

Title: The role of intellectual property rights in economic growth

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SUMMARY			
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Abstract

This study examines the relationship between intellectual property rights (IPR) protection and economic growth using cross-country data from 1960 to 1988. From an economic theory point of view, there exist two types of arguments. One side opines that strong IPR protection serves as a catalyst for economic growth by enhancing competition and innovation. The other side argues that strong IPR protection allows incumbents to raise significant barriers to entry, thus hindering innovation and ultimately economic growth. Empirical evidence suggests that stronger IPR protection has a significant positive impact on per capita GDP growth. The results imply that while the role of IPR in economic growth varies by trade regime, open economies benefit slightly more from robust IPR protection. However, these effects are not always statistically significant.

Keywords:

Intellectual property rights protection, Economic growth, International trade

Summary

1. Introduction

A key point in the debate over strengthening or weakening intellectual property rights (IPR) is whether IPR protection leads to higher innovation and economic growth. For example, one hypothesis suggests that companies innovate to capture or hold a market share. Thus, if their market share is relatively secure, stronger IPR protection may not increase their rate of innovation. Braga and Willmore (1991)¹ found evidence for this theory by examining 3,000 Brazilian companies in a then-closed economy. The reason was that competition in these markets was not driven by innovation. Instead, it is more likely that copying foreign technology was typically more profitable than innovating in a closed-trade regime. Therefore, stronger IPRs did not lead to more innovation or economic growth.

In contrast, Mansfield (1994)² surveyed 100 major U.S. firms in six manufacturing industries. He found that weak IPR protection deterred foreign direct investment and joint ventures, especially in R&D facilities. Accordingly, open trade regimes may show a stronger link between intellectual property protection and innovation. Open trade means local firms face competition from foreign producers that use advanced patented technology in production and end products. In addition, weak IPR protection in the home country may disincentivize local firms from purchasing foreign technology to stay competitive.

This study aims at understanding the role of IPR in economic growth. It uses cross-country data on overall levels of patent protection, trade regime, and country-specific characteristics. The result found is that IPR protection (proxied by the degree of patent protection³) is an important determinant of economic growth. In addition, the results imply that there is a weaker link between innovation and IPR protection in less competitive markets. The results are of particular importance for developing countries. While IPRs support economic growth, trade liberalization accompanied with intellectual property protection may enhance growth more effectively.

2. Intellectual property rights protection

Typically, products of intellectual nature are non-rivalrous. Intellectual property law aims at balancing private gain and public welfare. More specifically, once an intellectual product is created, many parties can use it at little or no additional cost. Governments must ensure that inventors can profit from their inventions to incentivize research. On the other hand, where IPRs are too stringent, the dissemination of new ideas and thus opportunities for economic growth are low.

Critics who argue for weaker IPR protection believe that strong protection permits monopolistic behavior from patent owners. Theory suggests that, under certain conditions, patents can create strong barriers to entry, allowing incumbents to rely on intellectual property rights. Chin and Grossman (1990)⁴ demonstrate that in some cases, the globally efficient degree of intellectual property protection does not necessarily maximize every country's welfare. Hence, IPR enforcement in these countries might deter competition and replace it with monopolistic behavior from firms. Furthermore, it is often argued that there should be free access to information that agents would otherwise have to

¹ Braga, H., & Willmore, L. (1991). Technological imports and technological effort: an analysis of their determinants in Brazilian firms. *The Journal of Industrial Economics*, 421-432.

² Mansfield, E., & Mundial, B. (1994). *Intellectual property protection, foreign direct investment, and technology transfer* (Vol. 19, pp. 1-43). Washington, DC: World Bank.

³ Proxy variables are variables used in statistics as stand-ins or substitutes for variables that one cares about but cannot measure directly. (For example, one cannot measure the health of a person, but one can reasonably approximate it through measuring the number of doctor visits in the last year.)

⁴ Chin, J. C., & Grossman, G. M. (1988). Intellectual property rights and North-South trade.

pay for. In addition, the cost of enforcing strong intellectual property laws is usually relatively higher in developing countries. The incentive for strong IPR may be reduced further when the local economy depends on developing substitutes for existing technologies. This can occur even if it violates intellectual property law (Diwan and Rodrik, 1991)⁵.

On the other hand, strong IPR protection can be argued to enable higher levels of innovation. Survey evidence from the United States indicates that protection encourages innovation (Mansfield, 1986)⁶. Additionally, the social return rate significantly exceeds the innovator's return rate (Mansfield et al., 1977)⁷. Mansfield (1994)⁸ observes that U.S. firms, particularly in chemicals and pharmaceuticals, exhibit lower foreign direct investment levels in countries with weak intellectual property protections. Additionally, it should be noted that a legal monopoly (such as a patent), does not constitute an economic one. There might be different inputs that could be used as substitutes. Evenson (1990)⁹ and Levin et al. (1987)¹⁰ are examples where market entry was observed despite the presence of strong patent protection. Additionally, it is argued that weak intellectual property protection and cheap technology acquisition may reduce welfare by making the economy less productive (MacLaughlin et al., 1988, p. 106)¹¹. Lastly, innovation-consuming nations have an incentive to protect intellectual property due to the risk of retaliation from innovation-producing countries (Gadbaw and Richards, 1988)¹².

3. Intellectual property rights and economic growth theory

Crucially, the debate about the interaction between IPR and innovation seldom understands IP as a potential catalyst for economic growth. This section relates IPR protection to endogenous growth theories. A common assumption in growth theories is that innovation is carried out to increase profits on the introduction of new products. Consequently, dynamics in innovation can be linked directly to the introduction of new products. Furthermore, a larger stock of human capital or more conducive economic environment for human knowledge accumulation will lead to greater economic growth. In short, IPR protection promotes an environment that allows for the accumulation of human knowledge, driving innovation and economic growth.

A second determining factor for economic growth is the openness of an economy. Grossman and Helpman (1991, pp. 238-246)¹³ have suggested that economic integration can help overcoming externalities of international scope. Consequently, local fluctuations in human capital or IPR protection have less impact on a country's economic growth. Instead, global trends in human capital and IPR protection are more significant.

⁵ Diwan, I., & Rodrik, D. (1991). Patents, appropriate technology, and North-South trade. *Journal of International economics*, 30(1-2), 27-47.

⁶ Mansfield, E. (1986). Patents and innovation: an empirical study. *Management science*, 32(2), 173-181.

⁷ Mansfield, E., Rapoport, J., Romeo, A., Wagner, S., & Beardsley, G. (1977). Social and private rates of return from industrial innovations. *The quarterly Journal of economics*, 91(2), 221-240.

⁸ Mansfield, E., & Mundial, B. (1994). *Intellectual property protection, foreign direct investment, and technology transfer* (Vol. 19, pp. 1-43). Washington, DC: World Bank.

⁹ Evenson, R. E. (1990), Survey of empirical studies, in: Siebeck, W. E. (1990). *Strengthening protection of intellectual property in developing countries: a survey of the literature*.

¹⁰ Levin, R. C., Klevorick, A. K., Nelson, R. R., Winter, S. G., Gilbert, R., & Griliches, Z. (1987). Appropriating the returns from industrial research and development. *Brookings papers on economic activity*, 1987(3), 783-831.

¹¹ MacLaughlin, J. H., T. J. Richards & L. A. Kenny (1988). The economic significance of piracy, in: Gadbaw, R. M., & Richards, T. J. (1988). *Intellectual property rights: Global consensus, global conflict?*.

¹² Gadbaw, R. M., & Richards, T. J. (1988). Introduction, in: Gadbaw, R. M., & Richards, T. J. (1988). *Intellectual property rights: Global consensus, global conflict?*.

¹³ Grossman, G. M., & Helpman, E. (1993). *Innovation and growth in the global economy*. MIT press.

Despite many theoretical approaches linking economic growth and innovation, only a few models explore the dynamic relationship between both factors. Segerstrom et al. (1990)¹⁴ find in a dynamic general equilibrium that the length of patent protection and the height of tariffs influence technological change and R&D. The result is that extending patent lengths in innovating regions increases R&D returns but also diverts resources to existing product production. It is concluded that strong IPR protection will encourage innovation in the short run as innovation profitability increases.

4. Intellectual property rights and economic growth: The results

Despite these theoretical settings, empirical evidence on growth, IPR and economic integration is still missing. This study aims at filling this research gap. The identification strategy of this paper compares the effects of IPR against a benchmark model of economic growth.

In a first step, the benchmark model is estimated using Ordinary Least Squares (OLS)¹⁵. The dependent variable is the average annual real per capita gross domestic product (GDP) growth rate between 1960 and 1988. The explanatory variables are (1) the log of real GDP per capita in 1960, (2) physical capital savings, which is the log of the share of investment in gross domestic product, and (3) a proxy for human capital savings, the log of secondary-school enrollment rates in 1960. The coefficients from this regression are consistent with common economic theory. That is, real GDP per capita in 1960 is negative and statistically significant, indicating income convergence with human capital. Physical and human capital savings are significant and positively related to the average annual real per capita GDP.¹⁶

In a second equation, the authors add the stock of human capital (proxied by literacy rates) to the regression. The initial coefficients do not change substantially in sign, magnitude or significance. The coefficient on the stock of human capital shows a large standard error and is therefore insignificant. However, it contributes to the explanatory power of the model¹⁷. A country with a 95% literacy rate in 1960 would have grown 0.18 percentage points faster annually, *ceteris paribus*, than one with 50%.

To address the effects of IPR protection, one should use a proxy for its measurement. Ideally, one would be able to measure a countries' degree of copyright, trade secret, and patent protection. However, this is difficult as one must account for the different ways of enforcing these laws. For example, one country might not have specific IPR laws, as intellectual property falls under the more general laws of physical property. Instead, the authors focus on patent protection – perhaps the most important aspect of intellectual property protection for economic growth. This study uses an index proposed by Rapp and Rozek (1990)¹⁸. It measures each nation's patent law conformity with the U.S. Chamber of Commerce Intellectual Property Task Force's proposed minimum standards for patent protection and enforcement. The index defines patent protection on a scale from one to six. One indicates that a nation has no patent laws and six reflects full compliance with minimum standards.

¹⁴ Segerstrom, P. S., Anant, T. C., & Dinopoulos, E. (1990). A Schumpeterian model of the product life cycle. *The American Economic Review*, 1077-1091.

¹⁵ OLS is a method used to find the "best fit" line through a set of data points. OLS does this by minimizing the total distance squared between the dots and the line. This method allows to calculate the effect of explanatory variables (such as Human capital or IPR protection) on dependent variables (economic growth).

¹⁶ Statistical Significance helps determine whether the relationships observed in the data (such as the effects of GDP per capita in 1960 on GDP growth) are likely to reflect true patterns or if they might just be due to random variation in the sample data. The thresholds in this study for statistical significance lie at 90% and 95% confidence. When speaking of significant results, this means there is "a 90% (95%) chance" that the true effect is not zero. Thus, the observed relationship is real, rather than being due to random variation or chance in the sample data.

¹⁷ Standard Errors are a measure of how precise the coefficient is estimated. The larger the standard error, the less likely the estimated coefficient is statistically significantly different from 0.

¹⁸ Rapp, R. T., & Rozek, R. P. (1990). Benefits and costs of intellectual property protection in developing countries. *J. World Trade*, 24, 75.

The authors acknowledge that the index primarily reflects laws in force against infringement but not their enforcement or implementation. Consequently, the level of protection in a country with strong laws but poor enforcement will be overestimated.

Descriptive statistics, without any further econometric analysis, reveal that countries with the highest IPR protection tended to grow the fastest. Interestingly, countries in the second lowest IPR protection level show higher average growth rates than those in the middle levels of patent protection.

Adding the proxy for intellectual property protection to the OLS model, one finds a marginally significant positive effect on average yearly per capita GDP. The coefficients are robust to a fourth specification, where control variables such as government spending, the degree of political instability, the number of assassinations, and binary variables¹⁹ for sub-Saharan Africa and Latin America are added.

Crucially, the OLS model might be biased for multiple reasons. For one, it could suffer from measurement error, because using levels of patent protection is, at best, a rough measure of theoretical IPR protection. Moreover, the coefficients could be biased due to endogenous factors, such as if rapidly growing economies tend to adopt more stringent IPR protection after growing. As a solution, the study adopts an instrumental variable (IV) approach²⁰. Instrumental variables must be correlated with the independent variable they instrument for and uncorrelated with any external factors potentially affecting economic growth. In this case, the authors use as instruments the following variables: (1) the average duration of patent protection, (2) a set of binary variables indicating a country's membership in an international convention that sets guidelines for IPR protection and (3) a set of binary variables indicating whether a country has patents for petty patents, or pharmaceuticals, food products, chemical products, plant/animal varieties, surgical procedures, and microorganisms and similar products.

Table 3 presents the results of the IV approach. Column 3 and 4 both show that the effect of IPR protection on economic growth is statistically significant at the 5% level. Adding control variables in column 4 reduces the significance of the effect slightly to the 8% significance level. Thus, it can be concluded that stronger IPR are, on average, associated with higher yearly per capita GDP growth.

As mentioned above, there might be heterogeneous effects of intellectual property protection between open and closed economies. A common challenge in economic literature is measuring the degree of outward or inward orientation of an economy. Realistically speaking, no variable will be perfect, as the true protection rate combines tariffs, quotas, exchange rate controls, and a host of administrative barriers. Therefore, the results are replicated using three different proxies for trade regimes. The first variable is defined by black market exchange rate premiums, because inward oriented countries typically show high premiums in this regard. The second variable is real exchange rate distortions. Lastly, the authors use an index introduced by Gould and Ruffin (1993)²¹. The index is a combination of measures for outward orientation, overall trade openness and trade intervention, trade orientation in 1963-73 and 1973-85, effective rate of protection, black market premiums, real exchange rate distortions, and the ratio of import taxes to imports.

¹⁹ Binary variables are a way of turning categories into numbers. This allows for calculating differences in categories of countries. (For example, one assigns countries that are part of sub-Saharan Africa "1" and everyone else "0".)

²⁰ An IV approach is used in statistics to deal with situations where there might be a problem figuring out the cause and effect (i.e. do strong IPR lead to economic growth or does economic growth lead to the adoption of strong IPR?). In the IV approach, instrumental variables allow to disentangle the effect of independent variables (degree of IPR protection) and third factors on dependent variables (economic growth). If the results between OLS and IV are similar (and in this case they are), this can be in general an indication that the model is robust, correctly specified and no outside factors are interfering with the analysis.

²¹ Gould, D. M., & Ruffin, R. J. (1993). *Human capital, trade, and economic growth* (Research Paper No. 9301). Federal Reserve Bank of Dallas.

Table 3

Growth and the role of intellectual property rights (instrumental variables estimation; (dependent variable: average yearly per capita GDP growth 1960–1988) ^a

	(1)	(2)	(3)	(4)
Constant	15.822 * (6.852)	14.220 * (5.605)	13.705 * (5.403)	13.075 * (4.992)
ln(Y60)	−0.857 * (−3.438)	−0.916 * (−3.653)	−0.990 * (−3.928)	−1.201 * (−4.479)
ln(I/Y)	3.361 * (6.921)	3.352 * (6.954)	3.385 * (7.056)	3.291 * (6.877)
ln(SEC)	0.835 * (5.388)	0.601 * (2.717)	0.604 * (2.748)	0.429 (1.551)
ln(LIT60)		0.419 (1.472)	0.374 (1.315)	0.198 (0.657)
ln(IPROP)			0.938 * (1.985)	1.086 * * (1.766)
GovCon				−1.133 * (−2.648)
ASSN				−0.045 (−1.070)
REV				−0.054 (−1.024)
AFRICA				−0.893 * * (−1.745)
LATAM				−0.156 (−0.320)
$\overline{R^2}$	0.57	0.58	0.59	0.64
R.m.s.e.	1.17	1.16	1.15	1.08
Observations	79	79	79	79

^a T-statistics in parentheses.

* Significant at the 5% level.

* * Significant at the 10% level.

In the following, an interaction term between the index for intellectual property protection and the variables measuring openness in an economy is introduced in the IV regression. Looking at the specification that uses black-market exchange rate premiums, the regression results do not change substantially relative to Table 3. Controlling for differences in trade regimes, the effect of IPR protection continues to be statistically significant. Its point estimate increases in magnitude, and the coefficient of the interaction term is negative but not significant. This suggests that IPR protection could play a slightly larger role in open economies.

In the second specification, which uses real exchange rate distortions, countries with high real exchange rate distortions are typically highly distorted and inward-oriented. The results point in a similar direction to before. IPRs continue to be a significant and positively related factor to economic growth. Once again, open trade regimes seem to profit more from IPR protection. All else being equal, an open economy with a moderate level of IPR protection grew about 1.4 percentage points faster than a closed economy with the same protection level. Here, the point estimate is lowly significant. However, it loses its significance when control variables are being added similar to column 4 of Table 3.

Lastly, the composite index of trade regime indicators is being used as a measure of trade orientation. Like the above, the effects point in the same direction but are larger in magnitude. Nonetheless, the standard errors grow too, and the effect is not significantly different from zero.

In a nutshell, this means that IPR protection is likely associated with higher economic growth. When looking at the trade regime, the effect seems to be slightly stronger for open economies. However, the latter effects are not statistically significant. This means that one cannot draw a definitive conclusion.

5. Conclusion

Economic theory lacks a clear consensus on the role of IPRs in economic growth. Nevertheless, empirical evidence from a cross-country sample indicates that stronger IPR protection is associated with higher economic growth rates. This study finds further evidence potentially suggesting that a nation's trade policy may influence the degree to which IPRs enhance growth. This implies that IPR protection plays a stronger role in more competitive, less protected markets. Consequently, in markets with possible competition entry, one might expect competitive forces to stimulate innovation and intellectual property protection to further induce it.