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Intellectual Property Rights and Inequality

Economic Considerations

Keith E. Maskus

INTRODUCTION

Growing economic inequality in many countries, perhaps especially in the United States, has become a central issue for scholarly analysis and policy debates. Numerous important treatises analyze the dimensions of the problem, ranging from educational inadequacies to tax and subsidy policies biased toward favoring the wealthy.[1] Concerns about the potential effects of income and wealth inequality include social stratification, a reduction in intergenerational economic mobility, diminished incentives to invest in innovation and human capital, and possibly violent political polarization. Elements of such factors loomed large in the U.S. presidential election of 2020 and similar elections elsewhere.

There are multiple and interrelated sources of inequality, which vary with national and local circumstances, making it a highly complex issue that defies straightforward categorization. Numerous determinants have been identified, including the following primary factors. First, economic globalization through trade and investment liberalization, falling trade costs, and offshoring of jobs through supply chains has placed considerable downward pressure on the real wages of lower-skilled workers in the advanced economies, exemplified most starkly in the impacts of the so-called China Shock in the United States.[2] Second, technological progress in automation and robotics has displaced workers performing relatively routine tasks, even if these workers are relatively skilled.[3] This is just one form, among many, of "skill-biased technical changes" that have increased wage gaps

[1] See, for example, Goldin and Katz (2008) and Piketty (2014).

[2] The phrase comes from Autor et al. (2013), who document these and other effects, kicking off a large literature on the labor-market impacts of low-wage imports.

[3] See Brynjolfsson and MacAfee (2011) for a strong statement of this thesis.

between the college-educated and others in advanced economies.[4] Third, the degree of unionization has fallen considerably in the United States and similar countries, reducing the workers' bargaining power and wages. Fourth, market concentration has increased markedly across most industries, raising the pricing power of the largest producers and generating above-normal profits that find their way into higher wages for managers and skilled workers while supporting increases in stock valuations. This outcome is consistent with the emergence of "superstar managers" in certain countries who command exceptionally high compensation packages.[5] Finally, at least in the United States, educational attainment has lagged the demand for technical skills, raising the relative wages of technical workers (Goldin and Katz, 2008).

Almost completely unstudied, at least by economists, have been the roles played by intellectual property (IP) protection in the emergence of inequality. It is easy to make intuitive claims about this question. For example, it is reasonable to argue that the exclusivity rights in IP raise the returns to invention, innovation, and creativity, all of which tend to be skill intensive. Moreover, patents, copyrights, and trade secrets have the potential to establish temporary but significant market power in specific industries and products, which seems correlated with rising market concentration, profit shares, and manager salaries. In these ways, strengthening IP rights ought to be a force for growing income and wealth inequality. There are offsetting factors, however. For example, to the extent that IP protection increases the rate of product innovation and encourages the diffusion of new goods and technologies, consumers benefit from greater variety and lower average prices. Such outcomes can be intricately linked to other policies, such as market opening and research and development (R&D) support. Whether these outcomes increase or decrease inequality is an empirical question about which we have little information. It is also important to note that inequality may be a determinant of innovation incentives, lending a two-way relationship between distributional disparities and support for IP rights. In brief, the entire question of how inequality interacts with IP is open for much-needed economic research.

These issues are addressed in this chapter, which proceeds as follows. The next section offers a brief overview of trends in basic data regarding inequality and IP rights across countries, followed by a review of extant empirical analysis of correlations between them. The second section elucidates the potential theoretical relationships between IP and inequality, moving from intuitive to subtle. It also considers recent microeconomic empirical studies of such questions, which are informative but far from definitive. The final section concludes with a call for additional work in this nascent area.

[4] Acemoglu (2002) offers a seminal discussion of the sources of accelerating skill bias in technology over prior decades.

[5] Piketty (2014) emphasizes this factor.

1.1 BASIC DATA ANALYSIS

1.1.1 *Statistical Overview*

Begin with a simple look at primary data on within-country income distributions across a large sample of countries at varying levels of development. The most common measure is the Gini coefficient, constructed to capture how unequally income is distributed across households. The coefficient runs, in principle, from zero (which means that all households have an identical share of national income) to 100 (which means that just one household captures all the income). The higher the Gini coefficient, the less equal the income distribution.[6] Historically, such coefficients were infrequently and intermittently estimated for different countries, making statistical analysis difficult. However, a current project has compiled and published annual Gini coefficients for many countries to facilitate cross-country comparisons.[7]

Table 1.1 shows the evolution of these measures from 1990 to 2015 for a selection of ninety-seven countries with data broken into income groups identified by the World Bank as of 1999. Two Gini coefficients are reported: the Gini Market, which is the coefficient based on incomes before taxes and transfers, and the Gini Disposable, which is the coefficient after such transfers are made. The difference between them indicates how much the income-transfer system in each country offsets (or reinforces) inequities established by the markets. Listed are simple averages within each country group and weighted averages, with the weights based on within-group populations. The countries are listed in Appendix Table A1.1.

These data suggest that there has been a steady but modest increase in inequality when all countries are averaged equally. Among the high-income countries (HICs), the average coefficient rose by two points using after-transfer income (around 7 percent) and by nearly four points using market incomes (almost 9 percent). The other income groups with rising coefficients were the lower-income countries (LICs) and lower-middle-income countries (LMICs). Interestingly, there was little net change in inequality in the upper-middle-income countries (UMICs) over the period. Presumably, this reflected a balance between higher inequality from technological change and lower inequality from the ability of lower-wage workers to gain from exporting labor-intensive goods, among other factors.

[6] Formally, the coefficient is proportional to the area between the diagonal of a box measuring total national income and the Lorenz Curve below the diagonal, where the Lorenz Curve traces the cumulative distribution of income from the lowest households to the highest. A sharply bowed curve implies a less equal distribution and a higher Gini coefficient.

[7] The project is the Standardized World Income Inequality Database, available at https://dataverse.harvard.edu/dataset.xhtml?persistentId=doi:10.7910/DVN/LM4OWF. For details, see Solt (2019).

TABLE 1.1 *Gini coefficients across country groups, 1990–2015*

	Gini Disposable: simple average					Gini Market: simple average				
Income group	**1990**	**2000**	**2010**	**2015**	**Percent change**	**1990**	**2000**	**2010**	**2015**	**Percent change**
High (28)	28.8	30.0	30.7	30.8	6.9	42.9	45.3	46.7	46.7	8.9
Upper-Middle (12)	38.5	39.4	38	37.4	−2.9	48.2	49.8	49.4	48.6	0.8
Lower-Middle (35)	37.3	40.1	38.6	37.7	1.1	43.3	45.7	44.5	43.7	0.9
Lower (22)	40.1	42.3	42.5	42.1	5.0	45.2	46.7	46.6	46.2	2.2
All (97)	35.6	37.6	37.1	36.7	3.1	44.2	46.3	46.2	45.7	3.4
United States	34.6	35.8	37	38.2	10.4	46.6	47.7	50.7	50.9	9.2
China	32.2	38.6	43	41.1	27.6	34.7	40.8	46.7	46.9	35.2

	Gini Disposable: pop-weighted average					Gini Market: pop-weighted average				
Income group	**1990**	**2000**	**2010**	**2015**	**Percent change**	**1990**	**2000**	**2010**	**2015**	**Percent change**
High (28)	30.4	31.8	33.0	33.5	10.2	43.8	45.8	48.0	48.1	9.8
Upper-Middle (12)	48.0	48.5	45.4	44.5	−7.3	54.3	54.9	52.8	51.3	−5.5
Lower-Middle (35)	34.4	39.5	41.6	40.5	17.7	37.9	42.6	45.5	45.4	19.8
Lower (22)	37.1	40.0	43.8	44.0	18.6	41.4	43.7	46.6	46.6	12.6
All (97)	35.6	39	41.2	40.8	14.6	41.3	44.5	46.9	46.7	13.1

Source: Standardized World Income Inequality Database and author's calculations

TABLE 1.2 *Pretax income shares of top 10 percent*

	HI (26)	UMI (8)	LMI (17)	LI (11)	ALL (62)	USA	China
1990	31.0	35.0	36.4	54.5	37.2	38.9	30.4
2000	33.7	39.7	41.3	52.9	40.0	44.0	35.6
2010	34.2	41.1	41.4	52.2	40.2	45.8	42.6
2015	34.7	42.0	41.0	50.7	40.2	47.3	41.4

Source: World Inequality Database and author's calculations

Unweighted averages can be misleading, however, as measures of inequality faced by large aggregations of households. The growth in the population-weighted average coefficients was considerably larger (though it declined in the UMICs), largely because of the significant increases in the United States (HI) and China (LMI). As shown, these two behemoths saw exceptionally large increases in both pretransfer and posttransfer household income inequality during this period of rapid globalization and technical change. In this context, those nations bear a significant share of the observed inequality.

It should be noted that the Gini coefficient may not be an accurate measure of rising inequality if that process is skewed toward higher incomes of the richest households. The way such coefficients are calculated gives small weights to households at the extremes (because there are not many in those ranges) and high weights to those in the middle ranges (where there are many). In consequence, if the top earners gain a disproportionate share of income within the distribution, the Gini may not go up by much, despite the rising disparities. Thus, Table 1.2 lists the pretax and pretransfer income shares (including capital gains) of the top 10 percent of households in a smaller sample of countries.[8] This measure offers readier evidence of rising inequality at the top, except for the LICs, where the highest households already captured more than 50 percent of income in 1990. The highest earners gained 3.7 points of income shares in the HICs, 7 points in the UMICs, and 4.6 points in the LMICs. Again, the United States and China were the largest contributors to these trends, with the top share in China rising by a remarkable 11 percentage points.

These figures show that there has been a marked rise in income disparities in the last thirty years, though some of that increase is concentrated in specific large countries. The question for this chapter is the degree to which stronger IP rights may be a factor. This is an exceptionally difficult question to answer statistically for many reasons that will be brought out in the text. For now, however, Table 1.3 demonstrates that there has been a marked increase in the strength of legalized patent rights over the same period. Listed are changes in the average Ginarte–Park

[8] These data are available from the World Inequality Database, available at https://wid.world/data.

TABLE 1.3 *GP indexes across country groups, 1990–2015*

	GP: simple average				
Income group	**1990**	**2000**	**2010**	**2015**	**Percent change**
High (28)	3.26	4.27	4.32	4.31	32.2
Upper-Middle (9)	1.98	3.49	3.97	4.01	102.5
Lower-Middle (34)	1.29	2.99	3.42	3.64	182.2
Lower (18)	1.59	2.46	2.98	3.03	90.6
All (89)	2.1	3.36	3.7	3.78	80.0

Calculations use World Bank 2020 income classifications

Source: Data from Walter G. Park and author's calculations

(GP) index of patent strength across another subsample of our main sample.[9] This index notes whether a country has a law or regulation offering various elements of patent scope across five categories: coverage, membership in international conventions, patent duration, the possibility of losing patent rights, and enforcement. These component scores are added, and the final index ranges, in principle, from zero to five.[10]

As seen in Table 1.3, the average index grew in all income groups during this period, reflecting a combination of unilateral reforms, adherence to standards required in the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) of the World Trade Organization (WTO), additional standards negotiated within regional trade agreements, and other factors. At the beginning of the period, the HICs already had strong protection on this measure and did not have to change their patent laws much over the period.[11] The eye-opening feature is the substantial increase in protection in emerging and developing countries (EDCs). The index doubled in the UMICs and nearly tripled in the LMICs while growing sharply even in the LICs. As described elsewhere, the period since 1990 ushered in the most remarkable transformation of global IP policies in history (Maskus, 2012).

An obvious question for this chapter is, how well did the IP reforms track changes in income inequality? Did countries with relatively stronger increases in the patent index see greater increases in inequality, at least as measured by the Gini coefficients? The evidence provided in Table 1.4 suggests the answer is "not much." The right-most panel depicts a growing but weakly positive correlation between the GP index and the market-based Gini coefficients in the HICs, consistent with higher inequality in more strongly protected jurisdictions. However, the correlation is negative in those countries using the posttransfer Gini measures, suggesting that

[9] See Ginarte and Park (1997) for the original index and construction details.
[10] Maskus (2012) reviews the index in detail and its growth across all countries in the GP sample.
[11] Of course, the relatively small increase in the GP index for the HICs is something of an artifact because the index is capped at 5.

TABLE 1.4 *Correlations between GP indexes and Gini coefficients, 1990–2015*

	GP with Gini Disposable				GP with Gini Market			
Income group	**1990**	**2000**	**2010**	**2015**	**1990**	**2000**	**2010**	**2015**
High (28)	−0.27	−0.22	−0.28	−0.08	0.14	0.35	0.31	0.42
Upper-Middle (9)	−0.1	0.09	−0.62	−0.29	0.25	0.27	−0.26	0.06
Lower-Middle (34)	0.03	−0.26	−0.49	−0.07	0.01	−0.16	−0.11	0.16
Lower (18)	0.26	0.25	0.21	0.2	0.12	0.11	0.1	0.13
All (89)	−0.44	−0.51	−0.59	−0.4	−0.03	−0.01	0.01	0.18

Source: prior databases and author's calculations

whatever contribution IP may have made to inequality was more than offset by redistribution policies. A similar process may exist in the UMICs. Otherwise, there is little evidence of any relationship between measured patent rights and household income inequality.

1.1.2 *Econometric Analyses*

Computing simple correlations does little to sort out potential relationships and says nothing about any causal impact of IP protection on inequality. The standardized database of Gini coefficients offers some scope for econometric analysis, however, and two studies have estimated the impact of IP protection on inequality using such data. Because these studies paint a consistent picture, it is worth reviewing their findings before asking if they are reliable.

The first paper was by Adams (2008), who sought to fit IP rights empirically into a selection of determinants of inequality. The author acquired Gini coefficients from the World Bank for intermittent years between 1985 and 2001 for a sample of sixty-two developing countries and regressed them on various independent variables that were lagged to try to reduce reverse causality problems. Specifically, the model related the Gini coefficients to various macroeconomic globalization and policy variables, including trade openness, the degree of incoming foreign direct investment (FDI), the GP index as a measure of IP rights, secondary education rates, government consumption, a measure of institutional quality, and GDP per capita. The estimation found a consistently positive and significant effect of the GP index on subsequent inequality, with the primary coefficient suggesting that a one-unit increase (e.g., from two to three) in the patent index would increase the average Gini coefficient by around 1.2 points, in a scale between 0 and 100. A stronger institutional environment tends to reduce inequality, indicating that if a country plans to strengthen its patents and is concerned about impacts on income distribution, it may wish to complement that policy with a more secure set of rules governing investment.

A second study was by Saini and Mehra (2018). The question they posed was whether strengthened IP rights in the post-TRIPS era had affected income inequality, using a sample of sixty-five developing and developed countries over the period 1995–2009. These authors used the Gini coefficients from the Standardized World Income Inequality Database (reviewed earlier) as the dependent variable in a panel regression highly similar to that in Adams (2008). Specifically, using five-year averages of most data, they regressed the posttransfer Gini measures on the GP index, openness to imports, inward FDI, GDP growth, and an indicator of political stability. The patent index interacted with the economic growth measure to assess whether faster-growing economies had a larger or smaller effect of IP on inequality. Similarly, it interacted with a dummy variable for developed countries to see if that relationship varied among poorer countries. They estimated a random-effects model because of the wide heterogeneity in country characteristics in conjunction with the higher dimensionality of countries than time periods.

Remarkably, the findings were completely at odds with Adam's (2008) findings. In particular, the authors estimated that increases in the GP index tended to reduce the average Gini coefficient in developing countries, suggesting that stronger patent protection reduced income inequality. The authors speculated that this outcome reflected that stronger IP rights tend to attract more inward technology transfer, which could raise the relative wages of lower-skilled workers in labor-abundant countries. The coefficient on the interaction term of the patent index and GDP per capita was significantly positive, implying that the inequality reduction was lower in rich nations. Indeed, the relationship could be positive for countries above a threshold income level, implying higher inequality with strengthened patent rights in developed economies. They interpreted this outcome to suggest that stronger patent laws may induce innovation in the latter group of countries, with rents to that activity favoring those with more technical and managerial skills. Unfortunately, the authors did not attempt to subject these broad conclusions to further empirical testing.

These results are intriguing because, for now, they stand as the only cross-country estimates available of the potential impacts of IP protection on internal income distribution. However, they find distinctly opposite impacts, suggesting that the correlation between the legal determinants of patent scope and inequality, as measured by Gini coefficients, is ambiguous. Its estimation may depend on the data used and the specifications set out.

Moreover, such results are not likely to be reliably robust for further study, given the nature of the analysis. Using national macroeconomic data to assess complex relationships is fraught with risks and subject to fragile interpretations, as shown in prominent debates over the macroeconomic sources of economic growth.[12] Both studies rely on reduced-form specifications that do not emerge from any particular

[12] See Levine and Renelt (1992) for an early critique, among many.

theory other than what may seem to be common sense, and neither worries about general equilibrium and feedback effects among the different variables employed. Their regressions are subject to omitted variable bias, meaning that both inequality and IP rights could be driven higher by excluded variables, leading to spurious positive correlations. Similarly, the GP index is highly correlated with other measures of institutional quality and property rights, raising questions about whether it is really IP or something else that may raise inequality.

All of which suggest that further analysis is needed to sharpen predictions and improve confidence in such estimates. The remarkable element is that so little sound empirical analysis of the underlying questions exists. For that purpose, cross-national macroeconomic studies are unlikely to provide much utility. Rather, the emphasis must be placed on clear theoretical approaches that make detectable predictions about the microeconomic aspects of IP rights and inequality, measured perhaps through wage differentials between skilled and unskilled workers. A literature of this kind is now emerging, as described in the next section.

1.2 ECONOMIC THEORY AND MICROECONOMETRIC ANALYSIS

As mentioned, the literature analyzing the determinants of within-country income and wealth inequality is deep and rapidly expanding. Surprisingly, IP protection has been virtually ignored in this context, except via informal and intuitive statements about raising returns to R&D investments, which filter through to higher wages for skilled and technical workers. In this context, IP rights are facilitating mechanisms for skill-biased technical change (SBTC). They are also viewed as devices for generating and protecting monopoly rents, which go disproportionately to entrepreneurs, managers, high-skilled workers, and shareholders.

1.2.1 *IP Protection and Effects on Inequality*

These are reasonable propositions, even if the mechanisms involved are understudied. They find some explanation and support in scarce theoretical and empirical studies. For example, Chu (2010) studied the impact of stronger patent scope on economic growth and inequality in a single-economy model. The theoretical foundation is the "quality ladders" model, in which a continuous innovation process generates products of increasing quality that displace those previously at the top of the ladder.[13] The canonical model assumes individuals share identical and homothetic preferences, implying that income distribution does not matter for innovation

[13] The "quality ladders" model is a workhorse of modern growth theory in which innovation is a purposeful and endogenous process and becomes the primary engine of growth. Its roots are described in Romer (1994), and it was refined by Grossman and Helpman (1991) and Aghion and Howitt (1992).

and growth, nor is it affected by growth outcomes. Chu extended the model to an environment where households have different wealth profiles. How much to work in the labor market depends on savings and consumption decisions. His model is limited in assuming the distribution of assets among rich and poor households is unchanged in all steady-state equilibrium growth paths.

In this environment, a policy raising the scope of patents increases wealth and income inequality by raising R&D, which enhances the growth rate and raises the interest rate. In turn, asset returns rise, disproportionately favoring the rich, who own more assets. Furthermore (and somewhat counterintuitively), because the higher interest rate raises savings and reduces consumption, it induces households to spend more time at work. This factor also generates relatively higher income for the rich, further expanding income inequality. However, because consumption is reduced by relatively less among the poor, the outcome of stronger patents may be reduced consumption inequality. The author noted that these results are consistent with macroeconomic data in the United States in the 1980s and 1990s when there was a sharp rise in wealth and income inequality but a much smaller rise in consumption inequality. Because this model is highly stylized and does not fit detailed data, it is impossible to determine how much stronger patent scope in this era contributed to inequality via this mechanism. Still, it offers an interesting mechanism for further study.

The paper just described posits a heterogeneous and unchanging asset distribution between rich and poor, without explaining why households might vary that way while arguing that investment returns drive changes in inequality. It does not consider the skill bias of patent-induced innovation. A model doing so is set out by Pan et al. (2015). The model is based on the idea of "directed technological change," also a fundamental model in modern growth theory.[14] This approach argues that investments in new technology depend on numerous factors, including relative factor costs. In skill-abundant countries, such as the United States, such investments tend to reduce demand for low-skilled labor (which is expensive relative to other countries) and raise demand for high-skilled labor. This R&D-skill complementarity, found clearly in information technologies, is one basis for the predominance of SBTC.

In the model by Pan et al., R&D investments predominantly seek new technical solutions in higher-skilled industries, raising the demand for skills and, in turn, increasing wage inequality. Patents may be gained in new technologies complementary to either low-skilled or high-skilled workers. The key assumption is that skill-intensive industries increase returns to scale, lowering costs and raising productivity as output expands. Thus, in countries with abundant skills, it is optimal to scale a patent policy to favor the latter. The optimal patent policy then favors broader breadth to encourage scale economies. The result is a "skill-biased patent policy," which raises wage inequality. It also imparts a clear bias between countries: Skill-abundant nations

[14] Directed technological change is an old concept but found its primary formalization in Acemoglu (1998).

prefer broader patents, and labor-abundant nations prefer narrower protection. This paper offers no empirical analysis, so it cannot assess the validity of its key assumptions or the contribution of patent policy to growth and inequality. Again, however, it offers a useful perspective on which to build further analysis.

If theory suggests that strong IP protection supports wage inequality based on skills, entrepreneurship, or other worker characteristics, an empirical analysis should gravitate toward considering micro data on wage gaps across regions or within firms. This approach is natural because a patent exists at the firm level in specific locations, suggesting that carefully specified analysis could trace the impacts of patenting on wage inequality within the enterprise.

Two recent papers of note take this approach. First, Aghion et al. (2019) analyzed state-level panel data in the United States to study whether "top income inequality" is caused to some degree by innovation. Top income inequality refers to increases in the income shares of the top 1 percent of households. The paper sets out a model of endogenous innovation by incumbents (who own patents and enjoy monopoly markups) and entrants (who innovate to gain patents). Innovation by either group raises the income shares of entrepreneurs and generates more top income inequality. But only investments by entrants increase social mobility, meaning the ability to enter the top income level. Entry may be blocked through high innovation costs, including extant patents. Such blockages slow mobility into the top tier. Regrettably, the model does not explicitly consider the role of stronger patent scope. Presumably, it has offsetting effects. On the one hand, patents should raise the returns on innovation and increase the top income shares. On the other, blocking entry should reduce the inequality associated with more rapid entry into entrepreneurship.

These predictions were tested using state-level panel data from 1975 to 2010. They gathered data on the top 1 percent and top 10 percent of income shares in all fifty states plus Washington, DC. Top income shares rose in every state, from an unweighted average of 8 percent in 1975 to a peak of 21 percent in 2007, before falling during the financial crisis. Moreover, there was increased variability across states, with the highest shares going toward states with stronger patent profiles. Additional data suggested that income from entrepreneurship (patent rents in the model) was disproportionately high in the top income group in such states.[15] The income figures were combined with state-level patenting data from the U.S. Patent and Trademark Office, including patent citations to construct quality measures. The cross-state variation in patenting was markedly high, generating scope for identification. The authors regressed the top income shares across states on lagged patents and patent quality, controlling for business conditions, the prevalence of the financial sector, state GDP, and population, plus state and year fixed effects. In ordinary least

[15] These data were taken from the World Top Income Database. See Alvaredo et al. (2014). This database is now called the World Inequality Database, available at http://wid.world/data, as mentioned *supra* note 9.

squares (OLS) regression, they found consistently positive and significant effects of patents and patent quality on the top 1 percent of incomes.

To control for the endogeneity of patents, they included each state's representation on Congressional Appropriations Committees and other factors as instrumental variables. These regressions reported similar impacts of patents on top income shares. In particular, in the preferred specification, they found that a 1 percent rise in patents per capita raised a state's top income share by 0.17 percent. That is, patenting alone could explain 17 percent of the rise in the top-level income proportion across states. This effect was even greater in high-patent states such as California. Put differently, if a state were to move from the bottom quartile of patents to the top quartile in 2000, the coefficients would imply an increase in its top income share of about 1.5 percentage points, a substantial increase. The authors argued that this calculation underestimated because it failed to account for the possibility that a successful inventor in a low-patent state would likely move to a high-patent state and other factors. Their results were robust to using other measures of top income inequality.

A second study of note is by Bhattacharya et al. (2022). Briefly, these authors took advantage of implementing a new Indian patent law between 2002 and 2005 to analyze whether the gap between manager wages and other wages within firms varied by whether those firms had patents before and after the legal implementation. They found strong evidence of an increase in these wage gaps, which was more pronounced in high-technology sectors. This evidence shows that firms do transfer patent rents disproportionately to skilled and managerial workers within firms, tending to raise wage inequality.

Studies using such microeconomic data are instructive and suggest that patenting and patent reforms can contribute to income and wage inequality through expected channels. The literature would benefit from considerably more such analyses, using other databases across countries, industries, and firms. It would be equally useful to quantify, with microdata, how patents and patent laws contribute to growing intra-industry market concentration and monopoly power within and across countries and how those rents have been distributed.

1.2.2 *Alternative Perspectives*

Even less studied by economists is the novel idea that inequality itself may be a determinant of innovation and the growth effects of IP protection. Put differently, while IP may generate higher growth and inequality, causation may also run from inequality to innovation and growth.[16] Mendez (2002) noted that in an economy

[16] A large antecedent literature was concerned with how concentrated market structures affected innovation. The seminal contribution was Kamien and Schwartz (1982). More broadly, Murphy et al. (1989) argued that for a country to transition from an agricultural base to industrialization required both a large market size and a sufficiently wide sharing of income to support demand for industrial goods.

with a dual labor market, where some workers are paid efficient wages and others competitive wages, even neutral technological change can further increase wage inequality, as can globalization.

Newer literature is emerging and needs much fuller development. However, two papers illustrate how certain mechanisms could link inequality and innovation. First, Weinhold and Nair-Reichert (2009) asked whether income inequality differences help explain innovation performance across countries.[17] There are two potential mechanisms identified. First, countries with large and growing middle classes (and therefore more limited inequality) should see political pressure raised for stronger governance institutions, including IP rights, which could increase innovation. Second, a larger middle class may offer more entrants into sufficiently skilled labor categories that raise the supply of innovation while increasing the demand for innovation through preferences for new goods. There are multiple relationships here to sort out through data analysis.

For this purpose, they used patenting data from the World Intellectual Property Organization (WIPO) database as measures of innovation, distinguishing between resident patent applications and foreign patent applications within each country.[18] They regress patenting on the size of each country's middle class and the GP index as a measure of patent strength, instrumenting the latter with various structural and geographic factors. The argument is that if the income distribution affects innovation only through institutional reforms (the first channel), it should not significantly affect the regression when IP rights are included. However, if it influences innovation directly through supply and demand factors (the second channel), it should be independently significant. Further, its effects should vary between domestic patents (with a positive impact) and foreign patents (with little or no impact). They estimate a cross-section model, averaging national data from 1994 to 2000, leaving just fifty-three observations across countries. Most regressions found a positive and significant coefficient on the instrumented GP variable in explaining domestic patent applications, supporting the institutional channel. More importantly, they found consistently positive and significant estimates of the size of a country's middle-income class on resident patenting, suggesting that more income equality is pro-innovation. In contrast, these variables had little effect on foreign patenting, which depended more on population, market size, and other macroeconomic factors.

This result is interesting but suffers from the usual concerns about cross-country econometric analysis with national data. The paper could be usefully extended, at

[17] A large literature has addressed the relationship between inequality and growth, failing to find robust evidence. See Lundberg and Squire (2003). However, there is stronger evidence that a large middle class could increase long-run growth through institutional quality enhancements, as noted in Persson and Tabellini (1994).

[18] The WIPO database is suspect for numerous reasons, suggesting this analysis should be updated with data from the European Patent Office's Worldwide Patent Statistical Database (PATSTAT) or related sources.

least through industry patenting data, in which comparisons are made between the technological orientation of industries. It would also be useful to see if explicit measures of income inequality would demonstrate negative impacts on innovation through the identified channels.

A second paper, by Kiedaisch (2021), offers a theoretical model aimed at the related but deeper question of whether the impact of IP rights on economic growth depends on the level of economic inequality. The author studied this possibility in a "product variety" model of endogenous growth.[19] In this model, innovators seek to develop new varieties of existing products across industries, responding to the idea that consumers prefer diverse choices and will pay a premium for such decisions. The economy's growth rate depends on the pace of new product development. Kiedaisch introduces inequality into the model by assuming that rich and poor consumers have different preferences. Specifically, richer households both consume a greater number of varieties and prefer more innovative or complex goods. Thus, in the model, the pace and nature of innovation in a country depend on income distribution. Along a balanced growth path, countries with more unequal distributions in the sense of relatively more rich people would have longer patent duration to incentivize more new products. In this sense, inequality increases expected growth.

The model has many more dimensions but, importantly for this chapter, establishes a theoretical mechanism that helps explain why countries with relatively larger rich groups (or more concentration of income and wealth at the top) prefer stronger IP protection, which in turn implies faster economic growth. The model has not yet been subjected to empirical analysis but doing so would be instructive. For example, while it seems intuitive and consistent with the casual observation that higher top incomes should push for stronger IP rights, the idea that such economies should grow faster clashes with the recent convergence in incomes between rich and emerging countries. Presumably, there is more to inequality across countries than can be explained in a single-country approach, as discussed in the following section.

1.3 INNOVATION, DIFFUSION, AND CROSS-COUNTRY INEQUALITY

The prior sections argued that the impact of IP protection on internal inequality within countries is difficult to conceptualize and demonstrate empirically, though the emerging literature is promising. It is also important to consider another form of inequality across countries. As noted, many EDCs have seen faster economic growth than the HICs over the past twenty-five years. Have IP rights played a role in this process? While this question has not been studied directly, there is considerable indirect evidence that the expansion of IP protection in EDCs has facilitated this convergence of incomes. In brief, the channel through which this happened is that

[19] This is the second workhorse model of endogenous growth and appears often in the literature. For an early explication, see Grossman and Helpman (1992).

TABLE 1.5 *GDP-weighted average annual growth rates in GDP per capita, 1990–2015*

Income group	1990–2000	2000–2010	2010–2015	1990–2015
High (83)	2.31	1.26	0.70	1.93
Low (29)	−1.27	3.80	1.54	1.57
Lower-Middle (70)	0.96	4.96	2.01	3.88
Upper-Middle (45)	2.03	6.67	2.25	5.83

GDP per capita is in 2017 U.S. dollars, at purchasing power parity

Source: World Bank, World Development Indicators, 2020 income classification

stronger IP rights, in conjunction with trade liberalization, have accelerated the international diffusion of technological information and knowledge, even to the point of shifting R&D resources to select EDCs.

1.3.1 *Stylized Facts*

To put this claim in perspective, consider the simple data in Table 1.5. These figures show, over certain subperiods and the full period, average annual growth in real GDP per capita, measured in 2017 U.S. dollars at purchasing power parity (PPP) exchange rates.[20] Such exchange rates are appropriate for focusing on changes in actual living standards.[21] Again, the data are broken down into income groups, but now using the 2020 classifications established by the World Bank. In particular, China is now considered a UMIC, and India is an LMIC. This updated breakdown is more appropriate for analyzing income convergence. The comprehensive samples, rather than limited to those nations with available Gini coefficients as above, paint a complete picture. Finally, they are weighted by consistently measured GDP totals, capturing actual growth experiences in the income groupings more accurately.

It is readily seen in Table 1.5 that the HICs saw their growth rates fall from 2.3 percent in the 1990s to 1.3 percent in the following decade, before the stagnation following the financial crisis of 2008–2010. The 1990s were a period of slow growth for both the LICs and LMICs, though both saw substantial increases in growth in the 2000s. For both the LMICs and UMICs, the 2000s were a period of extremely rapid growth in real consumption standards. This was a period of great convergence in real incomes between EMCs and the HICs.[22] Over the entire period, the UMICs

[20] Available at the World Bank World Development Indicators database, at https://datacatalog.worldbank.org/dataset/world-development-indicators.

[21] PPP exchange rates are defined as those currency values that would equalize the cost of a basket of goods and services in local currencies across countries. By neutralizing exchange-rate differences associated with other factors, they reflect the actual ability of local incomes to purchase goods and services.

[22] For extended analysis and data, see Baldwin (2016).

grew their consumption abilities sharply compared with the HICs, resulting in marked reductions in poverty and improvements in health and education status.[23] In contrast, the LICs remained in relative stagnation.

There are, therefore, the following stylized facts. From 1990 to the present, the UMICs and LMICs considerably expanded their legal IP rights, as shown in Table 1.3, while experiencing significantly faster economic growth than the rich world. The LICs also adopted stronger laws, though these remained well behind those of the other groups while stagnating in relative terms. In short, the period was one of both extensive IP reforms and notable "conditional convergence" in living standards. Again, it would be difficult to argue and not credible to demonstrate with macroeconomic data that the former caused the latter. This is because many other factors could have driven both upward, with no necessary relationship between IP protection and growth.[24]

While that claim is largely correct, it is misleading in at least one important context. Economic logic and evidence both suggest that, at a microeconomic level, IP reforms in EDCs have attracted more technology flows, raising productivity. The next two subsections develop that argument. At this point, it is important to note that higher real incomes in EDCs do not necessarily imply more equal internal income distributions, as the gains may have been acquired largely by the already well-off. Put differently, the growth impacts of IP reforms may not trickle down into widespread income gains.

1.3.2 *The Economics of IP Rights and Technology Development*

How can IP reforms in EDCs raise domestic incomes, at least in the aggregate? The economics literature has emphasized three factors. First is the possibility that stronger home patent rights may directly raise domestic innovation.[25] This question lies outside the scope of this chapter, and, in any case, the linkages from innovation to inequality remain unexplored in those countries.[26] Briefly, the literature suggests that strengthening domestic IP rights can stimulate innovation, typically measured by future patent applications at home or abroad. This conclusion, however, must be strongly conditioned. It holds largely for higher-income emerging economies with, among other things, large domestic markets, adequate supplies of human capital,

[23] For such social indicators, see Radelet (2015).

[24] Maskus (2012), for example, shows that the growth rates in IP rights and patents were essentially uncorrelated with economic growth in a basic data review.

[25] This literature has focused entirely on patent protection, to the exclusion of copyrights, trademarks, and trade secrets, all of which may affect innovation of new products and services. This reflects primarily both data shortages – measuring copyrights and trade secrets is essentially impossible, while patents data are ubiquitous – and conceptual difficulties in relating these IP rights to invention incentives.

[26] Readers seeking reviews of this literature may consult Maskus (2012, 2022).

robust market competition, and sound policy governance. Countries lacking in such dimensions do not become markedly more innovative after patent reforms, highlighting the complexity of effective innovation systems. Specifically, there is little evidence that formal innovation is responsive to patent reforms in the poorest countries simply because the promise of domestic patents is a small incentive in weak economic environments. A corollary is that stronger patent rights likely do not diminish formal domestic innovation in poor countries, a frequently heard concern. Regrettably, there is no systematic evidence about how IP reforms may influence informal (unmeasured) innovation or competition through local imitation in poor countries. It is likely that domestic firms engaged in imitation and counterfeit production may be forced out of the market after significant reforms. Still, shortcomings in economic surveys have defied the systematic linkage of firm exits with IP policy. This remains a significant shortcoming in the economics literature.

A further important qualification is that even in dynamic emerging economies, undertaking extensive upgrades of IP protection may not be advisable in the medium term. The reason is that local firms in those countries, while undertaking R&D programs and exhibiting some innovativeness, may still rely on imitative technical change, often borrowing foreign technologies and making minor adaptations. In this regard, significant IP reforms may discourage local innovation and economic development by securing, often on behalf of foreign inventors, strong exclusionary rights that raise the costs of imitative and adaptive innovation (Kim et al., 2012).

1.3.3 *Trade-Induced Innovation*

Trade liberalization and skill-biased technological change are commonly thought to be the primary sources of income and wealth inequality across countries, including in the developing world. This is largely true regarding SBTC, as noted earlier. Reductions in trade and investment barriers, however, have complex impacts and may reduce inequality in developing countries. The standard reason is that integration with the global economy offers more export opportunities for industries that rely on labor-intensive production, tending to raise the real wages of low-skilled workers. At the same time, it encourages more imports of capital-intensive and skill-intensive goods, diminishing those incomes.[27] Similarly, inward FDI into developing countries tends to be labor-seeking, raising local wages.

This tendency toward diminished inequality is far from certain, however. For example, current trade theory emphasizes that market opening pushes resources into the most efficient enterprises, which raises labor productivity and wages in general

[27] Readers may recognize this claim as the Stolper–Samuelson Theorem, which is foundational in international economics. A good explanation is in Feenstra and Taylor (2017). Evidence of this factor-based wage sorting in Mexico is presented in Chiquiar (2008).

but could raise the wages of those with greater skills.[28] Moreover, when global trade is liberalized, firms that start exporting generally must adopt globally efficient techniques, which tend to raise the relative wages of the most productive workers, who have higher skills even within occupational classes.[29] This logic helps explain why exporting firms and multinational enterprises (MNEs) in manufacturing and services tend to pay significantly higher wages in EDCs than local firms, enhancing this form of cross-firm inequality.[30]

An exceptional form of this process emerged sharply in the 1990s and 2000s, the era of rapid growth in offshoring through vertical production networks (Baldwin, 2016). The ability of multinational firms to fragment their production into lower-skilled activities (resource extraction, intermediate input production, and product assembly) and higher-skilled activities (design, marketing, R&D, and other headquarter services) and to transfer production of the former to developing markets was driven by cuts in trade costs and improvements in information and communication technologies. With lower transport costs and extremely low taxes on trade, parts and semi-finished goods could be shipped across borders multiple times in the production of final goods, a process exemplified by the proliferation of automobile production and trade within North America after the implementation of the North American Free Trade Agreement. The deployment of information and communication technologies permitted efficient inventory and shipping logistics management among nodes within production networks, greatly raising international trade in intermediate inputs.[31]

This fragmentation led to the rapid offshoring of lower-skilled and medium-skilled jobs from the United States, Europe, and other high-wage nations to a limited group of "globalizers" among EDCs, especially China (Baldwin, 2016). The harmful effects on low-skilled manufacturing and service jobs in these rich countries are widely identified as a source of inequality (Autor et al., 2013). Less widely appreciated, however, is that offshoring also may serve to increase inequality in recipient countries. The reason is that the transferred jobs, while coming from the low and medium ends of the skill distribution in, say, the United States, tend to require skills and commitment to formal employment at higher ends in EDCs.[32] Thus, recent globalization, at least within vertical production networks, has been a source of growing inequality in the HICs and EDCs. Recall, however, the earlier discussion of how trade liberalization could raise the demand for low-skilled labor in

[28] The basis for this theory is in Melitz (2003).

[29] Evidence for this outcome in Brazil is presented in Helpman et al. (2017).

[30] The empirical evidence for this claim is deep and robust. See, for example, Brown et al. (2003), Hijsen (2008), and Javorcik (2015). Note that this fact does not imply that inward FDI reduces domestic wage inequality; rather, the opposite is more likely to be true.

[31] Feenstra and Taylor (2017) explain such processes in detail.

[32] Again, see Feenstra and Taylor (2017).

EDCs through the comparative advantage channel. These counterbalancing impacts make the overall effects ambiguous.

Foreign direct investment and offshoring are important forms of trade-induced innovation because they generate new and more efficient forms of production processes in recipient countries. However, trade liberalization through tariff cuts and joining free trade agreements may also raise innovation on the part of domestic enterprises. As suggested earlier, firms must lower costs to compete with more efficient imports or develop new products to enter export markets.[33] Both processes require investments in R&D, new capital goods, and better management techniques. Initial evidence for this spur to innovation in the wake of trade opening is in Bustos (2011), who found that Argentinean firms experiencing relatively larger cuts in Brazilian tariffs after the foundation of MERCOSUR invested relatively more in upgraded technology.[34] However, this happened primarily among firms at the upper reaches of productivity within Argentinean firms, not among lower-productivity and inefficient firms. A second important study is by Aghion et al. (2018), who developed a theoretical model in which greater access to export markets changes the incentives of domestic firms to innovate. Specifically, high-productivity firms have the resources to invest more in R&D and develop new products, while competition forces low-productivity enterprises to reduce innovation spending. These predictions were borne out using exporting and patenting data from French firms from 1994 to 2012.

The relationships between trade and investment liberalization and innovation are considerably more complex than suggested here. Much depends on local circumstances in each country. The broad view, however, posits that increasing global integration has encouraged more innovation, at least in developed and higher-income emerging economies. Because these innovation responses are concentrated in high-productivity enterprises, they likely have contributed to higher wage inequality across skill classes and across (and even within) firms within occupational groups. These issues will continue to attract scholarly attention for years.

It is worth noting an additional complication involving trade and IP rights. Emerging and developing countries that seek to export higher-technology products to developed countries may encounter import barriers. Many advanced economies have laws blocking imports that violate patents or trademarks in the importers. A well-known example is section 337 of the U.S. Tariff Act of 1930. Shin et al. (2016) found evidence that the operation of such import restraints reduces the exports of more sophisticated products from emerging countries.

[33] In this "sorting" process, less productive domestic firms are pressured to shut down, as found in Chile by Pavcnik (2002).

[34] MERCOSUR (Southern Common Market) is a trade agreement among Argentina, Brazil, Paraguay, Uruguay, and Venezuela, founded in 1991.

While important background for this chapter, none of the prior reviews directly implicated IP rights and how they interact with globalization to affect inequality. At this stage, the best guess is indirect: To the extent that stronger IP protection has causally attracted more trade, FDI, and offshoring, it presumably has contributed to those sources of inequality within nations. And here, the evidence is clear, as developed in the next subsection.

1.3.4 *Technology Transfer and Income Convergence*

Massive literature is now studying how IP reforms affect international flows of technical information through high-technology trade, FDI, offshoring, and licensing. Reviewing that literature is beyond the scope of this subsection.[35] Rather, the intention here is to discuss three observations about how such flows could affect international inequality, defined as divergence or convergence in international living standards, as described empirically in Table 1.5. These issues can be subtle and counterintuitive, making it important to draw lessons from economic theory and empirical work.

1.3.4.1 Product-Cycle Dynamics

The first point is that divergence or convergence over time is a dynamic question requiring extended analysis. To some degree, cross-country income movements depend on relative trends in factor endowments. Emerging countries with high saving and investment rates, strong human capital and skills growth, and sound economic infrastructure and governance grow faster than others, including developed countries. This is a large part of the story in China and the rest of East Asia in recent decades. However, resource accumulation alone tends to run into diminishing returns, slowing down convergence after a time.

Sustained relative income growth requires continued increases in productivity from technological change, which, broadly put, can be driven by continuous domestic innovation or technology acquisition from abroad. Economists frequently study these processes through the lens of the dynamic product-cycle model, in which countries reside in an innovative North and an imitative South.[36] The simplest notion is that firms in the North develop new products or technologies, on which they have a temporary monopoly so long as the technical knowledge is not copied in the South. As soon as new technology is copied, however, production shifts to the South, and the product is exported back to the North, where firms devote resources to the next stages of innovation. What emerges is a continuous

[35] For reviews, see Park (2008) and Maskus (2012, 2022).

[36] The product-cycle model was first explicated by Vernon (1966) and is a workhorse model in trade and global business studies.

cycle of Northern innovation and Southern imitation, the primary form of technology diffusion.

From the standpoint of global income distribution, the relative rates of innovation and diffusion matter.[37] An exogenous rise in the rate of innovation generates a broader swath of Northern monopoly rents, which are paid as higher wages there. In contrast, an exogenous rise in the rate of imitation weakens those monopolies and transfers production more rapidly to the South, raising wages there. The key variable in such models, the ratio of Northern to Southern wages, rises with innovation and falls with imitation. If innovation is sufficiently slow and imitation sufficiently fast, this ratio could approach unity, implying full income convergence. It is evident that IP rights play a straightforward role in this dynamic. Stronger IP in the North expands innovation and protects wages there. Stronger IP in the South raises imitation costs, slowing imitation and reducing wages there. Unambiguously, then, increases in global IP protection would worsen international income inequality in the basic model.

It is fair to say that this simple proposition lies at the heart of concerns in developing countries and among development economists about the potential impacts of IP reforms associated with TRIPS at the WTO.[38] This view formed the essence of the first model translating the product-cycle dynamics into an endogenous growth framework through purposeful innovation and technology transfer, set out by Helpman (1993). He developed a "quality ladders" model, in which Northern innovation could be displaced by Southern imitation, resulting in instantaneous technology transfer and narrowing the North–South wage gap. In this framework, stronger IP protection in the South would sustain Northern technological monopolies for longer periods, leading to reduced rates of both imitation and innovation and limiting economic growth. This prediction suggested the policy harmonization demanded by TRIPS would be a dynamic mistake.

This result inspired lengthy literature extending the endogenous product-cycle model and IP rights in important directions. Most prominently, subsequent models by Lai (1998), Glass and Saggi (2002), and Yang and Maskus (2001) posited that there are two channels of technology diffusion from North to South: imitation and purposeful information transfers through FDI and licensing. Investment is sensitive to IP protection, especially in high-technology manufacturing and services, because multinational firms feel more confident that they can transfer advanced information and know-how without losing them to local imitation. Licensing should expand with IP protection for similar reasons and because enforceable domestic patent

[37] The canonical model is in Krugman (1979). This model and others following it posited identical consumers (workers) in each country, so that internal inequality was not an issue to be studied.

[38] Maskus (2012) discusses these concerns and the evolution of the IP system after TRIPS. For an extended critique of TRIPS and the broader complications with IP rights, see Stiglitz and Charlton (2005).

rights can reduce the costs of reaching mutually acceptable contracts. In turn, FDI and licensing flows increase Northern profits and speed up technology diffusion, raising Southern wages.

Moreover, liberating Northern labor from production permitted more resources to be devoted to innovation. Depending on model parameters, innovation may rise or fall while technology transfer is enhanced. In this context, stronger IP protection in the South has offsetting effects: It slows down uncompensated imitation but enhances market-oriented technology transfer through FDI and licensing. The impact on the North–South income gap depends on circumstances.

In consequence, how IP reforms affect income divergence or convergence is an empirical question. To date, there are no solid econometric studies of this issue for reasons already mentioned. However, there is substantial and consistent evidence that broader patent scope tends to attract more FDI, licensing, and offshoring to those EDCs that can deploy such information effectively into domestic production.[39] The implication is that stronger IP protection, at least in those countries, has accelerated technology transfer and encouraged income convergence by shifting employment abroad from the HICs. Thus, the extensive global IP enhancement period since TRIPS has almost surely reduced relative wages between the rich countries and the emerging countries through enhanced technology transfer. This conclusion may come as a surprise to rich-country politicians who enthusiastically support such reforms. The extent to which such reforms may be credited with this outcome, as opposed to other economic factors, is unclear but surely significant.

Again, it should be noted that this convergence is conditional: There is scant evidence of it in the LICs after their IP reforms. The best conclusion here is that IP rights are insufficient to attract greater technology flows. Countries need to complement those reforms with stronger investment climates, reduced corruption, better human capital, and the like.

1.3.4.2 The Property Rights Approach to Offshoring

There is a second theoretical framework in which stronger IP rights in the South can increase the incomes of local workers and input suppliers. The so-called property rights approach posits that foreign investors and domestic network partners, particularly in an international outsourcing context, operate as principals (the multinational) and agents (the local contractor).[40] The parent firm and the local input contractor must bargain over how they will share the profits from production within the network. The contractor pays lower wages than the parent firm in its location,

[39] Again, see Maskus (2012) for an extensive discussion.

[40] The property rights analysis of principal–agent problems was pioneered by Hart and Moore (1990) and Williamson (1985). It is a fundamental theory of the boundaries of a firm, analyzing conditions under which a firm would produce inputs in-house or outsource them to a contractor. It was extended to international outsourcing and IP rights by Antras (2003, 2005).

which is the incentive for offshoring. However, once the contract is signed, the supplier might choose to save costs through shirking, which is more likely if the parent firm cannot enforce its contract. The cheating may be through not producing the required volumes, but it also could involve stealing know-how or diluting the parent firm's trademark and reputation. It follows that stronger IP rights in the supplier's country would diminish the likelihood of shirking, making outsourcing more likely.

The empirical prediction is that countries with a reasonable ability to produce high-quality inputs are more likely to be invited into a production network if their governments offer enforceable contract rights, including in IP. Again, the evidence suggests that this is the case, for outsourcing locations at different stages of production, other things equal, are sensitive to local IP rights. This also applies to the recent emergence of R&D networks across countries within multinational firms.[41] Again, the implication is that EDCs with transparent IP rights are more likely to become nodes in vertical networks, a force for international wage convergence.

These broad perspectives may be usefully qualified. For example, the R&D spending of MNEs on local affiliates abroad may be either asset-exploiting or asset-augmenting, as discussed by Dunning and Narula (1995). The former case involves local R&D to adapt existing technologies to conditions in recipient markets, tending to lock in competitive advantages of the foreign firm and potentially reducing convergence. Patel and Vega (1999) studied patenting trends in the United States of major global firms, finding evidence that firms generally engaged in local R&D in technological areas where they were strong at home.

In the latter case, local R&D is devoted to acquiring new knowledge-based assets or creating new technologies that may support domestic production and even exports of novel goods. Much of the recent growth in R&D spending by foreign multinationals in China has been asset-augmenting, taking advantage of engineering skills and other Chinese factors. This process is more likely to raise the demand for skilled workers in recipient countries, tending toward international income convergence.

The net impact of international R&D programs within multinational firms on global convergence remains unclear and worthy of additional and deeper research.

1.3.4.3 Technology Spillovers

The third important element in the convergence story is the possibility that capital imports, FDI, and outsourcing contracts entering EDCs result in what economists call productivity spillovers or technology spillovers.[42] High-technology imports and FDI generally embody more advanced technical information and knowledge than

[41] See Branstetter and Maskus (2022) for further discussion.

[42] This is also a large literature. For a comprehensive review, see Keller (2010).

domestic production in lagging countries.[43] Incorporated into domestic production, they directly raise productivity within the firm or local contractor. However, those direct gains are typically paid for. Spillover occurs when a domestic firm or customer gains greater productivity without paying for the economic value of that improvement.

There are several channels through which such productivity spillovers operate. One is direct imitation as local firms observe the operations of MNE affiliates or contractors and figure out how to implement them into their facilities. Another is the practice of skilled engineers and managers to leave employment at an affiliate and take the knowledge learned there to another firm or start-up. A third is reverse engineering of high-technology imported inputs. Perhaps most important are backward and forward spillovers. A backward spillover occurs when a domestic input producer gains higher efficiency through supplying an affiliate of a global firm. This is most likely the result of the MNEs showing how to produce a higher-quality input, which the international firm requires to meet global standards. This ability to produce better inputs becomes a spillover when the input supplier uses it to expand sales to other purchasers. A forward spillover transpires when domestic purchasers of the goods and services produced by local affiliates of MNEs gain greater efficiency, which again permits them to expand sales generally.[44]

Technology spillovers gained through international trade and FDI are the primary source of measured productivity increases and economic growth in most developing countries.[45] Accordingly, the role of various policies and economic characteristics looms large in determining how rapidly such countries may grow relative to the advanced economies. In this context, IP rights again matter considerably, at least among those EDCs in a position to attract inward FDI and licensing. Here, the promise of IP rights is cross-cutting. Stronger patents and trade secrets protection should reduce the scope of uncompensated imitation, learning, and mobility of skilled labor from MNEs to domestic firms, suggesting again that IP rights could diminish growth in EDCs.

On the other hand, the greater volumes of inward technology flows associated with stronger IP protection generate more opportunities for spillovers through backward and forward linkages. Moreover, a policy might follow an intermediate track. China, for example, pursued for some years a regime in which multinationals in designated technology-oriented sectors were encouraged to invest in local joint ventures but under the expectation that the parent companies ultimately would

[43] In fact, the existence of multinational production is typically based on the decisions of parent companies to deploy more efficient technologies across production locations and stages, as analyzed in Markusen (2002).

[44] Evidence suggests that backward spillovers are common in EDCs, while forward spillovers are less frequently observed (Keller, 2010).

[45] For elaboration and quantification of this point, see Keller (2004).

share their key IP with their local partners.[46] Success in deploying such policies is not much in evidence elsewhere among EDCs.

Thus, the question of whether stronger or weaker IP rights raise technology spillovers ultimately is empirical, and data may be marshaled to support either conclusion. To date, there are no systematic econometric studies of this central issue in the debate over global IP requirements, a considerable missing element that should attract more study going forward. For this chapter, the lesson is that IP reforms have attracted considerably more technology transfer through formal channels to select EDCs, particularly the UMICs. It is likely that some domestic firms have suffered from this competition, either shutting down or losing market shares, but evidence on this point is scarce. For these economies, the balance of effects likely has supported income convergence toward the levels of the HICs. In contrast, IP reforms likely have not contributed to such convergence among the LICs.

CONCLUDING REMARKS

This chapter has reviewed the available economic theory and evidence about the potential impacts of IP rights on income and wealth inequality, emphasizing international comparisons. This is a critical question, particularly in light of the simultaneous increase in the scope and international application of IP rights and the growth of inequality across many countries. It is tempting in this context to assign causal importance to the former in explaining the latter.

However, an essential lesson is that establishing such causality is challenging, and systematic evidence is scarce. Cross-country macroeconomic regressions of Gini coefficients on available measures of IP protection, most readily the GP index of patent rights, suggest a correlation between inequality and IP. However, such evidence is surely fragile and should be treated with considerable caution. At the same time, micro-econometric evidence is emerging that firms engaged in more global patenting tend to have more unequal internal wages, even within occupational categories. These findings are suggestive but a long way from establishing a firm and generalizable relationship. Far more analysis is needed.

The chapter also pointed out that IP reforms may accompany trade and investment liberalization, contributing to internal inequality, especially in EDCs. However, while the channels through which globalization, involving trade, FDI, and outsourcing through production networks, can affect inequality are well understood and supported by systematic evidence, there has been almost no empirical study of how IP rights may contribute. This is surely a large gap in our

[46] This and related industrial policies formed the basis of the Section 301 case against China by the Trump Administration in 2018, ultimately launching the bilateral trade war. Maskus (2012) describes the essential characteristics of China's policies.

understanding and needs to be rectified with additional study. However, working out the appropriate frameworks and data to achieve it will again be challenging.

Finally, there is strong evidence that IP reforms in the past twenty years have contributed significantly to increased flows of market-mediated technology transfer from technologically advanced countries to select EDCs. Because these flows embody knowledge that can raise local productivity and generate industrial transformations, IP rights likely have had an indirect but substantially positive effect on raising average incomes in recipient EDCs relative to those in rich countries. However, such flows have not increased much in poorer countries, whose incomes continue to stagnate in relative terms. This process, called conditional convergence, is a first-order outcome of the globalized IP system but remains underappreciated and insufficiently studied.

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APPENDIX

TABLE A1.1 *Countries in the Gini coefficient sample*

HI	UMI	LMI	LI
Australia	Argentina	Belarus	Armenia
Austria	Brazil	Bolivia	Bangladesh
Belgium	Chile	Bulgaria	Botswana
Canada	Croatia	China	Cote d'Ivoire
Cyprus	Czech Rep	Colombia	Gambia
Denmark	Greece	Costa Rica	Georgia
Finland	Hungary	Dom Rep	Ghana
France	Malaysia	Ecuador	Honduras
Germany	Mexico	Egypt	India
Hong Kong	Slovenia	El Salvador	Kenya
Iceland	South Africa	Estonia	Kyrgyzstan
Ireland	Uruguay	Guatemala	Malawi
Israel		Indonesia	Mauritania
Italy		Iran	Niger
Japan		Jamaica	Pakistan
Korea		Jordan	Rwanda
Luxembourg		Kazakhstan	Sri Lanka
Netherlands		Latvia	Tajikistan
New Zealand		Lithuania	Tanzania
Norway		Moldova	Uganda
Portugal		Morocco	Vietnam
Singapore		Panama	Zambia
Spain		Paraguay	
Sweden		Peru	
Switzerland		Philippines	
Taiwan		Poland	
UK		Romania	
USA		Russia	
		Slovakia	
		Thailand	
		Tonga	
		Tunisia	
		Turkey	
		Ukraine	
		Venezuela	