PRODUCTIVITY COMMISSION

Trade-Related Aspects of Intellectual Property Rights

Staff Research Paper

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The views expressed in this paper are those of the staff involved and do not necessarily reflect those of the Productivity Commission. Appropriate citation is indicated overleaf.

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Preface

The primary motivation for this paper is to provide input to the upcoming legislative review of intellectual property rights. Other developments, including the resumption of the World Trade Organisation negotiations on agriculture and services, plus the prospect of a so-called 'Millennium Round' of new World Trade Organisation negotiations, make it timely to examine trade-related aspects of this subject. The aim of this paper is to contribute to a better understanding of intellectual property right issues from an economic perspective.

The paper was written by John Revesz under the direction of Philippa Dee. The paper was refereed within the Productivity Commission, but it does not necessarily reflects the views of the Commission. Helpful information and comments were provided by officers of IP Australia, the Attorney General's Department, the Intellectual Property Branch in the Department of Communications, Information Technology and the Arts and the Intellectual Property Unit in the Department of Foreign Affairs and Trade. The views expressed in this paper are not necessarily shared by the abovementioned departments or agency.

Abbreviations

ABS	Australian Bureau of Statistics
AGPS	Australian Government Publishing Service
AGD	Attorney General's Department
AIPO	Australian Industrial Property Organisation
ALRC	Australian Law Reform Commission
BERD	Business enterprise research and development
BIE	Bureau of Industry Economics
CD	Compact disk
CLRC	Copyright Law Review Committee
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DFAT	Department of Foreign Affairs and Trade
DIST	Department of Industry, Science and Technology
DOCA	Department of Communications and the Arts
GATT	General Agreement on Tariffs and Trade
GDP	Gross domestic product
IC	Industry Commission
IP	Intellectual property
IPR	Intellectual property right
OECD	Organisation for Economic Co-operation and Development
ORR	Office of Regulation Review
PC	Productivity Commission
PCT	Patent Cooperation Treaty
PSA	Prices Surveillance Authority
R&D	Research and development

TRIPS	Agreement on Trade-Related Aspects of Intellectual Property Rights
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UPOV	International Union for the Protection of New Varieties of Plants
USITC	United States International Trade Commission
WCT	WIPO Copyright Treaty
WIPO	World Intellectual Property Organisation
WPPT	WIPO Performance and Phonograms Treaty
WTO	World Trade Organisation
Y2K	Year 2000 computer bug

Overview

The purpose of this paper is to describe and analyse from an economic perspective major issues in the intellectual property rights (IPR) area. IPRs provide legal protection to intellectual property against imitations or copying through patents, copyrights, trade marks, industrial designs and to a certain extent also trade secrets.

Much of the discussion is concerned with the implications of the agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS). This international agreement was introduced in 1995 and is one of the set of agreements under the World Trade Organisation (WTO). The paper describes the TRIPS and other international IPR agreements, as well as broad features of Australian IPR legislation. On the empirical side, the paper presents various statistical indicators of Australian intellectual property, including some estimates of the patent and copyright cost content in production and trade. The rest of the paper is devoted to identifying and analysing IPR policy issues from an economic perspective.

TRIPS and intellectual property legislation

Over the last century, domestic IPR legislation has been strongly influenced by international conventions and agreements. International agreements on IPRs date back to the Paris Convention (1883) on industrial property (patents, trade marks and designs) and the Berne Convention on copyrights (1886). Bilateral IPR agreements between European countries started in 1829.

International cooperation in the IPR area is motivated by the fact that IPR protection restricted within national boundaries has little effect in preventing imitation or copying abroad, unless protection is also provided by other countries. The primary purpose of the Paris and Berne conventions and subsequent agreements is to ensure an international coverage of IPR protection by providing to foreigners equal protection as for domestic residents. In addition, these agreements seek to make it easier to obtain IPRs in different jurisdictions.

While these international agreements ensured some measure of global IPR protection over the last century, this became less satisfactory in recent years. One reason was the increasing globalisation of the world economy. The other was the

growing technological capabilities of developing countries, many of which were reluctant to join international agreements on IPR protection. Even some that joined these agreements did not effectively enforce IPR laws.

By and large, it is in the narrow national interest of technology and entertainment importing countries not to pay much attention to IPR protection, because this way they might be able to acquire IPR protected goods at cheaper prices through imitation or copying. In practice, the imitation of most recent inventions is fairly difficult in the absence of complementary (usually secretive) know-how, particularly in the case of complex engineering products. On the other hand, the copying (so called 'piracy') of literary work, recording of art performances and computer software is fairly simple, using widely available duplication technologies. Not surprisingly, the push to adopt stricter global IPR protection came from sectors that are particularly vulnerable to imitation or copying. These include pharmaceuticals, speciality chemicals, entertainment, publications and information technologies.

While TRIPS is based largely on earlier international IPR agreements, it contains some significant additions, such as the universal extension of patent terms to at least 20 years. TRIPS also provides clear guidelines about the effective and expeditious enforcement of IPRs — a crucial element that was missing in earlier international agreements. The main objective of TRIPS is to introduce a measure of compulsion (enforceable by sanctions) into the international arena, and in particular to improve IPR protection in developing countries, where in recent years most of the IPR infringing activities tended to occur. The dispute settlement provisions of TRIPS are part of the WTO enforcement measures agreed in the Uruguay Round negotiations.

Most of the relevant provisions of TRIPS were already incorporated into Australian law and enforcement practices before the adoption of the agreement. The most significant legislative change brought about by TRIPS in Australia was the increase in the patent protection term from 16 to 20 years. All current Australian IPR laws are compatible with the minimum standards required by TRIPS.

Statistical analysis

The estimates presented in this paper indicate that Australia imports significantly more than it exports in most product groups reliant on patent, copyright and trade mark protection. The reason for the large excess of intellectual property (IP) imports over exports is the traditional specialisation of Australia in exporting primary commodities and importing elaborately transformed manufactures, which, with some important exceptions, usually incorporate higher IP content. However, the

situation is changing. In the last decade, Australia has increased significantly its exports of patent intensive product groups and trade mark dependent goods (such as wines and processed food).

The paper presents some rather speculative estimates on the monetary value of patents and copyrights at the national level, based on input costs. Because of lack of adequate data, these estimates were not extended to trade marks and designs. The monetary estimates suggest that the patent content of Australian manufacturing and mining (based on the portion of domestic business R&D expenditure assumed to be recovered through patent protection) amounts to between 0.1 and 0.2 per cent of GDP. Copyright content (based on the aggregate value-added of copyright industries) is estimated to amount to between 1.7 and 2.2 per cent of GDP. On the imports side, patent content is estimated to be in the range between 0.1 and 0.2 per cent of GDP and copyright content to be about 0.4 per cent of GDP.

The finding that the patent content of domestic production is significantly lower than the copyright content is surprising. One explanation is that international trade helps to defray the cost of R&D (and patent content) over a large volume of sales, thereby lowering the unit cost of new technologies. On the other hand, in the case of most copyright material, international trade is less important in defraying the 'cost of creation'. A large portion of copyright content is sourced from domestic production whereas most patent content is imported. These findings highlight the point that through international cost defrayment, Australia gains much by relying on imported technologies, patent protected or otherwise.

The apparently greater importance of copyrights than patents is based on production costs, rather than economic benefits. On the benefits side, there may be significant positive economic externalities associated with patented technologies, more so than with most non-educational copyright material. Hence, from a dynamic perspective, the economic importance of patents is likely to be larger than indicated by the cost-based patent content alone.

Economic considerations

All intellectual property involves some investment in intellectual effort, or investment in reputation in the case of trade marks. These intangible investments often can be easily copied or imitated by competitors. In many cases, without IPR protection it would be impossible to prevent 'free-riding' by persons who did not contribute to the original IP investment, making it hard to recover commercially the cost of such investment. Consequently, market incentives for IP investment would be deficient. The prevention of free-riding is a key economic rationale of all IPRs.

In practice, the prevention of free-riding is not easy, and legislative considerations are further complicated by cross-border flows of goods and knowledge.

The prevention of free-riding is not the sole economic objective of IPR legislation. Whilst the prevention of free-riding is essential to ensure an adequate level of investment in IP, it is also in the interest of society to ensure the dissemination of new knowledge and ideas to the public. This is achieved by requiring patent disclosures, limiting the duration of patent protection and restricting copyright protection to expression but not ideas.

There is also a non-economic 'moral' argument for IPRs, based on the 'natural' right of people to the fruits of their labour. In a sense, this is a non-economic argument because it does not address the issue of how markets operate or should operate. The focus of attention in this paper is on economic rather than moral arguments in relation to IPR protection. Nonetheless, it must be recognised that moral arguments still play an important role in IPR policy formulation and the judicial process.

Additional considerations arise in regard to technological IPRs. Given that the application of new scientific and technological knowledge by one person does not diminish its usefulness for others (non-rivalry), there can be significant positive externalities associated with research and development (R&D). In this context, positive externalities mean that social benefits exceed private benefits. Thus, there may be justification on economic grounds for public support for technological innovations beyond just the prevention of free-riding.

Policy implications of TRIPS

Besides its significance in helping to secure agricultural trade liberalisation in the Uruguay Round, TRIPS has important implications for domestic policy. Given the strong international orientation of IPR protection, the analysis presented in this paper suggests that generally, Australia's best approach from an economic point of view seems to be to provide IPR protection that complies with the minimum protection standards required by TRIPS, but does not exceed those standards. Compliance with the minimum standards of TRIPS is advisable in order to avoid political and trade retaliation and disciplinary action under the WTO. On the other hand, providing protection beyond the minimum standards might hamper competition in the domestic market and provide additional income to foreign IPR holders at the expense of Australian consumers. Without reciprocal agreements with our major trading partners, providing protection above the minimum international standards does not help our exporters. However, in areas where IPR protection is

mainly aimed to prevent imitation and copying by domestic (rather than overseas) competitors, the rule not to exceed the minimum standards of TRIPS might not represent the best approach.

The fairly general rule outlined above suggests that Australia should avoid introducing legislative changes that might bring in protection standards well beyond the minimum requirements of TRIPS, unless other benefits can be shown to outweigh costs. There are currently a number of reform proposals under consideration by the Government (such as a new form of patents for low level innovations, changes to the protection of designs and improvements to the copyright protection of databases, digital transmissions and performers' rights) that are examined in the light of this criterion.

The minimum requirements of TRIPS are not always clearly defined. While TRIPS has clear provisions on issues such as the minimum time length of protection, the range of subject matter to be protected, non-discriminatory treatment of foreign residents and the enforcement measures that should be implemented, the agreement does not codify more detailed subjects, such as screening criteria for patents or detailed definition of infringements to copyrights. Thus, there may be some scope to adjust local guidelines without violating the provisions of TRIPS.

It is easier to define the best approach for domestic legislation, given the TRIPS, than to comment from an economic perspective on the stance that Australia should adopt in international IPR negotiations. The best policy prescription can differ markedly depending on whether one is taking a national or global perspective. Stronger IPR protection that might be beneficial for world technological progress and cultural endeavours might not be as beneficial for the economic interests of a net technology and entertainment importing country such as Australia. Generally, formulating a stance in international IPR negotiations requires a balance to be struck between national and global economic interests.

The TRIPS agreement has been an important move to shore up international cooperation in the IPR area that was not keeping up with changing technologies and business practices before TRIPS was introduced. While certain elements of TRIPS, such as the extension of the standard patent term to 20 years, has been questioned in this paper, the overall conclusion is that TRIPS represents an important achievement in international cooperation, and is likely to spur world technological progress and improve commercial incentives in the fields of arts, entertainment, media and aesthetic designs.

In regard to the current TRIPS negotiations covering biotechnology and geographical indications, a few comments can be made from a national perspective.

In the biotechnology area, where Australia is strong, it might be economically advantageous for Australia to support an international agreement that would strengthen the worldwide IPR protection of biological innovations. Currently, TRIPS requires IPR protection only for new micro-organisms and new plant varieties. As for geographical indications, the moves by the European Union to extend the strong protection of geographical indications now applied in TRIPS to wine and spirits to other products, such as processed foods, agricultural products and handicrafts, would hinder our competitiveness in export markets against regions that have already acquired a strong reputation for quality.

Parallel importing

Parallel importing of IPR protected goods from legitimate overseas suppliers other than the IPR owner is currently one of the prominent issues on the Australian IPR policy scene. Apart from sound recordings (where legislative changes were introduced in July 1998) and books that have not been put on the Australian market within a prescribed period, parallel importing is prohibited for other copyright material, including publications, films, videos and software. Parallel importing is formally allowed for patent and design protected goods, but the legislation provides exclusive rights over importation to the IPR right-holders, who can prevent parallel importation if they want to. TRIPS neither sanctions nor prohibits parallel importing.

Studies conducted by the Prices Surveillance Authority in the early 1990s suggested that the prohibition on parallel imports allowed price discrimination between national markets that was costly to Australian consumers. At that time, the prices of many IPR protected products in Australia were found to be more than 20 per cent higher than the respective prices in the United States and Western Europe.

There seems to be no strong economic reason for maintaining the prohibition on parallel imports. The argument that parallel imports might expose us to a flood of IPR infringing imports is losing its validity over time, given the intensified international fight against IPR infringements as a result of the TRIPS agreement. This is a costly restriction to combat IPR infringements abroad, which can be addressed through various law enforcement measures and the WTO dispute settlement mechanism.

However, if parallel importing is allowed, there could be merit in additional measures to help combat IP 'piracy' — for example, a legal requirement to attach labels to copyright and patent protected imported goods, indicating the name and location of the overseas enterprise from which the product was bought. This kind of

measure could help right-holders to track down IPR infringing products on the market.

1 Scope of the paper

The principal objective of this paper is to shed some light from an economic perspective on current intellectual property right (IPR) policy issues. In this context, considerable attention is given to the international dimensions of IPR protection, in particular the implications for Australia of the agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS), which is one of the set of agreements under the World Trade Organisation (WTO). While TRIPS is the dominant theme, attention is also given to IPR policy issues that are beyond or unrelated to the minimum protection standards required by TRIPS.

One motivation for the paper is to provide input to the upcoming review of IPR legislation (due to start in mid 1999). Other developments, including the resumption of the WTO negotiations on agriculture and services, plus the prospect of a so-called 'Millennium Round' of new WTO negotiations, make it even more timely to examine outstanding (particularly trade-related) IPR issues.

The emphasis throughout this paper is on the international dimensions of IPR protection. However, given that TRIPS and other international IPR agreements are at the core of much domestic IPR legislation, the examination of international issues inevitable touches on virtually every aspect of IPR protection. Some effort has been made to identify IPR issues that are unrelated to TRIPS, and issues that are related to TRIPS but are not codified in TRIPS, in order to show to what extent domestic legislation is constrained by international obligations.

IPRs can be divided broadly into three legally distinct groups. The first group is industrial property, which represents legally registered rights such as patents, industrial designs, trade marks and geographical indications. The second group, covering copyrights and neighbouring rights are unregistered, but automatically protect against unauthorised copying and reproduction. This group covers literary works, arts, music, performances, broadcasts, technical drawings, computer software and integrated circuit designs. A third category that has been included in TRIPS is trade secrets. They are given some legal protection through laws pertaining to fair trading practices and breach of confidence.

Chapter 2 and appendix A describe the various international agreements that have been established over the last hundred and twenty years to facilitate the protection of IPRs beyond national boundaries. The discussion is non-technical, the aim being

to provide relevant information to policy-makers, economists and the general public rather than for legal experts. Chapter 2 outlines the TRIPS agreement. Appendix A examines, for each major IPR category, in what respects TRIPS represents an addition or modification to earlier international IPR conventions and agreements. The main features of the Australian legislation are also examined in the light of TRIPS and other international agreements.

Chapter 2 and appendix A also identify outstanding policy issues in TRIPS, in international IPR agreements outside TRIPS (coordinated by the World Intellectual Property Organisation — WIPO) and other IPR policy issues currently under review in Australia.

Chapter 3 examines policy issues from an economic perspective. A number of questions are raised and some comments are provided.

- In the presence of TRIPS, what is the optimal policy in Australia's IPR legislation?
- What stance should Australia adopt in international IPR negotiations?
- Is there a difference between national and global perspectives on IPR issues?
- Was the introduction of TRIPS a positive development, and how does it serve Australia?
- What are the reasons for the controversies regarding TRIPS?
- Are there many non-economic considerations that should be taken into account in IPR policy?
- In which areas is there a scope for reform?

As a staff research paper, the emphasis is on the analytical points for possible policy judgements, rather than drawing firm policy conclusions.

On the crucial issue of the optimal direction in domestic IPR legislation, this paper suggests that in most cases gains would be maximised (or costs minimised) by not exceeding the minimum protection standards required by TRIPS. There are currently a number of reform proposals under consideration by the Government (such as a new form of patents for low level innovations, changes to the protection of industrial designs and improvements to the copyright protection of databases, digital transmissions and performers' rights) that are examined in the light of this comment. Attention is also given to the arguments for and against parallel importing.

Chapter 4 presents sectoral estimates of the IP content of Australian imports, exports and domestic sales. IP content represents the IP cost component recovered

through IPR protection. The analysis is divided into two parts, one dealing with patents, the other with copyrights.

The monetary value of the patent content embedded in production and trade is derived from business R&D data, which combined with trade and sales statistics of individual product groups, yields estimates of the business R&D cost content (in dollar values) of various product groups. In the next step, indications from the literature on the patent dependency in various sectors are used to estimate the portion of R&D that is recovered through patent protection.

Estimating the IP content of copyright protected items is more straightforward. Given the close relationships between copyrights and certain well defined product groups, such as books, magazines, sound recordings, movies and software, relevant statistics on value added and trade in copyright protected items are not difficult to find.

The IP content estimates are presented for the years 1976-77, 1986-87 and 1996-97 in order to provide a view about trends over time. The results indicate that in most IP intensive goods Australia is more an importer than an exporter, but significant changes have occurred over the last two decades.

All in all, the paper describes and analyses all major aspects of IPRs, with a strong emphasis on the international dimension of IPR protection. The aim is to contribute to a better understanding of IPR issues from an economic perspective, and thus to improvements in legislation and policy.

2 Description and background of TRIPS

This chapter describes the main elements of the TRIPS agreement administered by the WTO and explains the background for the agreement. Appendix A, which supplements this chapter, describes in some detail the Australian legal framework for IPR protection and indicates the constraints placed by TRIPS on domestic legislation. Appendix A also indicates the areas in which TRIPS is based on earlier international IPR agreements and where it departs from them. The chapter concludes by identifying outstanding issues in TRIPS and IPR policy more generally in Australia.

This chapter starts with the political and economic background for the TRIPS agreement. It outlines the main changes introduced by TRIPS over earlier international IPR agreements, with a particular emphasis on the compulsory provisions of TRIPS. The final section briefly reviews recent IPR policy initiatives in Australia, most of which are not directly related to the requirements of TRIPS.

Appendix A, which supplements this chapter, describes in non-technical terms the IPR legal framework in Australia as well as the provisions of TRIPS and earlier international IPR agreements. The discussion covers each IPR category separately — patents, copyrights, designs, trade marks, plant breeders' rights, printed circuit layouts and trade secrets. Appendix A provides further details on some of the material mentioned briefly in the text.

2.1 The history of international agreements

Background

The agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) came into effect on 1 January 1995. It was one of the major outcomes from the Uruguay Round of multilateral trade negotiations that led to the establishment of the World Trade Organisation (WTO). Developed country members of the WTO have

had to comply with all the provisions of TRIPS since 1 January 1996. Australia was a foundation member of the WTO on 1 January 1995, and agreed to abide by most of the provisions of TRIPS from 1 July 1995. However, the time limit until 1 January 1996 was used in relation to copyrights to allow for transitional arrangements.

For developing countries, the transitional arrangements incorporated into TRIPS allow a general phasing-in period of five years until 1 January 2000. Such a phasing-in period is also permitted to former centrally planned economies now in the process of transition to a market economy. For those countries on the United Nations list of least developed countries, the transitional period is eleven years. The agreement allows possible extension of the transitional period upon duly motivated request.

TRIPS is not the first agreement to protect IPRs on an international scale. It was preceded by international conventions that date back to the last century, including the Paris Convention (1883) on industrial property (patents, trade marks and designs) and the Berne Convention on copyrights (1886)[1]. More recent agreements include the Rome Convention (1961) on recording of performing arts, the Budapest Treaty (1977) on the deposit of new micro-organisms for the purpose of patent procedures and the Washington Treaty (1989) on integrated circuit layout designs.

An intergovernmental body (the so-called International Bureau) responsible for administration, monitoring and coordination was established after the Paris and Berne conventions in 1893. Nowadays this coordinating body is called the World Intellectual Property Organisation (WIPO). It is an agency of the United Nations with its headquarters located in Geneva. In the following discussion, all international conventions and agreements administered by WIPO (including the Paris, Berne and Rome conventions) will be referred to collectively as WIPO agreements.

The reason for the long-standing interest in trans-border coordination of the legislation and enforcement of IPRs stems from the realisation that patent or copyright protection restricted within national boundaries has little effect in preventing imitation or copying abroad, unless similar protection is offered by other countries. Hence all international agreements on patents, copyrights, designs and trade marks stipulate that each country should provide at least the same level of IPR protection to non-residents as to residents. This so-called 'national treatment'

[1] Ironically, the Paris and Berne conventions were negotiated partly because of frustration over the alleged infringements in the 'newly industrialising countries' of the day, such as the United States and Japan (Maskus 1997). Nowadays, the United States and Japan are frustrated by the behaviour of the recent crop of latecomers.

provision aims to prevent discrimination against non-resident applicants or right-holders. It represents the central tenet in the Paris and Berne conventions and derived agreements. In addition, these agreements seek to make it easier to obtain IPRs in different jurisdictions.

National treatment anti-discrimination provisions have been also incorporated into multilateral trade agreements under the GATT and the WTO, but whereas in trade agreements the objective is to prevent discrimination in government policy against goods from other countries, in the IPR agreements the non-discrimination provisions apply to persons or corporations.

While the international conventions and agreements mentioned above provided some measure of global IPR protection over the last century, this proved to be not entirely satisfactory in recent years. An important reason was the growing technological capabilities of developing countries, many of which were reluctant to join international agreements on IPR protection. Moreover, even some of those that joined WIPO agreements were not effectively enforcing IPRs (USITC 1988; Subramanian 1997; Primo Braga 1995).

By and large, it is in the narrow national interest of technology importing countries not to pay much attention to IPRs, because this way they might be able to 'free-ride' through imitation or copying on the creative effort carried out in other places. In practice, the imitation of most recent inventions is fairly difficult in the absence of complementary (usually secretive) know-how, particularly in the case of complex engineering products, a subject that is discussed in more detail in section 3.3. On the other hand, the copying (so called 'piracy') of literary work, recording of art performances and computer software is fairly simple, using widely available duplication technologies. Not surprisingly, the push to adopt stricter global IPR protection came from sectors that are particularly vulnerable to imitation or copying. These include pharmaceuticals, speciality chemicals, entertainment and informatics (Hoekman and Kostecki 1995).

In line with the terminology used in much of the literature, the unauthorised duplication of copyright or patent protected products is referred to as 'piracy'. When a deceptive trade mark and/or packaging is used without authority on a similar product, it is labelled a 'counterfeit'. Many IPR infringing items combine piracy with counterfeiting, to replicate (albeit often imperfectly) a legitimately marketed product.

The TRIPS negotiations

The earlier international IPR protection system coordinated by WIPO proved less than satisfactory in safeguarding against widespread 'piracy' of copyright protected items, the misappropriation of well known marks and the imitation of some patent protected inventions in member and non-member countries. The increasing globalisation of the world economy has made matters worse. Consequently, in the last two decades a growing political pressure emerged from developed IP exporting countries (particularly the United States) to strengthen the international protection of IPRs. Since many developing countries were reluctant to embrace stronger protection of IPRs, an agreement had to be worked out that offered some compensating benefits to these countries, to induce them to join a binding international IPR agreement.

This was accomplished through the forum of the Uruguay Round negotiations. Initially IPR protection entered into these multilateral trade negotiations as a result of complaints about exports from some East Asian and Latin American countries of 'pirated' copyright protected material and 'counterfeit' products that misappropriated well known marks. At a later stage, the agenda widened to include all IPR issues and not just these items. After protracted negotiations, developing countries agreed to join a new international IPR agreement, partly in exchange for the liberalisation of agricultural and textile imports by developed nations (Subramanian 1997; Primo Braga 1995). The ideological shift in many developing countries toward faith in the market and free trade may have contributed to accepting a larger role for IPRs in providing incentives for technological innovation and cultural endeavours, instead of viewing these areas as public responsibilities.

Stronger IPR protection may serve the economic interests of many developing countries by providing greater access to foreign technologies, a subject that is discussed in section 3.9. Last but not least, the threat of unilateral trade retaliation by the United States and the European Union against IPR infringing countries was another factor that convinced many developing countries to accept a multilateral IPR agreement. Some developing countries started to strengthen their IPR systems well before TRIPS was introduced, which seems to suggest that they found stronger IPR protection not against their national interest.

TRIPS and WIPO agreements

The new agreement (TRIPS) is being administered and monitored by the WTO. TRIPS inherited most (but not all) the provisions of the Paris, Berne and Rome conventions and the Washington treaty. WIPO continues to exist as a separate UN

agency independent of the WTO. In 1 January 1996, an agreement between WIPO and WTO entered into force. It provides for cooperation concerning the implementation of TRIPS, particularly in relation to intergovernmental organisations operating under the Paris, Berne and Rome conventions and the notification of laws and regulations. The WTO and WIPO also agreed to cooperate in providing technical assistance to developing countries to facilitate the implementation of TRIPS (WIPO 1997).

WIPO continues to administer the Paris, Berne and Rome conventions and other international IPR agreements. Signatories to WIPO treaties include Russia and China, who are not yet members in the WTO. There are a number of WIPO treaties that are not covered by TRIPS, such as the Patent Cooperation Treaty, the Madrid agreement on the international registration of trademarks, and the Hague agreement on the international registration of industrial designs. These WIPO agreements are reviewed in appendix A under the relevant IP categories. Each of the WIPO agreements is administered by an assembly of member states and a secretariat, representing in effect a separate intergovernmental organisation.

While TRIPS is based largely on previous WIPO agreements, it also contains some significant additions, such as the universal extension of patent terms to at least 20 years, something that was adopted before only in the European Union (Maskus 1993). TRIPS sets minimum standards for IPR protection. Member countries are free to implement stricter standards if they wish to do so. As many developing countries did not join major WIPO conventions and as TRIPS covers all WTO members, TRIPS has greater coverage than the WIPO conventions.

2.2 Enforcement of IPRs

Perhaps the most significant contribution of TRIPS to the promotion of IPR protection around the world comes from the enforcement provisions incorporated into the agreement. By contrast, WIPO agreements did not specify in detail how IPR protection should be enforced. There are two aspects to the new enforcement provisions — one provides guidelines for effective domestic enforcement, the other is concerned with dispute settlement between WTO members.

Guidelines for effective domestic enforcement

Under the general obligations of TRIPS concerning enforcement, member states are required to provide effective and expeditious remedies to prevent infringements. These measures should be fair and equitable, not be too complicated or costly, be

available to both foreign and domestic right holders, avoid the creation of barriers to legitimate trade and be open to judicial review. It is important to note, however, that there is no obligation for countries to put in place a dedicated judicial system for IPRs.

The TRIPS agreement requires that right holders have access to civil and administrative procedures. It includes provisions on evidence of proof, the way injunctions prohibiting the production or marketing of potentially infringing products should be carried out, payment of damages, and indemnification of parties wrongfully accused. Provisional measures for expeditious action — for example, when there is a risk of evidence being destroyed — should be also available. Border measures allowing for the suspension of release by custom authorities of suspect IPR infringing goods should be available. Moreover, members should provide for criminal procedures, at least in cases of blatant trade mark counterfeiting or copyright piracy on a commercial scale.

Overall, these general provisions did not require much action in Australia, which already had a fairly strong IPR enforcement regime, but will demand a significant overhaul of enforcement practices in many developing countries. Actually, some developing countries have a strong legal code for IPR protection, but enforcement practices are much weaker. For example, many developing countries in Africa adopted the British or French IPR legal code. While protection may have appeared strong on paper, enforcement procedures were almost non-existent (Maskus and Penubarti 1995). The enforcement issue is an area where disputes about compliance with TRIPS are likely to occur, given the limited administrative resources and capabilities of many developing countries' judicial systems.

It is not clear from the TRIPS agreement whether the IPR administrative and judicial standards expected from developing countries should match the standards in advanced economies. In many developing countries, law enforcement is performing poorly in general, due to underfunding and lack of skilled manpower. To lift performance to first world standards on IPR issues in isolation, in order to fulfil international obligations, might prove costly and problematic in many places. TRIPS is virtually the first global agreement to set performance standards for the judiciary and law enforcement in a civilian area (Subramanian 1997). However, Article 41.5 of TRIPS limits the obligations of developing countries to invest resources in IP enforcement.

The dispute settlement mechanism of the WTO

The new strengthened WTO dispute settlement procedures that have emerged from the Uruguay Round apply to the TRIPS agreement. These procedures are faster because of strict time limits, and provide for greater automaticity in the adoption of panel verdicts and their implementation. There is also provision for cross-retaliation, subject to certain conditions. A country could impose trade sanctions on another country for violation of TRIPS obligations, provided multilateral authorisation has been obtained. The WTO Dispute Settlement Understanding, which defines general dispute settlement procedures for all WTO agreements, also covers TRIPS disputes.

So far, only one TRIPS-related dispute has been concerned with domestic enforcement (regarding some provisional measures in Sweden). All other disputes have been on substantive legal provisions, such as the scope of exceptions to granted rights (European Union versus Canada) and the conformity of administrative systems with TRIPS standards (United States/European Union versus India).

There is a five year moratorium (equal to the standard transitional period for developing countries mentioned in section 2.1) on the use of the integrated dispute settlement procedures as far as indirect violations of the agreement are concerned. These indirect violations refer to laws and enforcement procedures that might impair the expected benefits or pose impediments to the objectives of TRIPS, but are not direct purposeful violations of the agreement. The transitional arrangements incorporated into TRIPS recognise that most developing countries will need time to build up the institutional structures and train personnel to carry out effective enforcement of IPRs. The Council for TRIPS will review the implementation of the agreement after the expiry of the transitional period, subject to possible further reviews at two-yearly intervals. For most developing countries, the transitional period is due to end in the year 2000.

The WTO dispute settlement mechanism might prove beneficial for some developing countries, because it effectively eliminates the more uncertain and unmanageable dispute settlement processes that were the norms in the 1980s, when differences in regard to IPRs were negotiated bilaterally under the threat of unilateral trade sanctions. The WTO dispute settlement mechanism establishes a more predictable rules-based environment.

2.3 A summary of changes introduced by TRIPS

As explained earlier, TRIPS is based largely on earlier international IPR agreements, including the Paris and Berne Conventions dating back to the last century and the more recent Rome Convention and Washington Treaty. In addition to mandating stricter enforcement procedures, TRIPS contains a number of additions and elaborations to the legal and institutional norms and practices specified in earlier international IPR agreements. The most significant ones are:

- the minimum patent term is set to 20 years, the minimum copyright protection term for sound recordings and performances is 50 years (from the date of recording) and for broadcasts 20 years;
- computer programs and databases must be protected with copyright;
- countries must provide for the registration of service marks;
- the provisions of the Paris Convention regarding the registration of well known marks have been strengthened;
- no country can force the use of a foreign trade mark in combination with a local mark;
- the provisions of the Paris Convention regarding geographical indications have been strengthened;
- integrated circuit layout designs must be protected for at least ten years;
- artificially developed new varieties of micro-organisms must be protected through patents;
- no area of technology can be excluded from patent protection, with the exception of medical methods and new life forms above the micro-organism level;
- countries must protect new plant varieties, either within their patent systems or with a separate system of breeders' rights;
- countries must develop a legal system for protecting trade secrets from unfair disclosure in accordance with principles of fair competition; and
- the application of compulsory licensing is subject to severe limitations and must bear adequate compensation.

More details about these changes are presented in appendix A, in context of the discussion about the implications of international agreements for individual IPR categories.

2.4 Outstanding issues in TRIPS

TRIPS has an in-built agenda for review and further consideration of issues that were not resolved during the original negotiations. There are currently two issues subject to review under this in-built agenda — biological innovations is one, geographical indications is the other.

IPR protection of biotechnology

A review on how to incorporate biological innovations into TRIPS has already started, though it is not clear when negotiations as such will commence. The major contentious issue in this area is whether TRIPS should require mandatory protection of bioengineering innovations above the micro-organism level. TRIPS already requires the patentability of new micro-organisms, as well as 'sui generis' (that is, specially designed) IPR protection of new plant varieties.

Some of the controversy is related to ethical concerns about the development of new life forms using genetic engineering techniques. There is also debate whether new life forms created through bioengineering techniques represent scientific discoveries (which are non-patentable) or technological innovations. Australia already permits the patenting of new life forms. More details about the IPR protection of biological innovations and the current debate in TRIPS are presented in section A.3 in the appendix.

Geographical indications

The protection of geographical indications (covering both countries and regions) formed part of the Paris Convention and consequently the original TRIPS agreement. Current negotiations on this subject have been at the request of the European Union, which would like to see the same 'strong' protection that is now applied to wine and spirit geographical indications in TRIPS be applied to other products, including processed foods, agricultural products and handicrafts. It wants protection for a variety of terms that are now protected within the European Union as geographical indications. More details about the current treatment in TRIPS of geographical indications and the issues examined in the negotiations are presented in section A.6.

2.5 TRIPS and current IPR policy issues in Australia

The adoption of TRIPS in 1995 did not necessitate significant changes to Australian IPR laws, with the exception of raising the standard patent term from 16 to 20 years. Other minor changes that have been introduced in the patent and copyright legislation to make them fully compatible with TRIPS are described in sections A.2 and A.7 in the appendix. TRIPS also had little effect on IPR protection in other developed market economies, which have had strong IPR systems for many decades. The main effect of TRIPS has been on developing countries, in terms of imposing minimum legal protection standards and requiring the implementation of appropriate enforcement.

Proposed legislative changes

Apart from the two outstanding issues in TRIPS described in section 2.4, there are currently a number of other IPR-related subjects under policy review in Australia. From an economic perspective, the most significant one appears to be parallel importing. This means importing legitimate IPR protected products from overseas distributors not affiliated with the right-holders. Legislation to remove the prohibition on the parallel importation of sound recordings passed through Parliament in July 1998. However, the prohibition on parallel importing still applies to other copyright protected items including videos, films, computer software and in part also to books. Importation without the consent of the right-holder is also not permitted for patent and design protected goods. TRIPS neither sanctions nor prohibits parallel importing. The current policy debate on this subject is analysed in section 3.8.

There are a number of other IPR issues currently under consideration that are beyond or unrelated to the minimum standards set by TRIPS. These include:

- extending and refining the copyright protection code in relation to digital communications, cablecasting and network databases, in line with a new WIPO agreement (section A.7);
- clarifying and improving the protection of the content of electronic databases, such as telephone directories (section A.7);
- providing extended IPR rights to performers in conformity with another new WIPO agreement (section A.7);
- joining the Madrid Protocol for the international registration of trade marks (section A.5); and

- replacing petty patents by a new Innovation Patent that would provide short and restricted protection for lower level inventions (section A.2).

Other proposed changes will entail interpretation of TRIPS standards. These include:

- making amendments to the copyright protection of computer software, particularly in relation to corrections and decompilations (section A.7); and
- making changes to industrial designs legislation (section A.4).

The main thrust of the proposed changes is to further strengthen and refine the Australian IPR system. Some changes will improve standards while others will relax them, all within the boundaries set by TRIPS. Detailed description of these proposals is presented in the discussion about individual IPR categories in appendix A. An economic analysis of these reform options is presented in chapter 3.

Examination guidelines

The minimum requirements of TRIPS are not always clearly defined. While TRIPS has clear provisions on issues such as the minimum time length of protection, the range of subject matter to be protected, non-discriminatory treatment of foreign residents and the enforcement measures that should be implemented, the agreement does not codify rules on more technology-specific and subjective matters, like screening criteria in relation to novelty and inventiveness for patents or detailed definition of infringements to copyrights. In these complicated and ambiguous definitional areas there may be some scope to change local examination guidelines to suit national economic interests without violating the provisions of TRIPS.

Since in Australia these examination guidelines are partly based on common law (that is previous court decisions), it may be difficult on institutional grounds to introduce extensive changes in this area in the short run, but the scope for change may be much wider in the long run. It should be noted that common law does not prevent legislation that seeks to codify novelty and inventiveness in greater detail. The absence of a strict legal code seems to be related to the general preference for flexible definitions that can be adapted to new technologies. The way in which examination guidelines could be changed to bring more benefits (or reduce losses) to Australia is analysed in the discussion of patent screening criteria in section 3.4.

3 Economic considerations

This chapter examines various IPR policy issues from an economic perspective. Particular attention is paid to the international aspects of IPR protection, which highlight the difference between national and global perspectives about the economic gains from IPRs. It is against this analytical background that chapter 4 presents estimates of the IP content of Australian production and trade. The economic analysis presented here also extends to IPR issues that are not closely related to TRIPS.

3.1 The economic rationale of IPRs

All intellectual property involves some investment in intellectual effort, or investment in reputation in the case of trade marks. These intangible investments often can be easily copied or imitated by competitors. In many cases, without IPR protection it would be impossible to prevent 'free-riding' by persons who did not contribute to the original IP investment, and thus impossible to recover commercially the cost of such investment. Consequently, market incentives for IP investment would be deficient. The prevention of free-riding is a principal aim of all IPRs.

But the prevention of free-riding is not the sole economic objective of IPR legislation. While the prevention of free-riding is essential to ensure an adequate level of investment in IP, it is also in the interest of society to ensure the dissemination of new knowledge and ideas to the public. This is achieved by requiring patent disclosures, limiting the duration of patent protection and restricting copyright protection to expression but not ideas.

There is also a non-economic 'moral' argument for IPRs, based on the 'natural' right of people to the fruits of their labour. The philosophical debate concerning 'natural' rights, and more generally the rights and obligations of an individual to society, are not covered here. The focus of attention in this paper is on the economic analysis of IP-related potential market failures and how to prevent them. While IPR protection is in large part an economic issue, moral arguments couched in terms of 'equity' and 'fairness' still play an important role in IPR policy formulation and the judicial process.

An additional consideration relevant to certain types of IPRs is provided by the economic theory of public goods. Arrow (1962) argued that new (inventive) knowledge has certain public good characteristics. One public good characteristic of new knowledge is its non-excludability, which refers to the difficulty facing the creator of new knowledge in preventing others from making use of it. As noted earlier, the prevention of free riding (that is, the enforcement of exclusion) is a principal aim of all IPRs.

Another public good aspect of new knowledge is its non-rivalry property. This means that the use of knowledge by one person does not prevent its use by another, nor will its value to society depreciate as a result of use, even if its value to the inventor is reduced as a result of imitation. Hence from a society-wide point of view, there is a clear advantage in making such knowledge widely available. An example is new scientific and technological knowledge, which can be used in spinoff inventions without depreciating its value to society. In the area of arts and entertainment, however, where novelty and originality are valued for their own sake, the use of an idea or expression by others may depreciate its value to society, so there is less case for encouraging widespread use.

The non-rivalrous nature of much R&D means that there can be significant positive externalities associated with it. Thus, consideration of the economic rationale of patents and other forms of technological IPRs, such as trade secrets, the copyright protection of software, the 'sui generis' protection of integrated circuit layouts and plant breeders' rights, involves matters beyond just the prevention of free-riding.

The implications of innovation-related market failure have been discussed extensively in the IC (1995b) report on R&D (particularly section A.5). One possible solution is to treat new knowledge as a public good (like law and order or defence) and supply it through public funding. In respect to inventions, this may imply conducting the R&D work in public research institutions (like CSIRO or universities), or in private institutions funded by the government, and making the research results freely available to the public, apart from charging for the cost of dissemination.

But in practice, public funding is not always needed. IC (1995b, p. 163) notes that even in the presence of significant knowledge spillovers, private scientific research may still be undertaken if there are sufficient benefits to the firm from its provision. One necessary condition for these benefits may be adequate provision of IPRs. Thus, if the research is conducted by private enterprise, little or no dissemination of results (through publications or other means) may occur.

Some of the literature (for example, David 1993 and BIE 1995) refer to the main public R&D support instruments as the three Ps — protection (patents and other technology related IPRs), production (public research) and patronage (subsidies for business R&D). The mix between the three Ps will obviously depend on political and economic factors. Suffice to note that the more the research is orientated toward knowledge that is non-rivalrous, the more the balance tilts in favour of public provision or public subsidies.

While government (or other sponsors') funding may be essential for some types of fundamental research, the same need not apply to technological R&D. Firms can reap adequate rewards by protecting the results of their research in many ways. Apart from patent protection, these include manufacturing and researching in secret, focusing efforts where there are 'first mover' advantages, contracting researchers not to work with competitors, disguising products in ways that make reverse engineering more difficult and so on (IC 1995b). Using these methods, private firms are in the position to exclude (at least partially) other potential users of the new knowledge and to recover the cost of successful research. One of the functions of patents and other technological IPRs is to support private appropriation and reduce the need for public funding of technological research.

Another reason why new technological research is usually left to the business sector is connected with efficiency considerations. Such research often requires practical production experience that is not available to outside research institutions. Also, the large amount of uncodified 'tacit' knowledge and know-how generated in technological research often makes it difficult to transfer it or license it, until extensive production experience has been gained. Consequently, technological research can often be more efficiently conducted at the firm level than in separate R&D institutions, publicly funded or otherwise (Nelson 1990).

3.2 Cross-border spillovers of R&D benefits

R&D externalities

Over the last two decades many economic and econometric studies have attempted to measure the externalities of R&D, that is the difference between the social and private returns to R&D. The interest in this subject is primarily motivated by the fact that the externalities of R&D are the main rationale for government support for R&D programs in public research institutions, universities and the private sector. An extensive literature review on the externalities of R&D is presented in IC (1995b, section A4 and appendix QA).

The main interest in this paper is not on the rationale for government support of R&D, but rather on international IPR agreements and the difference between national and international perspectives on the benefits from R&D.

The positive externalities of R&D (also commonly referred to as spillover benefits) arise because even in the presence of patent protection, inventors cannot fully appropriate the commercial benefits from their inventions. Key reasons include the leakage of technical information within a short time to competitors, through reverse engineering and personal contacts, or the incorporation of some elements of the invention after the expiry of the patent term into new spinoff inventions.

As indicated in the IC (1995b) review, there are various approaches to measuring R&D externalities at different levels of aggregation, including:

- case studies of individual inventions;
- sectoral studies; and
- national studies.

Social returns are usually measured in terms of productivity improvements, with 'hedonic' indexing used to measure the value of new products. Private returns are based on reported commercial returns from innovations by private companies, or are inferred from changes in non-labour income at the sectoral level.

Most of the studies cited in IC (1995b) were case studies and sectoral studies. The majority were conducted in the United States, with others coming from Canada, Japan and Europe. While these studies showed large variations between estimated private and social rates of return, most of them indicated that on average, social returns to business R&D amounted to more than twice the private returns. According to Jones and Williams (1998), these social returns are likely to be underestimates.

IC (1995b, appendix QB) estimated the social rate of return to total Australian R&D (that is the contribution to GDP growth of public and private R&D), to be in the range between 25 and 90 per cent a year. These estimates are much higher than the average real rate of return to physical investment, which was less than 10 per cent in recent years. Even allowing for the riskiness of R&D, under conditions of reasonable capital market arbitrage, the required private rate of return to R&D is unlikely to exceed 15 per cent on average (BIE 1994a; Gruen, Bruce and Prior 1996). The difference between the social rate of return (measured in terms of contribution to GDP growth) and the average required private rate of return represents the average level of R&D-related externalities at the national level.

Measuring cross-border spillovers

One of the most difficult problems in estimating the social returns from R&D is in quantifying the contribution of foreign R&D to local technological progress. This issue is important for international IPR agreements and TRIPS.

The productivity improvements in the economy depend not only on the R&D invested domestically, but also on the knowledge gained from abroad, through channels such as publications, discussions, licensing agreements or the knowledge embodied in imported equipment. This means that any country can passively gain from technological progress abroad, by virtue of importing cheaper products and more productive equipment and by obtaining 'disembodied' knowledge from licensing agreements and open publications, including patent disclosures. The result would show up as a productivity improvement, raising gross domestic product (GDP), though it is sourced from other countries.

Similar cross-border spillovers apply in regard to the flow of benefits from domestic R&D abroad. The ratio between domestic sales and exports can provide some indication about where the spillover benefits 'embodied' in products are flowing. This subject is examined in more detail in the statistical analysis in section 4.3.

The measured productivity growth that is attributable to technological innovation is an outcome of local and overseas R&D efforts. In a small country, the bulk of technological productivity improvements are sourced from abroad. The great importance of technology imports to Australia is illustrated by the fact that more than 90 per cent of the patents registered here belong to foreigners. Similar ratios apply in other small economies (BIE 1994a).

Recently some econometric studies attempted to estimate the value of cross-border spillovers using aggregate R&D data. This research is still at an early stage, which may explain the wide disparities between the estimates. For example, in the framework of a multi-country model, Coe and Helpman (1995) estimated that domestic R&D contributed more to Australia's total factor productivity growth than foreign R&D. By contrast, a different multi-country model by Eaton and Kortum (1996), which also included cross-country patent applications among the explanatory variables, estimated that only 8 per cent of Australian factor productivity growth in the 1980s was due to domestic R&D, while technological innovations from the United States contributed 40 per cent, Japan 16 per cent and Germany 12 per cent. The econometric analysis in IC (1995b, appendix QB) adopted the methodology of Coe and Helpman (1995) and estimated that domestic R&D contributed more to Australia's total factor productivity growth than overseas R&D.

The crucial point in regard to international agreements is that the domestic spillover benefits of domestic R&D will be smaller than its total international benefits, because some of the benefits will be exported. On the measurement side, this implies that the estimated domestic rate of return to R&D is smaller than its total international rate of return, by virtue of excluding the spillover economic gains that it brings to people abroad. TRIPS and other international IPR agreements can be used as a means to bring national R&D efforts closer to the optimal level from an international perspective.

3.3 Forms of IPR protection for R&D

Patents

A few empirical studies have been conducted on the economic impact of patents and their incentive effect on private innovation. Virtually all these studies were based on opinion surveys of business and R&D managers. Summaries of results from major surveys in the United States and the United Kingdom are presented in Taylor and Silberston (1973), Levin et al. (1987) and Griliches (1990).

One of the surprising findings from these opinion surveys was that most managers reported that only a small percentage of R&D is dependent on patent protection. This is particularly true for complex engineering products. However, in some technological areas, such as pharmaceuticals, specialty chemicals, small instruments, toys and games, where imitation costs often represent a fraction of the original R&D costs, the commercial incentive for R&D is strongly dependent on patent protection.

Table 3.1 **Mean rating of effectiveness of alternative means of protecting new products and processes[a]**

	Processes	*Products*
	Rating	Rating
Patents to prevent duplication	3.5	4.3
Patents to secure royalty income	3.3	3.7
Secrecy	4.3	3.6
Lead time	5.1	5.4
Moving quickly down the learning curve	5.0	5.1
Sales or service effort	4.5	5.6

a 1 = not an important limitation; 7 = very important limitation.

Source: Levin, Klevorick, Nelson and Winter (1987).

A questionnaire survey by Levin et al. (1987), which was answered by 650 US executives, explored in some detail the reasons for the low rating of the importance of patent protection in most technological fields. Their questions included the rating of the effectiveness of alternative means of protecting the competitive advantage of new or improved processes and products. The ratings ranged from 1 to 7, with 1 being not at all effective and 7 being very effective. Summary of results are presented in table 3.1.

The appropriation mechanisms listed in table 3.1 are not mutually exclusive, but reinforce each other. An important point to note is that some secrecy is also involved in lead time and moving quickly down the learning curve. In the later cases, the competitive advantage is maintained by keeping important details of the innovation hidden from competitors, at least for a time.

On a broad conceptual level, one can discern three distinct means of appropriation in table 3.1, and these are secrecy, patents and oligopolistic market power. Oligopolistic power is referred to in sales and service effort, and also to some extent in the advantage of lead time and moving quickly down the learning curve. From the ratings presented, it appears that secrecy along with market power are more important means of protection than patents, particularly in the case of new processes. In fact, many process innovations are not patented in order to avoid revealing secrets in patent disclosures.

A recent Australian innovation survey conducted by the ABS and reported in Phillips (1997) found similar results. The manufacturers participating in the survey reported relying mainly on secrecy, being ahead in the market and the complexity of the product, to protect their innovations from competitors. A much smaller proportion of innovations were protected by patents than by the abovementioned

Table 3.2 **Limitations of effectiveness of patents for new or improved processes and products[a]**

Limitation	*Processes*	*Products*
	Rating	Rating
Only novel processes and products patentable	4.3	3.8
Patents are unlikely to be valid when challenged	4.2	3.9
Firms do not enforce patents	4.3	3.8
Competitors legally 'invent around' patents	5.5	5.1
Technology moving so fast that patents are irrelevant	3.4	3.3
Patent document disclose too much information	4.2	3.6
Licensing required by court decisions	2.9	2.8
Firms participating in cross-licensing agreements	3.1	2.9

a 1 = not an important limitation; 7 = very important limitation.

Source: Levin, Klevorick, Nelson and Winter (1987).

methods, particularly in process innovations. The pattern of responses did not vary much across firm size.

There have been various explanations for the limited importance of patents as a mechanism for capturing commercial benefits by the innovating firm. Levin et al. (1987) used survey results to rate the importance of various patent limitations (on a scale from 1 to 7 in ascending order of importance), as shown in table 3.2.

According to these ratings, the main limitations were from challenges to legal validity and from difficulties in preventing infringements by 'inventing around' patents. The fundamental causes for these inherent problems are the difficulties in defining the uniqueness of concepts and ideas, the wide proliferation of patents, and the large number of possible technical combinations and permutations that can be used to obtain similar operational characteristics or satisfy similar consumer needs.

Despite the limitations of patents, they sometimes possess certain advantages over public subsidisation of business R&D. Unlike subsidisation, they are not prone to accounting manipulations to reclassify expenditure items in a way that will attract subsidies. Moreover, patents reward achievements rather than expenditure. In fact, among the three Ps, patents are the only one that reward only commercially successful results. By contrast, public research and subsidies for private R&D help to cover the cost of R&D inputs. Despite the fact that these supports are often conditional on some selection process, they are not necessarily restricted to successful outcomes. When patents can provide effective protection, their incentive compatibility is perhaps their greatest advantage over other administratively feasible innovation support measures.

Trade secrets and oligopolistic market power

Apart from patents, secrecy and oligopolistic market power were mentioned earlier as the principal means for private appropriation of the cost of R&D. In fact, it is rather difficult to separate secrecy from oligopolistic market power. Oligopolies arise as a result of economies of scale or from firm-specific assets, such as knowledge or brandname. Technical trade secrets represent an important firm-specific asset that is conducive to the evolution of oligopolistic (or monopolistic) markets. In the following discussion, no attempt is made to separate secrecy from oligopolistic market power. They are lumped together as non-patent related appropriation mechanisms. Suffice to note here that oligopolistic power may include other elements in addition to secret information over technical innovations, such as market knowledge, managerial skills, unique technical standards, distribution networks and brandname.

Some estimates from the literature about sectoral variations in the relative importance of patent protection versus trade secrets and market power are reviewed in section 4.3 and sectoral estimates are presented in table C.1 in appendix C. In recent years the importance of trade secrets has increased, because the pace of incremental innovations in dynamic sectors such as electronics has rendered patent protection less relevant. By the time the patent application has been accepted, the innovation might be already obsolete (USITC 1988).

An opinion survey by Sherwood (1993) of managers in countries that lack strong enforcement of patent and trade secret protection in Latin America and Eastern Europe revealed serious concerns about the loss of new technology to competitors and a reluctance to embark on business R&D without effective mechanisms to prevent the leakage of information to competitors. The businessmen interviewed reported resorting to various techniques by which they sought to minimise leakage of trade secrets in the absence of effective legal protection of confidential information. Competitors can often get their hands on new technological knowledge by hiring away key employees in a kind of 'predatory hiring'. To defend against this, companies often segment their technology, exposing only a few workers to each segment. Another widely used method to maintain secrecy is by concealing the details of product-specific (dedicated) production machinery that is not traded in open markets. In addition, the software used to assist the operation and control of many types of new equipment is virtually a 'black box' to outsiders, which makes it very difficult to carry out direct imitation. These and similar techniques manage to limit the loss of confidential information to competitors, yet these methods of concealment have a negative effect on the advancement of technological knowledge within the firm and human resource development can suffer in many ways. Wherever feasible, contractual agreements are usually a preferred approach to maintain secrecy.

In places where there is no effective legal protection of either patents or confidential information, there is a clear lack of incentive to perform business R&D. The fact that legal protection of secrecy is an alternative protection mechanism to patents, which in the case of complex engineering products seems to be more important than patents in ensuring private returns from R&D, is probably the motive for the stipulation in TRIPS that all member countries should establish appropriate legal mechanisms for the protection of confidential information.

While stricter legal protection of trade secrets can provide a significant commercial incentive for private innovation, it must be noted that in many respects trade secrets are an economically less efficient instrument than patents for the purpose of fostering innovation. First, there are more serious legal problems in enforcing secrecy than in enforcing patents, as explained in section A.9. A more worrying

problem is that unlike patents, trade secrets conceal information that can be useful for technological advance. While patent disclosures may not reveal many details, they at least indicate the nature of the invention and the principles behind it. This gives useful information to other inventors about recent developments. This information can prevent duplication in research effort and provide helpful signposts on how to proceed with new developments. According to Foray (1995), patents provide a 'central coordinating mechanism' for the innovation system that is missing with trade secrets. Apart from leading to wasteful duplication in research, secrecy reduces the scope for society to realise benefits from the cumulative, interactive process through which ideas proliferate and generate still more ideas.

Another advantage of patents over trade secrets is that they facilitate technology transfer. Patents provide protection for licensed inventions, where some leakage of confidential information to the licensee is unavoidable, and where legal protection of secrecy would be difficult to attain.

In recent years the protection of trade secrets has been considerably tightened in the United States, but not in Australia. Dreyfuss (1999) suggests that the new US legislation might stifle innovation, because much of the innovative dynamism of the free enterprise system arises from imperfect protection and information leakages over time. Stronger legal protection of trade secrets and confidential information might impair the job mobility of experienced research staff and impede reverse engineering studies that do not infringe patent protection. In trade secrets, as in other forms of technological IPRs, the level of protection must strike a balance between providing additional incentives for business R&D, while ensuring that in the long run the results are disseminated to the wider community and can be incorporated into spinoff inventions. This subject is examined in more detail in the next section.

3.4 Patent policy issues

This section examines the optimal length and breadth of patent protection. One of the central issues is that optimality conditions differ depending on whether one is looking from a domestic or international perspective. Studying the global and domestic optimality conditions sheds some light on the desirability of harmonising patent laws across countries. This section also examines the pros and cons of providing IPR protection to low level inventions.

The optimal patent term

Theoretically, the optimal patent term (length) can be found by applying a standard optimality condition based on balancing marginal benefits against marginal costs. Patents, like other IPRs, operate in inherently second-best markets, and are crude attempts to address the conflict between the need to provide adequate incentive to innovation and the need to ensure effective knowledge diffusion in the long run. According to Scherer (1983) and David (1993), at the optimal level the benefits from longer patent term, by way of inducing additional R&D, should balance the cost of additional deadweight losses incurred through longer lasting patent monopolies and the dynamic losses incurred because of the delayed introduction of spinoff inventions. In symbolic terms, this can be put as follows:

$$iR\&D * eR\&D = dw + del \qquad (3.1)$$

iR&D is the incentive effect, representing the discounted present value (using the social discount rate) of the additional R&D induced by extending the patent term by one year

eR&D is the average level of externalities associated with the induced R&D, calculated by dividing the total difference between social returns and private returns by private returns

dw is the total discounted present value (using the social discount rate) of additional deadweight losses that result from prolonging the lives of patent monopolies

del represents the discounted present value of the dynamic efficiency losses arising from the delayed introduction of spinoff inventions by others.[1]

The optimality condition in equation (3.1) requires the equalisation of the present value of benefits resulting from a marginal extension of patent length to the present value of consequential economic costs. When applying this optimality condition at the sectoral level, the optimal patent terms for individual industries will not be the same, because all the terms in equation (3.1) will differ across industries. The reason for adopting a uniform patent term is legal prudence, which dictates setting a single term, in the absence of adequate information to set different terms in a reliable and legally defensible manner.

1 Spinoff inventions by others are not always delayed until the patent expires — frequently, the improvement will be cross-licensed back to the original patentee.

Apart from differences between sectors, there can be also differences in the optimal average patent term between countries. TRIPS requires only a minimum term of 20 years, but member countries are free to choose longer terms if they wish to do so. It is worth noting that before the introduction of TRIPS, the standard Australian patent term was 16 years, while the term for pharmaceuticals was 20 years, in recognition of the long testing time needed to obtain approval from drug safety authorities.

National and global perspectives

It is impossible to apply the optimality condition in equation (3.1) without specifying whether one is trying to optimise from a domestic or an international perspective. At least three different optimisation problems can be posed, depending on assumptions and point of view.

- What should be the optimal patent term in Australia, assuming that non-uniform overseas patent terms are given and are unaffected by the length of the Australian term? Following the introduction of TRIPS, this is now a purely academic question.
- What should be the uniform international (universal) patent term for the purpose of maximising Australian welfare?
- What should be the universal patent term for the purpose of maximising world welfare?

Equation (3.1) can be applied to investigate the third question. In this context, iR&D represents the incentive effect of changing the universal patent term on world business R&D. eR&D represents the average level of spillover benefits per unit of business R&D expenditure around the world. dw and del represent induced global monopolistic deadweight losses and delayed spinoff costs.

There is not enough information to assess whether the 20 years minimum term set in TRIPS is close to the global optimum. Assuming a risk adjusted required real rate of return to R&D of around 15 per cent (as assumed by Taylor and Silberston (1973) and some later writers), any increase in the patent term beyond, say, 16 years will have a negligible effect on the present value of the patent, assuming the net income stream remains constant (BIE 1994a; Gruen, Bruce and Prior 1996). Consequently, any increase in the patent term beyond 16 years is likely to provide little additional current benefits from induced R&D. On the other hand, long patent terms may delay the introduction of spinoff inventions by others, and that could impose a serious threat to world technological progress. Hence, it is not certain that extending patent lives beyond 16 years is a cost-effective approach to foster global technological development.

As for the second question, what should be the optimal universal term in order to maximise Australia's economic welfare, the answer is even more difficult. Given that Australia is much more a technology importer than an exporter (see chapter 4), it might seem initially that setting the universal patent term to zero would be the best solution, because such a change would reduce import costs by much more than export earnings. However, a zero universal patent term might lead to a large contraction in private R&D around the world, something that would not be in our economic interest. Hence, with a bit foresight, it might be in Australia's economic interest to observe a positive universal patent term, but one that is shorter than the optimal term for the purpose of maximising world welfare.

For a small net technology importing country like Australia, the iR&D term in equation (3.1) will be smaller relative to the dw term than the world average, thus justifying a shorter patent term. In addition, from the national perspective, higher prices imposed by a foreign patentee are a real economic cost, whereas from the global perspective only the resultant deadweight losses matter, while the rest of the monopolistic price increase is a transfer from one population segment to another.

The study by Gruen, Bruce and Prior (1996) examined the effect on Australia of extending from 16 to 20 years the universal patent term, following the introduction of TRIPS. It estimated that in present value terms, this change may cost Australia between $376 million and $3.8 billion over the next thirty years. Australian users of patents and patented products will pay between $1.5 billion and $7.4 billion more, although this cost will be offset by gains of between $1.1 billion and $3.6 billion to Australian producers of patents and patented products. This calculation was based on the estimated patent content of imports and exports, but ignored the R&D inducement that may result from the extension of patent lives. According to Gruen et al. over half of the cost to Australia will come from extending patents already in force, providing 'windfall' gains to the owners of IP already produced. Gruen et al. suggest that Australia should have not extended the terms of existing patents. However, given the provisions of TRIPS for developed countries, it seems unlikely that such an approach would have been accepted by the WTO. Nevertheless, it follows from the analysis of Gruen et al. that the move toward a universal patent term of 20 years was unlikely to have maximised benefits for Australia.

In regard to the first question, what would be the optimal national patent term assuming that overseas patent terms are given and are unaffected by the length of the Australian term and provided there is no political or other retaliation, it appears that for a small country such as Australia the hypothetical answer is zero. While zero patent protection would reduce the incentive for domestic business R&D, this could be more than offset by domestic free-riding on foreign R&D, thereby reducing the cost of importable patented products. Moreover, in this hypothetical

situation a country could benefit from imitating and exporting products subject to patent protection abroad but not locally, assuming there are foreign countries which permit the importation of such 'pirated' goods. For that reason, the removal of patent protection might be optimal even for a country that is a net technology exporter, provided patent protection abroad remains unaffected.

The possibility that the optimal policy for a small open country might be to remove patent protection entirely, provided this did not invoke retaliation nor alter patent protection abroad, illustrates the crucial need for international cooperation in setting standards for patent protection. This is a classic case of what is known as the 'prisoner's dilemma'. If each country followed strictly its national economic interest, the outcome for all would be inferior to what could be obtained if they coordinated their policies and agreed on a common strategy. The TRIPS agreement represents the latest cooperative attempt to establish such a common position, by setting the minimum patent term to 20 years.

The suggestion that zero patent protection could be optimal is purely a theoretical idea, abstracting from practical realities. Apart from the prospect of strong political and trade retaliation that may be invoked in response to such a move, one should not ignore the fact that patent protection is a major facilitator of technology transfers from abroad. As discussed in section 3.9, even countries with very limited domestic technological capabilities often find stronger patent protection serving their national interest by encouraging technology transfer and direct foreign investment from abroad. This was probably one of the main reasons why less developed countries agreed to TRIPS.

Optimal patent screening

TRIPS sets the standard for minimum patent length but not patent breadth. As explained in section A.2, patent breadth refers to the degree the patent is protected against imitations, in the sense that a similar invention would be considered an infringement. In other words, it defines the 'height of the bar' used for testing novelty. There are two distinct legal aspects of screening for novelty or non-obviousness. One is the criteria used to determine the eligibility of an invention for grant of a patent, the other is the criteria used to determine whether a product or process is an infringement of a granted patent. In legal terms the two sets of criteria are not exactly the same, but since they are similar in practice they are treated together in the following discussion.

Neither TRIPS nor the Paris Convention codify how the novelty test should be applied. Neither do these international agreements define the non-obviousness

criteria that should be used to test for inventiveness. With these technology-dependent qualitative screening criteria, it is not possible to lay down simple unambiguous rules that will cover all inventions. Individual patent offices give to patent examiners detailed guidelines on how to decide about novelty and non-obviousness, depending on the type of invention. In Australia these guidelines are partly based on common law (that is, previous court rulings) and partly on decisions by the Commissioner of Patents.

Since no conditions on these screening criteria are specified in TRIPS, in principle it is possible to adjust them to suit national economic interest. For the purpose of weakening patent protection, the appropriate policy would be to adopt narrow patent breadth, implying that most similar products and processes would not be considered an infringement to the patented invention. This means a narrow 'zone of exclusion' around the patent in relation to novelty. While narrow patent breadth may result in more patent applications being accepted as novel, it reduces the monopoly power of each patentee by providing less effective legal protection against competition from similar (or even imitative) products.

An index for patent breadth (ranging from narrow to wide) can be used in equation (3.1), to replace the patent term as the control variable whose value is to be optimised. According to the same logic that dictates small technology importing countries should provide short patent terms on grounds of national economic interest, these countries should adopt narrow patent breadth, in order to reduce the effectiveness of patent protection granted to non-residents.

The other major selection criterion is non-obviousness. Tighter screening criteria in relation to non-obviousness will reduce the coverage of patents, by restricting the number of inventions that will be granted protection. Like narrow patent breadth, tighter non-obviousness criteria could benefit a technology importing country by weakening the strength of patent protection. The BIE (1994a) suggested tightening the non-obviousness criteria in order to bring Australian practice closer to the standards applied in some developed countries.

By changing screening criteria, a WTO member can effectively weaken patent protection without contravening TRIPS. This points to the possible need to adopt more thorough international patent law harmonisation in the future. A move toward harmonisation could improve the effectiveness of the global patent system (Sherwood 1993). But until such time that this kind of international harmonisation has been agreed on, Australia might have something to gain economically from relaxing the novelty test and adopting tighter non-obviousness criteria. At least in the short run, there could be significant institutional impediments to extensive alterations to patent examination guidelines, which are based partly on common law

(that is, previous court decisions). Nonetheless, this is an important subject that may deserve closer attention in the future.

On a related subject, Maskus (1997) notes that there is considerable room within the mandates set out in TRIPS for countries to adopt liberal policies in providing exemptions to exclusive rights in patents. He suggests that this potential flexibility could be used to promote reverse engineering aimed at developing non-infringing inventions. However, exemptions to exclusive rights under patents is currently a subject matter of a dispute in the WTO (between the European Union and Canada) and there is a related dispute on copyright. This dispute, and its outcome, would constraint any attempt to explore the boundaries of allowable exceptions to patent rights.

The treatment of low-level innovations

There are currently two proposals under consideration to give more IPR protection to low-level innovations. One is the Australian Innovation Patent mentioned in section A.2, which is intended to replace petty patents and is concerned with lowering the test for non-obviousness. The other proposal, raised in the ALRC (1995) report, is to extend IPR protection to certain functional designs, including the appearance of internal shapes that are usually not visible (see section A.4). In broad terms, the effect of both these proposals could be to provide IPR protection to low-level innovations that would not pass the standard patent test for novelty and non-obviousness.

As with most IPR policy issues, these suggestions have to be examined from a global and domestic perspective, because one gets different answers depending on the point of view. From an international perspective, there is some merit in providing IPR protection to low-level innovations. Like copyrights or aesthetic designs, such innovations require an initial intellectual investment that could be imitated at much lower cost by free-riding competitors. Hence, it can be argued that low-level technical innovations should receive protection like any other IP, even though they might yield fewer positive externalities than standard patents. Arguably, the absence of significant positive externalities also applies to most copyright protected works, ornamental designs and trade marks, and not just to low-level innovations.

However, there are a few problems in this area that do not apply to non-technological IPRs. First, if the term of protection for low-level innovations is close to that of patents (for example, in Australia designs are protected for 16 years), then this may result in more valuable inventions (involving more positive externalities)

not being rewarded with a longer term of protection. The way to overcome this problem is by providing significantly shorter term of protection to low-level innovations than the standard patent term.[2]

Secondly, the provision of IPR protection to various new applications and modifications of the existing technological stock may impose significant additional monitoring costs on innovators, to check what is protected and what is not. Hence, compliance costs could rise substantially, while the gains in terms of generating socially useful innovations may be low. Notwithstanding these problems, from a global perspective, the case for some IPR protection for low-level innovations cannot be easily dismissed.

The situation is quite different from the domestic perspective. Since TRIPS, the Paris Convention and other international IPR agreements do not require the protection of low-level innovations, many (but not all) countries do not offer such protection. Consequently, if Australia adopted a different line, it might offer protection beyond the international norm. This could lead to local and overseas innovators obtaining protection in Australia and charging higher prices in Australia than in other countries. The result could be the subsidisation by Australian users of IP that is not protected in many other places.

This issue highlights the point that from the perspective of national economic interest, it is generally not advisable to provide IPR protection beyond the minimum standards stipulated in international agreements.

The position on biological innovations

As noted in section A.3, Australia currently provides stronger protection for biological innovations than other countries in the world, with the possible exception of the United States and Japan. This brings back the issue discussed in the previous section that national economic wellbeing could generally not be enhanced by providing IPR protection beyond the standards required by international agreements. TRIPS requires patent protection for new micro-organisms and some form of IPR protection for new plant varieties. But the Australian legislation goes much beyond that and provides patent protection to many new life forms created through bioengineering techniques.

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2 Arguably, it could be in the national economic interest to provide less protection to innovations involving large externalities in order to encourage their diffusion in the economy. However, a preferred solution would be to support innovations with large externalities through patronage rather than protection, provided such innovations can be identified a priori.

A review of the provisions of TRIPS concerning the treatment of new life forms above the micro-organism level has already started, though it is not clear when formal negotiations will commence. Arguably, it could be in the global interest to introduce worldwide mandatory IPR protection for new life forms, similar to current practice in Australia. Examination of the pros and cons of this proposal from a global perspective is outside the scope of this paper.

In any event, until such time as an agreement along these lines has been reached, it does not seem advisable to provide protection beyond common international standards. The fact that Australia may be more an exporter than an importer of biotech innovations does not mean that stronger domestic protection standards would be to our benefit. Without reciprocal protection in other countries, our biotech exports remain unprotected abroad, while some foreign inventors might reap monopoly profits in Australia that they would not obtain in most other places. Only if the main threat to Australian inventors is from imitation by other Australians would higher protection standards be warranted to provide the desirable level of incentives for innovative activity. However, this is not very likely. It seems more likely that in the biotechnology, as in most other industries, the main sources of new technological knowledge as well as the major threats of imitation come from abroad.

It is possible that in a new field such as biotechnology, some demonstration examples are needed on the merits of stronger IPR protection. In this context, the experiences gained through stronger protection regimes in Australia, the United States and Japan might prove useful. However, if the TRIPS negotiations will not lead to the protection of biotech innovations in line with current Australian standards, then, perhaps, consideration should be given to lowering these protection standards in order to bring them closer to international norms.

3.5 Policy issues concerning industrial designs

The economic rationale for the protection of aesthetic designs rests on the principle of preventing free-riding. Unlike patents, aesthetic designs are generally not linked to economic externalities. For the purpose of preventing free-riding in respect to industrial designs, the principal requirement is to establish clear criteria for novelty or originality — not an easy task, given the similarities between many shapes and forms.

Current policy deliberations go beyond that issue. Following the Australian Law Reform Commission (ALRC) three year inquiry into the Designs Act (published in 1995), some of the policy issues that have been considered are whether to extend

the boundaries of design protection to cover certain functional designs and how to treat spare parts.

Functional designs

Functional designs usually refer to certain shapes dictated by aerodynamic or hydrodynamic considerations. Examples include aeroplane wings, the shape of ships, boats, propeller blades, turbines and the shape of car bodies to reduce wind drag. But in fact, the definition of functional design can extend further than that. The shape of virtually any part in machinery and equipment is designed to satisfy some function and to fit in with the shapes of other components in the equipment.

Consequently, if design protection is extended beyond protecting visual appearance to encompass certain functional designs, it is hard to define a clear boundary in the later case. As noted in section 3.4, in many cases the protection of functional designs could in effect be a protection for low level innovations (BIE 1995). The discussion there led to the conclusion that it would not be economically advantageous to provide protection to functional designs (or other low level innovations), given that this is not required in TRIPS or any other international agreement signed by Australia. Unless some binding international agreements emerge for the IPR protection of certain functional designs, or some agreement along this line is worked out with our major trading partners through the APEC forum, there is no sound economic case for the extension of protection to functional designs.

According to Robertson (1999), extending design protection to certain functional designs is not included among the options considered by the Government to reform design legislation.

Spare parts

Another issue that is under consideration by the Government following the ALRC (1995) report is the treatment of spare parts. Currently, motor vehicle exterior parts used in smash repair are design protected. The protection of at least some spare parts (even if only exterior) raises concerns about ethical trading practices (IC 1995a; Walker 1998). Since consumers of cars, boats and other consumer durables do not make fully informed decisions (reflecting the high cost of acquiring the necessary information), manufacturers can mislead the public about the real price of cars (and other consumer durables) by lowering the price of the original equipment and raising the price of spare parts. This cross-subsidisation may be a way for an oligopolist to beat the competition in the original equipment market, while

recouping its losses in the captive spare parts market, where monopoly profits can be made. The effect of this cross-subsidisation is price distortion that lowers economic efficiency.

The ALRC (1995) report proposed a regime under which spare parts would be protected under the Design Act, except where competition objections were raised and sustained by the Australian Competition and Consumer Commission (ACCC), which would be required to evaluate these problems and balance them against any public benefits arising from protection.

The IC (1995a, p. 139) report on vehicles and craft repair and insurance presented a simpler recommendation, saying that:

> Economic efficiency would be promoted if design protection were not provided in those instances where design is dictated solely by the function which products are sold to perform. In this regard, 'function' should be interpreted to include commercial as well as technical function. The function of a spare part for a motor vehicle is typically to restore the vehicle to its previous condition, appearance and value. Accordingly, where spare parts either 'must fit' or 'must match' the vehicle which they are intended to repair, their design is, to that extent, dictated by their function. Such parts should not qualify for design protection.

There is considerable merit in this proposal, which could reduce serious price distortions in the spare parts and vehicle repair markets. However, the removal of design protection on exterior spare panels and other visible parts might require further legal scrutiny, to ascertain that it complies with the requirement of TRIPS to provide protection for the appearance of new industrial designs. The Government is currently considering introducing legislation to remove design protection to exterior vehicle spare parts (Robertson 1999).

3.6 Policy issues concerning copyrights

As discussed in section A.7, copyrights protect a wide range of works, ranging from literature, music, and painting to films and software. The economic rationale of copyrights is primarily to prevent free-riding and plagiarism, so as to get optimum production.

Landes and Posner (1989) speculate on what would happen in the absence of copyright protection. In this situation, in the presence of rapid copying technologies, the main competitive advantage of the authors of, say, fiction, would be in a short headstart over their duplicators. This would give incentive to the creation of faddish, ephemeral and otherwise transitory works, where a short lead time can be useful. New releases would not be preannounced. There would be a shift toward the

production of works that are difficult to copy (through encryption techniques and the like). Authors would be more likely to circulate their work privately, and contractual restrictions on copying would multiply. In literature, media and the recorded arts the situation would be chaotic, assuming that any business activities could be sustained at all.

Evidently, copyright is an indispensable tool in modern societies to maintain proper business practices in areas where some intellectual investment is involved, even if the output is more for entertainment than for a better understanding of the world. In fact, copyright protection has a more important role in preventing market disorganisation than patents, given the vulnerability of most copyright material to easy duplications.

Copyrights versus contracts

It is interesting to note that Landes and Posner (1989) wrote their analysis of the rationale for copyrights before the rapid expansion in digital communication technologies. With these new technologies (including the Internet), it is theoretically possible to protect written and recorded material from unauthorised copying through instantaneous contractual agreement between the publisher and the user. In order to gain access to a digital file, the user may undertake, by clicking a button on the computer screen, not to copy the material or disseminate it, and to abide by other restrictions imposed by the publisher. This is the so-called 'clickwrap' licensing arrangement. A similar licensing method, so-called 'shrinkwrap' licensing, occurs when the user removes the plastic wrapping of a disk containing software or data, and thereby agrees to abide by the licence terms attached to the disk.

The increasing importance of contractual agreements between the user and the publisher through 'clickwrap' and 'shrinkwrap' licensing has aroused serious concerns in some legal circles (Evans 1999; Reichman 1999). Recently introduced legislation in the United States concerning information licences (Article 2B) accentuates the tendency for contracts to assume the leading role in the management of information for electronic transactions. The danger with private contractual arrangements is that they may exclude the 'public interest' provisions of copyright law, including the right to use ideas and data contained in copyright protected material, as well as the 'fair use' provisions for education, research and libraries. The implications in regard to the dissemination of scientific research are particularly worrying, because privately created information licences may prohibit the citation of data appearing in scientific publications, whereas the citation of published data (with credit given to the author) is permissible under copyright law.

The optimal breadth and length of copyright protection

As for patents, the examination of optimality conditions for copyright protection can yield insight, even though the formula itself cannot be applied to obtain numerical estimates in practice. On the most abstract level, an optimality condition similar to equation (3.1) would require the present value of marginal costs to be balanced against the present value of marginal benefits.

For the sake of illustration, assume that the length of the copyright term is the control variable, which means that marginal costs and benefits are estimated to result from lengthening the copyright term, say, by one year. In this case, the marginal benefits arise from reducing the under-production of expression. Marginal costs represent the deadweight losses incurred as a result of prolonging the lives of copyright monopolies.

Given that the market life of most copyright material does not exceed a few years, the standard copyright term lasting for 50 years after the death of the author may seem excessive. However, it should be borne in mind that only expression is protected, not concepts and ideas. Long copyright protection terms were adopted by major European countries already before the Berne Convention of 1886. At that time, communications were slower and the quantity of copyright output was much more limited than nowadays, so its commercial usefulness tended to last longer. Also, the rationale of legal protection was orientated more toward moral arguments than economic considerations.

A similar optimality condition to length can be derived for copyright breadth, by taking an index that represents the legal constraints placed on copying segments of the work or the restrictions placed on adaptations and translations. In this case, wider breadth (representing more legal constraints against copying and adaptations) would have a similar effect to a longer protection term, by providing more protection to the copyright holder. At the optimal level of copyright breadth (subject to a given copyright term), marginal benefits should balance marginal costs.

A different modelling approach is presented by Landes and Posner (1989). The model examines the protection of literary works. A higher level of copyright protection has two opposing effects. On the one hand, by providing more effective protection against copiers and imitators, it increases the profitability of new works and thus provides added incentives for their creation. On the other hand, a higher level of protection implies that tighter constraints are being placed on the author's ability to borrow expressions or style from earlier publications. That means that the fixed cost of creating new work will go up and originality will improve as well. There will be an optimal level of copyright protection (in terms of length, breadth or

a combination of both) that will balance the marginal benefit of a change in the level of protection against its impact on the 'cost of creation'.

An important point that emerges from this analysis is that copyright protection is more efficient, the more it can ensure protection against free-riding, without raising the cost of creating new work. This implies that protection ought to prevent the copying of expression without hampering the adoption of ideas. The protection of expression alone poses a substantial cost hurdle in the path of would be free-riders, because much of the original literary or artistic effort was invested in shaping and expressing the work.

Copyright legislation is an uneasy compromise between the aim to ensure a free flow of ideas and the goal to prevent free-riding by plagiarists and close imitators. While the law does not prevent the adoption and utilisation of ideas by others, there are certain elements in it that may impede the flow of ideas. The restrictions on the adaptation of existing work is a prime example. The ORR (1995) submission on copyrights suggested that expansion of the educational and 'fair use' defences against infringement may be one way to facilitate the dissemination of educational material. There may be also a case to review the legal restrictions on adaptations, which might impose an impediment to the diffusion of artistic ideas.

Finally, a few words about national and global perspectives. International coverage of copyright protection is absolutely essential, given the availability of easy-to-use copying equipment around the world. In contrast to patents, much of the copyright protected output consumed in Australia is locally created, as discussed in section 4.4 (see table 4.11). Nevertheless, Australia is still a net publications, arts and entertainment importer. The general orientation of our policy should be to adhere to the provisions of TRIPS and other relevant international agreements, but not to exceed the minimum required, if the aim is to minimise the transfer of income to foreigners.

In the following sections, a few comments are made on a number of copyright-related policy issues currently under review.

Copyright and technological change

Rapid technological changes in the computer and telecommunications industries and the convergence between them pose a challenge to copyright legislation. A major problem is that copying in a digital form can be done much quicker and more cheaply than through photocopiers or the printing press. As noted in section A.7, consideration is currently being given to modifying various sections of the law dealing with transmission rights through cables of text and images and rights related

to ‘making available to the public’ through the Internet. These deliberations are bound up with the question of whether to join the new WIPO Copyright Treaty (WCT), which deals mainly with transmission and digital communications rights.

Most of the technical details related to this subject are beyond the scope of this paper. The implications of the rapid progress in communications and digital technologies on copyright law has been under review for a number of years. In 1995, the Office of Regulation Review (ORR) made a submission to the Copyright Review Committee’s ongoing review of the Act. Much of the ORR’s submission was concerned with examining from an economic perspective the appropriate legislative responses to technological change, covering issues that are still pertinent today.

The main thrust of ORR (1995) recommendations was not to extend copyright protection beyond the minimum standards required by TRIPS and to follow a cautious line in making legislative changes. ORR advised extending the coverage of copyright material in small steps, should the need arise due to technological change. ORR expressed strong reservations about making the legislation ‘technology neutral’, because such a sweeping reform might introduce additional layers of protection that do not presently exist. An attempt to make copyright ‘technology neutral’ might be over-ambitious and represent a departure from historical experience, because in the past copyright law was adjusted to accommodate technological developments that had already occurred.

The ORR also had strong reservations against ‘simplifying’ the law, because it could lead to providing broader protection than is currently available. If the rights attached to copyright were simplified and broadened, the ORR suggested that it would be appropriate to extend the defences against infringements, such as ‘fair dealing’ and educational use.

The ORR submission also noted that digital communication not only leads to easier copying, but also offers various technological solutions to charge automatically for usage. These devices include passwords, account numbers, identification codes, encryption and the monitoring of use. The WCT treaty recognises the importance of these technical–commercial devices and includes provisions to prevent their abuse.

The ORR (1995) submission was written before the issue of joining the WCT treaty was raised. In the light of the analysis presented in this paper and the ORR submission, it appears that joining a more advanced international agreement, setting down a detailed code on how to deal with digital communications issues might be economically beneficial for Australia provided our major trading partners in the

copyright area (United States, Japan and the European Union) also joined the agreement.

As long as Australia follows general international standards in upgrading and clarifying the legislation on cablecasting, multi-media and digital communications, and provided these international standards are not excessive, the economic outcome will probably be beneficial. However, as noted in ORR (1995), the outcome is likely to be less positive if Australia adopted 'world leading edge' protection standards beyond current international norms. Such a policy might yield substantial profits to large transnational corporations, without bringing similar economic benefits to the local population. The danger lies in extending rights and coverage and not in improving and clarifying the code.

As noted in section A.7, the Government released in February 1999 for public comment a draft Copyright Amendment Bill concerned with reforming digital communications and transmission rights. The adoption of the bill would align Australian legislation more closely with the obligations prescribed by the WCT agreement.

Copyright and computer software

Computer software receives IPR protection as literary work — a method of protection that was adopted in Australia more than a decade before it was required in TRIPS. The protection of software against copying (but not against imitation) represents in effect a fairly strong IPR protection, because it is very difficult to understand or modify computer programs without access to full documentation and flow charts. In fact, it is usually easier to rewrite a program from scratch than try to make significant changes to it. If the program is only available in machine language (object code), it is virtually a 'black box' and modification is almost impossible.

Nonetheless, the need often arises to make minor changes to a program, either to correct mistakes that were uncovered in the course of working with it, or in order to make it compatible with a different operating system. As mentioned in section A.7, the CLRC (1995) review of software took the view that modifications and decompilations of programs should generally be permissible for the purpose of improving interoperability between systems and for correcting program errors. The IC (1995d) report on computers and software supported this recommendation. A reform along this line could help to improve the effectiveness and flexibility of using software. Program modifications do not undermine the purpose of the law to prevent free-riding, provided the modified version is only for internal use and is not permitted for resale by anyone other than the original owner. In February 1999 the

Minister for Communications, Information Technology and the Arts and the Attorney General (Alston and Williams, 1999a) announced that the Government intends to implement the recommendations of CLRC in relation to decompilations and error corrections.

While software is usually protected through copyright, in certain cases some patent protection is also provided. In the 1990s Australia has followed the lead of the United States in declaring certain computer software concepts and methods patentable. Previously, software techniques were not patentable because they were not considered to represent inventions. Stoianoff (1999) reports that many industry experts regard the non-obviousness level of most patented software techniques to be low. More worrying is the fact that the patenting of software may stifle innovation, given the simultaneous creation and recreation of similar software concepts and techniques around the world. Moreover, this type of protection, which is not explicitly required in TRIPS, might benefit mainly foreign patentees. In recent years the patenting of software has been growing rapidly in Australia and in 1997 the number of software registrations exceeded 1200 — more than 10 per cent of total patent registrations (Webber 1999).

TRIPS does not limit the technological field of patents. It is possible that countries that deny patent protection to new, inventive, industrially applicable software are in potential breach of TRIPS. In Australia, there is a need to review in which areas the patent protection of software techniques is justified on economic grounds, and to examine the minimum TRIPS-compatible patenting requirements.

The rights of performers and journalists

As noted in the appendix (section A.7), the copyright-related rights of performers and journalists have recently come under the spotlight. While the July 1998 amendment to the Copyright Act restricted the rights of employed journalists, the proposal to join the WIPO Performance and Phonograms Treaty (WPPT) aims to extend the rights of sound performers. Details on these rights are presented in section A.7.

The arguments put in favour of special ownership rights for performers and journalists tend to ignore the fact that the main economic rationale of copyright protection is the prevention of free-riding. The claim about the moral right of authors, publishers, performers or broadcasters to the fruits of their labour is based on an ethical understanding of what is ‘fair’ rather than on strictly economic reasoning (in the sense of not addressing problems of market efficiency).

Looking only at the economic rationale, it is hard to justify granting separate rights on the same piece of work to an employed journalist and a newspaper proprietor or to a singer and a record maker. For the purpose of maintaining a properly functioning IP investment environment through the prevention of free-riding, one would expect ownership rights to be allocated exclusively to the party who bears the commercial risks for creating that piece of work. According to this economic reasoning, it is hard to justify the current provisions granting copyright ownership of commissioned work to the author, artist or performer who carried out the work and not to the commissioning agent who paid for it. On the other hand, it can be argued that provided free-riding has been prevented, the ownership of IPR rights is a distributional issue that will have little effect on the incentive to produce or invest in IP.

A possible approach to allocating ownership rights is through contractual arrangements between the parties concerned. According to one view, the less is stipulated rigidly by law and the more is negotiated between the parties concerned, the more efficient the outcome is likely to be (Buchanan 1985). It is not necessarily the function of the law to define different types of ownership rights, depending on whether one is a performer, journalist, publisher, or broadcaster. It might be better to leave the allocation of ownership rights to contractual arrangements between the parties concerned. The Australian Copyright Act gives precedence to contractual agreements in defining ownership rights, which is in conformity with economic logic.

To examine in more concrete terms current policy issues in relation to ownership rights, consider the case of employed journalists. They are typically on a fixed salary, regardless of the cost of publishing the newspaper or the commercial risks related to the enterprise. In this situation, in order to ensure a properly functioning IP investment environment, all the rights attached to copyright protection should be given to the newspaper owner, who is funding the IP investment. Journalists should still be entitled to moral protection against misrepresentation of their writings that could damage their honour and reputation, but not to protection that can provide commercial gains on financial investments they did not make. This is similar to the case of salaried engineers working in a team on a patented invention. Such engineers are not entitled to any special rights in respect to the patent, and there is no economic reason why the same treatment should not be accorded to salaried journalists.

The situation of freelance journalists is different. They bear some commercial risks in the course of their work. Arguably, in this situation freelance journalists should be entitled to a certain share of the rights attached to the publication. What that share should be does not have to be dictated by law. The contractual arrangement

between journalists and publishers can specify (in addition to monetary rewards) copyright-related rights, such as the usage of the article in another publication, the rights related to adaptations and the like. In the absence of contractual agreements, freelance journalists currently possess all the rights over their copyright work.

Given the feasibility of allocating ownership rights in a flexible manner through contractual agreements, the allocation by law of dual ownership rights to journalists and newspaper proprietors or to performers and record makers has little economic justification. The amalgamation of copyright with other issues, such as 'equitable remuneration' in the proposed extended performers' rights, is rooted in a confused view about the basic economic rationale of copyright protection. In effect, it would tie copyright protection to remuneration rights that belong in the industrial relations area.

In summary, every effort should be made to minimise possible confusion arising from split ownership rights on the same piece of work. There does not appear to be an economic case to join the WIPO Performance and Phonograms Treaty (WPPT) which sets out dual copyright ownership over sound performances. Legal changes to the allocation of copyright ownership would not contravene TRIPS, provided the changes did not discriminate against foreigners.

3.7 The rationale for trade marks

As noted in section A.5, in some respects trade marks are not strictly a category of intellectual property. They are used to differentiate similar goods and services and to convey the message that the good bearing the mark possesses a certain quality. Despite their distinct character, the economic rationale for their protection is the same as for other IPRs — the prevention of free-riding. A firm that invested substantial resources in building up its reputation through quality control and advertising could lose much of this investment if free-riding competitors were not prevented by law from using its trade marks or very similar marks on their goods and services.

The benefits of trade marks

Landes and Posner (1987) identified two major economic benefits from trade marks. First and foremost, trade marks reduce consumer search costs. In their model, the real price of a good is made up of the market price plus the search cost for finding the most suitable choice among a range of substitutes. Properly differentiated and easily recognisable trade marks can cut down on search costs.

Secondly, in order to convince the consumers to reduce search costs by relying on the trade mark, the producer of the marked good has to maintain a consistent quality over time and across consumers. Hence trade mark protection encourages expenditure on quality. This means that trade marks have a self-enforcing feature. They are valuable because they denote consistent quality, and a firm has an incentive to develop a trade mark only if it is able to maintain consistent quality.

In many cases trade marks are more than just information tools, but provide some intrinsic utilitarian value to the consumer by virtue of representing status symbols. Sometimes, trade marks also fulfil a linguistic role in providing a short-cut reference to certain products.

The limitations of trade marks

On the cost side, trade marks are closely linked to oligopolistic competition, and the economic merits of this competition have been subject to much debate. In terms of efficiency losses, oligopolies have some common features with monopolies, including lower competitive pressures to improve efficiency and deviations between prices and long-run marginal costs. It is also claimed that oligopolies lead to a reduction in economic efficiency due to wasteful advertising and excessive distribution costs (Kaldor 1950). Apart from trade marks, aesthetic designs also play an important role in sustaining oligopolistic market structures.

To what extent trade marks are helpful in reducing search costs partly depends on the nature of the competition and advertising (deceptive or informative) in the market. In Australia deceptive advertising is actionable under the Trade Practices Act. It should be noted that indications to consumers about quality can be also provided through labelling by certified quality inspection agencies. The ingredient listing and calorie count labels attached to some food products and the energy consumption rating of equipment are alternative means to convey information about quality.

While in some cases trade marks may not provide the most suitable information, in many other cases they fulfil an important role in reducing consumer search costs. The economic benefits of trade marks, by way of identifying source and indicating quality, do not depend much on whether one is looking from a domestic or an international perspective.

Current trade mark-related policy issues

There are currently two major policy issues that are related to trade marks, both with significant international implications. One is the on-going TRIPS negotiations concerning geographical indications. This subject is reviewed in section A.6. Moves by the European Union to extend the strong protection of geographical indications now applied to wine and spirits to other products, such as processed foods, agricultural products and handicrafts, would hinder our competitiveness in export markets against regions that have already acquired a strong reputation for quality.

Another international issue that has recently emerged is the occasional conflict between trade mark names and similar or identical Internet 'domain' names used by other than the trade mark owner (Hourigan 1999). This is becoming a growing problem due to the rapid proliferation of Internet domain names (more than 4.5 million worldwide according to recent counts). WIPO is currently examining how to institute an international system of Internet domain names and establish dispute settlement procedures to resolve conflicts between trade marks and Internet domain names at the international level. In the Australian commercial name domain (COM.AU), such a conflict can be resolved either through negotiation, litigation or arbitration by the Australian Commercial Dispute Centre.

3.8 Parallel importing

Legal background

An IPR issue currently in the limelight is parallel importing. Parallel importing means to allow the importation of an Australian patent, copyright or design protected product from any distributor abroad who sells the legitimate IPR protected product but is not affiliated with the right-holder. Apart from sound recordings, packaging and labels (where legislative changes have been introduced in July 1998) and books that have not been imported into Australia within a prescribed period of time, parallel importing is prohibited for all copyright material. Parallel importing is formally allowed for patent and design protected goods, but the legislation provides exclusive right over importation to the right-holders, who can prevent parallel importation if they want to.

In legal terms, parallel importing is closely related to the concept of 'exhaustion' of IPRs. This means that after the first distribution of a product (for which IPR protection is available), right-holders will no longer be entitled to make use of their exclusive rights to prevent buyers from further distribution of the product. From an

international perspective, this means that Australian traders should be able to import IPR protected products that are sold by right-holders or their distributors in any overseas country.

The TRIPS agreement neither endorses nor prohibits the principle of 'exhaustion'. Despite serious efforts, the United States and other IP exporting countries were unable to include in the agreement a prohibition on 'exhaustion' (Subramanian 1997). At stake is the issue of whether right-holders could prevent parallel imports and sustain price discrimination between markets. Recognising 'exhaustion' means that governments can allow parallel importing in order to prevent domestic prices from reaching levels that a price discriminating monopolist would be able to maintain. The support of parallel importing by many developing countries in the TRIPS negotiations is a bit puzzling, given that some empirical evidence suggests that under conditions of IPR-related price discrimination, poorer countries often enjoyed lower (rather than higher) prices (Malueg and Schwartz 1993).

The Australian patent and design legislation allows for parallel importing under the 'exhaustion' principle. On the other hand, the legislation recognises the opposing principle of the exclusive right granted to the patentee over the commercial exploitation of the invention, including its importation. Despite the ambiguities of the legislation, legal problems in relation to parallel importing of Australian patent or design protected goods have seldom arisen in the past. The resolution of such disputes is based on common law (previous judgments).

The low level of litigation may be because with exclusive rights over importation provided to the right-holder, parallel importing without the consent of the right-holder is prevented in practice, notwithstanding that according to other sections of the law, parallel importing (presumably with the consent of the right-holder) is permitted. The PSA (1993, p. 154) report on farm chemicals states:

> Under the current Patents Act, parallel imports of products subject to an Australian patent are prohibited without the consent of the owner of the patent. Advice from the Government Solicitor has confirmed this.

Before the adoption of the July 1998 amendments concerning sound recordings and packagings, the Copyright Act explicitly prohibited parallel importing. A notable exception was for books, where parallel importing is allowed if a new title is not put on the local market within 30 days after its publication, or an existing title is unavailable in Australia 90 days after a notice had been served to the copyright holder. The purpose of this condition is to ensure the availability of books on the Australian market, rather than to prevent price discrimination against local consumers.

The legal framework for parallel importing is to a large extent a domestic issue. WIPO agreements do not deal with parallel importing. As noted earlier, the TRIPS agreement neither sanctions nor prohibits parallel importing — Article 6 of the agreement explicitly prevents the use of TRIPS dispute settlement procedures to address the issue of 'exhaustion'. On the other hand, when identifying the rights of the patentee, Article 28 of TRIPS explicitly mentions the right of importation. According to Primo Braga (1995), conflicts associated with parallel imports will continue to depend on interpretations of domestic laws for resolution.

Developments in the last decade

Parallel importing has been the subject of a number of inquiries in Australia over the last decade. The former Prices Surveillance Authority (PSA) raised the question of restrictions over parallel importing in its inquiries into books (PSA 1989), sound recordings (PSA 1990), computer software (PSA 1992) and farm chemicals (PSA 1993). In these studies, the prices of many IPR protected products in Australia were found to be more than 20 per cent higher than the respective prices in the United States and Western Europe. These high prices have been reflected in both high costs (for example, inefficient multiple distribution of books and wasteful advertising of sound recordings) and in excessive profits (Walker 1998).

The PSA took the view that while copyright and patent protection in the sphere of reproduction may be justified to prevent free-rider problems, no IPR-related restriction should be placed on the distribution of articles legally marketed. While it is necessary to prevent imports of pirated or counterfeit goods in order to make IPR protection effective, it is not necessary to restrict parallel imports of goods legally marketed overseas with the copyright or patent owner's permission.

Without restrictions on parallel importing and subject to universal IPR protection, prices around the world of IPR protected items would tend to be equalised, allowing for transport costs, import tariffs and the like. The prohibition on parallel importing, by preventing international price arbitrage, has allowed monopolistic price discrimination between national markets. Australia, being an affluent but small and isolated market, has been a loser in the price discrimination between national markets.

The prohibition on parallel importing also led to certain anti-competitive practices that have little to do with the protection of IPRs. The prohibition on parallel importing does not apply to trade marks, but it applies to copyright. Some overseas producers of packaged products (such as processed food) used the legal overlap between trade marks and copyrights to claim under the Copyright Act protection to

the art work on their packages. This enabled them to prevent the importation of their products from cheaper sources overseas, thereby maintaining higher prices in Australia than abroad on non-innovative goods, contrary to the intention of the IPR law. The July 1998 amendments to the Copyright Act effectively closed this loophole, by removing copyright control over the parallel importation of packaging and labelling. The Government announced a delay of 18 months in the introduction of this amendment, to give importers sufficient time to adapt their business operations.

As a result of the PSA inquiries, some amendments were made to the parallel import provisions for books, designed to improve the availability of titles. And after much political debate, legislation allowing the parallel importation of CD sound recordings passed through Parliament in July 1998. Given that it is hard to justify the prohibition of parallel importing on grounds of economic logic, and given that TRIPS and other international agreements do not require such restriction on imports, the rather slow progress in removing prohibitions on parallel importing requires a closer look at the arguments presented against changing the law. The next section reviews the objections presented in the debate concerning sound recordings. The following section presents the arguments raised in the CLRC (1995) report on computer software.

The debate concerning CD sound recordings

The proposal to allow parallel importing of CD music raised vehement opposition from industry sources. There are two major industry segments in Australia, local performers and CD music record producers. Each opposed the reform but for different reasons.

Local performers are working in a fairly unstable environment. Average product life is less than one year and distribution agreements are usually less formalised than in other industries. Most performers see the local market as their main source of income, but will endeavour to gain additional income from exports. They are usually in a weak bargaining position against overseas distributors and are not in the position to negotiate with them on the allocation of markets. In this situation, allowing parallel importing might prevent local performers from charging higher prices on their recordings in the domestic market than in overseas markets. Reducing the opportunities for price discrimination might harm to a certain extent the profitability of the local music industry (both agents and artists), though probably by much less than was claimed by industry sources. An interesting model, suggesting that parallel imports might have a less detrimental effect on young artists

trying to enter the market than on established artists, is presented in McCalman (1998b).

The production of sound recordings on CDs is a comparatively new industry in Australia, employing less than a thousand people. The industry is dominated by a few large multinational corporations. The CD sound record manufacturers claimed that allowing parallel importing would undermine their profitability and would threaten the viability of CD sound record manufacturing in Australia.

It is not clear in what way the prohibition on parallel importing influenced the location of CD sound record manufacturing in Australia. The prohibition provides sole distribution rights to the copyright owner, regardless of whether the CD record is manufactured in Australia or imported. The location in Australia of CD sound record manufacturing might have been motivated by factors unrelated to parallel importing, such as lower wages for skilled personnel than in other advanced countries, an English speaking culture and government incentives for the development of local information technology industries, such as the Partnerships for Development program (BIE 1994b). While transport costs were probably not a major factor in locating CD sound record manufacturing here, the close trade links with the Asia-Pacific region might have been in favour of Australia. Given that the location of CD sound record manufacturing in Australia was probably driven by other factors, it is unlikely that allowing parallel importing will cause the cessation of these manufacturing activities.

The strong opposition of the music industry to the proposed legislative change was also based on the fear that parallel importing would allow a flood of pirated imports. However, parallel importing only allows the importation of non-pirated products from legitimate overseas distributors. Given that one of the major objectives of TRIPS is to reduce copyright piracy in developing countries, this problem is expected to subside. Nonetheless, the problem of how to prevent the importation of pirated and counterfeit goods appears to be the strongest objection against parallel importing.

To allay fears that pirated CDs will flood the Australian market, the July 1998 legislative amendment to allow parallel importing of CDs was supplemented by a number of measures that improved protection for owners of copyright in sound recordings. In civil proceedings concerning importation of infringing copies of CDs, the onus of proof that the imported CD was not an infringing copy is placed on the importer or distributor. The legislation also raised the maximum penalties on copyright offences. Corporation can be fined over $300000 and individuals can face up to 5 years imprisonment.

Parallel importing of software

The CLRC (1995) report on computer software protection examined in some detail the parallel importation of software. The CLRC has been fairly ambivalent about this subject. In its final report, the CLRC suggested that the restrictions on parallel importing should remain (thereby reversing its recommendation in the draft report). However, the CLRC also recommended further review of this issue within three years.

The main reason for the CLRC recommendation to maintain the prohibition on parallel importing was the threat of an increase in the distribution of pirated and counterfeit software if parallel importing was allowed. Counterfeit software refers to pirated software that cannot be easily distinguished from the original, because even the trade mark, packaging and manuals were copied. An advice received from the Attorney General's Department cast some doubts on the compatibility with TRIPS of the earlier draft recommendation, that parallel importing should be allowed only from those countries that are the main source of computer programs used in Australia, in order to reduce the possibility of pirated imports.

Other considerations in the CLRC (1995) report were the effect on employment and on technical support services. In regard to employment, some submissions from industry sources claimed that allowing parallel imports would harm the future development of the local software industry. On the other hand, other submissions (including the one from Treasury) suggested that allowing parallel importing would create a more competitive environment, and thereby in the long run would stimulate the development and international competitiveness of the local industry.

In regard to the effect of parallel importing on the provision of technical services, there have been conflicting opinions. It appears that provided the software is imported from legitimate overseas distributors with good commercial reputation, parallel importing will not affect adversely the quality of after-sale technical services. Besides, which supplier to choose and how much to pay for the product and how much for supporting services should be up to the user to decide.

The CLRC found that the average difference between Australian and US software prices was not as great as indicated in the PSA software report. The PSA estimated Australian prices to be more than 40 per cent above US software prices. According to the CLRC, some of the price gap could be explained by cost handicaps in the Australian market. This is not necessarily an argument to maintain the prohibition, but rather an indication that the effect on prices of allowing parallel importation might not be as great as expected.

Another argument in favour of restricting parallel importing in the CLRC report is related to the economic rationale of IPR protection. On that subject the CLRC (1995, p. 201) report says:

> In the Committee's opinion the right to control parallel importation of copyright materials serves the same purpose as copyright laws in general — to encourage and reward investment and creative endeavour. The parallel importation provisions recognise that copyright laws, despite the 'harmonisation' that occurred as a result of various treaties, vary from territory to territory. They also recognise, as pointed out by the Law Council of Australia (LCA), that there is not a 'single world market'. The parallel importation provisions provide incentives for copyright owners in one territory to market (and exclusively license others to market) their copyright, and articles incorporating their copyright, in other territories. This incentive is negated if others may import those articles from other territories without incurring the marketing and other costs incurred by the owner of copyright.

This statement seems to imply that one of the objectives of copyright protection is to ensure that right-holders will recover their marketing costs. But in effect, the only economic rationale for copyright protection is the prevention of free-riding by would-be duplicators. Provided free-riding has been prevented, the recovery of marketing (and other) costs is a business problem which does not belong to the sphere of copyright protection.[3]

Only in the presence of identifiably positive externalities (such as for scientific or educational publications) is there an economic justification for public support beyond the prevention of free-riding. But in these cases the additional incentive for creative effort could be provided through public funding, rather than through a non-targeted measure such as the prohibition of parallel importing.

Concluding comments

In summary, none of the arguments presented against parallel importing is very convincing, if the objective is to optimise national economic interest subject to the constraints imposed by international obligations. It is true that allowing parallel imports might exacerbate the problem of pirated and counterfeit imports. However, given the intensified international fight against IP piracy as a result of the TRIPS agreement, there is no economic reason why Australia should use a very costly instrument, such as the prohibition of parallel imports, to combat a problem that can

[3] It can be argued that the advertising of the original copyright holder may also benefit a distributor relying on parallel imports. By the same token, the advertising of a parallel importer may benefit the copyright owner. There is no strong reason why these minor spillovers, which also exist in other forms of advertising, should be addressed through copyright legislation.

be addressed through various law enforcement measures and the WTO dispute settlement mechanism, among other means[4].

However, if parallel importing is permitted, it may have to be accompanied by supplementary legislation to help combat IP piracy — for example, a legal requirement to attach labels to copyright and patent protected imported goods, indicating the name and location of the overseas enterprise from which the product was bought. This kind of measure could help right-holders to track down pirated or counterfeit products on the market. Penalties for copyright offences have been already raised, as mentioned earlier.

The piecemeal approach adopted in the past to reform parallel importing item-by-item (books, sound recordings and packages) cannot be justified on economic grounds. It might be preferable to reform in one step the entire copyright law. If there is a need to reform the patent and design laws in regard to parallel importing, this should be also carried out in a comprehensive manner.

3.9 The impact of TRIPS on developing countries

As noted in chapter 2, the main purpose of the TRIPS agreement was to improve IPR enforcement in developing countries. IPR related legal and enforcement practices in the developing world is a very wide subject that will not be reviewed here. The interested reader can find relevant descriptive material in USITC (1988), Primo Braga (1995), Maskus and Penubarti (1996) and Subramanian (1997).

The purpose of the discussion in this section is to outline in broad terms the directions for reform in developing countries and to analyse certain developments that could be of relevance to Australia.

The main problem areas

As noted in section 2.1, exports from countries in East Asia and Latin America of pirated and counterfeit products was one of the prime motives for formulating the TRIPS agreement. These infringing exports were concentrated mainly in copyright material, in particular sound and video recordings, books and software. The misappropriation of trade marks of high class fashion goods was another major problem area.

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4 There is expected to be a Parliamentary inquiry into IPR enforcement in Australia, which will allow the claims and counter-claims on copyright piracy to be aired in an open forum.

Patent infringements in developing countries were a less serious problem, because the imitation of most patent-protected inventions requires advanced production facilities and a certain level of expertise to figure out hidden knowledge and know-how related to advanced technologies, an expertise that is usually very scarce in developing countries.

Frequently, IPR infringements in developing countries have not been effectively combated by the local authorities. In fact, a number of these countries were not members to the Paris, Berne and Rome conventions. The intention of TRIPS was to bring these countries under the umbrella of a binding international IPR agreement and to ensure stricter enforcement practices.

The apprehensions of developing countries about TRIPS were concerned mainly with two issues. First, stronger enforcement of IPRs might lead to the transfer of income from less developed countries to more affluent innovation producing nations. Second, a stricter IPR enforcement regime might curb the flow of technological knowledge to less developed countries.

Income transfers from developing to industrialised countries

In regard to the first issue, on income distributional grounds one would like to see the transfer of income from rich to poor nations and not the other way around, as is claimed to have happened as a result of TRIPS (Frischtak 1993). However, excluding the income transfer resulting from the decrease in the production and exports of IPR infringing goods from developing countries, there have not been many TRIPS-related income transfers from poorer to richer countries in connection with legitimate business transactions.

The exceptions relate to the fact that stronger IPR protection as a result of TRIPS might have disadvantaged some developing countries, particularly in the areas of pharmaceuticals, agricultural chemicals and new plant varieties, resulting in some income transfers from poor to rich nations on previously legitimate transactions. Unlike TRIPS, the Paris Convention did not require patent protection to cover all industries. Neither did it require IPR protection for new plant varieties. A number of developing countries refused to grant patents to medicines and agricultural chemicals (McCalman 1998a). Most developing countries also did not provide IPR protection for new plant varieties. Without patent protection, some of these countries managed to produce patented medicines and agricultural chemicals domestically or imported them at cheaper prices. The beneficiaries were mainly developing countries with pockets of high-tech industries, such as India, Brazil, Argentina and South Korea, which possessed the technological capabilities for

analysing and manufacturing complex chemicals, and not the least developed countries which lacked the required skills and resources. More on the subject of pharmaceuticals can be found in Subramanian (1997). The unauthorised use of the progeny of new plant varieties does not even require advanced technological capabilities, only access to a small quantity of the new seed.

It seems plausible (though no empirical evidence has been found) that following the introduction of TRIPS, research intensive pharmaceutical and chemical companies are now in the position to obtain better prices in developing countries on their patented products. Probably the same applies to the large transnational corporations engaged in developing new plant varieties. This may have resulted in some income losses to developing countries in respect to practices that did not contravene the Paris Convention but are not allowed under TRIPS.

Another measure that was partially sanctioned by the Paris Convention but is subject to much stricter restrictions under TRIPS is compulsory licensing. Under local laws, some developing countries induced overseas companies to set up production facilities in their territories after a few years of not working the patent locally. Compulsory licensing benefited mainly the more technologically advanced developing countries and not the least developed ones. Again, as a result of TRIPS, some developing countries may have incurred income losses from restrictions on such practices. TRIPS still permits compulsory licensing, but subject to more stringent restrictions and the payment of appropriate compensation to the licensor.

But probably much larger TRIPS-related income losses to developing countries occurred as a result of the reduction of illegitimate income from IPR piracy. A large scale survey published by the United States International Trade Commission (USITC) in 1988 suggested that in 1986, US companies lost between US$10 billion and US$25 billion in sales and royalty income due to IPR piracy in developing countries. The corresponding loss of profits was in the range between US$3 billion and US$7 billion. It is possible that the USITC estimates are inflated, because of response bias by the large US corporations who participated in this survey. Nonetheless, extrapolating from these figures to the international scene suggests that global sale losses to developed countries (and gains to developing countries) as a result of IPR infringements possibly exceeded US$30 billion in 1986, and the corresponding net income gains to developing countries were in excess of US$8 billion. A US$30 billion sales revenue gain to developing countries represented around 7 per cent of their total merchandise exports in 1986 and more than 12 per cent of their manufactured exports (WTO 1995). However, a significant proportion of pirated production was for domestic consumption rather than exports, hence the effect on exports was probably much smaller than that.

No doubt, the income losses to developing countries due to reduction in IP piracy could be substantial. However, if the objective is to support the development of poor countries, then there are many economically more efficient transfer instruments than allowing free-riding activities that could seriously impair the operation of copyright-related (and in some cases patent-related) markets.

Technology transfer and direct foreign investment

In regard to the transfer of technologies, tighter IPR protection disciplines are not entirely unfavourable for developing countries. The majority of recently patented inventions are largely irrelevant to the needs of developing countries, which are unable to imitate on a wide scale even technologies that are many decades old, due to shortages of capital, skilled labour and manufacturing experience. Addressing these problems is more crucial to their development needs than facing fewer restrictions on the imitation of the most recent inventions, apart from a few cases of easy free-riding.

Many developing countries are characterised by highly segmented economic structures, resulting in large variations in technological absorption capabilities. Some large developing countries, such as China, India, Brazil and Mexico have significant pockets of high-tech industries, even though these pockets are very small compared to the size of the local population and the economy.[5] These advanced industrial pockets could benefit from the imitation or compulsory licensing of some recent inventions. But these are exceptional cases.

While in most developing economies there is still plenty of scope to adopt well tested earlier technologies, there are certain types of recent inventions that are particularly well suited to the current needs of some of these countries. These include new tropical medicines, certain new plant varieties and capital saving technologies, such as radio telephony or small power generation units that are not connected to a grid. It seems preferable to encourage the transfer of such technologies through foreign aid programs than by weakening the IPR protection system across the board.

A number of opinion surveys and econometric studies suggest that by means of tighter IPR protection, developing countries would be able to attract more technology transfer and direct foreign investment from developed economies. It

[5] In many respects China is a special case. Most of its high-tech industries are still subject to central control. Missing from the list are developing countries such as South Korea and Taiwan that have already reached the stage in technological development where stronger IPR protection might be to their advantage.

should be remembered that much technology transfer involves the transmission of tacit knowledge and know-how that is not available from patent disclosures or from technical publications.

Mansfield (1993 and 1995) conducted opinion surveys among company and R&D managers in the United States, Germany and Japan on the effect of the strength of IPR protection on their investment decisions in developing countries. A regression analysis presented in Mansfield (1995), based on opinion survey results and US foreign direct investment data, suggests that holding other factors constant, if the proportion of firms regarding IPR protection in a particular country as inadequate falls by 10 percentage points, US foreign direct investment seems to increase there by about US$200 million a year.

The opinion survey results indicate that investment and technology transfer are particularly sensitive to IPR protection in high-tech industries and in imitation prone product lines such as medicines, specialty chemicals, small instruments and toys. Investment in R&D facilities and skill intensive manufacturing is much more responsive to perceptions about the strength of IPR protection than investment in marketing and distribution outlets or in low skilled assembly operations. All told, there is fairly strong empirical evidence to suggest that both technology transfer and direct foreign investment tend to increase as IPR protection becomes stronger.

Other econometric evidence presented in Maskus and Penubarti (1995) suggests that countries with effective IPR enforcement attract significantly more international trade. The reason seems to be that as pirating activities are reduced, the market for legitimate products expands, more than offsetting the tendency toward higher monopoly prices. Other studies cited in Maskus (1997) suggest that growth induced by more effective patent protection tends to be stronger in open economies, such as the East Asian tigers.

All told, a developing country can obtain more technology transfer, direct foreign investment and trade, by forsaking the gains from IP piracy. The fact that a number of developing countries started to overhaul their IPR systems a few years before TRIPS was introduced, indicates their belief that in the long run the gains from fair trade are likely to outweigh the loss of illegitimate free-riding income.

Implications for Australia

There are a number of implications for Australia from the TRIPS driven IPR reforms currently under way in the developing world, particularly in South and East Asia. While it is not clear to what extent IP piracy has diminished, there has been some improvement in the international cooperation to combat it. This weakens the

case for maintaining the prohibition on parallel imports, which is partly aimed at reducing the risk of importing pirated products (see section 3.8). At the present stage, this seems to be the most important policy implication from the on-going IPR reforms in developing countries.

Another implication is that as developing countries strengthen their IPR regimes, they become more attractive destinations for technology transfer and foreign direct investment. In the past, one of the advantages that Australia could offer to foreign equity investors was its strong IPR protection regime. This comparative advantage is likely to diminish in the future.

Maskus (1997) also mentions some more speculative implications for Australia. He calculates that even a small rise in the East Asian growth rate as a result of adopting TRIPS could provide a significant boost to Australian exports to the region, given the high income elasticity of East Asian import demand. But whether TRIPS has actually boosted East Asian economic growth in recent years remains an open question.

On a less speculative level, Maskus notes that much of Australian manufactured exports to the region are highly IPR dependent. This applies to high-tech exports such as pharmaceuticals, computers, software, telecommunications equipment and scientific and medical instruments, as well as to trade mark dependent goods such as wines and processed food. Stronger IPR protection in East Asia is likely to favour Australian exports by reducing the danger of piracy and the misappropriation of brand names.

4 Statistical analysis

This chapter presents estimates of the IP content of Australia's production and trade. In this context IP content refers to IP-related costs recovered through IPR protection. This quantitative analysis provides a better appreciation of the importance of IPR protection relative to GDP and trade. It may also provide a framework for estimating the economic impact of proposed IPR reforms. Apart from estimating IP content in monetary units, attention is also given to data on the number of applications and registrations of patents, trade marks and industrial designs.

4.1 Different approaches to quantitative analysis

The commonly used statistics in the IPR area are applications and registrations of patents, trade marks and designs. There is an extensive international database on these items, which makes it possible to compare figures between countries and over time. WIPO's annual statistical reports on industrial property present detailed summaries of applications and registrations in each member state by local residents and residents of other countries, disaggregated by major product groups. While some attention is given toward the end of this chapter to Australian trends in the total number of applications and registrations over the last decade and a half, the main focus of attention is not on registration counts but on estimating the monetary value of IP content in production and trade.

The first part of the chapter is devoted to examining trade statistics for commodity groups that are heavily dependent on patents, copyrights or trade marks, in line with the statistical analysis presented by Maskus (1993). After that, the discussion turns to the more complicated subject of estimating IP content. In the present discussion, IP content refers to IP-related costs that are recovered by means of IPR protection. Note, in this definition two conditions are specified — first, that the costs are IP related and second, that commercial returns are conditional on IPR protection. Given that IP costs are usually sunk before standard production has started, they are fixed costs. Therefore, other things equal, the larger is the quantity sold, the smaller will be the share of the IP content in the total cost of production.

Patent content is not measured by total business R&D costs (which represent in effect total IP-related costs) but only by that portion of business R&D costs that are recovered through patent protection. As explained in section 3.3, there are other means to recover the cost of business R&D, such as secrecy and market power.

The estimation of patent content is based on a two-stage calculation. First, estimates are presented on the business enterprise R&D (BERD) content of individual product groups and the distribution of BERD between imports, exports and domestic consumption. Second, using various estimates from the literature, some compromise estimates are adopted on the portion of BERD that is appropriated by means of patent protection. These estimates are presented in terms of upper and lower bounds.

In the case of copyright material, IP costs correspond to the fixed 'cost of creation' (see section 3.6). Given the widespread availability of rapid copying technologies, very little of the 'cost of creation' could be appropriated by the original creator without copyright protection. Consequently, most of the 'cost of creation' embedded in copyright material (corresponding to the R&D cost of inventions) seems to represent a 'copyright content' equivalent to the 'patent content' in BERD. The estimation of the IP content of copyright material is based largely on the estimated value added of copyright protected industries, including printing and publishing, arts, films, TV and software. The discussion in this paper relies to a large extent on an economic study of Australian copyright protected industries by Guldberg (1994).

There are also monetary premiums attached to trade marks and designs, but in the absence of suitable data to make appropriate quantitative inferences, these subjects are not covered here.

Little previous research has been done to estimate IP content. Most of the relevant studies concentrate on patents. These studies use various techniques to infer the monetary value of patents or to quantify the economic impact of patent protection. The indicators presented in this chapter rely on fairly simple and straightforward methodologies, outlined in Maskus (1993) and BIE (1994a). Other studies are reviewed briefly, to give a broader picture about the quantitative approaches used in this area, but no attempt is made to apply these more complicated methods. Two previous Australian studies, one by the BIE (1994a) and the other by Gruen, Bruce and Prior (1996), presented estimates on the aggregate value of patents in Australian trade. These estimates are reviewed.

4.2 The Maskus indices

The product groups chosen

A fairly simple quantitative approach, providing a comparative view of the relative importance of IPRs in trade, is presented in Maskus (1993). Maskus simply selected a number of product groups that he considered to be particularly vulnerable to patent, copyright or trade mark problems, and summarised their share in total merchandise trade in a number of countries. In the case of patents, the commodities chosen are those that have both high R&D intensity and can be imitated with relative ease in the absence of patent protection. The commodity groups selected, based on the Standard International Trade Classification (SITC revision 2) are shown in table 4.1. Some R&D intensive product groups, such as aircraft and telecommunications switching equipment were excluded from this list, because they were not considered vulnerable to imitation, given the complexity of the systems

Table 4.1 **Product groups with potential IPR problems**

SITC code	*Description*
	Patent-related
512	Alcohols, phenols and other basic chemical compounds
541	Medical and pharmaceutical products
583	Polymerisation products (mainly ingredients for plastics)
728	Machinery for special industries (construction, chemicals, etc.)
736	Metal working machine tools
751	Office machines
752	Automatic data processing equipment
774	Electro-medical and X-ray equipment
7764	Electronic microcircuits
8741	Surveying, measuring, drawing and gas control instruments
	Copyright-related
8921	Printed books, newspapers, periodicals
8983	Sound and audiovisual recordings, tapes, disks
	Trade mark-related
112	Alcoholic beverages
553	Perfumery, cosmetics, etc.
665	Glassware
784	Motor vehicle parts and accessories
821	Furniture and parts thereof
831	Travel goods, handbags
84	Clothing
8851	Watches, movements and cases
8942	Toys, indoor games, etc.

Source: Maskus (1993).

involved.

The index is simply the share of the selected product groups in total merchandise trade. By its nature, the Maskus index cannot account for graduations in the patent intensities of various traded items. Nonetheless, it can provide a useful and consistent (albeit somewhat arbitrary) index of the patent intensity of trade — an indicator that can be compared between countries and over time.

Maskus adopted a similar approach in respect to copyrights, as shown in the middle part of table 4.1. In this case only two SITC commodity groups were chosen — printed matter and electronic recordings on tapes and disks. These two categories cover the bulk of copyright material in merchandise trade. There are other copyright-related trade transactions, including royalties for films, computer programs, TV programs and the like, which are included in services trade. These 'service' items are discussed in more detail in section 4.4.

In regard to goods with potential trade mark problems, the group selected by Maskus is shown in the bottom part of table 4.1. While the marketing of many of these products is strongly dependent on trade marks, evidently there are many other heavily trade mark dependent items that have been excluded. Trade mark dependency is often more closely related to the quality of the product than to membership in a particular product group. Hence, in this case the selection of a reference set is more arbitrary than for patents or copyrights. Note, while motor vehicle parts and accessories are included, built-up motor vehicles are excluded from the reference set.

Patent-related goods

Despite their arbitrary nature, the Maskus indices have considerable appeal on grounds of simplicity and the availability of data for many countries. Table 4.2 presents comparative data on trade in patent-related items. The table shows the share of patent-related goods (as defined by Maskus) in Australian exports and imports in 1976-77, 1986-87 and 1996-97. These shares have been extracted from unpublished ABS trade merchandise data at the five digit SITC level. The shares for individual product groups are presented in table B.1 in the appendix. To put the Australian data in perspective, table 4.2 shows international data from 1989 presented in Maskus (1993).

There are a number of interesting features in these figures. First, the Australian data show that the importance of patent-related products has increased significantly in both exports and imports over the last 20 years. The share of patent-related items increased proportionally more for exports than for imports, reflecting the rising

importance in Australian exports of R&D intensive products, albeit from a low base. This subject is discussed in more detail in section 4.3.

Maskus (1993) presents international statistics on the growth of exports and imports for four years, between 1985 and 1989. Because of the short time span covered, these growth rates are not shown here. But even during this short period, trade growth of patent-related products outstripped total merchandise trade growth by a wide margin in most of the countries examined, indicating a growing patent content in international trade. This is connected with the growing R&D intensity of international trade. The rise in the share of patent-related products in Australian trade seems to parallel worldwide trends.

Table 4.2 **Trade in patent-dependent goods**

	Share of patent-related goods in merchandise exports[a]	*Share of patent-related goods in merchandise imports*[b]
	%	*%*
Australia 1996-97	2.9	12.4
Australia 1986-87	1.4	10.9
Australia 1976-77	1.2	6.7
1989 (Maskus)		
EC-12	7.1	7.2
Belgium-Luxembourg	5.5	5.5
Denmark	5.6	8.2
Germany	7.9	7.2
Greece	1.1	4.1
Spain	4.1	4.7
France	5.7	6.9
Ireland	13.8	9.4
Italy	6.6	7.7
Netherlands	7.7	9.2
Portugal	2.7	5.3
UK	8.1	7.4
EFTA	6.7	7.0
USA	10.5	7.4
Japan	13.2	4.6
Korea	10.1	8.4
Brazil	3.9	9.0
India	1.1	8.5

a In the overseas data the export percentages are directly from Maskus (1993). **b** The import figures are derived from the export and trade balance figures provided by Maskus combined with data on exports and imports in 1989 from WTO (1995).

Sources: ABS (*International Merchandise Trade*, Cat. no. 5422.0; unpublished data); Maskus (1993); WTO (1995).

Comparing the Australian data with the overseas data from 1989 reveals that in recent years, Australia has a greater proportion of imports which are patent-related than any of the other countries examined. Our share of patent-related goods in exports is lower than in most industrialised countries, and comparable to that of a semi-industrialised country like Portugal. The reason for this is Australia's traditional reliance on the exports of primary commodities and the imports of elaborately transformed manufactures. The difference between patent-related exports and imports has in fact narrowed in recent years. It is worth noting from the figures that the share of patent-related exports in trade is particularly high in the leading technology exporting countries such as the United States, Japan, United Kingdom and Germany. The figures suggest that Ireland and South Korea have joined the ranks of technology exporters.

In section 4.3 a more detailed analysis is presented on the trend in the patent content of Australia's trade over the last 20 years, but unlike the Maskus indices, the patent content estimates presented there cannot be compared with overseas data.

Copyright-related goods

A similar analysis was carried out by Maskus for copyright-related items. As noted earlier, in merchandise trade these items cover printed matter as well as sound and audio-visual recordings. The relevant data for Australia and overseas countries are presented in table 4.3. Again, the Australian data were extracted from unpublished ABS trade data at the five digit SITC level. Details are presented in table B.2 in appendix B.

The share of copyright material in merchandise trade increased less over the last 20 years than the share of patent-related goods. The share in imports increased from 1.9 per cent in 1976-77 to 2.2 per cent in 1996-97. However, the share of copyright material in merchandise exports more than doubled over the last 20 years, albeit from a very small base, increasing from 0.2 to 0.5 per cent. The main reason for the sharp increase in exports appears to be the establishment of an export orientated sound record manufacturing industry in Australia.

Interestingly, in contrast to the slow growth in the share of copyright material in Australian imports, the growth statistics presented by Maskus for the four years between 1985 and 1989 indicate that the growth in copyright-related imports in most countries exceeded the growth in patent-related imports. A better picture about the growth of trade in copyright material is presented in section 4.4, where consideration is also given to trade in copyright-related royalties that are included in services trade rather than merchandise trade.

Comparing the Australian copyright material percentage shares with overseas data reveals a similar pattern as for patents. The share of copyright material in merchandise imports is much higher than in exports. Australia shows the highest share of copyright imports in merchandise trade among the countries examined. By contrast, Australia's share of exports is lower than that of most countries.

Table 4.3 **Trade in copyright-dependent goods**

	Share of copyright material in merchandise exports[a]	*Share of copyright material in merchandise imports*[b]
	%	*%*
Australia 1996-97	0.5	2.2
Australia 1986-87	0.2	2.3
Australia 1976-77	0.2	1.9
1989 (Maskus)		
EC-12	0.8	0.7
Belgium-Luxembourg	0.5	0.8
Denmark	0.9	0.8
Germany	0.8	0.7
Greece	0.2	0.5
Spain	0.6	0.6
France	0.6	0.8
Ireland	4.9	1.0
Italy	0.4	0.5
Netherlands	1.0	0.9
Portugal	0.2	0.6
UK	1.1	0.9
EFTA	0.4	1.1
USA	1.1	0.5
Japan	0.8	0.4
Korea	1.3	0.2
Brazil	0.1	0.7
India	0.1	0.4

a In the overseas data the export percentages are directly from Maskus (1993). **b** The import figures are derived from the export and trade balance figures provided by Maskus combined with data on exports and imports in 1989 from WTO (1995).

Sources: ABS (*International Merchandise Trade*, Cat. no. 5422.0; unpublished data); Maskus (1993); WTO (1995).

Trade mark-related goods

Table 4.4 presents data on trade mark-dependent goods. Once again, the pattern is similar to patent and copyright-related items, with Australia recording persistently a large excess of imports over exports in these goods. But the situation is changing. While the share of trade mark-dependent goods in merchandise imports remained static over the last 20 years, their share in merchandise exports climbed from 0.8 per cent in 1976-77 to 2.5 per cent in 1996-97. The main reason for this increase was the large expansion in the exports of wines and car parts (see table B.3 in appendix B). The secular rise in the export share of other elaborately transformed manufactures also contributed to this trend.

Table 4.4 **Trade in trade mark-dependent goods**

	Share of trade mark-dependent goods in merchandise exports[a]	*Share of trade mark-dependent goods in merchandise imports*[b]	*Share of trade mark-dependent goods in exports excluding clothing*[c]
	%	%	%
Australia 1996–97	2.5	7.6	2.0
Australia 1986–87	1.3	6.7	1.2
Australia 1976–77	0.8	7.9	0.7
1989 (Maskus)			
EC-12	8.3	7.8	5.6
Belgium-Luxembrg	4.8	7.9	3.3
Denmark	7.6	7.1	5.3
Germany	7.4	9.7	5.8
Greece	21.0	6.1	1.4
Spain	7.7	6.1	6.7
France	10.1	8.9	8.0
Ireland	4.5	6.6	2.9
Italy	14.7	4.5	7.8
Netherlands	3.4	7.8	2.0
Portugal	25.0	7.4	4.8
UK	6.3	8.2	4.7
EFTA	6.0	8.9	4.8
USA	5.2	11.5	4.6
Japan	4.9	5.7	4.7
Korea	18.2	1.3	3.6
Brazil	2.5	3.1	1.8
India	14.9	1.1	1.5

[a] In the overseas data the export percentages are directly from Maskus (1993). [b] The import figures are derived from the export and trade balance figures provided by Maskus combined with data on exports and imports in 1989 from WTO (1995). [c] The overseas data are directly from Maskus (1993).

Sources: ABS (*International Merchandise Trade*, Cat. no. 5422.0; unpublished data); Maskus (1993); WTO (1995).

Nonetheless, even in 1996-97, the ratio between trade mark-related imports and exports in Australia remained more biased toward imports than in other countries examined by Maskus in 1989, with the exception of the United States. Again, the reason for the persistent excess of imports over exports in trade mark-dependent items is due to Australia's specialisation in the exports of primary commodities, and imports of elaborately transformed manufactures where trade marks are more important.

As noted earlier, the classification of trade mark-related goods is more arbitrary than the classification in respect to patents and copyrights. Given the importance of clothing in the selected group, and the fact that much cheap clothing is not particularly trade mark-dependent, Maskus (1993) also presented export shares excluding clothing. This is shown in the third column in table 4.4. With clothing excluded, the Australian export shares of trade mark-dependent items increase relative to the respective shares in other countries. When clothing is taken out, large drops in trade mark-related export shares are recorded for India, Korea, Portugal and Italy, while the corresponding export share in Australia is little affected.

4.3 Estimated patent content of production and trade

Methodology and sources of information

As noted in section 4.1, patent content is defined to cover the portion of business enterprise R&D (BERD) costs that is recovered commercially through patent protection. There are also other means to recover the cost of business R&D, such as secrecy and market power.

The estimation of the patent content in this section is based on a two-stage calculation. First, estimates are derived of the BERD content of individual product groups and their distribution between imports, exports and domestic consumption. After that, synthesising various estimates from the literature, certain compromise estimates are adopted on the portion of R&D costs that are appropriated through patent protection in various industries. The estimation of patent content is based on business R&D (BERD) expenditure only, because the R&D conducted in public research institutions and universities is usually not much related to patent protection (IC 1995b; BIE 1996).

The estimation of the BERD content of production and trade is fairly straightforward. Statistics on BERD expenditure have been collected in Australia by the ABS since the late 1960s. The data are disaggregated by more than 20 industry groups. These BERD data were allocated between domestic sales and exports in

tables C.2, C.4 and C.6 in appendix C for the financial years 1996-97, 1986-87 and 1976-77.

The split of BERD between domestic sales and exports was carried out by pro-rata allocation based on ABS data on domestic sales and merchandise exports at the sectoral level. These figures are shown in tables C.2, C.4 and C.6. On the imports side, the estimated average BERD intensities of various industries in OECD countries were used to impute the BERD content of imports. Data on the average BERD to turnover ratios of individual industries in the OECD group have been presented in various issues of the Science and Innovation Resource Briefs published by DIST. The OECD BERD to turnover ratios were multiplied by Australian imports, to obtain the estimated BERD content of imports, shown in tables C.2, C.4 and C.6.

The estimation of the BERD content of exports, imports and domestic sales completes the first stage of the calculations. The second stage is to impute patent contents to the sectoral BERD contents. For that purpose, some more speculative estimates have to be used. There are no accounting or statistical measures available on the value of patents or the portion of BERD costs that are recovered through patent protection. Nonetheless, some attempts have been made by economists to quantify the value of patents and relate them to R&D expenditure. The patent content estimates presented in table C.1 in the appendix, represent ratios between imputed patent values and BERD costs in individual industries, reflecting the estimated portion of business R&D expenditure whose commercial appropriation can be attributed to patent protection. The rest is recovered through other appropriation mechanisms, including secrecy and oligopolistic market power. The interested reader can find fairly comprehensive literature reviews on this subject in Griliches (1990) and BIE (1994a). Some Australian aggregate patent value estimates are presented in BIE (1994a) and Gruen, Bruce and Prior (1996).

The value of patents has been estimated in the literature using a number of different inferential techniques. The diversity of methodologies reflects the great difficulty in quantifying the economic impact of patents from the data available. Briefly, inferences on the value of patents have been based on the following methods.

- Survey of patent-holders on the commercial returns they obtained from their patents. This seems to be perhaps the most reliable approach. Unfortunately, no large scale surveys of this type have been conducted in the last three decades.
- Regression analysis, associating stock market valuation to the number and age of patents held by the firm. The reliability of these studies is limited by the strong collinearity between patents and BERD expenditure, and the fact that patents are usually a minor factor in determining the stock market valuation of the firm.

- Inferences based on patent renewal data. While patent renewal data can throw some light on the value of patents that were not renewed until the end of the legally permitted patent life, they are not suitable to infer the value of patents that were kept in force to the end.
- Patent values inferred from the payments and receipts of patent licence fees and royalties (Gruen, Bruce and Prior 1996).
- The aggregate value of patents inferred from an economic growth model that links cross-border knowledge flows to patent applications by non-residents (McCalman 1998a).

With the exception of the methods presented by Gruen, Bruce and Prior (1996) and McCalman (1998a), other relevant studies were reviewed in BIE (1994a). Based on the results of these studies, BIE (1994a) concluded that on average, commercial returns from patents accounted for between 15 and 30 per cent of BERD expenditure. This is below the respective values used in this paper, which are between 21 and 45 per cent of BERD costs. The reason for adopting higher estimates is to account for the fact that total private returns from BERD (on which no comprehensive statistics are available) are likely to exceed total BERD expenditure (on all failed and successful projects combined), given that the riskiness of R&D investment requires some risk premiums to be added to private returns on top of the recovery of R&D costs. This scaling up implies risk premiums of between 40 and 50 per cent of the rate of return to capital. This is in line with the required rate of return to R&D of up to 15 per cent mentioned in the literature (see section 3.2), which is more than 50 per cent higher than the real rate of return to fixed assets in recent years. The higher patent content estimates adopted here also conform better with the aggregate Australian estimates of Gruen, Bruce and Prior (1996) shown in table 4.8.

The focus of attention so far has been on BERD costs recovered through patent protection at the aggregate level. Few estimates are available on patent content at the sectoral level. Mansfield, Schwartz and Wagner (1981) estimated that because of patent protection, imitation costs increase by around 30 per cent in pharmaceuticals, 10 per cent in chemicals and 7 per cent in electronics and machinery. Other surveys, including Taylor and Silberston (1973), Levin et al. (1987) and USITC (1988) analysed in a more qualitative manner differences between sectors in terms of the strength of patent protection. The overall conclusion is that patent protection is more important in imitation prone industries, including drugs, specialty chemicals, small instruments, toys and games, photographic equipment and scientific and medical instruments. Patent protection is less important in industries where R&D is mainly concerned with process innovations, as in petroleum refining, metal fabrication, electrical equipment and cars. The same

applies to industries producing highly complex products, such as aircraft, telecommunications switching equipment and many types of industrial machinery. Based on this information, table C.1 presents 'best endeavour' estimates of patent content as a percentage of BERD expenditure in various industries. The estimates are presented in terms of upper and lower bounds. Depending on the sectoral weighting used, the average level of the upper bound ranges between 40 and 45 per cent of BERD expenditure and the average level of the lower bound is between 20 and 25 per cent of BERD (see the lower part of table 4.5). The aggregate estimates (in the range between 20 and 45 per cent) that were chosen a priori guided the selection of the sectoral estimates.

It should be emphasised that the patent intensity estimates represent sectoral aggregates. In relation to individual inventions, for many successful innovations that can be imitated with relative ease, patent protection can make it possible to obtain private returns well above BERD costs. But in other cases, significant innovations will be carried out without any patent protection, usually by relying on secrecy. The aggregate patent intensity estimates used here represent broad averages.

Having estimated ratios of patent content to BERD at the sectoral level, the total patent content of various industries (presented in tables C.3, C.5 and C.7 in appendix C) are calculated by multiplying the BERD content of exports, imports and domestic sales by the sectoral patent content to BERD ratios (from table C.1).

Patent content — estimates and trends

Having clarified the methodology, it is time to examine the results. Table 4.5 presents a summary of aggregate results. The upper part of the table presents BERD and patent content estimates as a percentage of GDP. All the figures are below one per cent of GDP. In 1996-97, total BERD amounted to $4.1 billion which was 0.8 per cent of GDP. Since patent-related BERD excludes the production of computer software and R&D related to services, the total BERD figure shown in table 4.5 for 1996-97 is only 0.6 per cent of GDP.

The distribution of BERD between domestic sales, exports and imports in table 4.5 provides an interesting perspective about the contribution of different sources of BERD to the economy. These figures, based on the pro-rata allocation outlined earlier, suggest that Australia is more heavily reliant on imported BERD than on domestic BERD, and it exports considerable less BERD than it imports. But on both fronts the difference has narrowed considerably between 1976-77 and 1996-97.

Table 4.5 **Share of BERD and patent content in GDP**

	1996-97	*1986-87*	*1976-77*
	% of GDP	% of GDP	% of GDP
BERD expenditure	0.58	0.28	0.17
imputed to domestic sales	0.37	0.22	0.14
imputed to exports	0.21	0.06	0.03
Overseas BERD embedded in imports	0.52	0.41	0.25
Australian patent content of			
domestic sales, lower estimate	0.08	0.06	0.04
domestic sales, upper estimate	0.15	0.10	0.06
exports, lower estimate	0.04	0.01	0.01
exports, upper estimate	0.08	0.02	0.01
Overseas patent content embedded in			
imports, lower estimate	0.13	0.09	0.06
imports, upper estimate	0.24	0.18	0.11
Share of patent content in BERD	% of BERD	% of BERD	% of BERD
domestic sales, lower estimate	22.3	25.4	25.4
domestic sales, upper estimate	40.6	44.8	45.1
exports, lower estimate	20.8	21.9	24.3
exports, upper estimate	40.3	42.4	44.6
imports, lower estimate	24.5	21.9	23.7
imports, upper estimate	46.5	42.9	44.5

Sources: Tables C.2, C.3, C.4, C.5, C.6, C.7 in appendix C.

The trends in patent content are in line with the trends in BERD. This is not surprising, bearing in mind that the patent content is calculated by multiplying the BERD content in sales and trade by constant coefficients (table C.1) that do not change over time. However, as shown in the bottom part of table 4.5, the aggregate ratio between patent content and BERD does not remain constant, but changes slightly depending on variations in sectoral composition over time.

The general story emerging from the patent content analysis is similar to that indicated in section 4.2 from the patent-related Maskus indices. Australia is importing more patent content than it exports, but the difference has narrowed over

Table 4.6 **Percentage share of patent content in total trade of goods and services**

	1996-97	*1986-87*	*1976-77*
	%	%	%
exports, lower estimate	0.21	0.08	0.03
exports, upper estimate	0.41	0.15	0.06
imports, lower estimate	0.63	0.50	0.37
imports, upper estimate	1.20	0.98	0.69

Sources: ABS (*Balance of Payments*, Cat. no. 5363.0); tables C.3, C.5, C.7 in appendix C.

the last 20 years, particularly in the last 10 years. This is related to the sharp rise in patent-related BERD expenditure, which climbed from 0.2 per cent of GDP in 1976-77 to 0.6 per cent in 1996-97.

A different perspective on patent content is presented in table 4.6, which shows the patent content of exports and imports as a percentage of the total trade in goods and services. The data show a strong trend of increasing patent content in both imports and exports, but more so in exports.

Decomposition analysis

The reason for the increase in the patent content of trade is analysed in table 4.7. This analysis is based on linear decomposition. The idea is to decompose algebraically the total change between two periods among several constituents. For the purpose of explaining this technique, denote the share of commodity group j in exports (or imports) as x_j. In the starting period, this share is denoted x_{j0} and in the closing period it is x_{j1}. The patent contents per unit sales in industry j are denoted p_{j0} and p_{j1} respectively. Now, the total change in the share of patent content in trade can be decomposed algebraically as follows:

$$\sum_j p_{j1} x_{j1} - \sum_j p_{j0} x_{j0} = \sum_j p_{j1} (x_{j1} - x_{j0}) + \sum_j x_{j1} (p_{j1} - p_{j0}) - \sum_j (x_{j1} - x_{j0}) (p_{j1} - p_{j0})$$

(4.1)

The first term in the right hand side of equation (4.1) represents the part of the change that is due to changes in the sectoral composition of trade. The second term represents the part that is due to changes in patent intensities. The third term, the so called 'interaction' term, accounts for the remainder.

This decomposition is described in the row titles in table 4.7. The figures reveal that the main reason for the increase in the patent content of exports has been the increase in patent intensities (denoting patent content over sales). Since the patent intensities in these calculations are linked through fixed coefficients to BERD intensities, the results reflect the well documented rise in the average BERD intensity of Australian industry (DIST Science and Innovation Briefs; BIE 1996). Changes in the sectoral composition of exports provided a minor contribution to the sharp increase in the average patent intensity of exports over the last 20 years.

In contrast, the rise in the patent content of imports has been driven mainly by changes in the composition of imports toward high-tech products with large BERD and patent intensities. As shown in the import figures in appendix B, the import share of patent and BERD intensive products, such as electronic equipment, scientific and medical instruments and medicines has increased markedly over the

Table 4.7 **Analysis of the increase in the patent content of trade**

	1976-77 — 1996-97	*1986-87 — 1996-97*
	% of trade	% of trade
Exports lower estimate – overall	0.18	0.13
compositional effect	0.02	0.03
change in patent intensity	0.13	0.12
interaction term	0.03	-0.02
Exports upper estimate – overall	0.35	0.26
compositional effect	0.04	0.06
change in patent intensity	0.24	0.24
interaction term	0.07	-0.04
Imports lower estimate – overall	0.27	0.13
compositional effect	0.21	0.08
change in patent intensity	0.03	0.02
interaction term	0.03	0.03
Imports upper estimate – overall	0.52	0.22
compositional effect	0.42	0.14
change in patent intensity	0.06	0.04
interaction term	0.04	0.04

Sources: Tables C.3, C.5, C.7 in appendix C.

last 20 years. This is in line with the rapid increase in the share of high-tech products in world trade (Maskus 1993; WTO 1995).

Comparison with the estimates of Gruen, Bruce and Prior

Finally, it might be appropriate to compare the estimated value of patents presented here with earlier estimates derived by Gruen, Bruce and Prior (1996). They based their estimates on ABS data on patent-related licence fees and royalties in 1992-93. These figures, translated into 1996-97 values, are shown in the first column in table 4.8.

Based on survey evidence indicating that most income from patents is derived from in-house production, Gruen, Bruce and Prior assumed that patent-related licence fees and royalties represent between 15 and 25 per cent of total commercial returns from patents. The estimated total annual incomes based on these parameters are shown in the second and third columns in the upper part of table 4.8. The lower part presents in dollar values the aggregate patent content estimates for 1996-97 used in this report and shown in table C.3 in appendix C.

Table 4.8 **Comparison of estimates of aggregate patent values[a]**

	licence fees and royalties	*licensing factor = 0.25*	*licensing factor=0.15*
	$m	$m	$m
Estimates of Gruen, Bruce & Prior (1996)			
Year	1992-93	1992-93	1992-93
Payments to overseas patent holders	267	1067	1779
Receipts from domestic patent users	32	129	215
Receipts from overseas patent users	49	197	328
Total		1393	2322
Aggregate patent content in this paper		Lower est.	Upper est.
Year		1996-97	1996-97
Imports		655	1247
Domestic sales		428	779
Exports		221	429
Total		1304	2455

a All estimates are in 1996-97 prices.

Sources: Table 2 in Gruen, Bruce and Prior (1996); table C.3 in appendix C of this paper.

In total, the upper and lower estimates according to the two sources are fairly similar. However, the patent content of domestic sales and exports in this paper is considerably higher than the corresponding estimates by Gruen, Bruce and Prior (1996), while for imports the patent content estimate in this report is considerably lower. Overall, given the highly speculative nature of estimating income attributable to patents, and given the definitional differences between what is measured, the two sets of estimates do not appear to be far apart.

4.4 The economic contribution of copyright protected industries

Estimated value added of copyright protected industries

Although copyright has been less extensively analysed in the economic literature than patents, as will be shown in this section, according to some economic indicators it is at least as important. The present analysis of the estimated economic contribution of copyright protection starts with the estimated value added of copyright industries. The analysis then turns to the estimated copyright content of domestic sales and trade. This is similar to the approach adopted earlier in respect to patents, where the discussion started with the estimation of BERD content and then turned to the patent content.

A detailed study of the economic contribution of copyright industries was carried out by Guldberg (1994) on behalf of the Australian Copyright Council. Much of Guldberg's analysis was concerned with estimating the value added of copyright protected industries in 1992-93. Since copyright industries do not correspond to the industrial classification used by the ABS, Guldberg had to rely on survey data from relevant industry associations, including the Australian Book Publishers Association, the Australian Record Industry Association, the Australian Film Commission, the Australian Broadcasting Authority and the Australian Information Industry Association. It should be noted that professional sports, which is becoming an increasingly important part of copyright-related entertainment industries, is not included in the definition of copyright protected sectors adopted by Guldberg. The value added estimates for 1992-93 by Guldberg (expressed in 1996-97 prices) and his estimates of the real growth rates between 1985-86 and 1992-93 are presented in table 4.9. The table also presents extrapolated values for 1996-97, based on the assumption that the growth rates recorded between 1985-86 and 1992-93 were maintained between 1992-93 and 1996-97.

The annual growth rates between 1985-86 and 1992-93 show some interesting trends. The main growth area during this period was computer software, which grew at the phenomenal rate of 16.5 per cent a year, while the growth in the publishing and entertainment sectors was more subdued. With software included, the growth of value added in copyright industries averaged 4.3 per cent a year between 1985-86 and 1992-93. With software excluded, the average growth rate drops to 2.6 per cent a year. By comparison, the GDP growth rate during this period averaged 2.7 per

Table 4.9 **Estimated value added of copyright protected industries[a]**

	Value added 1992-93	*Annual growth rate 1985-86 to 1992-93*	*Extrapolated value added 1996-97*
	$m	%	$m
Literature and print	5122	3.2	5810
Arts and related areas	1082	2.5	1194
Films and video	733	0.6	751
Radio and television	1371	1.5	1455
Computer software etc.	1783	16.5	3284
Advertising services	2042	4.6	2445
Total copyright based	12133	4.3	14939
Total excluding advertising	10091	4.2	12494
	% share		% share
Copyright VA as share of GDP	2.77		2.89
VA as share of GDP excl. advertising	2.30		2.42

a Monetary values in 1996-97 prices.

Source: Guldberg (1994).

cent a year. The fact that the average growth rate in publishing, arts and entertainment did not even reach the GDP growth rate during this period might have been connected with the severe recession in the early 1990s. Guldberg (1994) presents more information on this subject.

Two different totals are presented in table 4.9. One is the total for all the copyright-related industries listed by Guldberg, while the second excludes advertising. The reason for excluding advertising in the second total is because it is not clear whether advertising is strictly a copyright protected industry. Usually, the agents paying for advertising would not mind if others copied or used the advertisement in a way that would contribute to provide positive publicity to their product. On the other hand, they would want to be protected against misrepresentation of the advertised material. In most cases, copyright protection of advertising is less important than in relation to other copyright material. Looking from this perspective, a conservative estimate of the value added of copyright industries should not include advertising in the picture.

The bottom part of table 4.9 shows the value added of copyright industries as a share of GDP. This is in excess of 2.3 per cent, even if advertising is excluded. Given the (assumed) continuing rapid growth in software production, the extrapolated figures for 1996-97 indicate a further increase in the share of copyright industries in GDP. Guldberg cites several overseas studies to suggest that the share of copyright industries in Australia is in line with their shares in other industrialised countries.

Copyright in trade

Guldberg (1994) also presents statistics on trade in copyright material, but on that subject more extensive information, spanning the last 20 years, is available from the ABS, including estimates of IP-related royalty incomes, which are part of trade in services. Table 4.10 presents a summary of the shares of traded copyright material in GDP and in total trade (in goods and services combined). More detailed dissection of the components is shown in table D.1 in appendix D.

The figures present aggregate estimates for the two main components of copyright trade. One is licence fees and royalties paid for the use of products such as computer and information services, software, movies, TV programs and sound recordings. These royalties are included in trade in services in the balance of payments. The other component is part of merchandise trade. This component includes trade in commodities such as books, newspapers, periodicals, sound recordings and other recorded tapes and disks passing through merchandise trade.

Table 4.10 **Share of traded copyright material in total trade in goods and services and in GDP**

	1996-97	*1986-87*	*1976-77*
	%	%	%
Exports	share in exports	share in exports	share in exports
copyright royalties	0.8	0.4	0.1
copyright merchandise	0.4	0.2	0.1
total copyright material	1.2	0.5	0.2
	share in GDP	share in GDP	share in GDP
copyright royalties	0.2	0.1	0.0
copyright merchandise	0.1	0.0	0.0
total copyright material	0.2	0.1	0.0
Imports	share in imports	share in imports	share in imports
copyright royalties	1.5	1.1	0.8
copyright merchandise	1.7	1.8	1.4
total copyright material	3.1	2.9	2.2
	share in GDP	share in GDP	share in GDP
copyright royalties	0.3	0.2	0.1
copyright merchandise	0.3	0.3	0.2
total copyright material	0.6	0.5	0.3

Source: Table D.1 in appendix D.

These items have been already examined in section 4.2, in the discussion about copyright-related Maskus indices.

As shown in table 4.10, in the last two decades the share of copyright-related royalties increased much faster as a share of both imports and exports than the share of copyright-related merchandise trade. The increasing share of royalties in imports has been driven mainly by the substantial increase of trade in computer services and software. As a result of this trend, copyright-related royalties paid to foreign suppliers already approach payments for copyright-related merchandise imports. In exports, royalties now amount to more than twice the income from copyright-related merchandise exports. In this case, in addition to computer software and services, the rapid development of the local film industry over the last 20 years has been another major contributing factor to the rapid growth in royalties.

Comparing copyright and patent content

Finally, it might be appropriate to put the estimated copyright content of GDP and trade on a comparable basis to the patent content estimates presented in tables 4.5 and 4.6. Not all the value added of copyright industries is strictly copyright-related. Various overhead and distributional expenses are related to conducting the business

but not to copyright protection per se. Nonetheless, in the presence of rapid copying technologies, it is likely that most copyright industries would not be commercially viable without copyright protection. It seems reasonable to assume that between 70 and 90 per cent of the value added of copyright industries is as much related to copyright protection as the patent content estimates presented in section 4.3 are related to patent protection.

The 70 to 90 per cent copyright content estimate, combined with an estimated 53 per cent value added content in trade are used in table D.2 in appendix D to derive upper and lower estimates of the copyright content in production and trade. These estimates are based on the same logic as the patent content estimates presented in tables 4.5 and 4.6.

The aggregate copyright content estimates for 1996-97 are presented in table 4.11, together with a summary of the respective patent content estimates for the same year. The estimates indicate that the copyright content of domestic sales and trade as a share of GDP is considerably higher than the corresponding patent content. The difference is particularly large in domestic sales sourced from local production. The much higher overall value of copyright content comes from the higher level of base activities from which the estimates are derived. While the value added of copyright industries (excluding advertising) is estimated to be 2.4 per cent of GDP in 1996-97, total expenditure on BERD (excluding software and R&D in services), from which the patent content estimates are derived, amounted to only 0.6 per cent of GDP in that year. The difference between the two is further accentuated by the imputation of patent content at the range of 21 to 45 per cent of BERD, whereas the copyright content covers between 70 and 90 per cent of the value added of copyright industries.

Table 4.11 **Share of copyright content and patent content in GDP in 1996-97**

	Lower estimate	*Upper estimate*
	%	%
Copyright content		
Domestic sales from local production	1.55	1.99
Exports	0.14	0.18
Imports	0.33	0.42
Patent content		
Domestic sales from local production	0.08	0.15
Exports	0.05	0.09
Imports	0.13	0.24
Total VA of copyright industries	2.42	2.42
Total BERD (excluding software and services)	0.58	0.58

Sources: Tables 4.5, 4.9, D.2.

The figures in table 4.11, suggesting a greater economic importance for copyrights than for patents, must be interpreted with caution. First, there are likely to be fewer positive externalities associated with most copyright material than with patents and new inventions generally. Hence, from a dynamic perspective, the economic importance of patents is likely to be larger than indicated by the patent content alone.

Another point to note is that the relatively low patent content is a result of the heavy international trade in BERD intensive products. This is reflected in the relativities between domestic content and trade content for patents and copyright in table 4.11. Domestic sales from local production predominate in copyright content, whereas imports predominate in patent content.

To see the effect of trade on patent content, take the case of aircraft. According to table C.2 in appendix C, the BERD content of imported aircraft amounted to $178 million in 1996-97, which is less than 0.3 per cent of total Australian industrial output. But if access to imports was curtailed, probably all the resources of Australian industry would be insufficient to design and manufacture full replacement for imported aircraft. The BERD content (and patent content) is relatively low because of the success of international trade in defraying the cost of R&D over a large volume of sales and thereby reducing the unit cost of new technologies embedded in traded products.

4.5 Applications and registrations

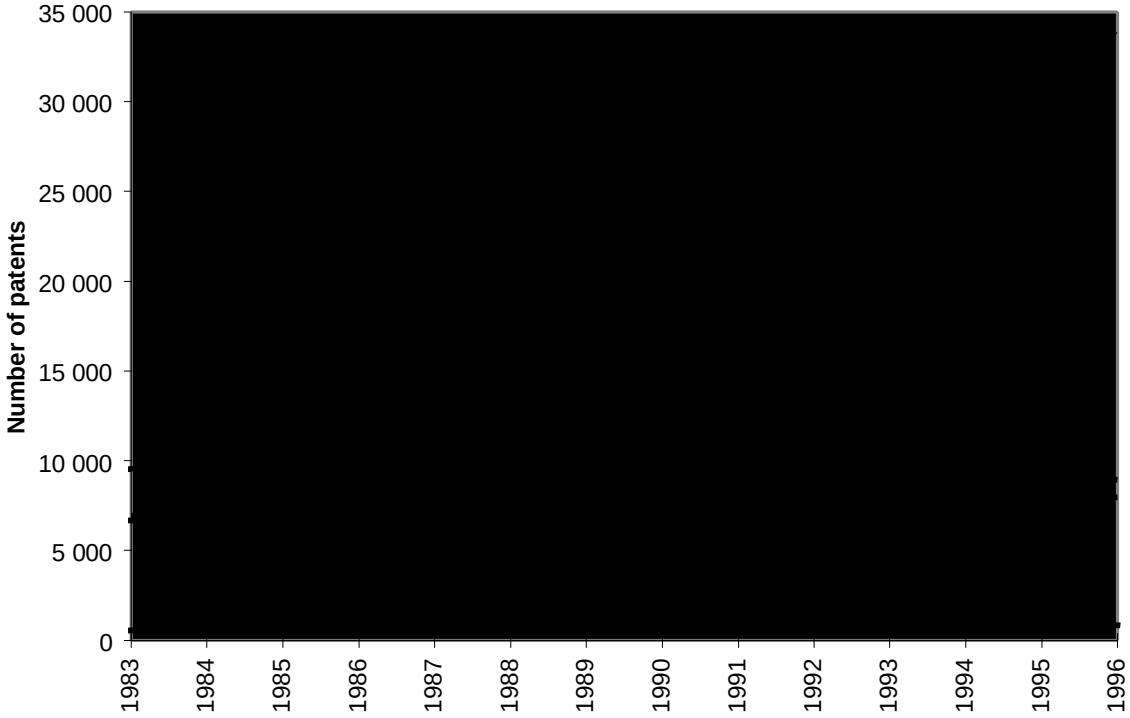
While it is not the purpose of this paper to analyse in depth the extensive statistics available on applications for and registrations of industrial property, it might be useful to highlight certain points from these data that are relevant to trade-related aspects of IPRs. The interested reader can find more detailed material on applications and registrations in Australia and abroad in IP (1998d).

Patents

Figure 4.1 summarises patent applications and registrations by residents and non-residents in recent years.

Perhaps the most significant development has been the rapid increase in patent applications by non-residents. This is connected with the increasing use of Patent Cooperation Treaty (PCT) applications around the world, a subject that is discussed in section A.2. In contrast to the rapid rise in applications, the number of registrations did not increase by much over the 1983–1996 period. In consequence,

Figure 4.1 **Patent applications and registrations 1983 to 1996**



Data source: Personal communications from IP Australia, 2 December 1998.

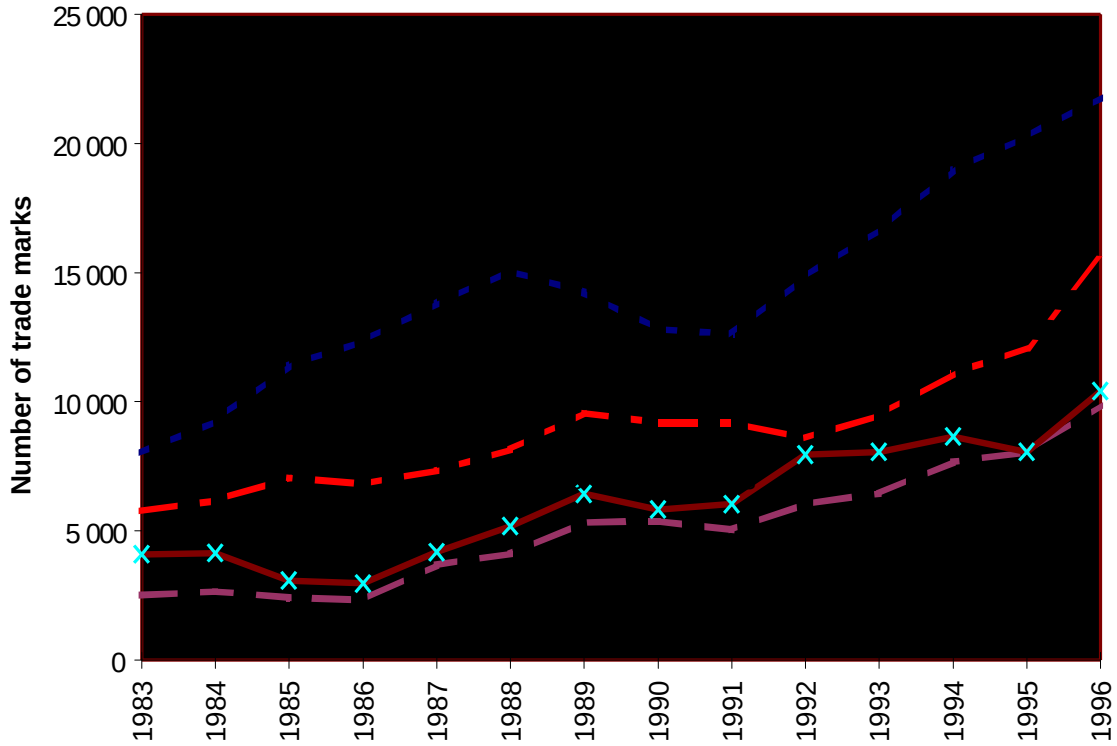
the ratio between applications and registrations, which was 2.3 in 1983, climbed to 4.9 in 1996.

In both applications and registrations, non-residents predominate. In 1996 only 9.6 per cent of patents granted were given to Australian residents. Over 90 per cent of patent registrations have been taken out by non-residents over a number of decades, as noted in BIE (1994a). The overwhelming importance of patenting by non-residents highlights the international nature of patent protection that was discussed in section 3.4.

Trade marks

Figure 4.2 summarises trade mark applications and registrations by residents and non-residents in recent years. The interesting trend in this area is the recent rapid growth in applications and registrations by both residents and non-residents. The total number of applications more than doubled between 1983 and 1996 and registrations more than tripled.

Figure 4.2 **Trade mark applications and registrations 1983 to 1996**



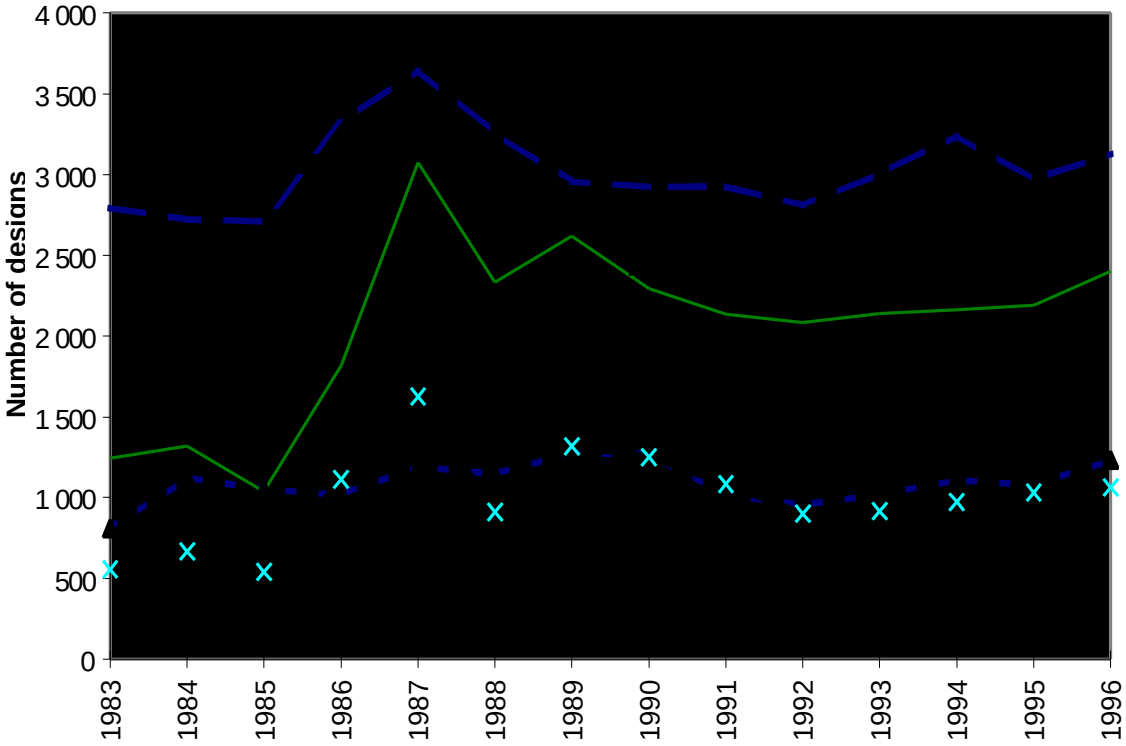
Data source: Personal communications from IP Australia, 2 December 1998.

Non-residents do not dominate trade marks. The share of non-residents in total registrations declined from 62 per cent in 1983 to 51 per cent in 1996. On the applications side, 59 per cent of applications in 1996 came from residents. Interestingly, non-residents show a significantly higher approval rate on their applications than residents. In 1996, the ratio between applications and registrations by non-residents was 1.5 whereas for residents the corresponding ratio was 2.2, implying that less than half of the applications were accepted.

Industrial designs

Figure 4.3 summarises industrial design applications and registrations by residents and non-residents in recent years. In many respects the situation in industrial designs is markedly different from that of patents. First, domestic residents dominate by a wide margin in both applications and registrations. In 1996, 69 per cent of registrations were granted to Australian residents.

Figure 4.3 **Industrial design applications and registrations 1983 to 1996**



Data source: Personal communications from IP Australia, 2 December 1998.

Also in marked contrast to patents and trade marks, the level of applications has remained fairly static in recent years. By contrast, the number of registrations granted more than doubled between 1983 and 1996. In consequence of this trend, the ratio between applications and registrations has decreased considerably. Whereas in 1983 the ratio between registrations and applications was 2.0, by 1996 this ratio had declined to 1.3. This may have been due to improvement in the quality of applications, or because screening had been relaxed.

4.6 A brief overview

The international comparisons presented in this chapter suggest that Australia has a large excess of imports over exports in all IP items, including patents, copyrights, designs and trademarks. The reason for the large excess of IP imports over exports is related to the traditional specialisation of Australia in the exports of primary commodities and the imports of elaborately transformed manufactures, which usually incorporate much more IP content. However, the situation is changing. In the last decade, Australia has increased significantly the exports of R&D intensive

products (such as pharmaceuticals, computers, telecommunications equipment, industrial machinery and scientific instruments) and trade mark-related goods (such as wines and processed food). The share of copyright-related royalties in service exports (related mainly to computer software and services and film production) has also increased sharply over the last 20 years. As a result, the patent and copyright content and the trade mark dependency of exports have risen significantly.

The IP content of imports has increased as well. Apart from the internal restructuring of the Australian economy, the growing IP content in both imports and exports is due to the rising share in international trade of elaborately transformed manufactures and professional services. Trade in products that are not much related to IP, such as simply transformed manufactures and primary commodities, is growing more slowly.

Estimates of the monetary value of patents and copyrights (based on cost of production rather than economic benefits) suggest that copyright protection is more important economically than patent protection. However, these estimates must be treated with caution, bearing in mind that they are based on costs rather than benefits. On the benefits side there may be significant positive economic externalities associated with patents, more so than with most non-educational copyright material.

This unexpected finding also highlights the fact that international trade is a powerful vehicle to defray the cost of R&D (and patent content) over a large volume of sales, thereby lowering the unit cost of new technologies. In many cases, Australia gains much by relying on imported technologies, patent protected or otherwise.

The increasing globalisation of the world economy has led to a large increase in patent and trade mark applications by non-residents. The rapidly growing number of patent applications has not been matched by a significant increase in patent grants.

A IP law and international agreements

This appendix describes in broad terms the IP legal framework in Australia, as well as the provisions of TRIPS and earlier international agreements. The discussion is non-technical, the aim being to provide relevant information to policy-makers, economists and the interested public rather than for legal experts. The legal framework and the provisions of international agreements are described separately for individual IPR categories, that is patents, copyrights, trade marks, trade secrets and the like. The discussion also identifies some current policy issues.

A.1 Intellectual property rights broadly defined

Intellectual property rights (IPRs) have been defined as ideas, inventions and creative expressions on which there is a public willingness to bestow the status of property (David 1993). IPRs provide certain exclusive rights to the creators of IP, in order to enable them to reap commercial benefits from their creative effort or reputation. The purpose of IPR legislation is to protect against unauthorised imitation, copying or deceptive usage of identifying marks. In terms of legal treatment, IPRs can be divided into three distinct groups.

Industrial property is generally protected by legally registered rights, including patents, trade marks and designs. Notwithstanding the similarity in the legal method of protection, this is a very diverse area, as will be discussed later. The administration of industrial property is carried out by IP Australia, an agency of the Department of Industry, Science and Resources.

Copyrights and neighbouring rights are unregistered but automatically apply against unauthorised copying and duplication. Copyrights protect expression but not ideas. This IPR group covers literary work, art work, performances and broadcasts. Policy responsibility for copyright is shared between the Attorney General's Department and the Department of Communications, Information Technology and the Arts on matters of interest and concern to the latter portfolio. The Attorney General's Department has responsibility for the Copyright Act under the Administrative Arrangements Order issued by the Prime Minister.

A borderline category that has been included in TRIPS is undisclosed information, in other words, trade secrets. They are protected by laws pertaining to breach of confidence and fair trade.

Apart from trade secrets, IPRs are usually treated legally in the same manner as any other property, with the creator or current owner having the exclusive right to sell, assign, rent or license the property or part of it, though the ownership is limited in time.

The following sections discuss each of the main IPR categories — patents, trade marks, designs, copyrights and neighbouring rights and trade secrets — covering the purpose and scope of the respective IPR protection, the legal framework in Australia, relevant WIPO agreements and the provisions of the TRIPS agreement. Attention is also given to legal overlaps between certain IPR categories. The discussion is based largely on government publications. The main features of the Australian IPR legislation are described in IP Australia (1998a, 1998b, 1998c) and AGD (1997). WIPO agreements are summarised in WIPO (1997) and the TRIPS agreement is outlined in WTO (1998).

A.2 Patents

The Patent Act

A patent confers the right to secure the enforcement power of the State to exclude unauthorised persons from making commercial use of a clearly identified, novel and useful invention. This protection enables patentees to stop others from manufacturing, using or selling the invention without their consent. The Australian system of granting patents to inventors is based upon British law, which can be traced back to the English Statute of Monopolies of 1624.

In fact, the granting of monopoly rights in exchange for new technologies started in England in the 14th century, initially for the purpose of attracting skilled craftsmen from abroad. Knowledge of the flourishing patent systems in Venice and Antwerp led England to adopt the practice of patents for inventions in the 16th century (David 1993; AIPO 1993).

The granting of monopoly rights appeared an attractive option to rulers in the Renaissance period for importing new crafts and skills and for stimulating new inventions, at the time that scarce public revenue was used mainly to finance the military and the elite. Whether this ancient instrument is well suited to foster innovation in modern times is a subject that is taken up in chapter 3. The fact that

early patents were used mainly to attract technology transfer from abroad highlights the fact that from the very start, the patent system had a strong international dimension, a subject that is the main focus of attention in this paper.

Under the Australian Patent Act, a patented invention must satisfy a number of criteria.

- It must be a clearly defined product or process, rather than just an idea or concept.
- The invention must be novel. The Australian patent law requires universal test of novelty, that is, the invention must be novel compared with previous patents filed in other countries and not just in Australia.
- The criteria of obviousness is applied to test the inventiveness of the patent. If the solution to the problem answered by the patent is deemed to be obvious to technical experts in the field, then the invention is not patentable.
- The invention must be useful for what it purports to do. Only inventions are patentable — scientific discoveries and works of art are not patentable.
- The patent application must present a clear description of the invention.

Patent examination is to a large extent a bibliographic search of prior art, using patent disclosures and the technical literature, to assess novelty and non-obviousness. The examination does not involve testing whether the invention works the way the inventor claims it does. That issue would be examined during litigation about alleged patent infringements. The examination of novelty and inventiveness is carried out using technology-specific public guidelines based partly on common law (that is, previous decisions by the courts). In the absence of relevant legal precedents, the guidelines are determined by the Commissioner of Patents.

Currently the maximum duration of patent protection is 20 years. Patents are subject to annual renewal fees starting from the third anniversary. If the invention is not commercially successful, the patentee can terminate protection any time after three years by not paying the renewal fee.

A standard application must provide a complete description defining the invention, including the principles and methods used by the inventor to carry out the invention. The original element(s) in the invention represent the claim(s). The date of application for the patent is used as the priority date of the claim. Put simply, the priority date of a claim is the date on which the novelty of the claim in assessed by the Patent Office (currently a division of IP Australia). It is the date on which patent protection comes into effect if the application is accepted.

It is possible to establish an earlier priority date by filing a provisional application, which describes the nature of the invention in broad terms. The date of the provisional application will be accepted as the priority date, provided a standard application with full specifications is filed within 12 months after the provisional application.

The Patent Office publishes all complete applications for standard patents 18 months after the priority date, which means that the patent application becomes open for public inspection. The public is informed about the new application through a notification in the Official Journal of the Patent Office[1]. The crucial point to note from an economic perspective is that patents are granted in exchange for the public disclosure of information by the patentee about the nature and working of the invention.

Australia has a two-tiered system of standard and petty patents. The term of a petty patent is 6 years — less than a third that for standard patents. Petty patents are restricted to a single claim whereas standard patents can combine a number of claims. The processing of petty patent applications is usually much quicker than for standard patents. Although the inventive threshold for petty patents is determined against the base of domestically registered prior art, it is broadly equivalent to the inventive height of the standard patent, since prior art registered in Australia parallels the international prior art (BIE 1995). Given similar screening criteria and much shorter length of protection, petty patents are not much used in Australia. Some reform options currently under consideration by the Government are reviewed later.

The Australian patent law resembles not only the British patent law on which it is founded, but also the patent laws in most other developed countries. While strictly speaking the Paris Convention and TRIPS do not require harmonisation of patent legislation, the similarity in broad patenting concepts across countries has been partly driven by international contacts and partly by the universal nature of technology.

[1] Another publication in the Official Journal occurs upon acceptance of the patent for registration. Any member of the public is entitled within three months of the advertisement to oppose the granting of the patent by presenting additional information. If this appeal is accepted by the Patent Commissioner, the patent will not be granted. About one per cent of applications are rejected this way every year (AIPO 1993).

Patents and the Paris Convention

As noted earlier, the Paris Convention originated in 1883. It was revised several times thereafter. The latest amendments were incorporated in 1979, and this is the version adopted in TRIPS. The Paris Convention applies to 'industrial property' including inventions, marks, industrial designs, utility models (a kind of 'small patent' for mechanical innovations not provided in Australia) and trade names (WIPO 1997).

In regard to patents (as well as trade marks, industrial designs and utilities) the substantive provisions of the convention fall into three categories — national treatment, right of priority and common rules.

- Under the provisions of 'national treatment', the convention requires that, as regards to the protection of industrial property, each contracting state must grant the same protection to nationals of the other contracting states as it grants to its own nationals.
- The convention provides for the 'right of priority' in the case of patents, marks and industrial designs. This right means that, on the basis of a regular first application filed in one of the contracting states, the applicant may within a certain period of time (12 months for patents and utility models, six months for industrial designs and marks) apply for protection in any of the other contracting states, and these later applications will be considered for novelty in each country according to the date of application in the originating state.
- The convention lays down a few 'common rules' that all the contracting states must follow. In regard to patents, the more important ones are:
  - patents granted in different states are independent of each other, so that a patent cannot be granted or refused depending on its acceptance in another contracting state to the convention;
  - a patent cannot be refused for the reason that the sale of the patented product is subject to restrictions or limitations resulting from domestic law; and
  - compulsory licensing of unworked patents by public authorities may be carried out only after three or four years of failure to work or insufficient working of the patented invention and it must not be pursued if the patentee gives legitimate reason to justify the inaction.

Looking at the provisions of the Paris Convention, the 'national treatment' provision preventing discrimination against non-residents appears the most significant. The provision about 'priority dates' is an extension clause to ensure a non-discriminatory reference date when testing for novelty. The independence of patent assessments means that separate applications (often accompanied by translations)

have to be lodged in each member state in order to obtain patent protection. Other 'common rule' clauses about restrictions in domestic sales and compulsory licensing relate to rather exceptional circumstances in Australia. Compulsory licensing has not applied here for the last 50 years.

While the Paris Convention ensured that non-residents are not being discriminated against in patent examination and legal enforcement, there is little in this convention to steer toward harmonisation of national patent systems. Prior to the introduction of TRIPS, the length and breadth of patent protection varied widely among member states to the Paris Convention (Frischtak 1993; Primo Braga 1995)[2]. Moreover, in some developing countries, products such as pharmaceuticals and agricultural chemicals were not protected through patents. In addition, there have been large variations in the national screening criteria applied in regard to novelty and non-obviousness, the conduct of infringement procedures as well as the requirements for and timing of disclosures. Following the introduction of TRIPS, the minimum length of patents and the coverage of subject matter has been standardised, but there are still large variations in screening criteria. The divergences between national patent laws may weaken the global protection system, as is discussed in section 3.4.

Patents and TRIPS

The introduction of TRIPS has made a significant contribution to patent law harmonisation, by setting the standard patent terms to at least 20 years. TRIPS also requires all products and processes to be patentable (including pharmaceuticals, food and agricultural chemicals). Exceptions include medical and surgical methods and inventions that can be dangerous to life and therefore should be prohibited from commercial exploitation. The most significant exception to patentability is new life forms above the micro-organism level — a subject for further negotiation that is discussed in greater detail in section A.3.

By and large, TRIPS does not deal with procedural details, but an unusual operational clause requires that in the context of civil litigation, the reversal of the burden of proof should be available under certain circumstances. For example, it should be upon the defendant to prove that the process to obtain a chemical product is different from the patented process. This clause was included in recognition of

2 In this context, length refers to the patent term. Patent breadth refers to the degree the patent is protected against imitations, in the sense that a similar invention would be considered an infringement. In other words, it defines the 'height of the bar' or the 'region of exclusion' concerning novelty. For an economic discussion on this subject, refer to Foray (1995) or van Dijk and van Caysele (1995).

difficulties experienced in many places in prosecuting infringements against process patents, given that manufacturing processes are usually not observable by outsiders.

Apart from extending patent terms and standardising the coverage of patentable subject matter, TRIPS also sets new guidelines in respect to compulsory licensing and government use without authorisation. While these measures are still allowed, TRIPS tightens the respective provisions in the Paris Convention by requiring adequate remuneration be paid according to the circumstances of each case, taking into account the economic value of the licence. Moreover, the decision about compulsory licensing should be subject to judicial or other independent review by a distinct higher authority.

Australia could not be a member of the WTO without agreeing to TRIPS. Some amendments had to be made to the Australian patent law in order to bring it into conformity with TRIPS. These amendments were included in the *Patent (World Trade Organisation Amendment) Act 1994*.

- The standard patent term was increased from 16 to 20 years. Pharmaceuticals were already protected for up to 20 years, in recognition of the long time lags involved in obtaining approval from drug safety authorities.
- In certain infringement proceedings, it is upon defendants to prove that their product was obtained by a process other than the patented process.
- The conditions for compulsory licensing have been tightened in line with the requirements of TRIPS.

The extension of the standard patent term from 16 to 20 years was a significant change in economic terms. Its economic impact on Australia has been analysed by Gruen, Bruce and Prior (1996). This subject is revisited in section 3.4.

Other patent-related treaties

The Patent Cooperation Treaty

An important patent-related WIPO agreement that is not covered by TRIPS is the Patent Cooperation Treaty (PCT). The PCT was signed in 1970 and currently 89 states are members to this Treaty, including Australia. This treaty makes it possible to seek patent protection for an invention simultaneously in a number of member states designated by the applicant, by filing an 'international' patent application. The international application is subject to what is called an 'international search'. The search is carried out in one of nine major patent offices, with the Australian Patent Office being one of them. The other patent offices designated to carry out

'international search' reports are Austria, China, Japan, Russia, Spain, Sweden, United States and the European Patent Office. The international search report presents a listing of the citations of public documents (primarily patent disclosures) that might affect the patentability of the invention around the world.

If the international application is not withdrawn after receiving the international search report, the application together with the international search report is published by WIPO and communicated to each designated patent office selected by the applicant. It is possible to go even further and request an 'international preliminary examination report', a report which is prepared by one of eight large patent offices (the nine mentioned earlier excluding Spain), and which gives a preliminary and non-binding opinion about the patentability of the claimed invention.

The search and examination work of the patent offices of designated states can be considerably reduced or virtually eliminated thanks to the international search report and where applicable, the international preliminary examination report. However, each patent office must still decide on the application according to its laws and screening criteria. The PCT does not obviate the need to lodge separate patent applications in different countries, but it can reduce the cost of doing so.

When using PCT procedures, the allowable delay for filing in other countries is considerably extended. Whereas under standard procedures filing in another Paris Convention member country must be lodged within 12 months of the original application, PCT applicants who use an international patent search can postpone their filing abroad by up to 20 months after lodging the PCT application. When using an international preliminary examination report, filing in other countries can be made within 30 months of the original PCT application.

The development of the PCT is shown by the fact that in 1979, 2625 applications were received by the PCT office, while the corresponding number was 4291 in 1996. The average number of designated states per application was 6.7 in 1979 and 56.2 in 1996, reflecting the rapidly increasing international coverage of patents (WIPO 1997). The increasing use of the PCT by developing countries (measured in accessions to the PCT and use of it) is noteworthy, as evidence of their growing interest in IP protection, independent of formal TRIPS obligations.

There is no such thing as an 'international patent', but there are currently three regional patent offices that provide a single patent recognised in all regional member states. These are the European Patent Office (for European Union countries), the Eurasian Patent Office (for countries of the former Soviet Union) and

the African Regional Industrial Property Organisation, which also incorporates a patent office. These regional organisations are outside the ambit of TRIPS or WIPO.

The Strasbourg Agreement

Another patent-related WIPO agreement is the Strasbourg Agreement (1971) on International Patent Classification (IPC). Australia is a party to this agreement. The IPC divides technology into eight main divisions and approximately 64000 subdivisions. This commonly used classification scheme facilitates international patent searches.

The proposed Innovation Patent

There is a proposed reform in the patent area, which is unrelated to TRIPS or any other international agreement. As noted earlier, Australia has a system of petty patents. Since the screening criteria for petty patents are almost the same as for standard patents, while the term of protection is less than a third of that for standard patents (6 years compared with 20), petty patents have not been much used in the past. The low level of usage of petty patents has prompted considerations to replace them with a so called Innovation Patent.

The proposed Innovation Patent would provide protection for lower level inventions, particularly by lowering the test for non-obviousness. It would reduce the compliance burden on users by providing easier, cheaper and quicker rights for inventions than the rights currently provided by the petty patent system. The idea is to stimulate low level innovation by providing means through which small and medium sized enterprises in particular can seek rights to exclude their competitors from copying inventions that the owners of the right have invested money to develop. Despite the apparent attractiveness of this proposition, it is not clear on economic grounds that Australia should provide monopoly rights to low level inventions. More detailed discussion on this subject is presented in section 3.4.

A.3 IPR protection of biological innovations

Background

The IPR protection of new life forms raises a number of difficult technical and ethical issues that do not apply to other inventions. For that reason, the patentability of new biological forms and processes is still not accepted in many countries.

Consequently, no final agreement could be reached during the TRIPS negotiations on how to tackle this complex subject.

TRIPS has an in-built agenda for review and further consideration of issues that were not resolved during the original negotiations. At the present, biological innovations is one unresolved issue, geographical indications is the other. Review of the IPR protection of all biological innovations above the micro-organism level has already commenced, but it is not clear when negotiations as such will start. New forms of micro-organisms should receive patent protection according to TRIPS.

Before discussing TRIPS further, a few explanations are needed on why the IPR protection of biotech innovations is so controversial. First, there are ethical issues concerning the creation of new life forms. While this is a legitimate concern, one should not lose sight of the fact that human societies have been creating new life forms through selective breeding and hybridisation of plants and animals for thousands of years. The social acceptability of new life forms is a moral issue well beyond the realm of IPR protection.

Then there is the economic issue that so far, agricultural and medical research has been conducted mainly in public research agencies and universities. One of the motives for stronger IPR protection is to shift some of this research to private enterprise. Some political and lobby groups claim that making research more profit-orientated might have adverse consequences for agricultural development and public health.

On the technical side, a frequently raised question in relation to biotechnological research is whether the new life form, or an organic substance derived from the new life form, is a scientific discovery or a technological invention. Patents are not supposed to cover scientific discoveries, only inventions. Moreover, many products of recombinant DNA are more a result of luck and patience than of original thinking. Much work in genetic engineering involves inserting and recombining genes using established techniques. It is not clear whether such recombinations should be eligible to pass the non-obviousness test, even if the result is quite novel (Barton 1993). But there are different opinions about what is obvious and what is not to technical experts in this new field of study.

Another technical question is whether the patent should be regarded as extending to the progeny of the protected life form. According to law, sellers generally exhaust their rights in the item sold, so that buyers are entitled to use it as they see fit. (The ‘exhaustion’ principle is also discussed in section 3.8 in the context of parallel importing.) Thus, according to this principle, the progeny belong to the buyer. On the other hand, the unauthorised reproduction of an article containing some patented

element(s) is an infringement of the patent. This clearly represents a conflict between two legal doctrines that has to be resolved.

As noted earlier, TRIPS does not provide a definite code regarding new life forms. The present version of TRIPS allows members to exclude from patent protection:

- plants and animals other than micro-organisms; and
- essentially biological processes for the production of plants or animals other than microbiological processes.

However, TRIPS stipulates that protection must be available for new plant varieties (including seeds), though this does not have to be necessarily by patents. Most countries, including Australia, offer specially designed (sui generis) protection to new plant varieties.

By virtue of requiring the protection of new micro-organisms by means of patents, TRIPS already covers most of the field of genetic engineering related to pharmaceuticals. The development of new proteins for pharmacological use (such as new vaccines, blood clotting agents, hormones and other therapeutic substances) depends on new strains of micro-organisms incorporating imported genes, rather than higher forms of life. New micro-organisms have been patentable in most industrialised countries (including Australia) for many years. However, there is no international consensus about what precisely should be covered by patents on micro-organisms (Maskus 1997).

The Budapest Treaty

Developments in the field of biological IPRs led to the Budapest Treaty (1977) on the international recognition of the deposit of micro-organisms for the purpose of patent procedures. Australia is a party to this WIPO agreement. Where an invention involves a micro-organism or the use of a micro-organism, disclosure is not always possible in writing, but can be effected by the deposit with an approved institution of a sample of the micro-organism. In order to eliminate the need to deposit in each country in which protection is sought, the Budapest Treaty provides that the deposit of a micro-organism with any one of two dozen approved institutions around the world suffices for the purpose of patent procedure in any member state. In Australia, this internationally approved institution is the Australian Government Analytical Laboratories.

The Patent Act and biological innovations

Australian IPR protection of new life forms exceeds the current requirements of TRIPS. Under the *Patents Act 1990*, patenting of biotechnology inventions is allowed. A patent can cover the method for creating the new life form, the life form itself and the production of substances using the new life form. The issue of whether genes and life forms should be excluded from the patent system was considered during the parliamentary debate of the legislation in 1989. The result of the debate was a single exclusion — human beings and biological processes for their generation are not patentable.

The biological patent application in Australia must meet all the usual requirements for patentability, that is novelty, inventiveness and appropriate description. In addition, a biological invention must be repeatable, a criterion that need not be considered for non-biological inventions. The requirement for repeatability rules out traditional methods for creating new life forms through selective breeding or hybridisation. It also excludes some modern techniques such as mutation by means of radioactive irridation. In all these cases, it is not possible to obtain the same outcome time and again. However, with techniques based on genetic manipulations, it is possible to obtain repeatable outcomes, at least for a fraction of the population being bred. Hence the patentability of new life forms is restricted almost exclusively to the field of genetic engineering.

Plant breeders' rights

Apart from providing patents for bioengineering inventions, Australia also offers protection for new plant varieties through a specifically-designed 'sui generis' protection regime. This protection is generally weaker than for patents. The protection of new plant varieties was first introduced in the United States in 1930. It was adopted later in Western Europe and was harmonised following the establishment of the International Union for the Protection of New Varieties of Plants (UPOV) in 1961. UPOV is an organisation largely independent of WIPO. The UPOV Convention has been revised several times since 1961.

The Australian plant breeders' rights legislation for the protection of new plant varieties is modelled on the UPOV Convention. Protection of plant breeders' rights is obtained from the Plant Breeders' Rights Office, an agency of the Department of Agriculture, Fisheries and Forestry. In order to gain protection, the new plant variety must be distinct, uniform and stable. Unlike biotechnological patents, there is no requirement for repeatability, therefore plant varieties developed through

selective breeding, hybridisation, budding, grafting and tissue cultures are all acceptable.

The plant breeder obtains the right for the sale and the distribution of the new variety. Based on the principle of 'exhaustion' of the IPR rights of sellers, the breeder's rights do not extend to the use of a grower's crop (that is, the grower does not have to pay royalty on the crop produced directly from the seeds or grafts sold by the right-holder). However, the breeder's rights extend to the use of the progeny from the plant variety sold. While buyers can use the progeny from the seed for the production of another crop on their land, the breeders of the new plant variety can exercise their IP rights (including the right for royalties) when the harvested material is disposed of commercially. The time limit for protection is 25 years for trees and vines and 20 years for other species.

The Australian plant breeders' rights legislation satisfies TRIPS requirement for at least some IPR protection for new plant varieties. Furthermore, in Australia patent protection can be taken out for a new plant variety created by genetic engineering, an option that is not available in many countries. In many cases plant breeders' rights offer a weaker protection than biological patents, because the protection does not extend to new genes or to the process of creating the new plant variety.

TRIPS negotiations on biotechnology

In the current TRIPS review of biological innovations (including new plant varieties), the broad contours of the negotiating camps are already discernible. According to the sketchy details presented by Hoinkes (1997), Farquhar (1998) and DFAT (1998) there appear to be three distinct groups.

The United States sees biotechnology patent protection as a key intellectual property and trade priority and would like to see mandatory IPR protection in this area around the world. On the opposite side of the fence are a number of developing countries, led by India, who are arguing for further strengthening of TRIPS provisions excluding plants and animals from the scope of mandatory protection. Some of these countries would like to see some new form of sui generis protection — for example, one recognising farmers' rights.

The third group is dominated by Europeans, who seem to be still struggling with the issue of patenting biotechnology. The European Union directive (Directive 98/44/EC of the European Parliament and of the Council of 6 July 1998 on the legal protection of biotechnological inventions) is a bit opaque, but essentially establishes plant and animal inventions as patentable, provided the technical feasibility of the invention is not confined to a particular plant or animal variety. This implies a patent on the process of creating the new life form, rather than patenting the new

animal or plant variety itself. This could be characterised as a mid-range approach between full and no patentability of transgenic innovations involving plants and animals above the micro-organism level. Currently the position of most European countries seems to be to maintain the status quo in the TRIPS agreement, which allows every member to decide for itself on how to protect biotech innovations, apart from micro-organisms and new plant varieties.

The patent protection afforded in Australia to new life forms is much closer to the US model than to practices in most other countries. Biotechnology, both in TRIPS and more widely, is emerging as a key trade policy issue with major implications for the development of Australia's agrifood and pharmaceutical industries. Given our relatively strong expertise in biotechnology, it seems likely that this is an area where Australian industry will want access to IPR protection in as many markets as possible (Farquhar 1998). Consequently, it might be in Australia's interest to support the United States position in favour of mandatory IPR protection for biotech innovations around the world.

A.4 Industrial designs

The Design Act

The Australian Design Act grants protection to the visual appearance or design of a manufactured article, if it is new or original. In this context, design refers to the ornamental aspect of an article that is produced in quantity. This ornamental aspect may be constituted by elements that are three-dimensional (the shape of the article) or two-dimensional (lines, designs, colours) but must not be dictated solely or essentially by technical or functional considerations.

Protection of an industrial design means that third parties not having the consent of the owner may not make, sell, or import articles bearing or embodying a design that is a copy, or substantially a copy, of the protected design, when such acts are undertaken for commercial purposes. The purpose of design protection is to provide an economic incentive for improving the visual appearance of manufactured products.

Protection is based on a system of registrations and can last for up to 16 years. Applications for registration must be accompanied by photographs and other graphics if necessary, and describe the product on which the design is applied. Approval for registration depends on satisfying the criteria of novelty or originality (but not necessarily both).

- Novelty means that the same or very similar design must be not known or previously registered in Australia.
- Originality means that the design has never been applied to the particular product specified in the claim, although it may have been applied to another type of product.

The protection is only for the appearance of the article and not how it works. As for patents, detailed examination guidelines are based partly on common law (that is, previous decisions by the courts). In the absence of relevant legal precedents, the guidelines are determined by the Registrar of Designs.

Design protection excludes non-visible internal parts, but does not exclude visible spare parts such as exterior panels, bumpers or wheel trims. Removing the design protection on currently protected spare parts was recommended in the IC (1995) report on vehicle and recreational marine craft repair. The BIE (1995) report noted that there is a degree of uncertainty about the protection provided to spare parts by the current legislation. The protection of spare parts is an important policy issue that is discussed in more detail in section 3.5.

Design registration is intended to protect designs that are applied industrially, rather than a single artistic work, where copyright protection would automatically apply. When artistic work can be applied on or to commercial articles, protection under both the Copyright Act or the Design Act may be available (AGD 1997). However, the Copyright Act will not provide protection to a design that, when applied to an article, results in a reproduction in three-dimensions of that design (so called 'corresponding design'). In most cases where dual protection is available, registered design provides a stronger legal protection than copyright, by virtue of having satisfied for registration the screening criteria regarding novelty or originality.

International agreements on designs

The Paris Convention's provisions concerning 'national treatment' and the 'right of priority', which prevent discrimination against non-residents, also apply to industrial designs. The convention specifically states that industrial designs must be protected in each contracting state, and protection may not be forfeited on the grounds that the articles incorporating the design are not manufactured in that state. In order to retain the priority date, application for design registration in other countries must be lodged within six months of the original application in the home country, while in the case of patents one year is allowed.

TRIPS does not contain any significant amendment to the Paris Convention in respect to industrial designs. TRIPS requires WTO members to grant protection for aesthetic designs, but does not require protection for designs dictated essentially by technical or functional considerations, in line with the Paris Convention. One of the articles of TRIPS contains a special provision aimed at taking into account the short life cycle and sheer number of new designs in the textile sector, requiring that the cost of relevant examinations should not unreasonably impair the opportunity to seek and obtain design protection in the textile industry.

TRIPS requires that the duration of protection available shall amount to at least 10 years. As noted earlier, the Australian law allows the protection term to extend for up to 16 years. The adoption of TRIPS did not necessitate changes in the Australian design legislation.

There are a couple of design related WIPO agreements that are not covered under TRIPS. In a similar manner to patents, there is an agreement to facilitate design registration in other countries and an agreement about international classification of industrial designs.

The Hague Agreement (1925) concerning the international 'deposit' of industrial designs enables the use of one international 'deposit' (in other words, set of specifications), based on pictures and description of the article, to lodge design applications in a number of designated member countries. The Hague system is a form of international registration (unlike the PCT which only facilitates patent applications under national systems). Notwithstanding the common registration, each member state can refuse granting protection in its jurisdiction, depending on its law and its stock of design registrations. Currently, the agreement has only 29 member countries. The main reason Australia did not join this agreement is because it does not allow for countries which have substantive (novelty) examination of design applications. Another reason for not joining is that the small number of member countries do not include our major trading and political partners, such as the United States, United Kingdom and Japan. The Hague system is due to be renegotiated in the near future, to rectify some of the deficiencies perceived by countries such as the United States, United Kingdom and Australia. The resultant new agreement might be more attractive to Australia.

The Locarno Agreement (1960) establishes an international classification for industrial designs. Australia is not a party to this agreement, because of the small number of participants, which exclude our major trading partners. However, the Australian Design Office uses a modified version of the Locarno classification in its design examination work.

Reform proposals for design protection

The Government is considering whether to revise the Design Act, which originated in 1906 (Entsch 1999). These deliberations are related to the recommendations of a three year inquiry by the Australian Law Reform Commission (ALRC) into the Design Act that was published in 1995. The ALRC recommended many changes to improve the effectiveness of protection in this area. Among other things, ALRC (1995) suggested that new design legislation should not expressly exclude designs 'dictated by function' from protection, which implies extending protection to certain functional designs.

These recommendations probably have been influenced by practices and proposed changes in overseas design protection (particularly in European Union countries) and the desire to harmonise the various levels of international protection of industrial designs (BIE, 1995). But one should not forget that neither the Paris Convention nor TRIPS requires Australia to harmonise its legislation with other countries beyond the minimum requirements specified in these international agreements. The economic arguments for and against the protection of functional designs and spare parts are reviewed in section 3.5.

In any event, it appears that the Government is considering to narrow the boundaries of design protection rather than extending them (Robertson 1999). Proposed changes include the abolition of design protection on exterior spare vehicle parts, a two-step registration threshold that requires both novelty and originality (instead of the current requirement to comply with one or the other), and reduction in the maximum term of design protection from 16 to 10 years, which is in line with the minimum requirement of TRIPS.

A.5 Trade marks

The Trade Marks Act

Under the Australian Trade Marks Act, registered trade marks grant protection to a letter, word, sound, smell, shape, logo, picture, aspect of packaging or a combination of these, used by traders on their goods and services to indicate their origin and to distinguish such goods and services from those of other traders. Initial registration lasts for 10 years, with the possibility for further renewals indefinitely.

As indicated from this definition, trade marks are signifiers that protect commercial reputation. Unlike patents, designs or copyrights they do not apply to 'knowledge

goods' or creative outputs. The economic rationale for trade mark protection is discussed in section 3.7.

The prime objective of the examination of trade mark applications is to verify that the proposed mark is not the same as, or very similar to, an already registered mark for the same or similar type of goods or services. The goal is to prevent deception of the public about the origin of goods and services. In addition, since a trade mark is used to distinguish the goods of one trader from another, it must not be a sign that other traders may wish to use to promote or describe their goods and services. This means that a trade mark cannot directly describe the commodity such as radio or bread or services such as plumbing. While it is very difficult to register a geographic name or surname, someone who has used extensively such a mark for a considerable period of time may be able to achieve registration. The issue of geographical indications is examined in section A.6. Trade marks that conflict in some way with earlier trade marks or would mislead the public about the nature of the goods or services are also difficult to register. Some words are protected by law and are prohibited in trade marks, for example, Olympic, Champion, Champagne.

A trade mark does not have to be registered in order to gain legal protection. Unauthorised usage of an existing trade mark can be challenged through the 'passing off' action in common law. Injured parties have to prove that they developed a reputation in the trade mark and that use of the other trade mark would be likely to confuse or deceive the public. This can be difficult and expensive, so proper registration can save time and money when it comes to litigation. The Trade Practices Act is probably just as important in dealing with misleading and deceptive use of trade marks (registered or otherwise) as the 'passing off' action in common law.

The registration of business names (carried out at the State level) is unrelated to the registration of trade marks by IP Australia. Registration of a business name provides no guarantee that it can be used as a trade mark – such use may infringe on someone else's trade mark rights.

The process of registration is similar to that of patents and designs. An application must be accompanied with a graphic representation. The application specifies the type of goods and services to which the mark will be applied. In the case of trade marks containing sounds, scents, shapes, colours and aspects of packaging, there are additional reporting requirements. English translations of foreign trade mark names can be accepted.

The application is examined for conformity with legal constraints on using names and non-infringement with existing registrations. As for other registered IPRs,

detailed examination guidelines are based partly on common law (that is, previous decisions by the courts). In the absence of relevant legal precedents, the guidelines are determined by the Registrar of Trade Marks. If the application is not rejected, it will be advertised in the Official Journal of Trade Marks and, provided no one objects to it within three months, the trade mark can be officially registered. The registration is from the date of filing the application and not the date of acceptance. Registration can be renewed after 10 years and, provided the trade mark is used, these renewals can continue indefinitely.

Trade marks and the Paris Convention

The basic requirements of the Paris Convention in respect to trade marks are the same as for patents and designs, based on the two fundamental provisions preventing discrimination against non-residents, that is 'national treatment' and the 'right of priority'. In order to maintain right of priority, the application for a trade mark must be lodged within six months of the original application in the home country. The Paris Convention includes a number of other requirements concerning trade marks and marks more generally.

- Some automatic legal protection must be available for trade names without the obligation of filing or registration.
- Measures must be taken in each contracting state against the use of false indications on the geographical source of the good or the identity of the producer, manufacturer or trader.
- Registration must be denied for trade marks which contain, without authorisation, State emblems or official signs that have been communicated to WIPO.
- All member states must refuse or cancel the registration of a mark conflicting with a mark from a domestic or foreign source that is well known.

Trade marks and TRIPS

The TRIPS agreement is based largely on the Paris Convention in respect to trade marks, but a few extra clauses have been added. The Paris Convention requirement to prevent duplication of well known marks has been extended to services. Moreover, the protection of well known marks must extend to goods and services that are not similar to those in respect of which the well known mark has been registered. Evidently, the stricter protection of well known marks may enhance the protection of the brand names of large transnational corporations.

TRIPS requires that each renewal of registration of a trade mark shall be for a term of no less than seven years. Provided the trade mark is used, registration is renewable indefinitely. Cancellation of a mark on the grounds of non-use cannot take place before three years of non-use, and can be applied only if the owner cannot demonstrate valid reasons for non-use.

Other clauses in TRIPS require that the use of a trade mark in the course of trade shall not be unjustifiably encumbered by special requirements, such as use in a special form or use in a manner detrimental to its capability to distinguish the goods or services. There can be no mandatory requirement to use one trade mark in combination with another, which means that owners of foreign marks may not be forced to use their marks in combination with local marks. Compulsory licensing of trade marks is prohibited. These provisions were probably aimed at practices in certain developing countries.

With the coming of TRIPS, there was no need for Australia to make substantial changes to the trade marks legislation. The *Trade Marks Act 1995* incorporated some minor changes in wording regarding the definition of a trade mark and the tests for registrability and infringement, to make the Act fully compatible with TRIPS. It is possible that in the future, further amendments will have to be made to the trade marks legislation, in light of the outcome from the current TRIPS negotiations concerning geographical indications, a subject that is discussed in section A.6.

Trade mark related WIPO agreements

There are a number of trade mark related WIPO agreements that are not covered in TRIPS. In 1998, Australia acceded to the Trademark Law Treaty (1994). In 1997, there were only eight members to this treaty (WIPO 1997). The aim of the Trademark Law Treaty is to make national and regional trade mark registration systems more user friendly.

Australia is also a member of the Nice Agreement (1957) concerning the international classification of goods and services for the purpose of registration of marks.

Australia is not a party to the Madrid Agreement (1891) concerning the international registration of marks. This agreement provides for the international registration of trade marks with WIPO. Registrations effected under the agreement are called international, as every registration has effect in several countries, potentially in all the contracting states. Unlike the PCT agreement for patents, which does not obviate the need for multiple applications, under the Madrid Agreement a single

trade mark registration is recognised in all member states. However, each state may reject the protection for the mark within its territory within one year of the international registration, for reasons connected with its national law or its stock of registered marks. Australia did not join this agreement, mainly because of the non-participation of our major trading partners, including the United States, Japan and the United Kingdom.

Consideration is now being given by IP Australia on whether to recommend to the Government to join the Protocol Relating to the Madrid Agreement (1989). The Madrid Protocol was adopted in order to introduce certain new features into the Madrid Agreement, and remove difficulties that were preventing certain countries from joining it. Among other things, the protocol provides mutual recognition with European Union trade mark registrations. The United Kingdom is a party to the protocol and the United States and Japan are close to joining it.

Australia is not a party to WIPO's Nairobi Treaty (1981) which obliges member states to protect the Olympic symbol — five interlaced rings — against use for commercial purpose without the authorisation of the International Olympic Committee and subject to commercial agreements negotiated with the committee. The reason Australia did not join this agreement is because the Olympic symbol is already protected as an emblem of an international organisation under the Paris Convention, which has the effect of prohibiting its use and registration as a trade mark. The Australian Trade Mark Act prohibits the use of the Olympic symbol without authorisation.

A.6 Geographical indications

As far back as 1891, an agreement was worked out in Madrid for the suppression of false or deceptive indications of the geographical source of goods. Australia is not a party to this WIPO agreement, because to a large extent its provisions are already covered under the Paris Convention. According to this agreement, all goods bearing a false or deceptive indication of source by country or place of origin must be seized upon importation, or other sanctions must be applied in connection with such importation. In addition, geographical indication is one of the few IPR related issues mentioned in the GATT, which forbade misleading labelling of geographic origin.

The TRIPS agreement contains a number of clauses about geographical indications, but the issue has not yet been fully resolved. TRIPS has an in-built agenda for review and further consideration of issues that were not resolved during the original negotiating mandate. At the present, the IPR protection of new life forms (see section A.3) is one such issue, geographical indications is the other.

Unlike the Paris Convention, which only prohibits false indication of geographical source, the TRIPS agreement prohibits the use of any mark that may mislead the public as to the geographical origin of the good. A special article on wines requires member states to have the legal means to prevent the use of inappropriate geographic indications for wines not originating in the place indicated by the geographical indication. This applies even if the geographical indication is accompanied by expressions such as 'kind', 'type' or 'style'.

However, there are possible exceptions. Members do not have to protect a geographical indication that has become a generic term for describing the product in question (manchester, china and the like). The measures governing geographical indications shall not prejudice prior trade mark rights that have been acquired in good faith. Members availing themselves of the use of these exceptions must be willing to enter into negotiations about their continued application.

The in-built agenda on geographical indications was included in TRIPS primarily at the request of the European Union, which has a strong interest in that matter, particularly in relation to wines. Originally, the European Union wanted the TRIPS agreement to provide wider protection on geographical indications than was actually agreed. It did not succeed at the time, because the United States was frustrated by the European Union's approach to agricultural trade in the Uruguay Round negotiations (Farquhar 1998).

The most contentious areas in the current review of geographical indications are likely to be:

- exceptions for generic names;
- conflict between geographic indications and trade marks registered in the past; and
- the range of products for which stricter protection of geographical indications should apply.

The European Union would like the same 'strong' protection now applied to wine and spirit geographical indications to be applied to other products, particularly processed foods, agricultural products and handicrafts. It wants protection for a variety of terms that are now protected within the European Union as geographical indications.

The view taken by most new world countries is that the review should focus on the practicalities of geographical indication protection, with a view of increasing transparency and understanding about the differing legal means available for the protection of geographical indications.

The current TRIPS agreement requires the establishment of a multilateral system of notifications and registrations of geographical indications for wine. The establishment of this system has been complicated by the fact that the European Union was successful in 1996 in including consideration of spirits in the proposed system of notifications and registrations. A main concern about the multilateral registration system currently proposed by the European Union is that it would extend the effect of protection for geographical indications — creating a strong presumption that any geographical indication protected in one country must be protected in another. Under this system, a WTO member would have to initiate dispute settlement proceedings to avoid the application to its jurisdiction of another member's protection system.

The current TRIPS review of geographical indications has potentially significant implications for the Australian agricultural and processed food industries. Therefore, the likely impact of proposed changes on these important export industries will need to be monitored carefully.

A.7 Copyrights and neighbouring rights

Historical background

Copyrights appeared on the scene more than a hundred years after patents. The demand for legal regulation of the publishing industry arose after the introduction of printing presses in Europe in the mid 15th century, which made the rewards for plagiarism much greater than before. In the beginning, copyrights were given to publishers rather than authors, and were used in much of Europe (including England) to foster the development of monopolistic printing guilds that served as instruments of censorship by church and state. The modern copyright protection of authors appeared in England in 1709, when the Act of Anne eliminated the guild monopoly on the holding of copyrights, enabling anyone to hold a copyright for a new work (David 1993). Following this change, copyright begun to assume a role in providing a commercial incentive for the expression of new forms and ideas. Later, copyrights were extended to musical compositions and the visual arts. In the 1900s, legislation had to be revised many times to cope with the emergence of new information recording and transmission technologies, such as sound recordings, films, radio, TV and digitised information.

The Copyright Act

Current copyright law protects the original expression of ideas, not the ideas themselves. It safeguards works of art, literature, music, films, broadcasts, illustrated packaging, technical drawings and computer programs from unauthorised copying or reproduction and certain other uses. Works of art include paintings, drawings, plans, moulds, sculptures and photographs. Copyright protects the work of authorship from the time that it is created, typically when material fixation of some sort occurs, as in writing, painting or recording.

The Australian Copyright Act gives exclusive rights to the right-holder of copyright material to do some or all of the following:

- reproduce or publish the work;
- perform the work in public;
- broadcast or transmit the work; and
- translate the work or make adaptations to it.

Rights vary according to the nature of the work. Those for artistic works, for instance, are different from those for literary and musical works. Like other IPRs, most of these rights can be sold, assigned and licensed.

The duration of protection for written and artistic work lasts for 50 years after the death of the person creating it. Anonymous or corporate work is generally protected for 50 years after being made available to the public. A 50 year term for films, sound recordings and broadcasts is provided and a 25 years term for published editions. The protection period begins from the date of publication.

The Australian Copyright Act provides creators with certain non-economic rights. These rights, which are intended to protect the honour and reputation of authors, include a duty to creators not to attribute falsely the authorship of their work to others or attribute to them the authorship of altered works.

Although making copies of copyright material can infringe exclusive rights, a certain amount of copying is permissible under the ‘fair dealing’ provisions of the legislation. Under these provisions, it is possible to make a single photocopy of part of a book for the purpose of teaching or research. One of the prime objectives of the legislation is not to hamper the dissemination of knowledge and information. The ideas expressed in copyright-protected work can be freely used by others, as long as they are expressed in a different form. Statistics published in protected work can be also used by others.

The objective of the legislation is to protect the commercial interests and the reputation of the copyright owner rather than to prevent any form of copying per se. For example, it is legal to cite word-by-word a paragraph from an article or a book, as long as proper reference is made to the source of the citation. Such a citation would seldom impair the commercial interest of the author. On the other hand, it is not legal to make without authorisation a 'derivative' adaptation of a copyright-protected work, such as rearrangement of a musical work or dramatisation or translation of a literary work. Although the result of such adaptation would differ in form (expression) from the original work, it could obviously harm the commercial interest of the copyright owner. Hence, the distinction can sometimes become blurred between expression that is protected, and ideas that are not.

Copyright protection is automatic, even for unpublished work, after material fixation of some sort has occurred. Automatic protection means that the right-holder can proceed with litigation against perceived infringements. The onus is on the injured party to prove that copyright infringement has occurred. In this respect, copyright offers weaker protection than registered IPRs. The absence of registration can be partly overcome by affixing a notification to the published work about the identity of the copyright owner and the date of creation of the work. Sometimes common law tests (based on previous court rulings) will be applied to decide whether an infringement has occurred.

Legal actions against infringements are often complicated by the fact that a number of different copyrights may exist in some works — particularly films, broadcasts and multimedia products. For example, copyright may subsist independently in a literary work, a film based on the work and a broadcast of the film.

In most cases, the copyright of commissioned work belongs to the author, artist or performer who made the work, rather than the commissioning agent (subject to contract agreements). In corporate work, the copyright belongs to the employer and not the employee. There are some exceptions to this rule, in the form of certain rights provided to journalists and performers — a complicated subject that is examined further in section 3.6. In some respects, copyright law is more complex than that of patents or trade marks, due to the possibility of different layers of copyright ownership and different bundles of rights.

Before turning to international conventions, a few notes about overlaps between copyrights and other IPRs. As indicated in the discussion about designs, in many cases copyright can provide an unregistered (automatic) form of protection for industrial designs, though not when a three dimensional artistic work is applied industrially. Copyright also can be used to protect trade marks in the form of labels, logos, writings, pictures, visual aspects of packaging and the like (see section 3.8).

Given that computer programs are protected by copyright, there is some overlap with patents, when software is patentable by virtue of incorporating innovative concepts. While copyrights will sometimes be less effective than registered IPRs when it comes to litigation, they offer a longer term of protection.

WIPO copyright agreements

The Berne Convention

Australia is a party to the Berne Convention on copyrights administered by WIPO. The Berne Convention for the protection of literary and artistic work was originally formulated in 1886 and has been revised several times thereafter. It is based on a few fundamental principles.

- The 'national treatment' provision prevents discrimination against residents of other member states. It provides automatic protection in all member countries to the work created by a resident of any member state.
- Such protection must not be conditional upon compliance with any formality (the principle of 'automatic' protection).
- Copyright protection must cover any work in the literary, scientific and artistic domains, whatever may be the mode or form of expression.
- Copyright protection of written work must last for at least 50 years after the death of the author, but shorter terms are provided for films and works of applied art.
- Subject to certain permitted reservations, the exclusive rights of authorisation must include the right to make reproductions, to translate, to perform in public, to broadcast, to use in audiovisual work or to make adaptations or rearrangements of the work.
- The 'moral right' of authors to object to changes that would be prejudicial to their honour and reputation must be upheld.

It should be noted that the Berne Convention imposes more binding constraints on national copyright laws than the Paris Convention imposes in respect to industrial property rights. First, the Berne Convention stipulates a minimum duration of protection, something that is not specified in the Paris Convention. Moreover, unlike the Paris convention, it spells out the scope of coverage by item, the mode of protection (that is 'automatic' — non-registered) and provides a list of exclusive rights. Hence the level of harmonisation in national copyright laws has been considerably greater than in industrial property laws. This is not surprising, bearing

in mind that copyright provides automatic protection across national boundaries. While there is no international patent, trade mark or design, there is in effect international copyright.

The Rome Convention

Australia is a party to the Rome Convention (1961) for the protection of performers, producers of phonograms and broadcasting organisations. This convention further elaborates on the Berne Convention in relation to the rights of performers (actors, musicians, dancers and the like). According to this convention, performers are protected against the unauthorised recording, reproduction and broadcasting of their performances. Producers of phonograms (sound recordings) have the right to authorise or prohibit the reproduction of their records. Broadcasting organisations have the right to authorise or prohibit the rebroadcasting, reproduction or recording of their broadcasts for commercial use.

Other international agreements

There are three copyright-related international agreements that have been adopted by Australia but are not referred to in TRIPS. One is the Geneva Convention (1971) of WIPO for the protection of producers of phonograms against unauthorised duplication of their phonograms.

The second is the Brussels Convention (1974) of WIPO that protects the distribution of program-carrying signals transmitted by satellite.

The third is the Universal Copyright Convention (1952) of UNESCO. Like the Berne Convention, the UNESCO Convention is also based on 'national treatment' type non-discrimination against foreign copyright holders. It provides for shorter length of protection than the Berne Convention. In recognition of the needs of developing countries, it grants exclusive right of translation for a seven-year period, subject to compulsory licensing under certain circumstances. Where there are differences between the UNESCO Convention and the Berne Convention, for members of the Berne Convention the later will take precedence.

Copyrights and TRIPS

The TRIPS agreement adopted most of the provisions of the Berne and Rome Conventions with a few alterations. The 'moral rights' provision has been excluded from TRIPS. However, there are areas in which TRIPS expands and clarifies Berne disciplines. It states, for example, that the term of protection should be not less than

50 years in those cases where the term is calculated on a basis other than the life of a person. This provides clear guidance for the term of protection of works that belong to corporations. TRIPS sets the minimum term of protection for performances and sound recordings to 50 years (from date of publication) and for broadcasts to 20 years.

The major clarifications of TRIPS, however, are related to computer programs, digital databases and rental rights. The TRIPS agreement establishes that both computer programs (software) and digital databases are to be protected as literary works under the Berne Convention. It confirms copyright law as the basic instrument of protection for software, despite the on-going debate about the appropriateness of this solution. Some countries have introduced in the past specially designed (sui generis) protection regimes for software, but Australia adopted the copyright approach many years before TRIPS.

The TRIPS agreement also introduced tighter disciplines with respect to rental rights. At least for computer programs and cinematographic works, the right-holders should be able to authorise or prohibit the commercial rentals of originals or copies of their work. This clause attempts to address a problem in some developing countries, where widespread copying linked to rented copies is allegedly impairing the economic rights of right-holders.

In regard to neighbouring rights, TRIPS endorses the relevant Rome Convention disciplines. The adoption of a 50 year minimum term of protection for performers and producers of phonograms expands the duration of protection required under the Rome Convention (20 years). And it extends the rental rights mentioned earlier to producers of phonograms (and other right-holders in sound recordings).

The adoption of TRIPS necessitated the introduction of some minor changes in the Australian legislation. The *Copyright (World Trade Organisation Amendment) Act 1994* included the following amendments:

- to grant rental rights in relation to computer software and sound recording;
- to extend the scope of performers' protection and raise the duration from 20 to 50 years; and
- to expand the border enforcement provisions against 'pirated' goods and parallel imports, a subject that is discussed more extensively in section 3.8.

Reform options beyond the requirements of TRIPS

Although the Australian legislation is now fully compliant with TRIPS, there are a number of reform options currently under review. These proposed reforms aim to

improve and clarify copyright protection beyond the minimum standards required by TRIPS.

Two proposed reforms are related to new copyright agreements formulated by WIPO that are outside of TRIPS. One of these non-mandatory agreements is the WIPO Copyright Treaty (WCT), the other is the WIPO Performance and Phonograms Treaty (WPPT). Both treaties aim to enhance the Berne and Rome Conventions.

WIPO Copyright Treaty (WCT)

The WCT agreement is mainly concerned with rights related to digital communications and information storage. The new package of standards in the WCT include:

- extension of the existing cablecasting right in the Berne Convention to the transmission of text and images;
- a new right called the right of making available to the public (particularly relevant to information accessible through the Internet);
- a requirement to outlaw tampering and abuse of digital copyright protection measures; and
- a requirement to outlaw the alteration or removal of digital identification and rights management information attached to copyright material.

In 1997, the Attorney General's Department (AGD) and the then Department of Communications and the Arts (DOCA) circulated a discussion paper canvassing whether Australia should join the WCT agreement. This discussion paper (AGD & DOCA 1997a) dealt with digital transmission rights, the right of making available to the public and appropriate enforcement measures related to cable and satellite transmission. The focus of attention was on the legal implications of advances in computer networking technologies (particularly the Internet) to copyright protection and how Australia should deal with these new developments.

Earlier, in 1995, the Office of Regulations Review (ORR) presented a submission to the Copyright Law Review Committee (CLRC) concerning proposed reform options in relation to new technologies. The ORR submission, which looked at the issue from an economic perspective, is discussed in section 3.6.

In February 1999 the Minister for Communications, the Information Technology and the Arts and the Attorney General (Alston and Williams, 1999b) released for public comment the draft Copyright Amendment (Digital Agenda) Bill 1999 — a

bill that is designed to address a wide range of issues concerning digital communications and transmission rights. The adoption of the bill would align Australian legislation more closely with the obligations prescribed by the WCT agreement.

Performance and Phonograms Treaty (WPPT)

The second new WIPO copyright treaty, the WPPT, is concerned with the rights of singers, musicians and other sound performers. This treaty provides the following rights to sound performers:

- protection of the 'moral' right of the performer against false attribution, as well as against distortion, mutilation or modification of sound records that could be prejudicial to the performer's reputation;
- the right to authorise the recording, broadcasting and other communications to the public of their performances;
- the right to authorise reproduction, distribution, rental and making available on-line to the public of sound recordings of their performances; and
- the right to share with producers of sound recordings in the single equitable remuneration payable for broadcasting and playing in public of sound recordings of their performances.

The rights covered in the WPPT are confined to sound recordings. The United States and India, the two largest film-makers in the world, did not want the treaty to extend to movies, since in these countries performers are dependent on contracts to specify their rights in relation to the films in which they appear.

A departmental discussion paper (AGD & DOCA 1997b) deals with performers' intellectual property rights and the scope for extending performers' rights in order to join the WPPT treaty. While current Australian law provides performers the right to prevent unauthorised recording of live performances, these rights are much more limited than those of authors, record producers and broadcasters. The proposed legislation aims to ensure that performers have adequate control over the use of their recorded performances and receive equitable remuneration for the exploitation of their performances. The concept of extended performers' rights has been opposed by interests such as broadcasters, film makers and record companies who claim that performers can already exercise sufficient control over the use of their performances through existing awards and contractual arrangements. The discussion paper by AGD & DOCA (1997b) canvassed the option of extending the rights of not only sound performers, but also audio-visual (that is, film and TV) performers.

The publication of discussion papers by AGD and DOCA on proposed copyright reforms is intended to get the interested public involved in the proposed legislative changes by inviting comments on the discussion papers and by conducting face-to-face consultations with major stakeholders.

Ownership rights of journalists

Interestingly, a recent amendment to the *Copyright Act (July 1998)* in relation to the ownership rights of journalists moves in the opposite direction to the proposed extension of the rights of performers. Before this amendment, newspaper proprietors owned the copyright in articles written by employed journalists for the purpose of publication in a newspaper or magazine or broadcasting. Employed journalists owned the copyright in all other uses of their work. The new amendment restricts the rights of journalists, and ensures that newspaper proprietors are free to develop new modes of distribution, such as the Internet, for their publications while leaving employed journalists with the rights to reproduce their articles in book form, and to benefit from the photocopying of their articles. Self-employed or freelance journalists continue to retain all rights to their copyright works.

The protection of software

In Australia, computer software has been formally protected since 1984 under the Copyright Act, in line with the practice in most other countries and the requirements of TRIPS. In 1995, the Copyright Law Review Committee (CLRC) published an extensive discussion paper concerning the copyright protection of software and presented recommendations on various issues, including back-up copies, software rentals, decompilation, program modifications for interoperability and networking, error corrections, overlaps with the Circuit Layout Act, parallel importing and digital databases.

The purpose of the CLRC (1995) review was to modify the law by taking into account various problems and disputes encountered in the course of administering the copyright protection of software. Most of the unique IPR issues related to this new technological field are not codified in TRIPS or WIPO agreements.

These unique issues include the right of the software user to introduce corrections or modifications into the program and the right to translate from object code into source code (decompile) for the purpose of making corrections or modifications, or for translating from one machine code to another (emulation). The CLRC took the view that program modifications and decompilations should generally be permissible for the purpose of improving interoperability between systems.

Modifications and decompilations should be also permissible to correct program errors if an error-free version of the program could not be obtained within a reasonable period of time. Program modifications to improve networking should be negotiated between the customer and the supplier.

In February 1999 the Minister for Communications, Information Technology and the Arts and the Attorney General (Alston and Williams, 1999a) announced that the Government intends to implement the recommendations of the CLRC concerning decompilations and error corrections. Legal changes in regard to decompilations and corrections associated with the year 2000 bug (Y2K) will take effect from the date of the announcement (23 February 1999), rather than the date when the legislation will receive Royal Assent. This exception is in recognition of the urgent nature of Y2K related correction work.

As indicated from the discussion above, there are a number of outstanding policy issues in Australia in relation to copyrights, which are unrelated or beyond the minimum protection standards required by TRIPS. More such issues are likely to emerge in the future, given the rapid progress in electronic recording and transmission technologies, which open the way for unforeseen applications and developments. Some comments about the appropriate responses to these legal dilemmas from an economic perspective are presented in section 3.6.

A.8 Circuit layout rights

A new form of IPR protection is represented by the legislation protecting the layout design (topographies) of integrated circuits (commonly known as semiconductor chips). Integrated circuit layouts are usually highly complex and may be of considerable value. An integrated circuit made by photolithographic or similar electrochemical techniques, using masks based on visible layout designs, is the key for all kinds of electronic devices, ranging from heart pacemakers to personal computers.

Circuit layout rights automatically protect original layout designs for integrated circuits and computer chips. While these rights are based on copyright law, they are a separate, unique form of protection. Like the plant variety rights discussed earlier, this legislation provides a specially designed (sui generis) form of IPR protection for the layout design and the chips manufactured from it. As with copyrights, there is no requirement for registration. The owner has the exclusive right to duplicate the layout design, manufacture integrated circuits from it and/or exploit it commercially in Australia.

The need to provide special protection to integrated circuit layouts has arisen partly from the availability of new 'peeling-off' reverse engineering techniques that can be used to reveal layer-by-layer the circuit layout(s) used to produce the chip (Anderssen 1995, p. 64). The original 'sui generis' legislation in this field was introduced in the United States in 1984. In 1989, an international treaty was formulated under the auspices of the WIPO — the Washington Treaty in Respect to Integrated Circuits. The Washington Treaty never actually entered into force, because the minimum number of five countries did not ratify it or accede to it. Nevertheless, the Washington Treaty has been incorporated by reference in the TRIPS agreement subject to the following modifications: the term of protection is 10 years rather than eight years and the exclusive rights also extend to articles incorporating integrated circuits based on the protected layout design.

The Australian *Circuit Layout Act (1989)* is based largely on the Washington Treaty. Under the Australian Act, rights in an original layout subsist for 10 years from the first commercial exploitation, provided this occurs within 10 years from the creation of the layout. The accession to TRIPS did not require modifications to the circuit layout legislation that was already in force.

A.9 Protection of undisclosed information

One of the novel features of TRIPS compared with earlier international IPR agreements is the explicit requirement to protect undisclosed information. This protection must apply to information that is secret, that has commercial value because it is secret and has been subject to reasonable steps to keep it secret. In broad terms, a trade secret (a term not used in the TRIPS agreement) can be characterised as any technological, marketing or other business information that is controlled as a secret, and that provides a competitive advantage to its owner. In technical fields, a large proportion of secretive undisclosed information is in the form of uncodified know-how. As discussed in section 3.3, in many industries keeping new knowledge and know-how secret is a more effective way to reap commercial benefits from inventions than by taking out patent protection.

Countries protect trade secrets in different ways: as legal property (United States); under contract law (Switzerland); or in the context of ethical business practices (France, Germany). In Australia, confidential information disclosed by one person to another may be protected legally through contract, or by the equitable action known as 'breach of confidence'. This protection is based on common law, that is, judgement dictated by legal precedents. Needless to say, there are inherent difficulties in proving the unethical disclosure of confidential information, which is usually carried out in unrecorded personal conversations. Moreover, some widely

used techniques for acquiring undisclosed information, such as the hiring of a person possessing secret knowledge/know-how, are difficult to prevent legally in a democratic society.

Despite the availability of some protection for confidential information in most developed countries, this item did not enter explicitly into WIPO agreements. Its incorporation into TRIPS has led to heated debates, with developing countries opposing the treatment of trade secrets as an IPR. This opposition relied in part on the argument that disclosure is a necessary counterpart of the social bargain associated with the granting of IPR protection. Moreover, it is difficult to protect legally something that has a secret content (Primo Braga 1995).

The approach adopted in TRIPS was to identify undisclosed information as something to be protected (not necessarily as a property) and to link its protection to practices against unfair competition identified in the Paris Convention. No exclusive rights are given to the holder of the trade secret by TRIPS. Confidential information that is voluntarily revealed, insufficiently guarded or has been reverse-engineered loses all protection. Only the acquisition of confidential information in a manner contrary to honest commercial practices can lead to action against the infringer. TRIPS also requires that test data submitted to public agencies for the purpose of drug and chemical tests should be treated as confidential information.

The common law coverage in Australia of confidential information, while representing a rather weak form of protection, is sufficient to satisfy the requirement of TRIPS to provide some (unspecified) legal protection for secretive information and know-how. The government has introduced specific forms of protection for test data, essentially for reasons of domestic policy but also to eliminate any doubt about our compliance with TRIPS. In some developing countries, legal protection of confidential technical and commercial information did not exist in the past.

B The Australian Maskus indices

Tables B.1, B.2 and B.3 show the detailed composition by commodity groups of the Australian Maskus indices presented in section 4.1.

Table B.1 **Share in merchandise trade of patent-related goods**

	Exports			*Imports*		
	1996-97	*1986-87*	*1976-77*	*1996-97*	*1986-87*	*1976-77*
	%	%	%	%	%	%
Alcohols, phenols, etc.	0.03	0.03	0.05	0.13	0.12	0.36
Pharmaceutical products	1.24	0.46	0.09	2.53	1.37	0.26
Polymerisation products, etc.	0.20	0.08	0.16	0.91	1.09	1.30
Other special machinery	0.71	0.28	0.43	1.51	1.34	0.77
Metalworking machine tools	0.11	0.04	0.00	0.45	0.91	0.50
Office machines	0.04	0.04	0.15	0.41	0.79	1.94
Data-processing equipment	0.47	0.37	[a]	4.71	4.42	[a]
Electro-medical equipment	0.05	0.05	0.29	0.36	0.33	1.56
Electronic microcircuits	0.02	0.01	0.00	1.20	0.33	0.00
Surveying & control instruments	0.07	0.04	0.00	0.23	0.18	0.00
Total (The Maskus index)	2.94	1.41	1.16	12.45	10.90	6.68

[a] In 1976-77 data processing equipment was included in office machines.

Source: ABS (*International Merchandise Trade*, Cat. no. 5422.0; unpublished data at the five digit SITC level).

Table B.2 **Share in merchandise trade of copyright-related goods**

	Exports			*Imports*		
	1996-97	*1986-87*	*1976-77*	*1996-97*	*1986-87*	*1976-77*
	%	%	%	%	%	%
Books, newspapers, periodicals	0.37	0.12	0.13	1.08	1.53	1.60
Sound recordings tapes, disks	0.13	0.11	0.04	1.14	0.79	0.30
Total (The Maskus index)	0.50	0.22	0.17	2.22	2.32	1.90

Source: ABS (*International Merchandise Trade*, Cat. no. 5422.0; unpublished data at the five digit SITC level).

Table B.3 **Share in merchandise trade of trade mark-related goods**

	Exports			*Imports*		
	1996-97	*1986-87*	*1976-77*	*1996-97*	*1986-87*	*1976-77*
	%	%	%	%	%	%
Alcoholic beverages	0.87	0.30	0.08	0.62	0.56	0.48
Perfumery, cosmetics, etc.	0.20	0.07	0.05	0.47	0.35	0.13
Glassware	0.04	0.03	0.04	0.24	0.33	0.35
Motor vehicle parts	0.67	0.56	0.36	2.05	1.74	2.67
Furniture and parts	0.12	0.09	0.02	0.67	0.64	0.52
Travel goods, handbags	0.02	0.01	0.00	0.43	0.49	0.29
Clothing	0.45	0.11	0.11	2.33	1.78	2.33
Watches, movements and cases	0.05	0.05	0.05	0.28	0.21	0.49
Toys, indoor games, etc.	0.02	0.06	0.06	0.50	0.62	0.59
Total (The Maskus index)	2.45	1.28	0.76	7.58	6.72	7.85
Total without clothing	2.00	1.17	0.65	5.25	4.94	5.52

Source: ABS (*International Merchandise Trade*, Cat. no. 5422.0; unpublished data at the five digit SITC level).

C The patent content in trade

This appendix presents details of the estimation of the patent content in production and trade, discussed in section 4.3. The conversion from business R&D (BERD) values into patent content is based on the estimated upper and lower bounds of patent content per unit BERD cost in individual industries. As noted in the text, these estimates were derived by synthesising various estimates from the sources listed below. These compromise estimates are shown in table C.1.

Table C.1 **Estimated patent content of BERD expenditure at the sectoral level**

	Estimated lower patent content	*Estimated upper patent content*
	%	%
Mining	15	30
Food and beverages mfg	30	50
Textile, clothing and footwear	15	30
Wood and paper products	10	20
Printing, publishing and recorded media	10	20
Petroleum refining	30	60
Medicinal and pharmaceutical products	60	90
Other chemicals	50	70
Plastics and rubber	40	60
Non-metallic minerals	30	50
Iron and steel	20	40
Non-ferrous metals	20	40
Fabricated metal products	10	25
Motor vehicles	15	30
Shipbuilding	15	25
Aircraft	10	25
Other transport equipment	15	25
Scientific and medical instruments	40	80
Electronic equipment	15	35
Electrical machinery and equipment	20	40
Industrial machinery	20	40
Miscellaneous manufacturing	30	60

Sources: BIE (1994a); Levin et al. (1987); Mansfield, Schwartz and Wagner (1981); USITC (1988).

Table C.2 **Sales, trade and BERD data at the sectoral level in 1996-97[ab]**

	Domestc sales[c]	*Exports*[d]	*Imports*[d]	*BERD domestic*	*BERD exports*	*BERD imports*[e]
	$m	$m	$m	$m	$m	$m
Mining	12 574	17 937	4 210	225.0	321.0	91.9
Food and beverages mfg	33 948	11 030	3 394	171.3	55.7	12.5
Textile, clothing & footwear	7 103	2 832	5 289	15.7	6.3	20.3
Wood and paper products	13 127	1 088	2 800	175.5	14.5	5.5
Printing, publishing & media	14 457	411	1 594	16.5	0.5	5.3
Petroleum refining	6 061	1 931	1 231	12.1	3.9	8.1
Pharmaceuticals	3 046	1 015	2 180	146.2	48.7	291.1
Other chemicals	11 155	1 938	6 198	68.2	11.8	97.5
Plastic and rubber	7 220	499	2 861	28.1	1.9	38.6
Non-metallic minerals	8 245	378	1 018	64.1	2.9	9.0
Iron and steel	9 044	1 747	1 310	141.6	27.4	10.1
Non-ferrous metals	350	12 102	1 243	3.4	118.6	14.3
Fabricated metal products	13 843	808	2 362	75.6	4.4	16.0
Motor vehicles	13 022	2 289	9 050	255.2	44.8	282.0
Shipbuilding	886	1 099	544	16.8	20.9	4.4
Aircraft	683	776	2 078	17.1	19.4	178.0
Other transport equipment	864	79	516	21.1	1.9	10.1
Scientific & medical instrum.	279	1 319	3 758	14.0	66.0	275.9
Electronic equipment	3 029	2 454	11 080	280.7	227.3	1084.4
Electrical equipment	5 103	1 476	3 954	62.1	17.9	67.1
Industrial machinery	5 339	2 563	9 448	92.6	44.4	116.3
Miscellan. manufacturing	3 041	672	1 847	14.7	3.3	36.2
Total industry and mining	172 420	66 440	77 965	1917.5	1063.6	2674.6

a For the purpose of calculating GDP and trade ratios the following estimates were used: GDP = $512.4 billion; Exports of goods and services = $105.3 billion; Imports of goods and services =$103.5 billion. **b** All figures are in current prices. **c** Domestic sales excluding imports. **d** Both imports and exports include re-exports, which is material that has been imported and then re-exported without further processing in Australia. **e** The calculation of the BERD content in imports is based on OECD estimates of average BERD intensities in member countries in 1994.

Sources: ABS (*International Merchandise Trade*, Cat. no. 5422.0; *Research and Experimental Development, Business Enterprises*, Cat. no. 8104.0; *Australian National Accounts: Input-Output Tables,* Cat. no. 5209.0; *Manufacturing Industry*, Cat. no. 8221.0).

Table C.3 **Estimated patent content in trade and domestic sales in 1996-97[a]**

	Domestic lower est.	*Domestic upper est.*	*Exports lower est.*	*Exports upper est.*	*Imports lower est.*	*Imports upper est.*
	$m	$m	$m	$m	$m	$m
Mining	33.8	67.5	48.1	96.3	13.8	27.6
Food and beverages mfg	51.4	85.7	16.7	27.8	3.7	6.2
Textile, clothing & footwear	2.4	4.7	0.9	1.9	3.0	6.1
Wood and paper products	17.5	35.1	1.5	2.9	0.5	1.1
Printing, publishing & media	1.7	3.3	0.0	0.1	0.5	1.1
Petroleum refining	3.6	7.3	1.2	2.3	2.4	4.9
Pharmaceuticals	87.7	131.6	29.2	43.8	174.7	262.0
Other chemicals	34.1	47.7	5.9	8.3	48.8	68.3
Plastic and rubber	11.2	16.8	0.8	1.2	15.4	23.2
Non-metallic minerals	19.2	32.0	0.9	1.5	2.7	4.5
Iron and steel	28.3	56.7	5.5	10.9	2.0	4.1
Non-ferrous metals	0.7	1.4	23.7	47.4	2.9	5.7
Fabricated metal products	7.6	18.9	0.4	1.1	1.6	4.0
Motor vehicles	38.3	76.5	6.7	13.5	42.3	84.6
Shipbuilding	2.5	4.2	3.1	5.2	0.7	1.1
Aircraft manufacturing	1.7	4.3	1.9	4.9	17.8	44.5
Other transport equipment	3.2	5.3	0.3	0.5	1.5	2.5
Scientific & medical instrum.	5.6	11.2	26.4	52.8	110.4	220.8
Electronic equipment	42.1	98.2	34.1	79.6	162.7	379.5
Electrical equipment	12.4	24.8	3.6	7.2	13.4	26.8
Industrial machinery	18.5	37.0	8.9	17.8	23.3	46.5
Miscellan. manufacturing	4.4	8.8	1.0	2.0	10.9	21.7
Total industry and mining	427.9	779.0	220.9	428.8	655.0	1246.7

a All figures are in current prices.

Sources: Tables C.1, C.2.

Table C.4 **Sales, trade and BERD data at the sectoral level in 1986-87[ab]**

	Domestc sales[c]	*Exports*[d]	*Imports*[d]	*BERD domestic*	*BERD exports*	*BERD imports*
	$m	$m	$m	$m	$m	$m
Mining	8 495	13 610	2 167	19.6	31.5	19.5
Food and beverages mfg	19 084	5 663	1 583	42.4	12.6	5.3
Textile, clothing & footwear	6 325	1 356	2 848	10.6	2.3	7.4
Wood and paper products	5 641	407	711	5.9	0.4	1.2
Paper and printing	10 201	200	1 770	9.2	0.2	5.6
Pharmaceuticals	1 147	170	485	38.2	5.7	45.4
Petroleum refining	908	826	1 194	2.4	2.2	14.1
Other chemicals	7 801	425	2 621	66.9	3.6	63.7
Non-metallic minerals	5 302	77	643	14.7	0.2	4.1
Basic iron and steel	6 138	608	725	34.2	3.4	4.4
Non-ferrous metals	2 048	5 436	335	7.4	19.6	4.2
Fabricated metal products	8 040	235	982	20.9	0.6	4.6
Motor vehicles	7 690	642	3 217	99.6	8.3	78.8
Shipbuilding	717	72	231	3.4	0.3	1.3
Aircraft	236	506	1 626	1.9	4.1	92.2
Other transport equipment	1 101	20	215	8.9	0.2	2.3
Scientific & medical instrum.	454	395	1 654	13.5	11.8	72.9
Electronic equipment	1 223	513	3 972	83.3	34.9	418.2
Electrical equipment	4 191	406	3 072	49.4	4.8	113.4
Industrial machinery	3 797	587	4 668	36.3	5.6	112.6
Rubber and plastics	4 483	98	1 493	10.2	0.2	12.4
Miscellan. manufacturing	1 237	303	949	4.4	1.1	12.8
Total industry and mining	63 876	32 555	37 162	583.4	153.6	1096.3

a For the purpose of calculating GDP and trade ratios the following estimates were used: GDP = $254.5 billion; Exports goods and services = $44.1 billion; Imports of goods and services =$48.2 billion. **b** All figures are in current prices. **c** Domestic sales excluding imports. **d** Both imports and exports include re-exports, which is material that has been imported and then re-exported without further processing in Australia.

Sources: ABS (*International Merchandise Trade*, Cat. no. 5422.0; *Research and Experimental Development, Business Enterprises,* Cat. no. 8104.0; *Australian National Accounts: Input-Output Tables*, Cat. no. 5209.0); IC (1995c).

Table C.5 **Estimated patent content in trade and domestic sales in 1986-87[a]**

	Domestic lower est.	*Domestic upper est.*	*Exports lower est.*	*Exports upper est.*	*Imports lower est.*	*Imports upper est.*
	$m	$m	$m	$m	$m	$m
Mining	2.9	5.9	4.7	9.4	2.9	5.9
Food and beverages mfg	12.7	21.2	3.8	6.3	1.6	2.6
Textile, clothing & footwear	1.6	3.2	0.3	0.7	1.1	2.2
Wood and paper products	0.6	1.2	0.0	0.1	0.1	0.2
Paper and printing	0.9	1.8	0.0	0.0	0.6	1.1
Pharmaceuticals	22.9	34.4	3.4	5.1	27.2	40.8
Petroleum refining	0.7	1.4	0.7	1.3	4.2	8.4
Other chemicals	33.4	46.8	1.8	2.5	31.8	44.6
Non-metallic minerals	4.4	7.3	0.1	0.1	1.2	2.0
Basic iron and steel	6.8	13.7	0.7	1.4	0.9	1.8
Non-ferrous metals	1.5	2.9	3.9	7.8	0.8	1.7
Fabricated metal products	2.1	5.2	0.1	0.2	0.5	1.1
Motor vehicles	14.9	29.9	1.2	2.5	11.8	23.6
Shipbuilding	0.5	0.9	0.1	0.1	0.2	0.3
Aircraft	0.2	0.5	0.4	1.0	9.2	23.0
Other transport equipment	1.3	2.2	0.0	0.0	0.3	0.6
Scientific & medical instrum.	5.4	10.8	4.7	9.4	29.2	58.3
Electronic equipment	12.5	29.1	5.2	12.2	62.7	146.4
Electrical equipment	9.9	19.8	1.0	1.9	22.7	45.3
Industrial machinery	7.3	14.5	1.1	2.2	22.5	45.0
Rubber and plastics	4.1	6.1	0.1	0.1	4.9	7.4
Miscellan. manufacturing	1.3	2.6	0.3	0.6	3.8	7.7
Total industry and mining	148.1	261.6	33.7	65.2	240.5	470.4

a All figures are in current prices.

Sources: Tables C.1, C.4.

Table C.6 **Sales, trade and BERD data at the sectoral level in 1976-77[ab]**

	Domestc sales[c]	*Exports*[d]	*Imports*[d]	*BERD domestic*	*BERD exports*	*BERD imports*[e]
	$m	$m	$m	$m	$m	$m
Mining	2 148	764	2 966	2.8	3.9	5.9
Food and beverages mfg	7 254	376	2 503	8.7	3.0	0.7
Textile, clothing & footwear	2 949	992	255	1.9	0.2	2.0
Wood and paper products	2 329	246	97	0.9	0.0	0.2
Paper and printing	3 081	515	38	3.3	0.0	1.3
Pharmaceuticals	391	98	39	4.1	0.4	8.9
Petroleum refining	451	559	0	2.0	0.0	1.9
Other chemicals	2 661	764	143	16.8	0.9	18.0
Non-metallic minerals	1 988	196	17	3.8	0.0	2.0
Basic iron and steel	2 464	227	441	13.2	2.4	2.0
Non-ferrous metals	1 878	53	1 350	2.0	1.4	0.4
Fabricated metal products	3 178	299	86	3.9	0.1	2.2
Motor vehicles	3 542	1 214	95	13.2	0.4	34.7
Shipbuilding	325	19	13	0.2	0.0	0.1
Aircraft	272	159	17	0.4	0.0	10.5
Other transport equipment	446	76	3	0.4	0.0	1.0
Scientific & medical instrum.	239	375	65	3.6	1.0	16.0
Electronic equipment	382	453	25	13.3	0.9	51.2
Electrical equipment	2 173	903	104	20.1	1.0	23.8
Industrial machinery	1 855	1 309	220	12.9	1.5	23.0
Rubber and plastics	1 561	400	26	3.0	0.1	5.2
Miscellan. manufacturing	414	266	97	0.4	0.1	4.1
Total industry and mining	41 981	10 262	8 600	130.9	17.2	215.2

a For the purpose of calculating GDP and trade ratios the following estimates were used: GDP = $87.6 billion, Exports goods and services = $13.4 billion; Imports of goods and services =$13.9 billion. **b** All figures are in current prices. **c** Domestic sales excluding imports. **d** Both imports and exports include re-exports, which is material that has been imported and then re-exported without further processing in Australia. **e** The calculation of BERD content in imports is based on OECD 1982 mean sectoral BERD intensity estimates, extrapolated back to 1976-77 on the basis of aggregate trends in BERD expenditure in OECD countries.

Sources: ABS *(International Merchandise Trade*, Cat. no. 5422.0; *Research and Experimental Development, Business Enterprises*, Cat. no. 8104.0; *Australian National Accounts: Input-Output Tables*, Cat. no. 5209.0); IC (1995c).

Table C.7 **Estimated patent content in trade and domestic sales in 1976-77[a]**

	Domestic lower est.	*Domesti c upper est.*	*Exports lower est.*	*Exports upper est.*	*Imports lower est.*	*Imports upper est.*
	$m	$m	$m	$m	$m	$m
Mining	0.4	0.8	0.6	1.2	0.9	1.8
Food and beverages mfg	2.6	4.3	0.9	1.5	0.2	0.4
Textile, clothing & footwear	0.3	0.6	0.0	0.0	0.3	0.6
Wood and paper products	0.1	0.2	0.0	0.0	0.0	0.0
Paper and printing	0.3	0.7	0.0	0.0	0.1	0.3
Pharmaceuticals	2.4	3.7	0.2	0.4	5.4	8.0
Petroleum refining	0.6	1.2	0.0	0.0	0.6	1.1
Other chemicals	8.4	11.7	0.5	0.6	9.0	12.6
Non-metallic minerals	1.1	1.9	0.0	0.0	0.6	1.0
Basic iron and steel	2.6	5.3	0.5	0.9	0.4	0.8
Non-ferrous metals	0.4	0.8	0.3	0.6	0.1	0.2
Fabricated metal products	0.4	1.0	0.0	0.0	0.2	0.6
Motor vehicles	2.0	4.0	0.1	0.1	5.2	10.4
Shipbuilding	0.0	0.1	0.0	0.0	0.0	0.0
Aircraft	0.0	0.1	0.0	0.0	1.0	2.6
Other transport equipment	0.1	0.1	0.0	0.0	0.1	0.2
Scientific & medical instrum.	1.4	2.9	0.4	0.8	6.4	12.8
Electronic equipment	2.0	4.7	0.1	0.3	7.7	17.9
Electrical equipment	4.0	8.0	0.2	0.4	4.8	9.5
Industrial machinery	2.6	5.2	0.3	0.6	4.6	9.2
Rubber and plastics	1.2	1.8	0.0	0.0	2.1	3.1
Miscellan. manufacturing	0.1	0.2	0.0	0.1	1.2	2.5
Total industry and mining	33.2	59.2	4.1	7.6	51.0	95.7

a All figures are in current prices.

Sources: Tables C.1, C.6.

D Trade in copyright material

This appendix presents further details about the copyright content estimates discussed in section 4.4. Table D.1 shows the source data for the percentage figures in table 4.10. The data on royalties and payments for services are from balance of payments statistics.

Table D.1 **Trade in copyright material**[a]

	1976-77	*1986-87*	*1996-97*
	$m	$m	$m
Exports			
Royalties and license fees [bcd]	11	159	288
Computer and information services	[b]	[b]	277
Audiovisual and related services	[c]	[c]	282
Sub-total royalties	11	159	847
Books, newspapers, periodicals	15	42	294
Sound recordings, tapes, disks	5	38	100
Sub-total merchandise	20	80	394
Total copyright exports	31	239	1 240
Imports			
Royalties and license fees [bd]	70	359	784
Computer and information services	[b]	[b]	253
Audiovisual and related services	37	183	467
Sub-total royalties	107	542	1 504
Books, newspapers, periodicals	166	565	855
Sound recordings, tapes, disks	31	292	899
Sub-total merchandise	197	857	1 754
Total copyright imports	305	1 399	3 258

[a] All figures are in current prices. [b] Before 1987-88 payments for computer services were not recorded separately from general licence fees and royalties. [c] Before 1987-88 the exports of audiovisual and related services were not recorded separately from general royalties and licence fees. [d] Excludes the estimated value of licence fees and royalties for technical services. These are generally patent rather than copyright-related.

Sources: ABS (*International Merchandise Trade*, Cat. no. 5422.0; unpublished data at the five digit SITC level; *Balance of Payments and International Investment Position,* Cat. no. 5363.0).

Table D.2 summarises the estimated copyright content in production and trade. All these estimates are based on the assumption that the copyright content represents between 70 and 90 per cent of value added, which are the lower and upper estimates. The value added of total production is based on Guldberg's (1994) estimates.

For the purpose of estimating copyright content, royalties are assumed to represent purely value added, that is, returns to labour or capital rather than to intermediate inputs. In the case of merchandise export and imports (printed matter, recorded tapes, disks and the like), value added is estimated to amount to 53 per cent of sales, based on figures from the ABS input-output tables (1994-94) for the printing and publishing industries. The estimated copyright content of merchandise exports and imports is obtained by multiplying the value of merchandise trade by 0.53 and then by 0.7 or 0.9.

Table D.2 **Estimated copyright content in trade and domestic sales 1996–97**

	Base values	*Lower est. copyright content*	*Upper est. copyright content*	*Lower est. copyright content*	*Upper est. copyright content*
	$m	$m	$m	% of GDP	% of GDP
Copyright royalties in exports	847	593	763		
Copyright merchandise exports	393	146	187		
Total exports	1 240	739	950	0.14	0.18
Copyright royalties in imports	1 504	1 053	1 353		
Copyright merchandise imports	1 754	651	837		
Total imports	3 258	1 703	2 190	0.33	0.42
Domestic VA (excl. exports)	11 254	8 007	10 294	1.55	1.99
Total value added	12 494	8 746	11 245	1.69	2.17

Sources: ABS (*Australian National Accounts: Input-Output Tables*, Cat. no. 5209.0); Guldberg (1994); Table D.1 in this appendix.

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