Intellectual Property Rights Protection and International Trade: An Economic Survey

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ABSTRACT *Intellectual property right (IPR) protection provides incentives for innovation and consequent spillover benefits for the global economy, but it may also have anti-competitive effects. Economic theory has only recently addressed the international trade flow implications of different IPR protection regimes—including those consistent with the TRIPS agreement. The theory suggests IPR protection offers grounds for both conflict and congruence between net technology importers (mostly developing countries) and net technology exporters. Empirical evidence suggests that IPR protection influences trade and investment flows, but that economic impacts vary across nations and industries. Debate continues over crucial measurement issues.*

Keywords: economic welfare, growth, intellectual property, international trade, TRIPS agreement.

When governments intervene in the economy, it can broadly speaking be for one of two reasons: to enhance efficiency and/or to address issues of perceived inequity. Intellectual property (IP) receives 'natural' protection from the difficulties associated with imitating tacit elements of knowledge possessed by inventors, from other costs of knowledge transfer, from an inventor's preference for secrecy, and from the costs of acquiring complementary inputs (physical, human and financial) required if another person's IP is to be put to effective use in production. Such features of the world may loosely be described as 'knowledge imperfections' or 'transaction costs' in the context of economic analysis. In the 'market imperfections' approach to economic policy, such features usually provide a rationale for intervention to remove or dilute such barriers to trade. Interestingly, however, that is not the way economists have traditionally approached framing policy for the protection of IP.

Instead, they have usually focused first on the perception that new knowledge is quick, easy and costless to transmit and should thus be priced very close to zero. They have then worried that if new ideas attract a near-zero price, there will be little (or insufficient) incentive to devote resources to generating new knowledge. The implication is that government should put institutional mechanisms such as patents and copyright protection in place to provide such incentives—mechanisms which at the same time make new ideas available to any who might wish to use them.

It is interesting that well-respected present-day authorities take quite different

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perspectives on the centuries-old question of the extent to which institutional IP protection is a good deal for society or not.[1] The social benefit of patents and copyrights should not be treated as obvious, and by observation the extent to which they are considered of value varies widely from sector to sector. What is important in this article is the efficiency and equity implications of protecting IP in an international framework. Nonetheless, it is important to keep at the back of our minds that even from the perspective of a single, self-contained country, there is real controversy about the social value of IPRs.

The reason for controversy in the single-country case is that on the one hand (and assuming away 'natural' protection initially), spillover effects which make imitation easy and appropriation of returns hard for the inventor discourage spending on the development of new ideas. While it is hard to know, empirically, what the socially optimal level of inventive activity might be in a country, the presumption is that, without institutional protection, too little will be spent on activities like invention and R&D. On the other hand, institutional protection of new knowledge creates a temporary monopoly. Those who generate new knowledge are given the legal right to charge a price above marginal cost (of transmission, at least) for the use of their idea. From the point of view of static efficiency, this is undesirable since socially optimal use of scarce resources is achieved by having users pay just the marginal cost of provision.[2]

But the appropriability versus monopoly trade-off, the static efficiency issue, is only a part of the controversy. Invention and innovation are features of changing, growing economies: it is important that policy encourages socially beneficial growth rather than stagnation[3] so dynamic as well as static efficiency issues must also be considered. In the dynamic context, the problem is that monopoly is known to dull managerial edge[4] but may be necessary to generate the profits required to generate ongoing innovation. The argument that IPR protection is required to encourage innovation and growth is at its strongest when it can be shown that 'natural' protection would fail to yield the profits required to facilitate enough (and the right) R&D. That, of course, is an empirical issue.

There is, however, another quite crucial issue, and one of special relevance in an international analysis. In a dynamic context, the diffusion of new knowledge is at least as important as its initial generation and usually more so. A patent system facilitates diffusion by encouraging inventors to make knowledge available for use by others. The interests of diffusion are further served by placing a finite limit on the duration of patents. On the other hand, much knowledge will be diffused anyway, once it is discovered. Whatever system of IPR is put in place, it has to strike a balance—between encouraging invention in the first place and ensuring the new knowledge is used and diffused efficiently, once discovered.

International Context

In the international context, all of these arguments reappear but running at other levels too. The central proposition of international trade theory is that free trade among all nations will yield higher global benefits than a world with impediments to trade. It will also yield higher (and better) global growth by encouraging the flow of new knowledge as well as all other resources to their most efficient uses around the world. Logically, however, an improved global outcome may be consistent with:

- improved national welfare for all individual nations;
- improved national welfare from some individual nations but not others;
- faster growth for all individual nations; and
- faster growth for some individual nations but not others.

What is more, changed global outcomes may affect the distribution of incomes and wealth within nations. Having canvassed some of the general economic issues that arise when IPR is discussed, we now look at some of the recent economic analysis that has been carried out when those issues occur in an international context.

Threads in the Literature

The implications of IPR protection have not, on the whole, received much attention in the international trade and trade policy literature of economics until quite recently. Penrose[5] was an early pioneer (as in other fields), but in well-known texts of the 1970s and 1980s there is not even a mention of IPR.[6] Like much traditional work on the economics of trade, there was analysis of how changes in technology can influence countries' production capabilities, how learning effects might offer a possible rationale for infant industry protection, and how trade can transfer knowledge and stimulate innovation. But it is only rather more recently that economists have turned their attention seriously to asking in an international context whether the choice of IPR regimes has any actual or potential effect on a country's or global welfare.

The forces which have drawn attention to the value of asking such questions are partly political. As leading trading nations such as the USA have lost their competitive edge in manufacturing traditional goods, they have come to see IP as a new basis for comparative advantage. They have therefore become increasingly concerned at the weakness of IPR protection in countries where IP-embodied goods are now often produced. On the other side of this coin, developing countries, usually net technology importers, seek ready access to the ideas of more R&D-intensive economies to assist them in their growth. At the same time, they wish to retain monopoly rights over ideas developed domestically. To an extent, such arguments reflect the tenor of strategic trade theory and the trade-related implications of sector-specific learning embodied in analysis developed in the 1980s.[7]

There has also been impetus from the so-called 'endogenous growth' literature.[8] This literature focused initially on domestic growth but was quickly adapted to address issues of economic growth in an international context.[9] The research programme here was prompted *inter alia* by the perception that older models had recognised the central role of technological progress in maintaining real economic growth but had failed satisfactorily to 'endogenise' the innovation process, i.e. to integrate it fully and interdependently within the system of relationships generating growth. While many of the concerns here were of an essentially technical nature, it was recognised that, located in an international context, endogenous growth models could be used to make predictions about the relative growth rates of different countries and different groups of countries, i.e. to shed light on empirical hypotheses relating to convergence (or divergence) in real income levels around the world.[10] Clearly, there is a strong resonance between the application of endogenous growth theory to this sort of issue and the politically motivated concerns, noted above, over the nature of IPR protection in technology exporting and technology importing countries. Unsurprisingly, therefore, pioneers in the endogenous growth literature have also started contributing to analysis of the implications of variations in IPR protection.[11]

Analysis

Given the focus of concern in this article, we shall say rather little here about the foundations of endogenous growth theory and rest content with a commentary on basic

Table 1. Policy options

Level	Manner	
	Discriminatory (D)	**Non-discriminatory (N)**
High (H)	HD	HN
Low (L)	LD	LN

insights in due course. But to provide a framework which encompasses many of the important ideas in this area, we shall draw principally on the analysis of Subramanian.[12] Like him, we shall focus to fix ideas on patents as the legal device used to provide IPR protection.

Patent protection has differing effects on economic welfare (i.e. economic benefits and costs) according to the variations in the level and the manner of the protection. The level of protection patents offer in a country varies with the length of patents within that regime, and with the coverage across sectors. The manner of protection relates to how nationals in a country are treated *vis-à-vis* foreigners. The principle of non-discriminatory (national) treatment obliges a country to grant to foreign nationals all the rights it grants to its own. Conversely, non-national treatment, which grants patent rights discriminating in favour of domestic nationals, is discriminatory in this sense. Policy options available to countries are therefore those summarised in Table 1.[13]

Monopoly Profit and Competitive Pricing

High levels of IPR protection generate a monopoly (for the duration of the patent) to the patent holder. The monopoly user of the idea may then produce and sell, with the patented knowledge, at a price above that which unprotected firms could charge. As a result monopoly profits (economic rent) may be earned.

To understand the implications of this for analysis, assume the world is divided into technology-exporting countries (TECs) which have high productivity, world low-cost production in technology-intensive goods and services, and technology-importing countries (TICs), whose cost structures are, relatively, less efficient. In Figure 1,[14] which views the world from the perspective of TICS, S^0_{TEC} and S^0_{TIC} represent the cost curves of the two groups, subscripted appropriately,[15] with S^0_{TEC} lying below S^0_{TIC}. (Ignore the zero superscripts for the time being.)

To simplify, think of the TECs as a single-country 'TEC' and the TICs as another single-country 'TIC'. DD is the demand curve in TIC for a patentable product or patentable process embodied in it. DM is the associated marginal revenue curve. Profit is maximised where marginal revenue equals marginal cost: at A^0 if a domestic (TIC) producer produces the good in TIC; at B^0 if a TEC producer is granted a TIC patent and exports the good to TIC.

The good is produced domestically in TIC if there is a high level of IPR protection specifically deployed to discriminate against TEC: the HD regime. Marginal cost is then equated to marginal revenue at A^0, and an amount U^0HD^0 is produced and sold at price U^0, yielding monopoly profit of $U^0HD^0A^0X^0$. Under the HN regime, locals or foreigners may be granted the patent in principle but assuming TEC producers receive the protection, they will produce at B_0 for TIC, selling V^0HN^0 of the product at price V^0 and reaping profit of $V^0HN^0B^0F^0$.

In the event that a low (say zero) level of IPR protection is offered by TIC, supply ceases to be monopolistic and many domestic or foreign producers may supply the

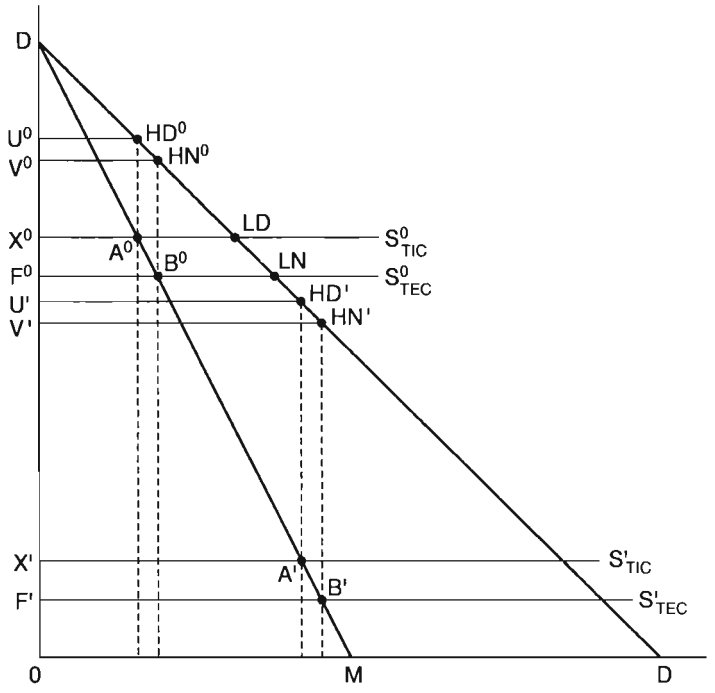

Figure 1.

market at a price reflecting marginal costs. If the patent regime discriminates in favour of TIC producers, X^0LD is produced at price X^0; if the regime is non-discriminatory, F^0LN is produced at price F^0.

Dynamic Effects

As noted earlier, an important policy purpose of patents is to encourage innovation by allowing returns to be appropriated by inventors which they would otherwise fail to receive. This argument may be viewed as a prospective one (the prospect of a patent encourages R&D which would not otherwise have taken place), or as a retrospective one (the reality of patent protection when an innovation reaches the market encourages productivity—enhancing R&D thereafter). The latter perspective may be seen as giving rise to dynamic benefits, the dynamic gains from the patent.[16] In the diagram, dynamic gains arise from the downward shift in cost curves under high levels of IPR protection: S^0_{TIC} falling to S^1_{TIC} and S^0_{TEC} falling to S^1TEC. (Cost curves remain at their initial levels in the low-level protection cases.)

For a fraction of the patent duration, therefore, the HD regime is associated with sales of U^1HD^1 at price U^1 and profits $U^1HD^1A^1X^1$, and the HN regime with sales of V^1HN^1 at price V^1, yielding profit of $V^1HN^1B^1F^1$.

After the Patent

Once the patent expires, no protection from that source any longer exists and production occurs on a competitive basis in its absence. As shown in Fig. 2 the relevant cost curves for the four regimes are S^0_{TIC} and S^1_{TIC}, S^0_{TEC} and S^1_{TEC}—and with price is set equal to production cost.[17] In the analysis that follows, we focus on the period during which the patient is effective.

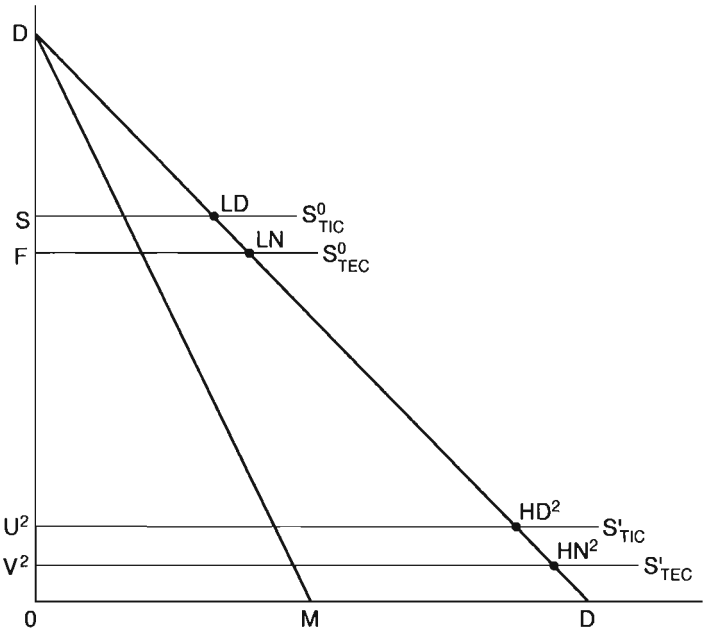

Figure 2.

Welfare

Welfare implications resulting from the different regimes may be viewed from the perspectives of TIC, TEC, and the whole world (TIC + TEC). In each case we look at consumer surplus (the area under the demand curve less what consumers actually pay out) and monopoly profit (available, in principle, for redistribution to consumers after governments have taxed firms). The following are noteworthy results:[18]

> *Result 1.* Ignoring dynamic effects, low levels of IPR protection are always preferred in TIC to high levels. The consumer surplus triangles DF^0LN and DX^0LD are both larger than the areas representing consumer surplus plus profit (e.g. $DU^0HD^0 + U^0HD^0A^0X^0$ for the HD regime) under high levels of patent protection. Economically, low levels of patent protection allow either fee-free domestic imitation of new foreign technology (along S^0_{TIC})—with some other form of protection if necessary, or purchases of IP-embodying goods at world low-cost price from TEC, (along S^0_{TEC}) Lower costs benefit consumers through competitive as opposed to monopoly prices. (S^1_{TEC} and S^1_{TIC} would never apply in the absence of dynamic effects.)

> *Result 2.* Still ignoring dynamic effects, TEC sells output in TIC only under HN and LN—and prefers HN to LN since it makes positive profit only under HN. Options discriminating against TEC would always be disfavoured.

Since these results ignore dynamic effects, it becomes important to determine whether high levels of patent protection actually do generate dynamic benefits. Ultimately, this is an empirical matter but it is well known that patents are highly regarded as means of enhancing appropriation only in a subset of cases.[19] Even when patents do enhance appropriability, dynamic benefits will be reaped only if the additional profits

yielded are used effectively to actually raise productivity. Again, the links between higher profit and more investment in R&D are unpredictable and even if more is invested in creative experiment, outcomes for higher productivity may be disappointing. While returns to additional R&D in TEC may be high, motivational, managerial and institutional constraints in TIC may imply much lower returns.[20]

The evidence suggests that in an interestingly large number of cases, we may therefore legitimately ignore dynamic effects. In that event, *TEC's first preference, HN, is in direct conflict with TIC's two first preferences, LD and LN.* TIC could aim for a compromise, however, by running an HN IPR protection regime, but then taxing away some or all of the TEC firm's profit. This would yield more consumer surplus than HD but, even when added to tax revenues, less welfare benefit than LN because of the so-called 'deadweight burden' HN^0B^0LN. To make the strategy defensible, the government of TIC would need to show that the country would do better out of reinvested profit than taking the benefits of the (larger) consumer surplus.

> *Result 3.* If dynamic effects are ignored, then from a *global* point of view, LN dominates all other regimes since profits generated by HD and HN generate no dynamic gains and, when added to consumer surplus, fall short of the consumer surpluses generated worldwide by low-cost production methods.

In some cases, however, dynamic effects cannot be ignored. Suppose that high-level patent protection causes S_{TIC} and S_{TEC} to shift down so far (i.e. to $S^1{}_{TIC}$ and $S^1{}_{TEC}$) that, as shown, U^1HD^1 and V^1HN^1 both lie below $F^0S^0{}_{TEC}$. This is our main example.[21] In this case:

> *Result 4.* TIC prefers any high-level patent protection regime to the low-level alternatives (because DU^1HD^1 and DV^1HN^1 are both larger than DF^0LN), but there is ambiguity over the welfare it achieves under HD as compared with HN. Because V^0HN^0 and V^1HN^1 lie respectively below U^0HD^0 and V^0HD^0, the non-discriminatory regime always yields greater consumer surplus. On the other hand, if foreigners are permitted to remit all monopoly profits, the discriminatory regime generates profits to local resource owners while the non-discriminatory regime may well result in all profits flowing abroad. If all profits are remitted to TEC and the profits lost to TIC are large enough to outweigh the consumer surplus differentials following HN, TIC would prefer HD to HN. In the diagram, the areas $U^0HD^0HN^0V^0$ and $U^1HD^1HN^1V^1$ must be compared with the loss of domestic profit areas $U^0HD^0A^0X^0$ and $U^1HD^1A^1X^1$. As drawn, TIC would prefer HD to HN, but the balance swings in favour of HN the further VHN is below UHD.

> *Result 5.* TEC prefers HN unambiguously if there are dynamic gains since it would reap profits unavailable to it at all under HD, LD or LN.

It is clear that there is a potential for TIC–TEC conflict in this sort of case since TEC prefers HN while TIC could prefer HD. In fact, Subramanian argues that:

> ...even if the domestic IPR owner-producer were highly inefficient ... as compared to a foreign IPR owner-producer, it would still be preferable (to TIC) in welfare terms to accord the patent right to the domestic national ... The requirements ... would be minimal to create conflicts relating to the manner of protection.[22]

This may be overstating the likelihood of TIC preferring HD and two important qualifications seem worth noting. First, the TEC firm may not have to depend on all (or any) of its profits in TIC to undertake the R&D required to bestow dynamic gains on TIC. If it is not, then TIC's government could tax away some of its profits without

fearing loss of ongoing productivity increases. Second, TEC firms might be in a better position to make use of monopoly profits to enhance productivity than TIC firms—so S^1_{TEC} might lie much farther below S^0_{TEC} than S^1_{TIC} lies below S^0_{TIC}. In that case, the consumer surplus differential in favour of HN would become much larger, and much larger relative to the loss of domestic profits under HD. As a result, both TIC and TEC might come to agree on HN as the optimising regime.

Notice finally that we have drawn S^1_{TC} and S^1_{TEC} well below S^0_{TIC} and S^0_{TEC}. In some industries, the potential for productivity-raising R&D funded by monopoly rents is very small. In cases such as these, U^1HD^1 and V^1HN^1 might lie above S^0_{TIC} so that even with the potential of dynamic gains from higher protection, TIC would still prefer a low level of protection.

> *Result 6.* At a global level, HD is not preferred over HN, even with substantial dynamic benefits and even if the result is a net gain to TIC. It is irrelevant from a global welfare perspective who reaps the profits.[23] So a non-discriminatory approach—which maximises profit for the duration of the patent and consumer surplus at all stages—is the global preference.

Asymmetric Technology Needs and Tastes

An important aspect of the debate which the foregoing analysis fails to emphasise is that TICs and TECs may well have different technological needs and tastes. TECs, for example, may prefer to be developing drugs to stem heart disease while TICs, if located mainly in the developing world, may want tropical diseases dealt with first. In this case, the strength of arguments in favour of TICs establishing weak IPR regimes to free-ride on TEC advances need to be qualified. Patents in TICs may have a role in promoting innovation particularly appropriate to their specific needs. This issue is considered by Diwan and Rodrik.[24] They find:

- an increase in patent protection generates more innovation in the type of country (TIC or TEC) in which IPRs have been strengthened. This skews the innovation process away from the needs of the other type of country;
- if the welfare of TICs is given greater weight in global welfare calculations than the welfare of TECs, each group of countries should have different IPR regimes. Given the trade-offs identified earlier, however, the differential might favour higher IPR in either TICs or TECs. In practice, TICs' welfare is likely most often to be best served by a higher level of IPR protection in TECs, generating innovation from which all may benefit; and
- where taste differences are small (e.g. textbooks, computer software) TICs have the greatest incentives to free-ride. In other areas (e.g. pharmaceuticals, agricultural innovations) TICs may stand to lose more by *not* granting strong patent protection with the aim of encouraging innovation (domestically and overseas) of special value to them and which would not otherwise have taken place.

IPR, Trade and Growth

An obvious shortcoming of the earlier analysis is that although so-called dynamic benefits are included in the analysis, the whole framework is constrained by its essentially static set-up. Genuinely dynamic analysis lends itself much less readily to simple diagrammatic analysis, however, and discussion of the growth literature with its dynamic content here will therefore be rather informal.

Recent models of endogenous growth[25] have in a number of cases exploited the proposition that at the micro-level, firms engage in product innovation for profit. The macroimplication of this is that economic growth is positively influenced by product innovation since every new product adds to our knowledge, in turn reducing the cost of further innovation. Innovation in IT, making high-powered and flexible computer technology widely available, is a good example.

In the context of models such as these, the prospects for growth in particular countries are seen to be enhanced by offering incentives to human knowledge accumulation—and IPR protection is one mechanism. But taking an international perspective, the enhancement of human knowledge accumulation in one country is likely to be small compared with the extent to which it benefits from creative effort globally. IPR protection thus becomes important for economic growth to the extent that it accelerates human knowledge accumulation from which all, through trade, may benefit.

The results of this qualitatively simply argument are, however, open to question. Helpman[26], for example, has shown that if TECs, exclusively, are innovators and TICs exclusively, imitators, strong IPR protection in the TECs has only short-run overall advantages. Increasing IPR protection in the TECs may initially allow all to gain as TEC firms increase their innovation effort and TICs import the innovation themselves. But in the long run, TECs' innovation effort falls away: the TICs exert less pressure of competition because of the restrictions on imitation, and firms in the TECs take monopoly rent in the form of less energetic commitment to progress.

Another and different style of model has attracted attention for its perceived relevance to natural resource-rich countries like Australia and Canada.[27] Two types of goods production—high technology and traditional—compete with each other and an R&D sector for two factors of production in every country. The hi-tech sector yields knowledge-related dynamic externalities (like learning by doing) not generated in the traditional sector. If free trade focuses a nation on its comparative advantage and that lies in producing traditional-sector goods, trade liberalisation may slow the growth rate of that country compared with the rate it might otherwise have achieved. IPR protection will tend to enhance innovation and growth in countries with comparative advantage in hi-tech goods production, but will offer less to countries with comparative advantage in traditional goods production.

As Dowrick has noted,[28] however, even if Australia-like countries do grow more slowly on this argument, they may not suffer in terms of welfare. If countries with a hi-tech comparative advantage specialise in producing goods by hi-tech means, the price of such goods should fall worldwide and consumers in all countries should benefit. Hall[29] has argued that even if countries have comparative advantage in traditional goods, this in itself is not a logical argument against developing knowledge-rich industries on a traditional base. He offers as an example the biotechnology industry growing from a traditional base in agriculture. In such cases, there might be an argument for IPR protection to allow such development (and its accompanying structural change) to get underway.

Much by way of outcomes depends on whether trading nations are similar or not, and if not, what asymmetries are assumed.[30] For example, wage rate differentials between TICs and TECs make a difference to the dynamic impact of changing the degree of IPR protection. An unsurprising result is that when wage rates in TICs and TECs are the same and only TECs perform R&D, an increase in patent length increases the rate of production innovation in TECs. On the other hand, if TEC wages are higher than those of TICs, increasing patent length offers the same positive incentive to innovation as before but this is offset by the negative impact of higher wage costs—and product innovation in TECs (and hence worldwide) decreases.[31]

In another example, Taylor performs dynamic, general equilibrium analysis that allows us to revisit the distinction between discriminatory and non-discriminatory IPR protection discussed earlier.[32] He finds that when discriminatory protection replaces non-discriminatory:

- wage rates in TICs rise relative to those in TECs;
- export markets for TEC knowledge-intensive goods are cut, along, therefore, with technology transfer between TECs and TICs;
- the amount of labour allocated to R&D worldwide is cut, and hence global R&D falls;
- TEC R&D is cut and TIC R&D raised; and
- world growth declines.

As often happens in economics, predictions depend sensitively on assumptions. It is time to turn to the empirical evidence.

Empirical Evidence

It is only relatively recently that systematic empirical work has began on the implications of differential IPR protection, trade and growth. Focusing first on trade alone, Maskus and Penubarti[33] ask the question: does the distribution of bilateral trade across nations depend on the importing country's patent regime? This is their way of asking whether IPRs are 'trade related'. From the argument in this article, it must be clear that the answer, *a priori*, is unpredictable. The empirical answer is that 'across all sections and countries a strengthening in effective patent strength does raise bilateral imports on average In brief, intellectual property rights are indeed "trade related" '.

The most exhaustive tests of growth-related issues are reported by Gould and Gruben[34]. First, they show that when an IPR protection variable is added to a list of standard explanatory variables for economic growth, there is a positive—albeit only marginally significant—impact on the explanatory power of their model: i.e. higher levels of IPR protection are correlated with higher growth rates, on average. (Their dataset covers 95 countries from the period 1960–88.) Second, they ask whether IPR protection varies in its impact on growth between open and closed economies. Using a dataset of 76 countries, they find that growth rates vary in both groups of countries according to variations in IPR protection but that IPR may play a (slightly) larger role in stimulating innovation and growth in open economies.

It should be remembered, of course, that in open economies the effect actually measured is not just a reflection of IPR protection on growth—it captures the interaction between openness and growth when IPR protection is applied.

It might be expected that one of more important causal links between IPR protection and economic growth could lie in foreign direct investment (FDI). IPR protection might, in principle, encourage FDI by offering a degree of monopoly power to the owners of assets protected by the local IPR regime. Or, conversely, the very absence of such protection might encourage investment in certain assets to counter the lack of protection.[35] Correa[36] finds results point in differing directions, depending on sector and country. In pharmaceuticals, for example, absence of patent protection has failed to discourage FDI in Argentina, Brazil and Turkey, and the granting of patent protection has favoured FDI in Italy but failed to encourage it in Nigeria. In software and semi-conductors, there is even less by way of clear-cut evidence.

Lee and Mansfield,[37] on the other hand, are prepared to be more forceful, on the basis of studying data from almost 100 US firms, their FDI decisions and their perceptions of IPR regimes in 14 developing countries. Their estimates suggest that if the

proportion of firms regarding IPR protection in a particular country as inadequate fell by 10 points, US FDI there might increase by about $140 m per annum. They caution, however, that developing countries are likely to accomplish little if they go through the motions of enacting a patent or copyright law but do not convince firms that these laws will be fairly and effectively enforced.

Conclusion

We have presented economic analysis which indicates why there may be conflict between technology-exporting and technology-importing countries in their preferred IPR regimes. This is the economic basis for understanding the heat generated among participants in the TRIPS debate. However, even within the terms of that analysis, congruence rather than conflict is possible and generalities are dangerous because the economic effects of IPR protection vary so widely across industries and economic environments. The empirical evidence on the effects of differing IPR regimes, FDI and economic growth shows how careful policy makers should be. IPR protection may or may not be the most effective means of enhancing appropriability, in part an enforceability problem, and if it does, may or may not encourage dynamic gains, depending on what use firms make of their innovation-generated profits. FDI and growth respond to a wide range of stimuli, of which the IPR protection regime can at best be only one, and the welfare effects associated with growth may be counterintuitive.

Policymakers must also confront issues of optimal design (concerning the length and width of patent protection) and of implementation. In principle, carefully calibrated variations within and among IPR regimes may offer the prospect of greater benefits than uniform levels of IPR protection (zero or positive) that would fail to give effective and substantial protection to innovations where gains promised to be largest. But the informational constraints on achieving appropriate calibration are heavy—and there is always likely to be dispute over the weight that should be given to the welfare of TICs compared with TECs.

It is easy to go along with historical precedents in favour of giving at least temporary protection to inventors. The market imperfections approach can be invoked in the name of encouraging investment in new knowledge which would not otherwise have occurred, so long as the result is not to take inventive activity to a level above the optimum. The evolutionary view of technological innovation offers the perspective that the process of experimentation may be unnecessarily constrained without at least some encouragement from institutionalised incentives. On the other hand, this approach emphasises creating knowledge rather than diffusing it and ignores the observed effectiveness of other mechanisms in allowing inventors to appropriate rewards. It also tends to underplay the impact of competitive forces in product markets on the derived demand for new ideas in knowledge markets, whether institutionalised protection is offered or not.

In the context of the TRIPS debate the impact of these broader questions can be seen, for example, in predictions that all countries may suffer if IPR regimes are too protective and so prevent the growth of competitive pressure in goods markets when TIC firms imitate TEC innovators. This, and the findings of some other models discussed in the article, suggest that the benefits of the global diffusion of ideas and ensuring competition may well be the critical issue here. It needs then only to be shown that adequate incentives exist to maintain an appropriate rate and composition of knowledge creation in the first place. As already noted, non-institutionalised impediments to information flow often serve this purpose more effectively than patents in any case.

Low-protection IPR regimes may encourage TECs to 'masque' their innovations to

impede imitation and hence slow down the diffusion of production to TICs [38] TICs can (and on efficiency grounds, usually should) import the product embodying the new knowledge anyway, but a consequence of 'masquing' might be to encourage TICs to perform more R&D to enhance their prospects of successfully reverse engineering the new products they particularly wish to produce. In the final analysis, therefore, the global net welfare implications of the TEC masquing argument against low levels of IPR protection look ambiguous.

Finally, as the TRIPS debate itself implies, the players in this game perceive (rightly or wrongly) large stakes to be at issue. The theory of public choice suggests that the higher the levels of protection (and associated rent) players expect to obtain from a political process, the more resources they will devote to obtaining such rewards. One of the often ignored benefits of establishing the expectation of low or modest levels of IPR protection, therefore, is that it should discourage the diversion of valuable resources into wasteful rent-seeking activity.

Notes and References

1. Two recent perspectives from quite different angles may be found in W. Oi, 'On the uncertain returns to inventive activity', in Bureau of Industry Economics, *1994 Conference of Industry Economics*, Australia Government Publishing Service, Canberra, 1994, and P. Romer, remarks at Industry Commission conference on R&D policy, Canberra, 19940, cited at p. 185 in Industry Commission, *Research and Development, Final Report 44*, Australian Government Publishing Service, Canberra, 1995.
2. See W. Nordhaus, *Invention, Growth and Welfare: A Theoretical Treatment of Technological Change*, MIT Press, Cambridge, MA, 1969 for a useful introduction to the issues.
3. It is not implied here that all growth is socially beneficial. Dynamic efficiency requires both the rate and structural composition of economic growth to have regard to long-term constraints.
4. J. Martin, 'X-inefficiency, managerial effort and protection', *Economica*, 45, 1978, pp. 273–286; P. Geroski, 'Innovation, technological opportunity, and market structure', *Oxford Economic Papers*, 42, 1990, pp. 586–602.
5. E. Penrose, 'International patenting in the less-developed countries', *Economic Journal*, 83, 1973, pp. 768–785.
6. For example, W. M. Corden, *Trade Policy and Economic Welfare*, Oxford University Press, Oxford, 1974; and G. Meier, *International Economics: The Theory of Policy*, Oxford University Press, Oxford, 1980).
7. Such thinking is often associated with the name of Paul Krugman. See, for example, P. Krugman, 'The narrow moving band, the dutch disease, and the competitive consequences of Mrs Thatcher: notes on trade in the presence of dynamic Scale economies', *Journal of Development Economics*, 27, 1987, pp. 41–55.
8. The literature was pioneered by P. Romer, 'Endogenous technological change', *Journal of Political Economy*, 98, 5, 1990, pp. S71–S102. See also P. Aghion & P. Howitt, *Endogenous Growth Theory*, MIT Press, Cambridge, MA, 1998.
9. G. Grossman & E. Helpman, 'Trade, innovation and growth', *American Economic Review (Papers and Proceedings)*, 80, 2, 1990, pp. 86–91. See also Aghion & Howitt, *op. cit.*, Ref. 8, Ch. 11.
10. The analysis and empirics of convergence are dealt with by S. Dowrick & D. Nguyen 'OECD comparative economic growth 1950–1985: catch-up and convergence', *American Economic Review*, 79, 5, 1989, pp. 1010–1030; and N.G. Mankiw, D.Romer & D. Weil, 'A contribution to the empirics of economic growth', *Quarterly Journal of Economics*, 107, 2, 1992, pp. 407-N437.
11. L. Rivera-Batiz & P. Romer, 'International trade with endogenous technological change', *European Economic Review*, 35, 1991, pp. 971–1004.
12. A. Subramanian, 'The international economics of intellectual property right protection: a welfare-theoretic trade policy analysis', *World Development* 19, 8, 1991, pp. 945–956.

13. *Ibid.*, p. 947.
14. Figure 1 is an adaptation of Subramanian, *op. cit.*, Ref. 12, Figure 2, p. 948.
15. The cost curves are drawn horizontally, reflecting an assumption of constant cost production conditions.
16. A third perspective may be that the prospect of a patent encourages R&D leading to the innovation and that this in turn permits learning and other productivity enhancements after the innovation is launched.
17. Adapted from Subramanian, *op. cit.*, Ref. 12, Figure 2, p. 948.
18. Results 1, 2, 4, and 5 are taken from Subramanian, *op. cit.*, Ref. 12, Section 3; results 3 and 6 are found in Section 5.
19. Patents are viewed as only third or fourth best as appropriation-enhancing mechanisms according to R. Levin, R. Klevorick, R. Nelson & S. Winter, 'Appropriating the returns from industrial research and development', *Brookings Papers on Economic Activity*, 3, 1987, pp. 783–832.
20. Evidence for developing countries is not available. For advanced industrial economies, estimated economy-wide returns from R&D range from 25% to 150%. See Industry Commission, *Research and Development*, Final Report 44, AGPS, Canberra, 1995; and S. Dowrick, 'The determinants of long-run growth', in P. Anderson, J. Dwyer & D. Gruen (eds), *Productivity and Growth*, Reserve Bank of Australia, Sydney, 1995.
21. Other possibilities are considered in subsequent commentary.
22. Subramanian, *op. cit.*, Ref. 12, p. 951.
23. Subramanian, *op. cit.*, Ref. 12, p. 952.
24. I. Diwan & D. Rodrik, 'Patents, appropriate technology and north–south trade', *Journal of International Economics*, 30, 1991, pp. 27–47.
25. See Refs 8 and 9.
26. E. Helpman, 'Innovation, imitation and intellectual property rights', *Econometrica*, 61, pp. 1247–1280.
27. The model has its origins in the work of R. E. Lucas, 'On the mechanics of economic development', *Journal of Monetary Economics*, 22, 1988, pp. 3–42; and G. Grossman & E. Helpman, *Innovation and Growth in the Global Economy*, MIT Press, Cambridge, MA, 1991. Commentary may be found in S. Dowrick, 'Openness and growth', in P. Lowe & J. Dwyer (eds), *International Integration of the Australian Economy*, Reserve Bank of Australia, Sydney, 1994; and P. Hall, 'Trade, growth and welfare in a natural-resource rich country', *International Journal of Social Economics*, 23, 1996, pp. 188–206.
28. See Ref. 27 for references.
29. See Ref. 27 for references.
30. See Rivera-Batiz & Romer, *op. cit.*, Ref. 11.
31. The results are found in P. Segerstrom, T. Anant & E. Dinopoulos, 'A Schumpeterian model of the product life cycle', *American Economic Review*, 80, 5, 1990, pp. 1077–1091.
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33. K. Maskus & M. Penubarti, 'How trade-related are intellectual property rights?', *Journal of International Economics*, 39, 1995, pp. 227–248.
34. D. Gould & W. Gruben, 'The role of intellectual property rights in economic growth', *Journal of Development Economics*, 48, 1996, pp. 323–350.
35. J. Dunning, 'The eclectic paradigm of international production: a restatement and some possible extensions', *Journal of International Business Studies*, 19, 1, 1998, pp. 1–32.
36. C. Correa, 'Intellectual property rights and foreign direct investment', *International Journal of Technology Management*, 10, 2/3, 1995, pp. 173–199.
37. J.-Y Lee & E. Mansfield, 'Intellectual property protection and US foreign direct investment', *Review of Economics and Statistics*, 78, 2, 1996, pp. 181–186.
38. See Scott Taylor *op. cit.*, Ref. 32.