions is the introduction of the Agreement on Trade-Related Aspects of Intellectual Property Rights Trade (TRIPS) of the World Trade Organization (WTO).

We note in particular in this paper a significant difference across countries in terms of IPR protection is not yet explained, given the economic, institutional and technological characteristics of the country.

Therefore, before taking action to fight against piracy should understand the different factors that explain software piracy. In this perspective several studies have attempted to identify the determinants of software piracy. Several factors have been suggested such as economic factors, technological factors, and cultural factors, socio-political factors and legal factors. In the same vein as this literature we seek to identify the various factors influencing software piracy. Unlike previous studies that have used cross-sectional analyzes, we use in this paper the method of panel data on a larger sample (96 countries) and on a longer period from 1996 to 2010. As the piracy rate is based on income and that income is itself likely to be a function of the rate of piracy, several studies have exposed the problem of endogeneity. We remedy this problem by adopting an instrumental variables approach.

The paper is organized as follows: The section 1présente the introduction, section 2 presents a review of theoretical literature on the main determinants of software piracy. Section 3 outlines the concepts of each determinant of software piracy and assumptions are proposed. Section4 the present model. Section 5 analyzes the results of empirical estimation.

THEORETICAL INVESTIGATION

In general, Canadian law defines software piracy as follows: It is a crime in Canada, to copy and sell protected by copyright software. It is the owner of the copyright to sue by contacting the Royal

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Canadian Mounted Police. It is then up to the courts to decide whether the owner of the software was injured. Cheng et al (1997), for example, studied the different motivations that may lie behind such behavior. Unsurprisingly, this is the price and will save that emerged as the most common reasons cited for software piracy. Wagner and Sanders (2001), meanwhile, have applied a model of ethical decision making in software piracy. It can therefore be argued that moral reflection occurs before piracy and over the perceived risk of the act, the more it is perceived as morally questionable, it will be less likely to occur.

In another vein, Husted (2002) lingered to examine the possible relationship between national culture of a country and its economic situation on the extent of the problem of software piracy within one it was therefore determined that the more collectivist societies, economically more developed and with a large middle class had a rate of software piracy by higher than the other person.

Husted (1996) examines some contextual factors, in particular the national culture of individuals, and examines its relationship with software piracy. The software proved to be a particularly vulnerable entity illegal copying and counterfeiting, given the ease with which copies can be made at negligible cost.

Furthermore, the copy quality has not degraded relative to the original. Thus, the total amount of pirated software amounted to 13.2 billion U.S. dollars in 1996.

Glass and Wood (1996) used the theory of equity borrowed from social psychology to explain the decision of the person who prepared software to be copied. They studied 271 non-graduate intentions to provide software to other students in order to produce illegal copies students. They found that the problem of software piracy is often perceived not as a moral issue, but as the result of the evaluation of the individual regarding the fairness of the distribution, which is based on the ratio of the relationship between this is given and what is received.

According Steidlmeier (1993), the protection of intellectual property is deeply rooted in Western cultural values of liberalism and individual rights. The European view contrasts significantly with the emphasis on social harmony and cooperation prevail in Asia, as noted Swinyard, Rinne and Kau Keng, 1990 and Donaldson, 1996.

In this sense, Hofstede (1997) defines culture as "the collective programming of the mind which distinguishes one group of people to another." Kluckhohn et al. (1951) defines a value as a conception, explicit or implicit, to a particular individual or characteristic of a group, what is desirable. This influences the selection of means of action.

Whitman, Townsend, Hendrickson and Rensvold (1998) found indicators of the interaction between culture and ethics of the use of a computer.

The work of Geert Hofstede show how work-related values can be associated with software piracy. The researcher considered these five values that characterize different cultures in the world: the degree of submission to authority, individualism, masculine character and aversion to uncertainty. These values are directly related to economic activity, unlike those of Rockeach (1973). Glass and Wood analyzed software piracy as an exchange involving an assessment of what is received compared to what is given (equity theory). This type of calculation seems logically prevail in an individualistic culture. Collectivist culture, in turn, puts more emphasis on sharing disinterested in the internal group, and the software is no exception to the rule. Bezmen and Depken (2006) show that there is a negative relationship between software piracy, income, taxes, and economic freedom.

Andrés (2006) uses cross-sectional data to examine the negative relationship between income inequality and piracy rates and found that the efficiency of the legal system and the protection of intellectual property is an important factor in the fight against increase in the rate of piracy.

Yang and Sommenz (2007) find that not only transnational exchange rate of software piracy were explained by cultural variables such as cost, religions and education individualism but also must find a negative relationship between income and gross national rate of software piracy. In this sense, Husted (2000) found that software piracy is significantly correlated with GDP per capita, income inequality and individualism.

THE DETERMINANTS OF SOFTWARE PIRACY AND ASSUMPTIONS

A number of factors may contribute to regional differences in piracy report software prices and income levels and the degree of protection of intellectual property to the availability of pirated via

cultural differences software. In addition, piracy is not uniform within a country: it varies between cities, industries and demographic categories.

However, regions with high piracy are also those where the market is growing strongly. The market for information technology advances today less than 4% in developed countries, while growth is close to 20% in countries with high piracy as China, India or Russia. Emerging countries in Asia Pacific, Latin America, Eastern Europe, Middle East and Africa now account for over 30% of deliveries microcomputers but less than 10% of deliveries software if piracy did not flinch in countries where this practice is widespread. Software piracy has many negative economic consequences: competition distorted by pirated software at the expense of local industries, loss of tax revenue and jobs software because of the lack of a legitimate market, cost ineffective punishment. These costs are passed upstream and downstream supply and distribution chains.

However, the difference in price is significant enough to convince the person to practice piracy. Regarding the film, the price of a place between 5 and 10 euros. Again, the cost is high compared to illegal copying. However, the cinema is a spectacle watching a movie on a computer can not replace is the argument advanced consumers to shirk their actions. It remains true that cinema attendance dropped in 2005 to 15% in Europe.

The second factor is undeniable waiting. DVD released in average trade and rent 6 months after theatrical release. Worse, the rental system newly established on the Internet allows you to see a movie between 6-9 months after the theatrical release. The reason for this is the will of the majors not to short-circuit the traditional distribution vectors while giving the illusion of establishing an alternative system hacking is actually not satisfactory to the consumer. With the download, you can get a film from its theatrical release. And, for some films released abroad and not in your country, you can get before that date, which gives the impression to the consumer extremely satisfying to have seen the movie preview.

The economic literature identifies five groups of factors influencing piracy: economic factors, cultural and socio-political factors, technological factors and legal factors.

Economic Factors

This is the group of the most common factors used to explain the variation in the rate of software piracy across countries.

Software are often considered unaffordable for most people in developing countries and even certain social categories of developed countries. These people generally believe that the only alternative is hacking software. Income levels may therefore influence the attitudes and behaviors towards software piracy. At national level, it is therefore expected that the variation in the rate of piracy can be partly explained by the change in GDP per capita.

Hypothesis1: The richest countries are likely to have the lowest piracy rates. A negative relationship between income and the piracy rate is expected.

Institutional Factors

The legal system in the field of IPR has been identified as one of the factors contributing to the variation in the rate of piracy.

Countries that have signed treaties and international conventions for the protection of IPR and who are members in international organizations for the protection of IPR are likely have the lowest piracy rates. In addition, a strict implementation of laws and an effective judicial system should reduce the rate of piracy.

Therefore, we expect a negative relationship between the degree of enforcement and piracy rates.

Hypothesis2: Countries with stronger enforcement tend to have a lower rate of software piracy (negative relationship).

Cultural and Social Factors

The importance of socio-political factors in economic decisions is well recognized in the literature and software piracy is not the exception. Countries with greater economic freedom should have the lowest piracy rates. This is due to the fact that the low prices of original software created by free competition make their pirated versions less attractive.

Hypothesis3: Countries with greater economic freedom tend to have a lower rate of software piracy (negative relationship).

Technological Factors

Technological capabilities may influence the ability to copy and sell software and promoting piracy. At the same time they can help to strengthen mechanisms for monitoring violations. So there are positive and negative externalities associated with the adoption of such technologies.

Hypothesis4: Greater access to the Internet and information technologies should reduce the piracy rate.

ESTIMATION MODEL

Taking into account all these considerations, we study the determinants of piracy by estimating the following equation:

Piracy = f (economic, legal, socio-political factors, technological factors)

Model specification

To identify the determinants of piracy we estimate the relationship between the rate of software piracy and the various factors identified above using the method of panel data on a sample of 96 countries observed for the period from 1996 to 2010. Specifically, we estimate the following equation:

$$\begin{aligned} \boldsymbol{piracy_{it}} = \boldsymbol{\alpha} + \boldsymbol{\beta_1}.\boldsymbol{log(PIB)_{it}} + \boldsymbol{\beta_2}.\boldsymbol{htech_{it}} + \boldsymbol{\beta_3}.\boldsymbol{overall_{it}} + \boldsymbol{\beta_4}.\boldsymbol{Rule\ of\ law_{it}} \\ + \boldsymbol{\beta_5}.\boldsymbol{Religious\ fractionalisation_{it}} \\ + \boldsymbol{\beta_6}\boldsymbol{Internet\ Uses_{it}} + \boldsymbol{\beta_7}.\boldsymbol{Urbanisation_{it}} + \boldsymbol{\beta_8}.\boldsymbol{inflation_{it}} \\ + \boldsymbol{\beta_9}\boldsymbol{Membership_{it}}\ \boldsymbol{\varepsilon_{it}} \end{aligned}$$

Where $piracy_{it}$ is the piracy rate in country i (i = 1, 2, ..., N) at time t (t = 1, 2, ..., T). β_s: Are the parameters to be estimated, is a constant α and Ɛ it is the model error on the individual i at time t. = +:ε_{it} $U_i V_{it}$ admits two components: specific unobservable fixed effect for each country U_i and the temporal effect.: V_{it} log(PIB)$_{it}$ is the log of per capita GDP; htech$_{it}$ percentage export of new technologies in exports of manufactured goods; overall$_{it}$ est An index of economic freedom; Membership$_{it}$: Designates membership from one country to the agreement on intellectual property rights (TRIPS). indicates the degree of enforcement in a p Rule of law$_{it}$; $Internet\ Uses_{it}$ means the number of computer and Internet users in a country. Religious fractionalisation$_{it}$ Measure the diversity of religions in a country. Urbanisation$_{it}$: Measures the percentage of the urban population and inflationit is the rate of inflation.

Table1. *Description of variables and data sources*

Variables	Definition of variables	Source
Piracy	The piracy rate is determined as the percentage of installed software and that have not been legally acquired.	***Busness Software Alliance (2006).*** *http://www.bsa.org/globalstudy/upload/2005 20% piracy*.
GDP	GDP per capita measured in U.S. dollar PPP, 2004.	World bank, online WDI (2007). http://www.worldbank.org/reference/
Htech	the share of exports of high technology exports in total. it is introduced as a control variable to capture the level of technology in the developed countries.	World bank, online WDI (2007). *http://data.worldbank.org/indicator*
Inflation	Inflation is measured by the annual growth rate implicit GDP deflators.	World bank, online WDI (2007). *http://www.worldbank.org/reference/*
Overall	AIndex of Economic FreedomThis index measures economic freedom.	Heritege foundation: the journal wall street *http://www.heritage.org/Index*
Rule of law	Rule of law measures the effectiveness and predictability of the legal system, and monitor the implementation of contracts (in which the intellectual property rights must be protected)	D. Kaufmann, A. Kraay, and M. Mastruzzi (2010), The Worldwide GovernanceIndicators: Methodology and Analytical Issues

Religiouse fractionalization	Different cultures between countries captured by the difference of language, religion and belonging.	Alesina et al. (2003)
Uses Internet	is measured by the number of computer users and Internet	World bank
Membership	This is membership the agreement on intellectual property rights (TRIPS), the Agreement on Trade-Related Aspects of Intellectual Property Trade.	WTO: World trade organization
Urbanization	The percentage of urban population.	World bank, online WDI (2007) *http://www.worldbank.org/reference.*
Life Expectancy	Life expectancy at birth indicates the average life of a fictitious population who lives his whole life under the conditions of mortality that year	World bank

Data

Data from different sources. Table 1 describes the variables in detail, specifying their definitions, acronyms and their sources.

The dependent variable in our study is the rate of software piracy which represents the percentage software installed and which were acquired in an illegal manner.

To explain piracy, we classify the variables into four categories:

Economic Factors

We use GDP per capita as a measure of economic prosperity in a nation; the percentage of exports of new technologies in manufacturing exports as a measure of the existence of creative industries in a country products and the inflation rate to account for the evolution price.

Legal Factors

To represent such factors, we use the variable Rule of law as a measure of the degree of enforcement and variable Membership as an indicator of the accession of a country the agreement on intellectual property rights (TRIPS)

Technological Factors

We consider Internet Users variable as an indicator of the spread of information technology in a nation.

Sociopolitical Factors

We use the variable as a measure of overall economic freedom, religious fractionalization variable as an indicator of religious diversity in a country and the urbanization variable as a measure of the degree of urbanization in a country.

Addressing The Problem of Endogeneity

Because piracy is a function of income is itself likely to be a function of piracy, we instrumentalisons variable per capita income. The approach by the instrumental variable is to find another variable that is highly correlated with income but not with the error term. We use the lagged GDP per capita and life expectancy at birth (Life Expectancy) as instrumental variables.

ESTIMATION RESULT

Table2. *Descriptive statistics*

Variable	Obs	Average	Standard deviation	Min	Max
Piracy	1320	59537	21374	0	99
Log (GDP)	1483	9196	1071	5310	11391
Htech	1290	11704	13282	0	74957
Life expectanc	1400	72397	7155	43143	82931
Overall	1465	62652	10897	15.6	90.5

Rule of law	1200	0260	1010	1942	2014
Religious Fracti	1122	33898	26111	0	86
Uses Internet	1386	20806	23498	0	94686
Urbanization	1500	65593	19.362	15	100
Inflation	1473	8253	21269	32814	381265
Membership	1499	0259	0438	0	1

Table3. *Correlation Matrix*

	Piracy	Log (GDP)	Htech	Overall	Rule Of Law	Religious fraction	Uses Internet	Urbanization	inflation	Membership
Piracy	1.00									
Log (GDP)	-0759	1.00								
Htech	-0260	0225	1.00							
Overall	-0656	0681	0.34	1.00						
Ruleofl w	-0810	0809	033 8	0733	1.00					
Religio usf	-0041	-0056	018 6	0102	-0000	1.00				
Internet	-0754	0714	027 1	0562	0694	0.0409	1.00			
Urban	-0476	0683	012 9	0532	0470	-0025	0430	1.00		
Inflatio n	0241	-0321	- 013 7	-0310	-0282	-0003	-0196	-0142	1.00	
Membe rs	-0234	0160	020 4	0264	0225	-0076	0278	0166	-0125	1.00

Table4. *Provides estimates of the model M, where per capita income is considered exogenous and is not instrumente*

	(M1) EF	(M2) RE	(M3) RE	(M4) FE	(M5) FE	(M6) FE	(M7) FE	(M8) FE	(M9)
Log (GDP)	10223 *** (1.29)	11593 *** (1006)	9387 *** (1052)	6736 *** (1706)	13669 *** (1205)	-6.959654 ** (2.168729)	-7.269027 ** (2.138454)	-6.959654 ** (2.168729)	-6.978642 ** 2.16879
Htech	-	-0080 (0059)	-0057 (0 .059)	-0.060 (0084)	-0033 (0060)	-0.0550822 (0.0601221)	-0.0578224 (0.0600287)	-0.0550822 (0.0601221)	- .0526796 (0 .0601688)
Overall	-		-0.375 *** (0.078)	-0431 *** (0113)	-0436 *** (1944)	-0.3542346 *** (0.0805392)	-0.3442856 *** (0.0800335)	- .3542346 *** (0.0805392)	-0.3646843 *** (0.0812046)
Rule of law	-	-	-	4761 * (2784)	0449 (1944)	1.208247 (1.936793)	0.8895755 (1.913853)	1.208247 (1.936793)	1.205657 (1.936776)
Religious fractionalization	-	-	-	-	6004 (144933)	38.1815 (142.6487)	38.03775 (142.5967)	38.1815 (142.6487)	21.5933 (143.5958)
Internet uses	-	-	-	-	-	-0.1271203 *** (0.0241643)	-0.1256167 *** (0.0242457)	-0.1252777 *** (0.0244142)	-0.132338 *** 0 .0254013
Urbanization	-	-	-	-	-	-	0.1473007 (0.186597)	0.1139036 (0.1884863)	0.1229624 (0.1886991)
Inf	-	-	-	-	-	-	-	0.0135515 (0.0151435)	0.0134271 (0 .0151439)
Membership	-	-	-	-	-	-	-	-	1.107337 (1.099949)
Constant	154362 *** (12046)	167.66 *** (9347)	171 134 *** (9390)	148148 *** (15869)	417037 (4912.184)	-1077.934 4830.945	145.7164 *** (11.55048)	-1149.148 (4821.187)	-588.4718 (4853.202)
Observation	1316	1156	1148	922	782	781	781	778	778
R-squared	0435	0434	0455	0284	0015	0.0009	0.0009	0.0011	0.0007
Within R-squared	0048	0050	0064	0046	0224	0.2547	0.2554	0.2561	0.2571
Between R-	0518	0478	0466	0315	0012	0.0002	0.0002	0.0002	0.0005

squared									
Fischer Test prob> *F*	62.01 (0000)	27.96 (0000)	23.96 (0000)	10.04 (0000)	40.74 (0 000)	39.88 (0000)	34.25 (0000)	29.90 (0000)	26.69 (0000)
Hausman test Test prob> *chi*2	3.44 (0063)	2.64 (0267)	2.02 (0567)	19.55 (0000)	31.04 (0000)	21.70 (0.0006)	21.87 (0.0013)	22.56 (0001)	22.91 (0.0018)
Breusch Pagan test prob> *chi*2	3049.89 (0000)	2285.43 (0000)	2151.41 (0000)	771.84 (0000)	1379.00 (0000)	1267.45 (0.0000)	1264.66 (0.0000)	1239.97 (0.0000)	1226.82 (0.0000)
Wooldridge test prob> *chi*2	1374.113 (0000)	863624 (0000)	819111 (0000)	1232.314 (0000)	193526 (0000)	208044 (0.0000)	215982 (0.0000)	216002 (0.0000)	212776 (0.0000)

The M1 model expresses the piracy rate simply as a function of per capita income. In model M2, we introduce another economic variable is the variable Htech. It expresses the share of exports of high-tech industries in manufacturing exports.

In the M3 model, we introduce a variable which is overall institutional and measures the degree of economic freedom.

The M4 and M5 models introduce a legal variable is Rule of Law and refers to the application of laws in a country and a social variable that is religious fractionalization and measures the diversity of religions in a nation respectively.

In the M6 model, we introduce a variable which is technological internet users and measures the internet and information technology.

In M7, M8 and M9 models other control variables are included. These variables urbanization which measures the degree of urbanization, inflation reflecting higher prices and membership that indicates the accession of a country to international treaty for the protection of IPR.

Fisher's exact test was applied to all models indicates that they are generally significant. The Haussaman test shows that the random effects model is preferable to the fixed effects model for M3 specification then for the other specifications is the fixed effects model was chosen. In rejecting the homoscedasticity, the test Breush-Pagan, reveals the existence of heteroskedasticity and for all estimated models. To remedy this problem, we used the method of MCG and corrected standard deviations by the Eicker-White method[1]. For all models, the Wooldridge test suggests the acceptance of the null hypothesis. This allows to conclude that the absence of autocorrelation in errors.

We discuss in the following our results in the context of different types of factors that we have already mentioned.

The Economic Effects

As shown in Table 4, the coefficient of per capita income is significant and negative in all M models (M1 to M9). In the M9 model an increase of 1% of GDP leads to a decrease of6.978642% rate of piracy.

This result is robust to the inclusion of other explanatory variables sequentially. It therefore confirms our main hypothesis suggesting the existence of a negative relationship between per capita income and the rate of piracy. It is also in line with previous studies developed by the results. On the one hand, individuals in the most prosperous countries have a greater ability to provide original software. On the other hand the cost of violation of the law is relatively higher in these countries. More richer countries can spend more on control and prevention of piracy.

Regarding the sign of the coefficient of the variable percentage of exports of advanced technology in the amount of total exports (h-tech), it is negative in all specifications but not significant. Regarding the inflation variable, we note that the coefficient on this variable is positive as was predicted but it is not significant in all models with this variable.

Socio-Political Factors

Our results indicate that greater economic freedom tends to reduce the rate of piracy. Indeed, the overall coefficient of the variable is negative and significant in all the specified models. In terms of

religious fractionalization variables and urbanization our results do reveal any evidence regarding their influence on the rate of piracy.

Technological Factors

The internet broadcasting and information technologies can allow both pirates as protecting intellectual property work better. Our results suggest that the second effect dominates the first. Indeed, the coefficient on the variable internet users is significantly negative wherever the variable figure. 2-4-4 legal factors the results we found out do not allow a clear effect. Indeed, the coefficients on Rule of Law and membership are not signifificatifs.

RESULT OF ESTIMATION BY INSTRUMENTAL VARIABLES APPROACH

As we have already mentioned, the per capita income variable is potentially endogenous since the piracy rate is expressed in terms of income, while income is itself likely to be a function of the rate of piracy. To overcome this problem we conducted an instrumental variables approach.

Table 5 provides estimates of model N where per capita income is instrumented.

Table5. *Results by instrumental variables approach*

	N1 (EF)	N2 (EF)
Log (GDP)	-6.445816 *** (1.540883)	-6.386611 *** (1.540611)
Htech	.0660736 (0.0516907)	0.0660861 (0 .0516888)
Overall	- .2331581 ** (0.0737837)	- .2331587 ** (0.0737806)
Rule of law	-7.799004 *** (1.220755)	-7.816863 *** (1.220687)
Religious fractionalization	- .0361668 (0.0395278)	-0.0360165 (0.0395269)
Uses Internet	- .0812178 ** (0.0246622)	-0.0818262 ** (0.0246597)
Urbanization	0.0832435 (0.0712757)	0.0816836 (0.0712707)
Inf	-0.0019079 (0.0142518)	-0.0018326 (0.0142512)
Membership	-0.1341544 (0.9643397)	-0131 (0.9642976)
Constant	132.0903 *** (12.65851)	131.6595 *** 12.65665
Observation	711	711
R-squared	0.7357	0.7360
Within R-squared	0.1219	0.1219
Between R-squared	0.7843	0.7846
Hausman test Test prob> *chi2*	22.91 (0.0018)	22.91 (0.0018)
Breusch Pagan test prob> *chi2*	1226.82 (0.0000)	1226.82 (0.0000)
Wooldridge test prob> *chi2*	212776 (0.0000)	212776 (0.0000)
Hausman test Durbun wu Prob> chi2	73.36 (0.0000)	74.04 (0.0000)
Sargan test P-value	0000 (0000)	5239 (0.0221)

N1 and N2 models use the same explanatory variables as the M9 model but the GDP per capita variable is manipulated. In the N1 model, the instrument is the lagged GDP per capita, while in the N2 model, we use as an instrument, the life Expectancy variable that measures life expectancy at birth.

As indicated in Table 5, in addition to the tests that have been applied to the model M, we performed, the test specification for each of Durbin-Wu-Hausman for detecting the presence of and the endogeneity Sargan test-Hansen test on identifying instruments.

The Haussaman test shows that the fixed effects model is preferable to random effects model for both N1 and N2 specifications. Testing Breush-Pagan reveals the existence of a heteroskedasticity estimated for both models. To remedy this problem, we used the method of MCG and corrected standard deviations by the Eicker-White method. For both models, the Wooldridge test suggests the acceptance of the null hypothesis which allows concluding that the absence of autocorrelation in errors. The Durbin-Wu-Hausman test reveals the presence of endogeneity and confirms the need to use instrumental variables.

The Sargan test confirms the validity of the instruments.

The coefficient of determination R in the N model (instrumental variable) recorded a significant improvement compared to the model M (which assumes the exogeneity of the variable GDP per capita). It is of the order of 73%, reflecting a better adjustment of the model

As shown tableau.5, the coefficient of per capita income is significantly negative in the N1 and N2 models. An increase in GDP per capita of 1% leads to a decrease in the piracy rate of about 6, 44%. This result supports that found with the other series of models that consider the per capita income as exogenous and confirms our main hypothesis suggesting the existence of a negative relationship between per capita income and the rate of piracy.

On the other explanatory variables, we note that the effect of the variable is not exactly the same as in the case of model M (which considers the variable per capita income as exogenous).

The Economic Effects

The sign of the coefficient of the variable percentage of exports of advanced technology in the amount of total exports (h-tech) remains negative in all specifications but not significant. Regarding the inflation variable, we note that the coefficient on this variable is negative but not significant.

Socio-Political Factors

We note that the overall coefficient of the variable remains negative and significant in all models specified indicating that greater economic freedom tends to reduce the rate of piracy.

In terms of religious fractionalization variables and urbanization our results still do not show obvious influence on the rate of piracy.

Technological Factors

The coefficient on the variable internet users is significantly negative. This supports the fact that greater access to the Internet and information technologies reduces piracy.

Legal Factors

The coefficient on rule of law is negative and significant (at 1%) in both models. This result confirms the hypothesis H which states.... it is also consistent with the results of previous studies. So an effective law enforcement with a strong copyright protection leads generally to lower piracy rate system. The coefficient of the variable remains non signifificatif membership.

CONCLUSION

Adopting an approach based on instrumental variables and using the method of panel data, we empirically tested several hypotheses about the determinants of the rate of software piracy. Our main results show that greater economic prosperity, greater economic freedom, better enforcement and greater access to internet mitigate software piracy.

It is clear from this analysis that the stage of development of a country and the quality of its institutions as well as access to information technologies have a wide impact on software piracy. Greater economic prosperity makes software more affordable and increase the opportunity cost associated with pirated versions of the software. Similarly, the most advanced countries tend to have systems to protect intellectual property rights the highest and most effective.

The main implication of this study is that it is difficult to separate the problem of piracy issues of poverty and governance. Our results are consistent with previous studies made by the results.

It is only when a country reaches a certain level of economic development we can expect a decline in the rate of software piracy.

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List of Countries

Albania, Algeria, Argentina, Armenia, Australia, Austria, Azerbaijan, Bahrain, Bangladesh, Belarus, Belguim, Bolivia, Bosnia, Botswana, Brazil, Brunei, Bulgaria, Cameroon, canada, chile, china, colombia, Costa Rica, Croatia, Cyprus , czech Republic, Ecuador, Egypt, El Salvador, Estonia, Finland, France, Georgia, Germany, Greece, Guatemala, Honduras, Hong Kong, Hungary, Iceland, India, Indonesia, Iraq, Ireland, Israel, Italy, Japan, Kazakhstan, Kenya, Kuwait, Lativia, Lebanon, Libya, Lithuania, Luxembourg, Malaysia, Malta, Mauritus, Mexico, Moldova, Marocoo, New Zealand, Nicaragua, Nigeria, Norway, Oman, Pakistan, Panama, Paraguay, Peru, Philippines, Poland, Portugal , Qatar, Romania, Russian-Federation, Saudi Arabia, Singapore, Slovakia, Slovenia, Sweden, Switzerland, Thailand, Tunisia, Turkey, UAE, Ukraine, United Kingdom, United States, Uruguay, Venezuela, Vietnam, Zimbabwe.

Abbreviation

TRIPS: The Agreement on Trade-Related Aspects of Intellectual Property Trade

ICC Code of Intellectual Property

DPI: The intellectual cleanliness

FDI: Foreign direct investment

IFPI: International Federation of the Phonographic Industry

INPI: National Institute of Industrial Property

MCO: The ordinary least square

OECD: Organization of Trade and Economic Development

WTO: The World Trade Organization

WIPO: The World Intellectual Property Organization

GDP: Gross domestic product per capita

PVD: The developing countries

R & D: Research and Development

GNI: The national income per capita

SCAM: Civil Society of Multimedia Authors

EU: European Union