
KEEPING PACE? A LOOK AT BRAZILIAN PATENT TENDENCIES

Fred Leite Siqueira Campos*¹; Antônio Suerlilton Barbosa da Silva²; Jonathan Daniel Friend¹

¹ *Universidade Federal de Itajubá (UNIFEI), Av. BPS, 1303, bairro Pinheirinho, Itajubá, MG, 37.500-903 (fredlsc@unifei.edu.br)*

² *Faculdade de Ciências Sociais Aplicadas do Sul de Minas (FACESM), Av. Presidente Tancredo de Almeida Neves, 45 - Itajubá, MG, 37504-066*

RESUMO

A inovação está diretamente ligada ao crescimento econômico. A quantidade de patentes depositadas em um país é uma das principais possibilidades de proteção de ativos (destacadamente inovadores) servindo, assim, como uma forma de análise e interpretação do crescimento econômico. Mais recentemente, “saltos” na propriedade intelectual foram vistos em países emergentes como Brasil, Rússia, China e Índia; Por meio de uma análise quantitativa do ritmo da produção de patentes brasileiras e fazendo-se análise de regressão, objetivou-se, com este artigo, prover maior entendimento sobre a habilidade do Brasil em gerir propriedade intelectual. Para o caso do Brasil, percebeu-se que a atividade relacionada à proteção endógena à Propriedade Intelectual (PI), elevada nos últimos 10 anos, pode ser explicada, em grande parte, devido aos esforços de empresas internacionais (que representam 88,1% dos depósitos de patentes no Brasil) em mudar suas estratégias no sentido de defenderem seus negócios em mercados emergentes.

Palavras-chave: patentes; Brasil; propriedade intelectual.

ABSTRACT

Innovation is directly linked to economic growth. The amount of patents deposited in a country is one of the main possibilities of assets protection (outstandingly innovative), serving, therefore, as a way of analysis and interpretation of economic growth. More lately, “leaps” in intellectual property were seen in developing countries such as Brazil, Russia, China, and India; By means of a quantitative analysis of the production rhythm of Brazilian patents, and doing regression analysis, it was aimed, with this study, provide greater understanding about Brazil’s ability in managing intellectual property. In the case of Brazil, it was noticed that the activity related to the endogenous protection to Intellectual Property (IP), high in the last 10 years, can be explained, mostly, due to efforts coming from international companies (which represent 88,1% of patents deposits in Brazil) in order to change their strategies in the sense of defend their business in emerging markets.

Key words: patents; Brazil; intellectual property.

Área tecnológica: Petróleo e Gás Natural; Energia.

INTRODUCTION

Innovation is directly linked to technological and scientific progress, as well as productivity and economic growth (BRONZINI; PISELLI, 2009; ANG, 2011; BASAK, 2011). The quantity of patents filings within a country is commonly regarded as an economic indicator (PÉREZ et al., 2011), as it is a form of documenting innovation and inventive activity for new ideas and products to be put on the market. Thus, patents serve as a manner by which to gauge economic activity and pioneering industrial undertakings leading into coming years.

As patents are a relevant economic indicator implicating innovative endeavors and subsequent industrialization, this type of analysis can help shed light on new technological life being produced by, or injected into, a regional economy. Brazil served as an example of this application as well as a point of discussion to compare emerging and developed economies.

This could be useful in generating global and regional forecasts for IP developments and their consequential economic developments in their respective countries, regions and economic blocks.

It has been said that the recent growth in global IP activity can be explained by a number of factors, those being: technological progress, shifting patent strategies from international firms and efforts to protect technology in international markets (WIPO, 2012).

In recent decades, patent filings have nearly tripled in markets spread around the world. Around 600,000 patents were filed in 1975. Global patent filings remained stable until the 1970s (WIPO, 2012). Since 1980s, USA, Japan and the Republic of Korea experienced its expansions market and brought, among others, effects on growth level (at higher rates) their numbers of patent applications. The number of patent filings nearly reached 1,800,000 in 2008. More recently, jumps in intellectual property have been seen in emerging markets such as Brazil, China and India; moreover, total global patent filings have reacted resiliently in spite of economic crisis (WIPO, 2012). Figure 1 shows the total number of patent filings from 1985 to 2010, according to the World Intellectual Property Organization (WIPO) database.

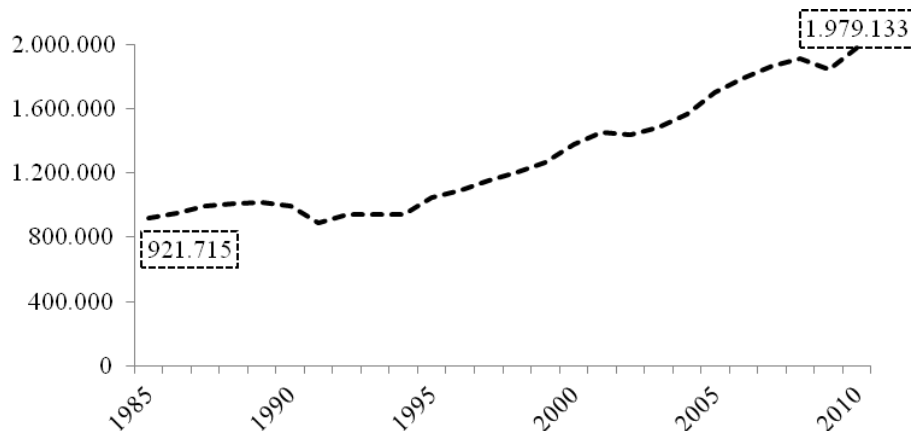


Figure 1: Total global patent applications. Source: Search Direct

This growth in developing economies may be characterized by a number of explanations, three of them being presented in the 2012 WIPO Intellectual Property Indicators Report. Technological progress leading to increased prosperity; shifting patent strategies being employed by international firms; Efforts to protect technology in international markets.

Despite there is ample information on the current state of global intellectual property, this article aims to take a more in depth look at Brazil’s patent history and its recent growth within the global IP context by means of statistical analysis.

Hartimann, Pyka and Hanusch (2010) and Herman and Avran (2011) states that, in order to better understand the impact of patents as an economic indicator for a country or region, it is important to take into consideration also those filed by non-residents within the country or region of interest. The objective of this article is to gain a greater understanding of the country’s ability to generate intellectual property. Based on comparisons with the other BRIC and G7 countries (Japan, the United States of America, the United Kingdom, Germany, France, Italy and Canada), it is possible to evaluate if Brazil has kept pace with the rest of the world in the intellectual property race while also generating a global portrait of patent production (COE et al., 2009)

As an initial attempt to describe trajectories relating to patent applications in Brazil as well as global IP tendencies, Figure 2 exhibits demonstrative data of the total number of patent filings in the Russian Federation (RF), India (IN) and Brazil (BR) from 2000 to 2010 (WIPO, 2012). It should be noted that, at the time of writing this paper, there was no report for India’s 2010 patent filing figures. It can be seen that India overtook Brazil in total patent filings in 2005.

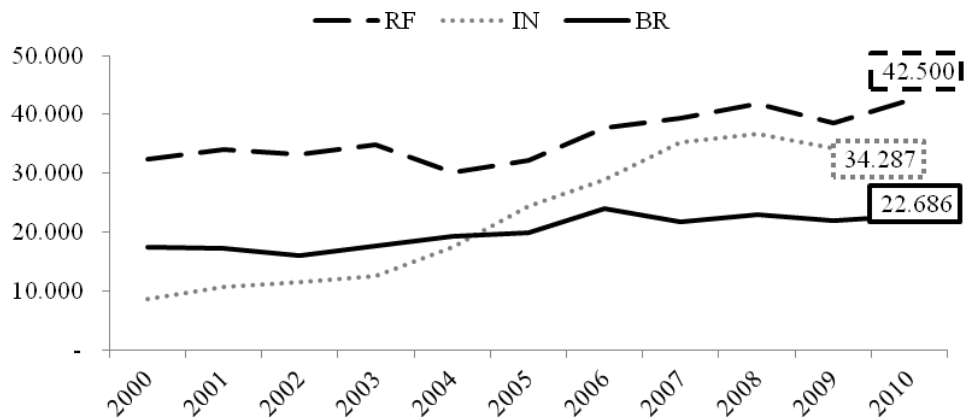


Figure 2: Total first patent filings, the Russian Federation (RF), India (IN) and Brazil (BR). Source: Search Direct.

The growth seen in these emerging economies has been overshadowed by the exponential expansion of patent filings in the People’s Republic of China (CN). Using the same data (in Figure 3), but including China in the count as well, it is possible to see the growth by the BRIC has been spurred by China’s patent boom.

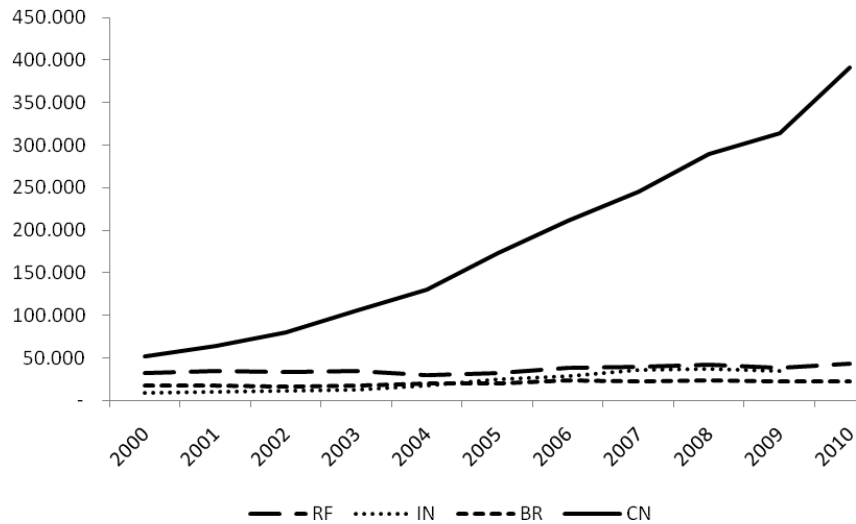


Figure 3: Total first patent filings, the Russian Federation (RF), India (IN), Brazil (BR) and the People’s Republic of China (CN). Source: Search Direct.

Although the IP growth in China has dwarfed the other BRIC countries, this is not to say that Brazil, India and the Russian Federation have not witnessed substantial growth, as witnessed in Figure 3. Thus, in order to gain a greater understanding of these tendencies in first patent filings, standardization and correlation were adopted for the second and third steps of this statistical analysis.

METHODOLOGY

In order to generate an understanding of the clip of first patent filing trends in Brazil and other BRIC and G7 countries, data obtained from WIPO regarding resident and non-resident filings (from 2000-2009) were utilized to elaborate an initial, standardized graph to show global tendencies. Due to the dramatic absolute differences in filings in offices such as Brazil and India (21,944 and 34,287 total filings, respectively, in 2009) and China (391,177 total filings in 2009), the data were standardized in order to better characterize and visualize their tendencies.

Data are comprised of the sum of total resident and non-resident patent filings for the five main areas of knowledge under which WIPO classifies patents (Electrical, Instrumentation, Chemical, Mechanical and Others). Individual country sums were then added up in their respective G7 and RIC groups, thus generating a year-by-year look at the agglomerated sum of first patent filings for the economic blocks. As Brazil is the focal point of this article, it was considered separately.

Standardization of these data is justified by Montgomery and Runger (2003), who state that standardization is an attractive option for statistical analysis when there is a great variance existent in normally distributed data sets and ratio comparisons are indeed meaningful. As the data came from WIPO, which registers all patent and IP information worldwide, all population parameters are

known and thus, standardization may be applied. Standardized data simply show the variation of the dataset in relation to the data's mean, thus generating a proportional interpretation of the data's tendency and shifts (OOSTERBEEK et al., 2010).

In order to achieve standardized data, first the mean and standard deviation of the dataset are calculated. Then, the mean is subtracted from each datum. The difference between the datum and the mean is then divided by the standard deviation to generate a standardized score (SECK, 2011).

As evidenced in Figure 4, the ratio of patents historically produced in Brazil has, at the least, accompanied global tendencies. Recalling the tendencies seen in Figure 3 it can be seen that the RIC countries are largely driven by the IP growth in China. This upswing in IP trends can be seen in Figure 4. Moreover, intellectual property production in G7 countries, considered to be developed economies, has remained steady since 2005 and even fallen off in recent years.

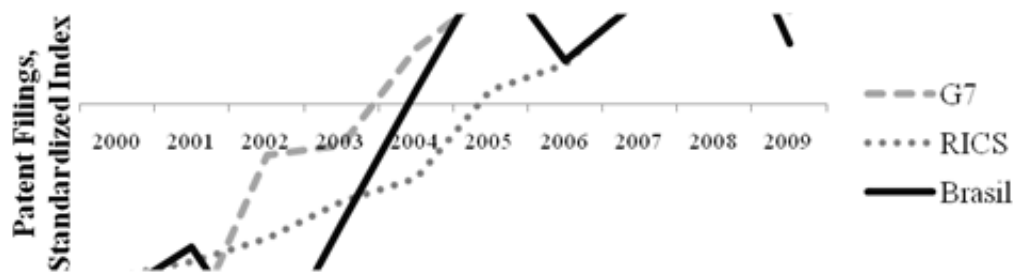


Figure 4: First Patent Filings from 2000 – 2009, Normalized: G7, Brazil and RIC. Source: Search Direct.

Studying the history of patents in Brazil, at first glance it appears that the South American country has kept up with the pace of patent filings generated by the two economic blocks under consideration in this paper: BRICs and G7. While G7's patent filings have proportionally remained stagnant over the last half decade, the RIC countries – largely spurred by an exponential boom in patent filings in China – have experienced a period of dramatic growth. Brazil has at times maintained the clip of global innovation (2002 – 2008), at least on a standardized, proportional scale.

However, Figure 4 in the previous section only serves as a preliminary visual representation of IP tendencies. In order to generate a deeper understanding of the pace of Brazilian IP and innovation, it is necessary to carry out more detailed statistical analysis. Aside from descriptive data, the Pearson coefficient measures the linear association between a response variable Y (in this case, Brazil) and an independent variable X (in this case, G7 and RIC) (Montgomery and Runger, 2003). That is, by using this simple statistical, it is possible to shed some light on the degree of the correlation between two variables of interest. By understanding the positive or negative correlation of the behavior of a response variable in relation to an independent variable, it may be possible to better understand Brazil's past IP tendencies based on observations of the patterns exhibited by G7 and other BRIC countries.

Correlation is a standardized scale which varies between -1 and 1. When a value is close to -1, this indicates a negative correlation and that the variables are inversely proportional. The opposite is also true; values close to 1 indicate a positive correlation and that the variables are directly proportional. Values closer to 0 indicate weak or inexistent correlation (MONTGOMERY et al., 2003).

The P-Value demonstrates the lowest significance level which leads to the rejection of the null hypothesis, H_0 (MONTGOMERY et al., 2003). Through analysis of the P-Value, it is possible to state if the findings are insignificant or not, thus implicating that there is some level of statistical significance (MONTGOMERY et al., 2003). The P-value is attained using a Student t test. The hypotheses are given below:

$$H_0: r = 0 \quad (1)$$

$$H_1: r \neq 0$$

where the significance level $\alpha = 0.05$. Thus, if the P-Value is greater than the significance level, the null hypothesis, H_0 , may be accepted, demonstrating that the correlation is equal to zero; that is, the correlation is statistically insignificant. If the P-Value is less than the significance level, the null hypothesis can be rejected and the alternative hypothesis, H_1 , accepted, implicating that the correlation is not equal to zero and, as such, implicating statistically significance.

Through the first analysis carried out, it can be seen in Table 1 that there is strong positive correlation between Brazil and both the G7 (+0.797) and RIC (+0.802) countries in terms of number of first patent filings among all knowledge areas between 2000 and 2009. In other words, as both economic blocks have increased in first patent filings, proportionally similar numbers were registered in Patent filing companies based in Brazil as well. That is, in terms of first patent filings throughout all areas of knowledge, Brazil is keeping up with the global IP production pace.

Table 1: Correlation between Brazil and G7 and other BRIC countries.

| | Total – Brazil |
|--------------------|-----------------------|
| Total – G7 | 0.797 |
| P-Value | 0.006 |
| Total – RIC | 0.802 |
| P-Value | 0.005 |

Source: Search Direct.

Regression analysis is a statistical technique used to model and investigate the relation between two or more variables (MONTGOMERY et al., 2003). In this case, historical data regarding the

number of patent filings registered by BRIC and G7 countries were used. In light of the fact that there is a strong positive correlation between Brazil and the G7 and other BRIC countries, it is possible to develop a linear regression model which serves the purpose of describing Brazil's past patent filing behavior in reference to the behavior of the two economic blocks being considered in this text. For this article, two regression models were developed: First Patent Filings, Brazil (Y) = Patent Filings, G7 Countries (X); First Patent Filings, Brazil (Y) = Patent Filings, other BRIC Countries (X).

In both cases, the models presented R^2 -adjusted values which showed themselves to be suitable in describing the experimental response (Brazil). That is, by evaluating the behavior of the two economic groups' numbers of first patent filings, it is possible to understand a significant amount of variance in Brazil's IP production.

For the first model, Brazil was considered as the response variable and the independent variable the total number of first patent filings among the G7 members. Through analysis of the graph and equation below, it can be seen that a suitable linear regression model can be elaborated based on historical data. With a fitted R value of 59%, it can be said that nearly 60% of Brazilian first patent filings can be explained by first patent filings registered in G7 countries. As the P-Value exhibited was 0.006, being less than the 0.05 significance level (α), it can also be said that the model adequately describes the phenomenon adequately to the fitted R value.

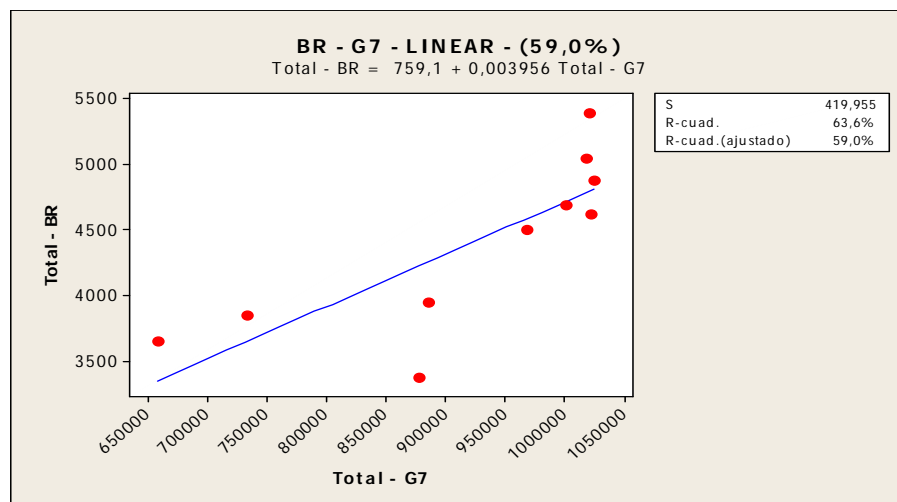


Figure 5: Linear Regression Model with Total First Patent Filings in Brazil (Y) as the experimental response variable and Total First Patent Filings in G7 countries. Source: Search Direct.

For the second model, Brazil was considered as the response variable (Y) and the independent variable the total number of first patent filings among the other BRIC members. Through analysis of the graph and equation below, it can be seen that a suitable linear regression model can be

elaborated based on historical data. With a fitted R value of 59.8%, it can be said that nearly 60% of Brazilian first patent filings can be explained by first patent filings registered in other BRIC countries. As the P-Value exhibited was 0.005, being less than the 0.05 significance level (α), it can also be said that the model describes the phenomenon adequately to the fitted R value.

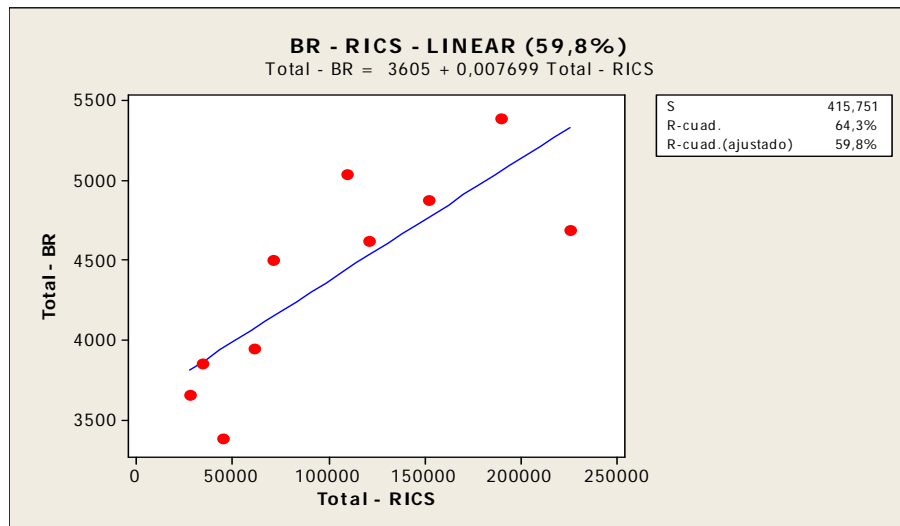


Figure 6: Linear Regression Model with Total First Patent Filings in Brazil (Y) as the experimental response variable and Total First Patent Filings in other BRIC countries. Source: Search Direct.

As shown in Figures 6 and 7, it is possible to explain at least the greatest portion of IP production in Brazil based on an analysis of the constituent nations of the BRIC and G7 economic blocks, considered emerging and developed countries. This statistical congruency implicates that Brazil, regardless of the proportion of resident-to-non-resident patent generation, is keeping up with global innovative efforts.

However, it is important to note that 88.1% of patent applications in Brazil in 2010 were filed by non-residents (WIPO, 2012).

CONCLUSION

For the case of Brazil, it does seem that recently heightened IP activity may be due to the efforts of international firms in changing their patent strategies and defending their innovative undertakings.

This can be understood by taking into considering a final statistic. While overall patent applications in Brazil have increased over the last ten years, according to WIPO's 2012 Intellectual Property Indicators, this growth has been entirely due to non-residential applications. That is, although intellectual property registered in Brazilian patent offices has indeed increased, these contributions

are coming principally from foreign firms rather than resident patent filings, which actually dropped.

In conclusion, this article has shown that historical patent data from G7 and other BRIC countries, may be used to explain IP developments in a variable of interest, in this case the Brazilian's PI. Not only can a general idea be generated by analyzing standardized and correlation data, one may also generate more specific valid linear models which can explain past behavior using regression models.

Recommendations for future studies include the analysis of other countries in emerging economies, such as other BRIC countries, as well as investigation of specific areas of knowledge among different countries. Another possibility would be the evaluation of the use of non-linear regression models to evaluate historic IP production, along with the use of historical data in order to generate forecasts of future IP activity. In order to do generate more precise models with a greater level of resolution, it is recommended that researchers evaluate data based on a monthly IP production rate.

REFERENCES

- ANG, J. B. Financial development, liberalization and technological deepening. **European Economic Review**, v. 55, p. 688-701, 2011.
- BASAK, K. Patents and Innovation: An Indian Scenario, 1990-2009. **Economic Affairs**, v. 56, n. 4, 2011.
- BRONZINI, R.; PISELLI, P. Determinants of long-run regional productivity with geographical spillovers: The role of R&D, human capital and public infrastructure. **Regional Science and Urban Economics**, v. 39, p. 187-199, 2009.
- COE, D. T.; HELPMAN, E.; HOFFMAISTER, A. W. International R&D spillovers and institutions. **European Economic Review**, v. 53, p. 723-741, 2009.
- HARTIMANN, D.; PYKA, A.; HANUSCH, H. Applying Comprehensive Neo-Schumpeterian Economics to Latin American Economies. **Structural Change and Economic Dynamics**, v. 21, p. 70-83, 2010.
- HERMAN, R.; AVRAM, R. The Contribution of the Neo-Schumpeterian Approach to the Development of the Economic Theory: Emphasis on the Meso-Economic Level. **Theoretical and Applied Economics**, v. 18, n. 7(560), p. 111-132, 2011.
- MONTGOMERY, C. D.; RUNGER, G. C. **Estatística aplicada e probabilidade para engenheiros**. 2. ed. São Paulo: LTC, 2003.
- OOSTERBEEK, Hessel; PRAAG, Mirjam Van; IJSSELSTEIN, Auke. The impact of entrepreneurship education on entrepreneurship skills and motivation. **European Economic Review**, v. 54, p. 442-454, 2010.
- PÉRES, P.; BENGOA, M.; FERNANDES, A. C. Technological capital and technical progress in the g5 countries. **Journal of Applied Economics**, v. 14, n. 2, p. 343-361, nov. 2011.

SECK, A. International technology diffusion and economic growth: Explaining the spillover benefits to developing countries. **Structural Change and Economic Dynamics**, 2011.

WIPO - WORLD INTELLECTUAL PROPERTY ORGANIZATION. Retrieved on 20 Oct. 2012. Available <<http://www.wipo.int/portal/index.html.en>>.