

The Measurement of International Intellectual Property Rights Protection and Enforcement: a new index of 21 countries

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In this paper, a new index of intellectual property rights (IPR) protection and enforcement strength for 21 developing and developed countries is reported that builds upon and extends indices by Ginarte and Park (1997) and Park (2008). Numerous studies have sought to quantify IPR protection levels of countries using composite indices, and these have been used in international business research to model and evaluate the relationship between IPR strength and economic phenomena such as inward investment levels, technology transfers and export intensity. However, existing IPR indices suffer from conceptual and methodological limitations, such as the absence of a satisfactory definition that delineates the boundaries of what comprises the institutional system of IPR protection and the lack of a robust measure (or set of measures) which quantifies the enforcement dimension of the institution. In this study, we address these shortcomings by reporting a new, reliable, transparent and robust IPR protection and enforcement index. This is informed by a conceptual framework which draws on both institutional and transaction costs theory and is quantified with the use of secondary data. A retrospective longitudinal IPR protection and enforcement index is established for the years 1998-2007. This is based on three newly developed sub-indices for each major type of IPR (patent, copyright and trademark protection). The new index can be further extended to depict IPR protection and enforcement levels in approximately 50 countries and is expected to provide a useful and better informed tool that can be considered in the econometric and other analyses of researchers in the field of international business.

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1. Introduction

Differences in the institutional regimes of countries and their effect on firm performance have received increasing attention in recent years in the field of international business (IB) (Dunning 1998, 2009; Shenkar 2004). Much of the research has focused on identifying and evaluating the impact of different institutional environments of countries on FDI flows and to understand and predict the way that firms internationalize (Buckley 2002; Griffith et al 2008; Tung and van Witteloostuijn 2008, Adler et al 2009). This is because – despite an intensification of the globalization process over the past two decades – the institutional systems of countries worldwide continue to vary significantly (Aharoni and Brock 2010). The accurate mapping and measurement of institutional regulatory systems becomes crucial if IB researchers are to understand the relationship and interactions between institutions and the activities of multinational enterprises (MNE) (Aharoni and Brock 2010).

It is possible to argue, however, that in-depth and conclusive understanding of the role of institutions on international business is incomplete. One reason for this is the difficulty associated with quantifying the effects of institutions in econometric models. An institution that is frequently investigated in IB studies is that of intellectual property rights (IPR). In this case, quantification has been done through the use of various IPR protection indices, with the most widely applied index in the literature being produced by Ginarte and Park (1997) and updated by Park (2008). However, a recent review of all thirty-one IPR indices developed between the years 1980-2008 (and including the Ginarte and Park index) by Papageorgiadis and Cross (2009) concludes that the IPR index creation process has been hampered by a number of conceptual and methodological limitations. The two most important limitations they identify are (i) the absence of a satisfactory definition of what the IPR institution constitutes that set the boundaries of what comprises this institution and which defines the elements that need to be accounted for when developing a national IPR protection and enforcement measure, and (ii) the absence of a robust measure (or set of measures) which quantifies the effect of IPR strength by country on the managerial and commercial activities of firms. In particular, Papageorgiadis and Cross (2009) argue that the IPR enforcement dimension (as opposed to the protection dimension) has only inadequately been captured in extant indices, especially in respect of actual or perceived enforcement levels in countries in contrast to the presence of relevant enforcement-related legislation. It is argued that the limitations evident in all existing IPR indices combined, have a negative effect on those (typically quantitative) IB studies that rely on them in order to proxy for the effect of the IPR institution on IB activity. In other words, IB scholars often use these IPR indices without due attention given to their limitations. This represents a serious shortcoming that has the potential to undermine the reliability of extant studies which use IPR indices and dependent or independent variables.

In this paper, we put forward a new more reliable dataset that captures both the IPR legislative protection as well as the enforcement strength in twenty-one different countries. This new index builds upon – and conceptually and theoretically extends – the widely used Ginarte and Park (1997) and Park (2008) patent index. The new index is constructed by developing and aggregating (in a fully transparent and replicable way) three new indices of different types of IPR, namely a patent, copyright and trademark index. The new indices and the aggregate IPR index overcome the seven limitations identified by Papageorgiadis and Cross (2009) providing a more reliable and robust instrument than has been devised before for the quantification of the Institutional System of IPR (ISI) protection and enforcement of countries.

Our general approach is informed by the derivation of a comprehensive yet concise theoretical framework informed by institutional theory and transaction cost theory. We follow Papageorgiadis (2010) conceptual framework, where the author used institutional theory in order to identify and depict the components of what can be considered as a general institutional system of IPR (ISI) protection and enforcement. Furthermore, the impact of the ISI on a firm's IB activity is conceptualized and theoretically supported by the same author using transaction cost theory (more information is provided in Papageorgiadis 2010). We use this framework and focus our attention in quantifying the theoretically expected transaction costs that occur from a firm's friction with the ISI, following a number of uniform and reliable index creation techniques recommended by the Organization for Economic Cooperation and Development (OECD) in their *Handbook on Composite Index Construction* (Nardo *et al.* 2005). Using these OECD guidelines a new composite IPR index for twenty-one developed and developing countries is devised, which better captures (amongst other things) the extent of national IPR protection and enforcement strength than do previous measures. Besides certain conceptual improvements, the new index is shown here to be empirically superior to earlier measures. This is evidenced in three ways: a) the high internal reliability of the new index, b) through a country-by-country comparison of the new index scores with the scores of Park (2008) and c) through the highly significant correlation of the new index with GDP data, supporting the expectations of existing theory. The results for internal consistency clearly show that the enforcement aspect of the new index is significantly more important in the calculation of the index than book-law protection (as measured by Park 2008).

In the remainder of the paper we first present the patent index developed by Ginarte and Park (1997) and updated by Park (2008) and discuss the seven associated limitations in index construction identified by Papageorgiadis and Cross (2009). We then go on to present a theoretical framework for the institutional system of IPR and its impact in terms of transaction costs this engenders for

businesses that engage with it, following Papageorgiadis (2010). This framework provides us with a solid theoretical foundation upon which to base the construction of the new IPR index. We then go on to show how the new IPR index is superior to existing indices and in conclusion, we discuss the potential contribution of the newly developed index of IPR protection and enforcement for future IB scholarship.

2. The Ginarte and Park patent index and its limitations

Over the last three decades (1980-2008) thirty-one IPR protection measurement indices have been developed for use in international business and management studies (Papageorgiadis and Cross 2009). These indices have been used in a variety of IB studies to identify the impact of IPR protection on phenomena such as the foreign market entry location decisions (Coeurderoy and Murray 2008), international technology licensing (Aulakh et al 2009), international innovative activities (Allred and Park 2007) and international R&D partnerships (Hagedoorn et al 2004). In this paper, we focus our attention upon the most widely cited IPR measure, the index of patent rights protection developed by Ginarte and Park (1997) and updated by Park (2008).¹ We first discuss the methodology underpinning the design of this index and then relate this account to the eight methodological limitations that IPR indices are found to suffer from as identified by Papageorgiadis and Cross (2009).

2.1. The Ginarte and Park index methodology: a brief discussion

Ginarte and Park (1997) (G&P) developed an index that attempted to quantify the levels of the ISI with regards to patent protection strength. This is the most widely applied patent (and IPR in general) index.² It was initially calculated for 110 countries, in five year intervals for the years 1960-1990 and was subsequently extended by Park (2008) up to the year 2005 and 122 countries. The authors use binary variables to depict the existence (or not) of a particular legislation in the patent legislative system of different countries. The index is comprised of five factors, namely: a) coverage, b) membership in international treaties, c) enforcement mechanisms, d) restrictions on patent rights and e) duration of protection. The coverage factor includes eight variables which aim to capture the availability of patent protection in certain type of sectors where patent protection is perceived as beneficial for the IP holder, such as the patentability of pharmaceutical products, surgical products, software and microorganisms. The membership in international treaties factor approximates the

¹ For a review of the entire literature on the development of IPR protection indices see Papageorgiadis and Cross (2009) and Papageorgiadis (2010).

² A Google Scholar search reveals that the Ginarte and Park (1997) index has been cited in more than 850 academic books and articles.

adherence of a country in international patent protection related treaties and includes five variables such as being signatory to the Patent Cooperation Treaty and the Trade Related Aspects of Intellectual Property rights agreement (TRIPS). The enforcement mechanism factor considers the existence (or not) of a legal framework that can enable patent enforcement, such as the availability of “preliminary injunctions” and “burden of proof reversal policies”. The restrictions on patent rights factor considers the existence or not of legislation that has the potential to negatively affect the appropriation of the patent rights of a firm. Three such laws are considered, a) the provisions that allow the application of compulsory licensing policies, b) legislation that enables the revocation of patents and c) policies affecting the working requirements of a patent (e.g. demanding a patent to be actively used in a country). Finally a fifth factor comprises only one variable, the duration of patent protection. Countries offering protection that lasts less than a 20 year period from the date of application or 17 from the patent granting date are scored lower than the value of one which is assigned to those countries that meet the aforementioned requirements.

Each of the variables described above is quantified by G&P with the use of binary variables according to the availability or not of the specific patent legislation in question. For example, the “preliminary injunctions” variable of the “enforcement mechanisms” factor is awarded with the value of “1” when this legislation exists in the patent system of a country and with “0” when this is not evident. Likewise, the total summated value of the variables comprising a factor constitutes the total index number that represents each factor (sum of total variables related to one factor).³ The overall patent protection index number of a country consists of the unweighted sum of all factors, with the values ranging between 0-5 with 0 signalling nonexistent patent protection in a country and 5 relating to higher levels of protection.

2.2. Limitations of the Ginarte and Park index

The G&P index (as well as the entire IPR index literature) suffers from seven inherent limitations identified by Papageorgiadis and Cross (2009). These are: a) limited measurement of enforcement issues, b) conceptual and theoretical limitations, c) selection of variables, d) contextual use of binary variables, e) absence of tests measuring the internal consistency and reliability of the index f) data availability, g) contemporaneity. These limitations are discussed below in relation to the G&P index.

³ No weighting scheme applied. G&P report the use of differential weighting but they did not find any significant changes in the ranking of countries. This might be because the sum of binary variables may not allow for significant variations in the data.

2.2.1. Limited measurement of enforcement issues

Jain (2004) recognises that international business researchers need to be more mindful of IPR-related issues especially in relation to variable levels enforcement and other factors that influence IPR protection intensity in different countries. A number of different authors have heavily criticized the G&P index for failing to consider the enforcement aspects of the patent institution and emphasizing only the availability of IPR protection in the legal systems of different countries (Maskus 2000, OECD 2008). In other words, it can be argued that the index only partially captures the full extent of the institutional framework where IPR protection and enforcement takes place and the associated dynamic effects on the decision-taking of economic actors (Maskus 2000). Indeed, this is recognized by Park (2008, p. 761) who when updating the index mentions that “the index was designed to provide an indicator of the strength of patent protection, not the quality of patent systems”. Ostergard (2000) comments that the variables used by G&P to measure IPR enforcement only capture the *potential* to enforce (e.g. with reference to simple book law or using an arbitrary proxy such as a corruption indicator) and not the *actual* enforcement performance or practices of a country. Even when enforcement is accounted for, it is generally done using binary variables that capture the existence of enforcement-related statutes (e.g. Ginarte and Park 1997): however, the level and range of IPR enforcement as seen in practice is seldom if at all captured. Furthermore, it is fair to suggest that, by not using a weighting scheme, the importance of IP enforcement is often reduced (or undervalued) relative to other variables included in the IPR index design.

2.2.2. Conceptual and theoretical limitations

The lack of consideration of enforcement issues is probably because the G&P index (and indeed none of the existing IPR indices) did not initially attempt to define the institution of patent rights. A definition would enable the authors to decide more accurately on the number and type of factors and variables that need to be considered and accounted in the calculation of the index. The absence of a definition in the form of an analytical conceptual framework that would assist in identifying those aspects of the patent institution that need to be incorporated in the creation of the index measured suggests that many potentially important factors (and variables) are omitted from the calculation of the index. Therefore the factors considered in the measurement of the index are questionable, especially (and as will be discussed below) since important aspects of the patent institution such as the effectiveness of enforcement attempts and quality of patent related administration are absent.

In addition to the lack of a definition, the factors and variables considered for the calculation of the patent index are entirely disconnected from widely applied economic theory. A theoretically supported conceptual framework would allow identifying the theoretical impact of the institution to

business activity. This would enable a tailor-made selection of variables that measure the important aspects of the IPR institution. Furthermore, since such theories are eventually tested by the use of indices such as the G&P index, it is important that the data collection informing the patent index focuses on those issues that have a direct or indirect effect on business activity. Therefore, there are conceptual and theoretical limitations that impact on the quality of extant IPR measures.

2.2.3. Selection of variables

The lack of a conceptual and theoretical framework also impacts on the selection and relevance of some of the proxy variables used in the G&P index. To illustrate, the authors incorporate variables that aim to capture the membership status of countries in TRIPS and the Paris Convention, although being a member in the former automatically obligates a country to comply with the rules of the latter (WIPO 2007). Furthermore, being a member of TRIPS also obligates the member-states to offer patent protection for at least twenty years which is an oxymoron since duration of protection constitutes one of the five factors of the G&P on its own right.

2.2.4. Contextual use of binary variables

The quantification of the selected variables in a binary mode has led to problems regarding the relevance of the data used. This is because the attempts to measure some variables relying on binary data lack sufficient levels of conceptual qualitative content. This in effect has an impact on what these variables are designed and perceived to measure and what they eventually achieve in capturing. It has to be underlined that the use of binary data in index creation is acceptable, particularly when the meaning can be captured in a dichotomous way. However, this is not the case when attempting to measure the patent institution. This is because, commonly, there is more meaning and variation hidden behind an answer to a binary question. For example, the mere fact that a country's legislative system includes a clause for compulsory licensing (as measured in the restriction of patent rights in the G&P index), does not provide any information about whether or not this clause was ever used, why it was used and if it was only used in a particular industry (such as the pharmaceutical industry). Hence, although the use of binary variables is desirable, but in the case of the measurement of the IPR institution this has been implemented at the expense of conceptually important information lost behind the variable attempted to measure.

2.2.5. Absence of tests measuring the internal consistency and reliability of the index

A striking absence from G&P's reporting of the methodology used in the index construction process is that there is no statistical test applied in order to examine the internal consistency and reliability of

their patent protection index. This is an omission of considerable importance and not only affects the reliability of the G&P index but more importantly, of the studies that reviewed, used and quoted this index. It suggests that although the index has been extensively applied in different studies, it is still not known what the internal quality of this index is, and if it makes statistical sense to use it.

Two multivariate analysis tests are commonly applied and reported in the index scale construction literature, namely a) Cronbach coefficient alpha and b) factor analysis (Nardo *et al.* 2005). These enable the researcher (as well as the reader) to identify the degree of correlation among a set of variables used to construct an indicator (or sub-indicator) and how well these associate and describe the indicator of concern (Hair *et al.* 2009). Such analysis enables those variables that do not have a good fit with the others to be identified and (if deemed appropriate) excluded from the model. It also allows the potential importance of the different component variables of the index to be identified, paving the way for the application of a weighting scheme.

Data from the factor analysis test (factor scores) can also be used to guide the application of a weighting scheme to calculate an index (Nardo *et al.* 2005). The consideration of a weighting scheme in the construction of an index can enable the researcher to assign higher weights to those variables that have a significant impact in the final index value, which is empirically desirable. It has to be underlined that all existing studies fail to apply or apply equal weighting to all the variables that comprise the total IPR index. This practice flattens the variable effect that each variable can have upon business activity. It effectively suggests that the existence of a law equals to the absence or not of the enforcement of this law.

2.2.6. Measurement during five year intervals and availability of data for different types of IPR

Finally there are also issues related to the five year interval measurement of the patent index as well as the non-availability of data for more types of IPR rather than patents protection only. These are not limitations *per se* but restrict the flexibility of IB researchers using such data. With regards to the five year interval measurement, this restricts the longitudinal matching of the dataset with other data in an econometric model. Furthermore the G&P index was developed to measure the patent protection related legislation only. This is often problematic as patent issues are commonly used in the literature as independent variables that proxy the overall IPR protection institution of a country. However, patent related issues are different by definition and nature to the other types of IPR such as copyright

and trademarks. Therefore a significant contribution would be made by creating a separate copyright and trademark index.

To sum up this review, although significant progress was made by Ginarte and Park (1997) in the measurement of the strength of patent protection, it is clear that this literature is still in a premature stage. Despite greater convergence of IPR law across countries in recent times (in response to TRIPS and other forces), different institutional settings, patchy enforcement and other country-specific factors necessitates the design of an up-to-date index of IPR regimes, especially one that differentiates better between the contrasting enforcement practices of countries than has hitherto been achieved in the majority of indices currently available.

The identified limitations of the G&P index helps us to establish a checklist of important issues that need to be corrected in an attempt to create a new IPR protection and enforcement index that can be argued to be superior to existing ones. We highlight and address these issues in the IPR protection and enforcement index construction process which we now describe, starting with the creation of a theoretical framework that maps and frames the ISI, providing a solid definition in order to support the development of the new index.

3. The conceptual and theoretical framework of the ISI

The previous discussion highlights that the literature concerning the measurement of the Institutional System of IPR protection and enforcement (ISI) is in need of greater theoretical input that will provide the foundations and assist in setting the boundaries for the measurement of the ISI. This would be a major step forwards as it would enable us to clearly delineate what constitutes the IPR institution. Theory will also guide the selection of those important aspects that need to be measured, with a particular focus on the aspects that cause friction between the institution and business activity undertaken within it.

3.1. Definition and boundaries of IPR protection and enforcement measurement

We first start with the definition of the institutional system of IPR (ISI). This is done by following the conceptualization of Papageorgiadis (2010) and Papageorgiadis and Cross (2010). This conceptualisation of the ISI is founded on the institutional work of North (1990) and Scott (2001) and identifies those elements that comprise the ISI through a comprehensive literature search and content

analysis of studies. These components are placed into one of three levels that map the general scope and jurisdiction of the ISI. These are: a) the *sub-national level* (where IPR is enforced), b) the *national level* (where IPR law is enacted) and c) the *supranational level* (where IPR-related treaties and concordats concluded between countries impinge upon national law). Components of the three levels are further categorised into *formal* institutional elements (which includes elements relating to the legal protection and enforcement of individual types of IPR) and *informal* elements (such as societal attitudes to IP infringement). To assist understanding, the formal elements are further dissembled into three categories (following North 1990), namely: a) legislative, b) administrative and c) supporting infrastructure. The legislative category includes the provision of IP laws that a country offers. The administrative elements include clerical functions required in order for the system to operate (e.g. prior art searches, examination, responses to applicants). The supporting infrastructure category includes the existence of organisations and firms that facilitate the effective use of the system by economic actors. Similarly, the informal elements are also divided into three categories, namely: a) supporting infrastructure, b) administrative, and c) societal levels. Supporting infrastructure and administration resemble those factors that are regarded as formal in effect but differ in application, whereas the societal factors includes aspects that depict the importance of societal attitudes to the implementation and enforcement of the rule of law (Scott 2001). It is argued that each of these elements of the ISI interact considerably to determine the level of IPR strength in a country. A pictorial representation of the ISI can be found in Figure 1 below.

-----Figure 1 around here-----

The performance of the ISI, in terms of structure and effectiveness, impacts on the way that business activity is organised within a particular institutional context because friction (caused by institutional inefficiency and related effects) raises actual costs and transaction costs for a company (Demirbag *et al.* 2007). This is because institutions such as the ISI enable companies to transact outside of their corporate boundaries through external market transactions. The performance of institutions becomes particularly important when firms engage in cross-border transactions (Henisz 2003; Mudambi and Navarra 2002; Peng 2002, 2003). This is because companies find it difficult to engage with host institutions that are substantively different, or “distant”, from their home institutions or others with which they are familiar (Kostova 1999; Xu and Shenkar 2002). Thereby, measuring the actual costs and transaction costs that companies face from their interaction with a country’s ISI enables us to consider if such costs are high or not. However, whilst the calculation of actual, numerically measured costs is arguably an easy calculative process the measurement of transaction costs is more difficult as they need to be first identified and then proxies found for them.

A transaction cost theory rationale is applied to analyse the impact of the ISI on firm activity. Using the theoretical foundations of transaction cost theory, Papageorgiadis (2010) conceptualises from a macro level standpoint the impact that the ISI has on firm behaviour. By examining the potential effects of the ISI on different parts of the firm four types of transaction costs can be recognised. These are search costs, servicing costs, property rights protection costs and monitoring costs (Clegg and Cross 2000; Williamson 1975; Anderson and Gatignon 1986). Search costs relate to those costs originating from the asset specificity dimension, while servicing costs, property rights protection costs and monitoring costs relate to environmental uncertainty and free-riding potential.

Search costs occur in the process of evaluating the level of statutory protection offered to IP-owners by the ISI. This process allows the distance to be calculated between the host ISI and the home system with which a firm is accustomed. The actual cost of searching may not be high (this function is often outsourced to IP specialists). However, it is the processing of this information that further determines cost levels. When the ISI of the host country is very different from that with which a firm is familiar then this translates into increased transaction costs as it acclimatises to, and become familiar with, the local institutional environment. Search costs can be identified for three component levels of the ISI, namely (i) the *national/formal/legislative*, (ii) the *supranational/formal /legislative*, and (iii) the *national/formal/supporting infrastructure* levels. Points one and two relate to the legislative environment which firms need to investigate and understand in order to establish how the host legal framework differs from the one at home. The third point relates to the quality and availability of IPR-related information provided by government agencies to firms and consumers, and how this is delivered to users.

Servicing costs comprise the costs involved in the transfer of IPR to a contracting party in the host country (Clegg and Cross 2000). Servicing costs can arise both internally and externally to the firm. Internally, servicing costs consist of, *inter alia*, those costs associated with codifying the proprietary asset to facilitate its transfer, the costs of transferring non-codifiable knowledge (such as know-how and show-how), the cost of implementing security measures to mitigate the threat of inappropriate leakage of knowledge to rivals, and the cost of educating the contracting party on how to effectively operationalise the proprietary asset (e.g. how to implement a brand strategy in the case of trademarks) (Clegg and Cross 2000). Many of these costs will be moderated by the absorptive capacity of the recipient firm. Externally, servicing costs arise in dealing with the ISI of a country. Servicing costs arise at two levels of the ISI: (i) the *national/formal/administrative*, and (ii) the *national/informal/supporting infrastructure* levels. The former relates to the quality of IPR administration (efficiency, quality and timeliness of IPR-related agencies, transparency, complexity

and communication of regulations and procedures, the level of discrimination and national treatment in the registration process, and the quality of decisions by IPR-related agencies). The latter relates to the quality, number and cost of supporting companies that assist IP-owners with the IPR application and exploitation process and in anti-infringement activities.

Transaction costs found in the property rights protection costs category relate to whether or not fair protection of IPR occurs when, for example, an infringement case is taken to court. Should such protection not happen, then the firm will incur costs as it takes steps to ameliorate this outcome. Time related issues are important, however, since there are various transaction costs involved in the time period between taking a case to court and reaching a verdict. Long delays would translate to high transaction costs ranging from direct costs (legal fees) to opportunity costs from the defendant's chance to continue profiting from the sale of the disputed articles (with regards to patent or counterfeiting cases). Other costs considered in this category are caused by the inefficiency of the judicial system. An independent jury that is generally expected not to accept bribes will be a safeguard for effective law enforcement, thereby keeping the associated TCs low. Property rights protection transaction costs therefore occur at: (i) the *national/formal/ administrative* level and (ii) the *sub-national/formal/administrative* level. The former includes aspects of the quality of the IPR administration in terms of quality and timeliness of IPR-related agencies and transparency of procedures (e.g. legal examination). The latter includes elements such as the accessibility, fairness, transparency, even-handedness, resourcing levels and timeliness of the judicial enforcement system as well as the nature of remedies in the case of successful prosecutions of infringement claims (including value and frequency).

Monitoring costs arise from a firm's effort to constrain the activities of those contracting parties or competitors who behave opportunistically and undertake to infringe the assets of IP-owners (Clegg and Cross 2000). Cost increasing activities include those efforts to motivate, inform and coordinate the activities of the police, border customs and other enforcement agencies. Such agencies are often ineffective in combating infringement due reasons of understaffing, inexperience, negative perceptions towards IPR protection and corruption (Ouma 2006), especially in less advanced economies.

These issues are closely related to the free-riding potential dimension and the opportunity cost assumption. Realising that its intellectual assets are used illegally by a non-affiliate party in foreign or domestic markets (constituting IPR infringement) has two implications for the firm. It may miss an opportunity to appropriate some or all of the profits arising from this unexploited market and it may

build a competitor by permitting an unrelated party to freely profit from its assets (Granstrand 1999; Maskus 2000). Monitoring costs therefore arise at four levels:

- a) The *sub-national/formal/administrative* level (which relates to local governmental attitudes towards IPR enforcement and the level of commitment they provide to such activities).
- b) The *sub-national/formal/supporting infrastructure* level (which considers the effectiveness, availability, allocated power, level of resourcing and extent of corruption of police and customs enforcement agencies).
- c) The *sub-national/informal/societal* level (which includes cultural and societal attitudes towards the purchase of infringing products, enforcement attempts and awareness of the IPR infringement impact on the economy, as well as perceptions of IP-owners to changes in a country's IP regime).
- d) The *supranational/informal/supporting infrastructure* level (which includes the role of international coalitions of IP-owners and trade association in a country and the extent of international diplomatic and trade pressures (coercion effects) relating to IPR enforcement between countries).

This approach allows the identification of the type of impact that different levels and elements of the ISI have on business activity, as seen in Table 1.

-----Table 1 around here-----

Overall, the combination of the two theoretical approaches (institutional theory and transaction costs theory) enables the ISI to be structured and defined and its impact on international business activity to be hypothesised. On the one hand, institutional theory informs the structure of the ISI and, on the other, transaction cost theory guides the identification of those variables that most influence the ISI and its effect on economic actors. Consequently, it can be argued that the theoretical support and structure provided by these two theoretical approaches and the conceptualisation that originates from the identification of the seven limitations associated with extant IPR indices provide a solid qualitative foundation for the creation of a new index.

4. New IPR index construction

We now focus our attention on the creation of a new IPR index based on the newly established conceptual framework. In so doing, the aim is to address the six remaining limitations identified by Papageorgiadis and Cross (2009). The process we report draws heavily from the OECD guidelines on composite index creation by Nardo *et al.* (2005). This Handbook is one of the most authoritative sources currently available on the creation of comparative national measures of macro phenomena (Fagerberga *et al.* 2007; Archibugi *et al.* 2009). It was decided to follow these guidelines for three reasons: (i) the handbook provides a comprehensive overview of the existing (general) index construction literature and offers tailor-made guidelines, information and advice about index creation in the areas of industrial competitiveness, sustainable development, globalisation and innovation (i.e. areas which resonate strongly with the subject matter of this study), (ii) it recommends a number of reliable, robust and uniform techniques that should be implemented during index construction to enhance the quality of the product in empirical and econometric studies, and (iii) it is advocated by, amongst others, the OECD, an organization which promotes the principles of free market economics by producing various composite indicators against which any new IPR indices ideally needs to be meaningfully comparable.

In this handbook, Nardo *et al.* (2005) propose a ten step procedure to guide data collection and analysis during an index creation process: i) development of a theoretical framework, ii) selection of data, iii) multivariate analysis for the evaluation of the scales, iv) imputation of missing data, v) normalisation of data, vi) weighting and aggregation of the data, vii) robustness and sensitivity test, viii) link to other variables, ix) visualisation of the new index and x) back to the real data (transparency). Each of the steps will be discussed and implemented below. To the best of our knowledge, this is the first time that these OECD guidelines have been followed to create an IPR index and this in itself constitutes a contribution and improvement to the extant literature.

4.1. Theoretical framework and selection of data

To begin with, the theoretical framework was reported in the previous section. Therefore, we now highlight the process of comprehensively searching for secondary sources in order to identify relevant proxies for the quantification of the transaction costs that result from a firm's interaction with the ISI. To allow for the creation of a concise IPR index that can be updated and recalculated on a regular basis (e.g. annually), each of the secondary data sources short-listed needs to satisfy certain criteria. It was decided *a priori* that the chosen variables should possess six key attributes. These relate to the initial year of their publication, the extent of temporal coverage, their periodicity, the country

coverage, their conceptual relevance and the cost of acquisition. These attributes were chosen for the following reasons. First, the earlier the date of initial publication, the more longitudinal will be the new index. Second, the more consistent the data collection method, the more reliable will be the new index. Three, the more frequently the data are reported, the more discriminating the index will be over time. Four, the broader the country coverage, the more countries for which an index measure can be calculated. Five, the secondary data need to have a close conceptual relevance to the theoretical framework in order to be good quality and meaningful proxies of the ISI and its transaction costs. Finally, data collection costs need to be minimised in order to facilitate replication and regular updating of the index. These criteria determined the secondary data collection process and this was the final phase of secondary source identification.

Seven data sources were identified that satisfied all the search criteria. These are: (i) the WEF *Global Competitiveness Report*, (ii) the IMD *World Competitiveness Yearbook*, (iii) the *International Country Risk Guide* published by the PRS Group, (iv) the *Corruption Perceptions Index* produced by Transparency International, (v) data on piracy rates reported by the BSA, (vi) the USTR *301 Report* and (vii) the patent, copyright and trademark law indices by Park (2008) and Reynolds (2004). A number of variables found in each of these sources were used to proxy for the transaction costs constructs. The seven sources of secondary data and the variables of interest they report are described below together with their relationship to the ISI and the transaction costs they will be used to proxy.

Global Competitiveness Report. The Global Competitiveness Report (GCR) is published by the World Economic Forum (WEF). The GCR conducts an annual questionnaire survey entitled “Executive Opinion Survey” which contains two variables that offer a good fit as proxies for elements of the ISI namely (i) intellectual property protection and (ii) judiciary independence.

The “intellectual property protection” indicator was introduced by the WEF in 1997 and is measured by executives’ response to the question “Intellectual property is well protected in your country”. The minimum score assignable is “1”, which equates to weak or nonexistent IP protection while the maximum is “7”, equating to a protection level comparable to “the world’s most stringent” (a concept not defined further). This indicator is used to proxy the monitoring costs that arise from the institutional element “Positive/negative perceptions of IP owners to changes in a country’s IPR protection and enforcement regime”. This factor is located at the *Sub-national/informal/societal level* of the ISI (See Table 2).

Similarly, the “judicial independence” indicator was introduced to the GCR in 1998 and is measured by executives’ responses to the question “Is the judiciary in your country independent from political influences of members of government, citizens or firms?” The minimum score respondents can assign is “1” (political influence is high) and the maximum is “7” (the judicial system is entirely independent). This variable is used to proxy the property rights protection costs occurring from the ISI variable “Judicial enforcement”, which is part of the *Sub national/formal/administrative* level of the ISI. The assumption is made that higher levels of political interference correlates to weaker judicial enforcement and therefore to higher property rights protection costs (See Table 2).

World Competitiveness Yearbook. The World Competitiveness Yearbook (WCY) is an annually published report based on the research activities by the International Institute of Management Development (IMD). The WCY assesses the actual and perceived competitiveness of nations by, amongst other things, collecting annual data through their “Executive Opinion Survey” which targets business leaders in top and middle management positions of local and foreign companies within different countries. There are three variables in the WCY which offer a good fit as proxies for the theoretical framework of the ISI. These relate to (i) intellectual property protection (ii) bureaucratic quality and (iii) justice is fairly administered.

The indicator for “intellectual property protection” was introduced by the IMD in 1997 in its current form and is measured by managers’ responses to the statement “Intellectual property rights are adequately enforced”.⁴ The lowest score assignable is “0”, which equates to weak or nonexistent IP enforcement while the maximum score of “10” equates to the maximum IPR enforcement available. We use this score to proxy the monitoring costs that arise from the component “Positive/negative perceptions of IP owners to changes in a country’s IPR protection and enforcement regime”. This component is present at the *sub-national/informal/societal* level of the ISI (See Table 2).

The indicator for the statement “Bureaucracy does not hinder business activity” is also calculated from respondents’ answers with the minimum score of “0” equating to bureaucracy levels that heavily influence business activity and the maximum “10” to bureaucracy that does not at all restrict business activity. This variable is used to proxy the servicing costs arising from two components of the ISI,

⁴ This indicator was stated specifically to refer to “patent and copyright protection” for the year 1996. For consistency reasons this indicator is not used for that year.

namely “quality of IPR administration” and “time-related administrative framework”. Both of these components are found at the *National/formal/administrative* level of the ISI. The assumption here is that the agencies that administer the IP-related laws and regulations of countries will be perceived by respondents in the same way as overall national bureaucratic quality (See Table 2).

Finally, the indicator “Justice is fairly administrated” includes responses varying along a scale from “0” (‘low levels of fairness and even-handedness’) to “10” (high levels). This indicator is used to proxy for the judicial enforcement component of the ISI, which is present at the *Sub-national/formal/administrative* level (See Table 2). An assumption is made that there will be a close correlation between the way that IPR rights are enforced by the judicial system of a country, and respondents’ perceptions of the overall fairness of a country’s judiciary.

International Country Risk Guide. The International Country Risk Guide (ICRG) is published by the Political Risk Services Group (PRS) and ranks the perceived political risk levels of countries based on an analysis of relevant secondary data. The overall political risk ranking is comprised of twelve components two of which offer a good fit to proxy for the theoretical framework of the ISI, namely (i) “law and order” and (ii) “bureaucracy quality”.

As its label suggests, the “law and order” index is quantified by the ICRG using two different sub-components, that of “law” and that of “order”, with both ranging from a minimum score of “0” to a maximum of “3”. The “law” sub-component is a proxy of the strength and impartiality of the legal system of a country, while the “order” sub-component is calculated by assessing popular beliefs concerning law enforcement (e.g. low/high crime rates). The combined indicator therefore ranges along a scale from “0” to “6” (a summation of the two sub-variable scores). In the present study, the ICRG ‘law and order’ indicator is used to proxy the property rights protection costs that arise from the “Judicial enforcement” component of the ISI which is found at the *Sub-national/formal/administrative* level (See Table 2).

The “Bureaucracy quality index” of the ICRG measures a country’s ability to implement its policies without significant institutional changes and interruptions in government services. Therefore, countries with weak bureaucracies which cannot absorb policy changes without affecting daily administration factors score low, whereas strong and established bureaucracies that act without government intervention score high. The values assigned to this component range along a scale from “0” (weak

bureaucracy) to “4” (strong bureaucracy). As with the IMD bureaucracy-related index, this variable is used to proxy the servicing costs occurring from two components of the ISI, namely (i) quality of IPR administration and (ii) time related administrative framework. Both components are located at the *national/formal/administrative* level of the ISI (See Table 2).

Corruption Perceptions Index. The Corruption Perceptions Index (CPI) is an annual composite index published by Transparency International (TI). The CPI index (2008) compiles data from thirteen different sources originating from ten different institutions and the final index score for each country is the mean (and standard deviation) of the different normalised values compiled.⁵ Scores range along on a scale from “0” (highly corrupt) to “10” (highly ‘clean’). In the present study, this indicator is used to proxy two different types of transaction costs arising from the ISI: (i) the property rights protection costs and (ii) monitoring costs. With regards to the property rights protection costs, these occur from the ISI variable “Level of corruption in judiciary” which is a component of the *sub-national/formal/administrative* level of the ISI. Monitoring costs arise from the two variables: a) level of corruption amongst police and b) level of corruption amongst customs officials, both found at the *sub-national/formal/supporting infrastructure* level of the ISI (See Table 2).

Piracy Rates. The Business Software Alliance (BSA) publishes an annual piracy report that offers an estimate of piracy levels and software revenue lost to piracy. The scores are calculated using the following three methodological steps. Firstly, the BSA determines the amount of PC software packages deployed in a market. It then calculates the number of software packages legally sold in the same market. The final step involves the subtraction of these two figures, the result of which provides an estimate of the amount of software pirated in a market. This calculation is based on PC shipment tracking data as well as data collected within countries. The piracy rates are used to proxy the monitoring costs occurring from three components of the ISI, namely: (i) levels of infringement rates, (ii) cultural and societal attitudes towards the purchase of infringing goods and (iii) levels of public commitment to IP protection. These components are present at the *Sub-national/informal/societal* level of the ISI (See Table 2).

The ‘USTR 301 Report’. The office of the United States Trade Representative (USTR) reviews IPR protection and enforcement around the world on an annual basis. This review is published as a report,

⁵ The ten different institutions are the following: Asian Development Bank; African Development Bank; Bertelsmann Foundation; Economist Intelligence Unit; Freedom House; Global Insight; IMD International; Political and Economic Risk Consultancy, The World Bank; World Economic Forum.

commonly known as the “Special 301” report, as it originates from the Special 301 provisions of the US Trade Act of 1974. The purpose is to highlight negative and positive developments in IPR enforcement among trading partners of the USA, and especially how these countries treat US companies and their IPR. The ultimate aim is to encourage and maintain effective IPR protection and enforcement internationally. It is informed by different US stakeholders, including private and industrial alliance representatives as well as US and foreign governmental sources. Moreover information related to the piracy levels for records and music, motion pictures, business software and books are also assessed.⁶ The report offers a qualitative categorisation whereby countries that are considered to offer inadequate levels of IPR protection and enforcement (relative to the USA) are grouped into one of three different categories, namely: a) “Watch List”, b) “Priority Watch List” and c) “Section 306 Monitoring”. Countries that fall in the “Watch List” are those with problematic IPR protection and enforcement levels. Those placed in the “Priority Watch List” suffer from the same issues but attract greater attention from the US government because of their importance in bilateral trade (either because they attract more complaints by US companies who request bilateral action to solve the problem, or to increase pressure on them for other economic reasons, such as in response to anti-dumping complaints). Finally, the “Section 306 Monitoring” list includes countries previously listed in the “Priority Watch List” and which the USTR is monitoring closely with the aim of actually imposing trade-related and other sanctions if they do not comply with USTR recommendations. Additionally, some countries are not named in USTR specific categories (due to their generally acceptable IPR enforcement levels) but are still mentioned in the report because they suffer from some enforcement deficiencies in particular aspects of the ISI. This suggests that these countries offer what might be regarded by firms and policy-makers as an acceptable level of IPR protection and enforcement but can still improve their enforcement efforts in some regard. On the other hand, countries not named at all in the report are assumed to present fewer IPR enforcement issues or that they are unimportant for US trade. Consequently, the number of countries listed annually in this report is not fixed since countries move in and out of the listings depending on their IPR-related performance as perceived by the USTR.⁷

In order to quantify information from the “Special 301” report, we follow Smarzynska (2002) who assigned different values depending on the list in which a country is placed.⁸ However, we go one step

⁶The BSA piracy rates (presented previously) is one of the data sources considered for the development of the report, however, not the only one.

⁷ The “301 Report” has been criticised for categorising countries not only on the basis of their IPR-related performance but also on US commercial (and arguably political) grounds (Smarzynska 2002).

⁸ Smarzynska (2002) assigns values for the three categories ranging from “1” to “3”. Countries included in the “Section 306” category are given the value of “1” to indicate those lacking adequate IPR protection as of 1995 while “3” is given to countries in the “Watch List” to represent those in which “close to adequate IPR legislation present by the end of 1995; some enforcement efforts undertaken”.

further in order to positively reward those countries not categorised but are mentioned in the report as well as those not mentioned at all. Data are codified with values ranging from a minimum of “1” (weak IPR protection and enforcement) to a maximum of “5” (strong) depending on whether a country is listed in the USTR 301 Report as follows: in “Section 306 Monitoring” (‘1’), in the “Priority Watch List” (‘2’), in the “Watch List” (‘3’), negative IPR perceptions are indicated in the report but not named in the aforementioned categories (‘4’), not named in the aforementioned categories or are mentioned as a positive example of good practice in the area of IPR protection and enforcement (‘5’). The country values identified using the USTR “301 Report” are used to proxy the monitoring costs that arise from the ISI. They proxy for two different components, namely: (i) the effectiveness of police enforcement, and (ii) the strength of border controls. These are key factors taken into account in the USTR’s country classification scheme. These components occur at the *Sub-national/formal/supporting infrastructure* and *Sub-national/informal/societal* levels of the ISI, respectively. (see Table 2)

Patent Index by Park (2008) and Copyright and Trademark Indices by Reynolds (2004). We use two sources of data to proxy for the search costs originating from the ISI, the Park (2008) index on patents as well as the copyright and trademark legal protection (only) indices produced by Reynolds (2004). The main limitation of these indices is that they estimate the existing legal framework of IP protection (i.e. ‘book law’) without taking due account of enforcement practices within a country. This means that, despite their limitations, these indices nevertheless provide an adequate proxy for the search cost factor related to the respective IP type because they reflect national differences in book law. Consequently, these indices that are based on the book law regarding patent, copyright and trademark protection are used to proxy search costs within the ISI, since they are derived in order to evaluate the existing IPR legislation in place (Ginarte and Park 1997; Reynolds 2004; Park 2008). The Park (2008) patent index is used to proxy the patent-related legislation available, while the Reynolds (2004) indices are used to proxy trademark and copyright related legislation. The Park (2008) index is updated quinquennially and is therefore applied for each year while the Reynolds (2004) indices provide annual values up to the year 2002. Closer examination of the Reynolds indices reveals that the score for the vast majority of countries has not changed over the past decade. A search of the WIPO country guide on IPR revealed no major new legislation after 2002 that might have affected the scores of the Reynolds indices. It was therefore decided to extend their application to the year 2007, since that would provide a good proxy for the level of copyright and trademark protection in place. This issue of data imputation is further discussed in Step Five of the OECD methodology below. All three variables are used to proxy the search costs that companies face in their efforts to identify dissimilarities and gaps in the legislation concerning patent, copyright and trademark protection in the ISI of a country. These are present at the *National/formal/legislative* and *Supranational/formal/legislative* levels of the ISI. (see Table 2).

The six data sources offer a good fit as proxies for the theoretical framework of the ISI and satisfy the selection criteria set out above. However all the selected data are collected at the national level, which does not enable us to independently account for the sub-national levels of the institution as identified in the ISI. For this reason the aspects of the ISI evident at the sub-national level will be proxied at the national level and a single numerical proxy will be calculated to account for their effect (instead of the average of the different sub-national levels). This suggests that the new index values can only proxy for the overall effect of the ISI of a country, instead of enabling us to differentiate between different sub-national regions. However, this does not undermine the overall quality of the final indices since we will still be able to proxy for the overall (undifferentiated) picture within a country.

An overall summary of the data chosen to proxy the components of each level of the ISI is presented in Table 2. Following the discussion related to the transaction cost ‘footprint’ of the ISI, these proxies provide a means of measuring the transaction costs resulting from the engagement of firms with the ISI. Table 3 presents a further categorization according to the different types of transaction costs that the data proxy.

-----Table 2 and 3 around here-----

4.2. Data normalisation, imputation of missing values and multivariate analysis

In accordance with the OECD guidelines the next step was to normalize the data, because each of the studies from which data are drawn use differing measurement scales. Following Nardo *et al.* (2005), the standardisation technique (z-scores) was chosen to transform all the data to a single scale with a mean of zero (0) and a standard deviation of one (1) (Nardo *et al.* 2005).⁹

In order to apply the multivariate tests, we categorised and aggregated the data according to the transaction cost construct they are used to proxy, which led to the creation of four constructs to measure: a) search costs, b) servicing costs, c) property rights protection costs, and d) monitoring costs. As Figure 2 shows, this process constituted Phase One in the design of a new IPR index.

⁹ A variety of different normalization techniques were considered (e.g. ranking, rescaling, distance to a reference indicator/country etc) but they were deemed non-relevant or non-operational to the theoretical framework of this study.

-----Figure 2 around here-----

The Cronbach-alpha test was applied only to the variables included in the constructs according to the transaction cost category they are used to proxy. A score equal or higher than 0.70 is considered as an acceptable threshold in the literature for variables measured with proxies and indicate strong internal consistency of the examined construct (Nunally 1978; Hair *et al* 2009). The results for the monitoring cost property rights protection cost construct were very positive. The test revealed strong internal consistency in each of the constructs, with all eight variables scoring significantly higher or very close to the predetermined 0.70 threshold. However, the score for the data from the USTR “301 Report” (0.6264) falls below the 0.70 threshold. Nevertheless, because this is a particularly high squared multiple correlation score (close to the threshold set) and its conceptual relevance is very high, it was decided to retain it in the analysis, on the basis that it would be assigned a low weighting in the factor analysis used to determine the weighting scheme for the sub-indices and aggregate index creation. The total C-alpha score and the standardized item alpha for both constructs are higher than .90, indicating that the constructs are internally consistent.

The cronbach-alpha test was also conducted on the servicing cost construct (the search costs construct was not tested since this comprises only one variable which accounts for the total variation of the index). The results were not very promising as both variables had a very low squared multiple correlation of .1622 with an overall C-Alpha score of .5737 and a standardized item alpha of .5743. These results suggest that the two variables do not provide an adequate measurement scale. However, bearing in mind that C-alpha increases with the number of variables included in a scale, it was decided to question the reliability of this scale with a factor analysis test (Miller 1995). If factor analysis also proved inadequate, then omitting the measurement of this construct should be considered.

To summarise the results from the Cronbach-a test, the findings suggest that the variables used to estimate the monitoring and property rights protection constructs form reliable scales that are internally consistent and readily replicable. However, findings for the servicing costs construct are lower than the accepted threshold. For this reason, the view was taken that a final decision on whether or not to retain this construct would be based on results of the second multivariate analysis test; that is, during the factor analysis.

4.3. Factor analysis

Factor analysis was used to identify the varying levels of importance of the different component variables of the constructs, as well as the varying effect that the individual indices had in the creation of the overall aggregate IPR index. The results of this statistical technique were used to inform the weighting scheme to be applied during the aggregation process. The statistical weighting revealed that the variables relating to the enforcement aspects of the transaction costs constructs (Monitoring and Property Rights Protection Costs) were the most significant. Consequently, these constructs were accorded higher weightings in the calculation of the individual indices. As a result the aggregate index (as well as the individual indices) depict and place particular importance on the enforcement dimension of the ISI.

We draw attention to two tables of the factor analysis output: a) the table of communalities and b) the “total variance explained test”. The communalities tables reveal that the variables comprising each of the three constructs have a good representation in the factor, with all having an extraction score higher than .700. The table with the total variance of each factor enables the identification of those variables which are not highly performing and that should either be excluded from the factor calculation (following the cronbach-a reliability analysis) or be retained but with the application of a lower weight in the calculation of the sub-index. The aim is to identify the weighting scheme to be used to calculate each sub-index.

Following this rationale and as seen on Table 4, the variable that represents the variance of the construct most significantly with regards to the Monitoring Costs construct is the WEF IP protection variable, with a score of 83.594%. The other variables were found to be of only minor importance. If any were to be omitted, these would be BSA PIRA (BSA piracy rates) and the USTR IA (USTR 301 Report) variables since their eigenvalues are less than 0.30, the lowest threshold recommended in the literature (Van Schuur 2009). However, even though these variables were not removed from the calculations, their weighting in the construct will be significantly lower as suggested by the limited level of variance that both accounted for, 5.0 and 2.5 % respectively. This means that their contribution will be effectively reduced in any case. A similar weighting scheme will apply for the Property Rights construct where the variable CPI accounts for most of the variance, with the other three variables sharing very low weights. Finally, the Servicing Cost construct has a more balanced weighting scheme, with the ICRG bureaucracy variable accounting for approximately 70% of the variance and the IMD bureaucracy variable for 30%.

-----Table 4 around here-----

The weighting suggested by the factor analysis was applied to the data for each of the variables within the three constructs and this enables a score for each of the transaction cost constructs to be calculated.

Phase Two

Factor analysis was then run within the three constructs and each of the Search Costs variables (patents, copyrights, trademarks) in order to identify a suitable weighting scheme to be applied for the calculation of the three individual sub-indices (i.e. a patent index, a copyright index and a trademark index).

The communalities results reveal that the three main (and constant) factors have a very good representation in the three individual indices, with each having a much higher extraction score than .700. However, the three variables which comprise the search costs for the patents, copyrights and trademarks constructs, score relatively lower than .700 (.588 and .542, respectively) with the Search Costs construct for the individual variable for patents scoring as low as .128. This would suggest that the Search Cost constructs could be excluded from the calculation of the individual indices, since their representation in each of the indices is very low. Indeed, the same conclusion could be drawn from the eigenvalues found for each construct, which are depicted in Table 5. These findings lend support to the argument that the search costs construct should be dropped since it scores less than .30, the lowest threshold generally accepted for a factor (or construct in our case) to be included in a scale (Fabrigar *et al.* 1999; Pett, *et al.* 2003). However, since the search cost constructs appear to have only limited relevance since the enforcement of the actual law is more important, the view was taken that a proxy for the legal system should be present in each of the three individual indices, even if it is allocated a very low weight.¹⁰ The search costs constructs were therefore included as indeed, such low results were theoretically anticipated since the literature suggests that IPR enforcement *de facto* quality is more important than the *de jure* protection provided by book law (Maskus 2000) in terms of how economic actors are influenced by the ISI.

¹⁰ According to Nardo *et al.* (2005) it is for the researcher to decide if the results from the factor analysis or reliability analysis make conceptual sense.

The “total variance explained” Table 5 also suggests that the most important construct in each of the individual indices is the Property Rights Protection costs construct, followed by the Monitoring Costs construct. Additionally, the percentage of variance that each of the constructs is responsible in each of the final indices suggests the weighting scheme to be used to calculate each of the individual indices. For example, the patent sub-index has a 70% weight given to the Property Rights protection construct, 23% to the Monitoring Costs construct, 5% to the Servicing Costs construct and only 2% for the patent-related Search Costs construct.

-----Table 5 around here-----

Since the determination of weights is now complete, we go on to develop an index for each different IPR type. This is done by merging the data of the different constructs and by applying the weights determined above. Three individual indices were thus created, one for each different type of IPR, namely a Patent Index, a Copyright Index and a Trademark Index for each country concerned.

Phase Three

Finally, an overall aggregate IPR index was again calculated using factor analysis in order to check the reliability of the overall index and allocate the weights of each of the three individual sub-indices (the patent, copyright and trademark index).

The communalities test shows that all three individual indices have a very good representation in the aggregate IPR index, with two of them having a much higher extraction score than .700. The Patent Index appears not to be well represented in the aggregate IPR index, and it is therefore expected that this factor will receive a lower weight in the “total variance explained” score in Table 6. The Copyright Index is found to have the highest significance in the aggregate IPR index, followed by the Trademark and Patent indices. As discussed earlier, the percentage of variance which an individual index enjoys represents the weighting that occurs from the factor analysis. The identification of the weights leads to the calculation of the aggregate IPR index, the average values of which are presented in Table 7.¹¹

¹¹ Due to the unavailability of trademark data for four countries (Israel, India, New Zealand and Thailand) the average IPR index is calculated by equally spreading the weight of the trademark index and adding it to the weights of the Patent and Copyright index respectively. Additionally the overall IPR value for Israel is only informed by the patent protection index data. Although the associated shortcomings of this approach, we still

-----Tables 6 and 7 around here-----

The new IPR index is therefore presented together with the three individual indices that it is comprised from. As discussed above, the new index is statistically proven to be reliable and consistent. In the next section, we go on to further prove that the new index benefits the IB literature by relating it to data on GDP and identify if the new index is performing according to the theoretical expectations.

4.4. Relationship of the overall IPR index with GDP and GDP per capita

The new indices were related to other variables in order to identify if the results conform to theoretical expectations. This was done with data on GDP and GDP per capita in order to identify any potential relationships and trends. Prior research found that higher national GDP levels are closely associated with stronger IPR protection levels (e.g. Gould and Gruben 1996; Thompson and Rushing 1996 and 1999; Park and Ginarte 1997; Pryor 2006). Data on GDP (current prices) and GDP per capita were obtained from the United Nations Statistics Division for each of the twenty-one countries for which an aggregate IPR index was calculated. Correlations between GDP and the IPR index were found to be positive and statistically significant at the 99% level, confirming both theoretical expectations and providing additional support to the studies cited above (see Figure 3 and 4). It should be noted, however, that while high correlations infer high quality of the new index, they do not infer causality.

-----Figure 3 and 4 around here-----

4.5. Transparency

Transparency in the construction of the index was a fundamental issue considered in the research method design and this is why each step taken to create the new indices has been carefully outlined in detail in this paper. Together with the use of publically available secondary data, this should help guarantee that other researchers will be able to replicate the indices, adapt them for a particular purpose and extend them for future years and additional countries should this be desired.

decided to use these averages in the overall IPR index when considering that the overall variance of the three indices is very limited.

5. Discussion

This study builds upon and advances previous efforts in the area of institutional measurement and conceptual and methodological issues of index creation. The new indices calculated address each of the following limitations identified for earlier indices: namely (i) absence of a conceptual and theoretical support, (ii) limited selection of variables and secondary data, (iii) relevance of data, iv) limited account taken of enforcement issues, (v) lack of transparency, (vi) absence of weighting schemes applied, (vii) data availability (i.e. frequency of scores reported over time), and (viii) contemporaneity.

One of the key contributions made by the calculation of the new IPR indices reported here is that they are built upon the sound conceptual and theoretical framework developed by Papageorgiadis (2010) Papageorgiadis and Cross (2010). This framework accords with expectations derived from international business theory regarding what aspects should be considered in the measurement of ISI and these are consistent with both institution theory and transaction cost theory. This structured approach helps us to define and exemplify precisely which aspects of the ISI these indices are measuring. It also allows the influence of fundamental issues arising from how economic actors engage with the ISI to be captured in a quantifiable way, whilst avoiding the consideration of less important institutional elements such as minor differences in individual laws, for example. A structured screening approach was used to identify the most relevant secondary data sources with which to build the new indices and this process was successful since all secondary data used have an actual and relevant relationship to the ISI dimension they are intended to proxy.

Additionally, the new indices explicitly address the measurement of enforcement issues in all countries. In fact, enforcement is found to have the most significant contributory effect, with the dimension measuring the Property Rights Protection Costs construct receiving the highest weightings from each of the factor analysis results. This finding not only underscores the importance of the IPR enforcement dimension in the new indices, but highlights the likely extent of omitted variable bias in equivalent extent indices. The role of enforcement is especially illustrated in Figure 5 which compares the newly created Patent Index scores against those of Park (2008) for the year 2005. It will be recalled that the latter index only captures ‘book law’ in different countries and ranges from “0” to “5”, whereas the new Patent Index captures enforcement of the law as well as book law and ranges from “0” to “10”. After normalizing Park’s data by transforming them in a 0-10 scale, it might be expected that the two indices would have a similar range, with the new index having a similar magnitude to the Park index, thereby depicting similar levels of protection and enforcement. However, it can be seen that this is not the case, especially for countries scoring low in the patent index such as Argentina, China, India and

Indonesia. It is highly likely that this discrepancy arises from the fact that, while these countries have adapted their legal system to include provisions for stronger patent protection and therefore score high in the Park (2008) index (WIPO 2009), they are weak at enforcing these laws, as evidenced by the new Patent Index. Additionally, the slightly lower values assigned to high scoring countries in the new patent index, such as Germany for example, probably reflect some of the enforcement problems that are also evident in top performing countries (an example of evidence of counterfeit activity in high performing countries can be found on the website: www.plagiarius.com which “awards” the best counterfeit products in the market. The top ten products in 2010 include three German manufacturing and distributing companies).

-----**Figure 5 around here**-----

Importantly, the methodology used to construct the new indices is fully transparent, following established and reliable methods that can be replicated readily by an interested researcher. The approach followed ensures that subjectivity has been kept to a minimum. A particularly important methodological accomplishment is the application of a statistical technique, namely factor analysis, to determine the weight scheme used to calculate each new index. This weighting technique has allowed those variables statistically proven to be more influential to be distinguished from those which are less important. It has also helped to ensure that the weighting is not subjectively determined according to a researcher’s beliefs concerning, for example, the balance of power in the ISI. Rather, it has originated from a more objective technique which models the impact according to the data and which can be readily replicated by other researchers.

Finally, the new indices have been calculated using data that cover most of the last decade (1997-2007), providing up-to-date information that can be used in other research investigating contemporary international business and other phenomena. It should be a relatively easy task to update the indices regularly, since the methodology is fully transparent and the data are readily available from simple online searches (providing the sources continue to report them). The new indices are also wider in scope than previously reported indices, since they capture the protection of patents, copyrights and trademarks. Finally, the countries covered offer a good mix of developing and developed countries with a potential to readily extend the coverage to a broader set of countries in the future, subject to data availability.

Overall, the rationale, methodology and research design used to construct the new indices have enabled to address all the limitations associated of previous similar efforts identified by Papageorgiadis and Cross (2009). Arguably, this has generated a more rigorous and reliable tool for both the current study and for future empirical investigation of the role of institutions such as the ISI on international business activity.

6. References

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7. List of Tables and Figures

Table 1: Transaction cost footprint of the ISI

Institutional Level		Element	Transaction Cost Type
Supranational	Formal	Legislative	Search Costs
	Informal	Supporting Infrastructure	Monitoring Costs
National	Formal	Legislative	Search Costs
		Administrative	Servicing; Property Rights Protection Costs
		Supporting Infrastructure	Search Costs
	Informal	Supporting Infrastructure	Servicing Costs
Sub-national	Formal	Administrative	Property Rights Protection; Monitoring Costs
		Supporting Infrastructure	Monitoring Costs
	Informal	Societal	Monitoring Costs

Table 2. The ISI and the proxy variables used for its quantification

ISI Level	Cost Type	ISI Variable	Proxy Data & Source
Sub-national/ Formal/ Administrative	Property Rights Protection Costs	Level of Corruption in Judiciary	Corruption Perceptions Index (Transparency International: Global Corruption Report)
Sub-national/ Formal/ Supporting Infrastructure	Monitoring Costs	Level of Corruption Among Police	
		Level of Corruption Among Customs Officials	
Sub-national/ Formal/ Administrative	Property Rights Protection Costs	Judicial Enforcement	“Judicial Independence” (WEF: Global Competitiveness Report)
			“Law and Order” (PRS Group: International Country Risk Guide)
			“Justice is fairly administered” (IMD: World Competitiveness Yearbook)
Sub-national/ Formal/ Supporting Infrastructure	Monitoring Costs	Effectiveness of Police Enforcement	Country listings from the Special 301 Report (United States Trade Representative)
Sub-national/ Informal/ Societal		Strength of Border Controls	
Sub-national/ Informal/ Societal	Monitoring Costs	Positive/negative Perceptions of IP Owners to Changes in a Country’s IPR Protection and Enforcement	Patent & Copyright Protection (IMD: World Competitiveness Yearbook)
			IP Protection (WEF: Global Competitiveness Report)

Sub-national/ Informal/ Societal	Monitoring Costs	Level of Infringement Rates.	Global PC Software Piracy (BSA: Global Software Piracy Study)
		Cultural and Societal Attitudes Towards the Purchase of Infringing Goods.	
		Level of Public Commitment to IP Protection	
National/ Formal/ Administrative	Servicing Costs	Quality of IPR Administration	Bureaucracy Quality Index (PRS Group: International Country Risk Guide)
		Time Related Administrative Framework	Bureaucracy Does Not Hinder Business Activity Index (IMD: World Competitiveness Yearbook)
National/ Formal/ Legislative	Search Costs	Patent protection	Patent Protection Index (Park 2008)
	Search Costs	Copyright Protection	Copyright Protection Index (Reynolds 2004)
	Search Costs	Trademark Protection	Trademark Protection Index (Reynolds 2004)
Supranational/ Formal/ Legislative	Search Costs	Signatory Status of a Country to International IP Related treaties and Conventions	Patent/ Copyright/ Trademark Index (Park 2008; Reynolds 2004)

Table 3. ISI transaction costs and selected proxy variables

Search Costs:
• Ginarte and Park (1995-2005) Patent Index
• Reynolds (2004) Copyright Index
• Reynolds (2004) Trademark Index
Servicing Costs:
• ICRG ‘Bureaucracy Quality’ Index
• IMD ‘Bureaucracy Does Not Hinder Business Activity’ Index
Property Rights Protection Costs
• Transparency International ‘Corruption Perceptions’ Index
• WEF ‘Judicial Independence’ Index
• IMD ‘Justice Is Fairly Administered’ Index
• ICRG ‘Law And Order’ Index
Monitoring Costs
• WEF ‘IP Protection’ Index
• IMD ‘IP Protection’ Index
• BSA Piracy Rates
• USTR 301 Report

Source: the authors

Table 4: “Total variance explained” test for the Monitoring, Property Rights Protection and Servicing costs constructs

Component	Initial Eigenvalues		
	Total	% of Variance	Cumulative %
Monitoring Cost construct			
WEF IP protection index	3.344	83.594	83.594
IMD IP protection index	.349	8.727	92.321
BSA piracy rates	.207	5.179	97.500
USTR 301 report	1.000E – 01	2.500	100.000
Property Rights Protection Construct			
Corruption perceptions index	3.453	86.322	86.322
WEF Judicial independence index	.287	7.170	93.492
IMD justice is fairly administrated index	.176	4.400	97.892
ICRG law and order index	8.431E - 02	2.108	100.000
Servicing Cost Construct			
ICRG bureaucracy quality index	1.403	70.139	70.139
IMD bureaucracy does not hinder business activity index	.597	29.861	100.000

Source: The authors

Table 5: Total variance explained for each of the three sub-indices

Component	Initial Eigenvalues		
	Total	% of Variance	Cumulative %
Patent Index			
Property Rights Index	2.788	69.709	69.709
Monitoring Costs Index	.918	22.955	92.664
Servicing Costs Index	.213	5.325	97.989
Patent Index	8.042E-02	2.011	100.000
Copyrights Index			
Property Rights Index	3.208	80.207	80.207
Monitoring Costs Index	.528	13.203	93.410
Servicing Costs Index	.184	4.603	98.013
Copyright Index	7.949E-02	1.987	100.000
Trademark Index			
Property Rights Index	3.134	78.352	78.352
Monitoring Costs Index	.575	14.383	92.735
Servicing Costs Index	.216	5.406	98.141
Trademark Index	7.437-02	1.859	100.000

Source: The authors

Table 6: Aggregate IPR Index: total variance explained

Component	Initial Eigenvalues		
	Total	% of Variance	Cumulative %
Copyright Index	2.330	77.665	77.665
Trademark Index	.566	18.873	96.538
Patent Index	.104	3.462	100.000

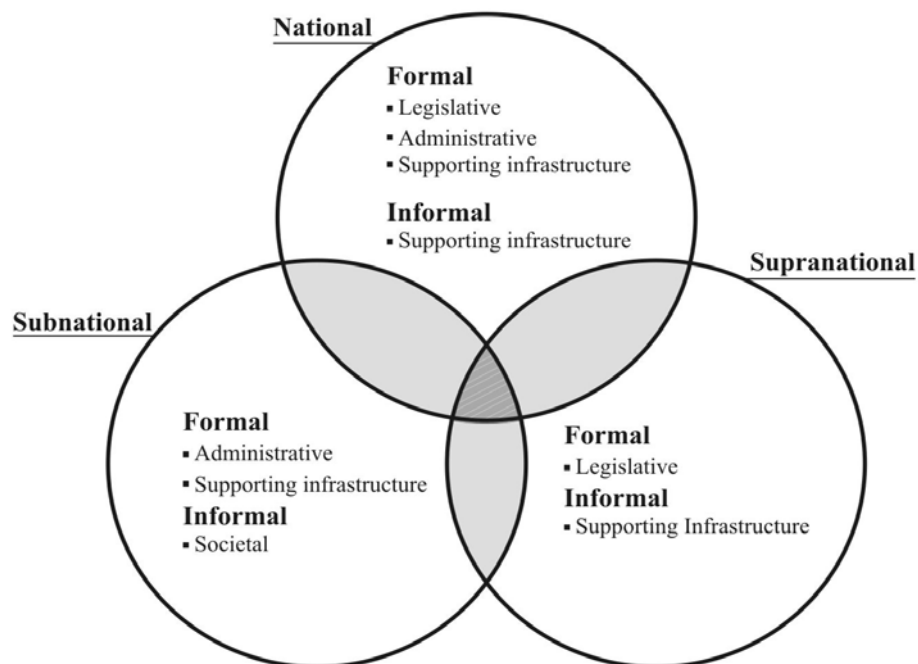
Source: The authors

Table 7: Aggregate IPR index scores by country

Argentina	3.37	Malaysia	5.46
Australia	8.58	Mexico	3.95
Chile	6.91	Netherlands	8.73
China	4.02	New Zealand	8.98
France	7.11	Philippines	3.40
Germany	8.03	Singapore	8.48
Hong Kong	7.80	Spain	6.81
India	4.00	Switzerland	8.76
Indonesia	2.69	Thailand	4.24
Israel	7.00	UK	8.49
Japan	6.99		

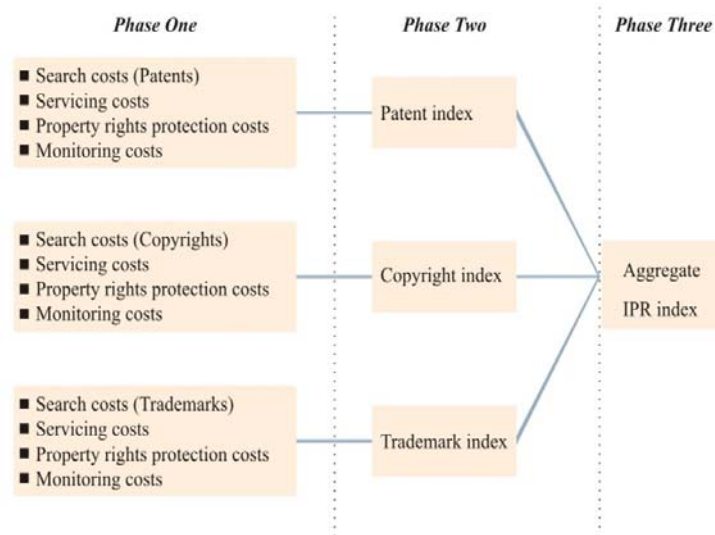
Source: The authors

Figure 1: Pictorial representation of the ISI



Source: Papageorgiadis and Cross (2010)

Figure 2: The three phases of the IPR index development



Source: The authors

Figure 3: Correlation between IPI and GDP

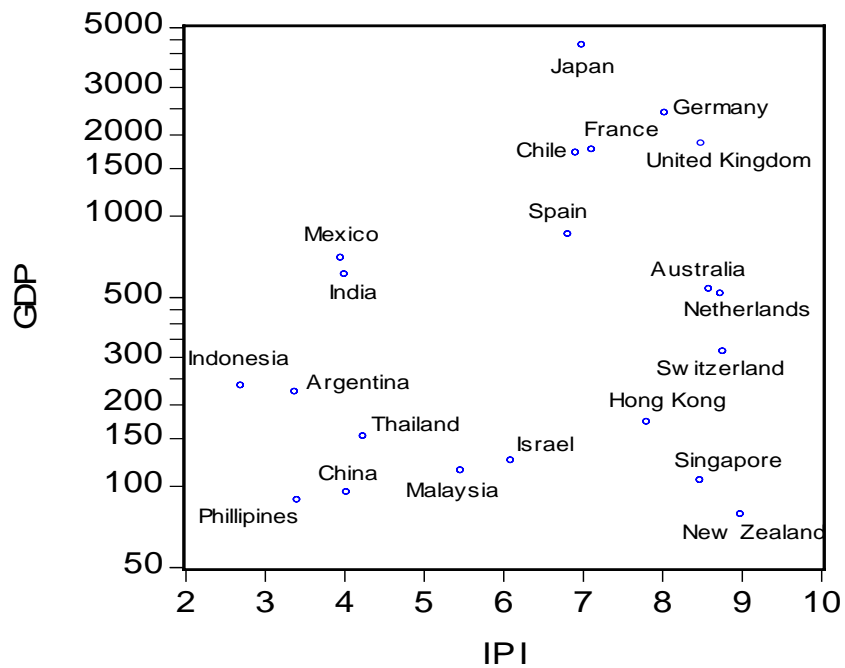


Figure 4: Correlation between IPI and GDP per capita

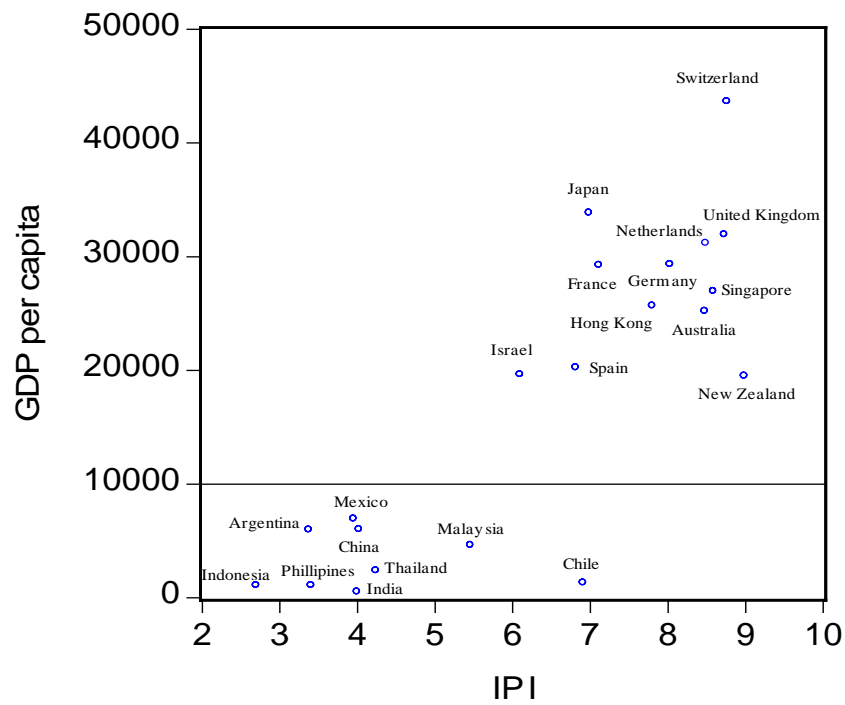


Figure 5: New Patent Index compared to that of Park (2008) for 2005

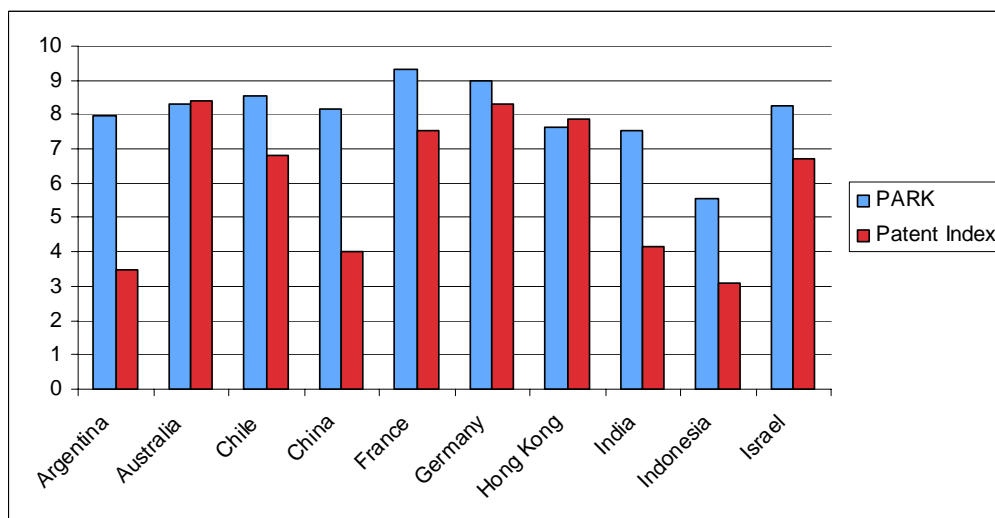


Figure 5 continued

