MASTER THESIS

Titel der Master Thesis / Title of the Master's Thesis

„The Impact of Intellectual Property Right Enforcement upon GDP Growth: An Econometric Analysis "

verfasst von / submitted by

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angestrebter akademischer Grad / in partial fulfilment of the requirements for the degree of

Master of Advanced International Studies (M.A.I.S.)

Wien 2017 / Vienna 2017

diplomatische
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Abstract

To date, the literature examining the link between intellectual property rights (IPRs) and economic growth has focused on the existence of IPR law. Attempts to differentiate between the *de jure* and *de facto* enforcement of these rights and its impact upon growth have typically drawn upon subjective, US-centric measures of enforcement, or have employed rule-of-law indicators as a proxy for the enforcement of IPRs. These fail to capture the role that the private sector has to play in the enforcement of IPRs. In an effort to establish an objective measure of enforcement, this thesis experiments with using cross-border payments for the use of intellectual property as a proxy for IPR enforcement. The effect of this upon GDP per capita growth is estimated using cross panel time series data for 38 countries between 1990 and 2004. The relationship between the two variables does not prove to be statistically significant, suggesting that balance of payment data is not a suitable proxy for the enforcement of IPRs. The results are otherwise consistent with neoclassical models of economic growth.

Abstract

Bis heute konzentrierte sich die akademische Literatur über die Zusammenhänge zwischen geistigem Eigentum und Wirtschaftswachstum rein auf die Existenz von Urheberrechten. Versuche einer Unterscheidung zwischen der de jure- und der de facto- Durchsetzung dieser Jurisdiktion sowie deren Auswirkung auf Wirtschaftswachstum waren typischerweise auf subjektive, rein auf US-Recht basierende Maßnahmen ausgerichtet oder benutzten rechtsstaatliche Indikatoren als Proxy-Variable zur Durchsetzung des geistigen Urheberrechts. Diese vernachlässigen die Rolle des privaten Sektors bei der Durchsetzung von geistigem Urheberrecht. Im Versuch, objektive Durchsetzungsmaßnahmen zu schaffen, analysiert diese Arbeit den Einsatz von grenzüberschreitendem Zahlungsverkehr im Urheberrecht als mögliches Mittel der Rechtsdurchsetzung. Die Auswirkungen auf das BIP Pro-Kopf-Wachstum wurden anhand von Paneldaten aus 38 Staaten und für den Zeitraum zwischen 1990 und 2004 ermittelt. Die Beziehung zwischen den beiden Variablen erweist sich als statistisch nicht signifikant. Dies impliziert, dass Daten des Zahlungsverkehrs für die Durchsetzung von Recht über geistiges Eigentum als nicht geeignet erscheinen. Ansonsten bestätigen die Resultate die Vorhersagen der neoklassischen Wachstumsmodellen.

Contents

Introduction

The importance of property rights for economic growth is well established. The Nobel Prize laureate Douglass North wrote extensively on the role of institutions, constraints, and formal rules to reduce the uncertainty surrounding economic exchanges. Institutions provide the incentive structure of an economy[1] and induce productivity increases.[2]

Within a developmental context, formal property rights allow for credit markets to function properly; without property rights, property cannot be used as collateral.[3] They can also lead to an increased supply of labor,[4] attitude change,[5] the empowerment of women,[6] a decrease in property-related conflict,[7] and even environmental benefits.[8]

While the role of *intellectual* property rights (IPRs) remains contested, they too are designed to provide an incentive structure that facilitates increases in productivity; North identifies institutions which provide "incentives for the acquisition of knowledge and learning, induce innovation, and encourage risk taking and creative activity" as being essential for sustained economic efficiency[9] (dynamic efficiency). While the concept of IPRs is an ancient one—potters' marks were honored and craft guilds' secrets were protected[10]—the formal institutionalization of innovation is an indication of social development. In primitive societies with no formal rights to intellectual property, the concealment of one's identity is the only way that individuals can hope to appropriate the benefits of their inventions.[11] This is a result of traditional communal hostility towards those who accumulate rather than give away wealth. The dense living conditions and community structures needed to minimize information costs in primitive societies seldom allow for privacy or anonymity, imposing heavy costs on those who try. Richard Posner asserts that this helps to explain why primitive societies

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[1] Douglass North, "Institutions" *Journal of Economic Perspectives* 5 (1991): 97
[2] North (1991): 98
[3] Hernando de Soto, "*The Mystery of Capital: Why Capitalism Triumphs in the West and Fails Everywhere Else*" London: Bantam Press (2000)
Erica Field and Maximo Torero, "*Do Property Titles Increase Credit Access Among the Urban Poor?*" Harvard University, Working Paper (2006)
[4] Erica Field, "Entitled to Work: Urban Property Rights and Labour Supply in Peru" *The Quarterly Journal of Economics* 122 (2007): 1561-1602
[5] Sebastian Galiani and Ernesto Schargrodsky, "Property rights for the poor: Effects of land titling" *Journal of Public Economics* 94 (2010)
[6] Keera Allendorf, "Do Women's Land Rights Promote Empowerment and Child Health in Nepal?" *World Development* 35 (2007)
Daniel Ali, Klaus Deininger and Markus Goldstein, "*Environmental and Gender Impacts of Land Tenure Regularization in Africa: Pilot evidene from Rwanda*" World Bank, Policy Research Working Paper 5765 (2011)
[7] Christopher Udry, "*Land Tensure*", in Ernest Aryeetey, Shantayanan Devarajan and Ravi Kanbur, (eds.) "*The Oxford Companion to the Economics of Africa*" Oxford: Oxford University Press (2012)
[8] Ali, Deininger and Goldstein (2011)
[9] Douglass North, "*Transaction Costs, Institutions, and Economic Performance*" San Francisco: ICS Press (1992): 9
[10] Robert Sherwood, "Intellectual Property Systems and Investment Simulation: The Rating of Systems in Eighteen Developing Countries" *IDEA* 37 (1997): 358
[11] Richard Posner, "A Theory of Primitive Society, with Special Reference to Law" *The Journal of Law and Economics* 23 (1980): 7

experience sluggish economic development and accrete knowledge slowly. In this sense, by removing the need for anonymity, the development of IPRs reduces transaction costs. Ronald Coase identifies devices that reduce transaction costs as the key to unlocking the neoclassical results of efficient markets.[12]

This thesis will seek to identify the impact of IPR enforcement upon economic growth. In effect, it will attempt to distinguish between *de jure* and *de facto* IPR enforcement. In doing so, it will join what Posner describes as the "rise of the law and economics movement."[13] The question of IPR enforcement is of consequence for three reasons. First, the proliferation of IPR in recent years has made the legal environment surrounding intellectual property of increasing importance for both scholars and practitioners, as the world moves towards a knowledge economy.[14] It is therefore important that efforts be made to refine our understanding of this aspect of our economic environment.

Second, while progress has been made surrounding our understanding of the interaction between the existence of IPRs and a number of dependent variables (including foreign direct investment [FDI], technology transfers, and GDP growth), research attempting to quantify and tease out the impact of IPR enforcement is still at an early stage. This is an issue that has been referenced in a number of recent studies as an area in need of attention.[15] A better understanding of IPR enforcement is likely to have significant implications for existing research which assesses the economic impact of IPR legislation. Estimating the role that enforcement has to play in the interface between IPR legislation and economic growth has the potential to shed light on the extent to which its omission in previous work could be leading to estimation errors as a result of omitted variable biases (OVBs).

Third, it has the potential to generate meaningful policy implications. In the age of the World Trade Organization (WTO) and its Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS), domestic IPR statutes and minimum standards are becoming increasingly homogenous across countries. More than ever before, it is the enforcement—rather than the mere existence—of IPRs that distinguishes countries from one another and informs investment decisions.

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[12] North, (1992): 6

[13] Richard Posner, "Intellectual Property: The Law and Economics Approach" *Journal of Economic Perspectives* 19 (2005): 57

[14] Joseph Stiglitz, "*Making Globalization Work*" London: W. W. Norton and Company Ltd. (2006)

[15] Padraig Dixon and Christine Greenhalgh, "*The Economics of Intellectual Property: A Review to Identify Themes for Future Research*" University of Oxford Discussion Paper Series, Number 135 (2002): 53

Robert Ostergard, "The Measurement of Intellectual Property Rights Protection" *Journal of International Business Studies* 31 (2000): 357

WIPO, "*The Economics of Intellectual Property: Suggestions for Further Research in Developing Countries and Countries with Economies in Transition*" Report (2009): 23

Selected Literature Review

While incomplete, a healthy literature is developing around the law and economics of IPRs. This literature review will follow a two-part structure: the first section will assess existing research into the existence of IPR legislation (what Papageorgiadis, Cross and Alexiou call the presence of patent-related "book law"), its economic impact and the implications of this for policy makers and practitioners. The second will assess existing attempts to move beyond this by examining the enforcement of this legislation and the role of enforcement in economic growth.

Existing Efforts to Quantify IPR Legislation

Broadly speaking, attempts to assess the presence of patent-related book law fall into two categories: those which draw upon analyses of published legislation, and those which rely upon data collected through interviews and questionnaires.

The first two significant contributions towards the quantification of IPR legislation fall into the former category. The work of Gadbaw and Richards in 1988[16] and Rapp and Rozek in 1990[17] gave rise to indices which drew upon the first-hand examination of book law across countries. Rapp and Rozek assigned scores on a 0-5 scale to 159 countries (see Table 1). These scores represent how consistent a country's legislation is with the US Chamber of Commerce's Intellectual Property Task Force's minimum standards. Rapp and Rozek do not provide a detailed

Table 1: Rapp and Rozek's Scale for Intellectual Property Rights/Patent Protection	
Scale	**Description**
0	No intellectual property protection laws
1	Inadequate protection laws; no law prohibiting piracy
2	Seriously flawed laws
3	Flaws in laws, some enforcement laws
4	Generally good laws
5	Protection and enforcement laws fully consistent with minimum standards proposed by the US Chamber of Commerce

Source: Rapp and Rozek (1990)

insight into which criteria were used to deem IPR laws "flawed" or "generally good", making replication difficult and subjective. Given the bar against which laws were being judged, this also makes for a US-centric assessment. Nevertheless, it is an early example of a methodology which was

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[16] Michael Gadbaw and Timothy Richards, "Intellectual Property Rights: Global Consensus, Global Conflict?" Colarado: Westview Press (1988)

[17] Richard Rapp and Richard Rozek, "Benefits and Costs of Intellectual Property Protection in Developing Countries" *Journal of World Trade* 24 (1990)

to be replicated and refined in the years to come; it was widely cited and used by the US government to underpin their policy position on IPRs.[18]

These efforts were soon built upon by Seyoum[19] and Sherwood.[20] Seyoum's research drew upon the same minimum standards as a guideline, but attempted to construct an index which was a little less subjective by rendering a 0-3 scale using data collected through the use of questionnaires administered to IPR practitioners. A random sample of 27 countries was used to compute this index and the analysis involved assessing the impact of eight independent variables (patents, trademarks, trade secrets, copyrights, market size, ratio of public investment to GDP, ratio of external debt to exports and the exchange rate) on FDI flows.[21] This was undertaken using a regression analysis covering the years 1975-1990. Seyoum found that FDI flows are affected by intellectual property laws, though no relationship was found to exist between patents and FDI flows in less-developed countries.

Sherwood's paper constitutes a step forward in the literature and the beginning of a transition towards attempts to capture the enforcement of IPRs. In its construction, Sherwood's research (covering 18 countries) emulated what had come before, once again using the US Chamber of Commerce's guidelines. A product of consultancy work with a number of development organizations, it builds upon professional interviews and effectively equates the enforcement of IPRs with the potential for enforcement[22] (among a number of indicators representing the existence of IPRs, the theoretical enforceability of laws was given a weighting of 25%). Points were subtracted from a theoretical score of 103 to represent deficiencies and shortcomings in the IPR regime of each country. Sherwood also focuses upon the impact of IPRs upon FDI and identifies what he terms a "pent-up demand" for IPRs in the developing world to encourage innovation, technology imports, and growth.

The next major contribution was made by Ginarte and Park in 1997[23] and updated in 2008[24] (hereafter referred to as the GP index). This remains a widely-utilized gold standard for the measurement of IPR book-law between 1960 and 2005. It is comprehensive not only in its scope (covering 110 countries) but in its depth. This index ranks countries on the basis of their membership to relevant

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[18] Ostergard (2000): 350

[19] Belay Seyoum, "The impact of intellectual property rights on foreign direct investment" *The Columbia Journal of World Business* 31 (1996)

[20] Sherwood (1997)

[21] Seyoum (1996): 53

[22] Sherwood (1997): 264

[23] Juan Carlos Ginarte and Walter Park, "Intellectual Property Rights and Economic Growth" *Contemporary Economic Policy* 26 (1997)

[24] Walter Park, "International Patent Protection: 1960-2005" *Research Policy* 37 (2008)

international treaties, the breadth of methods and technologies covered by IPRs, the duration of IPR applicability, the risk of losing IPR protection and the presence of enforcement mechanisms on paper (as distinct from *de facto* enforcement).[25]

While an important foundation for analyzing the full impact of IPRs on a variety of dependent variables, these works makes no attempt to quantify the efficacy of enforcement, beyond what is theoretically enforceable on paper.

Existing Efforts to Quantify IPR Enforcement

The enforcement of IPRs is a notoriously difficult feature to capture. Regardless, it is of great importance; as Sherwood acknowledges, "if intellectual property rights cannot be effectively enforced, they are worth little."[26] In outlining the need for data representing enforcement, Hu and Png note that the "1990 [GP] index rated Malawi (3.24) and Nigeria (3.05) substantially ahead of Hong Kong (2.57) and Singapore (2.57) … the index [does] not reflect the actual state of patent rights, *as enforced*."[27]

This is an area in which there remains room for progress.[28] Efforts began in 2000 with Ostergard's enforcement index.[29] Once again, the US Chamber of Commerce's minimum standards are used as a benchmark. Two coders used IP statutes to code the IPR regimes of 76 countries. An inter-coder agreement score of .90 bodes well for replicability and marks something of a step forward in the objectivity of book law quantification. The enforcement component of Ostergard's measurement is derived from the US State Department's *Country Reports on Economic and Trade Practices*. This semi-annual report came about as a result of the 1988 Omnibus Trade and Competitiveness Act[30] and requires an annual assessment of IPR enforcement. Ostergard then computes scale scores for the existence of IPR legislation and multiplies it by scale scores representing enforcement, as determined by the US State Department's assessments.[31] Only a modest correlation was found between the Rapp and Rozek, and Sherwood and Seyoum indices and Ostergard's enforcement index, indicating the magnitude of the OVBs present in studies which do not adequately account for enforcement. While an important development, Ostergard's index remains US-centric. The country selection was also

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[25] Park (2008)
Emmanuel Hassan, Ohid Yaqub and Stephanie Diepeveen, "*Intellectual Property and Developing Countries: A Review of the Literature*" Technical Report, RAND Corporation (2010): 2
[26] Sherwood (1997): 266
[27] Albert Hu and I. P. L Png, "Patent rights and economic growth: evidence from cross-country panels of manufacturing industries" *Oxford Economic Papers* 65 (2013): 10
[28] Park (2008): 765
Dixon and Greenhalgh (2002): 54
[29] Ostergard (2000)
[30] Ostergard (2000): 354
[31] Ostergard (2000): 355

non-random—countries were chosen on the basis of having appeared in the State Department's Country Reports on Economic and Trade Practices. It is quite plausible that these countries were selected by the State Department on political grounds, or because of other non-random characteristics.

In a similar vein, Ginsburg's 2005 research piece involves the construction of an index that uses the International Intellectual Property Alliance's (IIPA) infringement recommendations as a proxy for the enforcement of IPRs. [32] These recommendations are written to inform decisions taken by the US Trade Representative (USTR) when publishing their annual Special 301 Report. The Special 301 Report is a tool used by the USTR to identify and publicize those IPR enforcement practices which are deemed to fall short of US IPR guidelines; this listing can, in turn, give rise to

Table 2: Ginsberg's IPR Enforcement Scale	
Scale	Description
0	Country recommended to be listed as a Priority Foreign Country
1	Country recommended for placement on the Priority Watch List
2	Country recommended for placement on the Watch List
3	Country given a special mention in the IIPA report
4	Country given a special mention in the IIPA report

Source: Ginsberg (1990)

'Special 301 action'—sanctions designed to penalize offenders. Ginsburg's decision use IIPA recommendations as opposed to the Special 301 Report's findings is an attempt to disentangle violation judgements from political criteria which may come to bear on the final report. Ratings from 0 to 4 were assignment to countries, representing the IIPA's recommendations (see Table 2).

This remains a subjective measurement and in effect simply substitutes the IIPA interpretation of adherence to the US's minimum guidelines for the interpretation of the researcher. There is also no way to distinguish between countries which did not warrant mention in an IIPA report because of satisfactory IPR enforcement, and those which do not appear because they simply were not reviewed in a given year. [33] Nonetheless, it constitutes an application of the approach developed by Ostergard, who did not employ his index to investigate an independent-dependent variable interaction.

In using this index, Ginsberg assesses the impact of IPR enforcement on the growth of GDP per capita between 1995 and 2005. She found the enforcement of IPRs to have a positive effect upon growth.

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[32] Melissa Ginsberg, "The Effects of Intellectual Property Protection on Growth in Transition Economies", Dissertation, University of Massachusetts Amherst (2005)
[33] Ginsberg (2005): 17

Using a pooled ordinary least squares (OLS) estimator, she yields a percentage point increase in GDP per capita of between 0.69-1.49 for every standard deviation increase in the index.[34]

Hu and Png's 2013 paper[35] is an attempt to combine a measure of enforcement with the otherwise powerful GP index. They turn to data published by the Canadian think tank 'the Fraser Institute' representing the legal security of private ownership rights, the viability of contracts, and the rule of law across countries. This data is collected by the Institute through the use of surveys administered to businesses. Hu and Png's patent rights index is simply a product of these two indices (GP index × Fraser index). It is worth noting that the methodology behind the Fraser index makes no mention of intellectual property rights.[36] It is assumed by Hu and Png that ac ountry's physical property rights and its general legal environment can be treated as proxies for IPR enforcement.

In 2014, Papageorgiadis, Cross and Alexiou[37] built on existing efforts to report the integrity of IPR regimes and created a new composite index of 48 developing and industrialized countries, reporting data from 1998-2011. They recognize the need to progress beyond what the GP index is able to achieve and attempt to accomplish this by way of adapting data from the World Economic Forum's Global Competitiveness Report, the International Institute of Management Development's World Competitiveness Yearbook, Transparency International's Corruption Perceptions Index (CPI), the Business Software Alliance's data on piracy rates, and the USTR's Special 301 Report.[38] The data gathered from these sources serve as proxies for the transaction costs associated with different IPR regimes; these are described as the costs which IP holders must bear when they are forced to take action to ameliorate the effects of poor IPR enforcement on the part of judiciaries, police forces, customs officials and other government agencies.[39]

Data is then normalized to ensure comparability and weighted (giving particular weight to the CPI component of the index) in an effort to achieve high score variability. Scores are then compared with the GP index for the year 2005. The correlation coefficient between the two is 0.53 and the difference is described by Papageorgiadis, Cross and Alexiou as representing the gap between the existence of book law and perceptions regarding its implementation and enforcement.[40] Mean scores are then regressed against mean GDP per capita data for the years 1998-2011. A statistically significant

[34] Ginsberg (2005): 32
[35] Hu and Png (2013)
[36] Fraser Institute, "Economic Freedom: Methodology" (Website, accessed 21st January 2017: https://www.fraserinstitute.org/economic-freedom/approach)
[37] Nikolaos Papageorgiadis, Adam Cross and Constantinos Alexiou, "International patent systems strength 1998-2011" *Journal of World Business* 49 (2014)
[38] Papageorgiadis, Cross and Alexiou (2014): 590
[39] Papageorgiadis, Cross and Alexiou (2014): 581
[40] Papageorgiadis, Cross and Alexiou (2014): 593

correlation coefficient of 0.58 was derived. Interestingly, Papageorgiadis, Cross and Alexiou assume a direction of causation by describing stronger protection and enforcement as being a result of greater wealth, citing Keith Maskus' 2000 book *Intellectual Property Rights in the Global Economy*. They assert that "this is because as incomes rise so does consumer demand for higher quality and more differentiated products on the one hand and the technological capabilities of domestic producers on the other, putting pressure on national governments to strengthen their IP system."[41]

Theoretical Framework

The economic role of innovation-driven growth was, for a long time, not a core part of an under- or postgraduate training in economics. Those with an interest in the institutionalization of innovation would have inevitably needed to turn to the work of Joseph Schumpeter. A proponent of innovation-driven market power, Schumpeter famously asserted that the competition to innovate necessarily resulted in temporary monopolies. This competition to replace the incumbent monopolist came to be known as *Schumpeterian competition.*[42] While not the first to use it, he popularized the term "Creative Destruction" to describe the fundamental role that the substitution of consumer goods, methods of production, transportation and industrial organization for new and innovative replacements has to play in capitalist growth.[43] In addressing the necessary market conditions needed to facilitate growth-inducing innovation, he asserted that:

> "Perfectly free entry into a *new* field may make it impossible to enter at all. The introduction of new methods of production and new commodities is hardly conceivable with perfect—and perfectly prompt—competition from the start. And this means that the bulk of what we call economic progress is incompatible with it."[44]

He went on to assert that market interventions that insulate innovators from perfect competition are nothing new:

> "As a matter of fact, perfect competition is and always has been temporarily suspended whenever anything new is being introduced—automatically or by measures devised for the purpose—even in otherwise perfectly competitive conditions."[45]

This was, in effect, an endorsement of the mechanism upon which the system of IPRs is based. He described the incentive for innovators to patent as being grounded in "the protection it affords against temporary disorganization of the market and the space it secures for long-range planning," rather than

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[41] Papageorgiadis, Cross and Alexiou (2014): 595
[42] Joseph Stiglitz, "Economic Foundations of Intellectual Property Rights" *Duke Law Journal* 57 (2008): 1705
[43] Joseph Schumpeter, "*Capitalism, Socialism and Democracy (5th ed.)*" London: Taylor and Francis (2003): 83
[44] Schumpeter (2003): 105
[45] Schumpeter (2003): 105

"the opportunity to behave temporarily according to the monopolist schema."[46] Implicit in this description is the trade-off that accompanies the issuing of patents and other IPRs. This is the essence of the balancing act that IPRs attempt to achieve. While the protection of intellectual property arguably allows for long-term planning (through the return that innovators can expect to receive on their investments), they generate inefficiencies of their own. Dynamic efficiency is balanced against market inefficiencies.

These inefficiencies include the transaction costs that accompany IPR regimes. The private returns to intellectual property rights do not necessarily equate to the marginal social return of an innovation.[47] For an outcome to be economically efficient, compensation ought to be tethered to social returns. IPRs also distort financing patterns, encouraging developers to allocate resources to areas in which IP protections are most readily available, or in which elasticities of demand are likely to be low such that the benefits enjoyed during the period of monopolization can be maximized. The 'licensing' of monopolies and the gap between the price and marginal cost of production (dubbed by Stiglitz as a "monopoly benefit tax"[48]) is central to the balancing act that IPRs undertake; this monopoly status is effectively the reward offered to innovators for having taken risks and invested capital.

The economic inefficiencies of monopoly markets have long been understood, and these are largely at odds with the benefits generated by the increased pace of innovation that IPRs engender. Supply is curtailed to maximize revenue, absorbing the consumer surplus created by the introduction of the novel good or service. By allowing for revenues that are higher than market competition would normally allow for, the incentive to develop production technologies that lower the cost of production is diminished; there is even an incentive for the beneficiaries of IPRs to stymie their rivals' efforts to innovate to protect their monopolistic position. These competing effects, one seemingly a necessary precondition for the existence of the other, are what have given rise to the debate surrounding the efficacy of IPRs. The question of which of these effects prevail is central to the controversy. It is here that the temporary nature of these artificial monopolies is critical.

Joseph Stiglitz is a vocal critic of the contemporary IPR regime and challenges the temporary nature of these monopolies, asserting that monopoly power can easily be perpetuated, once established.[49] This can be true in the case of ever-greening, and is particularly evident in the case of computing soft- and hardware. Microsoft long enjoyed monopoly-like power once its operating systems had become an industry standard for personal computing. Not only would switching involve a process of re-

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[46] Schumpeter (2003): 102
[47] Posner (2005): 59
[48] Stiglitz (2008): 1693
[49] Stiglitz (2008): 1705

learning for the consumer, but additional financial costs would be imposed as software was, for years, Windows-specific.

While these are legitimate observations, by deeming Schumpeter to be "wrong" on the issue of temporary monopolies,[50] Stiglitz fails to acknowledge that Schumpeter addressed the issue of monopoly perpetuation. Schumpeter recognizes that the features which normally stop these temporary monopolies from becoming long-term monopolies—the competition posed by existing commodities and the need for a demand schedule to be built up; that is, for consumers to develop a need or taste for the commodity—can be ineffective "in cases of spectacular superiority of the new device, particularly if it can be leased like shoe machinery."[51] While acknowledging that the protection of intellectual property can occasionally gift long-term monopoly status to innovators, Schumpeter effectively treats these cases as anomalies:

> "the quantitative importance of that clement, its volatile nature and its function in the process in which it emerges put it in a class by itself."[52]

Perhaps Schumpeter was not altogether "wrong" in his assessment of temporary monopolies and the importance of exceptions to the rule, but the examples cited by Stiglitz to illustrate his critique (such as the Microsoft example touched upon above) were not of Schumpeter's time. The question might more accurately be, whether a system which was designed to allow for temporary monopolization is still suited to a world in which the distribution costs of software are close to zero and life-saving drugs are covered by international IP agreements.

The issue of life-saving drugs is a particularly sensitive one. Not only can the protection of intellectual property lead to market failures (whether temporary or otherwise), but they generate moral dilemmas when they result in prices or production volumes that place medicines out of reach of potential beneficiaries. When assessed in parallel with their growth-inducing and dynamically efficient nature these critiques means that it is, from an economic perspective, not entirely clear as to whether intellectual property rights are a source of net social utility.[53] This remains a matter of discussion and has led to the formulation of alternatives to Schumpeterian competition. Chief among these alternatives is the use of prizes to encourage innovation. This typically involves a government (though individuals and the private sector have long played a role[54]) offering a fixed lump sum in exchange for an invention that meets a set of technical specifications laid out in advance (such as the X-Prize),

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[50] Stiglitz (2008): 1693
[51] Schumpeter (2003): 102
[52] Schumpeter (2003): 102
[53] Posner (2005): 59
[54] Stephen Foley (2015) "The power of prizes to encourage innovation", *The Financial Times* [Online] September 16 [Accessed May
[30] 2017] Available from: https://www.ft.com/content/764866a2-56be-11e5-9846-de406ccb37f2

or demonstrably solves a problem. In the 1700s, the British government offered a prize of £20,000 for a means by which ships could determine their longitude while at sea.[55] The use of prizes aims to avoid the deadweight loss created by monopoly-like behavior. There are, however, a number of issues with such an approach. Many important innovations were the product of endeavors without immediately obvious relevance to technological progress. Though almost eight decades old, Abraham Flexner's essay *The Usefulness of Useless Knowledge* still articulates this point effectively.[56] Moreover, it is not a straight-forward process for a government to accurately determine the social or monetary value of an invention without waiting for IPRs to "reveal their value to consumers."[57] Prizes have historically represented a small fraction of the social value of new technologies and processes.[58] Because of their shortcomings, these systems are typically employed in parallel, or in conjunction, with traditional IPR frameworks. Deviations of the basic prize concept (such as advance market commitments) have allowed governments to fine-tune this approach in accordance with political and economy-specific priorities.[59]

There is also debate between proponents of reward mechanisms as to how best to administer these alternative systems. While money-for-innovation models typically operate on a 'winner-takes-all' basis, some argue that innovators should share prizes with subsequent independent duplicators. This too has its shortcomings; Denicolò and Franzoni describe the risks of this turning the innovation race into a "waiting game."[60]

An Economic Analysis of Law

This thesis will operate within the relatively recently established[61] law and economics movement. While in the early phase of its development, the Chicago (also the "positive" school) and Yale (also the "normative" school) schools emerged as distinguishable approaches. While both had their roots in the legal work of Ronald Coase and Guido Calabresi, the Chicago school came to be most associated with Richard Posner and grounded itself in the notion that law is the result of an effort to induce efficient outcomes.[62] The Yale school grew out of a belief in the need for legal interventions to correct for certain market failures and, in this vein, often addresses distributional concerns.[63] The

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[55] Michael Kremer and Heidi Williams, "Incentivizing Innovation: Adding to the Tool Kit" *Innovation Policy and the Economy* 10 (2010)

[56] Abraham Flexner, "The Usefulness of Useless Knowledge" *Harpers* 179 (1939)

[57] Benjamin Roin, "Intellectual Property versus Prizes: Reframing the Debate" *The University of Chicago Law Review* 81 (2014)

[58] Joseph DiMasi, Ronald Hansen and Henry Grabowski, "The price of innovation: new estimates of drug development costs" *Journal of Health Economics* 22 (2003)

[59] Kremer and Williams (2010): 4

[60] Vincenzo Denicolò and Luigi Franzoni, "On the winner-take-all principles in innovation races" *Journal of the European Economic Association* 8 (2010)

[61] Jonathan Klick and Francesco Parisi, "Wealth, Utility, and the Human Dimension" *NYU Journal of Law and Liberty* 1 (2005): 591

[62] Klick and Parisi (2005): 592

[63] Klick and Parisi (2005): 594

1990s saw the birth of the functional approach which brought public theory into the fold of legal/economic analyses. Owing to what are perceived as structural and political failures, the functional school is skeptical of the notion that law develops to remedy market failures or engender efficiency. While the Chicago school emphasizes the inherent efficiency of law and the Yale school emphasizes the role of law in correcting market failures, the functional approach acknowledges the possibility of both market and legal failures. It makes use of economic theory to design legal rules that lead to social welfare maximization *ex ante,* rejecting the Yale school's focus upon *ex post* corrections.[64]

The Chicago school of thought rests on the efficiency of the common law hypothesis – the notion that common law is an attempt (whether conscious or not) to engender Pareto or Kaldor-Hicks efficiency[65] (a Posnerian view of efficiency constitutes "wealth maximization"[66]). Within the Pareto model, a law is to be considered efficient if it has the capacity to make an individual or group better off, without reducing social welfare elsewhere. Within the Kaldor-Hicks model, a law is to be considered efficient if it simply results in more welfare winners than it does losers.[67] Law can engender efficient outcomes through a number of channels; law raises the cost of certain behaviors which may be associated with inefficiency (corruption, theft etc.) and facilitates wealth-creating behaviors. Contract law, for example, reduces the transaction costs associated with trade by strengthening trust and lessening the need for costly negotiations.[68]

An economic analysis of IPR law is, in Posner's view, suited to drawing parallels between intellectual and tangible property.[69] To illustrate this, he asserts that this comparison provides a particularly rich way of explaining why certain IPRs are time-limited, while others are not (as is the case with rights covering physical property). Put simply, inventions and artistic works feed into the public domain; a vital resource for further progress and gains in efficiency (this, of course, does not apply to physical property). Posner asserts that the system of IPR registration is unsophisticated when compared with that of registering physical property, making the transaction costs associated with tracking down the holders of IPRs significant. Because of the 'public' nature of these goods, it is efficient that the law removes these transactional barriers after a period of time, contributing towards further dynamic efficiency.[70] Copyrights, on the other hand, are not necessarily time-limited. Like physical property

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[64] Klick and Parisis (2005): 591
[65] Klick and Parisis (2005): 531
[66] Richard Posner, "*The Economics of Justice: An Analysis of Wealth Maximization as a Normative Goal*" Cambridge; Mass.: Harvard University Press (1981)
[67] Eric Posner and Alan Sykes, "*Economic Foundations of International Law*" Cambridge; Mass.: Harvard University Press (2013): 13
[68] Posner and Sykes (2013): 13
[69] Posner (2005): 59
[70] Posner (2005): 61

rights, this has the effect of protecting against over-use. Over-grazing on a plot of land might result in the land being of little use to anyone and toll booths can decrease congestion which could otherwise dilute or even negate the benefits to be enjoyed from road use. Similarly, the uncontrolled duplication of copyrighted items (whether this be a brand or cartoon character) would lead to a situation in which the marginal utility of the item in question would be zero, rendering it useless to consumers and producers alike. Guarding against over-use therefore protects the item's value. In an earlier work, Landes and Posner illustrate the efficiency thesis by arguing that the legal distinctions (within the field of copyright law) between idea, expression and the fair use doctrine, "can be understood as attempts to promote efficiency by balancing the effect of greater copyright protection … against the effect of less protection."[71]

Within an international context, law has the capacity to engender efficiency by tackling the international externalities that would surface without legal cooperation. Implicit in this economic analysis of the efficiency of international law is the assumption that nation states only have regard for the interests and welfare of their own citizens.[72] When divergences between national and global interests develop in the absence of common legal constraints, policy decisions which violate the Pareto and/or Kaldor-Hicks paradigms of efficiency can arise. This can lead to a Nash equilibrium in which nation states are content with their policy decisions, given the decisions of their international partners, despite a sub-optimal outcome. Cross-border pollution and tariffs are straight-forward examples of this. In the case of trade, a Nash equilibrium would involve the implementation of inefficient tariffs. Unable to influence the behavior of their trading partners, countries would not risk disadvantage by removing tariffs given that this would result in a situation in which their trading partners could 'steal' some of their welfare by enacting their own tariffs. As such, all partners would enact tariffs in lieu of (arguably) welfare-enhancing free trade. Bilateral trade agreements and the system of law that exists within the World Trade Organization (WTO) allows for nation states to progress beyond this non-cooperative equilibrium through a system that allows for a balance of national and global interests. In this example, efficiency, at the global level, is therefore improved. This can, however, have distributional implications at the domestic level with the potential to negatively impact upon the welfare of certain sectors within an economy. The Chicago school does not disregard the importance of distributional concerns, but questions if laws are the most efficient policy tool with which to address distributional issues[73].

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[71] William Landes and Richard Posner, "An Economic Analysis of Copyright Law" *The Journal of Legal Studies* 18 (1989)
[72] Posner and Sykes (2013): 18
[73] Posner and Sykes (2013): 13

The Yale school, on the other hand, treats law as being an instrument with which to address distributional problems. This difference stems from the divergent lenses through which the two schools evaluate the efficacy of laws. The Yale school uses justice and fairness as the yardstick against which to assess legal systems. Value-tainted in a way that the Chicago school is not, it advocates for interventionism to address market failures. MacKaay dubs the efficiency argument unfalsifiable (and therefore of little use for testing theory), arguing that where there is no apparent inefficiency argument, hithero unnoticed costs can be cited to account for it.[74] He also describes the differences among modern legal systems as posing a challenge to the efficiency thesis, asserting that "if there is a tendency towards efficiency and the efficient solution to any legal problem is unique, legal systems should converge."[75] This, however, does little to acknowledge that a positivist approach grounds law in social practice. Multiple equilibria can exist across different legal environments owing to different preferences and social structures.

The issue of pharmaceutical IPRs provides a good example of an area of law which underscores the attraction of a normative approach. Here, an efficient outcome (particularly in the Kaldor-Hicks sense of efficient) could be seen as distributionally unacceptable. While pharmaceutical patents are designed to encourage the large investments needed to bring medicines to market that might not have otherwise been developed (a dynamically efficient scenario), they are also responsible for limiting access to drugs in the developing world by pricing medicines out of reach of the population. In these cases, a market failure (a by-product of the innovation-incentive mechanism) means that a demand for medicines goes without being satisfied. Because of the moral dimension which accompanies the issue of pharmaceuticals, this has resulted in laws and conventions which seek to correct for this. Compulsory licensing is one of the 'flexibilities' which exists under the WTO's TRIPS Agreement. Article 31 of the TRIPS agreement is a provision which, among other things, empowers governments to issue compulsory licenses. Once the entity applying for the license has "made efforts to obtain authorization from the right holder on reasonable commercial terms"[76] and been unsuccessful, a government can decide the terms on which a manufacturer can produce a patented substance without the approval of the patent holder. Moreover, while Article 31(f) emphasizes that compulsory licenses ought to be used to produce drugs predominantly for the domestic market, the Declaration on TRIPS and Public Health gave rise to a decision in 2003 which allowed for compulsory licenses to be used to satisfy demand where there is a lack of capacity to manufacture outside of the producing country. These legal rules were clearly drafted on the back of values.

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[74] Ejan Mackaay, "*History of Law and Economics*" in Boudewijn Bouckaert and Gerrit De Geest, (eds.), "*Encyclopedia of Law and Economics, Volume I. The History and Methodology of Law and Economics*" Cheltenham: Edward Elgar (2000)
[75] Mackaay (2000): 78
[76] WTO, Agreement on Trade-Related Aspects of Intellectual Property Rights, Apr. 15, 1994, Marrakesh Agreement Establishing the World Trade Organization, Annex 1C, 1869 U.N.T.S. 299. (1994), Art. 31[b]

At odds with both approaches is the relatively recent Functional Approach. Wary of a generalized efficiency hypothesis and cautious of an approach which bases decisions to intervene on a simplified model of reality (which an economic model necessarily is),[77] it assumes that we cannot expect actors in the legal environment to be equipped or capable of measuring the efficiency of laws using technical economic or mathematical paradigms. Instead, it borrows heavily from the notion of methodological individualism. In an expose of how rules are chosen, Buchanan describes the "implicit presumption that collectivities choose analogously to individuals"[78] that exists within conventional economics as being an over-simplification, asserting that individual choices are constrained "by nature, by history, by a sequence of past choices, by other persons, by laws and institutional arrangements, or even by custom and convention."[79] It is, seen through the lens of methodological individualism, only individuals which act. As such, any attempt to understand the creation of a law or rule at the aggregate level must properly acknowledge the role of the individual. Within normative individualism, "only the judgement of the single individuals can provide a relevant benchmark against which the merits of alternative rules can be evaluated."[80] Decisions regarding the appropriateness of laws are the product of a confluence of market and non-market factors, acting upon individual decision makers. Klick and Parisi sum this up as a human-centered *ex ante* efficiency perspective.[81] The inclusion of subjective values makes this perspective difficult to include in a predictive model. Economic models necessarily constitute a reductionist projection of reality. While the extent of simplification is a matter of legitimate debate, the prospect of assessing law on the basis of "a calculus of individual interests"[82] is a daunting one.

Methodology

Existing attempts to benchmark the strength of IPRs around the world, such as those made by Hu and Png, and Papageorgiadis, Cross and Alexiou, often equate the state of IPR enforcement in a country with the state of its legal and political systems. It is not an unreasonable assumption that a government's track record in other areas will serve as a useful proxy for its enforcement of IPRs, but it does not account for the role that private actors, in partnership with the state, play in enforcement. In an effort to establish an objective measure of enforcement that accounts for the behavior of both private and public actors, this thesis will experiment with the use data pertaining to payments for the use of intellectual property as a proxy for the enforcement of IPRs. Payments for the use of intellectual

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[77] Klick and Parisi (2005): 595
[78] James Buchanan, "The Domain of Constitutional Economics" *Constitutional Political Economy* 1 (1990)
[79] Buchanan (1990)
[80] Klick and Parisi (2005): 595
[81] Klick and Parisi (2005): 605
[82] Buchanan (1990)

property has the potential to capture the *de facto*, as opposed to the *de jure*, enforcement of IPRs. I hypothesise that both an increase in these payments and a high absolute level of payments will correlate positively with the enforcement of IPRs (and therefore growth), while I expect fewer payments to be made in a climate in which IPRs are easily circumvented or remain unenforced in practice.

This thesis will undertake an econometric analysis of the relationship between cross-border IP payments (the independent variable) and GDP per capita growth (the dependent variable) between 1990 and 2004. Using cross-sectional time series data and an OLS estimator, both the absolute level of payments for the use of IP as a percentage of GDP and the change in these payments over a four-year period will be regressed against GDP per-capita growth over the same period, while controlling for factors identified in the existing literature as having growth-inducing properties. The use of four-year periods is intended to minimize the noise caused by business cycles and other fluctuations in the economy. The estimator will take the linear form of

$$Y_{ct} = \alpha_{ct} + \beta_1 P_{ct} + \beta_2 T_{ct} + \beta_3 L + \beta_4 (P \times L) + \beta_5 INC_{ct} + \beta_6 G_{ct} + \beta_7 I_{ct} + \epsilon_{ct}$$

where *Y* represents GDP per-capita growth[83] as a percentage point change over four, four-year periods (from 1990 to 1994, 1995 to 1999, 2000 to 2004, and 2005 to 2009 respectively) in country *c* at time *t*. α is the intercept. *P* represents relative changes in payments for the use of IP (as a percentage of GDP) over a four-year period in country *c* at time *t* in iteration (1) of the regression, and payments for the use of IP as a percentage of GDP in the initial year of each four-year period in country *c* at time *t* in iteration (2) of the regression. Similarly, *T* represents overall changes in trade (exports plus imports) as a percentage of GDP over a four-year period in country *c* at time *t* in iteration (1) of the regression, and total trade as a percentage of GDP in the initial year of each four-year period in country *c* at time *t* in iteration (2) of the regression. *L* represents the existence of IPR legislation in country *c* at time *t*; *PL* constitutes an interaction variable, coding for the joint effect of IP payments and the existence of legislation. This will control for the effect of IP payments, dependent upon the existence of IPR legislation in country *c* at time *t*. In-keeping with other cross-country growth regressions,[84] *INC* represents the log of initial GDP per capita in each time period in order to account for conditional convergence dynamics. *G* accounts the human and physical capital, and the population growth rate across a four-year period in country *c* at time *t*. These factors were identified in Mankiw,

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[83] 2010 USD

[84] Robert Barro, "Government Spending in a Simple Model of Endogenous Growth" *Journal Of Political Economy* 98 (1990)
Sebastian Edwards, "Openness, trade liberalization and growth in developing countries" *Journal of Economic Literature* 32 (1993)
Gregory Mankiw, Paul Romer and David Weil, "A contribution to the empirics of economic growth" *Quarterly Journal of Economics* 106 (1992)

Romer and Weil's 1992 study on the empirics of growth as accounting for growth.[85] Controlling for levels of human capital will control for the capacity of countries paying for the use of IP to absorb new methods and technologies. *I* is a period dummy variable and ε represents errors in country *c* at time *t*. Fixed effects will be controlled for in each iteration.

Data representing cross-border payments of the use of IP will be taken from the International Monetary Fund's *Balance of Payments Statistics Yearbook*. GDP figures, trade and gross capital formation data will be taken from the World Bank's National Accounts Data. The existence of IPR legislation will be represented by the GP index. Population growth data will be taken from the United Nations Population Division's World Population Prospects data. Finally, the mean number of years of a population's schooling will be used as a proxy for human capital. This data will be taken from the Wittgenstein Centre's data repository.

Each regression will feature a sample of 38 countries (see Annex). These were chosen on the basis of data availability, and to ensure broad regional and income-related representation. Nineteen are categorized by the World Bank as being high income, ten as upper-middle, nine as lower-middle, and three as low-income. Of these, nine are in Latin America and the Caribbean, four in East Asia and the Pacific, six in Sub-Saharan Africa, two in North America, ten in Europe and Central Asia, one in south Asia and two are in the Middle East and North Africa. I hypothesize that both changes in payments for the use of intellectual property and the absolute level of payments as a percentage of GDP will correlate positively with GDP growth over a four-year period.

This empirical strategy ought to be accompanied by two caveats. First, the model does not adequately account for the issue of endogeneity surrounding the structure of an economy. For example, those countries which choose to enforce legislation may do so because their economies rely little upon IP-intensive industries and, as such, they stand to lose little by clamping down on IP infringement through enforcement. Conversely, a country may be lax or selective in their enforcement of IPRs due to the benefits derived from allowing for IP infringement. As such, the impact of an economy's structure versus the enforcement of IPRs upon growth may be entangled in some cases. While a sample size of 38 ought to go some way towards mitigating this, it should be borne in mind when interpreting results. Second, though discussed in the Mankiw, Romer and Weil paper as having a role to play in the growth equation, spending on research and development (R&D) has not been included as a control variable due to data availability. While this allowed for a greater sample size, it leaves a

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[85]Mankiw, Romer and Weil, "A Contribution to the Empirics of Economic Growth" *Quarterly Journal of Economics* 107 (1992)

second issue of endogeneity unaddressed; those countries with large investments in R&D may be more concerned about enforcing IPRs than their counterparts with few investments in R&D. The effect that R&D might have upon growth could become entangled with the effect of IPR enforcement.

Empirical Results

Table 1 lists the coefficients derived from regressions 1 (the effect of the percentage change in IP payments and trade over a four-year period upon GDP per capita growth over the same period) and 2 (the effect of the absolute levels of IP payments and trade in the initial year of each period upon GDP per capita growth over a four-year period).

Table 1: Summary Statistics

Variable	(1)		(2)		Observations
IP payments	-63.528		-31.025		152
	(140.6295)		(137.556)		
Trade	-0.113	**	0.120	**	152
	(0.036)		(0.048)		
IP payments/trade interaction variable	17.979		-4.744		152
	(43.788)		(42.498)		
Population growth	-1.715	***	-1.611	**	152
	(0.487)		(0.51)		
Existence of Legislation	1.097		0.798		152
	(1.12)		(1.138)		
Log of initial income	-84.055	***	-94.701	***	152
	(13.07)		(13.925)		
Mean years of schooling	3.144		3.873		152
	(2.764)		(2.859)		
Gross capital formation	0.842	***	0.726	***	152
	(0.107)		(0.109))		

(1)R-sq: within = 0.634

(2)R-sq: within = 0.623

Standard deviations are in parentheses

***: $p \leq 0.001$

**: $p \leq 0.05$

Importantly, neither regression showed the IP payments variable to have a significant relationship with GDP per capita growth over a four-year period. As a robustness check, variables were checked for collinearity to rule out the possibility of one variable masking the effect of another. In the case of

both regressions, there was nothing to suggest that this was the case. Unsurprisingly—in the case of regression (1)—there is a correlation of 0.39 between change in trade as a percentage of GDP over a four-year period and the change in IP payments as a percentage of GDP over the same period.

These results alone do not make it clear as to whether the enforcement of IPRs has no significant effect upon GDP per capita growth rates over a four-year period, or if there is simply not a strong relationship between cross-border IP payment data and the enforcement of IPRs. However, previous work exhibiting the relationship between alternative proxies for enforcement and GDP growth make it likely that a balance of payment (BoP) measurement of IP payments is simply not a reliable proxy for the enforcement of IPRs. Though cross-border IP payments were identified because they had the potential to capture the behavior of private as well as public actors, the complex networks used by multinationals of the sort that own and use intellectual property might by one reason why it proved to be unsuitable. The housing of intellectual property in different jurisdictions, the transfer of IP ownership, tax rebate laws and the categorization of international payments under different headings may have resulted in a complex web that undermines the simplistic assumption that there might be a meaningful relationship between the degree to which a jurisdiction enforces IP law and cross border payments made for the use of IP. Moreover, despite efforts to control for overall trade flows, BoP IP payment data in one country may be affected by the behavior of its trading partners in ways that is difficult to isolate.

In both regressions, four of the eight regressors proved to be statistically significant, three of which—within the context of a short-run scenario—are consistent with the neoclassical textbook model of economic growth advanced by Robert Solow and Trevor Swan.[86] The Solow-Swan model puts emphasis upon the role of capital accumulation in changes to the long-run steady state of an economy's output. Table 1 associates a percentage point increase in gross capital accumulation with a 0.842 and a 0.726 percentage point increase in GDP per capita growth over a four-year period in the case of regressions (1) and (2) respectively. Within a neoclassical framework, this would suggest movement towards a higher long-run steady-state of output. The Solow model of growth is represented in the production function

$$Y = (K, AL)$$

where Y is output, K is capital, L is labour and A is a proxy for technological development. Within this framework, the change in capital stock evolves over time according to

[86] Robert Solow, "A Contribution to the Theory of Economic Growth" *The Quarterly Journal of Economics* 70 (1956)
Trevor Swan, "Economic growth and capital accumulation" *Economic Record* 32 (1956)

$$\dot{k} = sf(k) - (n + g + \delta)k$$

where s is the rate of saving, *n* is the rate of population growth, *g* is technological growth, and δ is the capital depreciation rate. Given the above, the coefficients of -1.715 and -1.611 representing a negative correlation between population growth and GDP per capita growth over a four-year period are entirely logical. With an upward change in *n,* the model predicts that an economy would begin to shift towards a lower steady state of output (a lower GDP per capita), if not matched with a concurrent increase in capital.

The central role of capital in this model has also been used to explain the differential growth rates between countries at different stages of development. Table 1 shows an increase in the log of initial income (GDP per capita) as being associated with a decrease in GDP per capita growth over a four-year period. This supports the notion of convergence—specifically beta-convergence, a dynamic that underpins the Solow growth model[87]—whereby countries with a lower per-capita income (though this alone is not a sufficient condition) will see their incomes grow faster than their wealthier counterparts as they head towards a steady state growth rate.[88] This 'catch-up' effect is partly a product of the weaker effect of diminishing returns in capital-poor countries, as well as opportunities that exist to replace old capital with capital that embodies frontier knowledge through imports or replication. The older and more backward a country's methods and technologies, the greater the potential for large leaps in productivity.[89] Mobile phone infrastructure is an example of this. While a shift from landline telephones towards mobile cell phones represented progress, the leap forward was limited by the advancement of technical knowledge. For those countries which never established a reliable system of landline phones, however, the relative improvement in adopting mobile phone infrastructure when compared with a starting point without phones will have been far greater. Technological leaps forward can also improve allocative labour efficiency, shifting redundant workers away from agriculture and petty trade.[90]

It is perhaps not entirely intuitive that mean years of schooling—here, a proxy for human capital—is not shown to have a statistically significant relationship with GDP per capita growth over a four-year period. While a typical choice for a human capital proxy in growth regressions, this is not the first

[87] Solow (1956)
[88] Peter Phillips and Donggyu Sul, "Economic Transition and Growth" *Journal of Applied Econometrics* 24 (2009)
[89] Moses Abramovitz, "Cathcing Up, Forging Ahead, and Falling Behind" *The Journal of Economic History* 46 (1986)
[90] Abramovitz (1986)

time that years of education has been identified as a non-statistically significant variable.[91] Results have been mixed. There remains controversy in the literature as to whether the level of years of schooling (favored by endogenous growth models) or the change in years of schooling (favored by neoclassical models) is the most effective predictor of economic growth and development.[92] An obvious shortcoming of using a population's mean years of schooling as a proxy is that a year of schooling is unlikely to have the same results between countries. As an alternative, test scores have been proposed as a more reliable measure of human capital than mean years of schooling.[93] Although there is a correlation of 0.92 between schooling and initial income in regression (2), the removal of the initial income variable does not render schooling statistically significant.

Trade (exports plus imports) proved to be positively correlated with GDP per capita growth over a four-year period in regression (2), but has an effect of the same magnitude in the opposite direction in the case of regression (1). This may be because those countries which are experiencing the largest increases in trade as a percentage of GDP are countries that are starting from a more 'closed' position than that of their counterparts which are not experiencing such large leaps in trade. This is suggested by the results in regression (2) and is even more plausible within the context of the time-frame in question, given the political and economic changes which were taking place across Latin America in the 1990s (a region accounting for almost on quarter of countries in the data set) and the establishment of the region's free-trade bloc and customs union Mercosur in 1991. Latin American exports as a share of GDP rose from 15 percent in the early 1990s to 21 percent in the early 2000s.[94] Latin America's relatively low openness to trade as an absolute share of GDP when compared with countries of similar income elsewhere in the world was identified by the IMF as being a factor explaining the long periods with little growth that the region has experienced.[95] The coefficient in regression (2) complements a well-established literature on the relationship between trade and economic growth,[96] though does not necessarily capture the relationship's nuances. Cavallo, De Gregorio and Loayza find that openness to trade is also associated with output volatility;[97] something

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[91] Michael Delgado, Dniel Henderson and Christopher Parmeter, "*Does Education Matter for Economic Growth?*" IZA Discussion Paper No. 7089 (2012)

[92] Eric Hanushek and Ludger Wößmann "Education and Economic Growth" *Economics of Education* (2010)

[93] Delgado, Henderson and Parmeter (2012)

[94] Anoop Singh et al. "*Stabilization and Reform in Latin America: A Macroeconomic Perspective on the Experience Since the Early 1990s*" Occasional Paper 238, International Monetary Fund (2005)

[95] Singh et al. (2005)

[96] Amjad Naveed and Ghulam Shabbir, "Trade Openness, FDI and Economic Growth: A Panel Study" *Pakistan Economic and Social Review* 44 (1992)

David Dollar and Aart Kraay, "Trade, Growth and Poverty" *The Economic Journal* 114 (2004)

Edmund Sheehey, "Trade, Efficiency, and Growth in a Cross Section of Countries" *Weltwirtschaftliches Archiv* 131 (1995)

[97] Eduardo Cavallo, José De Gregorio and Norman Loayza, "Output Volatility and Openness to Trade: A Reassessment" *Economía* 9 (2008)

that has been found to correlate negatively with economic growth.[98] The construction of the regressions represented in Table 1 was designed to minimize the impact of short-run volatility on results by focusing on four-year periods.

Moreover, an empirical examination of trading patterns across 100 counties brought to light the importance of trading partners' wealth[99] when assessing the impact of trade on growth, and a 2008 study found evidence to suggest that only countries in the Middle Income group exhibit a positive long-term relationship between trade and growth.[100] An additional two regressions—using the dataset from regression (2)—which separate countries by income group (see Table 2), found no evidence that this holds true in the short-run. Regression (3) represents high-income countries, while regression (4) represents middle- income (10 upper-middle and 9 lower-middle) countries. While a percentage point increase in trade as a percentage of GDP is associated with a 0.12 percentage point increase in GDP per capita growth over a four-year period in the case of high-income countries, a similar result for middle-income countries yields a p-value of 0.209 (though in both cases the sample size is too small on which to be basing substantive conclusions).

Table 2: Summary Statistics

Variable	(3)		Observations	(4)		Observations
IP payments as a % of GDP	75.898		64	127.607		76
	(358.136)			(282.337)		
Trade as a % of GDP	0.11513	**	64	0.110		76
	(0.039)			(0.086)		
IP payments/trade interaction variable	-32.163		64	-83.580		76
	(101.054)			(138.396)		
Population growth	-0.86	*	64	-1.959	*	76
	(0.479)			(0.977)		
Existence of Legislation	-0.138		64	-0.046		76
	(1.32)			(1.913)		
Log of initial income	-86.583	***	64	-94.373	***	76
	(16.554)			(24.371)		
Mean years of schooling	3.657		64	-10.348		76
	(2.176)			(9.181)		
Gross capital formation	1.093	***	64	0.707	***	76
	(0.16)			(0.161)		

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[98] Garey Ramey and Valerie Ramey, "Cross-Country Evidence on the Link between Volatility and Growth" *American Economic Review* 85 (1995)
[99] Vivek Arora and Athanasios Vamvakidis, "*How Much Do Trading Partners Matter for Economic Growth?*" IMF Staff Papers 52 (2005)
[100] Prabirjit Sarkar, "Trade Openness and Growth: Is There Any Link?" *Journal of Economic Issues* 42 (2008)

(3)R-sq: within = 0.872

(4)R-sq: within = 0.614

Standard deviations are in parentheses

***: $p \leq 0.001$

**: $p \leq 0.05$

*: $p \leq 0.1$

Conclusion

The four regressions underpinning this thesis did not lend credence to the hypothesis that cross-border IP payment data could be used as a reliable proxy for the *de facto* enforcement of IPR in effect within a country. Though the results alone do not allow for a definitive conclusion to be drawn regarding the impact of enforcing IPRs on growth, or the efficacy of cross-border IP payments as a proxy for the enforcement of IPRs, empirical evidence elsewhere demonstrating the relationship between growth and IPRs[101] suggests that BoP data was an unsuitable proxy for the enforcement of IPRs. Regressions (1)-(4) were otherwise in-keeping with neoclassical models of growth. While there are deficiencies in the explanatory power of the Solow-Swan neoclassical growth model, it is—as described by Mankiw, Phelps and Romer—a natural place to start when discussing what we know about growth.[102]

Future research could capitalize on the conceptual utility of using payments for the use of intellectual property as a novel measure of *de facto* enforcement within a country. If sub-national data could be employed in the same way as this thesis employed BoP data, there would be the potential for the results to be free from the distortions of trade and international corporate payment networks. This would be particularly interesting in countries such as Brazil, or the US where large federal systems could facilitate the collection of a meaningful amount of sub-national data. This would also complement the recent development of literature focusing on regional growth and development.[103]

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[101] Keith Maskus, "Intellectual Property Rights and Economic Development" *Case Western Reserve Journal of International Law* 32 (2000)

[102] Gregory Mankiw, Edmund Phelps and Paul Romer, "The Growth of Nations" *Brookings Papers on Economic Activity* 1 (1995)

[103] Fabio Manca, "*Human Capital Composition and Economic Growth at a Regional Level*" Research Institute of Applied Economics, Working Paper 13 (2009)

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Annex

Argentina
Australia
Bolivia
Brazil
Cameroon
Canada
Chile
Colombia
Cyprus
Ecuador
El Salvador
Finland
France
Germany
Greece
Honduras
India
Italy
Kenya
Korea, Rep.
Madagascar
Malta
Mexico
Morocco
Netherlands
Niger
Norway
Panama
Paraguay
Peru
Philippines
Portugal
Senegal
South Africa
Swaziland
Sweden
Thailand
United States

On my honor as a student of the Diplomatic Academy of Vienna, I submit this work in good faith and pledge that I have neither given nor received unauthorized assistance on it.

Jamie Lee-Brown