Interactive Effects of Intellectual Property Rights and Trade Openness on Economic Growth

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Interactive Effects of Intellectual Property Rights and Trade Openness on Economic Growth

Undergraduate Honors Thesis

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Abstract:

This paper analyzes the interactive effect of trade openness and intellectual property rights (IPR) on economic growth. Recent literature suggests that IPR may work through the mechanisms of trade and FDI to affect growth. An IPR interaction with openness may aid in detecting this effect. This paper also analyzes whether this effect varies depending on income level of the country. Building from Gould and Gruben (1996), this empirical analysis uses a panel regression with 62 countries in ten year periods from 1980 to 2010. The results suggest that: (1) the interaction between trade openness and IPR is important in understanding the effect of IPR on growth; (2) this interaction plays a significant role in understanding the “U-shaped” effect of IPR on economic growth for countries with different levels of income. These findings suggest that effects of trade and FDI are important considerations for understanding IPR and growth. It also suggests but that the level of development a country is in also matters significantly.
Introduction:

Since the signing of the international Trade-Related Aspects of Intellectual Property Rights (TRIPS) in 1995, the relationship between intellectual property protection and trade has been of increased interest to researchers and policymakers alike. One area of interest is the degree to which the strength of intellectual property rights (IPR) and trade affect economic growth of nations. Particularly for policy makers, it is important to understand whether agreements like TRIPS could potentially harm growth in countries. There is currently a rich literature on the effect of trade and trade openness on economic growth. Likewise, the existing literature on the effect of IPR strength on growth is large, though not as extensive as trade-related literature. However, possible interactive effects of IPR and trade openness have largely been neglected.

Gould and Gruben (1996) was the first paper to have empirically analyzed the issue of IPR, trade openness, and growth since the advent of endogenous growth theory. Using a cross-sectional growth regression of countries from 1960-1990, it looked at both the effect of IPR strength and its interactive effect with trade openness. Although its results were not very robust, it suggested that IPR strength may be more effective in encouraging growth in open trade regimes. However, a true successor to this paper was never produced. In this paper, I update Gould and Gruben (1996) in order to examine the separate and interactive effects of IPR and trade openness.

The motivation for this update comes largely from recent discoveries in the literature. Maskus and Penurbarti (1995) and Maskus (2000) were the first to look at a “u-shaped” relationship between IPR and income level of nations. Falvey, Foster, and Greenaway (2005) furthered this research, finding a similar pattern for IPR and economic growth using a threshold
regression, suggesting effects may be dependent on income level. They also suggest that trade
may be an important factor in this growth. Branstetter, Fisman, Foley, and Saggi (2007)(2011),
using firm and affiliate-level multinational enterprise (MNE) data, concludes that strengthening
of IPR can promote overall industrial development through technology transfer and increased
MNE activity. Schneider (2005) emphasizes the importance of income differences in the effect
of IPR on growth. It also suggests that strengthening IPR encourages foreign patent applications
while discouraging domestic patent applications. Its conclusions for growth are ambiguous.
This paper uses these to update the methodology and theory extensively. Like Gould and Gruben
(1996), I will set up a baseline growth regression and then add in an IPR index, an openness
index, and an interaction of the two. My sample consists of a panel of 62 nations (22 developed,
40 developing) in three 10-year periods from 1980 to 2010. I run a panel regression using
country and period fixed effects as well as a number of standard growth regression right-hand
side variables. I also separate the sample into income brackets to measure effects at different
levels of development. My results suggest that the effect of intellectual property rights on growth
is highly dependent on both the income level and trade openness of the nation.

The rest of the paper is organized as follows. Section 2 discusses relevant background,
literature, and their applications in this paper. Section 3 explains the data and methodology used.
Section 4 explains the results and analysis. Section 4 summarizes and concludes.

Existing Literature and Background:

Theoretical basis:

The possible role of intellectual property rights protection in encouraging or discouraging
economic growth stems from the evolution of endogenous growth theory. By nature, intellectual
products are non-rival goods- once they are developed, they can be used by many without incurring large costs. This leads to a conflict between private interests and public welfare. If intellectual property rights aren’t protected, this can cause a lack of incentive for innovation. If they are protected too stringently, then it can hamper the dissemination of ideas and create competitive failures.

The importance of innovation and R&D in endogenous growth theory has been emphasized by papers like Grossman and Helpman (1990) and Romer (1990). In these models, investors perform R&D in hopes of profits when IPR are protected. This raises the public stock of ideas and benefits society by lowering the cost of future innovation. As Maskus (2000) points out, it can also aid in the decision of multinational enterprises (MNEs) to invest in countries via foreign direct investment (FDI), as well as to trade with those countries. These are vectors for technology transfer and can again aid in economic growth.

However, Maskus (2000) also points out that that in certain economies, there are large numbers of jobs dedicated towards copying technology. When IPR protections are introduced, those workers are displaced and the price of those goods can also rise. The extent of the effect on these shadow economies is often difficult to see, however. Maskus (2000) also points out that if IPRs are too strong, they can hamper the dissemination of technologies available. This can result in market distortions and decreased competition. This can be particularly important in developing nations where costs of innovation can be high.

The seminal theoretical model was developed by Helpman (1993). It develops a North-South model for IPR where the North innovates and the South imitates. This yields the result that IPR protection is never in the interest of the South. Lai (1998) expands this model to allow FDI and imitation to be endogenously determined. Branstetter, Fisman, Foley, and Saggi (2007)
further allows innovation to be endogenously determined. These revisions open up the possibility of IPR aiding industrial development in the south and are the basis for the later empirical work of Branstetter, et. al. (2011).

*Empirical Studies:*

Gould and Gruben (1996) was one of the first to look at the issue of IPR, trade, and growth, analyzing IPR and their relation to growth in respect to openness. It finds weak, though positive effects of patent protections on economic growth. It also finds a positive interactive effect between trade openness and IPR. Branstetter, et. al. (2007)(2011) use firm level data to support this idea at an industry-level. They find that IPR strengthening reforms tend to lead to overall growth in industries of developing countries, with increased MNE affiliate activity (largely FDI) outweighing any losses. They also find that initial export episodes to the US increase after IPR reform in countries. This means that the number of types of goods exported to the US from those nations increases after reform. Schneider (2005) looks at IPR, FDI inflows, and high-technology trade, but does so to analyze their effects on innovation within a country. Its primary finding was that IPR affects different income levels. It also found that strengthening IPR increases foreign patent applications in reforming nations and lessen domestic applications. However, Gould and Gruben (1996) is now fairly outdated and a true successor never emerged.

The motivation behind this paper is to update Gould and Gruben (1996) using newer methods, data, and economic theory.

In terms of underlying economic theory, quite a bit has changed as well. An important consideration is that it is now well understood that IPR protection changes have a greater effect for some countries than others. A U-shaped relationship was first identified in Maskus and
Penubarti (1995), and was further explained in Maskus (2000a). The results of Falvey, Foster, and Greenaway (2006)’s threshold estimation support this. It appears that IPR strengthening has positive effects for low and high income nations, but negligible effects for mid-income nations. Gould and Gruben (1996) did not take this into account and treated all income levels in the same way.

Also, as explained in Maskus (2012), increased IPR strength is now understood to have a positive effect on both imports and exports. Ivus (2010) analyzed trade pre- and post-TRIPS and found that high-technology exports to reforming nations increased significantly faster than low-technology exports. Maskus and Yang (2012) find that IPR protections play a significant role in trade determination, especially after the implementation of TRIPS. Branstetter et. al. (2011), as mentioned before, found an increase in the level of exports from IPR reforming nations. These developments further the motivation for updating Gould and Gruben (1996) and shed light on possible mechanisms for a relationship between openness and IPR in explaining economic growth.

**Empirical Estimation:**

From the literature, IPR seems likely to affect economic growth through the mechanisms of international trade and FDI. In line with Gould and Gruben (1996), it seems logical to test IPR, trade openness, and their interaction in a growth regression to see their explanatory power. To do this, I create a panel dataset then develop a benchmark growth regression to account for the primary factors that affect growth as identified by the literature. I then add in the variables of interest to estimate their effect on growth. If developmental gains from trade and FDI with stronger IPR outweigh any competitive losses or “crowding out” of imitators we should see a
positive interactive term between openness and IPR. This would be in line with conclusions from works like Branstetter, et. al. (2011).

For this purpose, I develop a balanced panel data set. The sample consists of 62 countries over three 10-year time periods from 1980-2010. It contains 22 developed and 40 developing nations. A complete list of these is available in appendix A. Although these countries are spread throughout all the non-Antarctic continents, there are some limitations. Firstly, in many ways the sample was selected based on data availability. For this reason, the data may be skewed towards higher income or more westernized nations where data gathering is easier. I address this problem later on. Also, because of the balanced nature of the panel, I was unable to use former Soviet Bloc states due to unavailable data prior to 1990.

Benchmark Regression:

To set up the benchmark model, I follow the work of Gould and Gruben (1996), Falvey, Foster, and Greenaway (2006), Schneider(2005) and Barro and Sala-i-Martin (2004). The benchmark model is as follows:

$$Growth_{tc} = \alpha + \gamma_t + \gamma_c + \beta_1 IGDP_{tc} + \beta_2 PopG_{tc} + \beta_3 CI_{tc} + \beta_4 SEC_{tc} + \beta_5 INST_{tc} + \epsilon$$

$Growth$ is the dependent variable for all regressions in this study. It is the logged ratio of real GDP per capita at the end of the period to the real GDP per capita at the beginning of the period $= \ln \left( \frac{RGDP/C_{t+10}}{RGDP/C_t} \right)$. This is calculated using Penn World Table measures of RGDP. Because of the specification of this, interpretation will be of a 10-year growth rate rather than a yearly rate. Although there are numerous measures of economic growth, a derivation of real GDP is the most widely available and used. However, one possible limitation to this is that it
does not include shadow, or informal, economies. This may be an issue as developing countries tend to have larger shadow economies, especially if they are engaging in (possibly illegal) imitative activities. As such, crowding-out effects could be largely understated. However, due to lack of data on shadow economies, this is a topic for future research.

$PopG$ is the average yearly population growth rate during the period $t$ for nation $c$. This is taken from the World Bank development indicators database. $CI$ is the average investment share of GDP over the period for a nation. $IGDP$ is the logged level of initial GDP per capita in the period for a nation. These are both taken directly from the Penn World Table ($IGDP$ is measured in calculated international dollars). $SEC$ is a proxy for the level of human capital. It is the log of the average years of secondary schooling at the beginning of a period for a given nation. This was taken from Barro and Lee calculations.\(^1\) These are common controls in most of the growth regressions that I base my analysis on.

Measures of institutional quality and stability are also quite common. Gould and Gruben(1996) uses assassinations during the period and average revolutions/coups per year. Barro and Sala-i-Martin (2004) uses indices of rule of law (from the International Country Risk Guide) and level of democracy as measured by Freedom House. For my measure of institutional quality, $INST$, I use the Fraser Institute’s summary of their five indices calculated within their 2012 Economic Freedom of the World Report.\(^2\) This is a measure of 5 areas: government intrusion in markets, rule of law and property rights, monetary stability, freedom to trade internationally, and regulation of markets. The purpose of including this is not only to complete the benchmark model, but also to reduce the chances that my IPR measure is acting as a proxy for other institutional qualities.

\(^1\) Available from www.barrolee.com/data/dataexp.htm
\(^2\) Available at www.freetheworld.com/reports.html
The $\gamma_t$ and $\gamma_c$ are period and country fixed effects respectively. These are extremely valuable tools that the use of a panel regression grants me. They allow me to control for other, unseen factors that exist in certain countries or during certain years (such as cultural or business cycle effects).

**Key Variables of Interest:**

For the primary analysis, I need adequate measures of IPR and trade openness, in addition to my growth measure from before. Economic growth data (derived from real GDP/capita) and other growth-regression variables are relatively abundant. Measures of IPR protection, in contrast, have perennially presented problems for economists. Rapp and Rozek (1990) developed one of the first indices based on the existence and content of patent laws (used in Gould and Gruben (1996)). This has since been superseded by the Ginarte and Park (GP) index, last updated in 2008. This is a more thorough and objective patent law index, measuring the presence of 5 qualities of patent law: coverage, membership in international patent agreements, provisions for loss of protection, enforcement mechanisms, and duration. Subjective measures are also often used to attempt to capture enforcement of laws in addition to their existence. Even if a means of enforcement is provided for legally, the actual enforcement may vary substantially. For this paper, I borrow a method from Hu and Png (2009) that involves interacting the GP index with a more subjective measure- the Fraser Institute’s index of legal systems and property rights. This is a composite index of various measures including judicial integrity, contract enforcement, and property rights. Maskus and Yang (2012) also uses this method to capture enforceability in addition to patent law. The interaction is simply
multiplication of the two. The logic behind this is that law and enforcement are partially substitutable but largely complementary. I then scale this new index to lie between 1 and 5.

A concern with this index is endogeneity. Economic growth may affect a countries’ desire to change their IPR protections. To control for this, the IPR measurement is taken at the beginning of each 10-year period. While law-makers could be thinking ahead 5 or 10 years, it is unlikely. For this reason, the openness index is also taken at the beginning of the period. In future research, it may be helpful to use an instrumental variable if an appropriate one can be found for this type of panel regression.

The standard measure of openness is to take the ratio of imports plus exports to GDP. This is what Wu, et. al. (2013) use in their analysis of trade, IPR, and growth. However, this has the actual level of trade ingrained into it, so it would end up controlling for trade and eliminating possible effects from IPR increasing trade. As such, I use the Fraser Institute’s index of freedom to trade internationally, which ranges 1-10. This is a composite index of country characteristics such as tariffs, quotas, exchange rates, and, importantly, restrictions on physical and human capital flows. The index has a higher value if these restraints are low. Because of the nature of this index, I should be able to capture effects of IPR working through trade and, to a degree, FDI. However, I will not attempt to separate these effects.

As it is a product of IPR and openness, the interaction term ranges from 1-50. The addition of these variables (IPR and OPEN respectively) results in the following regressions:

\[
Growth_{tc} = \alpha + \gamma_t + \gamma_c + \beta_1 GDP_{tc} + \beta_2 PopG_{tc} + \beta_3 Cl_{tc} + \beta_4 SEC_{tc} + \beta_5 INST_{tc} + \beta_6 IPR_{tc} + \beta_7 OPEN_{tc} + \epsilon
\]

\[
Growth_{tc} = \alpha + \gamma_t + \gamma_c + \beta_1 GDP_{tc} + \beta_2 PopG_{tc} + \beta_3 Cl_{tc} + \beta_4 SEC_{tc} + \beta_5 INST_{tc} + \beta_6 IPR_{tc} + \beta_7 OPEN_{tc} + \beta_6 IPR_{tc} \times OPEN_{tc} + \epsilon
\]
Finally, in order to capture the effects of IPR for different income levels, I divide up the dataset into thirds (by the 33.3 and 66.7 percentiles) based on income level in 1980. I use 1980 to get rid of any possible endogeneity and to have balanced panels where countries do not move between income ranges. I then run the same regressions on those datasets individually.

However, as I mentioned before, my dataset may be skewed towards higher income countries. As such, the results may not represent true “worldwide” income brackets. In order to correct for this, I take a sample of 159 countries and calculate the brackets from there. Then I impose them on my dataset and run the regressions again.

**Empirical results:**

*Benchmark Growth Regression:*

Table 1 contains the results from the initial growth model for the entire sample (fixed effects not shown):

<table>
<thead>
<tr>
<th></th>
<th>(1) Benchmark</th>
<th>(2) IPR &amp; OPEN</th>
<th>(3) Interaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>IGDP</td>
<td>-0.701***</td>
<td>-0.674***</td>
<td>-0.636***</td>
</tr>
<tr>
<td></td>
<td>(0.0856)</td>
<td>(0.0875)</td>
<td>(0.0861)</td>
</tr>
<tr>
<td>PopG</td>
<td>-0.0424</td>
<td>-0.0352</td>
<td>0.0136</td>
</tr>
<tr>
<td></td>
<td>(0.0533)</td>
<td>(0.0533)</td>
<td>(0.0522)</td>
</tr>
<tr>
<td>CI</td>
<td>0.00544</td>
<td>0.00428</td>
<td>0.00301</td>
</tr>
<tr>
<td></td>
<td>(0.00609)</td>
<td>(0.00625)</td>
<td>(0.00630)</td>
</tr>
<tr>
<td>SEC</td>
<td>-0.0396</td>
<td>-0.0862</td>
<td>-0.160*</td>
</tr>
<tr>
<td></td>
<td>(0.0890)</td>
<td>(0.0893)</td>
<td>(0.0939)</td>
</tr>
<tr>
<td>INST</td>
<td>0.0380</td>
<td>0.0432</td>
<td>0.0262</td>
</tr>
<tr>
<td></td>
<td>(0.0296)</td>
<td>(0.0346)</td>
<td>(0.0331)</td>
</tr>
<tr>
<td>IPR</td>
<td>-0.0632</td>
<td>0.228***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.0386)</td>
<td>(0.0807)</td>
<td></td>
</tr>
<tr>
<td>OPEN</td>
<td>0.00472</td>
<td>0.0360**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.0131)</td>
<td>(0.0153)</td>
<td></td>
</tr>
<tr>
<td>IPR*OPEN</td>
<td></td>
<td>-0.0333***</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.00808)</td>
<td></td>
</tr>
<tr>
<td>Observations</td>
<td>186</td>
<td>186</td>
<td>186</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.753</td>
<td>0.759</td>
<td>0.784</td>
</tr>
</tbody>
</table>

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
The results for the benchmark model are fairly consistent with the benchmark results for Falvey, Foster, and Greenaway (2006) and Schneider (2005). The only possible concern is with the negative sign on education. However, the coefficient is not significantly different than zero and in this it is similar to the benchmark in Falvey, Foster, and Greenaway (2006). Because it is taken at the beginning of the period, endogeneity with growth should not be a worrisome issue. I believe that its effect is probably being eaten up by an overlap with initial GDP and the institutional measure. That being said, these are merely controls designed to enhance the results of the IPR and openness terms.

The second regression shows that IPR tends to have a negative effect on growth, and openness tends to have a small, positive effect on growth. However, neither of these coefficients is significantly different from zero. This makes sense regarding the u-shaped effect taken from Falvey, Foster, and Greenaway (2006), other literature, and possible effects of the interaction term.

The third regression has highly significant results for all variables of interest. The partial effect of IPR is a baseline increase of 23% (per unit increase in the index) in $1 + r$ (where $r$ is the traditionally stated growth rate)$^3$, but diminishes as the level of openness increases. This eventually becomes negative at a level of openness of about 6.8. This is a little suspicious, as high income nations (in this sample) have an average openness of just under .8, meaning they would be hurt by increased IPR strengthening. This is fairly contradictory to the literature. Saving any further analysis for later, these results at the very least demonstrate that the interaction term is important when thinking about IPR and openness.

$^3$ Note: if growth was 0% initially, this could be explained as a 22 percentage point increase. The effects are magnified or dampened respectively as the current level of growth increases or decreases.
Table 2 contains the breakdown of the above three regressions when the sample is divided into 3 separate income levels (by the 33.3 and 66.6 percentiles) based on their real GDP/cap in 1980. The results don’t quite appear consistent with a u-shaped effect, but are certainly different for low and high/medium income nations. More importantly, these regressions seem to reinforce that the interaction between trade openness and intellectual property rights plays a significant role in this effect.

Looking at the low-income set without the interaction term, the effects of IPR and openness are small and insignificant. However, when the interaction term is included the coefficient on IPR becomes negative and nearly doubles in magnitude. Though not technically significant at traditional levels, it is significant at the 10.1% level. The interaction term itself is very significant and of fair magnitude.

Testing numbers using tables 2 and 3 reveals some interesting dynamics. At the average level openness for a low income nation, the partial effect of an increase in IPR is negative, reducing the 10 year growth rate \((1 + r)\) by about 1.7% per index unit increase in IPR. However, if a low income nation were to adopt the mean openness of the medium income nations, the partial effect becomes positive at about 5%. See appendix B for more of these calculations. This implies that in order for IPR strengthening to help economic growth in these low income nations, they must have an adequate level of openness to trade (which, remembering the index, includes physical/human capital flows like FDI). This makes sense economically. Without openness, strengthened IPR may simply inhibit imitative industries and hurt growth. However, if these nations are open to trade and FDI, they may receive the benefits of MNEs who feel safer bringing new technology into the country.
Table 3 contains average value for the IPR and OPEN by income level.

<table>
<thead>
<tr>
<th></th>
<th>Low Income</th>
<th>Medium Income</th>
<th>High Income</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>IPR (1-5)</strong></td>
<td>0.884</td>
<td>1.175</td>
<td>2.846</td>
<td>1.642</td>
</tr>
<tr>
<td><strong>OPEN (1-10)</strong></td>
<td>4.539</td>
<td>5.92</td>
<td>7.936</td>
<td>6.135</td>
</tr>
</tbody>
</table>

Medium and high-income nations also follow the trend of small, insignificant effects without the interaction and large, significant effects with. However, the coefficients seem to behave in the opposite way to low income nations. They have strong positive effects of IPR and openness individually, but their effects are diminished by the interaction term. Because of this, the partial effect of strengthening IPR in both high and medium income nations crosses the zero threshold when trade openness reaches a little over 8 (on the scale of 1-10). Economically, the reason for this is somewhat less obvious. It may be the result of strengthened market power and decreased competition. For instance, if you were open enough, you might imagine that foreign MNEs might simply patent high-tech goods. Since these are better developed nations, it would prevent domestic production, hinder innovation, and potentially limit gains from trade due to decreased output by the foreign monopolist. Also, the benefits from FDI may be lower for high income countries, which might cause competitive losses to begin to outweigh trade/FDI gains.

There is also the issue of potentially skewed data. If my data is skewed towards high-income nations, then the conclusions drawn about various income levels may be false. To correct for this, table 4 represents the same regressions as table two, but using a full, 159 country sample for the cutoff percentiles (33.3 and 66.6) then applied to the primary dataset to sort the income brackets.
<table>
<thead>
<tr>
<th>Table 2</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
<th>(7)</th>
<th>(8)</th>
<th>(9)</th>
</tr>
</thead>
<tbody>
<tr>
<td>IGDP</td>
<td>-0.457***</td>
<td>-0.466***</td>
<td>-0.514***</td>
<td>-0.774***</td>
<td>-0.774***</td>
<td>-0.631***</td>
<td>-1.103***</td>
<td>-1.087***</td>
<td>-0.974***</td>
</tr>
<tr>
<td></td>
<td>(0.0953)</td>
<td>(0.0984)</td>
<td>(0.102)</td>
<td>(0.0542)</td>
<td>(0.0573)</td>
<td>(0.0718)</td>
<td>(0.140)</td>
<td>(0.153)</td>
<td>(0.107)</td>
</tr>
<tr>
<td>PopG</td>
<td>0.0717</td>
<td>0.0736</td>
<td>0.0529</td>
<td>-0.0624</td>
<td>-0.0585</td>
<td>-0.0168</td>
<td>0.109</td>
<td>0.119*</td>
<td>0.141**</td>
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<tr>
<td></td>
<td>(0.0535)</td>
<td>(0.0559)</td>
<td>(0.0557)</td>
<td>(0.0641)</td>
<td>(0.0550)</td>
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<tr>
<td>CI</td>
<td>0.0119</td>
<td>0.0119</td>
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<td>-0.0154</td>
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<td></td>
<td>(0.00767)</td>
<td>(0.00783)</td>
<td>(0.00766)</td>
<td>(0.00506)</td>
<td>(0.00579)</td>
<td>(0.00512)</td>
<td>(0.0103)</td>
<td>(0.0104)</td>
<td>(0.0102)</td>
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<tr>
<td>SEC</td>
<td>-0.168</td>
<td>-0.153</td>
<td>-0.110</td>
<td>-0.447*</td>
<td>-0.456*</td>
<td>-0.549**</td>
<td>-0.117</td>
<td>-0.128</td>
<td>-0.148</td>
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<tr>
<td></td>
<td>(0.154)</td>
<td>(0.156)</td>
<td>(0.150)</td>
<td>(0.222)</td>
<td>(0.234)</td>
<td>(0.224)</td>
<td>(0.0907)</td>
<td>(0.0919)</td>
<td>(0.0925)</td>
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<tr>
<td>INST</td>
<td>0.0250</td>
<td>0.0342</td>
<td>0.0347</td>
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<td></td>
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<td>(0.0682)</td>
<td>(0.0624)</td>
<td>(0.0319)</td>
<td>(0.0404)</td>
<td>(0.0330)</td>
<td>(0.0464)</td>
<td>(0.0494)</td>
<td>(0.0523)</td>
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<tr>
<td>IPR</td>
<td>0.0132</td>
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<tr>
<td>Constant</td>
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<td>2.185**</td>
<td>2.758***</td>
<td>6.881***</td>
<td>6.047***</td>
<td>4.459***</td>
<td>11.25***</td>
<td>11.17***</td>
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<td>(0.772)</td>
<td>(0.834)</td>
<td>(0.877)</td>
<td>(0.492)</td>
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<td>(1.412)</td>
<td>(1.432)</td>
<td>(0.997)</td>
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</table>

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1
The first thing to notice is that the data is clearly skewed towards high-income nations; half the data is now grouped into the high-income bracket. This is unsurprising considering they are easier to get complete data for. This may also explain why the full-sample and the table 2 medium income regressions look so similar to the table 2 high-income regressions. Compared to the old results, the low income nation regression is now not significantly different from zero. However, something to notice is that the magnitudes (and signs) of the coefficients on the interaction regression are fairly similar, and the partial effect of IPR on growth goes from positive to negative in nearly the same place. The lack of significance here, therefore, may be due more to lack of data.

For high income levels, the results are still highly significant and are nearly identical to the previous regressions. This is unsurprising considering they make up half of the dataset. However, the medium income level has changed drastically. Not only have they become highly insignificant, but the magnitudes have all but disappeared. This may seem concerning, but in fact it seems to reinforce the idea of a u-shaped effect with positive effects in the extremes of the income scale and little effect in the middle. This might be explained by two counter-acting effects: (1) the discouraging of imitation and loss of competitiveness, (2) increase in FDI and trade related gains.

This may be the case because middle-income countries may have the resources to imitate, but not to innovate. In contrast, in low-income nations imitation may be a much smaller part of the economy due to simple technological incapacity to do so. This might explain why they would gain and middle-income countries would not. High income nations, on the other hand, can both
imitate and innovate. Because of this, the effects of innovation and trade/FDI may outweigh competitive losses for some values of IPR and openness.

<table>
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<th>Table 5</th>
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<th>High Income</th>
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Table 5 contains average value for the IPR and OPEN by income level using the full-sample brackets.
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<tr>
<th>Table 4</th>
<th>(1) Low Full</th>
<th>(2) Low Full</th>
<th>(3) Low Full</th>
<th>(4) Med Full</th>
<th>(5) Med Full</th>
<th>(6) Med Full</th>
<th>(7) High Full</th>
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Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Conclusion:

This paper set out to analyze possible interactive effects that intellectual property rights may have with trade openness in influencing growth. Gould and Gruben (1996) first looked at this question and concluded that a positive relationship did seem to exist. Although various papers have touched on the subject since, few have seriously analyzed interactive effects between the two. By utilizing the relevant literature and updating methods and data, this paper was able to empirically examine and estimate this interactive effect. By using a panel regression, it was able to utilize the invaluable tool of fixed effects. This paper also took existing knowledge about the “U-shaped” effect of IPR and income and expanded upon it. The results of this study suggest empirically that there is a relationship between the “U-shape” and the link between IPR and trade openness. It furthermore provides policymakers with information about the possible implications of strengthening IPR on growth, particularly with trade-based IPR agreements like TRIPS. And perhaps most importantly, this paper serves to stimulate interest in this interactive effect for further study.

However, the results here warrant further research. As new data arises, these effects can be analyzed with more accuracy, especially for lower-income nations. The apparent link between the “U-shape,” IPR, and trade openness certainly warrants further research. Also, although this paper addresses the issue of IPR and trade openness, it fails to detangle the possible effects of trade vs FDI in this process. Further research in this area may shed light on the exact nature of the patterns observed in the paper.
## Appendix A: Dataset

### Countries in Dataset

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<td>Malaysia</td>
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<td>Portugal</td>
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Appendix B: Partial Effects of IPR on Growth

From Table 2

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From Table 3

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Bibliography:


